

June 5, 1962

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3,037,518

AUTOMATIC MULTISTAGE REGULATING NOZZLE

Filed Jan. 7, 1957

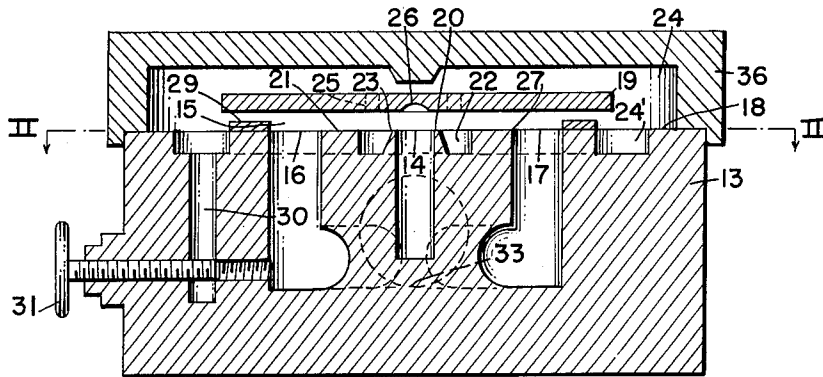


FIG. 1

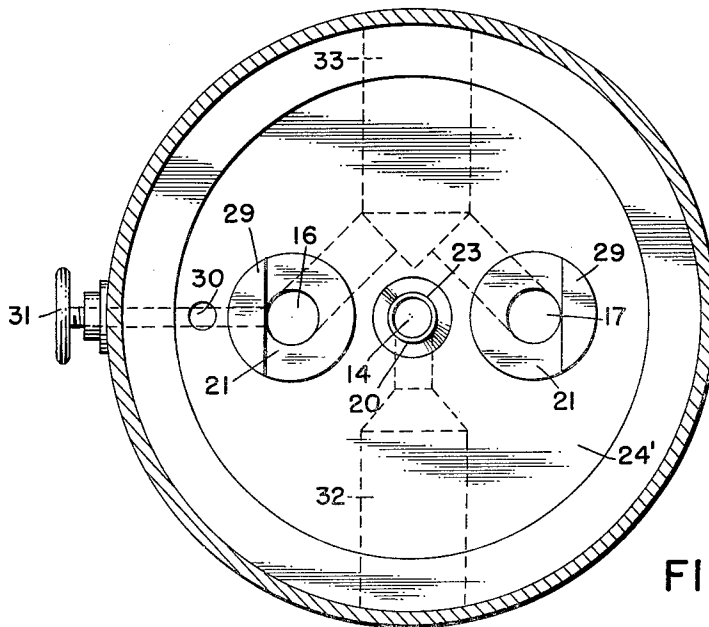


FIG. 2

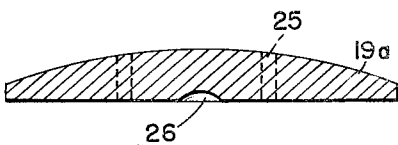


FIG. 3

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AUTOMATIC MULTISTAGE REGULATING NOZZLE

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Filed Jan. 7, 1957, Ser. No. 632,682

5 Claims. (Cl. 137—183)

This invention relates to a multistage regulating nozzle intended for the removal of steam water and the like.

Regulating nozzles known in prior art have the drawback that when they are used for the removal of steam water or some other boiling hot liquid and when the supply of such liquid, which may be steam water, suddenly is interrupted or drops to a great extent, a steam shock takes place which under some circumstances can result in damage to the apparatus, provided that at that time the regulating body was not shifted to its closing position. Steering means known in prior art were not satisfactory, since they required substantial additional costs and resulted in smaller security of operation.

An object of the present invention is to eliminate these drawbacks of prior art constructions.

Other objects of the present invention will become apparent in the course of the following specification.

In accordance with the present invention a multistage regulating nozzle is constructed in such manner that when a liquid, such as water or steam, is caused to flow through it, the different intermediate pressures in the individual stages are directly utilized for the automatic operation of the regulating body.

According to an embodiment of the invention, a particularly effective construction is attained when the last stage of the multistage regulating nozzle is divided into two stage halves which are interconnected in parallel and which have the narrowest cross-section of flow of the same size, whereby the fluid flows through one stage half in a direction corresponding to the movement of the regulating body to its open position, while the fluid flows through the other stage half in a direction corresponding to the movement of the regulating body to its closed position. In each case the pressure receiving surfaces of the regulating mandrel increase from stage to stage in such manner that when cold liquid flows through the nozzle the regulating mandrel will be moved toward its open position, while when steam flows through the nozzle, the regulating mandrel will move toward its closed position.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings showing, by way of example, preferred embodiments of the inventive idea.

In the drawings:

FIGURE 1 is a longitudinal section through a two-stage regulating nozzle having a regulating body which has the shape of a plate.

FIGURE 2 is a section through the regulating nozzle of FIGURE 1 along the line II—II.

FIGURE 3 is a section through a somewhat differently shaped regulating body.

An embodiment of the present invention consisting of a two-stage regulating nozzle, is illustrated in FIGURES 1 and 2. In this construction, the casing 13 having a cover 36 encloses a chamber 24. A flat plate 19 located in the chamber 24 serves as the regulating body. All the sealing surfaces of the plate 19 are in one plane. The plate 19 is freely mounted in the chamber 24 so that it can move in all directions.

The casing 13 has an inlet opening 14 through which steam water or boiling hot liquid can flow into a chamber 15 which is constructed as a vortex chamber. The

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flow of the condensate from the inlet opening 14 into the vortex chamber 15 constitutes the first stage of the two-stage regulating nozzle.

Outflow openings 16 and 17 are provided in the casing 13 symmetrically to the inflow opening 14. The penetration of the fluid in the outlet openings 16 and 17 constitutes the second stage of the expansion. The two stages are located in a single plane 18.

It is apparent, that in the simplest possible construction a single inlet opening and a single outlet opening would suffice for the regulation of the steam water or the boiling hot liquids to be discharged. However, this would result in a lack of symmetry in the load distribution and consequently in a non-uniform wear of the regulating body.

According to the present invention this is eliminated by the use of one or more symmetrically arranged inlet openings 14 constituting the first stage, and one or more outlet openings 16 and 17 constituting the second stage and arranged symmetrically to the inlet openings 14.

A bore hole passage 32 is used to supply the fluid to the two-stage regulating nozzle, and the fluid leaves the nozzle through the bore hole passage 33. The passage 33 is connected at one end with the outflow openings 16 and 17 and at the other end with an outside outflow conduit which is not shown in the drawing.

Very narrow surfaces 20 which may have, by way of example, the thickness of one-half of a millimeter are provided at the inflow opening 14, and wide surfaces 21 which may be many times as great as the surfaces 20 of the inflow opening 14, are provided at the outflow openings 16 and 17, in order to prevent the formation of a wake at the inflow opening 14 or at the inflow openings, and a damping effect at the outflow openings 16 and 17.

To prevent the impact of steam which may take place when the flow of liquids drops sharply and abruptly or stops altogether, and which may result in a most substantial loss, and in order to avoid formation of sub-atmospheric pressure between the inflow opening and the outflow opening, which would result in a smaller water output, the chamber 15 between the inflow opening 14 and outflow openings 16 and 17, is formed as a vortex chamber which is sufficiently great to eliminate steam blow. Mouths of the inflow and outflow openings 14, 16 and 17 are preferably shaped as valve seats with projections. Furthermore, it was found advantageous to provide around the inflow opening 14 an annular vortex channel 22 having walls 23 directed toward the inflow opening 14, which are preferably inclined. Due to this arrangement the cross-sectional area of the flow behind the mouth of the inflow opening 14, which has the shape of a valve seat, and which constitutes the first stage of the expansion, is increased gradually in the direction toward the chamber 15.

To increase the cold water lift, pressure-balancing bore holes 25 are provided in the plate 19 between the chamber 15 shaped as the vortex chamber and the space 24 located above the plate 19. A recess 26 is provided for the same purpose in the plate 19 above the inflow opening 14.

A stop 29 or the like, which is preferably made adjustable, is used to limit the closing movement of the regulating body 19. The position of the stop 29 should be such that the open cross-sectional area of flow limited by the stop, suffices to remove the condensate in normal continuous operation when the steam plant is completely warmed up, without creating a blow. This is attained in that the plate 19 in the construction shown in FIGURES 1 and 2 is so located that the condensate precipitated during normal continuous operation at full boiling temperature is removed completely without moving the

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plate 19. This results in a minimum of noise and mechanical friction.

In accordance with the present invention, a branch channel 30 is provided in the casing 13 which may be closed and regulated by a regulating and locking valve 31. The channel 30 serves the purpose of quickly removing air from the inner chambers of the apparatus through the use of a blowing device or other suitable means, and also for varying the outflow temperature of hot water. The channel 30 leads from the inner chamber 15, 22, 24 of the multistage regulating nozzle to the outflow passage 33 leading to the condensate collecting pipe or to the atmosphere.

The valve 31 is operated manually by means of a hand wheel.

To facilitate a quick removal of air and water from the apparatus while it is cold, for example, before the plant begins to operate, and on the other hand to provide the smallest possible loss of steam when the plant is completely warmed up, and there is no flow of condensate at all, the thermically actuated channel 30 should be opened at room temperature and should be closed at steam temperature.

According to another embodiment of the present invention, the regulating body 19 may have the shape of a curved cupola-like body 19a shown in FIGURE 3, which is advantageous for large size constructions.

It is apparent that in the above-described and illustrated embodiments a channel is provided by means of which the direction of flow of the medium through the nozzle is changed to the extent of 180°. In the construction of FIGURE 1 this result is attained by the chamber 15.

It is apparent that further variations and modifications may be made within the scope of the present invention subject to the limitations of the appended claims.

What is claimed is:

1. A multistage regulating nozzle for the removal of steam water and the like, comprising a casing having formed therein an inlet and an outlet, an inlet opening in said casing and communicating with said inlet, at least one outlet opening coplanar with said inlet opening and communicating with said outlet, a casing cover engaging said casing and enclosing a space above said inlet and outlet openings, said casing having co-planar surfaces enclosing said inlet and outlet openings, a stop upon one of said surfaces and a single valve plate freely movable in said space and extending over said inlet and outlet openings, said valve plate being adapted to be raised by fluid pressure from a position upon said stop adjacent said inlet and outlet openings in which said valve plate maintains a fluid pressure cushion over said surfaces.

2. A nozzle in accordance with claim 1, wherein the width of the surface enclosing the outlet opening is a

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plurality of times greater than the width of the surface enclosing the inlet opening.

3. A nozzle in accordance with claim 1, wherein said valve plate has at least one pressure-balancing bore hole formed therein.

4. A multistage regulating nozzle for the removal of steam water and the like, comprising a casing having formed therein an inlet and an outlet, an inlet opening in said casing and communicating with said inlet, at least two outlet openings co-planar with said inlet opening and disposed symmetrically thereto, said outlet openings communicating with said outlet, a casing cover engaging said casing and enclosing a space above said inlet and outlet openings, said casing having co-planar surfaces enclosing said inlet and outlet openings, a stop upon one of said surfaces and a single valve plate freely movable in said space and extending over said inlet and outlet openings, said valve plate being adapted to be raised by fluid pressure from a position upon said stop adjacent said inlet and outlet openings in which said valve plate maintains a fluid pressure cushion over said surfaces.

5. A multistage regulating nozzle for the removal of steam water and the like, comprising a casing having formed therein an inlet and an outlet, an inlet opening in said casing and communicating with said inlet, at least one outlet opening co-planar with said inlet opening and communicating with said outlet, a casing cover engaging said casing and enclosing a space above said inlet and outlet openings, said casing having co-planar surfaces enclosing said inlet and outlet openings, a stop upon one of said surfaces, a single valve plate freely movable in said space and extending over said inlet and outlet openings, said valve plate being adapted to be raised by fluid pressure from a position upon said stop adjacent said inlet and outlet openings in which said valve plate maintains a fluid pressure cushion over said surfaces, said casing further having formed therein a branch channel communicating with said space and said outlet, and a regulating and locking valve located in said casing for closing said channel.

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