May 26, 1959 J. A. HJULIAN 2,888,209

AERATOR

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Fig. 1.

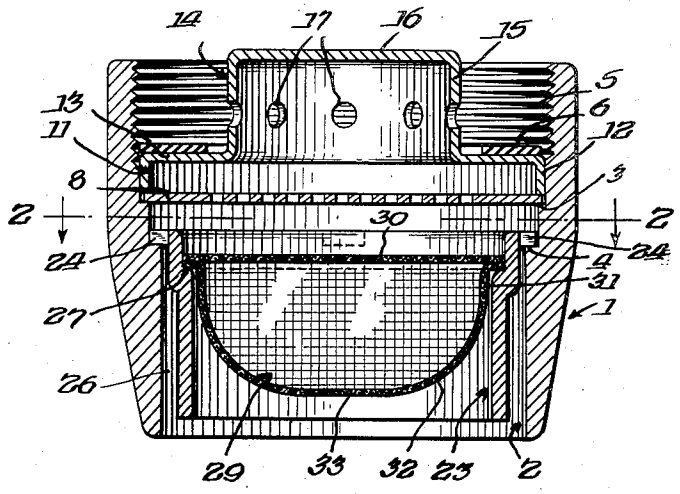
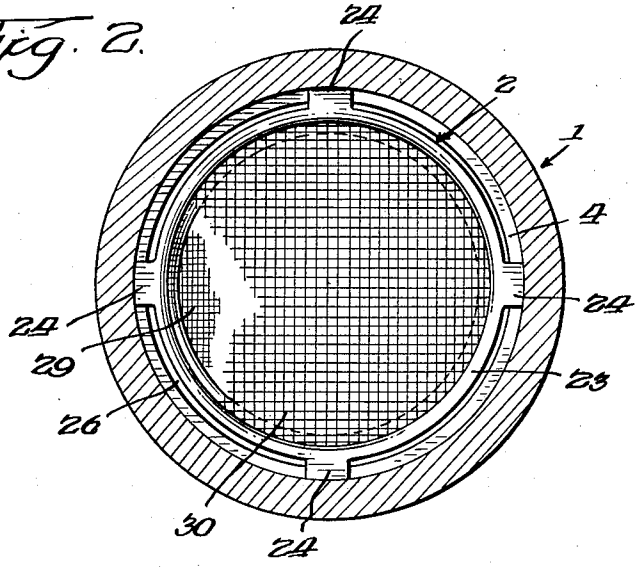


Fig. 2.



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AERATOR

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2 Claims. (Cl. 239—430)

This invention relates to aerators or devices for intimately mixing gas such as atmospheric air with liquid, applied to the conventional tap or faucet, and having novel means for maintaining said aerator in a sanitary condition.

The present invention constitutes an improvement over the aerators disclosed in co-pending application Serial No. 333,577, filed January 27, 1953, now Patent No. 2,744,738. In this latter application it was pointed out that the use of a flow guide within the outlet opening was desirable for the production of smooth, coherent pattern of the discharging fluid flow necessary for a commercial item. Such flow guide consisted preferably of thin corrugated sheet metal elements that had to be rolled or formed into rings and inserted within the discharge end of the aerator. The flow guide preferably comprised inner and outer corrugated rings separated by a generally cylindrical portion extending from the inner flow guide element.

The formation and insertion of these flow guide elements had to be done by hand and were subject to great variation in the matter of uniformity of cell pattern and proper positioning necessary for the desired quality of discharge flow. It was found that unless the flow guides were perfectly made up and assembled in exactly the right position rough, irregular, often shifting or fluctuating discharge streams resulted. Further, if a flow guide assembly was made that produced the proper quality stream, the same was subject to movement or disruption by a housewife or user of the device which would throw the device out of adjustment causing an improper flow pattern. Further yet, if the flow guide elements should be removed for any reason, it was practically impossible for the average person to replace the same so as to give satisfactory performance.

In view of the above, the use of the flow guide means for producing the proper quality discharge stream was highly unsatisfactory because of the difficulty of proper assembly even by skilled workers and also the varying non-uniform results had by the use of such means.

It is accordingly a primary object of the present invention to provide flow improving or refining means for an aerator or similar device which is not subject to variation as a result of assembly but which is productive of a uniform high quality flow pattern in every instance.

Another important object is to provide an improved aerator or the like having flow refining means which is not critical in the matter of mounting but which may be easily inserted by anyone in the proper position for the desired high quality discharge stream.

A further object is to provide flow refining means for an aerator or the like which is not subject to dislocation and being put out of adjustment by housewives or others in the course of ordinary use.

Still another object is to provide flow refining means for an aerator or the like which can be disassembled or reassembled within the aerator without destroying the proper operative relation necessary for the high quality discharge flow pattern.

Another object and one of paramount importance is to provide flow refining means in which the large labor costs involved in the prior construction in attempting by time consuming trial and error to properly assemble the same for the desired flow pattern is eliminated.

A further object is to provide combined intake channeling and improved flow refining means permitting drastic shortening of the aerator housing within which it is mounted and overall depth of the aerator over that of previous aerators.

A further important object is to provide aerator means in which means for maintaining a sanitary condition is conveniently provided.

Other objects and advantages will be apparent and become more readily understood upon proceeding with the following description read in the light of the accompanying drawing in which:

Fig. 1 is an enlarged longitudinal sectional assembly view of a preferred form of aerator device embodying the present invention; and

Fig. 2 is a cross section taken on line 2—2 of Fig. 1.

Like numerals referred to the same parts in the drawing figures.

Referring more particularly to the drawing, reference numeral 1 generally designates a casing or body member which is of conduit form having a flow passage 2 therethrough and adapted to be attached as by means of threading 5 directly to the discharge end of a fluid line, such as a water faucet, or indirectly thereto by means of an adaptor piece. It should particularly be noted that the body member is imperforate between the inlet and outlet ends shown at the top and bottom of Fig. 1. Further, it should be understood that when the body member is attached to the end of a faucet for instance, that by means of the gasket 6 a fluid tight connection is made with such fluid line or faucet and that the combination of the body 1 and fluid line including an adaptor where employed comprises a conduit combination or means which is imperforate to the discharge end of the body portion 1.

Positioned within this combined conduit means in the body 1 thereof is an aerator portion of the device which may be referred to as aerator means. In the present construction, this aerator means consists of a downwardly opening hollow member generally designated 11, below which is a perforated plate 8, both of which members are supported on an internal shoulder 3 within the body portion 1. The upper hollow member is provided with a rim 12 resting on top of the perforated plate and a transversely extending flat portion 13 terminating in an inner cup shaped portion 14 having a cylindrical side wall 15 and flat top 16.

Extending through the cylindrical side wall 15 intermediate the top and open bottom thereof are a plurality of equidistantly spaced apertures or orifices. These orifices are adapted to permit the inflowing of water or other liquid in jet-streams of substantial velocity intercepting substantially at the center of the cup shaped portion for diffusion and breaking up of the stream into minute particles and admixture with air or the like drawn in through the space 26 and plate 8 for the production of an aerated stream discharging from the aerator. The inside of the cup shaped portion and space inwardly of the rim portion 12 provide a chamber for this action.

The aerated liquid then passes through the perforated plate 8, the function of which is not entirely understood. This plate, however, appears to be necessary in the detailed construction shown and it is believed that further admixture with the air or exterior atmosphere takes place below the plate. Although the plate 8 is so disclosed in

the present construction, this member may be dispensed with in some installations in which a member 11 of a larger cup diameter is employed. It should be understood that still other changes in the aerator means or even different constructions may be employed for this portion of the device so long as line fluid is diffused and broken up into fine particles and intimately admixed with gaseous fluid such as atmospheric air drawn up into the device for the production of an aerated or gaseous admixed fluid discharge.

Below the aerator means and foraminous plate 8 is an annular sleeve 23 provided with spaced lugs or projections 24 at the top. These lugs are adapted to rest on a lower annular shoulder 4 within the body 1 of the aerator device for concentric, spaced relation of the sleeve member to the inner cylindrical wall of the lower portion of the body member. The sleeve member providing the spacing 26 between the same and the body serves a similar function to the outer walls of an ordinary flow guide by channeling the flow of atmospheric air entering the lower part of the aerator device at the inner periphery of the body portion for introduction of the air into the area of admixture with the liquid. There is one vital difference, however, and that is that the use of the sleeve member in combination with the inner parts to be covered subsequently produces a much smoother and more desirable discharge flow pattern. It should be noted from Fig. 2 that the space 26 is somewhat reduced at the top and continues past the lugs 24 although divided at this point into four portions by the lugs.

Essential to the present invention and forming a central part thereof is the provision of a downwardly extending cup shaped foraminous screen 29 extending across the open center of the sleeve member and across the path of the discharging aerated stream therethrough. This member is preferably provided with a peripheral rim for support within the sleeve member on the annular shoulder 27 thereof. This cup shaped member extends downwardly from its point of support in close contact at 31 with the inner side walls of the sleeve member from which at a lower point, or more particularly along a horizontal plane, the screen loses contact and gradually diverges from the side walls of the sleeve in a smooth curve, in the present case defining an annularly extending toroidal surface 32. The latter curved portion preferably extends at least half way towards the center of the open sleeve 23, the center part in the present construction being flat at 33 across the inner portion.

Cooperating with the cup shaped screen member is a second foraminous screen 30 extended across the open center of the sleeve 23 and preferably being flat in form, in the present instance conveniently resting above the peripheral rim of the lower screen.

The applicant has discovered that by the use of this relationship of screens that a somewhat similar although superior effect to the use of the conventional flow guide is provided in the production of a coherent, solid, non-fluctuating, clearly defined, smooth discharge stream. The manner of producing the latter effect is not entirely understood but it appears that the flow of aerated or gas admixed liquid is first slowed up in velocity somewhat by the resistance offered by the upper screen 30 after which the stream tends to flow inwardly along the inner curved surface of the lower screen producing a discharged stream of uniform density throughout its entire cross section. This screen arrangement apparently pulls the stream together to form a solid center whereas without this arrangement the stream spreads or balloons out at the lower limits of the aerator device to a decided and undesirable extent making commercial exploitation of such a device impossible or inadvisable.

The above screen arrangement can be easily formed from relatively fine screen material and easily dropped into place within the shoulder 27 of the sleeve and by virtue of this shoulder engagement as well as a certain length of contact along the inner surface of the sleeve member 23 admits of no variance or misassembly whether so deposited on the assembly line or by a home owner. This construction therefore avoids variation due to formation and assembly to which the previously employed flow guide was subject. In the present instance there is but a single way to assemble the flow improving parts.

An essential aspect of the present construction therefore is that a relatively deep cup shaped lower screen be employed which curves inwardly from a lower line or plane of contact with the inner wall of the sleeve at least a substantial distance towards the center of the sleeve member. Whether the center of the screen is flat as shown, rounded, or otherwise shaped appears immaterial and also, a hemispherical screen has been employed with good results. It would appear that other shapes of screens such as parabolic could also be employed.

It is of particular significance, however, that the lower screen not be shallow or merely concave or dished, but that it be deep or cup shaped at least approximately to the extent of the screen shown in the drawing. This is of course a matter of proportioning the depth to the diameter inasmuch as the drawing figures are enlarged over the actual size of the device. Unless total depth to diameter proportioning is at least approximately that of the illustrated form, extensive experimentation by the applicant has shown that objectionable ballooning or bulging takes place at the point of discharge. It is also found that a more deeply formed lower screen member than that shown also produces good results, except that a longer body and possibly sleeve would be necessary to protect the center of the screen against injury, thus increasing the cost and adding to the size and extent of projection below the bottom of a faucet, which is objectionable in the matter of sales and to health authorities.

Although the upper screen 30 is shown flat and positioned slightly below the top of the sleeve in the drawing, it should be understood that variation in shape and positioning can be had without seriously affecting the quality of the discharge stream.

As a further significant aspect of this invention, it should also be noted that the annular sleeve 23 within which the screens 29 and 30 are mounted is loosely received within the body 1, the sleeve merely resting on the shoulder 4 of the body by means of the lugs 24. By virtue of the spaced, concentric relation of the main portion of the sleeve within the lower part of the body and the vertical space provided between the top of the lugs and the bottom of the plate 8, the sleeve member and supported screen are capable of loose vertical movement within the limits noted upon pressure being applied to the bottom of the sleeve or lower screen as by pressing up with the finger. This selective reciprocal movement is important in providing a means of loosely moving the sleeve unit within the body member for dislodging of any material that may be deposited between the sleeve and body or at the top of the sleeve. Tapping of the sleeve unit against the bottom of the plate 8 is quite effective in keeping the air space relatively clean and free of foreign matter without the necessity of dismounting the body from the faucet and removing the inner parts for cleaning.

It is desired to allow for variations, modifications, and applications other than those spoken of in the above description, which should be construed within the terms of the appended claims.

I claim:

1. An aerator combination comprising conduit means having liquid inlet means and an open end, said conduit means being substantially imperforate to gaseous intake between the inlet means and open end and being provided with interior upstream facing support surface means, means within said conduit means and upstream from the open end for breaking up the liquid flow with-

in the conduit means, means within said conduit means open through the center for the flow of liquid therethrough and normally in abutting contact with said support surface means and movable upstream a substantial distance therefrom, passage means provided between said conduit means and said open centered means about said open centered means, foraminous means extending across the open center of said open centered means, said foraminous means comprising a cup-shaped foraminous member having an outer portion at least in proximity to the inside wall of said open centered means and then gradually diverging therefrom for an appreciable distance in the downstream direction and thereafter extending towards the center at a faster rate in curving form, said latter curved portion extending at least a substantial distance towards the center of the open centered means, said foraminous means including a second foraminous member extending substantially across the open center of said open centered means and upstream of at least the major portion of the cup-shaped member, said flow breakup means being upstream of said foraminous means, said passage means openly communicating with the open end of the conduit means and also the space upstream of said foraminous means for delivery to said space of atmospheric intake drawn in through the open end of the conduit means and for admixture with the liquid passing downstream from said flow breakup means, said second foraminous means being at an upstream location at least proximate where said passage means delivers atmospheric intake to the space upstream from said foraminous means.

2. An aerator combination comprising conduit means having liquid inlet means and an open end, said conduit means being substantially imperforate to gaseous intake between the inlet means and open end and being provided with interior upstream facing support surface means, means within said conduit means and upstream from the open end for breaking up the liquid flow within the conduit means, means within said conduit means open through the center for the flow of liquid therethrough and in abutting contact with said support surface means, passage means provided between said conduit means and said open centered means about said open centered means, foraminous means extending across the open center of said open centered means, said foraminous means comprising a cup-shaped foraminous member having an outer portion at least in proximity to the inside wall of said open centered means and then gradually diverging therefrom for an appreciable distance in the downstream direction and thereafter extending towards the center at a faster rate in curving form, said latter curved portion extending at least a substantial distance towards the center of the open centered means, said foraminous means including a second foraminous member extending substantially across the open center of said open centered means and upstream of at least the major portion of the cup-shaped member, said flow breakup means being upstream of said foraminous means, said passage means openly communicating with the open end of the conduit means and also the space upstream of said foraminous means for delivery to said space of atmospheric intake drawn in through the open end of the conduit means and for admixture with the liquid passing downstream from said flow breakup means, said second foraminous means being at an upstream location at least proximate where said passage means delivers atmospheric intake to the space upstream from said foraminous means.

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