SWIVEL SPRAY APPARATUS

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ABSTRACT

A swivel type of apparatus, suitable as a plumbing fitting, for providing a single stream or a spray stream. The apparatus includes a ball type of swivel employing an O-ring positioned along the axis of the ball structure so as to seal the swivel arrangement against leakage. The apparatus also includes a hand-controlled slider component which may be moved either to a position so as to render the apparatus capable of supplying the single steam, or to another position so as to provide the spray steam.

The apparatus also includes a flow controller in the form of a pair of disks for rendering the two types of streams developed by the apparatus substantially free of the effect of varying pressures of the liquid supplied to the apparatus. The disks include (1) a rigid disk having a plurality of small apertures which are parallel to each other and (2) a flexible disk mounted closely adjacent to the rigid disk, the flexible disk having a smaller number of apertures of larger diameter. The flexible disk also includes a plurality of flexible projections which normally are barely in contact with the rigid disk and which become compressed to reduce the "open" area of fluid transmission as the pressure of the fluid rises above a predetermined value so as to render the exit stream substantially independent of the pressure variations.
3,647,144 SWIVEL SPRAY APPARATUS

This invention relates to fluid spouts capable of producing either of two different types of fluid streams, (1) a single stream and (2) a spray stream. This invention also relates to spout apparatus employing a ball type of swivel so arranged that the spout apparatus may be turned or rotated into any desired direction to change the path of the generated stream. This invention also relates to flexible spout apparatus which includes means for rendering the stream, whether it is a single stream or a spray stream, substantially free of variations in the pressure of the liquid transmitted to the spout apparatus.

This invention will be better and more clearly understood from the following and more detailed description and explanation hereinafter following when read in connection with the accompanying drawing in which,

FIG. 1 illustrates schematically a longitudinal cross-sectional view through the center of the swivel spout apparatus of this invention;

FIGS. 2 and 3 illustrate, respectively, a plan view and a central cross-sectional view of a flexible disk which is part of the flow controller of the apparatus shown in FIG. 1;

FIGS. 4 and 5 illustrate, respectively, a plan view and a central cross-sectional view of the rigid disk of the flow controller of the apparatus shown in FIG. 1; and, in contrast to FIG. 1,

FIGS. 6 and 7 respectively illustrate fragments of the longitudinal cross-sectional views of the mechanism of this invention in its single stream position and its spray stream position.

Referring particularly to FIG. 1 of the drawing, which shows schematically a general assembly of the parts of the swivel spout apparatus of this invention, and referring also to FIGS. 6 and 7, which show the apparatus in the single stream position and in the spray stream position, respectively, the ball type of swivel is designated 1 and it is arcuately retained within a socket cap 2, as shown. As better seen in FIG. 1, the ball structure 1 also includes a shoulder segment 1a, under which a shroud 3 is positioned. The apparatus also includes a hand-controlled, contoured outer body 4 which encloses an adjacent director 5. The director 5 includes an inner sleeve 5a which retains another sleeve 6. The sleeve 6 embodies an inner collar 6a which is supported against a stationary inner body 7. The inner body 7 and the outer body 4 have an opening between them in which a cup-shaped seal 8 is positioned.

Within the sleeve 6 there is a fixed screw retainer 9 which is contoured so as to receive four screens each designated 11 and a screen spacer 10. The screen spacer 10 separates the upper two screens from the lower two screens. All four screens 11 and the screen spacer 10 are held in position by a retainer screw 20 which is threaded into and held by a collar 21.

An adapter 12 is screw threaded to the socket cap 2 as already noted. The external threads of the adapter 12 are so designed for connection to a kitchen spout, for example, which may be located in, and may be part of, a kitchen sink to which the swivel spout apparatus of this invention may be physically connected. The adapter 12 supports a flow controller 13 which consists of two disks, a flexible disk 14 and a rigid disk 15 which are closely adjacent to each other.

As shown more clearly in FIGS. 2 and 3, the flexible disk 14 embodies a plurality of apertures which are normally substantially cylindrical in shape and parallel to each other. The central aperture is designated A1 and the six peripheral apertures are designated A11. The peripheral apertures are all equally spaced from each other and from the central aperture A1. Moreover, the flexible disk 14 includes a multiplicity of projections, all of which are flexible. All of these projections designated P preferably may be semishperical in shape but any other shape may be satisfactory.

The rigid disk 15 embodies a larger number of parallel apertures A12 which are also closely adjacent to each other. The diameter fluid is smaller than the diameter of the apertures A1 and A11 of the flexible disk 14. The rigid disk 15 also includes a retaining seat R5 which is provided to receive and hold the circumferential aperture AP of the flexible disk 14. The rigid disk 15 may also include a skirt SK which may extend in the flow direction for any desired length, as may be desired in particular structures.

FIG. 1 is a schematic drawing which has been sketched to show the outer body 4 in two positions, (1) the position at the left-hand side of the drawing which is the position in which the single stream will be produced, and (2) the position at the right-hand side of the drawing which is the position of the outer body 4 when the spray pattern is to be produced. FIGS. 6 and 7 illustrate fragments of the apparatus to show the outer body 4 and the adjacent and related parts for the single stream position and the spray position, respectively.

The outer body 4 may be manipulated by the hand of the user to place the outer body 4 either in the position at the left to establish the single stream or in the position at the right to establish the spray stream. When the outer body 4 is manipulated to the position at the left, the director 5 and the sleeve 6 will be in their uppermost positions for yielding the single stream. The structure will yield a downwardly directed single stream through the spray apparatus of FIG. 1 over a path as indicated by the central flow arrows 100 and, near the bottom of the inner body 7, the stream will be diverted into a path through an aperture 110 and then again downwardly moved in the direction of the arrow 120 through all of the screens 11 adjacent the exit or mouth of the spout apparatus.

If a spray stream is desired instead of a single stream, the outer body 4 may be manipulated by the user into the position shown schematically at the right-hand side of FIG. 1. In this position, the director 5 and the sleeve 6 will be in their lowermost positions. Hence, water travelling along the path of the directional arrows 100 will be diverted laterally, as shown by the arrow 200, into the downward path of the arrows 210 and then exiting as a spray pattern established between and formed by the director 5 and the sleeve 6. The single stream corresponding to the position at the left of FIG. 1 may be used, for example, for washing dishes, while the spray stream produced by the positioning of the apparatus, as shown at the right of FIG. 1, may be employed for rinsing the dishes.

One of the features of this invention is the employment of the O-ring 16 which is positioned along a diameter of the swivel ball 1, the O-ring being substantially aligned with the center of the ball 1. This position of the O-ring 16 provides not only a good seal against the escape of water between the ball structure 1 and the cap 2, but it also contributes to the even, uniform movement of the spout apparatus as it is swiveled from one angular position to another, as desired, to change the direction in which the flow of fluid is to be emitted by the apparatus. If the O-ring is in a position substantially different from a diameter of the ball structure, there would be an increased tendency for leakage through the apparatus and, moreover, the swivel action would subject the ring to increased wear.

Whether the apparatus is in a single stream position or in a spray stream position, or whether or not the angle through which the apparatus is tilted is large or small, the flow of water through the apparatus will be substantially uniform notwithstanding wide variations in the pressure of the fluid supplied to the apparatus above a predetermined pressure. This is an important feature of the apparatus. The fluid entering the apparatus will traverse the parallel apertures of both the flexible disk 14 and the rigid disk 15 and be emitted through the exit or mouth of the apparatus. If the fluid pressure is equal to, or substantially equal to, a predetermined value such as, for example, 30 p.s.i., the flexible disk 14 and the rigid disk 15 will both be substantially parallel to each other. The projections P on the flexible disk 14 will barely touch the adjacent surface of the rigid disk 15. However, as will be explained, substantially wide pressure variations will not significantly alter the volume or flow path of the escape fluid.

As the fluid pressure rises above the predetermined value of, for example, 30 p.s.i., the fluid will develop a substantially uniform but increased pressure against the adjacent upstream side of the flexible disk 14. The increased pressure will deflect the projections P of the flexible disk 14, according to the mag-
nitude of the increased pressure, the projections $P$ being depressed into somewhat different shapes depending upon the magnitude of the increased pressure. This will result in a reduction, not only in the spacing between the centers of the two disks 14 and 15, but also in a reduction of the exposed area or of the "openings" of the apertures A1 to A50 of the rigid disk 15. Notwithstanding the increased fluid pressure, the flow of fluid through the swivel spout apparatus will be substantially constant.

The flexible disk 14 and the rigid disk 15 are described and illustrated in a copending application of R. G. Parkinson, filed of even date herewith, which is assigned to the assignee of the present application.

The swivel spout apparatus of this application employs no springs for holding any of the parts or components in their assigned positions. No springs are required. When the sleeve 6 is in its uppermost position, as is schematically shown on the left-hand side of FIG. 1, the sleeve 6 will remain in that position at all times, whether or not fluid is flowing through the apparatus. In the upper position of the sleeve 6, the flow of water above the screen retainer 9 will provide an increased pressure level due to the restriction of the flow path due to the intersection of the rim of retainer 9. This pressure will hold the collar 6a of sleeve 6 in the upper position notwithstanding the downward pressure applied against the screens 11. Were the restriction of the spacing not provided, the collar 6a would require some spring action or other assistance. The absence of a spring naturally improves the operation and also reduces maintenance problems.

In the down position of the sleeve 6, as is shown schematically at the right-hand side of FIG. 1, the sleeve 6 will be held in its lowermost position due to the pressure level in the chamber 18 above sleeve 6. Again, no springs will be required to maintain the sleeve 6 in this position.

It is especially noted that the outer body 4 has an external contour which is concave in shape. This is especially suitable for use in a fluid spout apparatus which is to be manually adjustable for producing either a single stream or a spray stream. The user's fingers will readily be retained on the inwardly directed external contour of the outer body 4 to shift from one position to another even when the surface or the fingers are wet. Thus, by gripping the outer body by finger pressure, the user can readily manipulate the apparatus without slippage.

The flow controller apparatus, which consists, as already explained, of the flexible disk 14 and the rigid disk 15, is especially important for the home user in that it serves to reduce the splash that would ordinarily accompany random changes in the pressure of the water supplied to the apparatus. The structure conserves water because the flow through the apparatus is maintained at the desired or optimal rate. It is further noted that, by the use of the spout apparatus of this invention, applied fluid pressures as high as 120 p.s.i. will not introduce splash in the water emitted from the spout apparatus. Thus, the flow of water from the spout apparatus and the operating conditions will remain uniform at the desired or optimal rate notwithstanding changes in the incident water pressure above a predetermined level.

The flow control apparatus shown and described in this application is disclosed in a copending application of R. G. Parkinson, Ser. No. 24,248, filed of even date, entitled "Flow Control Valve for a Plumbing Fitting," which is assigned to the assignee of the present application.

The swivel spout apparatus of this invention significantly employs no aerator. This not only reduces the manufacturing cost, but it also reduces the manufacturing cost. In addition, contamination of the stream, due to the advent of dirt, etc., accumulating at the openings required for aeration, are minimized and health hazards are also obviated.

Furthermore, the position of the O-ring 16, by being located along the centerline of the spherical ball member of the swivel structure, improves the rotatability of the swivel structure when adjusted to obtain a flow path in any desired direction. By maintaining this centerline position of the O-ring, pressure against the ball structure will remain uniform and frictional wear will remain minimal even under the widely diverse pressure changes.

One of the parts of the swivel spout apparatus, if desired, may be made of plastic materials, but the shroud 3 may preferably be made of a metallic material suitably coated or plated. Because of this construction, the arrangement will be relatively simple, low in cost and easily cleaned.

It will be observed that the director 5 and the sleeve 6, although shown as two separate parts, may be combined or constructed as a single part. This would further simplify the manufacture of the apparatus and also reduce its cost.

Although the swivel spout apparatus has been shown and described as embodying means for generating two different types of stream patterns, i.e., a single stream pattern and a spray stream pattern, the structure can readily be modified according to this invention to generate any other types of stream patterns. Moreover, the structure may also be modified, according to this invention, to embody means for generating more than two different stream patterns. The manually controllable outer body structure 4 may, in any case, be gripped by the user at the exterior concave surface thereof to manipulate the outer body structure 4 to select only one of the stream patterns to the exclusion of all other stream patterns. It is a feature of the apparatus shown and described in this invention that only one stream pattern can be developed at any one time; it is impossible for two stream patterns to be generated or transmitted simultaneously.

While this invention has been shown and described in certain particular arrangements merely for illustration and explanation, it will be clearly understood that the invention, in its various aspects, may be arranged in other and widely varied organizations without departing from the spirit or scope of the invention.

What is claimed is:

1. A spout apparatus for connection at the end of a faucet comprising means for producing a single stream, means for producing a spray stream, manually adjustable means for selectively operating the single stream producing means or the spray stream producing means, and a flow controller for rendering the apparatus substantially free of incoming fluid pressure variations exceeding a predetermined level, said flow controller including two adjacent normally parallel disks having apertures through which fluid traverses, one of said disks having flexible projections which become deflected as the pressure level rises above the predetermined level and effectively reduces the fluid transmission area of said apertures.

2. A spout apparatus according to claim 1, including a ball-type swivel structure for changing the flow direction of the emitted stream.

3. A spout apparatus according to claim 2, in which one of the disks of the flow controller is made of a flexible material and the other disk is made of a rigid material, both disks including a plurality of apertures, the number of apertures in the rigid disk exceeding the number in the flexible disk.

4. A spout controller apparatus according to claim 3, in which the manually adjustable means includes a concave outer body which may be gripped by the fingers of the user to select the desired stream to be emitted.

5. A spout apparatus for a faucet comprising a flow controller consisting of two adjacent normally parallel disks each having a plurality of apertures throughout which fluid travels, said disks having flexible projections which are deflected in accordance with elevation of the fluid pressure above a predetermined value, a ball-type swivel member having a central aperture, said swivel member being contiguous to and downstream of the flow controller, a director structure shaped so as to produce a spray stream, a plurality of grooves being formed on said director structure which cause the fluid to flow in a single stream and a concavely shaped outer body coupled to said director structure and said screen structure, the concave surface of said outer body being grippable.
by the hand of the user to move the outer body to select the path of fluid flow either through the director structure or through the screen structure.

6. Spout apparatus for a faucet according to claim 5 including a socket cup for retaining the flow controller and the swivel structure while permitting angular adjustability of the swivel structure.

7. Spout apparatus comprising means for establishing a plurality of different stream patterns, means for selecting one of the stream patterns for transmission through the apparatus to the exclusion of the other stream patterns, and means for rendering all of the stream patterns emitted by the apparatus substantially free of pressure variations in the incoming fluid exceeding a predetermined value, said rendering means including a pair of closely adjacent parallel disks each embodying a plurality of apertures, one of the disks including a plurality of flexible projections adjacent to the other disk, the projections being distorted in response to the magnitude of the applied pressure.

8. Spout apparatus according to claim 7, in which the selecting means includes a manually controllable concave member which may be gripped by the user to control the stream pattern to be selected.

9. Spout apparatus according to claim 7, including a ball-type swivel structure for manually adjusting and controlling the angular path of fluid flow through the apparatus.

10. Spout apparatus for selectively generating either one of two different fluid stream patterns, comprising means including a central exit flow path for generating the first of the streams, means including an exit flow path coaxial with the central exit flow path for generating the second of the streams, a manipulable outer body which is concavely shaped and which, when manipulated in one direction, will render the apparatus operative to generate the first stream and, when manipulated in the opposite direction, will render the apparatus operative to generate the second stream, and a flow controller upstream of said stream generating means for rendering the generated streams substantially independent of changes in fluid pressure exceeding a predetermined value, said flow controller including a pair of adjacent disks each having a plurality of apertures through which the fluid may traverse continually, the upstream disk having a plurality of flexible projections which become deflected by increased fluid pressures above said predetermined value to modify the effective areas of said apertures of the downstream disk.

11. Spout apparatus according to claim 10 in which the manipulable body is shaped and proportioned that the flow paths are substantially balanced so that no springs are required to change from the stream of one of the flow paths to the stream of the other flow path.

12. Spout apparatus according to claim 10 in which the manipulable outer body is concave in shape.

13. Spout apparatus according to claim 10 which includes a ball-type swivel structure for manually changing the direction of the selected flow path of the apparatus.

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