United States Patent

Shames et al.

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[54] **AERATOR CONSTRUCTION**

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[51] **Int. Cl.**.....**E03c 1/08**

[58] **Field of Search**.....239/428.5, DIG. 18, DIG. 19

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[57] **ABSTRACT**

An inexpensive faucet aerator is provided by an imperforate annular metal housing with a sub-assembly of molded parts, that may be pre-assembled without separate fasteners, and which are arranged to be slid through the open upstream end of the housing, and to cooperate with each other and with the housing to provide a mixing chamber and air inlets to the mixing chamber. Two of the molded parts are snap-connected together prior to insertion in the housing to insure proper assemblage, and the cooperation of the parts with the housing wall prevents inadvertent separation of the parts.

4 Claims, 5 Drawing Figures

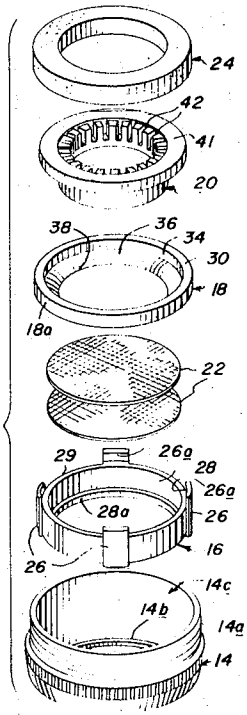


Fig. 1

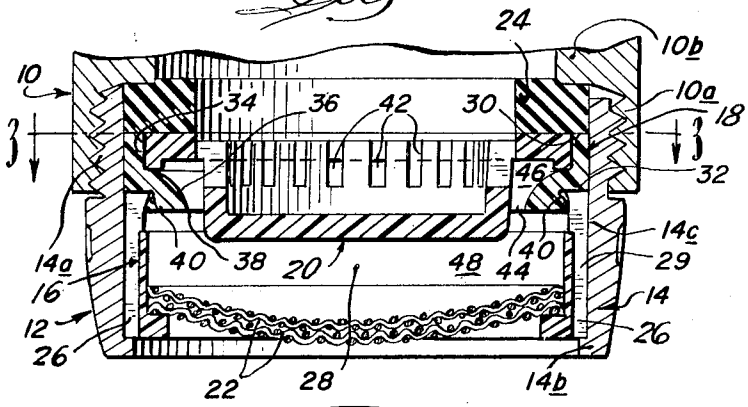


Fig. 5

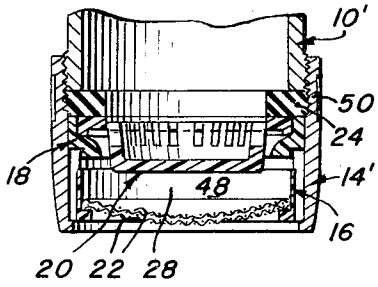


Fig. 2

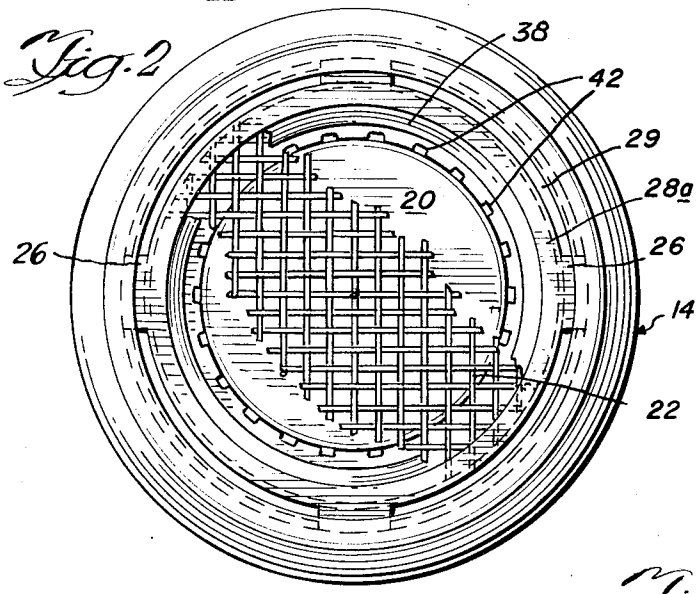


Fig. 3

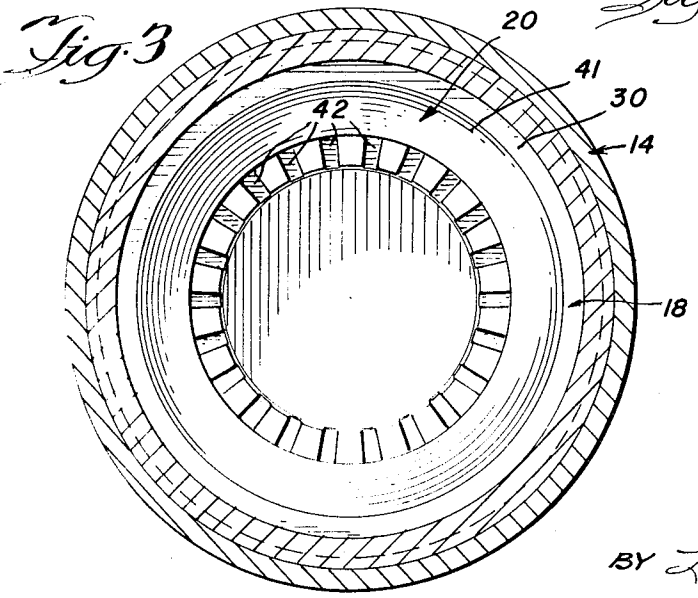
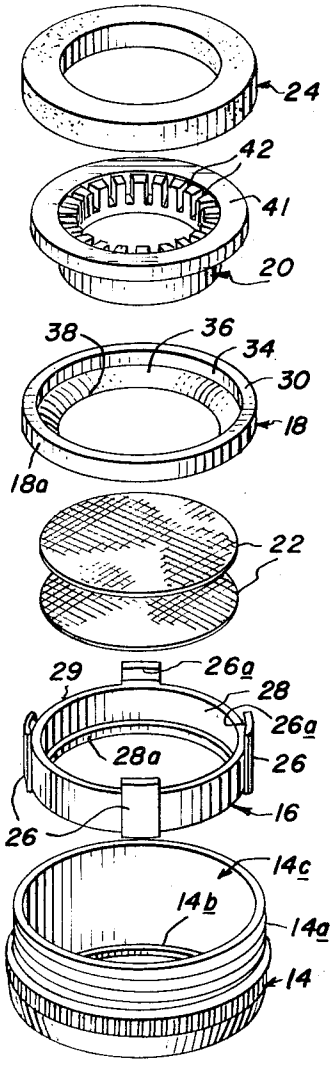


Fig. 4



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AERATOR CONSTRUCTION

BACKGROUND OF THE INVENTION

Faucet aerators of many different forms are known in the prior art. In substantially all such aerators, water-jet forming means, of one or more nozzles located at one or more upstream locations, discharge water at high speed into a mixing chamber into which air in-gested by the local drop in static pressure. Means for mixing the water and air are provided, and screen-like flow straightening and mixing means may be provided at the discharge end of the mixing chamber. In some forms of aerator constructions an abutment is provided against which the jets are impinged to effect minute break up of the water jets prior to mixing with air. In other forms air is drawn into the mixing chamber through air passageways that extend from adjacent the outlet of the aerator in a direction opposite to the direction of water flow before entering the mixing chamber and then moving downstream with the mixture of water and air.

Although originally constructed entirely of brass parts, or molded of rubber and arranged to receive a plurality of jet-forming metal discs and screens, the trend of construction has constantly been to seek less expensive constructions. It has heretofore been suggested to mold at least some aerator parts of plastic. However, practical experience has shown until now that the most satisfactory aerator constructions require at least some internal parts being formed of metal.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a water aerator with desirable performance characteristics wherein all the internal parts except the discharge screen are molded of plastic.

It is another object of this invention to provide a water aerator that is primarily constructed of three molded plastic parts that are so designed and arranged as to provide for convenience in assembly and results in an aerator characterized by inexpensiveness of fabrication and effectiveness of performance.

It is a further object of this invention to provide a water aerator wherein molded plastic internal parts are secured together without separate fasteners in a manner to insure proper relationship between the parts, and wherein the arrangement of parts within the aerator's barrel prevents inadvertent separation of the internal parts.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an enlarged, vertical cross-sectional view through the longitudinal axis of an aerator embodying the invention and having a male-threaded connector;

FIG. 2 is a bottom plan view of the same with portions broken away;

FIG. 3 is a cross-sectional view taken substantially on line 3—3 of FIG. 1;

FIG. 4 is a reduced exploded view of the aerator of FIG. 1; and

FIG. 5 is a view similar to FIG. 1 but of reduced size and showing the aerator with a female-threaded connector.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings there is shown the discharge end of a spout **10** to which is screw-connected an aerator, generally **12**, that embodies the invention. The aerator **12** includes a barrel or casing **14**, that preferably is a screw machine part formed of metal, but also could be molded of plastic. Within the barrel **14** are a molded plastic lower part **16**, a molded plastic annulus **18** that is snap-coupled to the lower part **16**, and a molded plastic, cup-shaped part **20** which provides water-jet defining means and which enters the upstream end of annulus **18**. The molded plastic parts are formed of a plastic, such as Delrin, that does not swell in the presence of water. The aerator **14** also includes at least one, and preferably a pair of, wire mesh screens **22** that are carried by lower part **16**, and an upstream washer **24** of resilient material to provide both for a water-tight connection between the aerator **12** and the spout **10** and to retain part **20** in position.

More specifically, the water-supplying spout **10** is female-threaded at **10***a* and is shaped to provide an upstream shoulder **10***b* against which the sealing washer **24** abuts. The barrel **14** is male threaded at its upstream end at **14***a*, and has an inturned abutment flange, or lip, **14***b* that serves to retain within the aerator the internal parts thereof. The barrel **14** has imperforate side walls and provides a cylindrical wall **14***c* for receiving sliding entry of the internal parts of the aerator through the open upstream end of the barrel.

The lower part **16** is a combination support-and-air-intake and is shaped to provide a plurality (at least three) of spaced, elongated support struts **26**, preferably four in number as shown, joined by a continuous cylindrical sleeve, or ring, **28**. The lower ends of struts **26** engage barrel lip **14***b*, while their upper ends each project above the upper edge of sleeve **28** to engage annulus **18** and provide inturned lips **26***a* for snap-connection to said annulus. The struts **26** being located outwardly of sleeve **28** cooperate with wall **14***c* of barrel **14** to provide substantially annularly arranged air intake means or passageways **29**. The lower edge of sleeve **28** has a continuous inturned flange, or lip, **28***a* for supporting screens **22**.

The annulus **18** provides: an outermost cylindrical wall **18***a*, of a dimension to just slidably enter the bore defined by **55** wall **14***c*; an upstream annular shoulder **30**, against which sealing washer **24** abuts; a downstream annular shoulder **32**, adapted to engage the upper edges of struts **26** to be supported thereby; a cylindrical centering wall, or sleeve, **34** for slidably receiving cup-shaped part **20**; and a convexly curved impingement surface **36**, the outermost portion of which supports part **20**, extending inwardly of sleeve **34** and projecting downstream to terminate at a downstream, inner, annular edge **38**. The underside of annulus **18** is also provided with a continuous groove **40** adapted to receive thereinto, by a snap-connection, the lips **26***a* at the upper ends of the struts **26**.

The cup-shaped, jet-defining member **20** has an outwardly extending flange **41**, that is supported by annulus **18**, and whose upstream surface is arranged to lie co-planar with shoulder **30** of the annulus **18** so as to be engaged by sealing washer **24** which prevents flow of water past sleeve **34**. The upright side wall of member **20** is provided with a series of radially-extending, jet-forming grooves **42** that are vertically elongated as shown and are of a height to extend below the level of flange **41**, but which terminate at a height spaced upstream, or above, the downstream edge **38** of annulus **18**. The lower central portion and bottom of cup-shaped member **20** that is downstream of grooves **42** projects axially downstream and centrally through annulus **18** to be in spaced relation to edge **38** so as to define an annular, constricted, flow aperture **44** located between the said spaced portions of the annulus **18** and the cup-shaped member **20** and which separates an upstream annular flow chamber **46** from a downstream mixing chamber **48**.

The annularly arranged air intake means **29** extend vertically upwardly from the discharge end of aerator **12** to communicate around the upper edge of ring **28** and into the mixing chamber **48** which is bounded at its downstream end by screens **22**. To prevent discharge of water through air intake passageways **29**, the upper edge of ring **28** is located at a plane upstream of the furthermost downstream portion of the cup-shaped member **20**.

The principal difference between the two forms of construction shown respectively in FIGS. **1–4** and FIG. **5** is that in FIGS. **1–4** the barrel **14** is male-threaded, while in FIG. **5** the barrel **14'** is provided at its upstream end with female threads **50** for securement of aerator **12'** to the discharge end of a male-threaded spout **10'**.

In the forms of aerator construction disclosed, the screens **22** are first assembled onto lip **26*a*** of the lower part **16** by a light press fit, and the parts **16** and **18** are then snapped together by axially applied pressure which operates to cause lips **26*a*** to first cam outwardly and to then enter the continuous circumferential groove **40** on annulus **18**. While the arrangement of lips **26*a*** in groove **40** permits of relative rotation between the parts, the arrangement provides a sub-assembly which may be slid into barrel **14** through the open upstream end. The cup-shaped member **20** is alternatively dropped into position in annulus **18** before the sub-assembly is slid into the casing **14** or dropped in after the sub-assembly is in position. The inturned lips **26*a*** cooperating with annulus **18** provides a construction wherein any tendency of the support struts **26** to spread apart, or lips **26*a*** to move outwardly of groove **40**, is foreclosed by the abutment of support struts **26** against the inner wall **14*c*** of the barrel. Thus, with use of only plastic parts **16** and **18**, there is provided a construction that when inserted in barrel **14** is rigidly maintained in assembled condition without fear of structural failure or inadvertent dis-assembly.

The slots **42** in jet-forming member **20** provide a series of jets of water that are outwardly directed to impinge against the convex impingement surface **36** of annulus **18** to effect a minute break-up of the water streams, and the incoherent water then passes through constricted, annular, aperture **44** into the mixing chamber **48** where air that is drawn in through air intake means **29** is mixed intimately with the water before passing through screens **22** to issue as a coherent aerated stream.

As can be seen in FIG. **1**, the size of lip **14*b*** on the barrel and the radial thickness of support struts **26** is so selected that the outer diameter of sleeve **28** is spaced inwardly of the inner edge of lip **14*b***, to provide an air gap to the air-intake passageways **29**.

The arrangement of the convexly curved impingement surface **36**, surrounding and spaced from the upright wall having grooves **42** therein which terminate upstream of the downstream edge of said impingement surface **36**, desirably produces aeration of the water by directing the water in jet form outwardly against the convex impingement surface **36** where there is breaking up of the jets and the jets then are reflected back against the annular upright wall of member **20** before passing downstream through the annular constricted flow passageway **44**.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a faucet aerator of the type that provides a mixing chamber having upstream and downstream ends, water-jet defining means at the upstream end of said chamber, air intake means to said chamber, and at least one screen adjacent the downstream end of said chamber, the improvement comprising, in combination: an elongated, sleeve-like, imperforate barrel with screw threads thereon at the upstream end and an inturned lip at the downstream end, and a sub-assembly of molded parts arranged for sliding fit into the barrel to be supported by the barrel's lip, said sub-assembly being constructed to cooperate with the barrel to provide air intake means, and to provide a mixing chamber, the water-jet defining means, and a support for the screen, said sub-assembly including a downstream support-and-air-intake member, an upstream annulus snap-connected to said downstream support, and a cup-shaped jet-former carried centrally in said annulus and held in position by gravity, said upstream annulus providing an outer portion slidably engaging the inner wall of the barrel and an inner periphery which provides an upstream centering sleeve and a downstream convexly curved impingement surface against which streams of water are directed, and the cup-shaped jet-former providing an out-turned flange which slidably cooperates with the centering sleeve to position the jet-formers to direct their streams radially outwardly against said impingement surface.

2. An aerator as in claim **1** wherein the cup-shaped jet-former extends through and downstream of the upstream annulus to provide an annular passageway through which flow of water is directed into the mixing chamber.

3. In a faucet aerator of the type that provides a mixing chamber having upstream and downstream ends,

water-jet defining means at the upstream end of said chamber, air intake means to said chamber, and at least one screen adjacent the downstream end of said chamber, the improvement comprising, in combination; an elongated, sleeve-like, imperforate barrel with screw threads thereon at the upstream end and an inturned lip at the downstream end, and a sub-assembly of molded parts arranged for sliding fit into the barrel to be supported by the barrel's lip, said sub-assembly being constructed to cooperate with the barrel to provide air intake means, and to provide a mixing chamber, the water-jet defining means, and a support for the screen, said sub-assembly including a downstream support-and-air-intake member, an upstream annulus snap-connected to said downstream support, and a cup-shaped jet-former carried centrally in said annulus and held in position by gravity, the downstream support-and-air-intake member being shaped to provide at least three elongated, upright supports spaced circumferentially to lie against the barrel's wall and to engage the barrel's lip, a ring secured to said upright supports to hold same in spaced relation and to be spaced inwardly of the barrel's wall to provide substantially annular air intake means, the supports extending upwardly of and above the ring to engage and support the annulus, the upper ends of said supports having adjacent inturned lips, and the upstream annulus having a continuous circumferential groove that faces outwardly to receive the inturned lips on said supports to snap-connect the parts together prior to insertion of the sub-assembly in the barrel, and said construction positioning the supports adjacent the wall of the barrel to prevent accidental separation of the snap-connected parts when in position in the barrel.

4. An aerator as in claim 3 wherein said ring of the downstream member has an inturned flange for supporting thereon a screen at the downstream end of the mixing chamber.

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