May 8, 1956 J. A. HJULIAN 2,744,738

AERATOR DEVICE

Filed Jan. 27, 1953 3 Sheets-Sheet 1

Fig. 1.

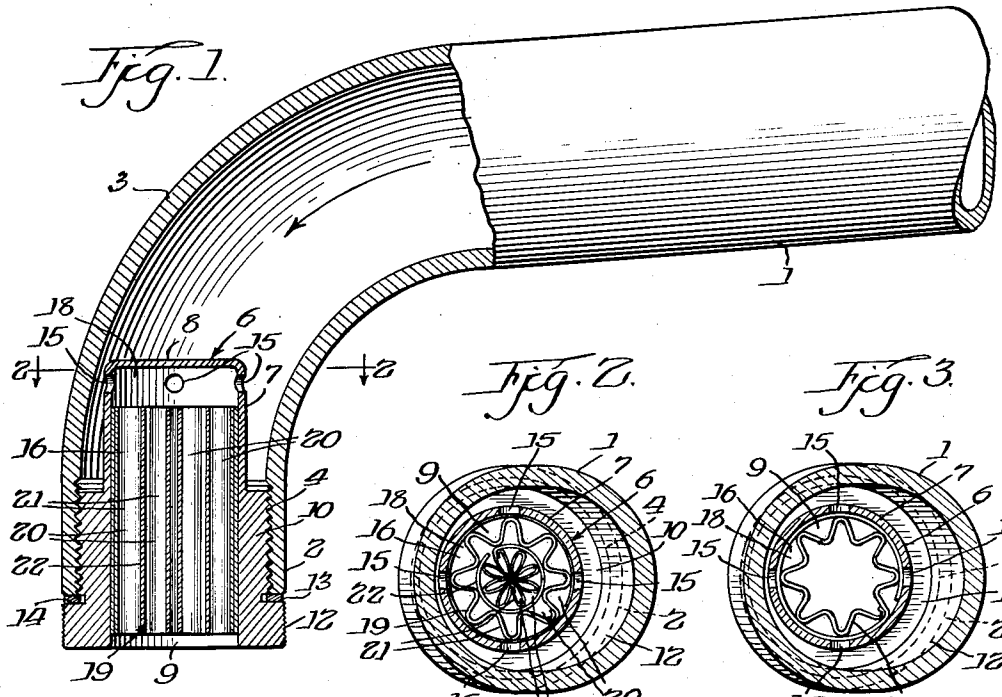


Fig. 2.

Fig. 3.

Fig. 4.

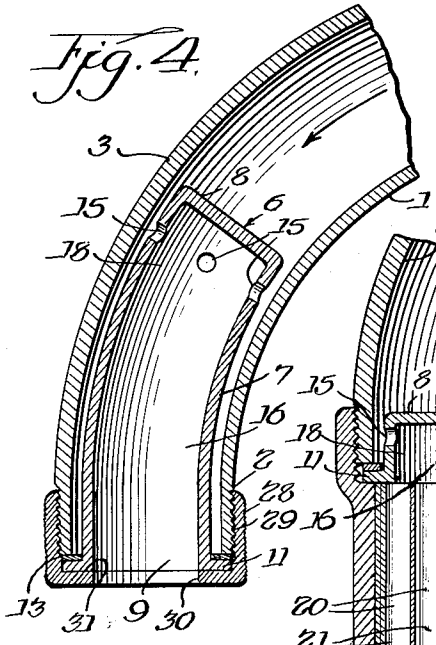


Fig. 5.

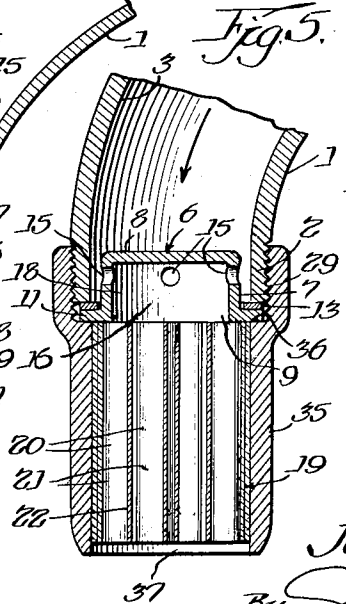
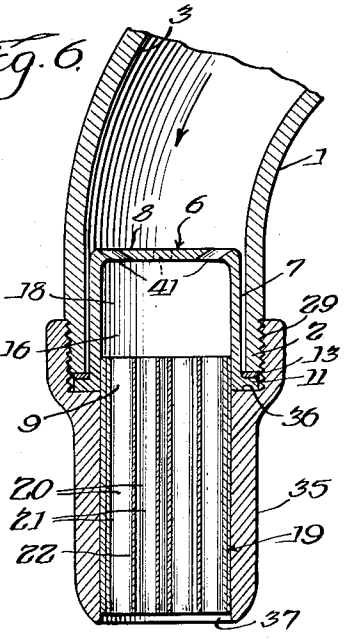


Fig. 6.



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May 8, 1956 J. A. HJULIAN 2,744,738

AERATOR DEVICE

Filed Jan. 27, 1953 3 Sheets-Sheet 2

Fig. 7.

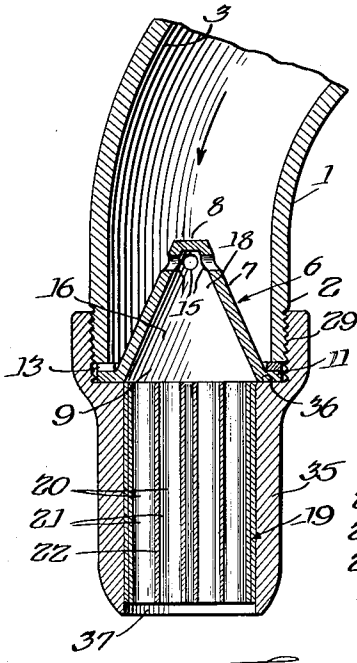


Fig. 8.

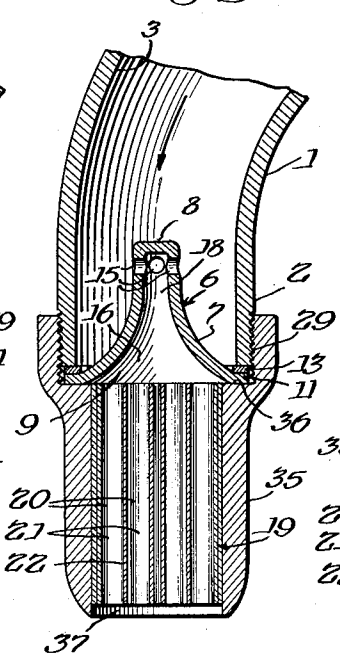


Fig. 9.

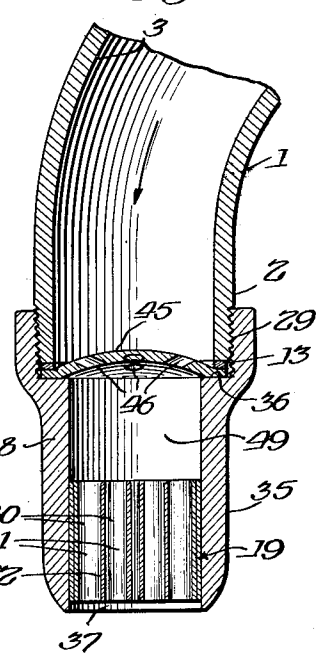


Fig. 10.

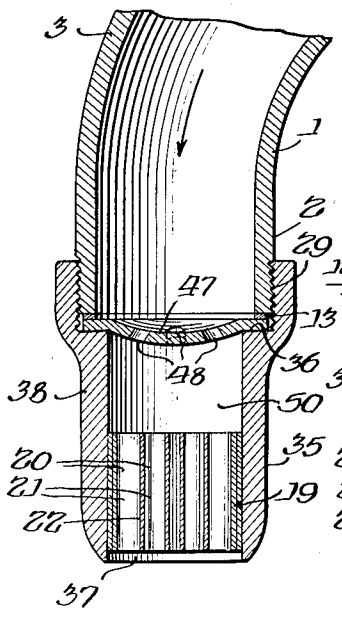


Fig. 11

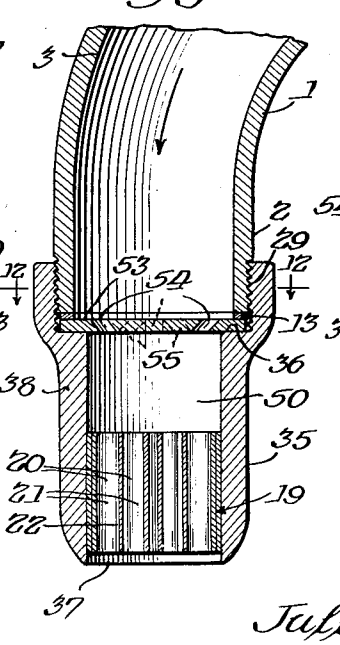
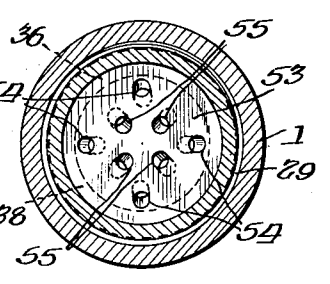


Fig. 12.



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May 8, 1956 J. A. HJULIAN 2,744,738

AERATOR DEVICE

Filed Jan. 27, 1953 3 Sheets-Sheet 3

Fig. 13.

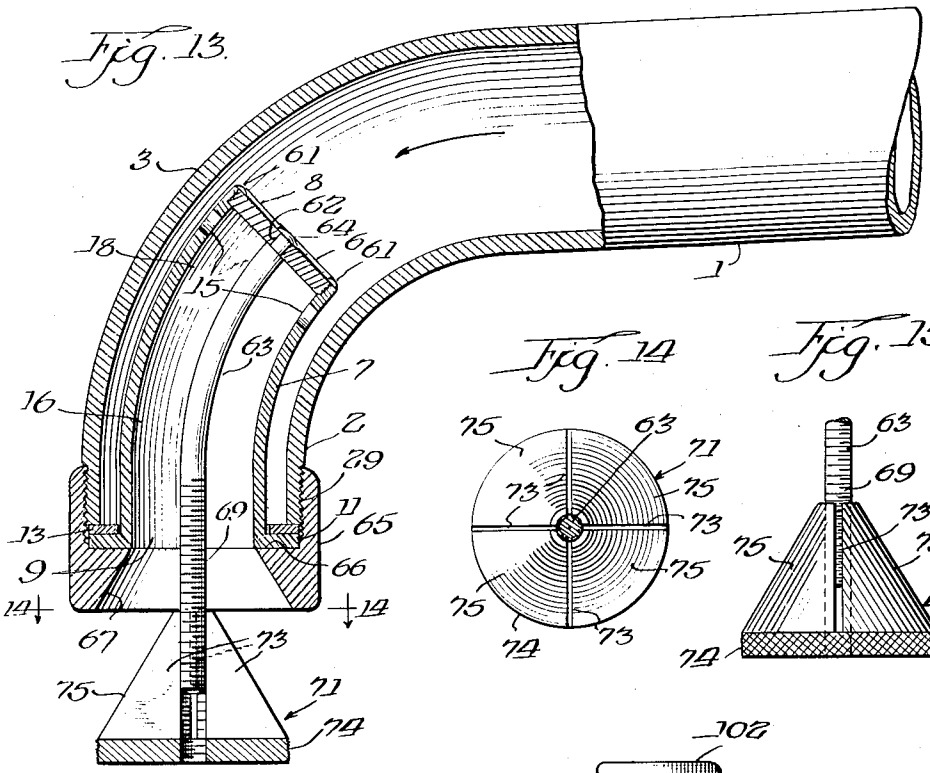
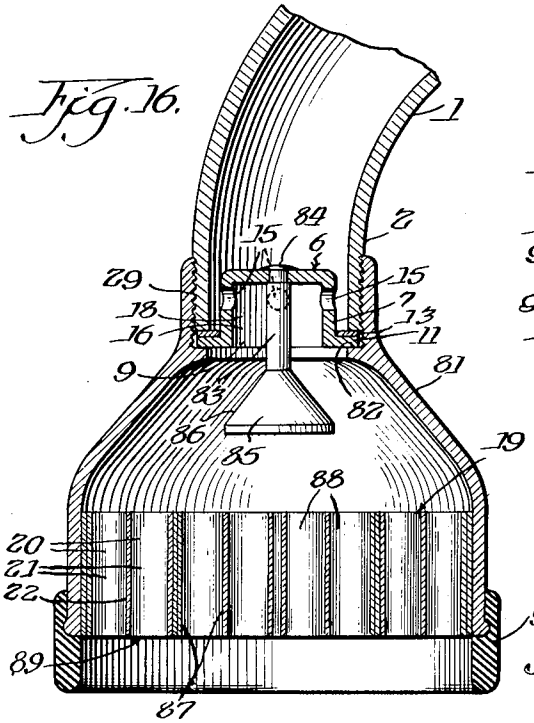


Fig. 14

Fig. 15.

Fig. 16.



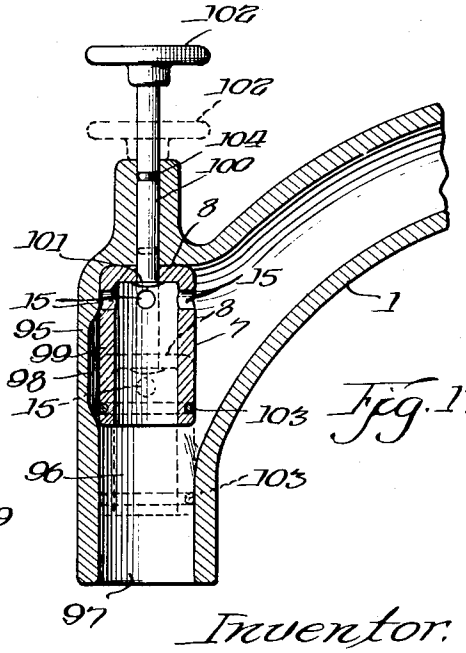


Fig. 17.

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AERATOR DEVICE

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Application January 27, 1953, Serial No. 333,577

7 Claims. (Cl. 261—115)

This invention relates to a device for mixing air or other gases with liquids, and more particularly pertains to aerators for admixing air with water passing through conduits, valves, faucets or the like discharging preferably to atmosphere.

Up to the present time, it should be noted that aerators have been of somewhat complex structure, frequently requiring the use of a number of internal parts assembled in a particular arrangement or manner. It has been necessary to mount these parts in a depending member, secured to the end of a faucet spout, for example, in which special ports have been provided in the side or top of the device for the admission of air for the aeration process. There has been a tendency for these air ports to catch and collect dirt, grease, and even soap suds where the user has accidentally come in contact with the side of the device while lathering his hands, for instance. Many of the prior aerators are peculiarly subject to clogging because of their use of screens and perforated plates and restrictions generally, and in all cases, there has been the danger of burns to the face, for instance, and damage from streams of hot water being forced out through the air ports by the formation of back pressure for several reasons.

The present invention is for an aerator of comparatively simple design and having a minimum of parts. The air ports formerly accepted as being necessary to proper aeration, have been eliminated and an imperforate tube or the spout itself employed for suitable housing purposes. It has been found that effective aeration can be produced by the use, within such housing means, of a hollow member having an open bottom and a plurality of openings or orifices leading into the hollow interior, the orifices being sufficiently large to prevent clogging and further being angularly disposed with respect to the longitudinal axis of the member or to the direction of downstream flow from the open bottom thereof. This aerator member need not be contained in a depending tube or housing, but as already suggested may be inserted within the discharge end of the fluid line or spout. The latter arrangement besides being more economical avoids previous unsightliness and further, the extension of the spout or tap with possible danger of back siphonage and contamination of the water system in certain installations. The present device is more sanitary in all respects.

Other objects and advantages will become more readily apparent upon proceeding with the following description read in light of the accompanying drawings, in which

Fig. 1 is an enlarged fragmentary sectional view of a preferred form of an aerator device according to this invention.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a sectional view at the same location as for Fig. 2 but showing an alternate form of flow guide.

Figs. 4 to 11 inclusive are fragmentary sectional views of modified forms of aerators embodying my invention.

Fig. 12 is a transverse sectional view taken on line 12—12 of Fig. 11.

Fig. 13 illustrates another embodiment of the invention.

Fig. 14 is a transverse view taken on line 14—14 of Fig. 13.

Fig. 15 is an exterior side view of the deflector member of Fig. 14.

Fig. 16 illustrates another shower or spray head adaptation.

Fig. 17 shows another modified form of the invention.

Similar reference numerals refer to similar parts throughout the several views.

Referring to Figs. 1 and 2 of the drawing, 1 is a fluid conduit, such as a discharge spout of a kitchen sink faucet, for instance, of which 2 is the outlet or open end portion thereof, and 3 is the usual curved or bent portion of the spout. The fluid conduit or spout 1 is threaded at 4 adjacent the outlet opening for attachment of an aerator device or member, generally designated 6, within the discharge opening thereof, thus serving as a housing for the member.

The latter member is preferably of inverted cup shape having a flat top portion 8 as shown and cylindrical side walls 7, being open at the bottom or downstream end at 9 for discharge to atmosphere. An enlarged or thickened portion 10 is provided adjacent the lower end which is threaded around the outer periphery for engagement with the threading 4 at the lower end of the spout, conduit or other fluid discharge line 1. A preferably knurled portion 12 of larger diameter is provided at the bottom of the cup-shaped flow restricting member 6 below the threaded portion thereof for gripping useful in attachment of the said member tightly into position within the outlet opening of the conduit 1. An annular gasket 13 is interposed between the end of the conduit and the shoulder 14 formed by the knurled or flanged portion 12 for fluid tight connection.

A plurality of openings or orifices 15 are provided in the upper end portion of the cup-shaped flow restricting member 6, which are disposed at an angle with respect to the direction of downstream fluid flow from said member at the open end 9 thereof or in the case of a cylindrical or straight member as shown in Figs. 1 and 2 to the longitudinal axis of the member. It will be noted that these orifices connect the inside of the conduit 1 with the hollow interior 16 of the flow restricting member for effecting the passage of water or other liquid therebetween, the orifices being adapted to permit the inflow of the liquid into the latter in jet-like or relatively small streams of substantial or increased velocity.

The liquid of these jet streams is diffused and broken up within a mixing portion or chamber 18 of the hollow interior of the member 6 into fine particles which become thoroughly admixed with air or other gas within the member and discharge through the bottom opening 9 as aerated water, for instance. It appears that interception and collision of the jet streams with each other and/or impingement of the same against the side walls of the mixing chamber 18 together with normal diffusion is responsible for the action and consequent admixture with the air which is drawn in from the lowermost or discharge end 9. A soft, foamy, highly-aerated stream, the air of which does not dissipate after discharge, thus flows from the open end 9 of the cup-shaped aerator member, and results indicate an intimate admixture and entrapment of the said air with the liquid passing through the device. Since the conduit or tubular housing 1 is imperforate to the terminus or bottom of the end portion 2, it is clear that the supply of air necessary to said admixture is renewed and replenished from exterior to the conduit, being drawn in through said end portion or more particularly through the bottom of the cup-shaped member inserted therein. It

has been found that replenishment of such air has no turbulent effect on the discharging stream, but on the contrary, the stream is smooth and coherent.

In some cases, in order to provide for even a more smooth and more coherent liquid flow pattern at the discharge 9, a flow guide, generally designated **19**, may be employed within the aerator device or flow restricting member 6 adjacent the open bottom 9 thereof. This flow guide comprises a cellular structure as shown more clearly in Fig. 2, extending preferably, but not necessarily, across the entire path of the discharge stream of aerated liquid. It will be observed that the flow structure presents a multiplicity of small passageways or cells **20** for the admission of the incoming air and passage of outgoing admixed air and liquid having axially or longitudinally extending side walls. In this structure, the side walls may be formed by corrugated strips of metal **21** and a circular separating wall **22**. It is not necessary that separating walls be used or that a symmetrical pattern be provided. A spiral arrangement of corrugations starting at the center or a pattern of irregular folds may also be employed, if desired, as long as they substantially fill the entire cross-sectional area of the tubular device with a multiplicity of small cells.

A flow guide of the type described is suited to the present aerator in its various forms, because of the great turbulence produced in the liquid in the aerator chamber above the flow guide. It aids in improved stratification or channeling of the flow for discharge. Under certain circumstances, however, a corrugated, ring-like flow guide, such as that illustrated in Fig. 3 and designated **23** may also be employed with satisfactory results, or the flow guide may be omitted entirely. A flow guide is not indispensable to the process of aeration, but it does materially improve the flow pattern of the discharging stream, effecting coherence and smoothness of the same. Anti-splash means, such as a screen or plurality of screens may be employed, if desired, although it is preferable to avoid the use of small openings which are likely to clog from deposits or collection of foreign matter, rendering the device inoperative. In this connection, the orifices **15** at the top of the flow restricting member **6** are of sufficient size to easily permit the passage of such matter therethrough, while not so large as to reduce the velocity of the jet streams below that degree necessary for proper operation of the device.

One of the advantages of the present aerator is its compactness, which is achieved by placing the orifices **15** in the upper end portion of the hollow flow restricting member adjacent the flat top **8** thereof. The particular shape of the top is not critical and may be dished or rounded, if desired. The orifices may also lead into the hollow interior of the member flush with the underside of the flat top, but best results are had by providing at least slight spacing of the inner limits of the orifices below the inner surface of the top or by the use of an upwardly dished or curved top. This is particularly applicable for the Fig. 1 and other forms in which the orifices are disposed at right angles to the longitudinal axis of downstream fluid flow from the open bottom of the aerator member. This arrangement provides for maximum compactness and as shown in Fig. 1, the flow guide **19** extending from near the lower end of the member up to substantially the bottom of the orifices at the top for maximum effectiveness.

Although four symmetrical and annularly arranged orifices are shown (see Fig. 2), the number of openings **15** is not critical. Too many might cause an interference in proper liquid dispersal and mixing of the same with air or have a tendency to fill up the interior of the aerator member with liquid to the exclusion of the air necessary for the aeration process. Limitation of the orifices to four, as shown, permits the use of larger openings than would otherwise be possible or advisable, thus drastically reducing the possibility of clogging by hardness deposit or otherwise. In connection with the latter, it should be noted that sufficient clearance is provided between the upper part of the cup-shaped aerator member **6** and the inside of the conduit to eliminate restriction at this point and consequent collection of foreign matter and further to provide for free fluid flow past the top and into the orifices **15**.

It is not necessary that the side walls **7** of the aerator or flow restricting member **6** be cylindrical or even straight, but the same may be longitudinally bent or curved with no apparent effect on the quality or amount of aeration of the water discharging therefrom. Thus, the structure is capable of numerous modifications without departing from the objective.

Fig. 4 shows a modification wherein the use of a curved member conforms to the interior shape of the conduit **1**. The flow restricting member in this form is the same as that of Fig. 1 except that it extends further into the conduit or discharge spout **1** proper by virtue of the curved shape noted and is provided with an annular flange **11** at the open downstream end **9**. A gasket **13** is applied between the upper surface of the said flange or shoulder **11** and the lower end surface of the conduit **1** to insure a fluid tight connection, the flow restricting member being secured to the conduit by a hollow nut or ring member **28** which threadedly engages the exterior of the conduit at **29**. The nut member is preferably knurled for gripping between the fingers and is of the same inside diameter at **30** as the cup-shaped flow restricting member **6**. It is further provided with a shoulder **31** for support of the latter member.

It should be noted that a flow guide has not been illustrated in Fig. 4. Such means may, of course, be used to improve the coherence and quality of the discharge stream, but it has been found that the tubular side walls of the hollow member **6**, and, in this case, the inside of the nut or ring member at **30** confine and direct the flow, having a flow guiding function. As the length of the tube or hollow member is increased, the need for separate flow guide means decreases, and therefore, has been omitted for illustration.

The length of the side walls or tube for omission of separate guide means is optional. In this connection, the tube may be of appreciable length, and the distance between the orifices and the point of air intake therebelow relatively removed without apparently effecting the aeration process. It has been found that a hose several feet long may be secured to the end of a device of the Fig. 1 or Fig. 5 form in a fluid tight manner, and highly aerated water flowed from the lower end.

Fig. 5 shows another embodiment of the invention in which an extension piece or housing **35** of conduit form is secured to the end of the spout or conduit **1** as by threading at **29** thus making a combined conduit. A shoulder is provided at **36** around the inside of the member **35** for the support of the aerator device or flow restricting member **6** which is similar to that of Fig. 4 except that it is of straight cylindrical side walls and preferably shorter in length. A gasket **13** is interposed between the flange **11** of this member and the lower end surface of the conduit **1** as in the previous forms, the member **35** being drawn up tightly at **29** for fluid tight connection. The combined conduit is thus imperforate to the open end **37** thereof. The side walls **7** of the flow restricting member are also orificed at **15** adjacent the flat top **8**, the orifices being annularly arranged and disposed at right angles to the direction of downstream fluid flow at the open end **9** of the member or to the axis thereof since the member in this case is cylindrical or straight as was the case in the Fig. 1 form. A mixing chamber **18** is also provided, in this instance, comprising substantially the entire hollow interior **16** of the flow restricting member **6**, since the latter is relatively short. A flow guide **19**, preferably of the type shown in Figs. 1 and 2, may be employed which extends from substantially the lower end **37** of the conduit-like housing member **35** to the bottom

of the cup-shaped member **6**, resting against the flange **11** or lower rim of the member.

The lower inside diameter of the conduit housing **35** should preferably be as large as the inside diameter of the flow restricting member **6** or larger, the latter being the relationship shown in Fig. 5. Referring to the flow guide, the outer ring or corrugated strip **21** or the ring **23** of the Fig. 3 form may not extend beyond the inner wall of the cup-shaped member **6**, remaining completely under the step, if desired, to provide a more definite path for the introduction of the air in the stepped arrangement of Fig. 5; that is, the air may be more easily channelized to the exclusion of the discharge stream. In this arrangement of course at least a slight amount of space should be provided between the top of the flow guide and under surface of the step for free flow of air into the mixing chamber.

The cup-shaped flow restricting member may extend further into the spout or conduit **1** if increased length for flow guide and mixing purposes is desired. Fig. 6 shows a similar conduit **1** and attachment piece or conduit housing **35** to which a cup-shaped member **6** of greater length is provided. In this case, the inside diameter of the latter member and of the depending housing or conduit section are of the same size, although the step relationship of Fig. 5 may be used, and a longer flow guide like that of Figs. 1 and 2 may be inserted which extends within both members for better discharge flow characteristics.

Since it is not essential for the openings or orifices to be in the side walls **7** or if in the side walls to be disposed at right angles to the axis of the flow restricting member **6** or to the direction of downstream flow from the open end **9**, the annularly arranged orifices **41** in this case are located by way of example in the flat top **8** and are inclined towards the downstream side of the member so that the jet streams therefrom intercept to accomplish substantially the same result as before. A somewhat larger mixing chamber **18** is necessary for this arrangement and disposition of orifices and the flow guide **19**, which may either be integral or of separate sections, cannot extend as far towards the orifices as in the previous forms. In this case, substantial clearance is not necessary between the outside of the aerator member **6** and the inside of the conduit **1**, inasmuch as the orifices **41** are in the top portion rather than in the side walls of the member.

Fig. 7 shows a further modified form of aerator device or flow-restricting member **6** as applied to the conduit **1** and depending attachment piece or conduit section **35**. It will be noted that this member instead of being cylindrical has substantially conical side walls **7** presenting an open bottom at **9** and converging towards the top or upstream end. The top limit surface **8** may be either pointed or flattened, as shown. Four annularly arranged orifices **15** are provided in the upper end portion, preferably disposed at right angles to the direction of downstream fluid flow at the open end of the member. However, the orifices may also be inwardly inclined towards the downstream side as in Fig. 6, being in this case at or approximately at right angles to the side walls. A flow guide **19** of the type shown in Figs. 1 and 2 may also be provided, extending up to the lower limits of the hollow conical flow restricting member **6**.

Fig. 8 shows a further modified device wherein a cup-shaped flow restricting member **6** is used which is substantially the same as that of Fig. 7 except that here the side walls **7** thereof are curved or outwardly flared towards the bottom rather than straight as in that figure or in the previous forms. In all other respects, the performance of the device is similar to those previously described.

Referring now to the modifications in Figs. 9 and 10 of the drawings, wherein upwardly and downwardly dished or concave flow restricting members **45** and **47**, respectively, are illustrated, the latter members are supported

across the path of fluid flow through the conduit **1** and the extension or conduit housing **35** attached to the end thereof. The annularly arranged orifices **46** and **48** are inwardly and outwardly inclined, respectively in the two forms shown. The mixing chambers **49** and **50** in these embodiments are formed by the side walls **38** of the conduit housing **35** below the orificed flow restricting members **45** and **47**. The process of mixing and diffusion in the first of these forms, namely, Fig. 9, is substantially the same as that of Fig. 6 and similar to the other forms previously described, while the jet streams of the Fig. 10 form first impinge on and are deflected from the side walls **38** of the housing member **35**. Flow guides **19**, similar to the flow guide described in connection with Figs. 1 and 2, may also be employed in these forms, being of somewhat shorter length to provide the necessary mixing space for suitable diffusion of the jet streams and admixture of the liquid with air drawn up from the open bottom **37** of the conduit means **35** and through the flow guide.

Figs. 11 and 12 show a similar embodiment to those of Figs. 9 and 10, except for the use of a flat plate or disc **53** rather than dished members and the use of both inwardly and outwardly inclined orifices **54** and **55** respectively. Thus, this form is essentially a composite of the previous two forms, although the flow restricting member **53** can be limited to either inwardly or outwardly inclined orifices as suggested by Figs. 9 and 10 taken singly. The number of orifices in the case of dual inclination as shown should preferably be limited to eight; four inwardly inclined and four outwardly inclined orifices preferably, but not necessarily, arranged in concentric relation, or the inner orifices **55**, which are inclined outwardly in the figures, but could be inwardly inclined towards the downstream side could be limited to two. A flow guide **19** like that of Figs. 1 and 2 may also be used below the mixing chamber **50** for the production of a more coherent flow pattern of the discharge stream of aerated water.

An adaptation of the novel aerator device for spray or shower-bath purposes is illustrated in Figs. 13 through 15. The aerator or flow restricting member **6** is of inverted hollow cup shape with curved side walls **7** and of uniform circular cross section similar to that of Fig. 4, except that the top **8** is formed of a separate piece united to the upper end of the member by peening or rolling over of the side walls **7** at **61**. The top is recessed at **62** for the reception of a centrally positioned curved stem **63**, the latter being secured therein by suitable means, such as by riveting at **64**. An annular retaining nut **65** is threadedly secured at **29** to the conduit **1**, being provided with a shoulder **66** for support of the aerator member through the flange **11** as shown. The usual gasket **13** is employed for effecting a fluid tight connection. The lower end of the stem **63** is threaded at **69** for adjustable reception of a pilot or cone deflector generally designated **71** which depends below the device in the path of the discharge stream. This member is slotted at **73** for the purpose of more tightly engaging the stem through resiliency of the member in order to retain the member on the threads in the position selected and to prevent the adjustment from changing. The lower part **74** of this member is disc shaped, the outer periphery being knurled to facilitate manual adjustment if necessary.

Orifices **15** are provided in the upper end portion of the inverted cup-shaped flow restricting member **6**, being angularly disposed with respect to the direction of downstream fluid flow from the open end **9** thereof. In this modification as in the case of the Fig. 4 form, however, the orifices and jet streams therefrom are so arranged as to be in co-planar relation with each other, the plane being at an angle to that describing the lower end of the device. The latter structure is unlike the arrangement of Figs. 1, 5, 7, and 8 where the orifices are arranged in parallel relation with the bottom of the aerator member **6**. The stem **63** is shaped so as to extend along the center of fluid flow through the curved aerator member, so as to

produce a desirable even discharge stream. It should also be noted that the annular nut member 65 is beveled at 67 to cooperate with the conical surface 75 of the pilot member in diverting or spreading the discharge stream of aerated water.

In another modification, Fig. 16 shows another spray or showerhead arrangement in which a flared head or conduit housing 81 is attached to the discharge end 2 of a conduit or fluid line 1, which may be either a pipe as shown or a flexible rubber tubing or the like for shampoo or rinsing purposes, for example. The aerator device or flow restricting member 6 is of cylindrical cup shape and substantially the same as in the Fig. 5 form, being provided with orifices 15 in the side walls 7 disposed in co-planar relation and substantially at right angles of the axis of the member and to downstream fluid flow at the open end 9 thereof and providing a mixing chamber 18 and a flange 11 for support of the member. The flange rests on a shoulder 82 in the head or casing member 81 and is drawn up tightly against the gasket 13 at the lower end of the conduit 1 by means of screw threads at 29.

For the purpose of spreading the aerated liquid or water flowing from the open end 9 of the flow restricting member so as to better fill the showerhead casing 81 for spray purposes, a unitary diverter 85 is provided. The upper portion 83 of this diverter is of stem-like form and extends within the inverted cup-shaped member 6 along the center or axis thereof, being secured through a recess at the top as by peaning or riveting at 84. The lower part 86 is of conical shape and is equivalent to the conical member 71 of the Fig. 13 form, except that the same is within the casing 81 and is non-adjustable, as shown.

A flow guide 19 may be employed within the showerhead or casing member 81 adjacent the open or bottom end 89 thereof, the flow guide being substantially the same and for the same purpose as the Figs. 1 and 2 guide except that it is of greater diameter and is provided with additional spacers 87 and corrugating portions 88 to fill the space across the bottom of the casing. A rubber guard or ring 90 of conventional design is preferably employed around the outer periphery of the casing adjacent the discharge end 89 thereof to protect the user against contact with the flow restricting member and for the purposes ordinarily intented for such members.

Although the aerator or flow restricting members have been described and illustrated as being held in fixed relation with the conduit 1 and in certain forms with the depending conduit housing 35, such structure is not necessarily always required. Fig. 17, for instance, shows the use of a flow restricting member 99 which is reciprocably mounted within the conduit 1. This member, as illustrated, is also of inverted cup shape, having cylindrical side walls 7 and a flat top 8 and orifices 15 through the side walls disposed in co-planar relation substantially at right angles to the axis of the member and to the direction of downstream flow therefrom when the member is in the lowermost (shown in dotted lines) position for use as an aerator. An actuating stem 100 is secured to the member by suitable means as by riveting at 101 and extends through the casing 95 at the top for manual lowering and raising of the aerator member 99 by means of a knob 102 into and out of position, respectively in the restricted lower portion 96 of the conduit 1 adjacent the outlet opening 97 thereof. The inner diameter of the lower portion 96 of the conduit is of only slightly greater diameter than the outer diameter of the aerator member 99, the latter being provided with an O-ring 103 within an annular groove adjacent the lower end of the same for substantially fluid sealing relation of the member within the lower portion of the conduit 1 when the member is in the lower or aerating position. Another O-ring 104 is also provided around the stem at the top.

It should also be noted that the side wall of the conduit is relieved at 98 to permit the passage of water or liquid behind the aerator member 99 and into the hollow interior of the member through the orifices 15 leading thereinto when the aerator member is in the lowermost position indicated or in an intermediate position not shown. The full line showing of the figure illustrates the device in the non-aerating or fully raised position.

It should also be noted that a throttling action may be had in which aerator member 99 is in an intermediate position in which some aeration is provided, the extent of which being dependent upon the particular position selected. This modified arrangement therefore provides a variable control of the fluid discharging through the outlet opening at 97.

Although the orifices in Figs. 1 through 9 and 17 and the inner orifices in Fig. 11 have been arranged for interception of the jet streams, it is not the desire to limit the invention to such specific action inasmuch as the same may not uniformly take place or to any great extent, if at all, in some of the items to be produced. Impingement of the jet streams on the side walls of the mixing chamber in the form in Fig. 10 and against the centrally disposed stems in the Figs. 13 and 16 forms has already been relied on. Impingement on the side walls or partial interception and impingement will take place if the orifices of the other forms were inadvertently or intentionally misaligned, resulting in the action of Fig. 10, for instance.

In connection with Figs. 5 through 12 and 16, separate flow restricting members have therein been illustrated. The same members may, of course be formed or otherwise made integral with the extension or conduit housing at the lower end of the conduit and in this connection, the flow restricting members illustrated in some or all of these figures and also in Figs. 1 through 4 and 13 could be adapted for formation with or integral connection to the conduit or spout 1. Certain of these flow restricting members or means, particularly those of Figs. 9 through 12 for instance, could be inserted or formed within the conduit, well back of or upstream of the outlet or discharge opening, if desired. If sufficiently spaced from the outlet opening, the special flow guide means hereinabove could be eliminated.

In Figs. 6 and 9 through 12 or whenever the orifices are disposed in non-coplanar relation to each other, annular surface means such as a shoulder or protruding flange may be employed below the orifices to serve as baffle means for improved deflection and diffusion of the jet streams or liquid therefrom.

Although the present invention has been applied to the aeration of water or other liquid, the same could be employed for the mixing or solution of other gases with other liquids. In this connection, the gas or gases could be drawn into the conduit through an end opening as in the drawing figures or through an opening or openings in the sidewalls permitting introduction of the gas. The latter could be in communication with a jacket or supply lines of the gas or gases for instance and the conduit may not terminate but may conduct the mixture downstream. The terms "aeration" or "aerator" in the specification and claims are therefore not intended to restrict the invention necessarily to the admixture of air with liquid, but should be interpreted more broadly along the lines indicated.

It is thus seen that a novel aerator combination or the like has been produced which is comparatively simple in construction, broad of application and effective in operation, while being at the same time sanitary and safe.

It should be further understood that although certain embodiments have been illustrated and described, these disclosures are only representative of the invention and the latter should be limited only by the spirit of the same and by the scope of the appended claims.

I claim:

1. An aerator combination or the like comprising conduit means having an end portion, flow restricting means for said conduit means extending across the path of liquid flow therethrough, said flow restricting means having an

inner orificed portion substantially upstream from said end portion of the conduit means, the orifices thereof being disposed inwardly in angular relation to the direction of fluid discharge through said end portion of the conduit means and being adapted to permit the passage of liquid through the orificed portion in substantially intercepting jet streams of substantial velocity whereby the liquid is diffused and broken up into fine particles and drawing in fluid such as air from exterior to said conduit means upstream through said end portion thereof for admixture with the liquid and production of an aerated stream flowing from said conduit means, said conduit means being substantially imperforate to the terminus of said end portion of the same said aerator combination being of uniform internal size from the point of discharge substantially to the inner orificed portion, the internal size not being less than a circle within which the inner ends of the orifices of the orificed portion fall, the inner ends of a minimum of two orifices falling adjacent said circle, said aerator combination being sufficiently open across the inside thereof from the point of discharge to said orifices to permit an established and continuous flow of the fluid such as air into the region of the aerator combination into which the inner ends of the said orifices open and the passage therefrom of admixed fluid such as air and liquid during operation of the device.

2. The subject matter of claim 1, said orificed portion of the flow restricting means extending below the orifices thereof to provide a chamber for the diffusion and breaking up of the jet-streams, said aerator combination including means within said portion thereof of uniform internal size adapted to channelize the fluid such as air at the periphery of said latter portion, said channeling means extending up to within at least proximity of said chamber of the flow restricting means.

3. An aerator combination or the like comprising conduit means having an end portion, means extending within said conduit means for the restriction of liquid flow therethrough, said flow restricting means being hollow on the inside and open at the downstream end, said flow restricting means having a plurality of orifices adapted to permit the passage of liquid within the hollow interior thereof in intercepting jet streams of substantial velocity whereby the liquid thereof is broken up into fine particles drawing in fluid such as air from exterior of said conduit means upstream through said end portion thereof for admixture with the liquid and production of an aerated stream flowing from said conduit means, said conduit means being substantially imperforate to the terminus of said end portion of the same, said flow restricting means comprising a single member removably secured at the lower part thereof to said conduit means, the latter member extending across the entire inside of said conduit means and being so secured to the conduit means in fluid tight relation therewith, said orifices of the flow restricting means being predeterminately spaced above the portion of said flow restricting means secured to said conduit means, said orifices communicating solely with the portion of the conduit means upstream from the portion of the flow restricting means secured to said conduit means and under upstream fluid pressure during operation, said flow restricting means being imperforate between said orifices and said part of the flow restricting means secured to said conduit means, at least part of the hollow interior of said flow restricting means forming a chamber for the admixing of the liquid and fluid such as air, said aerator combination having a portion of uniform internal size from the point of discharge substantially up as far as the chamber of said flow restricting means.

4. The subject matter of claim 3 including means within said portion of the aerator combination of uniform internal size adapted to channelize the fluid such as air at the periphery of said latter portion of the aerator combination, said channeling means extending up to a point at least relatively close to the chamber of said flow restricting means for the admixture of the liquid and fluid such as air.

5. The subject matter of claim 3, said single member comprising said flow restricting means having at least a substantial portion of relatively thin walled inverted cup-shape formation, said orifices of said flow restricting means being substantially above the bottom of the thin walled portion, the side walls of said thin walled portion being laterally spaced from the inside walls of said conduit means for free unrestricted flow of liquid through said orifices and settlement of scale and foreign matter below said orifices.

6. The subject matter of claim 5, the orifices of said flow restricting means being substantially circular in cross section, the axes thereof extending substantially in a single plane, said flow restricting means being of uniform substantial thickness around each of said orifices for giving direction and a measure of cohesion to said jet-streams so as to form a relatively sharp area of interception at the center of said flow restricting means substantially along said plane.

7. The subject matter of claim 5, said conduit means comprising an open ended conduit member and an annular body member attached to and depending from the conduit member, said single member of the flow restricting means being of inverted cup-shape with an annular flange extending outwardly thereof, said latter flange being interposed between an upwardly facing shouldered portion of said body and said conduit member, said aerator combination also including means within said portion thereof of uniform internal size adapted to channelize the fluid such as air at the periphery of said latter portion of the aerator combination, said channeling means extending up to a point at least near the bottom of said inverted cup-shaped flow restricting member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,213,140	Andrew	Jan. 23, 1917
1,880,880	Dietsch	Oct. 4, 1932
2,103,425	Lehman	Dec. 28, 1937
2,347,476	Graham	Apr. 25, 1944
2,395,621	Funke	Feb. 26, 1946
2,541,854	Bachli et al.	Feb. 13, 1951
2,558,238	Collins	June 26, 1951
2,570,669	Hannigan	Oct. 9, 1951
2,605,144	Northup	July 29, 1952
2,624,559	Hyde	Jan. 6, 1953
2,643,104	Holden	June 23, 1953

FOREIGN PATENTS

12,660	Norway	Aug. 31, 1903
1,000,443	France	Oct. 10, 1951