VALVE MEANS FOR CONVERTING SUPERHEATED HIGH PRESSURE STEAM INTO STEAM OF LOWER PRESSURE AND TEMPERATURE
8 Claims, 3 Drawing Figs.

ABSTRACT: Valve means comprising a steam valve and a water supply valve proportioning water to a steam conduit downstream of the steam valve, said water valve being adapted to close a little before the steam valve is closed.
VALVE MEANS FOR CONVERTING SUPERHEATED HIGH PRESSURE STEAM INTO STEAM OF LOWER PRESSURE AND TEMPERATURE

BACKGROUND OF THE INVENTION

The invention relates to valve means for converting superheated high-pressure steam into steam of lower pressure and temperature by supply of a proportioned amount of water.

A known valve mechanism used for this purpose comprises a steam valve housing in which a valve spindle is movable axially and cooperates with a surrounding annular valve seat to control the supply of steam from a steam conduit connected to the housing. Further, at least one channel extending axially through at least a part of said spindle and ending downstream of the steam valve seat has its inlet end in communication with a source of pressurized water over a water supply valve. The latter valve has comprised a valve body carried by the steam valve spindle and cooperating with a stationary seat. Thus the water supply valve is throttled in dependence on the movement of the steam valve spindle, and the mechanism is intended to function in such a way that the supply of water is proportioned exactly in relation to the amount of steam passing the valve housing. However, in practice this will often not be the case, as the heat supplied by the steam causes the valve housing to dilate a little more than the valve spindle which is cooled by the water passing therethrough. Above all, this circumstance has the disadvantage that the supply of water is not stopped entirely when the steam valve is closed. The water thus collected in the valve housing may often result in troubles, as its vaporization proceeds only slowly and may cause unpleasant shocks. On the other hand, if the water supply valve were adjusted to close a little earlier, the result would be an incomplete closing of the steam valve.

SUMMARY OF THE INVENTION

The object of the invention is to provide valve means by which said inconveniences are eliminated. For that purpose, the valve body of the water supply valve is movable in relation to the steam valve spindle in the axial direction of the latter and spring-loaded in its closing direction. Moreover, when said spindle is moved in its closing direction, the water valve body is adapted to close by engaging its seat a little before the steam valve is closed. When the water valve is closed, the steam valve spindle continues to move to its closing position independently of the water valve, and in this way it will be ensured that appearing differences in temperature never cause a leakage of water when the steam valve is closed. Of course, the relative movement of the water valve body will be rather small, as the variations in length caused by the differences in temperature are generally smaller than 1 mm.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention will be described in detail in the following with reference to the accompanying drawings which show a preferred embodiment.

In the drawings:
FIG. 1 is an axial section through the valve means.
FIG. 2 shows, on a larger scale, the resilient connection between the water valve body and the steam valve spindle.
FIG. 3 shows, likewise on a larger scale, the two valves in a position, where the water valve has just been closed.
In FIG. 1, 4 designates a valve housing having an inlet pipe socket 5 and an outlet pipe socket 6, said pipes 5, 6 extending at an angle of 90° in relation to each other. The inlet 5 is adapted to be connected to a source of high-pressure steam, while the outlet 6 is adapted to be connected to a conduit for supply of steam of reduced pressure and temperature to a place of consumption. coaxially in alignment to the outlet 6, the housing 4 has another pipe socket 7 in which a substantially cylindrical pipe 8 is inserted and secured by flanged rings 9, 10 and screw bolts 11 to serve as a housing for the water valve. The steam valve spindle which extends axially through the pipe 8, is composed of a rather thick, cylindrical member 12 projecting into the steam valve housing 4 and a rod 13 which has a threaded end portion screwed into a correspondingly threaded bore in the rear end of the cylinder 12. The thick spindle portion 12 is guided by a sleeve 14 inserted in the pipe 8, and its fore end is widened to form a valve body 15 which is adapted to cooperate with a seat ring 16 mounted at the inner end of the outlet socket 6. A fore portion of the valve body 15 extends through the seat ring 16 and is tapered conically, while the rear valve body portion is extended radially to form an annular flange adapted to engage the inner end surface of the seat ring 16. Further, the fore spindle portion 12 is formed with a number of channels 17 extending axially therethrough and ending in the valve body surface turned to the outlet 6.

The spindle rod 13 extends through a sleeve 18 with a clearance as small as possible. The sleeve 18 is movable axially and is guided in a leakproof bushing 19 which is inserted in a cover 21 secured to the flanged outer end of the pipe 8 by means of bolts 20. The inner end portion of the sleeve 18 is tapered to form a valve cone 22 which is adapted to cooperate with a surrounding annular seat 23 secured within the pipe 8. The inner diameter of the seat ring 23 is only a little greater than the greatest diameter of the valve cone 22. As a result of the seat 23 the valve cone is widened radially to an annular portion 22' adapted to engage the outer end surface of the seat ring 23. Between the seat ring 23 and the end cover 21 the pipe 8 communicates with a pipe socket 24 which projects radially and is adapted to be connected to a thrust water conduit.

The outer end of the spindle rod 13 is threaded and screwed in a correspondingly threaded axial bore in a plate 25. The opposite side of the plate 25 has a rodlike axial extension 26 which is by some suitable means, such as a screw joint, connected to one end of a coaxial rod 27 pertaining to a control mechanism. As especially appears from FIG. 2, the sleeve 18 has its outer end located at some distance from the plate 25, and a ring 28 secured to the sleeve is by means of screws 29 connected to a somewhat wider ring 30 which is in this way kept in close contact with the end surface of the sleeve. A number of cup springs 32 are inserted in a space formed between the ring 30 and another ring 31 which is supported by the plate 25. Though not shown, setscrews may be screwed through the plate 25 to make possible an adjustment of the position of the ring and thus a change of the tension of the springs 32. The cup springs 32 leave an annular space around the spindle rod 13, and within this space the rod 13 is surrounded by a bellows 33 which has one end sealed to the ring 30, while its other end is clamped to the rod 13 by means of a ring 34 secured to the plate 25. The bellows 33 serves to prevent leakage of water through a possible clearance between the rod 13 and the sleeve 18.

The resilient connection between the spindle rod 13 and the sleeve 18 is enclosed by a cylindrical casing 35 which has one end secured to the cover 21 by means of the screws 20. At its opposite end the casing 35 has a tubular extension 36 in which the control rod 27 is guided by means of a bushing 37. A link 39 adjustable in length has one end pivoted to an ear 39 projecting from the tube 36, while its other end is linked to one end of a lever 40. At some distance from said link 39 the lever 40 is pivotedly connected to the rod 27, and the opposite end of the lever 40 is pivotally connected to a piston rod 41 projecting from a double-acting pressure-fluid operated cylinder 42. By means of this cylinder 42 the valve means described may thus be closed or set in a desired opened state. To make possible an observation of the position of the steam valve spindle a pointer 43 may be fixed to the rod 27 to move along a scale 44 mounted within the casing 35. In such a case, the casing 35 must, of course, be provided with a window.

As mentioned, the two valves are adapted such that the water supply valve 22 is closed a little before the steam valve
15. In FIG. 3, the spindle 12, 13 and the sleeve 18 have been moved to a position where the valve body 22 of the water valve has just engaged its seat 23, while the steam valve is still a little open. On further movement of the spindle 12, 13 in closing direction (to the closed position shown in FIG. 1), the sleeve is kept stationary, and consequently the springs 32 and the bellows 33 will be correspondingly compressed. Of course, the difference between the closing positions of the valves increases at higher temperatures, as the high-pressure steam supplied at a temperature of 350°—550° C, for instance, heats the valve housing 4 such that the distance between the valve seats 16 and 23 increases a little more than the elongation of the valve spindle 12, 13. It is true that the spindle is partly surrounded by steam, but at the same time the spindle is subjected to the lower temperature of the water passing through the pipe 8 and the channels 17. When the water is supplied from a boiler, it may have a temperature of 110°—250° C, for instance.

When the two valves are closed (FIG. 1), there should preferably be a minor clearance of about 0.3—0.8 mm., for instance, between the rear end of the thick spindle portion 12 and the fore end of the sleeve 18, as indicated in FIG. 1. On moving the spindle 12, 13 outwardly from its closing position, the steam valve will thus be opened first, but immediately thereafter the spindle portion 12 engages the sleeve 18 and drives it so that the water valve is also opened. During the following movement in opening direction the springs 32 keep the sleeve 18 in contact with the spindle portion 12 so that both valves are opened to the same extent, and consequently the supply of water through the channels 17 is proportioned in relation to the amount of steam passing through the outlet 6. Due to the conical shapes of the valve bodies the cross section areas of the valve openings are increased rather slowly at the movement in opening direction, and this circumstance may also facilitate a correct proportioning of water and steam.

What I claim is:

1. Valve means for converting superheated high-pressure steam into steam of lower pressure and temperature, comprising a steam valve housing having an annular steam valve seat, a steam valve having a spindle movable axially in said housing to cooperate with said steam valve seat, a channel having an inlet and outlet extending axially through a part of said spindle extending downstream of said steam valve seat, a water supply valve controlling said inlet to said channel, said water supply valve comprising a body movably mounted on said steam valve spindle, a stationary valve seat connected to said steam valve housing cooperating with said valve body, means for moving said valve body relative to said spindle in the axial direction of said spindle, resilient means urging said valve body to closing direction whereby said valve body will engage said stationary valve seat before said steam valve engages said steam valve seat when said spindle is moved in closing direction.

2. Valve means as set forth in claim 1 wherein said resilient means connect said valve body to said spindle to provide a lost motion so that, when both valves are open, the distance between the water valve body and its seat is a little shorter than the distance between the steam valve body and its seat, so that the water valve is closed a little before the steam valve, when the spindle is moved in closing direction.

3. Valve means as claimed in claim 2, wherein a second housing is provided connected to a source of pressurized water through which said spindle extends, said second housing communicating with said steam valve housing through said water supply valve.

4. Valve means as set forth in claim 3 wherein said valve body is formed on a sleeve surrounding said spindle within said second housing and said sleeve is resiliently connected by said resilient means to said spindle.

5. Valve means as set forth in claim 4 wherein said water supply channel extends through a thickened spindle portion projecting into said second valve housing.

6. Valve means as set forth in claim 5 wherein a spindle rod carries said sleeve and the rear end of said thickened spindle portion is located at a little distance from the adjacent end of said sleeve when both valves are closed.

7. Valve means as claimed in claim 4 wherein the rear ends of said spindles and said sleeve are connected by a bellows to seal the clearance between said spindle and sleeve.

8. Valve means as claimed in claim 1 wherein both valves are closed when said spindle is moved into said steam valve housing.