Feb. 18, 1958 J. BALTER 2,823,693

AUTOMATIC VENT VALVE

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FIG. 1.

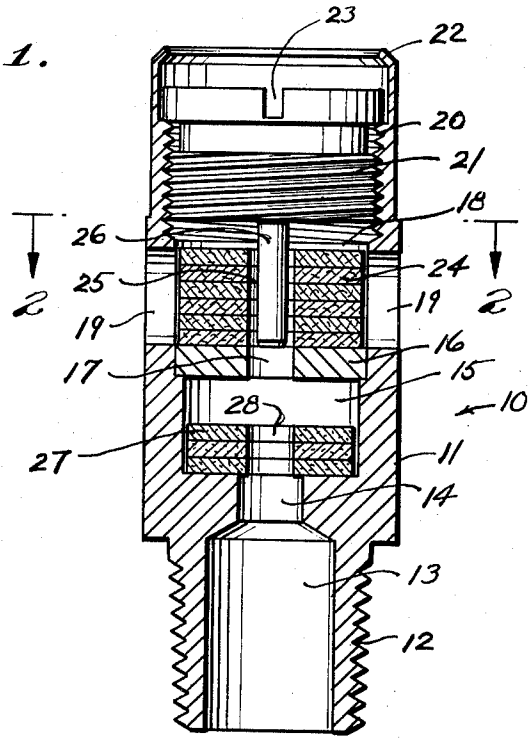
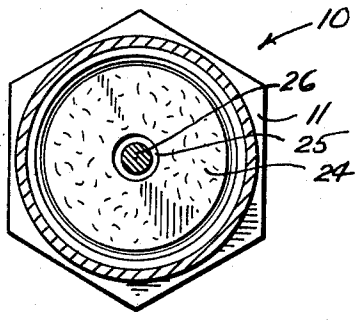


FIG. 2.



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AUTOMATIC VENT VALVE

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2 Claims. (Cl. 137—197)

This invention relates to an automatically operating vent valve permitting the passage of air or other dry gases therethrough and closing off the passage of steam or other moist vapors when the latter reaches the valve, the steam or moist vapor condensing so as to cause the valve to shut off, such a valve being especially adaptable for use in a steam heating system, or other system requiring venting of air or gas.

In a steam heating system having radiators, such as in well-known domestic heating arrangements, it is necessary to vent air or other gases therefrom so that the heating medium or vapor can completely fill the radiator or heat exchanger. In the case of steam heating systems, the boiler, when activated, furnishes steam to the various radiators, and in order for steam to fill each radiator, the air or gas contained in the radiator must be removed or vented. The failure to vent the air from the radiator results in incomplete filling of the latter with steam, and, as a result, in improper functioning of the radiator.

Heretofore, an automatic vent valve has been provided wherein a fibrous means capable of passing air, when dry or substantially dry, is interposed between the inlet and outlet passageways in the body of a steam vent valve. While the fibrous means is normally pervious to air, it becomes substantially impervious to water upon becoming wet. It is intended that a vent valve of the described character will initially vent air through the fibrous means to permit filling of an associated radiator with steam, and that, when steam reaches the valve, the steam condenses on or in the fibrous means to wet the latter which then prevents the escape of liquid or moist steam from the outlet passageway. One of the difficulties has been that if slugs or droplets of water come into contact with the fibrous body before the air is completely vented the valve may close prematurely.

Accordingly, one of the principal objects of the present invention is to provide a vent valve of the described character, for use in steam heating systems and the like, which will vent air or substantially dry gas from the associated radiator or the like, but will not close prematurely.

In one aspect of the invention, moisture absorbent means is interposed between the fibrous means and the inlet passageway of the valve body so that, when slugs or droplets of water in the air reach the valve body such moisture absorbent means takes up a substantial quantity of the water or droplets in the air before steam reaches the fibrous body.

The fibrous means, in a vent valve embodying the invention, peferably consists of a stack of individual discs or washers disposed within a chamber of the valve body interposed between the inlet and outlet passageways of the body and having clearance within the related chamber when the discs or washers are in dry condition, but with the individual discs or washers being made of fibers capable, upon wetting by water or the like, of swelling

a major amount to cause said discs or washers to close the passage between said inlet and outlet passageways through said chamber. For example, the fibers employed for the discs or washers can be cellulose fibers normally used in the manufacture of paper or paper board and which has not been subsequently treated so as to reduce the swelling characteristics, such as, by vulcanizing. Such a fiber will be termed herein as "untreated" cellulose fiber, and normally is made from wood pulp or cotton.

An example of a suitable fiber having unreduced swelling characteristics is a kraft process fiber.

The dimensions of the fibrous discs or washers should be selected so that the swelling thereof, when wet and under unrestrained conditions, will exceed the normal clearance of the discs or washers in the related chamber, whereby the swelling causes the discs or washers to more than fill the chamber, at least in the direction across the outlet passageway. In order to prevent premature closure, a moisture absorbent means is disposed within a chamber apart from the chamber containing the fibrous discs or washers but communicating with the last mentioned chamber between the latter and the inlet passageway of the valve body. The moisture absorbent means can be formed of any suitably absorbent material which, after absorbing water or condenses steam, will not interfere with the passage through the related chamber of additional water or condensed steam. For example, the moisture absorbent means may be formed of discs or washers of the same fibers employed for the discs or washers of the fibrous means, but with such discs or washers of the moisture absorbent means having sufficient normal clearance within the related chamber so that, even after swelling thereof has been completed, the absorbent discs or washers will not completely fill the related chamber to obstruct the passage of liquid therethrough. Preferably, the moisture absorbent discs have aperture means therethrough.

These and other objects, features and advantages of the invention will become apparent from the following description and the accompanying drawings which are merely exemplary.

In the drawings:

Fig. 1 is an axial, sectional view of a vent valve embodying the present invention, with the valve shown in venting condition; and

Fig. 2 is a transverse, sectional view taken along the line 2—2 of Fig. 1.

Referring to the drawings in detail, one form of the invention is there illustrated and generally identified by the reference numeral **10**. Vent valve **10** includes a valve body **11** which may be made of any suitable material, such as brass and the like. Valve body **11** includes a screw-threaded, hollow portion **12** at one end defining an inlet passageway **13** and adapted to be inserted into the radiator to be controlled or the portion of a system to be vented.

Inlet passageway **13** opens, as at **14**, into a cavity or chamber **15** for moisture absorbent means and which preferably has a diameter greater than that of the opening **14**. The end of cavity **15** remote from the inlet passageway is defined by a partition or wall **16** having a central opening **17** which establishes communication between cavity **15** and a main cavity or chamber **18** for accommodating fibrous means controlling the venting. As seen in Fig. 1, body **11** is formed with ports **19** opening laterally from chamber **18** and defining the outlet passageway of the valve body, while the end of the valve body remote from portion **12** is internally threaded, as at **20**, to receive a threaded cap **21** which defines the end wall of chamber **18** opposite wall or partition **16**. Preferably, the end edge of body **11** is turned inwardly, as at **22**, after cap **21** has been inserted thereby to prevent removal of

the cap from the valve body, while the top surface of cap **21** has a slot **23** therein engageable by a tool for rotating the cap to adjust the axial extent of chamber **18** between the confronting surfaces of cap **21** and wall **16**.

It is apparent that flow through valve body **11** follows a path defined by inlet passageway **13**, opening **14**, cavity or chamber **15**, opening **17**, chamber **18** and ports **19** which represent an outlet passageway.

The moisture absorbent body may comprise a plurality of fibrous elements **24**, preferably in the form of annular discs or washers having central openings **25** arranged in an axially extending stack in chamber **18** between the confronting surfaces of cap **21** and wall **16**. A stem **26** projects from cap **21** into chamber **18** and passes loosely through the openings **25** of the fibrous washers with an annular space being defined between that stem and the fibrous washers.

The fibrous washers **24** preferably are made from a kraft process fiber although other similar fibers can be employed. As an example of one type of satisfactory fibrous washer, the fiber thereof in its manufacture can be medium well-cooked and beaten and the fiber board made on a conventional wet machine. Preferably, the fibers are arranged in parallel layers, with the fibers in each layer being randomly oriented therein.

As an example of the characteristics of a satisfactory fibrous washer, one can be used having an apparent density of from 0.80 to 1.40 with an initial swell rate, that is, the percentage increase in thickness of the normally dry fibrous element per specified unit of time as it becomes wet, of more than 5% for the first minute when exposed to water with the washer unrestrained. In one suitable fiber, the initial swell rate is 20% for the first minute and 70% for the first five minutes, such fiber being a kraft process fiber manufactured as described above. The swell rate is not necessarily a straight line relationship, but must be rapid or quick for the first minute. The particular swell rate of the fibrous element or washer also is related to the real volume of the fibers. Another example is a wood fiber having some chemical treatment, a fibrous element formed thereof having a swell rate of 5% in the first minute and 21% during five minutes.

The real volume of the fibers of the fibrous element or washer preferably should be a certain predetermined volume of the active space of the washer, that is, of the actual space occupied by the fibrous washer after the latter is wet by the steam or condensed steam. If the real volume of the fibers is at least 50% of the volume of the active space thereof, it has been found that the fibrous elements or washers will, under most operating conditions, satisfactorily close off and prevent the flow of steam or of condensed steam or water from the outlet ports **19** of the valve.

As seen in Fig. 1, the axial distance between the confronting surfaces of cap **21** and wall **16** is greater than the axial dimension of the stack of washers **24**, when the latter are in a dry condition, while under the same conditions, the diameter of chamber **18** is greater than the outer diameters of the fibrous washers. Thus, so long as dry air or other gas is supplied to the inlet passageway **13** from the associated radiator or the like, such air will pass radially through and between the washers **24** and be vented to the atmosphere at the ports **19**.

However, when the fibrous washers are confronted by steam which condenses on or in the washers or by water, the fibrous washers are wet and swell in the manner described above to more than fill or take up the axial space between the confronting surfaces of cap **21** and wall **16**, whereby the fibrous washers seal off the ports **19** and prevent the escape of the steam or moisture.

The washers **24** are effective to operate in the above described manner for preventing the escape of water or vapor from the valve, only if the water or condensed steam is deposited on or in the washers at a rate which does not exceed that at which the washers can absorb moisture to effect the swelling thereof and the eventual sealing off of ports **19**.

In accordance with the present invention, the premature closing is prevented by providing moisture absorbent material in the cavity or chamber **15**. As seen in Fig. 1, such moisture absorbent material may be in the form of annular discs or washers **27** having central openings **28** and arranged in a stack within cavity **15**. The washers **27** may be formed of the same material described above as being suitable for the washers **24**, that is, of kraft process fibers, and the axial dimension of cavity **15** is greater than the height of the stack of washers **27** when the latter are saturated and the swelling thereof is completed so that the washers **27** are always loosely disposed in cavity **15** thereby to avoid any interference with the flow of gas or liquid from inlet passageway **13** to chamber **18**.

After a period of venting of air or relatively dry gas, the washers **24** and **27** are all in dry condition. When water or steam first reaches valve **10** and passes through cavity **15**, the fibrous washers **27** absorb sufficient quantities of the moisture so that water or condensed steam is deposited on or in fibrous washers **24** at a rate which the latter can completely absorb to cause the swelling of the washers **24** and sealing off of ports **19** forming the outlet passageway. By the time washers **27** are saturated and no longer capable of absorbing moisture, washers **24** have absorbed sufficient water or condensed steam to create a pressure therein capable of preventing passage of steam or water therethrough, thus, within certain limits, the valve will then function independent of the pressure in the associated radiator or system. Further, as mentioned above, the washers **27**, when saturated, do not close off or restrict the flow of gas or liquid through cavity **15** so that liquid or condensed steam evaporating from the outer surfaces of washers **24** is replaced in the latter by condensed steam from the inlet passageway of the valve thereby to keep the ports **19** sealed off against the passage of moisture therethrough.

While the moisture absorbent material in cavity **15** of the above described and illustrated embodiment of the invention is in the form of a stack of fibrous washers, it is to be understood that the latter may be replaced by any other suitably absorbent body, for example, a cylinder of absorbent cotton, which, when dry or saturated, does not close-off or obstruct the flow through cavity **15**. It is also apparent that other and further modifications can be made in the details of the described construction without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In an automatic steam vent valve; the combination comprising a valve body having inlet and outlet passageways, a chamber communicating with said outlet passageway and a cavity between said inlet passageway and said chamber, said cavity communicating with said chamber, fibrous means in said chamber between said cavity and said outlet passageway and directly controlling flow through said chamber, said fibrous means, when dry, passing air to said outlet passageway and, when wet, being impervious to the passage of steam and liquid therethrough, and moisture absorbent means in said cavity defining a continuously open passage through the latter between said inlet passageway and said chamber, said moisture absorbent means being operative to absorb moisture in and thereon from air passing through said cavity to said chamber so that premature closing of the valve is inhibited prior to the time air is exhausted.

2. In an automatic steam vent valve the combination comprising a valve body having an annular chamber with outlet passages in the side wall thereof, a cavity communicating with said chamber through an opening at one end thereof, a closing cap at the other end of said chamber and an inlet passage opening into said cavity at the end of the latter remote from said chamber, a

plurality of fibrous wafers in said chamber between said cap and said one end of the latter, said wafers, when dry, being pervious to air to permit venting of the latter through said outlet passages and, when wet, swelling to fill the space between said cap and one end of the chamber and become impervious to steam and liquid for sealing off said outlet passages, and moisture absorbent fibrous washers in said cavity defining a continuously open passage through the latter between said inlet passageway and said opening to the chamber and operative to absorb water from the flow through said cavity to said chamber so that premature closing of the valve is inhibited, said

moisture absorbent fibrous washers fitting loosely in said cavity, with the clearance between said washers and the walls of the cavity, when said washers are in a dry condition, being greater than the swelling of said washers resulting from saturation of the latter.

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