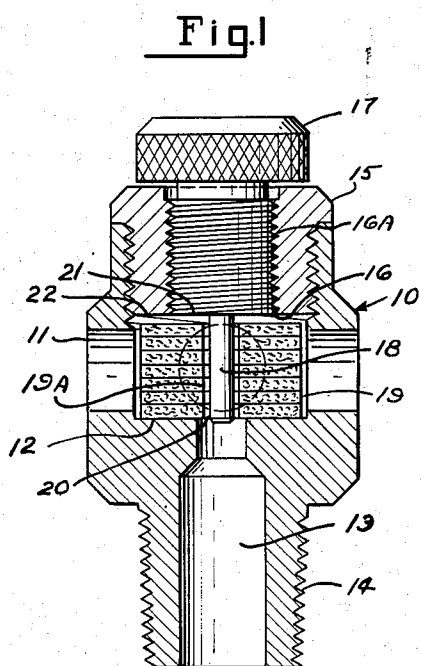
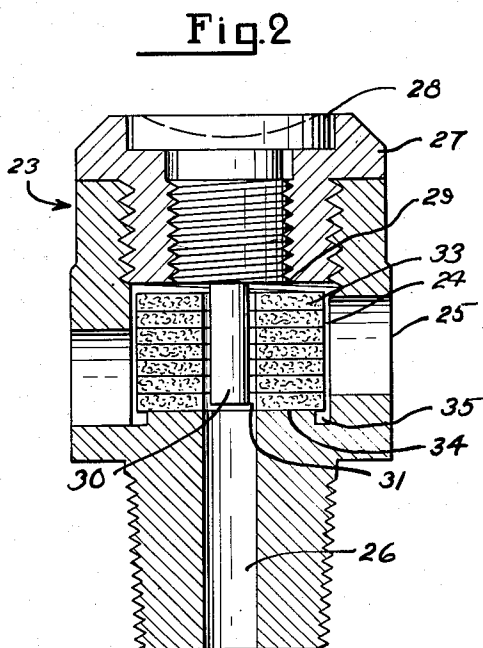
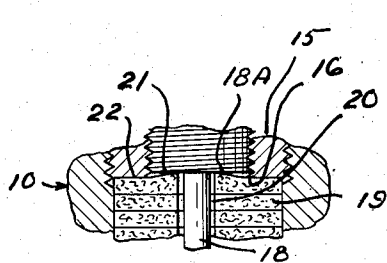
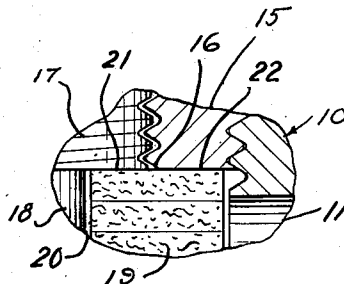
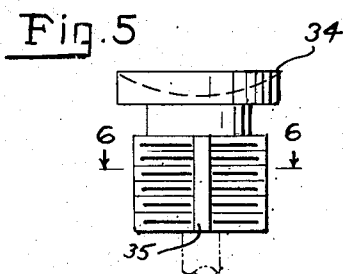
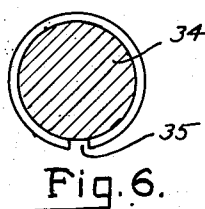


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AUTOMATIC VENT VALVE

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AUTOMATIC VENT VALVE

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This invention relates to an automatically operating vent valve arrangement for use in a heating system, particularly a steam heating system, or similar arrangement, wherein it is necessary to vent air or gas from a space and yet prevent the escape of liquid or vapor.

In a heating system having radiators, such as in well-known domestic arrangements, it is necessary to vent air or other gases therefrom so that the heating medium or vapor in the radiator or heat exchanger can completely fill the radiator. In the case of steam heating systems, the boiler when activated or steaming will furnish steam to the various radiators, and in order for steam to fill each radiator, it is required that air be vented from each. If this is not done, the steam will not be able to fill the radiator concerned and as a result the radiator will not function properly. When the boiler is turned off and as the system cools, the condensing of steam will produce a vacuum and it is necessary that the various vent valves be opened. This becomes a difficult problem in some instances because it is necessary to break said vacuum in a radiator. Various types of mechanically operated valves have been employed previously for venting air but none of these have been entirely satisfactory partly because they are complicated, do not operate consistently, are not reliable, and in some instances are noisy. Also, some of the mechanically operated valves move between entirely closed and entirely open positions, there being no intermediate positions or graduated operation. Many operate to close when a predetermined minimum temperature is reached without regard to whether the fluid being vented is air or steam so that wet steam or droplets of water may be vented undesirably.

One of the objects of the present invention is to provide an improved automatic vent valve which will vent air but which will prevent the passage of steam, water, or liquid therefrom.

Another object of the invention is to provide a vent particularly suitable for use in a steam heating system which will vent air from the radiators, will prevent escape of steam or water, and will open promptly as the boiler cools.

A further object of the invention is to increase the sensitivity of operation of an automatically operating vent valve.

In one aspect of the invention, the valve body can have a main outlet passage with a cavity therein, the cavity having opposed restraining walls, with an inlet passage leading into one of said restraining walls, and an auxiliary outlet

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passage in the opposite restraining wall. Main outlet apertures can be connected to or formed in the side walls of said cavity. A fibrous body or a swellable or distendable body is located in or across the main outlet cavity, the body being one which will swell between said opposed or restraining walls when wet with water or condensed steam and which will close off the flow path between the inlet passage and the main outlet apertures. The auxiliary passage also is controlled by said body and serves to assist in opening the valve as the body starts to dry.

The fibrous body preferably is formed of a plurality of wafers or elements with a central aperture therethrough, the auxiliary passage being in the restraining wall of the cavity opposite the inlet passage, the auxiliary passage being located between said central aperture and the exterior walls of the fibrous body. Preferably, the passage is annular in shape. Swelling of the fibrous body will cause the surface thereof adjacent the restraining wall having the auxiliary passage to close said auxiliary passage. The air being vented may pass through and between said wafers, and it also may pass between the restraining wall of the cavity opposite the inlet passage and the wafer surface adjacent thereto. There may be metallic wafers between the fibrous wafers to assist in the drying or opening thereof.

When the boiler is activated and the valve is open due to the fibrous body being in a venting condition, air or substantially dry gas from the radiator will be vented principally through the main outlet aperture until steam or liquid reaches the fibrous body. At this time, the fibrous body will swell and cut-off flow through the main outlet to the outlet apertures and also to the auxiliary outlet passage. When the boiler is stopped, the condensing steam in the radiator will result in a vacuum or decrease in pressure therein. The fibrous body will start to dry and it can be theorized that the auxiliary passage will open first, which will permit room or ambient air to pass by the fibrous body into the radiator and accelerate drying of the fibrous body so as to thereafter open the passage to the main outlet apertures. It may be that atmospheric pressure acting against a transverse face of the fibrous body will compress it longitudinally so as to assist in the opening. This is in contrast with atmospheric pressure being exerted on the exterior longitudinal walls of the body which will not tend to open the same.

The fibrous body preferably should be made of fibers which will swell a major amount when

unconfined when the body is wet with water or the like. In addition, the swelling should be reasonably fast so that when the fibrous body is confronted with steam or condensed steam, it will swell sufficiently fast so as to close the passage between the inlet passage and both the auxiliary passage and the outlet passage.

The fiber may be composed, for example, of a cotton cellulose fiber which has not been treated so as to reduce the swelling characteristics, such as by vulcanizing. It has been found that a wood fiber tends to oxidize at the higher temperatures involved in a steam radiator, as compared with a hot water system, so that the wood fiber deteriorates more rapidly than a cotton cellulose body. The body and fibers preferably can be selected so that the dry fibers have at least a predetermined real volume in relation to the "active" or actual space occupied by the fibrous body itself and to have a predetermined swell rate when unconfined. The term "active space" means the actual space occupied by the fibrous body or plurality of members constituting the fibrous body after they are once wet by the steam, condensed steam, or liquid. "Swell rate" can be defined as the percentage increase in thickness of the normally dry fibrous body per specified unit of time. The fibrous body should be chosen so that when it swells under unrestrained conditions, the swelled body will more than fill the space between the opposite walls of the cavity which it occupies.

The fibrous body, when it is relatively dry, may have intercommunicating pores therethrough which will be squeezed closed when the body is confined between the opposite restraining walls of the cavity. When the fibrous body is exposed to steam or condensed steam, the fibrous body normally pervious to air will become impervious to passage of water upon becoming wet. The fibers may be substantially randomly oriented in substantially parallel layers.

In a preferred aspect, the restraining wall of the cavity opposite the inlet passage therein has a closing member defining an auxiliary passage lying between the central aperture of a fibrous body in said cavity and the exterior longitudinally extending walls thereof, said passage being closable by the fibrous body. The transverse outside walls of said fibrous body are contactable with said restraining walls of the cavity. The closing member may be screw-threadedly engaged in the valve body or a bushing in the mouth thereof, the screw-threads being relatively loose so as to form a passage from the cavity to the exterior. This passage thus is seen to be restricted. The closing member is retractable relative to said cavity wall so as to provide a recess. When the fibrous body expands, the portion thereof adjacent the central aperture will bend up into said recess. These fibers will be resilient so that upon initial drying or release of pressure, they will spring downward and thus open the auxiliary passage. The recess depth is adjustable so that the sensitivity of the operation can be made that required. As the recess is increased, the sensitivity or quickness of opening normally is increased because the atmospheric pressure acting on the distorted resilient fibers tend to open the auxiliary passage more rapidly than when the top of the fibrous body is substantially flat. During venting, more time is required for the fibers to swell into the recess and thus the closing or sealing is delayed with increase of recess depth. The adjustable or closing member can be adjusted to make the opening quicker and closing slower or can be set so as

to slow the opening and speed the closing. This permits adjustment of the valve according to varying pressures in the different radiators and moisture conditions in each. The closing member can be completely removed for draining or manual venting purposes.

One of the main advantages of the invention described herein is that the valve will permit air to be vented but will not allow the escape of steam. It is arranged in relation to the auxiliary passage so that the drying out or opening of the vent will be accelerated or made possible. The arrangement also is such that it can be adjusted and will properly operate.

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

In the drawings:

Figure 1 is a sectional view of one form of the invention.

Figure 2 is a sectional view of a slightly modified form of construction of Figure 1.

Figure 3 is a fragmentary view of the arrangement in Figure 1 of Figure 2 showing the adjustable closure member backed-off a slight amount, illustrating the bending of the fibers in the fibrous body adjacent the auxiliary passage.

Figure 4 is an enlarged fragmentary view of Figure 3 showing the closure member adjusted so that it is flat in relation to the restraining wall of the outlet cavity opposite to the inlet passage.

Figure 5 is a side view of an alternative form of closing member.

Figure 6 is a sectional view taken along the line 6-6 of Fig. 5.

Valve body 10 may be made of metal such as brass or any suitable material, the valve body having an outlet passage including main outlet apertures 11 and outlet passage cavity or chamber 12. The inlet passage 13 connects with the outlet or fibrous body cavity 12, screw-threaded portion 14 of the valve body 10 being insertable into the radiator to be controlled or portion of the system to be vented. Fibrous body retaining bushing 15 is engageable screw-threadedly with the mouth of valve body 10, the fibrous body 19 being insertable through the mouth of the valve body before the bushing is put in place.

The bushing is interiorly threaded at 16A for relatively loosely receiving the closing or adjusting plug or member 17, the space between the interior aperture of the bushing 15 and the closure member 17 forming an auxiliary passage having an opening 16 into the cavity 12 for venting air from the outlet cavity. Preferably, the tips of the threads on plug 17 are removed as illustrated in Fig. 4 to provide a larger passage than is available in a standard thread. The amount removed can be in the range of .005 inch of diameter per side. Merely by way of example, in a standard 1/4 inch diameter 28 threads per inch screw thread, the rod used for the screw portion can be reduced prior to thread cutting to 0.235 inch from the standard diameter of approximately 0.248 inch. Of course, the clearance can be made greater if desired or an auxiliary port connected to the auxiliary passage to augment the venting path, the path being closable by the fibrous body when wet. The fit should be such as to provide for the passage of air to and from the radiator.

One example of an auxiliary port is illustrated in Figs. 5 and 6 wherein a closing member 34 corresponding to 17 or 28 of Fig. 1 or 2 can have

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a slot 35 cut the depth of the threads. The slot is closed off by the fibrous body together with the opening 16. In the form shown in Figs. 5 and 6, the post has been omitted and such can be done especially where a moist radiator condition exists.

As an example of the characteristics of a fibrous body which will operate, the wafers used can have an apparent density of between 0.80 and 1.40 and an initial swell rate for the first minute of more than 5% when exposed to water with the body unrestrained. In a preferred fibrous body, the initial swell rate is 20% for the first minute and it will swell 70% in 5 minutes. The fiber preferably is a cotton cellulose fiber or primary alpha cellulose fiber, the fibers being substantially randomly oriented in substantially parallel layers. The swell rate is not necessarily a straight line relationship but should be relatively rapid or quick during the first minute.

Theoretically, the fibrous body will absorb only enough liquid to create a sufficient pressure to prevent further passage of water therein. Thus, within practical limits, the valve will shut-off regardless of the pressure existing in the radiator. After the body has absorbed sufficient liquid to close off, liquid may evaporate from the surfaces thereof, but this will be replaced.

The real volume of the fibers of the body should be a certain predetermined volume of the "active" space of the fibrous body. It has been found, for example, that if the real volume is at least 50% of the active space, that the valve will close off properly and prevent the flow of steam to the outside of the radiator.

As mentioned, it will be apparent that air can pass through the space 20 between post 13 and the central apertures 19A, through the fibrous body, between the wafers, and between the cavity wall opposite the inlet passage to the main outlet apertures 11. Air also can pass through the auxiliary passageway 16 when the valve is open.

If the closing member 17 is adjusted so that its face 21 is substantially flush with the inner face 22 of bushing 15 as seen in Figure 4, the fibrous body 19 upon swelling will close off the auxiliary passageway 16 (Figure 4) and also the passage between face 22 and the fibrous body leading to the main outlet passage 11. After the boiler has been stopped and the system starts to cool, the fibrous body 19 will start to dry. First it will dry sufficiently to open the auxiliary passage 16 which will permit outside or room air to pass by the threads through the auxiliary passage 16 and around the fibrous members 19 through passageway 20. This will accelerate the drying process of the fibrous body causing the main passageway 11 to be opened promptly. If subject to vacuum, the atmospheric pressure acting on the longitudinal walls of the fibrous body through outlet apertures 11 will not act to cause opening of the valve as it starts to dry, whereas pressure acting longitudinally through auxiliary passage 16 will tend to compress the body and open the valve.

If an adjustment needs to be made so as to insure quicker opening of the auxiliary passageway, the closure member 17 may be adjusted in bushing 15 so that it is withdrawn relative to the fibrous body cavity 12 forming a recess in the cavity wall, as can be seen in Figure 3, wherein member 17 has been moved outwardly relative to face 22 of bushing 15. The cavity face 21 of member 17 defines one wall of a recess into which the fibers of the upper portion of the fibrous body 19 can swell. This is illustrated at 18A (Fig. 3)

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wherein the fibers are forced out of their substantially parallel relationship to the upper face of the fibrous body. The fibers naturally tend to straighten because of their resiliency so that as the drying action starts, these fibers will spring back toward the former straight relationship and thus open the auxiliary passageway 16 to permit air to flow to passage 20 and thus accelerate the drying action of the fibrous body to open the main outlet apertures.

A slightly different arrangement of the parts of the invention is illustrated in Figure 2 wherein valve body 23 has a fibrous body cavity 24 with main outlet apertures 25. In the form illustrated, the outlet apertures are not aligned. Inlet passage 26 is connected with the fibrous body cavity 24. Bushing 27 is screw-threadedly engaged in the mouth of valve body 23 and may have a closure member 28 loosely threaded therein so as to provide an auxiliary passage 29 as in Figure 1. The closure member 28 may have a depending post 30 as in the previous form, there being a passageway 31 between said post and the aperture walls 32 of the fibrous body means 33. Fibrous body restraining or opposed wall 34 of the fibrous body cavity 24 may be undercut so as to provide an annular recess 35 therearound providing an additional ventilated fiber area. The closure member 28 may be adjusted in the same manner as that described for Figure 1, and the device will operate in a similar manner.

It should be apparent that variations can be made in the construction of the valve and that the bushing could be pressed into the mouth of the valve body and held in by crimping. Also, the valve body could be made in two parts. Other variations will readily be suggested, all coming within the scope of the invention as set forth in the appended claims.

What is claimed is:

1. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein, main outlet means connected to said cavity, an inlet passageway in said body connected to said cavity, a water absorbent fibrous body in said cavity, said fibrous body normally passing air from said inlet passageway to said main outlet means and shutting off passage of air to said main outlet means when subjected to moisture, and an auxiliary outlet passage between said fibrous body and said main outlet means, said auxiliary passage being controlled by said fibrous body, said auxiliary passage being closeable by said fibrous body when said fibrous body is subjected to moisture and openable to accelerate opening of said main outlet means.

2. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein and a main outlet from said cavity, an inlet passageway connected to said cavity, a restricted auxiliary passage connected with said cavity, and a water absorbent fibrous body in said cavity, said fibrous body normally passing air through said cavity from said inlet passage to said outlet and shutting off said flow when subjected to moisture, said fibrous body closing said auxiliary passage and normally opening said auxiliary passageway before said main outlet.

3. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein and a main outlet from said cavity, an inlet passage in said body connected to said cavity, an auxiliary passage connected to said cavity at a point between said

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inlet passage and said main outlet, said auxiliary passage terminating in one end wall of said cavity, said end wall having a surface adjustable from a plane surface to a surface having a recess, and a fibrous body extendable between walls of said cavity when wet closing off said main outlet and said auxiliary passageway, one surface of said fibrous body following said wall of said cavity into said recess, said auxiliary passageway accelerating opening of said fibrous body so as to facilitate opening of said main vent.

4. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein with transverse main outlet means therefrom, an inlet passage having a longitudinally located opening into a transverse restraining wall of said cavity, an auxiliary passage opening into a restraining wall of said cavity opposite said inlet passageway, a water absorbent fibrous body between said restraining walls, said fibrous body normally passing air from said inlet passage to said main outlet means but when subjected to moisture, closing off both said main outlet and said auxiliary passage, said auxiliary passage upon opening accelerating opening of said fibrous body.

5. An automatic air vent valve comprising a valve body, an outlet passage in said body having a cavity therein with transverse main outlet aperture means connected therewith, an inlet passage having a longitudinally located opening into a transverse wall of said cavity, an annular auxiliary passageway opening into the wall opposite said inlet passageway, a water absorbent fibrous body between said walls, said fibrous body having a longitudinally extending passage therethrough terminating interiorly of said annular auxiliary passageway so that one surface of said fibrous body when wet can close off said annular auxiliary passageway, said fibrous body normally passing air but when subjected to moisture, closing off both said main outlet and said auxiliary passageway, said auxiliary passageway accelerating opening of said fibrous body.

6. An automatic air vent valve comprising a valve body, an outlet passage in said body having a cavity therein with transverse main outlet aperture means connected therewith, an inlet passage having a longitudinally located opening into a transverse wall of said cavity, an auxiliary passageway opening into the wall opposite said in-

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let passageway, a water absorbent fibrous body composed of a plurality of wafers located between said walls, said wafers having apertures defining a longitudinally extending passage therethrough terminating interiorly of said auxiliary passageway so that one surface of said fibrous body when wet will close off said annular auxiliary passageway, said fibrous body normally passing air but when subjected to moisture, closing off both said main outlet and said auxiliary passageway, said auxiliary passageway accelerating opening of said fibrous body.

7. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein with main outlet aperture means connected to said cavity between end walls thereof, an inlet passage connected to one of said end walls, a screw threaded plug in the opposite end wall defining an auxiliary annular outlet passage, an apertured water absorbent fibrous body located between said end walls, one face of said fibrous body being adapted to close off said annular outlet passage when subjected to moisture, said auxiliary passage admitting air to said fibrous body so as to assist in opening the passage to the main outlet.

8. An automatic air vent valve comprising a valve body, a main outlet passageway in said body having a cavity therein with a main outlet aperture means connected to said cavity between end walls thereof, an inlet passage connected to one of said end walls, a screw threaded plug in the opposite end wall defining an auxiliary annular outlet passage, a water absorbent fibrous body located between said end walls, said fibrous body having an aperture extending therethrough, one face of said fibrous body being adapted to close off said annular outlet passage when subjected to moisture, and a stem depending from said plug through the aperture in said fibrous body, said auxiliary passage accelerating initial opening of the valve.

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