W. M. FULTON.

AIR VALVE FOR STEAM RADIATORS.

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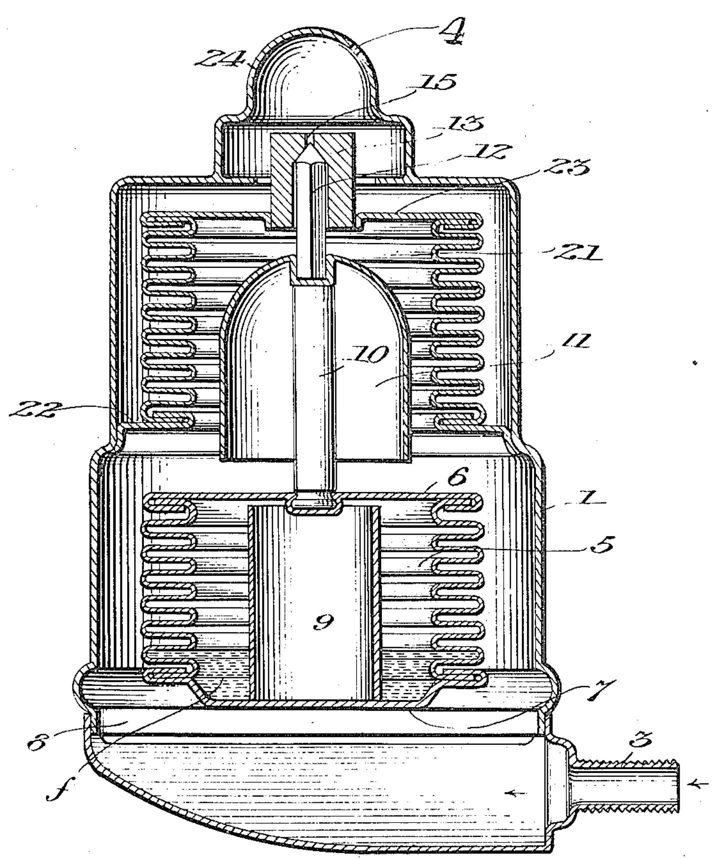
1,044,040. Patented Nov. 12, 1912.



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UNITED STATES PATENT OFFICE.

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AIR-VALVE FOR STEAM-RADIATORS.

1,044,040. Specification of Letters Patent. Patented Nov. 12, 1912.

Application filed April 12, 1910. Serial No. 554,989.

To all whom it may concern:

Be it known that I, WESTON M. FULTON, of Knoxville, Tennessee, have invented new and useful Improvements in Air-Valves for Steam-Radiators, which invention is fully set forth in the following specification.

This invention relates to valves and particularly to air valves for steam radiators and has for its object to provide an automatic valve of the above kind which is positive in action and reliable under all conditions whereby air is permitted to escape from the radiator in advance of the entering steam, while the steam and water are prevented from escaping; and also to provide a valve combining these capabilities and the further capability of venting air from the radiator, but preventing return of air to the radiator when the temperature of the latter falls.

In radiator air valves, it is usual to close the valve opening by means of a valve which is moved into seating position by the expansion of a rod or by the movement of a diaphragm operated by the expansion of a fluid. In either form of such valves, means are necessary to protect the valve against the occasional excessive force of expansion of the rod or diaphragm; otherwise undue pressure of the valve on its seat may occur or may cause the valve stem to buckle or strain some of the valve parts so that it cannot operate correctly at the moderate temperature for which it was originally adjusted.

It is the primary object of my invention to overcome this objection and to provide an air valve in which the expanding element for causing the seating of the valve always exerts a predetermined and substantially uniform maximum pressure for all temperatures of the steam in the radiator thereby protecting the valve parts from injury due to undue pressure on the valve and avoiding special mechanical constructions for protecting the valve. To accomplish this object, I provide within the usual air valve casing a collapsible and expansible vessel in which is placed a small quantity of liquid, such as water, and a gas, such as air, hermetically sealed therein. The combined pressure of the water vapor and air in the vessel should be materially lower than atmospheric pressure at ordinary temperatures and at the temperature of steam as used in steam heating the excess of fluid pressure inside the vessel shall have a slight but practically constant excess of pressure over that on the exterior walls of the vessel. This is readily accomplished at the time of sealing the vessel after introducing the liquid by rarefying the air by pumping out a material part thereof from the vessel at the ordinary room temperature.

The quantity of water in the vessel is sufficient to insure water in liquid form in the vessel when exposed to the steam from the radiator. I prefer this combination of fluids because the expansive force of water vapor and air inside the vessel will always bear an approximately constant ratio to the pressure of the steam on the outside of the vessel and within the valve casing. For example, suppose that a maximum pressure of 5 pounds per square inch is desired on the movable end of the collapsible and expansible vessel to act on the valve when steam is turned on to the radiator and the steam happens to be at 213° F. The water vapor pressure in the vessel at this temperature of 213° F., the assumed temperature, will be 15 pounds per square inch, which with the 5 pounds of air pressure amounts to 20 pounds per square inch tending to expand the vessel. The steam at 213° F. outside the expansible and collapsible vessel and within the valve casing exerts a pressure of 15 pounds per square inch to collapse the vessel. There is therefore an effective force to expand the vessel of 5 pounds per square inch. This is substantially the maximum pressure for a vessel filled under the conditions named and is practically the same for all temperatures met with in steam radiator heating. It is obvious that the valve which is seated by the expansion of the expansible member will not be pressed against its seat with more than this maximum pressure, whatever the temperature of the steam in the radiator. While I have mentioned 5 pounds pressure per square inch as a convenient maximum for the vessel, yet any predetermined pressure may be selected for the purpose of meeting varying conditions of steam heating. Instead of water and its vapor, I may use any other volatile liquid, provided that its vapor tension approximates that of the steam used in heating. I, however, prefer to use water for obvious reasons of economy and because it is identical with the heating fluid used in the radiators. I may employ this same principle of operation in any type of air valve attached to a steam radiator and designed to vent air and cut off escape of steam, or venting air and cutting off steam and water and preventing return of air to the radiator.

In order that the invention may be clearly understood, I will describe the same with reference to one mechanical expression of the same represented by way of example in the accompanying drawings, in which—

1 is a valve casing provided at or near its lower portion with a nipple 3 for connecting the casing with the space in a radiator not shown. To the central part of this casing is secured by aid of a ledge 22 an inverted collapsible and expansible vessel 21 making a tight connection therewith. Mounted on the movable end wall 23 is a vent tube 13 having a vent opening 15. This tube also serves as a loose guide for a square valve stem 12 mounted on an inverted bell float 11. Within the valve casing 1 and below the corrugated member 21 is located a corrugated collapsible and expansible vessel 5 provided with rigid end walls 6, 7 the top wall being movable and the bottom wall being stationary and supported in any suitable manner as by ribs 8 fast to the wall 1 of the casing. In order to limit the downward movement of the upper wall 6 when the vessel collapses, a stop or limiting member 9 is preferably employed. Within the vessel 5 is placed a volatile liquid *f* whose vapor tension is below atmospheric pressure at ordinary temperatures but is substantially equal to said pressure at the temperature of steam. For this purpose, water has been found to be a suitable fluid though other fluids are no doubt available to meet the requirements. The remaining space within the vessel is filled with an inert gas, such as air, the pressure of which at ordinary temperatures is below atmospheric pressure and may vary depending on the pressure desired as the maximum for closing the valve. To guide and at times to act as a support for the bell 11, a support 10 is mounted on the movable end wall 6. A closure 24 having a vent 4 is preferably provided in connection with the outer upper wall of casing 1 to protect the working parts.

With the parts in position as shown in the figure, the valve is assumed to be in normal position and ready to operate to vent air The vessel 5 is under external atmospheric when steam is turned on the cold radiator. pressure at room temperature and in collapsed position. Float 11 rests on its support 10. Vessel 21 is acting through the resiliency of its walls to press the valve seat in guide 13 against the end of the valve stem 12 to close the vent 15. When steam is turned on, the air in the radiator is forced forward under more or less pressure, enters the valve casing through connection 3 and extends the wall of vessel 21 upward, thereby lifting the valve seat off the valve and permits the air to escape. In case water is present in the radiator and enters the valve casing, the float raises as previously explained and closes the valve opening. When the steam reaches the valve casing the heat thereof acts on vessel 5 in the manner above described to finally maintain the vent opening 11 closed. In case the steam pressure falls in the system, air does not now enter the radiator because the contractile force acting through the end wall 23 of vessel 21 overcomes steam pressure in the valve casing, thereby causing the valve seat in guide 13 to press on and follow the valve stem to its initial position.

It will be apparent from this description that a considerable vacuum can be maintained in the system, provided the pipe connections are tight whereby circulation of vapor through the radiators at a temperature below that of boiling water may be maintained, thus prolonging the efficient action of the steam generating boiler when the supply of fuel has been partly consumed.

What is claimed is:—

1. In an air valve for steam radiators, a chamber open to the steam space of the radiator and comprising a rigid portion and a corrugated collapsible and expansible vessel portion, a valve seat on said yielding portion, a collapsible and expansible thermosensitive vessel within said chamber and having a stationary end wall and a movable end wall, and a valve loosely mounted between the movable end walls of said vessels and normally held in seated position by the same.

2. In an air valve for steam radiators, a chamber open to the steam space of a radiator and comprising a rigid portion and a corrugated collapsible and expansible vessel portion, a valve seat on said yielding portion, a collapsible and expansible thermosensitive vessel within said chamber and having a stationary end wall and a movable end wall, a valve provided with a float loosely mounted between the movable end walls of said vessels and normally held in seated position by the same.

3. In an air valve for steam radiators, a chamber open to the steam space of a radiator and comprising a rigid portion and a valve collapsible and expansible portion, a valve seat on said yielding portion, a collapsible and expansible vessel containing a volatile liquid and a gas under a pressure at ordinary atmospheric temperatures less than at-

mospheric pressure, said vessel having a stationary end wall and a movable end wall, and a valve loosely mounted between the movable end walls of said yielding portions and normally held in seated position by the same.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:
M. L. JONES,
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