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SHOWER NOZZLE

Filed March 29, 1963

Fig. 1

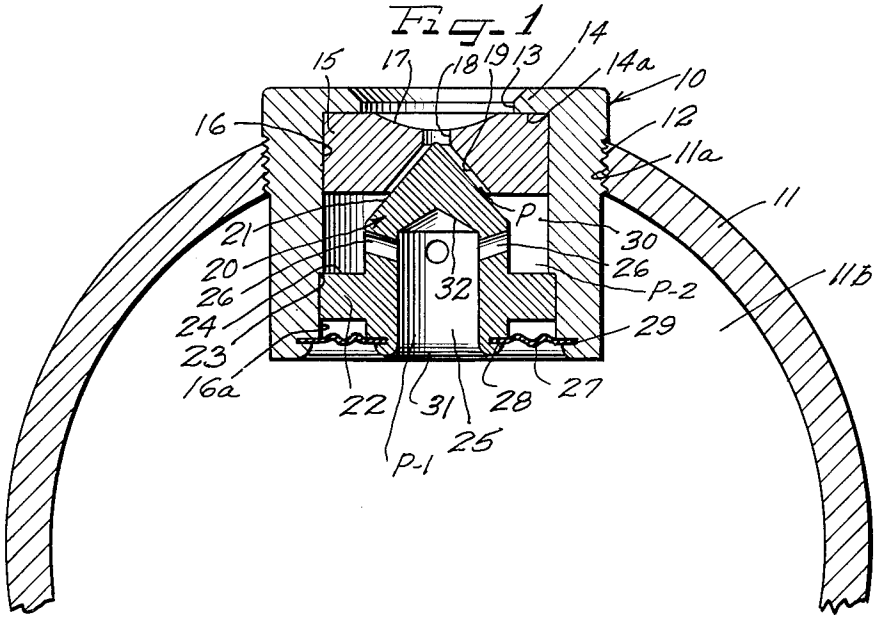


Fig. 3

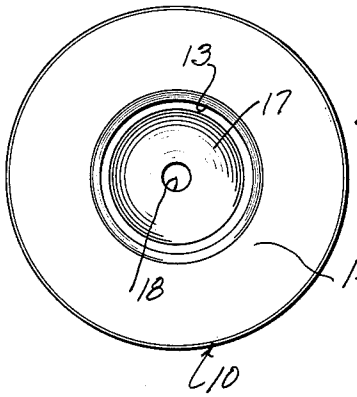
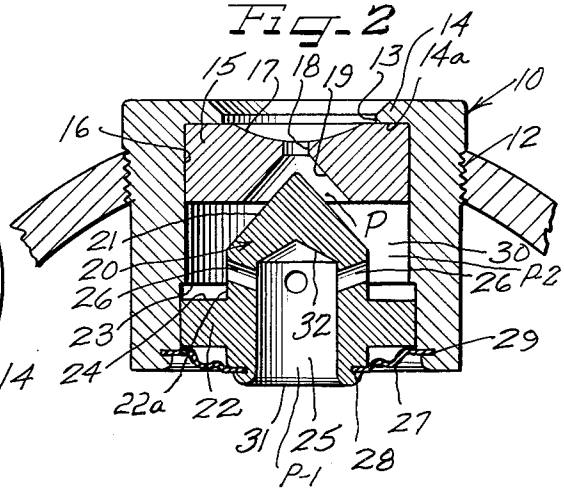


Fig. 2



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SHOWER NOZZLE

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The present invention relates to improvements in spray nozzles and more particularly to a self-cleaning spray nozzle which is substantially recessed on the part on which it is mounted and which is self-cleaning when it becomes partially or fully stopped due to particles and foreign matter.

The features of the invention are particularly well adapted for use in a spray nozzle to be installed in places where the available space is limited or restricted. For example, in papermaking machines there are locations where it is necessary to wash parts of the papermaking machine, such as rolls, wires, felts and the like, in order to avoid accumulation of fibers and grit which might create defects in the pulp sheet which is being made, and which may even damage rolls, wires and felts. These nozzles are often mounted in inaccessible locations which are hard to clean and a multitude of nozzles must be provided over a wide machine making manual cleaning impractical. Further, it is critical that the nozzle maintain continuous operation since failure to provide a spray of water in one location may result in the accumulation of foreign matter and damage the machine part or create a defect in the pulp sheet being made.

Accordingly, it is an object of the invention to provide an improved spray nozzle which is self-cleaning and will automatically operate to remove foreign particles which tend to clog the spray passages of the nozzle.

A further object of the invention is to provide an improved spray nozzle which has working parts for self-cleaning and which is constructed so that it can be mounted with very little of the structure protruding on the outside of a mounting wall.

A still further object of the invention is to provide a self-cleaning spray nozzle wherein the parts move automatically to enlarge spray passages when they become impeded or partially clogged and wherein the moving parts are simple and ruggedly constructed for continued long operation without attention or adjustment.

A further object of the invention is to provide a self-cleaning spray nozzle which has a minimum of components all of which are circular in one cross section and may be therefore easily and inexpensively manufactured.

A still further object of the invention is to provide a self-cleaning spray nozzle wherein the parts can be simply and readily assembled and are in part held together by the pressure of supply liquid and wherein threaded elements and other finely constructed parts need not be employed.

Other objects, advantages, and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiment thereof in the specification, claims and drawings, in which:

FIGURE 1 is a vertical sectional view taken through the axis of a spray nozzle embodying the principles of the present invention, showing the parts in normal operating position;

FIGURE 2 is a view similar to FIGURE 1, showing the parts moved to a cleaning position; and

FIGURE 3 is a top plan view of the spray nozzle of FIGURES 1 and 2.

On the drawings:

The spray nozzle assembly includes a nozzle body **10** which is adapted to be mounted in a wall **11** of a conduit containing supply liquid under pressure. The wall is provided with a threaded circular opening **11***a* into which the body is threaded. For this purpose, annular threads **12** are provided in the outer surface of the body member near the outer or downstream end, so that when the body is mounted in position only a small portion projects and the major portion is enclosed within the passage or chamber **11***b* enclosed within the wall **11**. While a threaded mount is provided it of course will be appreciated that other forms of mounts may be employed.

The nozzle body **10** has an outer central opening **13** which is centered and circular in shape and counterbored to form a chamfered edge.

The interior of the body has a cylindrical bore **16** which receives the circular parts of the nozzle assembly. An outer end wall **14** on the downstream end of the body, which receives the opening **13**, provides an upstream facing shoulder **14***a*. Against this shoulder rests a cylindrical shaped nozzle insert **15**. The insert is preferably tightly fit into the bore **16** but need not be overly snug since the pressure of the supply liquid will hold it in place and therefore close manufacturing tolerances need not be observed and the insert **15** can be manufactured so that it will merely drop into the bore.

The nozzle insert has a fragmental spherical or concave surface **17** which faces in a downstream direction toward the body opening **13**. Centrally located in the insert is a nozzle opening **18**.

Leading to the nozzle opening is a conical recess **19** which tapers toward the nozzle opening **18**.

Moveably mounted within the cylindrical bore **16** of the body **10** is a plunger **20**.

The plunger **20** is moveable in the bore between a first operating position, which is the position shown in FIGURE 1, and a second retracted or cleaning position, which is the position of FIGURE 2. It will be understood that FIGURE 2 shows the fully retracted position for the plunger **20** which it takes when the supply pressure is shut off. The plunger moves toward this position when the nozzle starts to plug but may not fully reach it since it will move back to its normal operation position of FIGURE 1 as soon as the nozzle has automatically cleared itself.

The plunger has a conical tip or downstream terminal end **21** which projects into the conical recess **19** in the first operating position of the plunger to provide a spray passage for liquid flowing to the nozzle opening **18**. In the second position the conical tip **21** is retracted away from the recess **19** to substantially increase the size of the passage so that any particles lodged therein will be immediately released and flushed out of the nozzle by the liquid.

Thus, small pieces of lint, particles of dirt and grit, or scale from the lining of the pipes or other parts may tend to plug the nozzle passage P and this will automatically become cleared when it tends to close as will be fully described.

The plunger **20** has an annular radially outwardly extending flange **22** formed thereon on a side wall **22***a* which extends in an upstream direction from the terminal end or conical tip **21**. The bore **16** is made slightly larger on the upstream end of the body **10**, as shown at **16***a*, to provide a second stop shoulder **23** on the body **10**, which is engaged by the flange **22** to limit movement of the plunger in its first position. The plunger is urged to this first position by upstream pressure, or in other words, pressure of the supply liquid in the supply conduit **11***b*.

The supply liquid flows into the plunger into a chamber **25** formed therein by the side wall **22***a*, which is open on the upstream end, and from the chamber the liquid flows out through radial passages **26** formed in the side

wall 22*a* into an upstream chamber 30 formed within the bore 16 of the body and located between the plunger flange 22 and the insert 15. This chamber of course communicates with the nozzle passage P.

The plunger is biased toward its second position away from the nozzle insert 15 by an annular disk spring 27. This spring is suitably secured at its outer edge to the body 10 such as by being seated in a notch 29. In assembly, the notch will be formed so that a recess opens axially outwardly on the body, and when the spring 27 is seated as shown, a shoulder or lip of material will be pushed over the spring to hold it in place. Other forms of supporting the spring may be employed, such as by providing a snap ring or threaded ring, but the present arrangement provides a simple inexpensive assembly structure.

The inner edge of the spring 27 is seated in a similar notch 28 in the plunger 20.

The upstream facing surface of the spring provides a pressure surface against which the pressure of the supply liquid acts, and the liquid acts also against the upstream facing exposed surfaces of the plunger, including the end surface 31 of the plunger and the surface 32 at the base of the plunger chamber 25.

Under normal flow conditions of the nozzle, the radial passages 26 act as pressure drop passages so that the pressure P–2 within the body chamber 30 and within the passage P is slightly less than the upstream supply pressure P–1 so that the plunger will be held in its first position (FIGURE 1).

However, when the passage P begins to plug, flow will be reduced so that pressure drop through the passages 26 will decrease. The pressure downstream P–2 will begin to approach the pressure upstream P–1 acting on the plunger. The spring 27 is biased so that it applies a force to the plunger urging it toward the second position (FIGURE 2). When the force of the spring 27 plus the downstream pressure P–2 exceeds the upstream pressure P–1 the nozzle will tend to move toward its second position (FIGURE 2) thus opening the size of the passage P. This will free particles caught and the passage P will automatically clear itself so that flow will return to normal and the plunger will return to its first position (FIGURE 1).

All this will normally happen very rapidly and the plunger will move downwardly at a rate proportional to the pressure increase downstream of the plunger.

In summary, during normal operation the plunger 20 operates in the first position (FIGURE 1) shown with the conical tip 21 inserted into the conical recess 19. As particles tend to clog the nozzle passage P, the downstream pressure in the chamber 30 will tend to increase and this force plus the force of the spring 27 will move the plunger toward the second position (FIGURE 2), away from the conical recess 19 to increase the size of the nozzle passage P to clear it. The passage P will also be self cleaning when the supply pressure is cut off since the plunger 20 will move to the second position (FIGURE 2) before flow through the passage P completely stops.

Thus, it will be seen that I have provided a simple reliable nozzle assembly which meets the objectives and advantages above set forth. The structure provides a relatively small passage P through which particles must pass before they reach the nozzle opening 18. The passage P will be substantially smaller than any of the openings upstream of it such as the chamber 25 in the plunger or the plunger passages 26, and will be substantially smaller than the nozzle opening 18. Thus, any particles which occur in the supply liquid such as those which may escape a filter or be picked up within the supply conduit will be trapped in the supply passage P rather than in other locations and this passage will automatically clean itself.

Also, each time the supply pressure is cut off during periods of non-operation the valve plunger will move to its second position so that the passages can easily drain. When the supply liquid is again turned on, and before pressure builds up liquid will flush through the valve cleaning it before operation.

The drawings and specifications present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. A nozzle assembly comprising,
a body member having a cylindrical bore therein,
a cylindrical nozzle insert within said bore,
a shoulder on said body member facing upstream limiting the position of said insert so that the pressure of supply liquid holds the insert against said shoulder,
a centered fragmental spherical surface on said insert facing downstream,
a central nozzle opening in said insert,
a conical recess leading to said nozzle opening and facing upstream in said insert,
a plunger within said bore,
a conical tip on said plunger projecting into said conical recess,
said plunger moveable between a first position wherein the conical projection coacts with the recess for forming a spray,
and a second position wherein the tip is spaced from said recess for cleaning,
an annular flange on said plunger slidably engaging the walls of the bore in the body member with a body chamber defined between said flange and said insert,
a plunger chamber having an inlet upstream of the plunger for receiving a supply liquid,
lateral passages leading through the plunger from said plunger chamber to said body chamber,
a second shoulder on said body member limiting movement of said plunger in said first position,
an annular disk spring secured at its outer edge to said body member and its inner edge to said plunger providing a surface facing upstream for liquid supply pressure to urge the plunger to said first position and biased to move the plunger to said second position with decrease in flow through the spray nozzle opening,
and mounting threads on the outer surface of said body member adjacent the downstream end so that the major portion of the body member will be enclosed within a receiving mount into which the body member is threaded.

2. A nozzle assembly comprising,
a body member,
means defining a bore in said body member and a shoulder facing upstream in said bore,
means defining a spray nozzle opening in said body member downstream of the bore and in communication therewith,
a plunger within said bore moveable between first and second positions and a projection formed on said plunger which coacts with said opening in the first position of said plunger to form a spray nozzle and is spaced from said opening in the second position of said plunger for cleaning said spray nozzle,
a pressure surface formed on said plunger facing said shoulder with a body chamber formed in said bore between said shoulder and said pressure surface to urge said plunger toward said second position,
a plunger chamber having an inlet upstream of the plunger for receiving a supply liquid,
pressure drop passages leading through the plunger from said plunger chamber to said body chamber, and

spring means interconnecting said body member and said plunger to urge said plunger toward said second position.

3. A nozzle assembly for supplying liquid comprising

a body member having a cylindrical bore formed therein,

a communication with the supply liquid,

a cylindrical plunger within said bore and closed at the downstream terminal end thereof and having a side wall extending in an upstream direction to form a first chamber in communication with the supply liquid,

said plunger being movable within said bore between a downstream spray position and an upstream cleaning position and having a diameter less than the diameter of said bore to form a second chamber therearound within said bore,

a flange formed on said plunger and engageable with the wall of said bore to partition said second chamber into an upstream chamber and a downstream chamber,

said flange being subjected to liquid pressure in said upstream chamber to urge said plunger in a downstream direction and being subjected to liquid pressure in said downstream chamber to urge said plunger in an upstream direction,

a pressure drop passageway formed in said side wall and communicating said first chamber with said downstream chamber to reduce the pressure of liquid flowing therebetween,

means defining a spray nozzle opening in said body member coacting with said closed terminal end of said plunger in the spray position of the plunger for spraying liquid supplied to the nozzle, and

a spring member interconnecting said plunger and said body member and urging said plunger in the upstream cleaning position thereof.

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