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NOZZLE

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This invention relates to nozzles for controlling the discharge of fluid, such as air or steam, under pressure, and particularly to be used for admitting fluid pressure to a container for pulverulent, granular or like materials to aerate such material in and discharge the material from the container.

In the use of nozzles with containers for this purpose the nozzles are mounted in and open to the container through the bottom thereof, which bottom is usually of conical form. Should the material in the container consist of pulverulent material, such as flour and particularly cement, the material by settling in the container, for instance in the transporting of the container with the material therein, will enter into the nozzles through the nozzle orifice and pack so tightly in the nozzles as to effectively choke the same and prevent the passage of the fluid pressure through the nozzles into the container when the nozzles are connected with the source of fluid pressure.

It is an object of the invention to provide nozzles for this purpose having means automatically operative to normally close the nozzle orifice or outlet and adapted to be actuated to position to open the nozzle outlet and discharge the fluid pressure therethrough by the fluid pressure admitted to the nozzle.

It is a further object of the invention to provide an improved valve means for nozzles for this purpose which normally closes the nozzle outlet and is actuated to position to open the nozzle outlet by fluid pressure admitted to the nozzle, and the valve and nozzle arranged to control the direction of the flow of the stream issuing from the nozzle.

It is another object of the invention to provide in nozzles for this purpose a valve to control the nozzle outlet which is adapted to be actuated to position to close the nozzle outlet by the material in the container and prevent material in the container entering the nozzle through the nozzle outlet.

In the use of nozzles with containers for the transporting of flour and like pulverulent materials it is essential that no foreign substances, such as lubricant, for instance, be admitted to the container through the nozzles, and it is a further object of the invention to provide a nozzle wherein the adjacent parts are constructed of different materials that will not corrode and thereby render the same inoperative and will not require lubricating the parts.

It is a further object of the invention to provide a nozzle of this character which may be

readily mounted in and removed from the container wall, and taken apart for replacement or cleaning thereof.

It is another object of the invention to provide a nozzle comprising a casing and valve means including a stem slidable in the nozzle casing arranged with heads at the opposite ends thereof, one of said heads being exteriorly of and adapted to control the nozzle outlet, and the other head arranged within the casing and adapted for the impingement against the same of the fluid pressure admitted to the casing and thereby actuated to move the valve head exteriorly of the casing to outlet opening position, and the stem provided with a passage or passages for the flow of the fluid pressure from the nozzle casing into the container, and the provision of means to prevent rotation of the stem with the heads relative to the nozzle casing to discharge the fluid pressure from the nozzle casing in a predetermined direction into the container.

In the drawing accompanying and forming a part of this application, Figure 1 is a longitudinal sectional view of a nozzle embodying the invention and showing the manner of mounting the same in a container wall to admit fluid pressure into the container to aerate the material and discharge the same from the container and showing the valve means in position to close the nozzle orifice or outlet, and

Figure 2 is a view similar to Figure 1 but showing a modified arrangement of valvehead to control the nozzle outlet and direct the flow of the fluid pressure from the nozzle in a predetermined direction.

In carrying out the embodiment of the invention illustrated in the drawing there is provided a tubular or cylindrical casing 3 externally screw threaded at the opposite ends, as at 4 and 5, the screw threaded portion 5 being removably engaged in a screw threaded opening 6 in a container wall 7 to mount the same therein, and the casing is retained in said opening by a nut 8 engaged on the screw threaded portion 5 in abutment with the outer surface of the container wall, only so much of the container being shown as is essential to an understanding of the invention. The opposite screw threaded end portion 4 is removably engaged in a coupling member 9 of cup or cap shape internally screw threaded, as at 10, for threaded connection with the screw threaded portion 4 of the casing, the closed end of the cap member being provided with a central opening screw threaded for the removable connection of a supply pipe 12 adapted to be con-

nected to and leading from a source of fluid pressure, such as air or steam under pressure, and admitting the same to the casing. The exterior of the casing intermediate the screw threaded portions and the outer contour of the cup member 9 may be arranged of a shape to be readily engaged by and implement, such as a wrench, to rotate the casing in mounting it in the container wall and to apply and remove the cup member from the casing. To pressure seal the connection of the cup member or coupling with the casing there is provided an annular gasket 13 of suitable flexible and resilient packing material, such as rubber or rubber composition, engaged in the cup member 9, said gasket being arranged with a portion of reduced thickness having an internal diameter substantially the same as the internal diameter of and to abut the end of the casing 3 engaged in the cup member. The opening 11 in the cup or coupling member and the opening in the gasket 13 are of the same diameter and constitute the inlet opening to the casing.

Within the outer end of the casing cylinder 3 adapted to be engaged in the container opening 6 there is arranged an annular end closure plate or partition 14 provided with an axial tubular portion 15 extending outward from the cylinder. At the outer side or face of said end closure plate 14 is arranged an annular member of resilient material, such as rubber or rubber composition, said member being engaged upon the tubular projecting portion of the plate 14 and is of a thickness to extend beyond the end of said tubular portion 15, as shown at 16, said member having an annular reduced portion at the outer end to provide a shoulder 17 adapted to be engaged by an annular member 18, shown in Figure 2 in the form of a ring engaged and secured in the end of the casing cylinder 3 by suitable means, as by welding or otherwise, as shown at 19, whereby the plate or end closure member 14 is retained in the casing cylinder 3. In the nozzle shown in Figure 1 the member 18 is in the form of a sleeve of considerable length, and constituting a cylindrical extension of the casing 3 for a purpose to be hereinafter described.

The passage of the fluid pressure from the pipe 12 into and through the nozzle casing 3 is controlled by valve mechanism or means normally closing the casing outlet and shutting off the casing from the container 7, and adapted to be actuated to position to open the nozzle through the nozzle outlet to the container by the fluid pressure admitted into the nozzle casing 3 through the pipe 12. This valve means comprises a stem 21 slidably mounted in the tubular portion 15 of the end closure or plate 14 with one end of the stem extending into and terminating within the casing cylinder 3 and the opposite end extending from the end of the casing. The stem is of slightly less diameter than the opening in the tubular portion 15 of the end closure plate 14 to permit of the passage of a small amount of the fluid pressure from the casing through the tubular portion 15 about the stem 21. The stem 21 is arranged with a passage or passages extending longitudinally of the stem for the discharge of the fluid pressure from the casing 3, and comprising a recess or recesses 22 in the peripheral wall of the stem of arcuate shape longitudinally of the stem, as shown in dotted lines. In the Figure 1 arrangement the stem 21 is provided with a series of three of such recesses arranged in spaced relation to each other about the stem intermediate

the ends thereof and arranged to extend through the tubular portion 15 of the end closure 14 and terminating exteriorly of and within the casing. In the Figure 2 arrangement the stem is provided with a single recess 22 of greater length than the recesses 22 in the Figure 1 arrangement. The valve stem in the structures of both Figures 1 and 2 is arranged at the inner end thereof with a head 24, in the nature of a piston head having two diameters, the portion of least diameter at the end opposite and of greater diameter than the diameter of the opening in the gasket 13 and the opening 11 in the cup or coupling member 9 to receive the full force of the pressure of the fluid admitted into the nozzle casing 3 through the inlet opening from the pipe 12. The diameter 25 of the portion of the head of greater diameter at the inner end of the head is of a diameter to permit of the passage of fluid pressure between said portion of the head and the casing cylinder 3 from the outer side of the head to the cylinder casing at the opposite end of the head.

The end of the stem 21 extended from the casing in the Figure 1 arrangement carries a valve head 26 of greater length than diameter and is positioned on the stem so that the greater portion of the head will be within the sleeve member 18 in all the positions thereof, the inner end of said head being arranged with a face extending at an obtuse angle to the axis of the stem to engage a face of the yielding or resilient member 16 extending at an acute angle to the axis of the stem, as at 27, to close the space between the stem and bore of the portion 15 of the end closure 14 and the recesses or passages 22 to prevent the entrance of material into the casing 3 therethrough. The remaining portion of the valve head 26 tapers from the obtuse angle face to the outer end and co-operates with the member 18 to direct the fluid pressure from the nozzle in a longitudinal direction coaxially of the nozzle. The nozzle of Figure 1 is particularly adapted to be mounted at the end of a conduit at which it is connected to the outlet of a container and through which conduit the material is discharged, the fluid pressure discharged from such nozzle into the conduit serving to convey the material through the conduit.

The valve head 26 in the Figure 2 arrangement is of greater diameter than length and has a straight horizontal face at the inner end to engage the outer peripheral portion of the face of the resilient or yielding member 16 which extends inward at an acute angle to the axis of the stem 21 greater than the angle of the face of the member 16 in the Figure 1 arrangement, as at 29, so that at the initial positioning of the valve 26 away from the seal 16, as shown in dotted lines, the fluid pressure is caused to flow in an arcuate reverse direction toward the container wall 7, and in the fully open position of the valve head 26 the fluid pressure issuing from the nozzle will be directed parallelly of and along the container wall to dislodge material adhering to said wall and aerate the material in the lower portion of the container. The recess or passage 22 extends in an arcuate direction from the enlargement 25 of the piston head to the straight horizontal face of the valve head 26 exteriorly of the tubular portion 15 of the end closure 14, but will be closed and shut off from the exterior of the nozzle casing when the horizontal face of the valve head 26 engages or is seated against the outer peripheral portion of the resilient seat 16. The outer end

portion of the valve head 26 tapers toward said end.

The valve mechanism or means in both structure is normally urged to engage the valve head 26 with the face 27 or 29 of the resilient seat 16, and position the head 24, 25 adjacent to and in alignment with the openings in the gasket 13 and cup member 9, by a helical spring 30 coiled about the valve stem 21 and compressed between the enlargement 25 of the piston head 24 and an annular wear plate engaged on the stem and juxtaposed to the inner face of the end closure or plate 14.

To prevent rotation of the valve means relative to nozzle casing 3 a pin 32 is engaged in a bore extending diametrically through the head 24 and is of a length greater than the diameter of said head with the opposite ends of the pin extending from diametrically opposite portions of the head to an extent slightly greater than the head enlargement 25 and engaging diametrically opposite slots 33 in the inner end of a sleeve 34 engaged and fixed in the nozzle casing 3 with the inner end abutting the gasket 13 and the other end abutting the end closure plate 14 and encircling the wear plate 31. The sleeve or liner 34 is adapted to be rotatably adjusted within the casing 3 and thereby adjust the valve mechanism, so that in the arrangement as shown in Figure 2, wherein the stem is provided with a single recess, the recess or outlet passage may be positioned so that the air will be discharged in a predetermined direction laterally of the head 26, for instance, in an upward direction along the wall of the conical bottom of the container, and the sleeve and valve mechanism is retained in adjusted position by the impingement of gasket 13 against the end of the sleeve as the cap member 9 is screwed onto the casing 3. The outward movement of the valve mechanism is limited by the ends of the pin 32 engaging the end wall of the slots 33, and the engagement of said valve head with the seat 16 will position the head 24 at a proper distance from the cup or coupling member 9 to receive the full force of the impact of the fluid pressure delivered from the pipe 12. The diameter of the piston head enlargement 25 is slightly less than the diameter of the bore of the sleeve 34 to permit of the passage of the fluid pressure between the sleeve 34 and said piston head enlargement 25 to a chamber formed in the casing 3 by said piston head enlargement and the end closure plate 14. By the arrangement of the valve head 26 at the exterior of the casing 3 it will be exposed to the force of the pressure of the material thereon within the container 7, which also tends to maintain the valve mechanism in position with the head 26 in nozzle sealing engagement with the seat 16 when the nozzle is not connected with the source of fluid pressure through the pipe 12, or should such pressure be less than the pressure in the container 7, and prevent material entering the nozzle from the container. However, by the tapered arrangement of the valve head 26 the force or pressure of the material in the container 7 thereon and tending to resist the opening movement of the valve means by the pressure in the casing 3 is materially reduced and will permit of the ready nozzle opening movement of the valve means.

As stated, it is an object of the invention to provide a valve controlled nozzle wherein the parts are constructed of different materials to eliminate the requirement of lubricating the parts as well as prevent corroding of the parts with a

consequent freezing of one part of another part. For this purpose the casing 3 as well as the stem 21 and the head 26 are made of a suitable steel, the head 24, 25 is made of brass or bronze, and the sleeve and end closure plate 14 are made of stainless steel.

Having described my invention, I claim:

1. In a valve controlled nozzle for admitting fluid under pressure into a container, a casing having an inlet opening adapted to be connected to a source of fluid under pressure and an outlet, a member of resilient material disposed about the outlet exterior of the casing arranged with a valve seat, and valve means to control the discharge of the fluid pressure through the casing comprising a stem slidably mounted in the casing having heads at the opposite ends thereof, one of said heads arranged exterior of the casing and constituting a valve head adapted to be seated against the valve seat to seal and control the outlet and the other head arranged within the casing constituting a piston head of slightly less diameter than the casing and adapted to receive the force of the fluid pressure admitted into the casing and actuate the valve means to move the valve head away from the valve seat and open the casing outlet to permit passage of the fluid through the outlet, and means to yieldingly normally urge the valve means to position to seat the valve head against the valve seat and close the casing outlet when the inlet of the casing is shut off from the source of fluid under pressure.

2. In a nozzle for admitting fluid under pressure into a container for discharging material therefrom, a casing having an inlet opening axially at one end adapted to be connected to a source of fluid under pressure and an outlet opening axially in the opposite end, and adapted to be mounted at said end in an opening in the wall of a container with the outlet opening in communication with the container, a member of resilient material disposed about the outlet opening exterior of the casing arranged with a valve seat, valve means comprising a stem slidably mounted in the outlet opening having heads at the opposite ends with one of said heads within the casing to constitute a piston head of slightly less diameter than the casing and the other head exterior of the casing to constitute a valve head adapted to be seated against the valve seat to close and control the casing outlet, and means to urge the valve means in a direction to seat the valve head against the valve seat and seal the outlet opening and the head within the casing adjacent to the inlet opening to be impinged by the fluid pressure admitted to the casing through the inlet opening and thereby actuate the valve means to position the valve head exterior of the casing away from the valve seat and open the outlet opening, and means to effect rotative adjustment of and retain the valve means in adjusted position and limit the outlet opening movement of the valve means.

3. A valve controlled nozzle as claimed in claim 2, wherein the means to effect rotative adjustment of and retain the valve means in adjusted position and limit the outlet opening movement of the valve means comprises a sleeve fixed in the casing having slots of a predetermined length extended into an end thereof and projections extending laterally from the piston head slidably engaging in said slots.

4. In a nozzle for admitting fluid under pressure into a container to discharge material therefrom by the container, a casing having an inlet

opening axially at one end adapted for connection of means to connect the casing to a source of and admit fluid under pressure into the casing and an outlet opening axially at the opposite end, a member of yielding material carried exterior of the casing disposed about the outlet opening arranged with a valve seat, and valve means to control the discharge of the fluid pressure through the casing, comprising a stem extended through and slidable in the outlet opening arranged with a recess extending longitudinal thereof in communication with the interior and exterior of the casing and constituting a discharge passage through the outlet opening, and heads at the opposite ends of the stem with one head constituting a piston head of less diameter than and within the casing adjacent the inlet opening and the other head constituting a valve head exterior of the casing and adapted to be seated against the valve seat of the member of yielding material to shut off and seal the outlet opening and stem recess from the casing and open the stem recess to the exterior of the casing, and said valve head and seat arranged to direct the stream or fluid issuing from the casing outlet in a predetermined direction, and the valve head arranged to receive pressure exteriorly thereof to urge the valve means in a direction to seat the valve head against the valve seat.

5. In a nozzle for admitting air under pressure into a container to discharge material thereby from the container, a cylindrical casing having an inlet opening at one end adapted for coupling a supply pipe thereto for and admit air under pressure into the casing and an outlet opening at the opposite end in alinement with the inlet opening and arranged with a valve seat exterior of the casing, valve means to control the discharge of air pressure through the casing, comprising a stem extended through and slidable

in the outlet opening having heads fixed to the opposite ends thereof, one head being exterior of the casing and constituting a valve head adapted to be seated against the valve seat to close and seal the outlet and control the outlet and discharge of the air pressure from the casing and the other head positioned within the casing adjacent and opposed to the inlet opening and constitute a piston head for the impingement thereon of the air under pressure admitted through the inlet opening into the casing, means to yieldingly urge the valve means to position with the valve head into engagement with the valve seat, and the impingement of the air under pressure admitted to the casing onto the head within the casing adapted to actuate the valve means against the action of said yielding means to position the valve head to open the outlet opening, and a tubular member fixed to and extending from the outlet end of the casing in enclosing relation to the valve head to direct the discharged air pressure longitudinally of the casing.

6. A nozzle as claimed in claim 4, wherein the valve stem is provided with a series of longitudinal recesses spaced about the stem and arranged in the stem to extend through the outlet opening and terminate within and exterior of the casing to constitute passages through the outlet opening of the casing for the passage of air pressure from the casing with the valve means positioned with the valve head away from the valve seat and said passages adapted to be shut off from the exterior of the casing when the valve means is positioned with the valve head seated against the valve seat, and means to rotatably adjust the valve means relative to the casing and retain the valve means in adjusted position and limit the outlet opening movement thereof.