No. 893,204. PATENTED JULY 14, 1908.

J. E. STARR & T. C. WOOD.

VALVE.

APPLICATION FILED MAY 18, 1905.

2 SHEETS—SHEET 1.

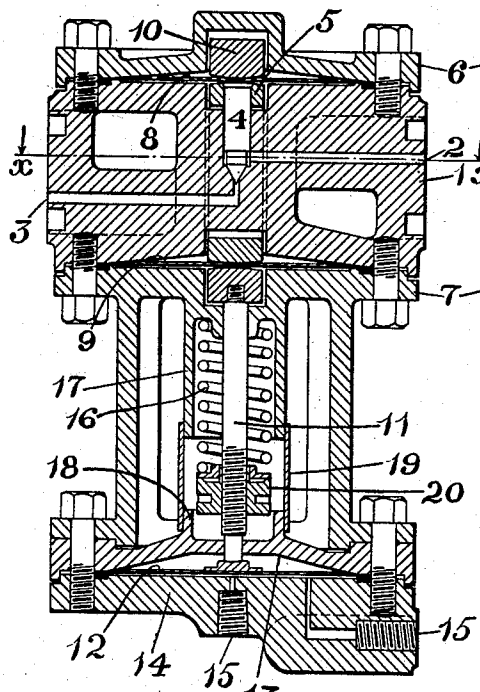


Fig. 1

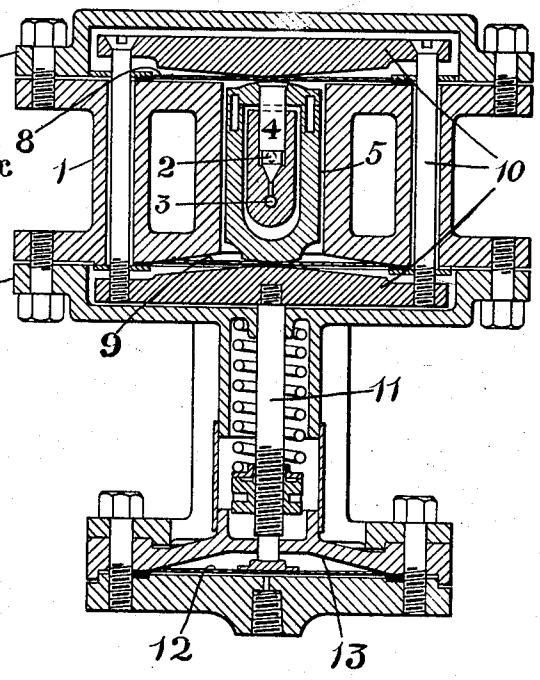


Fig. 2

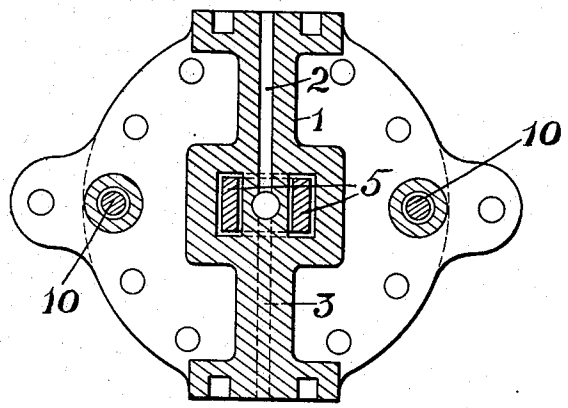


Fig. 3

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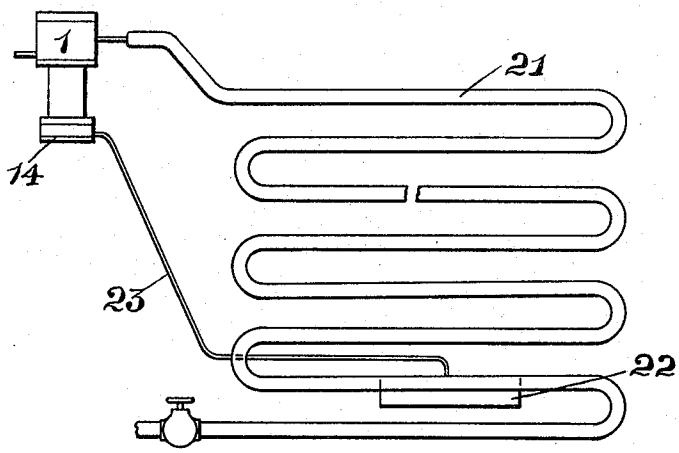
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2 SHEETS—SHEET 2.

Fig. 4



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VALVE.

No. 893,204. Specification of Letters Patent. Patented July 14, 1908.

Application filed May 18, 1905. Serial No. 260,954.

To all whom it may concern:

Be it known that we, JOHN E. STARR and THOMAS C. WOOD, both citizens of the United States, residing in the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Valves; and we do hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in flow regulating devices commonly termed valves, and particularly to improvements in what are known as expansion valves, such as are employed in refrigerating systems.

The objects of our invention are to balance the valve, to avoid the use of stuffing boxes and the like, to prevent the escape of the ammonia or other fluid controlled, to prevent interference with the operation of the valve by the collection of frost or ice thereon, to make the valve exceedingly sensitive and responsive to delicate controlling devices, and generally to render the valve simple, compact, easy of construction, easy to assemble, reliable and relatively inexpensive.

We will now proceed to describe our invention with reference to the accompanying drawings, in which

Figure 1 shows a central vertical section of one form of valve constructed in accordance with our invention. Fig. 2 shows another central vertical section taken at right angles to Fig. 1, of said valve. Fig. 3 shows a horizontal section on the line X—X of Figs. 1 and 2. Fig. 4 is a diagram illustrating the use of the valve, in connection with a controlling thermostat, in a refrigerating system.

In the said drawings, 1 designates a block containing passages 2 and 3, and a seat for a valve plug 4, the latter mounted to slide in a hole in said block and being carried by a yoke 5, likewise mounted to slide in a chamber formed in said plug 1.

Numerals 6 and 7 designate respectively a top plate and a bottom plate secured to block 1, and numerals 8 and 9 designate diaphragms located respectively above and below block 1 and yoke 5, and clamped at their edges between the block 1 and top and bottom plates 6 and 7. Another yoke 10 embraces these diaphragms, its top and bottom members located in suitable recesses in plates 6 and 7, respectively, its sides passing through suitable apertures of block 1. To this yoke 10 is connected a stem 11 connected at the bottom to a diaphragm 12 located within a diaphragm chamber 13. The bottom plate 14 of this diaphragm is provided with two apertures 15 into either of which a pipe may be screwed. One or the other of these holes 15 is plugged in practice, the other being used. They serve to connect the valve to a controlling thermostat (see Fig. 4) consisting of a tube or chamber containing an expansible fluid, the expansion and contraction of which will influence diaphragm 12 and so will operate the stem 11. Obviously, instead of a fluid thermostat and a diaphragm operated thereby, any other actuating device for operating the valve might be substituted. Such a thermostat and a diaphragm operated thereby, are commonly used, however, for controlling expansion valves employed in refrigerating systems. The stem 11 and spring 16 are completely inclosed by a housing comprising a tube 17, a tubular boss 18 on the top of diaphragm chamber 13, and a movable section or thimble 19, and by sliding this thimble upward on tube 17, access may be obtained to the adjusting nut 20 by which the pressure of spring 16 is adjusted.

In the operation of this valve, increase of pressure below operating diaphragm 12, when sufficient to overcome the pressure of spring 16, raises stem 11, and such motion is transmitted through yoke 10 and diaphragm 9 to yoke 5 and thence to valve 4, whereby said valve is raised from its seat. Conversely, decrease of pressure beneath the diaphragm 12, when the valve is open, causes said stem 11, under influence of spring 16, to move downward, and such motion is transmitted through yoke 10 and diaphragm 8 to valve plug 4. In this way the valve may be opened or closed by the action of the thermostat, or adjusted to various intermediate positions.

It will be observed that no stuffing boxes interfere with the free movement of the valve plug 4 and its operating stem 11; that the pressure upon the diaphragms 8 and 9, due to possible leakage of fluid past the valve plug 4 into the space inclosed by said diaphragms, balance; and that fluid pressure upon yoke 5 and valve plug 4 is also balanced when the valve is open, and nearly balanced when the valve is closed. Diaphragms 8 and 9 offer substantially no resistance to the

movement of the valve plug. It follows, therefore, that this valve is exceedingly sensitive in operation, and is capable of responding to extremely small variations of pressure in the thermostat. Further, since the joints between diaphragms 8 and 9 and the valve casing (block 1 and plates 5 and 6) are easy to make and are permanent, there can be no escape of gas, as might be the case if a stuffing box were employed.

Ammonia, the gas usually employed in refrigeration, is exceedingly prone to escape through very small pores or openings—openings which would not permit the escape of fluids such as steam for example. It is also destructive of most of the packing materials commonly employed. It will readily be seen, therefore, that it is exceedingly desirable in expansion valves, which of necessity must be delicate, to avoid stuffing boxes and packed joints in which elastic packing material must be employed. This is accomplished by our invention.

The spring 16 of the valve being completely surrounded by a tube, none of the parts of which move during the operation of the valve, said spring is completely protected from the action of frost or ice which accumulates on valves of this type in use, and if such protection were not provided, would tend to interfere with the action of the spring and of the stem 11.

Fig. 4 illustrates diagrammatically one application of our improved valve, namely, its application to a refrigerating system and its control by a fluid-pressure-thermostat of such system. In said figure, 21 designates the expansion coil, controlled as shown by our improved valve, and 22 designates a fluid-pressure-thermostat comprising a vessel containing an expansible liquid or gas, such as anhydrous ammonia, said thermostat connected by a pipe 23 to the operating diaphragm chamber of our improved valve.

It is obvious that our improved valve is applicable to many uses besides those illustrated and described herein; also that said valve is susceptible of many variations and modifications without departing from the spirit and scope of our invention and that certain parts may be used in connection with other parts of different construction. We do not limit ourselves therefore, to the particular details of arrangement, construction or operation herein illustrated and described.

What we claim is:

1. In a flow regulating device, the combination with a casing comprising passages and a valve seat, and a valve, of a yoke within said casing connected to said valve, diaphragms embracing said yoke, another yoke embracing said diaphragms, and means for operating the valve, connected to said second yoke.

2. In a flow regulating device, the combination with a casing comprising passages and a valve seat, and a valve, of a yoke within said casing connected to said valve, diaphragms embracing said yoke, another yoke embracing said diaphragms, and automatic means for operating said valve connected to said second yoke.

3. In a flow regulating device, the combination with a casing comprising passages and a valve seat, and a valve, of a yoke within said casing connected to said valve, diaphragms embracing said yoke, another yoke embracing said diaphragms, and thermostatically-operated means for operating said valve, connected to said second yoke.

4. In a flow regulating device, the combination with a casing comprising passages and a valve seat, and a valve, of a yoke within said casing connected to said valve, diaphragms embracing said yoke, another yoke embracing said diaphragms, and fluid-pressure-operated means for operating said valve, connected to said second yoke.

5. In a flow regulating device, the combination with a casing comprising passages and a valve seat, and a valve, of a yoke within said casing connected to said valve, diaphragms embracing said yoke, another yoke embracing said diaphragms, a diaphragm chamber, another diaphragm therein and means connecting said last named diaphragm to said second yoke, for operating the valve.

6. In a flow-controlling device, the combination with a casing comprising passages and a valve seat, and a valve adapted to coact with said seat, of means for operating said valve comprising flexible gas-tight walls on opposite sides of said valve and inclosing and sealing up the same within said casing, said valve being disconnected from said walls and arranged to be actuated directly by movements thereof, said operating means further comprising means abutting against said flexible walls for positively moving the same in both directions.

7. In a flow-controlling device, the combination with a casing comprising passages and a valve seat, and a valve adapted to coact with said seat, of means for operating said valve comprising flexible gas-tight walls on opposite sides of said valve and inclosing and sealing up the same within said casing, said valve being disconnected from said walls and arranged to be actuated directly by movements thereof, said operating means further comprising means abutting against said flexible walls for positively moving the same in both directions, and automatic operating means for said abutting means.

8. In a flow-controlling device, the combination with a casing comprising passages and a valve seat, and a valve adapted to coact with said seat, of thermostatically operated means for operating said valve comprising flexible gas-tight walls on opposite sides of

said valve and inclosing and sealing up the same within said casing, said valve being disconnected from said walls and arranged to be actuated directly by movements thereof, said operating means further comprising thermostatically operated means abutting against said flexible walls for positively moving the same in both directions.

9. In a flow-controlling device, the combination with a casing comprising passages and a valve seat, and a valve adapted to coact with said seat, of fluid pressure operated means for operating said valve comprising flexible gas-tight walls on opposite sides of said valve and inclosing and sealing up the same within said casing, said valve being disconnected from said walls and arranged to be actuated directly by movements thereof, said operating means further comprising fluid-pressure-operated means abutting against said flexible walls for positively moving the same in both directions.

10. In a flow regulating device, the combination with a casing comprising a main section having within it passages and a valve seat, and comprising also covers on opposite sides of said main section and diaphragms interposed between said covers and main section, of a valve within said main section and provided with means abutting against said diaphragms, but disconnected therefrom, whereby said valve may be operated in both directions, and means adapted to move said valve in either direction, through the diaphragms, located outside of said diaphragms, and arranged to engage the same mechanically.

11. In a flow regulating device, the combination with a casing comprising a main section having within it passages and a valve seat, and comprising also covers on opposite sides of said main section and diaphragms interposed between said covers and said main section, of a valve within said main section, a yoke connected thereto and abutting against said diaphragms, another yoke located outside of said diaphragms for operating said valve through the diaphragms, and operating means connected to said second yoke.

12. A regulating device comprising in combination a flow regulator and operating means therefor comprising a diaphragm and diaphragm chamber and a chamber connected to said diaphragm chamber on one side of the diaphragm and containing an expansible fluid, said flow regulator comprising a casing having passages and a valve seat and a valve adapted to coact with said seat and diaphragms on opposite sides of said valve and seat and forming gas-tight walls inclosing the same.

In testimony whereof we affix our signatures, in the presence of two witnesses.

JOHN E. STARR.
THOMAS C. WOOD.

Witnesses:
H. M. MARBLE,
ROGER H. LYON.