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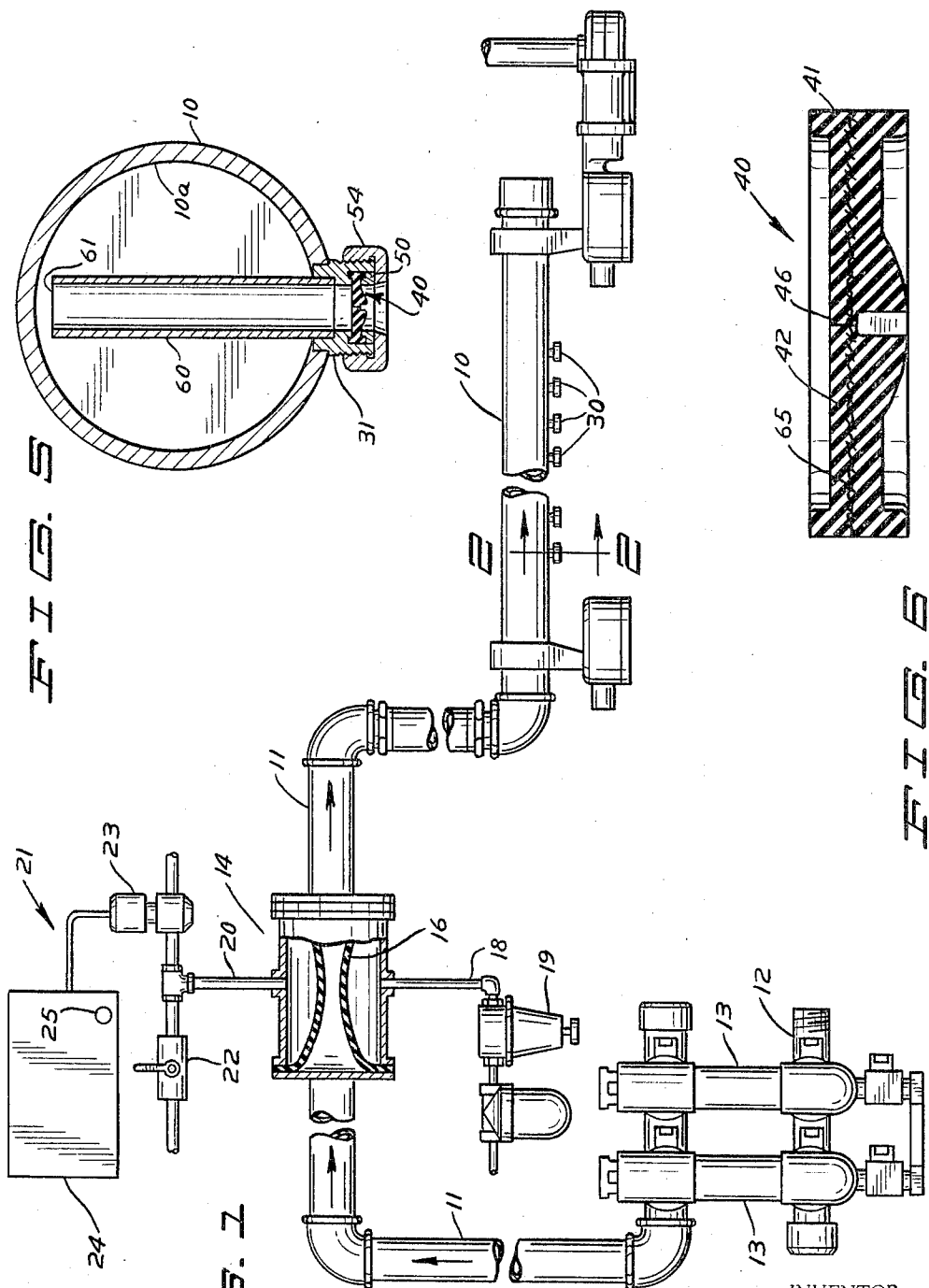
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3,288,371

SPRAY SHOWER ASSEMBLY WITH SELF-CLEANING NOZZLE

Filed April 22, 1964

2 Sheets-Sheet 1



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FIG. 2

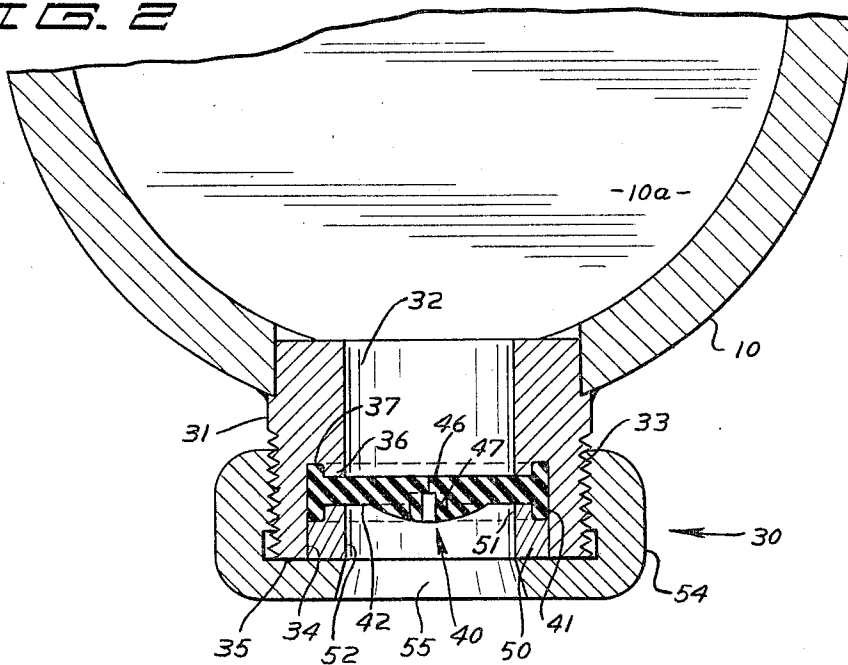


FIG. 3

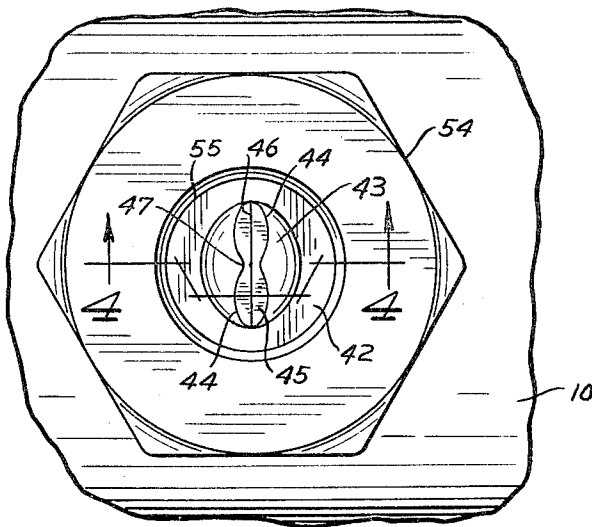
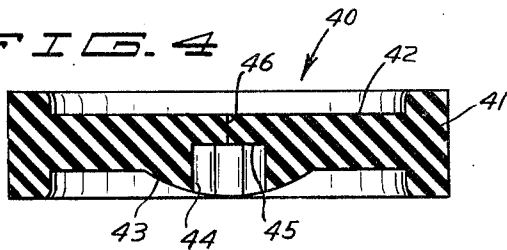


FIG. 4



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SPRAY SHOWER ASSEMBLY WITH SELF-CLEANING NOZZLE

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This invention relates generally to spray showers and more particularly to a shower assembly for water containing solid particles and including a self-cleaning nozzle system having pressure responsive orifice members which are able to cleanse themselves by expanding in response to the application of increased pressure.

In the past various spray showers have been provided for paper making machines to effectively spray white water contains solids. These systems generally have required a complicated cleaning mechanism in order to produce an efficient periodic cleaning function to provide a uniform spray pattern. This application however provides a new and unique pressure responsive orifice defining member for white water showers which is designed to expand and enlarge the orifice opening in response to an increase in pressure thus allowing the expanded orifice to pass the nozzle clogging particles. The size of the orifice opening being pressure responsive may likewise be controlled by merely varying the pressure of the liquid being supplied thereto.

With this cleaning system it is also possible to eliminate any lateral connections which are normally required and which require excess installation room. Rather with this system it is necessary to only provide a single pressure line to the shower tube with control means for regulating the pressure to the tube.

It is therefore an object of applicant's invention to provide a spray shower having pressure responsive orifice defining means therein which increase the orifice opening in response to a surge in pressure to permit cleaning of the orifices of any solid material that may accumulate therein.

It is a further object of this invention to provide a spray shower assembly having control means which will provide a surge pressure to a white water shower tube to automatically open pressure responsive orifice defining members to permit particles to pass therethrough.

It is a further object of this invention to provide a white water shower system wherein the required installation room is substantially less than that required by a conventional shower tube and may be provided with a single pressure supply line while still providing the proper cleaning operation for the shower.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a diagrammatic view illustrating a typical installation of a white water shower system embodying the concepts of the system;

FIG. 2 is a vertical section taken substantially along line 2-2 of FIG. 1 and showing a nozzle structure and orifice member in cross section;

FIG. 3 is a plan view taken substantially from FIG. 2;

FIG. 4 is a vertical section taken substantially along line 4-4 of FIG. 3 showing another cross sectional view of the orifice defining member;

FIG. 5 is a vertical section similar to FIG. 2 showing a modified form of a nozzle installation in a shower tube;

FIG. 6 is another cross section of the orifice member slightly modified from that view of FIG. 2.

As shown in the accompanying drawings and particularly the diagrammatic illustration in FIG. 1 a shower system embodying the pressure responsive orifice de-

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fining member provided by applicant includes a shower tube 10 having a supply conduit 11 arranged in communicating relation to convey white water for spraying or may be sterilized to convey any pressure medium to the shower tube 10. The supply conduit 11 is fed from a main supply conduit 12 through strainers 13-13 which are shown purely as a means for straining larger particles such as rust or grit from the white water. A control valve mechanism 14 is installed in the supply conduit 11 and the function of this control is to reduce the pressure in the supply conduit 11 such that for example in the system shown in FIG. 1 the pressure to the left of the control mechanism 14 would be substantially higher than the pressure to the right and in the shower tube 10. By controlling the opening through the control valve 14 the pressure in the shower tube 10 may be increased to that of the supply and if the opening is increased quickly it will create a necessary pressure surge. Although many forms of pressure control systems may be provided the form illustrated herein comprises a system operated by air pressure to control the opening through a circumferential diaphragm 16 and thus control the pressure of the fluid flowing therethrough.

The control system in this form includes a high pressure air supply line 18 having a control valve 19 to control the air pressure and thus control the size of the passage through the diaphragm 16. An outlet conduit 20 is provided and may include either an automatic system 21 or a manual valve system 22. The operation of the manual valve system is to provide a normally closed valve 23 which upon actuation will open and reduce the pressure acting on diaphragm 16, allowing the same to open and thus equalize the pressure in the conduit 11 and tube 10 at the high pressure level. Closure of the manual valve 22 will of course cause the diaphragm 16 to again constrict and provide the pressure differential on either side of the control 14. The automatic pressure control system 21 includes a normally closed solenoid valve 23 and a control mechanism 24 which most desirably would include both an automatic timer control and a manual operating button 25 to open the solenoid valve 23 at timed intervals or at the operators command. The system under automatic operation would be the same as the manual system.

Although the form illustrated will deliver a surge of white water under increased pressure to the shower tube 10 it is of course possible to provide various control valves 14 such as one which would stop the flow of white water in the conduit 11 and introduce therein air or gas pressure. The form shown is purely a means to provide a pressure differential to the shower tube 10, the necessity of which will be described hereinafter.

To provide the shower system a plurality of nozzle structures 30 are mounted through the periphery of the shower tube 10 and in the preferred form as shown in FIGS. 2, 3 and 4 the nozzles 30 each comprise an orifice locating and attachment member 31 having a central longitudinal passage 32 communicating with the interior 10a of the shower tube 10 to allow the flow of materials therethrough. The orifice locating and positioning member 31 is provided with threads 33 on the outer periphery thereof and is provided with an interior orifice locating structure which comprises a generally arcuate passage 34 extending inwardly into the positioning members 31 and having a radially spaced circumferential flange 36 at the bottommost portion of the passage 34 to provide a circumferential recess 37 between the flange 36 and wall of the passage 34.

Orifice defining member 40 is generally arcuate in shape and includes a peripheral flange 41 extending entirely therearound having a flat flexible resilient arcuate center portion 42 extending thereacross. The orifice de-

fining member 40 is held in position within the nozzle locating member 31 by providing a positioning ring 50 receivable into the nozzle passage 34 and having an up-standing inner circumference lip 51 which when in position extends over the peripheral flange 41 of the orifice member 40 to abut with the arcuate center section 42 thus holding the member securely therein. The ring member 50 is provided with a central passage 52 to allow material to be sprayed therefrom.

A closure capturing nut 54 is provided for threaded engagement with the threaded portion 33 of the nozzle locating member or boss 31 to positively capture the ring 50 and orifice member 40 therein. Again a central arcuate passage 55 is provided in the capturing element 54 to provide a passage for material to be sprayed there-through.

The orifice defining member 40 in the preferred form is providing with an arcuately shaped smoothly raised central support section 43 which defines a pair of communicating ovals 44—44 therein wherein the area 45 defined within the ovals 44 is reduced in thickness from the remainder of the orifice defining member 40. The actual orifice opening 46 is defined by a slot extending lengthwise of the ovals 44 and intermediate the sides thereof. A comparison of the decreased width portion 45 is illustrated in the two cross sections of FIG. 2 and FIG. 4 which clearly illustrates that at the point of communication 47 between the ovals 44 the cross section of the reduced thickness area 45 is substantially less than that of a thickness area 45 is substantially less than that of a section taken through the midpoint of either of the ovals 44. To prevent the slit orifice 46 from tearing the material the ends of the slit 46 abut with the ovals 44.

The theory behind this unique orifice member construction is to provide additional support at the central portion 47 of the orifice slot 46 such that as pressure is exerted therebehind the slit will open uniformly in relation to the pressure throughout its entire length to emit a knife edge conically shaped spray pattern. Orifice defining member 40 is provided of a flexible material to flex in response to pressure exerted thereon and at the present time the applicant believes that either neoprene or buna-n will be a suitable material and further that through testing thus far the material should have a rating of 70 durometer although other ratings may prove successful. These materials the properties of course may possibly be varied according to the application and pressure for which the nozzle will be used.

It is essential in the design of the orifice member 40 to provide a material which is pressure responsive such that the actual orifice 46 or opening slot will open wider upon an increase in pressure such that clogging particles may be easily discharged therethrough. The pressure responsiveness of the nozzle will also be affected by the diameter of the passage 32 through the nozzle positioning boss 31 and likewise by the diameter 52 of the capturing ring 50.

When this form of nozzle and orifice is used in the system as described in FIG. 1 it is obvious that a surge in pressure provided by opening the control valve 14 will provide an automatically opening and closing orifice in response to the pressure surge to pass particles that may be contained in the white water.

A modified form of installation for this above described orifice is shown in FIG. 5 wherein an inwardly extending conduit 60 is arranged in the nozzle locating boss 31 and sealed thereto and which extends inwardly across the shower tube 10 to have its open end 61 in closely spaced relation to the opposite inner surface 10a of the shower tube 10. The reasoning behind this extension conduit 60 is to provide an immediate opening orifice member 40 to spray in response to a sensing mechanism. When the nozzle boss 31 is extended rearwardly the nozzle conduit 60 remains full of water or fluid at all times and when a sensing mechanism opens a supply valve the nozzles will spray immediately. Again in this situation

when all pressure is decreased to the shower tube 10 the nozzle member 40 automatically closes and the conduit 60 remains full of water. The instantaneous response of the orifice is increased somewhat by this conduit 60 although applicant has found that it is possible to design the orifice 40 to close and seal rapidly at pressures below a predetermined level and to open rapidly in response to pressures above a predetermined level.

A second modified form of the orifice member is illustrated in FIG. 6. In this form of orifice member 40 the outer configuration support portion 43 and slot 46 are exactly the same as in the preferred form. The primary departure in this form comes from the inclusion of an additional support member 65 provided integrally with the arcuate center portion 42 of the orifice. This strengthening material 65 may comprise a cloth or nylon fabric, which have been tested and have been found successful, or may include a metallic spring member such as one formed from beryllium copper. The principal of the strengthening member is of course to add resistance to the orifice member and not allow it to stretch.

The use of the orifice member 40 has many unique applications where a pressure responsive system is desirable. By substituting this type of orifice member 40 pressure responsive valves could be eliminated by designing the orifice to open at any specific pressure.

To describe the entire white water shower system supplied with these pressure responsive orifice members it is convenient to return to FIG. 1 which shows an entire system. For the sake of convenience the white water inlet pressure to the left of the control mechanism 14 will be stated to be 100 p.s.i. By controlling the circumferential diaphragm 16 through manipulation of the air inlet 19 the pressure in the shower tube 10 may be controlled and reduced to 80 p.s.i. Either by manual manipulation of valve 22 or automatic manipulation of solenoid 23 the air load on diaphragm 16 may be dropped to allow the diaphragm 16 to contract and open the passage therethrough to provide a surge in pressure to the shower tube 10. When the pressure surge takes place the orifice slot 46 will open wider and allow particles to pass therethrough thus automatically cleaning not only the nozzles 30 but also the tube 10 and supply conduits 11.

Although in the above described system hydraulic pressure is shown to be the orifice actuating medium, it would likewise be possible to replace the control valve 14 with a selector valve which would close the white water supply and select another higher pressure medium to expand the orifice openings 46 and clear the system of particles. This new medium could easily be air pressure.

It should be pointed out particularly that the system as designed requires only a single supply conduit to the shower tube and this singular system will depend upon what type of cleaning medium is used. If air is used, naturally an air conduit will have to be provided to a selector valve but again the supply to the tube 10 may be a single line.

It should be obvious that applicant has provided a unique white water shower system requiring only a single supply conduit for both operation and cleaning.

It should also be obvious that applicant has provided a unique pressure responsive orifice member for use in not only white water shower systems but for use in systems or apparatus which require pressure responsive fluid emission and positive sealing upon reduction of the pressure.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportion of parts without departing from the scope of my invention, which generally stated consists in the matter set forth in the appended claims.

What I claim is:

1. A nozzle, particularly adapted for spraying liquids containing solid particles, said nozzle including:

- (a) a mounting structure adapted to be connected with a source of liquid under pressure permitting flow of liquid therethrough;
- (b) an orifice defining member sealingly carried by said mounting structure disposed to control the flow of liquid, provided of resilient material having a first cross sectional dimension and including:

- (1) an elongated slit arranged generally centrally thereon;
- (2) a support area of increased cross sectional dimension on said member substantially encompassing said slit; and
- (3) selected portions of said support area adjacent said slit being of reduced cross sectional dimension providing areas of diminished support to said member whereby the shape of the slit is in opened position and may be controlled to permit a knife edged fan shaped spray to be emitted therefrom.

2. The structure set forth in claim 1, wherein said selected diminished portions include a pair of generally oval shaped areas arranged longitudinally along said slit and communicating generally intermediate the ends of the slit to provide a pair of diminished support areas with an area of greater support therebetween.

3. The structure set forth in claim 1 and an integral peripheral flange provided on at least one side of said orifice defining member to facilitate sealingly mounting the same on said mounting structure.

4. The structure set forth in claim 1 and a reinforcing material integrally molded into said orifice defining member.

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