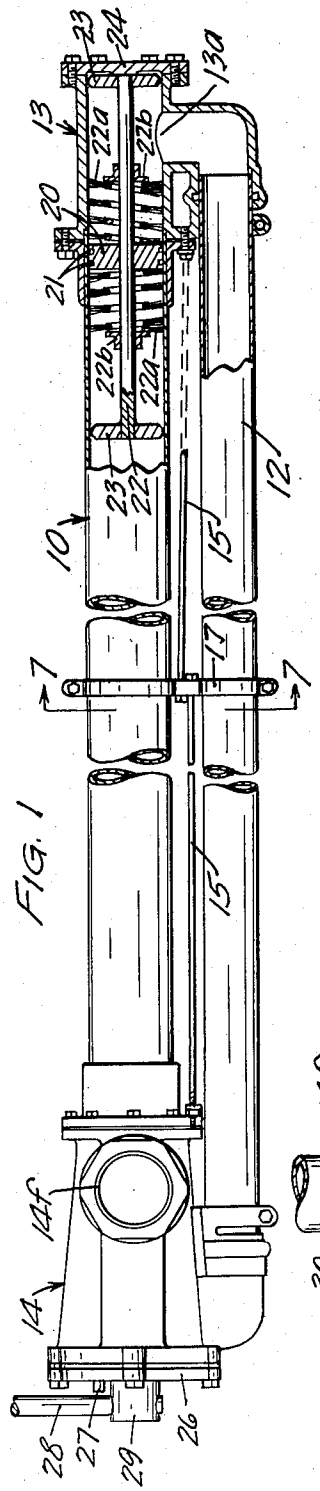
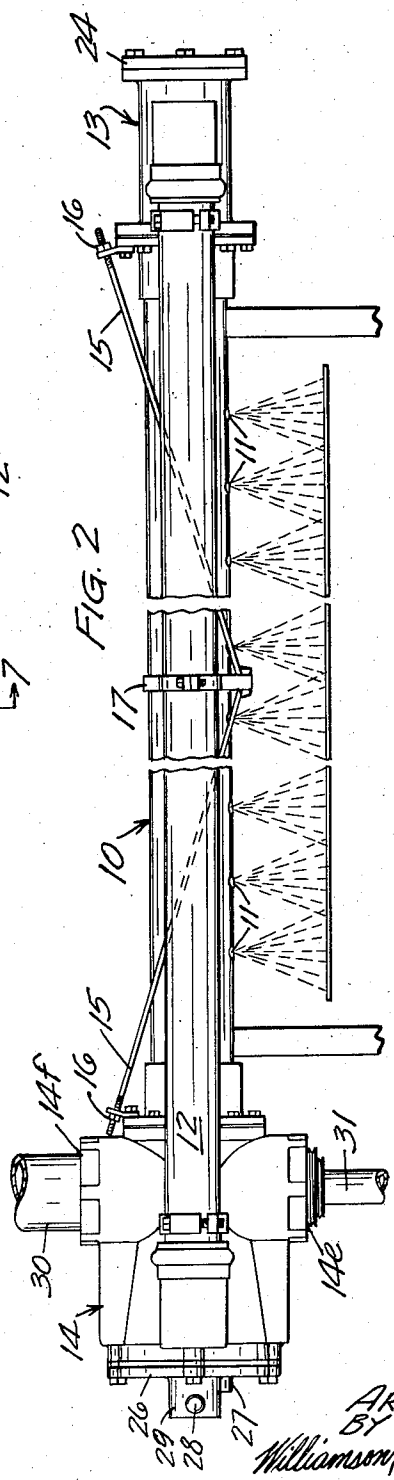
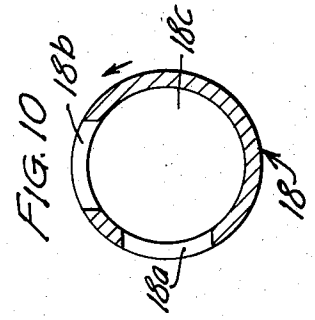
April 28, 1959 A. E. BROUGHTON 2,884,203

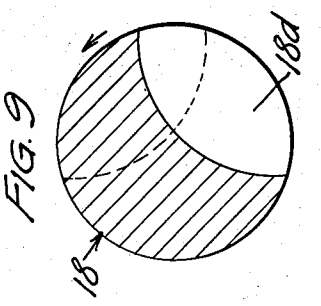
SPRAY SHOWER ASSEMBLY

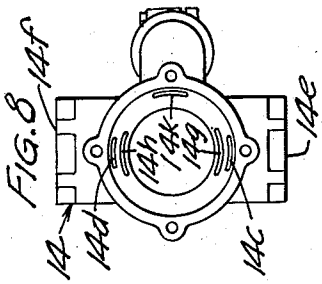
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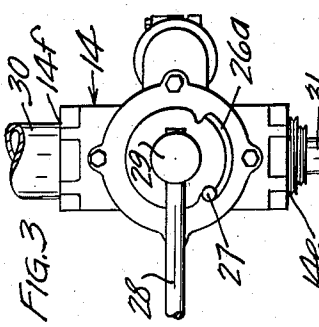












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SPRAY SHOWER ASSEMBLY

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FIG. 4

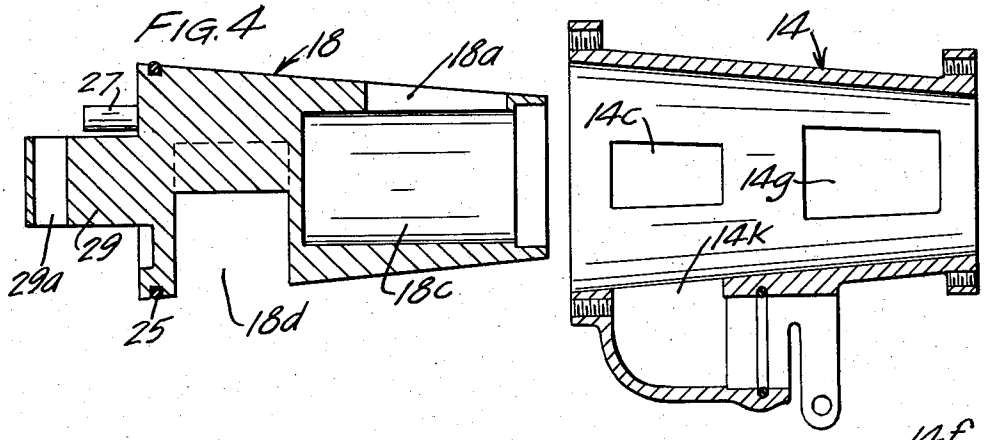


FIG. 5

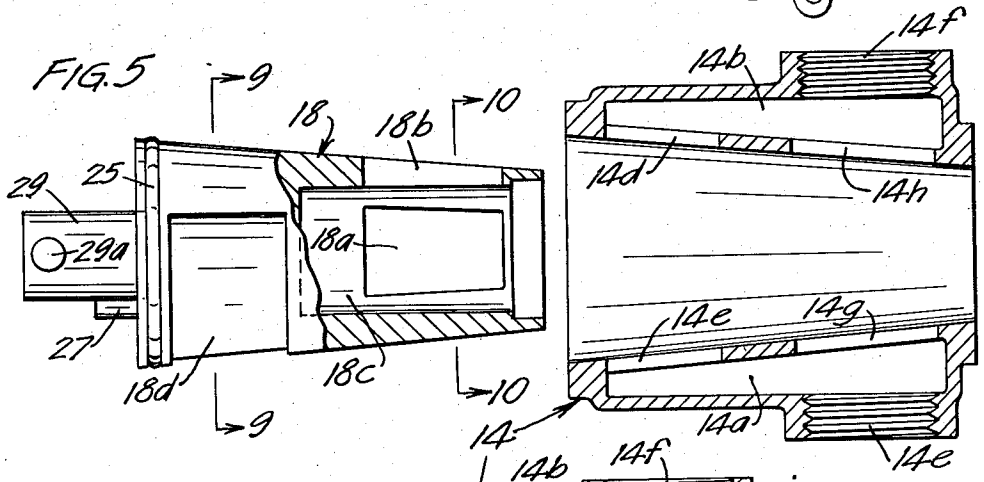


FIG. 6

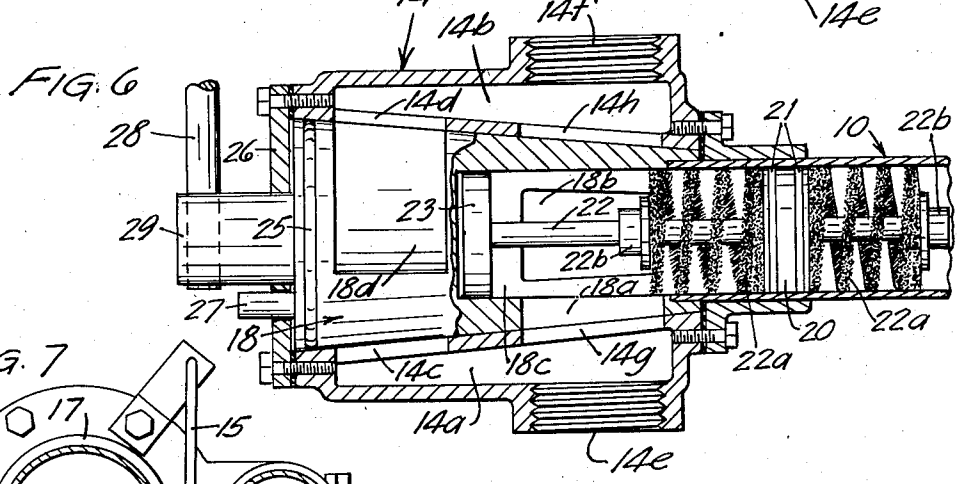
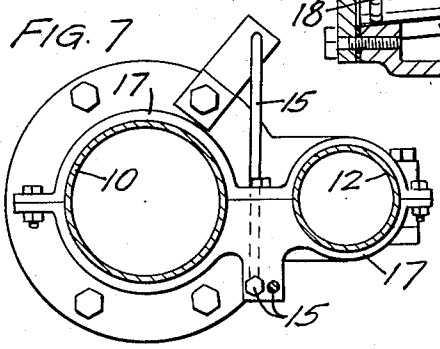


FIG. 7



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SPRAY SHOWER ASSEMBLY

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Application April 8, 1957, Serial No. 651,243

10 Claims. (Cl. 239—116)

This invention relates generally to spray showers and more particularly to a shower assembly for water containing solid particles and including a cleaning mechanism for the nozzles and a compact control valve for reversing the flow through said shower to actuate said cleaning mechanism.

It has long been a problem to use water containing solids such as white water from paper making machines in spray showers since the solid particles such as the paper pulp carried by the water clog the nozzles of the shower. It is, however, often desirable to use this water in order to avoid wasting the same as well as the solids contained therein. When this water is merely disposed of cold water must be added by the showers to the paper machine system which requires supplying additional heat to the paper pulp to maintain the desired temperature thereof. While the shower assembly disclosed in my co-pending application Serial No. 413,197, now Patent Number 2,829,005, filed March 1, 1954, as a continuation in part of my prior invention Serial No. 202,789, now abandoned, filed December 26, 1950, discloses a satisfactory shower for water containing solids such as white water, I have found that this shower assembly produces a substantial head loss in the water flowing therethrough by requiring abrupt changes in the direction of flow of said water, and I have also found that my prior assembly required excessive lateral space which prevents installation on many shower units where only limited lateral space is available.

It is, therefore, an object of my present invention to provide a spray shower having compact and efficient means for cleaning the nozzles thereof to permit the use of water which contains particles of solid material in suspension therein.

It is also a specific object of my present invention to provide a shower particularly adapted for use with white water in paper making machines wherein the entire assembly is constructed to require only slightly more lateral space than is required by a conventional shower tube per se and which is specifically designed to minimize the head loss of the water supplied to the nozzles thereof.

More specifically it is an object to provide a white water shower with a cleaning mechanism and a control valve axially aligned with the shower tube for reversing the direction of flow through said shower to actuate said cleaning mechanism and maintain the spray nozzles of the shower in a clean unobstructed condition for efficient operation thereof.

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

Fig. 1 is a top plan view of my new shower assembly showing portions thereof in horizontal section;

Fig. 2 is a front elevational view of the structure shown in Fig. 1;

Fig. 3 is an end elevational view of the structure shown in Figs. 1 and 2;

Fig. 4 is an exploded longitudinal horizontal sectional view of the valve casing and valve plug with said plug oriented in its normal spraying position;

Fig. 5 is an exploded longitudinal vertical sectional view of the valve casing and valve plug with said plug shown in the same oriented relation as in Fig. 4;

Fig. 6 is a longitudinal vertical sectional view illustrating the valve in assembled position and showing the plug oriented in its rotated reversing position;

Fig. 7 is an enlarged transverse vertical sectional view taken substantially along the line 7—7 of Fig. 1;

Fig. 8 is an end elevational view of the valve casing per se;

Fig. 9 is a transverse vertical sectional view of the plug member per se taken substantially along the line 9—9 of Fig. 5 and showing said plug in its normal operative position as illustrated in Figs. 4 and 5 by full lines and in its rotated position by dotted lines; and

Fig. 10 is a transverse vertical sectional view of said plug member per se taken substantially along the line 10—10 of Fig. 5 and showing said plug member in its normal position by full lines and its rotated reversing position by dotted lines.

A specific embodiment of my invention is illustrated in the accompanying drawings wherein I show a white water shower assembly for a paper making machine and having a shower tube **10** made from any suitable corrosion resisting material such as stainless steel or the like and including a plurality of spaced spray nozzles **11** in the bottom thereof. These spray nozzles may be of any suitable design wherein the inside surface of the shower tube **10** is maintained substantially smooth and unobstructed such as the nozzles disclosed and claimed in my U.S. Patent No. 2,665,946, issued January 12, 1954. A bypass or reversing conduit **12** is disposed in close side by side parallel relation to the shower tube **10** and communicates with said shower tube by means of a suitable connection member such as the casting **13** provided at one end thereof and the valve assembly including a housing or casting member **14** provided at the other end thereof.

In relatively long shower assemblies it is apparent that the center portions of the tubes or conduits **10** and **12** will tend to sag due to the weight thereof. It is, therefore, important that sufficient support be provided to prevent such sagging. I have solved this problem with my present shower assembly by providing a tension type reinforcing truss wherein the ends of a pair of tension members **15** are securely anchored to the respective castings **13** and **14** as by the mounting members and adjustment nuts **16**. A double ring type bracket **17** surrounds both of said tubes **10** and **12** and is securely anchored thereto as by being clamped therearound as best shown in Fig. 7 and provides an anchor for the inner ends of the members **15**. In the form shown any suitable means for tensioning the two members **15** may be provided such as the nuts **16**.

Figs. 4 and 5 illustrate my tapered plug type control valve which is specifically designed to permit compact construction of the shower assembly and to reduce the head loss of the water flowing therethrough. The inside of the casing or housing member **14** has a tapered valve chamber formed therein and a cooperatively tapered valve plug member designated as an entirety by the numeral **18** is rotatably received within the chamber in sealingly engaged wall to wall relation. This valve plug **18** has a hollow inner chamber providing an inner section with a pair of openings or ports **18***a* and **18***b* formed in the side

wall thereof and a closed outer end thereof. These ports are disposed in the form shown in 90° circumferentially spaced apart relation. The hollow valve chamber with which said ports communicate is designated by the reference character 18*c* and is cylindrical in shape and has the same inside diameter as the inside diameter of the shower tube **10**. The inner end portion of the valve plug **18** is machined out to receive the end portion of the shower tube as best shown in Fig. 6 to form a smooth continuation of the cylindrical inside surface of said tube for purposes to be brought out hereafter. The outer section of the valve plug **18** has a cut out portion defining a control passage 18*d* which extends around the circumference of said plug member for a distance of more than 90° and less than 180° as best shown in Fig. 9.

The valve housing **14** has a pair of elongated generally longitudinally disposed communication passages formed on the outside thereof and respectively designated by the reference characters **14***a* and **14***b*. The valve plug **18** divides the valve chamber of the housing **14** into an inner section and an outer section, since the outside tapered surface of the valve plug sealingly engages the inside cooperatively tapered wall surface of the housing chamber. The outer section of the chamber communicates with the passages **14***a* and **14***b*, respectively, through the control ports **14***c* and **14***d* and the inner section communicates with passages **14***a* and **14***b*, respectively, through the ports **14***g* and **14***h*. A pair of conduit connection openings **14***e* and **14***f* are respectively aligned with the ports **14***g* and **14***h* and respectively communicate directly therewith across the inner end of passages **14***a* and **14***b*. The ports **14***g* and **14***h* are of sufficient size to permit unrestricted flow of the water therethrough into said shower tube **10**. I have found that providing an area of approximately 25% greater than the cross sectional area of the supply conduit works very efficiently in preventing head loss through said ports **14***g* and **14***h*. Also, the direct alignment of said ports with the respective conduit connection openings **14***e* and **14***f* eliminates any change of direction in the water flow into said shower tube **10**. It is apparent that either the opening **14***e* or the opening **14***f* may form the inlet opening by connection with a supply conduit and the other forming the outlet opening. In the installation illustrated the opening **14***f* is shown as the inlet opening and is connected to the supply conduit **30**, and the opening **14***e* is the discharge or drain opening. It should be noted that for purposes to be brought out hereafter a conduit **31** of substantially reduced size restricts the flow through the drain opening. As best shown in Fig. 8 the housing **14** has a by-pass port **14***k* formed therein which affords communication between the reversing conduit **12** and the outer section of the valve chamber. The ports **14***c*, **14***d* and **14***k*, formed in the outer section of the housing chamber are circumferentially spaced apart 90° in the form of the invention illustrated. These outer ports are in substantial circumferential alignment to permit selective interconnection thereof by the cut out passage 18*d* formed in the outer section of valve plug **18** and the inner ports **14***g* and **14***h* are in substantial circumferential alignment to permit selective registration with the two valve control ports **18***a* and **18***b* formed at the inner hollow cylindrical section of valve plug **18**. In Figs. 4, 5, 9 and 10 the valve plug **18** is shown in normal operative position where the water supplied to the shower tube **10** flows directly into the hollow valve chamber **18***c* and from there into the orificed shower tube **10**. During normal operation of the shower which discharges a cleaning spray from the nozzles thereof as illustrated in Fig. 2, the cleaning mechanism consisting in a cleaning and sealing piston **20** is, of course, disposed at the end of the shower tube remote from the control valve. The piston **20** has in the form shown a pair of cleaning and sealing rings **21** mounted around the circumference thereof for resiliently engaging the inside wall of the shower tube **10**. I have found that stainless steel rings provide the most efficient results for the cleaning operation, and any leakage therearound is prevented by an accumulation of the solid particles carried by the water so that an effective seal is formed by the ringed piston at the end of the shower tube to prevent head loss on the water being supplied to the spray nozzles. A pair of longitudinally extending connecting rods **22** are securely fixed to the piston **20** axially thereof and connect said piston to a pair of spaced apart stabilizing and cushioning plungers **23** of slightly smaller diameter than the inside diameter of the shower tube. The cushioning operation of these plungers **23** will be described hereafter. It will be seen from the operative position of the piston **20** and plunger **23** in Fig. 1 that said plunger will provide suitable stop means for preventing the piston from traveling beyond the opening **13***a* in the casting **13** in order to permit actuation of the cleaning piston to force the same back to the valve end of the shower tube **10** by reversing the direction of flow through said shower tube as will hereinafter be described.

A pair of generally helical brush segments **22***a* are mounted on each side of the piston **20** and are held against longitudinal shifting movement between a pair of collars **22***b* and said piston **20**. I have found that nylon bristles work very efficiently for this purpose.

Figs. 4, 5, 9 and 10 show the valve plug in normal operative position wherein the valve plug port **18***b* is registered with housing port **14***h* to permit flow directly into the valve end of the shower tube through cylindrical chamber **18***c*. With the valve port **18***b* registered with the inlet opening **14***f* directly through port **14***h* there is only a minimum of directional change of the water flowing into the shower tube and therefore a minimum of head loss of the water being supplied to the nozzles. In this position of the valve the port **14***g* is, of course, closed by an imperforate wall portion of the inner plug section and the port **14***d* is closed by an imperforate portion of the outer section of valve plug **18**. The outer valve control passage **18***d* in this position of said valve plug interconnects by-pass port **14***k* and **14***c* as best shown by the full line position of Fig. 9 and the end elevational view of the housing as shown in Fig. 8. This, of course, affords communication between the by-pass conduit **12** and the drain conduit **31** through longitudinal passage **14***a*. In order to reverse the flow through the shower tube for cleaning purposes the valve plug is rotated through 90°. As viewed in Fig. 3 this rotation is in a counterclockwise direction and swings the outer control passage **18***d* up into the dotted line position shown in Fig. 9 to interconnect port **14***k* with port **14***d* and to close off port **14***c*. The inner valve section is rotated into the dotted line position shown in Fig. 10 which brings the port **18***a* into registration with the port **14***g* and closes off port **14***h* by swinging port **18***b* out of registration therewith. Thus the water flowing in through conduit **30** and conduit connection opening **14***f* is carried outwardly through passage **14***b* and into by-pass conduit **12** through port **14***d*, control passage **18***d*, and port **14***k*. This, of course, applies the water pressure to the remote side of the piston **20** through opening **13***a* and forces the cleaning piston assembly down toward the valve end of the shower tube. The substantially solid stainless steel rings provide positive cleaning and breaking off of any solid particles caught in the shower tube orifices and carry any solids removed from said orifices down to the valve end of the tube to discharge the same through the ports **18***a* and **14***g* and directly across the passage **14***a* into the restricted drain conduit **31**. It will be noted that the cylindrical chamber **18***c* extends outwardly a substantial distance beyond the ports **18***a* and **18***b* thus forming a closed end cushioning segment into which the cushioning plunger **23** will move. The cushioning plunger **23** is only slightly smaller than the diameter of said cylindrical segment and therefore restricts the flow of water therearound to provide the desired braking action

at the valve end of the cleaning stroke to prevent damaging impact of the cleaning assembly against the abutment provided therefor. The piston is then reversed and carried back to the normal sealing position thereof by shifting the valve plug **18** back to its normal position wherein ports **14***h* and **18***b* are in registration and ports **14***c* and **15***k* are interconnected and ports **14***d* and **14***g* are closed. During the movement of the piston back to the remote end of the shower tube the water in the shower tube is forced out through opening **13***a* and back through by-pass conduit **12** to drain conduit **31** through ports **14***k*, **14***c*, passage **14***a* and opening **14***e*. Any residue removed on the return stroke of the piston is, of course, carried out through the drain conduit **31**. As the piston approaches the end of this return conduit the other plunger **23** travels beyond opening **13***a* and into a generally cylindrical cushioning segment formed in the casting **13** which is similar to the cushioning segment described at the outer end of chamber **18***c*. This plunger **23** thus gradually brakes the piston at the end of its return stroke and forms a positive stop for positioning the same between the opening **13***a* and openings **18***a* and **18***b* in the valve plug **18**. By providing the reduced drain conduit **31** sufficient pressure is maintained on the drain side of the piston to maintain the cushioning of segments full of water at all times in order to permit efficient operation of the cushioning plungers **23** as they travel into said respective segments at the ends of the strokes thereof. Obviously, highly efficient normal operation of the shower is obtained by permitting the supply water to flow unrestricted directly into the valve end of the shower tube **10**.

Obviously, suitable means must be provided for sealing the ends of the castings **13** and **14** such as the closure cap **24** sealingly connected to the outer end of casting **13** as by suitable cap screws and O-ring **25** which surrounds the extreme outer marginal edge portion of the valve plug member **18**. A retaining collar **26** suitably anchored to the outer end of casting **14** as by cap screws positively holds the valve plug member **18** with its tapered surface in sealed engagement within the valve chamber of housing **14** and this collar has suitable stop means for positioning the valve plug member **18** in its two selected positions. A 90° segmental portion **26***a* with abutment stops at the ends thereof receives a stop pin **27** fixed in the end of valve plug **18**. In order to prevent the valve plug member from being inserted in an improper position within the casing, one of the cap screws of the retaining collar is of a different diameter than the others so that said collar will always be oriented in the proper manner when attached to the valve casing **14**. Suitable means for turning the valve plug **18** may be provided such as the lever **28** as best shown in Fig. 3 which extends through a suitable passage **29***a* formed through an axially disposed central hub **29** of the valve plug member **18**.

It will be seen that I have provided a relatively simple yet highly efficient and compact shower assembly particularly designed for showers using water containing solids such as white water showers in paper making machines. This invention greatly facilitates the use of such water carrying solid particles by providing a highly efficient cleaning mechanism without materially increasing the space required for conventional showers. By permitting the use of white water for showers in paper making machines considerable economic savings are produced. The head loss by adding clear filtered water through the shower sprays is entirely eliminated. Also it is obvious that any water added to the system at any point must be removed in the paper manufacturing process. Thus if this water added through the shower carries with it a percentage of paper pulp the amount of actual water to be removed is thus reduced. The use of white water also, of course, produces a material saving in the water being used as well as a saving of the valuable paper pulp previously disposed of with the waste white water.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention which consists of the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. A shower assembly comprising an elongated shower tube having a plurality of spaced discharge orifices therein, a cleaning and sealing piston assembly working in longitudinally slidable relation within said tube and provided with means for engaging the inside wall surface of the tube, a by-pass tube connected at its respective end portions to the end portions of the shower tube, a control valve assembly having a supply inlet and a discharge outlet and including a controllable valve plug member arranged generally axially of one of said tubes and mounted in the one end thereof for rotation about the longitudinal axis of said tube and provided with a plurality of circumferentially spaced opening for reversing the flow through said tubes to move said piston from one end of the shower tube to the other end to remove the solid foreign material from the tube orifices and carry the same out through the discharge outlet.

2. The structure set forth in claim 1 wherein the control valve and rotatable valve member thereof are disposed axially of the shower tube adjacent one end thereof.

3. The structure set forth in claim 2 and said rotatable valve member having a hollow generally cylindrical chamber formed at the inner end portion thereof to form a continuation of the inside of the shower tube and permit a portion of the cleaning piston assembly to travel into said chamber.

4. The structure set forth in claim 3 and said cylindrical chamber having a pair of valve ports formed through the side wall thereof in circumferentially spaced apart relation and said chamber extending outwardly beyond said ports to provide a closed-end plunger receiving section, and said cleaning piston being provided with a cushioning plunger disposed in longitudinally spaced relation thereto and being of a size only slightly smaller than the inside diameter of said cushioning plunger receiving section of said chamber to restrict the flow of water around said plunger as said plunger approaches the end of its stroke into said chamber to cushion the end of the plunger stroke.

5. The structure set forth in claim 4 and a similar cushioning plunger spaced longitudinally on the other side of said piston and means defining a generally cylindrical closed end cushioning segment disposed remotely of the communication opening between the tubes at the ends thereof remote from said valve to restrict the flow of water around said second plunger and thereby cushion the other end of said piston stroke.

6. In combination with an orificed shower tube, a reciprocating piston assembly working in said tube and including a cleaning and sealing piston with peripheral portions disposed in close fitting relation within said tube, means closing the ends of said tube, said tube having flow openings in inwardly spaced relation from said tube ends to provide generally cylindrical cushioning segments at the ends of said tube outwardly of said openings, a pair of cushioning plungers of slightly smaller diameter than the inside diameter of said cushioning segments and longitudinally spaced from said piston on both sides thereof to be respectively received in said cylindrical segments at the ends of the reciprocating strokes of said piston through the tube, means for reversing the direction of flow of water through said tube to cause said piston to be reciprocated from one end thereof to the other.

7. The structure set forth in claim 6 and said flow reversing means including a valve assembly having a rotatably mounted control valve member disposed generally axially of said shower tube and forming the end

closure of said tube at one end thereof including said cylindrical cushioning segment.

8. An orificed shower particularly designed for use with water containing solids and including a mechanism for cleaning the shower orifices, said shower comprising an orificed shower tube, means defining an opening at one end of said tube, a cleaning and sealing piston slidably mounted within said tube for reciprocation in response to the flow of water through the tube, a valve assembly axially mounted with respect to said tube and including a plug member having a cylindrical segment forming a continuation of said tube, said cylindrical portion being rotatable and including a plurality of control ports therethrough, a by-pass circuit affording communication between the ends of said tube and connected with said valve to permit reversing of the flow of the water through said tube to cause reciprocation of said piston from one end thereof to the other, said piston forming a seal at the respective ends of its structure to permit maintaining of the desired pressure in said shower tube during normal operation thereof.

9. The structure set forth in claim 8 and said piston having a pair of brush units mounted on each side thereof to assist in cleaning the inside of said orifice tube.

10. An orificed shower particularly designed for use with water containing solids and including a mechanism for cleaning the shower orifices, said shower comprising an orificed shower tube, a valve housing at one end of said tube and defining a plug receiving chamber communicating in sealed relation with said tube, a valve plug member rotatably mounted in said chamber and defining an axially disposed passage in the end portion thereof adjacent said shower tube, a cleaning and sealing piston assembly mounted for reciprocation in said shower tube in response to water flowing therethrough, said plug member having a plurality of flow control openings formed therein and flow confining apparatus cooperatively associated with said valve and said shower tube to permit the direction of flow of water through said shower tube to be reversed.

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