March 13, 1928. 1,662,659

W. W. BIRNSTOCK

MODULATING VALVE

Filed April 23, 1927

Fig. 1.

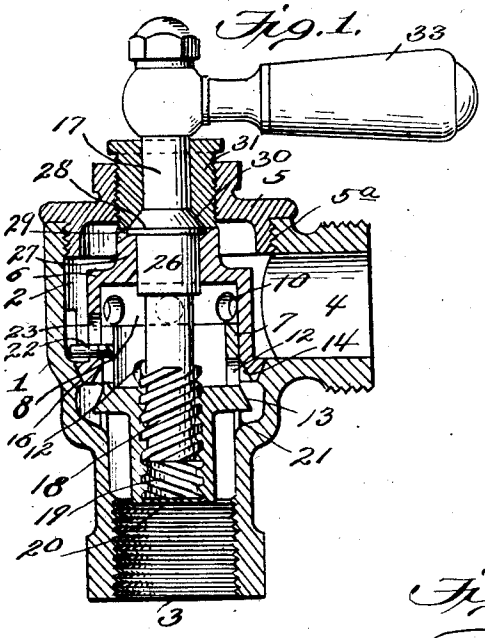


Fig. 2.

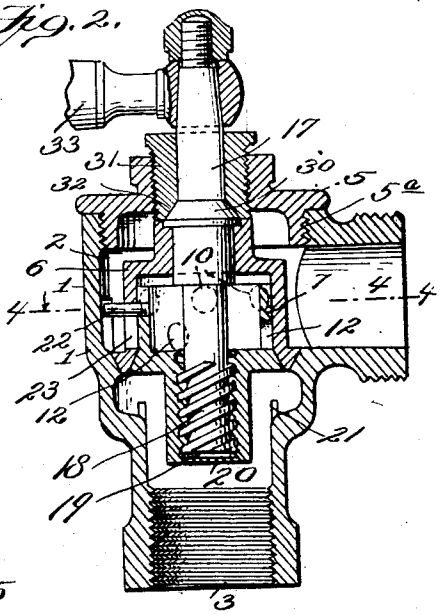


Fig. 5

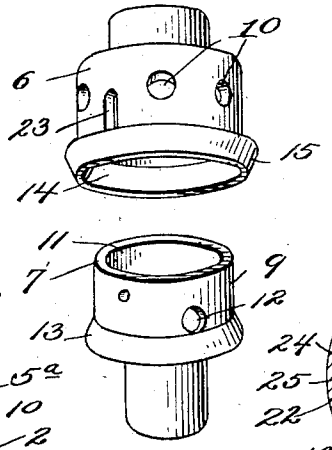


Fig. 3.

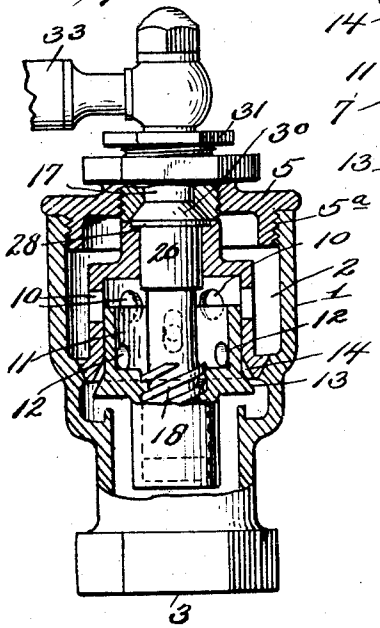
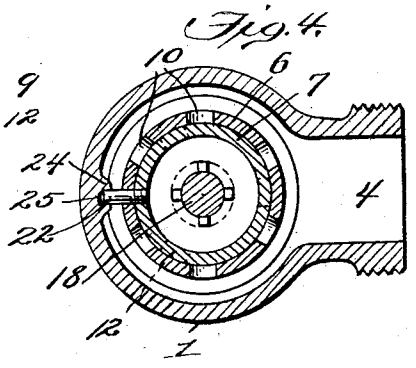


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MODULATING VALVE.

Application filed April 23, 1927. Serial No. 186,117.

The present invention relates to improvements in valves, and more especially to those of the type adapted for use in vapor or steam heating systems for modulating the supply of vapor or steam to the radiators or other heating units.

The principal object is to provide a valve of this type which comprises valve and seat members which constitute a unit capable of being bodily removed from the valve casing for repair or replacement, the valve stem is provided with a joint-forming collar to prevent leakage of vapor or steam along the stem from the interior of the casing, and a member fitted into the valve cap bears on the collar on the stem to form a fluid-tight joint therewith and also acts on the seat member to force it on to and to hold it in fluid-tight engagement with the seat in the casing. The improved valve thus possesses the advantages derived from the use of removable valve and seat members and it avoids the objections incident to the use of a stuffing box for the valve stem, and the same part which forms a leakless joint around the stem serves to force the seat member against its seat in the casing and to hold it in such position, thereby simplifying and improving the construction of the valve.

Another object is to provide a novel and improved construction and arrangement of the valve and seat members whereby modulation of the flow of vapor or steam and tight closing of the valve, even when steam at a considerable pressure is used, may be attained with ease and facility, and sticking of the valve member, due to corrosion of the valve and seat members, is avoided, notwithstanding that the valve may be operated or adjusted infrequently.

A further object of the invention is to provide an improved construction and arrangement of the valve and seat members and the threaded portions of the stem and valve members which cooperate to open and close the valve, whereby compactness is attained.

To these and other ends, the invention consists in certain improvements and combinations and arrangements of parts all as will be hereinafter described in detail, the features of novelty being pointed out particularly in the claims at the end of the specification.

In the accompanying drawing:—

Fig. 1 represents a section taken axially through a modulating valve constructed in accordance with the preferred embodiment of the invention, the valve being shown open;

Fig. 2 is a view similar to Fig. 1 but showing the valve closed;

Fig. 3 is a view similar to Figs. 1 and 2 but showing the valve partly open to modulate the flow of vapor or steam;

Fig. 4 represents a transverse section through the valve, the section being taken on the line 4—4 of Fig. 2; and

Fig. 5 is a collective view showing the cooperative valve and seat members in perspective.

Similar parts are designated by the same reference characters in all of the figures.

Valves embodying the present invention are applicable to various uses where it is desired to modulate closely the flow of a fluid or to completely interrupt the flow. The invention, however is particularly applicable to vapor or steam heating systems for the purpose of regulating or controlling the supply of vapor or steam to the radiators or other heating units. The valve provided by the present invention is adapted to be used in either vapor heating systems or systems using steam at an appreciable pressure, as the valve is capable not only of modulating the flow of the heating fluid but it is also capable of cutting off completely the flow of steam although the latter may be under a considerable pressure, and when so used, the valve avoids loss of heat which would otherwise result when it is desired to cut off the heat from a radiator. The preferred embodiment of the invention is shown in the accompanying drawing and will be hereinafter more fully described, but it is to be understood that the invention is not restricted to the precise construction shown as equivalent construction are contemplated and such will be included within the scope of the claims.

In the present instance, the valve comprises a casing 1 which forms a chamber 2 therein, and branch passages 3 and 4, the top of the chamber 2 being closed by a cap 5 which is threaded or otherwise removably fitted to the top of the casing. The valve shown is of the type adapted for use on the radiator of a vapor or steam heating system, for which purpose, the passage 3 is

arranged vertically and is threaded or otherwise adapted for connection to the vapor or steam supply pipe while the passage 4 extends laterally or horizontally and is threaded or otherwise adapted for connection to the radiator.

The valve structure is contained substantially within the chamber 2 in the casing, and it comprises, according to the present invention, a seat member 6 and a cooperating valve member 7. The seat member is formed with an interior cylindrical chamber 8 and the valve member is formed with a cooperating cylindrical sleeve-like portion 9 capable of telescoping within the valve member and moving axially therein during opening, closing and adjusting of the valve. The wall of the seat member is provided with a suitable number of ports 10 which establish communication between the interior chamber of this member and the exterior thereof or the chamber 2 in the valve casing, and these ports are adapted to be either lapped completely and thus closed by the telescoping sleeve-like portion 9 of the valve member, as shown in Fig. 2 or completely uncovered by the valve member and thus completely opened, as shown in Fig. 1, or these ports may be partially lapped, more or less, by the upper edge of the valve member, as shown in Fig. 3, whereby the flow of vapor or steam through these ports is modulated. The partial or complete opening or closing of the ports 10 it will be understood, is effected by adjustment of the axial position of the cylindrical sleeve 9 of the valve member within the cylindrical chamber of the seat member. The valve member 7 is also formed with an interior chamber 11 and with ports 12 which extend through the wall of the sleeve 9 and communicate with the chamber 11. These ports 12 are arranged so that they will be covered and uncovered by the lower end of the cylindrical interior portion of the seat member concurrently with the opening and closing of the ports 10, during axial movements of the valve member relatively to the seat member. The vapor or steam thus reaches the interior chambers of the valve and seat members through the ports 12 and discharges therefrom through the ports 10.

In order to avoid the difficulties resulting from sticking of the valve and seat members as heretofore experienced in modulating valves, due to corrosion of these parts the sleeve-like cylindrical portion 9 of the valve member is fitted sufficiently loosely in the cylindrical chamber 8 of the seat member to allow movement of the valve member notwithstanding corrosion that may form on these cooperating surfaces, but the fit of these parts will be sufficiently close to avoid appreciable leakage between them so that the ports 10 and 12 will function to modulate the flow of vapor or steam, as desired. For practical purposes, a clearance of 1 or 2 hundredths of an inch between the cooperating cylindrical surfaces of the valve and seat members will be satisfactory. However, in order to effectively close the valve and especially when used in a steam heating system wherein the steam is at an appreciable pressure above atmospheric, tight closing surfaces are provided which are brought into engagement when the valve member reaches its fully closed position. In the present instance, a conical valve surface 13 is provided on the valve member, it projecting circumferentially from the base or lower end of the cylindrical surface 9 thereon, and the seat member 6 is formed with a corresponding conical surface or seat 14 which extends outwardly from the lower end of the cylindrical bore in the seat member. When the valve is moved into its uppermost position to completely lap and close the modulating ports 10 and 12, as shown in Fig. 2, the conical valve surface 13 comes into engagement with the conical seat 14 and thereby effects a tight closing of the valve, the valve being then capable of withstanding steam pressure without leakage of steam therefrom to the radiator. It will be understood that when the valve member is moved to or toward open position, the conical valve surface 13 recedes from the conical seat 14, thus providing a passageway between these conical surfaces through which the vapor or steam may flow to and enter the ports 12, as will be clear from Figs. 1 and 3.

The seat member 6 is removably fitted into the valve casing and is contained in the chamber 2 therein. According to the present invention, the lower outer circular edge of the seat member is formed with a conical surface 15 the angle of which is the reverse of that of the conical seat 14, and the valve casing is formed, at the bottom of the chamber 2, with a conical seat 16 which conforms with and makes a fluid-tight fit therewith. The opening 5^a in the top of the casing and which is normally closed by the cap 5 is of a diameter somewhat greater than that of the conical portion 15 or the portion of the seat member which is of the greatest diameter so that the seat member may be inserted and removed through this opening. This construction enables the conical surfaces 15 and 16 to be ground or lapped one against the other in a manner which will be well understood, thus enabling an effective fluid-tight joint to be formed.

The valve member is shifted axially within the seat member to open or close or adjust the valve opening by a rotatable stem 17 which extends downwardly through the cap 5 and the seat member 6 and has a threaded lower end 18 which engages in a correspondingly threaded sleeve 19 which is

fixed to and extends downwardly from the valve member 7, the bottom of this threaded sleeve being closed by the wall 20. The downwardly projecting threaded sleeve 19 is accommodated in the branch passage 3 of the valve casing, the location of this threaded sleeve and the co-operating threaded portion of the valve stem at this point resulting in a more compact structure than is the case where the operating thread on the stem is located above the valve member or on the upper portion of the stem. It will be understood that the threaded portion of the stem and the correspondingly threaded portion of the valve are such that rotation of the stem while held against axial movement will cause axial movement of the valve member relatively to the seat member. The threaded construction is preferably so proportioned that a half revolution of the valve stem will serve to completely open or completely close the valve. Rotation of the stem in a direction to close the valve will be arrested by the engagement of the conical valve seat 13 with the conical surface 14, and rotation of the valve stem in a direction to open the valve may be arrested by the engagement of the valve member 7 with lugs or similar portions 21 within the valve casing and below the conical surface 13 thereon. The valve member is held from rotation under the influence of the rotation of the valve stem by a pin 22 which may be threaded or otherwise fixed in the valve member 7 and guided to move axially by a slot 23 in the seat member 6, the pin reciprocating axially in the slot 23 but being held from rotation thereby. Furthermore, rotation of the seat member 6 within the valve casing is prevented by forming the casing with a pair of ribs 24 which extend vertically or axially within the chamber 2 and provide a channel or groove 25 between them in which the outer end of the pin 22 may reciprocate vertically in unison with the opening and closing movements of the valve member. When the conical surface 15 of the seat member is to be ground or lapped against the conical seating surface 16 in the casing, the pin 22 may be unscrewed or otherwise removed from the valve member, and the seat member may then be rotated and otherwise manipulated within the valve casing as the lapping or grinding operation may require. While the pin 22 is fixed in place, it unites the valve and seat members as a unit which may be bodily inserted into or removed from the casing together with the stem.

The stem has a relatively close rotatable fit in the top of the seat member 6, it being provided in the present instance with a cylindrical enlargement 26 which fits closely within a tubular extension 27 on the top of the seat member. The stem is provided with a collar 28 which is fixed thereon and is arranged immediately above the seat member so that it will bear at its under side on the top of the tubular extension 27. Preferably, the upper end of the tubular extension 27 is formed with a circular recess 29 into which the lower portion of the collar fits. The upper side of the collar 28 is formed preferably with a conical surface 30, and a bushing 31 is threaded into and through the cap 5 and has a conical surface 32 thereon which conforms with and is adapted to make a fluid-tight fit with the conical surface 30 on the collar on the stem. The lower end of the bushing surrounding the collar 28 on the stem is adapted to bear on the upper end of the tubular extension 27 of the seat member exteriorly of the circular recess 29, so that when the bushing is screwed down in the cap, it forces the seat member solidly into fluid-tight engagement with the conical seat 16 in the casing and at the same time forms a fluid-tight joint with the upper surface of the collar on the stem so that leakage of vapor or steam along the stem is prevented. The bushing will act to prevent upward displacement of the stem, and the bearing of the collar 28 on the top of the seat member will prevent downward displacement of the stem. Axial displacement of the stem in either direction is thereby prevented. While the bushing 31 when tightened forms a fluid-tight joint with the collar on the valve stem, undue pressure of the bushing against the collar, which would render difficult or would prevent rotation of the stem, is prevented by the engagement of the lower end of the bushing with the upper end of the tubular extension on the seat member, the latter thus serving as a stop which properly limits the pressure exerted by the bushing on the collar. The stem has fixed thereto above the bushing a handle 33 which serves as means for rotating the stem to open and close and adjust the valve to modulate the flow of vapor or steam therethrough. This handle is removable so that the bushing 31 may be detached from the stem or lapped or ground against the conical joint forming surface on the collar on the stem.

Unscrewing of the cap 5 will permit removal of all of the operative parts of the valve from the casing, and unscrewing of the stem from the threaded portion 19 of the valve member 7 enables the valve stem together with the cap to be detached from the valve and seat members. While the parts are removed from the casing, the conical surfaces 13 and 14 of the valve and seat members may be ground or lapped against one another, during which operation, the pin 22 is removed, and as previously stated, the seat member may be ground or lapped in the casing while the pin 22 is removed. After the parts have been assem-

bled and the cap 5 has been applied and tightened solidly in the casing, tightening of the bushing 31 performs the dual function of forcing the seat member 6 to its seat in the casing and of forming a fluid-tight fit with the collar on the stem. While the parts are held in this condition, endwise displacement of the stem is prevented, and rotation of the stem in the appropriate direction and to a suitable extent will open, close or adjust the valve as may be desired.

By avoiding the use of a stuffing box and constructing the valve and valve seat members so that they have sufficient clearance to avoid sticking together of these parts when corroded, a valve is provided which is always in condition for operation, notwithstanding that the valve may be operated or adjusted only at infrequent intervals. The removable construction of the parts enables them to be reground or refitted with ease and facility, and the combination and arrangement whereby a single bushing serves to form a fluid-tight joint with the collar on the stem and to hold the valve seat member against its seat in the casing simplifies and improves the valve and facilitates its assembly and maintenance.

I claim as my invention:—

1. A valve comprising a casing, a valve seat member adapted to seat therein, a valve member cooperative with the seat member, a rotatable actuating stem for the valve member having a collar thereon, and an element operative to seat the seat member in the casing and to form a fluid-tight joint with the collar on the stem.

2. A valve comprising a casing having a seat therein, a valve seat member adapted to engage said seat in the casing, a valve member cooperative with said seat member, a rotatable stem having a thread connection with the valve member and also having a collar fixed thereon and arranged to abut against said seat member, and an element operative to form a fluid tight joint with said collar on the stem and to hold the seat member against its seat in the casing.

3. A valve comprising a casing having a seat therein, a valve seat member adapted to engage said seat in the casing, a valve member for cooperating with said seat member, a rotatable actuating stem for the valve member having a fixed circumferential collar thereon, and a bushing surrounding the stem and adjustable axially thereof to engage and form a fluid-tight joint with said collar and to bear on the seat member to hold it on its seat in the casing.

4. A valve comprising a casing having a seat therein and an opening opposite to and of a diameter at least as large as said seat, a seat member capable of insertion and removal through said opening and adapted to engage said seat in the casing, a valve member cooperative with the seat member, a cap separate from the seat member and fitted to the casing to close said opening therein, a rotatable actuating stem for the valve member, extending through the cap and having a fixed collar thereon, and a bushing threaded in the cap and engaging the collar on the stem to form a fluid-tight joint therewith and bearing on said seat member to hold it against its seat in the casing.

5. A valve comprising a casing having angularly arranged fluid passages therein, a valve seat member adapted to communicate axially with one of said passages and laterally with the other passage, a valve member movable axially with respect to said seat member, and having a threaded portion thereon which extends axially toward one of said fluid passages, and a valve stem extending into the portion of the casing opposite to said last-mentioned fluid passage and engaging said threaded portion of the valve member for actuating it.

6. A valve comprising a casing and cooperative cylindrical valve seat and valve members fitted loosely one within the other and relatively movable axially, said members having conical valve surfaces which are brought into engagement when said members are moved in one direction, the inner member having fluid conducting ports arranged therein adjacent to the conical valve surface thereon whereby said ports will be uncovered when the conical valve surfaces are separated, and modulating ports in one of said members arranged to be lapped and controlled by the other member during relative axial movements of said members.

7. A valve comprising a casing having a seat therein and an opening opposite to and of a diameter at least as large as said seat, a valve seat member capable of insertion and removal through said opening and having a portion adapted to form a fluid-tight joint with said seat in the casing, a valve member cooperative with and movable axially with respect to said seat member, said valve member having a threaded portion therein, a cap fitted in the casing and closing said opening therein, a rotatable stem extending through the cap and having a threaded portion which engages said threaded portion of the valve member to actuate the latter and having a collar fixed thereon above and bearing on the valve seat member, and a bushing on the stem threaded in the cap and movable axially of the stem to engage and form a fluid-tight joint with the collar thereon and to hold said collar against the valve seat member.

In testimony whereof I have hereunto set my hand.

WILLIAM W. BIRNSTOCK.