

June 27, 1961

B. BLUMBERG ET AL

2,990,122

SPRAY AERATOR

Filed Feb. 14, 1961

2 Sheets-Sheet 1

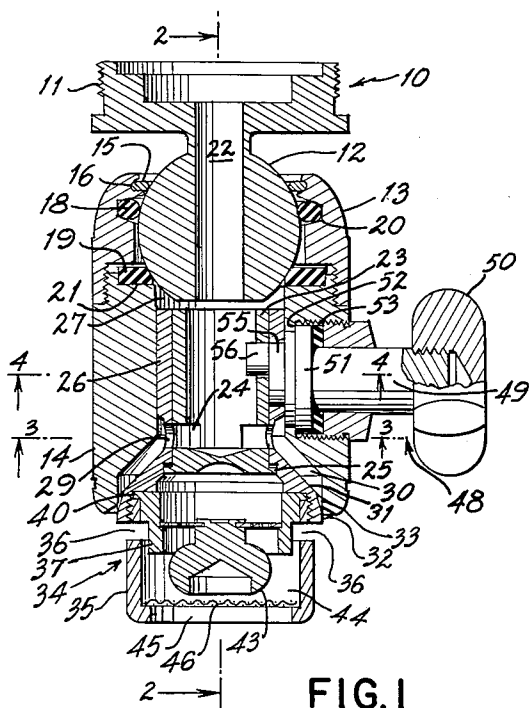


FIG. 1

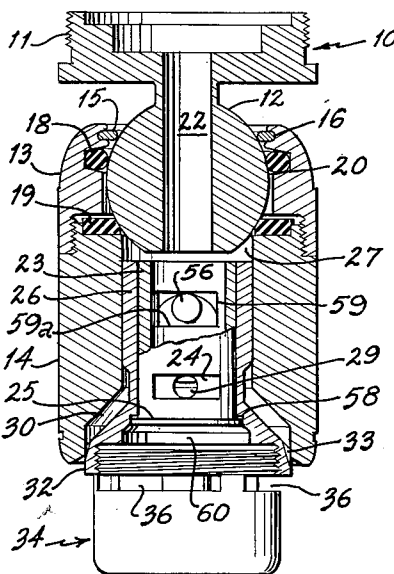


FIG. 2

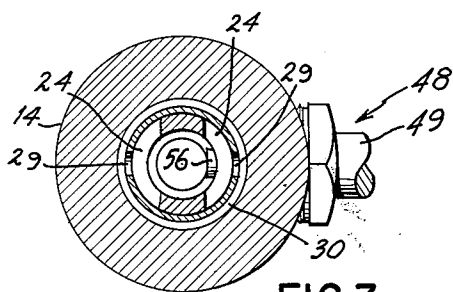


FIG. 3

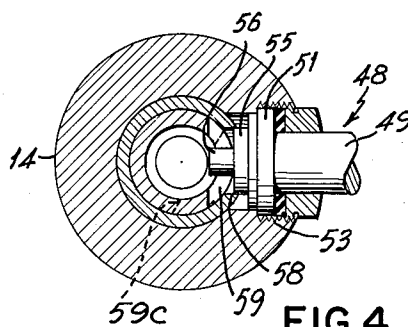


FIG. 4

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2 Sheets-Sheet 2

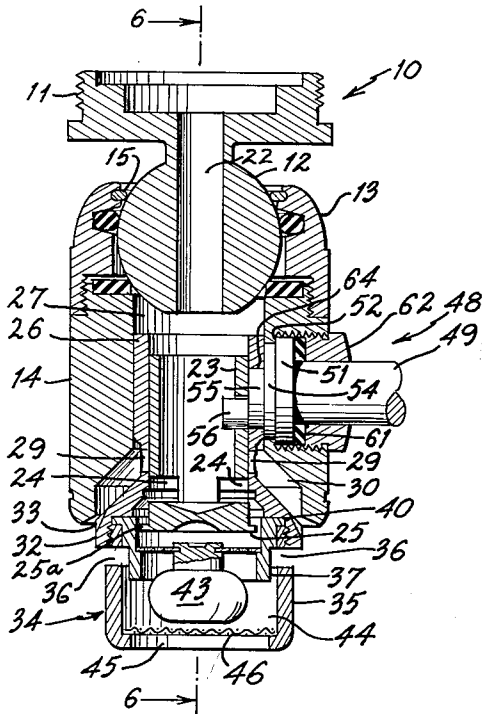


FIG. 5

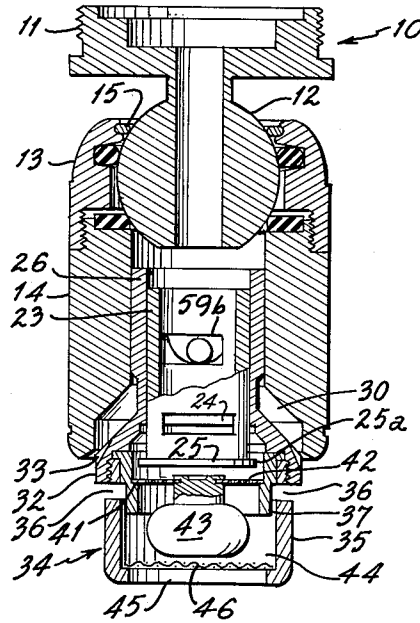


FIG. 6

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SPRAY AERATOR

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This invention relates to a liquid flow regulating device.

The invention is particularly concerned with a device for regulating the flow of a liquid such as water so as to produce a spray or aerated stream thereof, as desired.

The availability of such a fluid flow is desirable for many purposes. Thus, for example, for cleaning purposes, it is often desirable to make use of the mechanical action of a spray to loosen dirt and debris from a surface to be cleaned and thereafter to make use of an aerated stream which, in conjunction with a soap or detergent or the like, can produce a soapy foam and thereby accomplish an effective contact with such surface. Such a fluid flow may be utilized to advantage in the cleaning of household articles such as dishes, pots, pans and the like.

The availability of such a fluid flow is also desirable for the purpose of washing and shampooing the scalp and hair. Thus, the mechanical action of the aforesaid spray may be utilized to provide an invigorating massage to the scalp and the aerated stream may be alternately employed to produce an abundant and penetrating soapy foam for shampooing the hair and scalp.

It is therefore an object of the present invention to provide a device capable of producing alternately a fluid flow in the nature of a liquid spray or an aerated stream, as desired.

In producing aerated liquids by conventional aerators attached to a faucet or other supply of liquid, it has been observed that many of such aerators require a flow of liquid from such faucet or other supply of liquid at a fairly rapid rate before the liquid can be mixed with a sufficient amount of air to achieve aeration. Such conventional aerators are thus inherently inefficient under such conditions and, where the available supply of liquid is limited available only at very low pressures, cannot achieve desirable degrees of aeration. Thus, for example, in older buildings where the water supply systems have accumulated considerable quantities of clogging substances therein so as to produce a substantial pressure drop during the flow of water therethrough, the water available from such systems is often to be had only at a very low rate of flow. When used with such systems, conventional aerators are either very inefficient in producing aeration or produce no aeration at all.

Hence, it is an object of the present invention to provide a device which tends to insure aeration of the liquid supplied thereto even though that liquid is supplied at a pressure or rate lower than that at which a conventional aerator is operable according to arrangements heretofore employed.

Another object of the present invention is to provide a means for increasing the efficiency of a conventional aerator.

Another object of the present invention is to provide a device capable of the alternate production of a conically directed spray or an axially directed aerated stream of a liquid such as water, said axially directed aerated stream being disposed centrally of the outlet for said conically directed spray.

Another object of the invention is to provide a device of the character last-described which has improved means for preventing leakage between the spray producing means and the aerated stream producing means.

Another object of the invention is to provide a device

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of the character described in the form of an extremely compact unit which is easily installed for operative use and easily assembled and disassembled, as desired.

A further object of the invention is to provide a device of the character described which may be easily installed upon a household faucet, shower outlet, pipe and the like and which may be swivelled so as to direct the liquid issuing therefrom where desired.

A further object of the invention is to provide a device incorporating means for diverting a supply of water therefrom from a spray outlet to an outlet for an aerated stream and vice versa.

A further object of the invention is to provide a device of the character last-described which is automatically self-cleaning.

Yet a further object of the invention is to provide a means for producing alternately a liquid spray or an aerated stream, which device is simple and strong in design and economical to manufacture.

Other objects and advantages of the present invention will become apparent from the following description as read in connection with the accompanying drawings.

In the drawings:

FIGURE 1 is a cross-sectional view of one embodiment of the invention wherein the spray forming means is in an open position and available to deliver a conical spray;

FIGURE 2 is a cross-sectional view taken about the line 2-2 of FIGURE 1;

FIGURE 3 is a cross-sectional view taken about the line 3-3 of FIGURE 1;

FIGURE 4 is a cross-sectional view taken about the line 4-4 of FIGURE 1;

FIGURE 5 is a cross-sectional view similar to that of FIGURE 1 but showing the spray forming means in a closed position and the aerated stream producing means in an open position and available to deliver an aerated stream;

FIGURE 6 is a cross-sectional view taken about the line 6-6 of FIGURE 5.

Similar numerals are employed to indicate similar parts throughout the various views.

As shown in the accompanying drawings, one embodiment of the present invention comprises a coupling, generally designated by the numeral 10 and provided with external threads 11 engageable with a faucet (not shown) or pipe (not shown) such as is employable conventionally to supply water as to a shower head. The coupling 10 is formed integrally with a ball member 12 which is received within a sleeve 13 threadedly engaged with a housing 14. The ball member 12 is secured within the sleeve 13 by a springable retaining ring 15 which is seated within an annular groove 16 formed in the sleeve 13.

The sleeve 13 and housing 14 are swivelable about the ball member 12, the outer periphery of said ball member 12 being maintained in contact with an O-ring 18 and washer 19, the said O-ring being seated within an annular groove 20 provided in the sleeve 13. The washer 19 is seated upon an annular shoulder 21 formed in the upper portion of the housing 14.

A circular channel 22 is provided in the ball member 12, said channel 22 receiving a supply of water from the coupling 10 and faucet or pipe engageable therewith as aforesaid.

The channel 22 directs the water into a hollow inner pin 23 provided with a pair of diametrically opposed lower slots 24 and a flange 25. The hollow pin 23 is slidably contactable with a concentrically disposed, hollow outer pin 26 which is received within an axial aperture 27 formed in the housing 14.

The outer pin 26 is provided with a pair of diametrically opposed circular apertures 29 which are alignable with

the aforesaid lower slots 24, as shown in FIGURES 1, 2 and 3 of the drawings.

The apertures 29 also communicate with a circular mouth 30 provided at the lower end of the housing 14. This mouth 30 also receives a tapered portion 31 of the outer pin 26 and an expanded cylindrical portion 32 of said outer pin 26, the said expanded cylindrical portion being characterized by a plurality of inclined notches 33 adapted to form a conical spray in cooperation with the periphery of the mouth 30 when said expanded cylindrical portion 32 is in the raised position depicted in FIGURES 1 and 2, water being supplied to said notches 33 in the manner hereinafter explained.

The expanded cylindrical portion 32 of the outer pin 26 is also threadedly engaged with an aerator, generally designated by the numeral 34. The said aerator is provided with a barrel 35 formed with a plurality of air-admitting apertures 36 and a hollow apron 37.

The apron 37 is provided with an annular flange 40 seated upon the upper end of the barrel 35, the said apron 37 also being provided with an annular shoulder 41 supporting a perforated disc 42 which, in turn, supports a baffle 43 disposed below said perforated disc 42. The baffle 43 is disposed within a mixing chamber 44 communicating with an outlet aperture 45 in said barrel by way of a screen 46.

As shown in FIGURES 1, 2, 5 and 6 of the drawings, the inner pin 23 and outer pin 26 are vertically adjustable with respect to each other and with respect to the housing 14 by means of a cam member generally designated by the numeral 48. The cam member 48 includes a shaft 49 disposed transversely of the housing 14 and threadedly engaged with a rotatable handle 50. The shaft 49 is also formed integrally with a first annular flange 51 abuttable against a shoulder 52 formed at one end of a threaded aperture 53 provided in the housing 14. Said annular flange 51 is also formed integrally with a raised circular head 54 which abuts against the outer pin 26.

The head 54 is also provided with a first eccentric 55 and a second eccentric 56. These eccentrics 55, 56 are received respectively in a circular aperture 58 formed in the outer pin 26 and an upper rectangular slot 59 provided in the inner pin 23. Upon rotation of the handle 50, the inner and outer pins 23, 26 are vertically movable between the raised position depicted in FIGURES 1 and 2, corresponding with the raised position of the eccentrics 55, 56, and the lowered position depicted in FIGURES 5 and 6, corresponding with the lowered position of said eccentrics 55, 56, the shaft 49 being rotated 180 degrees between said raised and lowered positions of the eccentrics 55, 56.

The operation of the above-described embodiment of the invention can best be understood from the following explanation:

It will be seen from the drawings that water flowing through the channel 22 will be introduced into the inner pin 23. When the inner pin 23 is in its raised position, as depicted in FIGURES 1 and 2, the circular apertures 29 of the outer pin 26 are aligned with the lower slots 24 in the inner pin 23, thereby permitting the water in the inner pin 23 to flow through said lower slots 24 and apertures 29 into the mouth 30 of the housing 14 from whence said water is formed into a conical spray by the notches 33 provided upon the expanded cylindrical portion 32 of the outer pin 26, the said expanded cylindrical portion 32 being disposed in contact with the periphery of said mouth 30 when said inner and outer pins 23, 26 are in their raised positions. In these positions also, the flange 25 is withdrawn into an annular cavity 58 formed in the outer pin 26, said flange 25 being slidably contactable with the circumferential periphery of said cavity 58. Such withdrawal of the flange 25, as well as the slidable contact between the inner and outer pins 23, 26 prevents any leakage of water from the inner pin 23 into a circular chamber 60 provided in the outer pin 26 below said flange 25 and above the aerator 34.

Thus in the withdrawn position of the flange 25, it acts as a closure element and only a conical spray is available from the notches 33.

However, when the inner pin 23 is lowered to the position depicted in FIGURES 5 and 6, as by rotating the handle 180 degrees from the above described raised position of the eccentrics 55, 56, the slots 24 of the inner pin 23 are displaced with respect to the apertures 29, the second eccentric traveling vertically a greater distance than the first eccentric 55. With such displacement, the apertures 29 communicate with the outer periphery of the inner pin 23 and the slots 24 communicate with the inner periphery of the outer pin 26, thereby sealing said apertures 29 and slots 24 against the flow of water from the inner pin 23 to the mouth 30 of the housing 14 and the spray-forming notches 33.

However, the said lowered position of the eccentrics 55, 56 projects the flange 25 out of the annular cavity 58 so that said slots 24 are disposed within the chamber 60, thereby permitting water to flow from said inner pin 23 into the aerator 34 and out of its outlet 45 in the form of an aerated stream.

Thus, by rotating the handle of the cam member, it is possible to divert the water received from the channel 22 to the spray forming notches 33 or the aerator 34 which is capable of forming an aerated stream of said water. In this manner, an axial stream of aerated water, characterized by a soft, bubbly consistency, may be formed alternately of a conical spray disposed concentrically of said axial stream.

The housing 14 is sealed against leakage through the transverse threaded aperture 53 by a packing nut 62 and washer or packing ring 61 disposed intermediately of said packing nut 62 and the flange 51, said packing nut 62 and washer 61 also receiving the shaft 49 of the cam member.

It will also be noted that an important feature of the invention resides in its means for preventing leakage between the inner pin 23 and the outer pin 26 when said pins 23, 26 are in the previously described lowered position depicted in FIGURES 5 and 6 of the drawings. Thus, not only is the eccentric 56 received within the slot 59 of the inner pin 23 but said eccentric 56 also contact the lower surface 59a of said slot 59 during the downward stroke of the eccentric 56 for the purpose of lowering the pins 23, 26 and contacts the upper surface 59b of said slot 59 during the upward stroke of said eccentric 56 for the purpose of raising the pins 23, 26. Hence, by virtue of such contact and the rotation of the eccentric 56 during said strokes, the slot 59 may be rotated between the position depicted in solid lines in FIGURE 4, for example, corresponding with the raised position of said pins 23, 26, and the position depicted in dotted lines in FIGURE 4, corresponding with the lowered position of the pins 23, 26 and designated by the numeral 59c.

Since such rotation is substantially different in magnitude than any rotational movement imposed upon the outer pin 26 by the eccentric 55, said eccentric 55 being slidably received in a circular aperture 64 formed in the outer pin 26, the average distance between the slots 24 and their adjacent aperture 29 is not only determined by the vertical distance between said apertures 29 and slots 24 when the pins 23, 26 are in their lowered position but is also determined by the rotational displacement of said apertures 29 with respect to said slots 24 when said pins 23, 26 are in their lowered position. This displacement of the apertures 29 with respect to the slots 24 results in a throttling effect which, in conjunction with the slidable contact between the inner and outer pins 23, 26 obstructs leakage of water therebetween when said pins 23, 26 are lowered from their raised position. In this manner, a maximum supply of water is made available for the formation of said aerated stream when the pins 23, 26 are in their lowered position.

Another important feature of the invention resides in

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its means for increasing the efficiency of the aerator 34 incorporated in the presently described device. Thus, when the flange 25 is in its lowered position, as depicted in FIGURES 5 and 6, it projects within the apron 37 of the aerator 34. The circumferential periphery 25a of the flange 25 and the inner periphery of the apron 37 thereby form an annular orifice or reduced area for the flow of water from the slots 24 of the inner pin 23. This orifice increases the speed of such flow into the aerator 34 and by directing said flow against the inner periphery of the apron 37, causes the water to rebound against the perforated disc 42. The increased speed of the water, as well as the impact thereof against the inner periphery of the apron 37 and the perforated disc 42 causes said water to flow through the perforated disc 42 at a speed substantially greater than that otherwise available without said orifice, the said water thereby being caused to impinge against the baffle 43 with greater force so as to facilitate mixing thereof with the air drawn through the aerator slots 36 and into the mixing chamber 44. Moreover, the said orifice creates a substantial amount of atomization and turbulence in the water emerging therefrom, thereby aiding in the subsequent continuation of these processes accomplished by the baffle 43 in the course of aeration.

It will therefore be seen that even though the channel 22 introduces water at a low pressure or low rate of flow into the housing 14, the action of the orifice makes it possible to aerate said water or to aerate it to a greater degree than would otherwise be possible without said orifice.

Beyond these considerations, it will also be seen that when the outer pin 26 is moved to its lowered position, any debris which may be caught between its expanded cylindrical portion 32 and the periphery of the mouth 30 of the housing 14 may be loosened by said movement and subsequently flushed therefrom by the flow of water to the notches 32 when said notches 32 are employed to form the conical spray, as aforesaid.

The aerator 34 may also be unscrewed from the outer pin 26 for cleaning purposes if desired.

It will be seen from the foregoing that the entire unit is inherently compact and that, by reason of the movement permitted the sleeve 13 about the ball member 12, said unit may be swivelled in any direction. Thus, for example, if the unit is connected to a sink faucet, its spray, as well as its aerated stream may be directed to any part of the sink.

It will also be seen that the above described device is simple in design and manufacture and easy to assemble and disassemble.

It is noteworthy that while the above described embodiment of the invention utilizes an outer and inner pin which are engaged with means for vertically moving them with respect to each other and the housing 14, it is possible to anchor said outer or inner pin with respect to the housing without departing from the spirit of the invention.

The embodiment of the invention illustrated and described hereinabove has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the present invention is susceptible to being modified in respect to details of construction, combination and arrangement of parts which may be resorted to without departure from the spirit and scope of the invention as claimed.

We claim:

1. An improved liquid flow regulating device comprising, in combination: a housing; means for introducing a liquid into said housing; a hollow pin disposed axially within said housing and communicable with said liquid; a hollow outer pin disposed concentrically of said first-mentioned pin; said hollow outer pin being provided with an expanded cylindrical portion characterized by a plu-

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5 rality of inclined notches; said hollow outer pin being provided with at least one transverse aperture communicable with at least one transverse slot formed in said first-mentioned pin, thereby defining a channel communicating between the interior of said first-mentioned pin and the external periphery of said hollow outer pin; the said liquid flowing through said channel and said notches to form a conical spray; the said pins being vertically adjustable with respect to each other by transverse means received within said housing; said vertical adjustment disposing said transverse aperture into communication with the outer periphery of said first-mentioned pin, whereby said channel is closed; said vertical adjustment also disposing said transverse slot into communication with a cavity provided in said outer pin and communicating with an aerator; the said liquid being diverted through said transverse slot and said aerator to form an aerated stream; the said notches being disposed concentrically with respect to the outlet of said aerator.

2. An improved liquid flow regulating device comprising, in combination: a housing; means for introducing a liquid into said housing; a pair of concentric hollow pins slidably disposed within said housing and engaged with means for vertically adjusting said pins with respect to each other; the outer of said pins being provided with an expanded cylindrical portion characterized by a plurality of inclined notches; the said outer pin also being provided with an annular cavity at the lower portion of said outer pin and a depending aerator disposed below said annular cavity; the inner of said hollow pins being provided with an annular flange vertically retractable within and projectable from said annular cavity; the said pins being disposable by said vertically adjusting means in a first position wherein at least one slot provided in said inner pin communicates with at least one aperture provided in said outer pin and said notches are disposed within an aperture provided at the lower portion of said housing; the said liquid flowing from the said inner pin through said slot and apertures to said notches, thereby forming a conical spray; the said annular flange being retracted within said annular cavity during said liquid flow, thereby obstructing liquid flow from said inner pin to said aerator; the said pins also being disposable by said vertically adjusting means in a second position whereby the said aperture in said outer pin communicates with the periphery of said inner pin, thereby obstructing the aforesaid liquid flow, and the said annular flange projects outside of said annular cavity, the said slot being disposed in communication with said annular cavity, whereby the aforesaid liquid flow is diverted to said cavity and into said aerator to form an aerated stream disposed axially of said notches.

3. In a liquid flow regulating device including a housing and means for introducing a liquid into said housing, the combination comprising: a pair of concentric hollow pins within said housing; the inner of said pins being communicable with said liquid and provided with a closure member receivable within an annular cavity formed in the outer of said pins; the outer of said pins being provided with an annularly disposed spray forming means and an axially depending aerator disposed adjacent to said annular cavity; the said pins being engaged with vertically adjusting means received transversely within said housing; the said pins being disposable by said vertically adjusting means to a first position wherein at least one slot formed in said inner pin adjacent to said closure member is aligned with at least one aperture formed in said outer pin, thereby permitting liquid flow from said inner pin to said spray forming means, the said closure member being received within said annular cavity when said pins are disposed in said first position, thereby obstructing liquid flow into said aerator; the said pins being disposable by said vertically adjusting means to a second position wherein the said slot is withdrawn from communication with the said aperture and the said clo-

sure member is withdrawn from said annular cavity to permit communication between said cavity and said slot, thereby diverting said liquid flow from said spray forming means to said aerator.

4. In a liquid flow regulating device including a housing, means for introducing a liquid into said housing and a pair of concentric hollow pins vertically adjustable to provide alternately a channel for forming a conical spray and a channel for forming an aerated stream issuing axially of said housing, the combination comprising: means disposed transversely within said housing and provided with a pair of eccentric members; one of said eccentric members engaging a slot provided in the inner of said concentric pins and the other of said eccentric members engaging an aperture provided in the outer of said concentric pins; the said pins being disposed in slidable contact; the said eccentric members rotating the said slot and aperture laterally with respect to each other upon rotation of said means disposed transversely within said housing, whereby at least one second slot provided in said inner pin and at least one second aperture provided in said outer pin are alignable to provide said channel for forming a conical spray and disposable in spaced relation to close said channel; the said pins cooperating upon the closure of said channel to throttle leakage between said inner pin and said spray forming means.

5. In a device according to claim 4, the said eccentric member engaging said slot being contactable with upper and lower surfaces thereof to rotate said inner pin with respect to said outer pin when said means disposed transversely within said housing is rotated.

6. In a device according to claim 4, the said means disposed transversely within said housing including a rotatable shaft; the said eccentric members including a first circular cam disposed radially of the axis of said shaft and a second circular cam disposed radially of the axis of said shaft and of the axis of said first circular cam; the said first circular cam being engaged with the first of said apertures provided in said outer pin; said first aperture being of circular conformation; the said second circular cam being engageable with the first of said slots provided in said inner pin; said first slot having a rectangular conformation; the said first and second circular cams being abutable against the edges of said first aperture and slot to impart a relatively different rotational displacement to the said inner and outer pins.

7. In a liquid flow regulating device including a housing and means for introducing a liquid into said housing, the combination comprising: at least one hollow pin vertically adjustable within said housing and communicating with said liquid; the said pin being disposed within a substantially cylindrical member supporting an aerator; the said pin being provided with an annular element receivable within an annular cavity provided in said substantially cylindrical member to obstruct said flow of said liquid into said aerator; the said aerator being provided with a hollow circular apron supporting a perforated disc above an air and liquid mixing chamber provided in said aerator; the said annular element being projectable within said apron to permit flow of said liquid into said aerator; the edge of said annular element and the inner periphery of said apron defining an orifice for the said liquid flow, whereby the rate of said liquid flow into contact with said perforated disc and into the said mixing chamber is increased.

8. In a device according to claim 7, the said annular element being in the form of an annular flange provided at the lower end of said pin.

9. An improved liquid flow regulating device comprising, in combination: a housing; means for introducing a liquid into said housing; a pair of concentric hollow pins disposed within said housing; an aerator depending from the outer of said pins; the said liquid communicating with the inner of said pins and with a closure element provided upon one of said pins; the other of said pins being pro-

vided with a cavity wherein said closure element is receivable to obstruct the flow of said liquid into a hollow apron provided in said aerator; the said housing being provided with means for disposing said closure element adjacent to the inner periphery of said apron, whereby the said closure element and inner periphery of said apron define an orifice for the flow of said liquid, the rate of said flow through said orifice being greater than the rate of flow at which it was introduced into said housing; the said liquid impinging upon a perforated disc and a baffle within said aerator after emerging from said orifice, whereby the said liquid is subjected to aeration.

10. An improved liquid flow regulating device comprising, in combination: a housing; means for introducing a liquid into said housing; said liquid introducing means being provided with a ball member; said housing being swivelably engaged with said ball member; an inner hollow pin disposed axially within said housing, the said liquid being received within said inner pin when introduced into said housing; the said inner pin being slidably disposed within a hollow, concentric outer pin; the said outer pin being slidably disposed within said housing; the said housing being provided with a transverse cam member characterized by a shaft and a first and second circular cam formed integrally with said shaft; said first cam being spaced apart radially from the axis of said shaft; said second cam being spaced apart radially from the axis of said shaft and the axis of said first cam; the said first cam being engaged with a first circular aperture provided in said outer pin; said second cam being disposed within a first rectangular slot formed in said inner pin; the said shaft being rotatable to dispose said inner and outer pins in a raised and a lowered position; the said inner pin being provided with an annular flange at the base of said inner pin and a pair of diametrically opposed rectangular slots adjacent to said annular flange; the said outer pin being provided with a pair of circular apertures aligned with said pair of diametrically opposed rectangular slots when said pins are in said raised position, whereby said liquid communicates with the outer periphery of the outer pin and with a plurality of inclined notches provided upon an expanded cylindrical portion of said outer pin; the said expanded cylindrical portion of said outer pin being received within a circular mouth provided at the lower portion of said housing, whereby the said notches in cooperation with the inner periphery of said mouth direct the said liquid exteriorly of the housing in a conical spray; an aerator also being engaged with said outer pin and disposed axially of said expanded cylindrical portion of said outer pin; the said annular flange being slidably received within an annular cavity formed in the outer pin when said pins are in said raised position; the said annular flange obstructing flow of said liquid from said pair of diametrically opposed slots of said inner pin to said aerator when said flange is received within said annular cavity; the said flange being lowered out of said annular cavity and into said aerator when said pins are in said lowered position; the said pairs of diametrically opposed rectangular slots and circular apertures being vertically displaced with respect to each other when said pins are in said lowered position, the said circular apertures communicating with the outer periphery of the inner pin when said pins are in said lowered position, whereby said liquid flow to the outer periphery of said outer pin is obstructed; the said pair of diametrically opposed rectangular slots of said inner pin communicating with the said annular cavity when said pins are in said lowered position, whereby said liquid communicates with said aerator to form an aerated stream of liquid axially of said expanded cylindrical portion of said outer pin; the said outer pin being projected outwardly of said mouth of said housing when said pins are in said lowered position; the said inner and outer pins being rotated with respect to each other by the said first and second circular cams when said pins are moved

from their raised to their lowered positions, thereby throttling leakage of said liquid between said pins.

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