Sept. 5, 1961 E. P. AGHNIDES 2,998,932

FRAMED MOVABLE SCREENS FOR USE IN AERATOR DEVICES

Filed April 24, 1958

FIG. 1A.

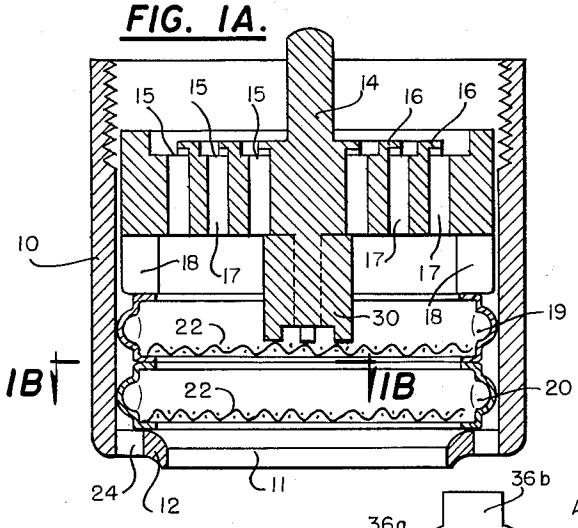


FIG. 1B.

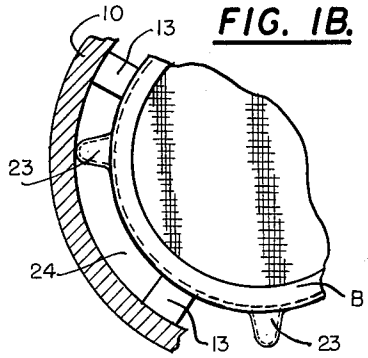


FIG. 1C.

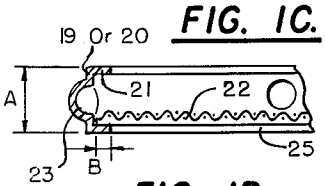


FIG. 1D.

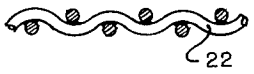


FIG. 2.

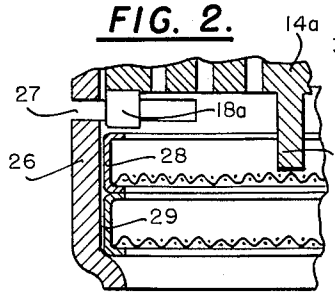


FIG. 3A.

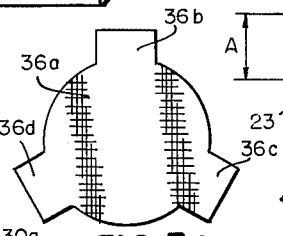


FIG. 3.

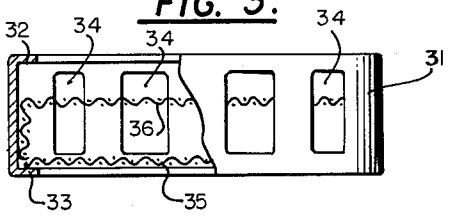


FIG. 4.

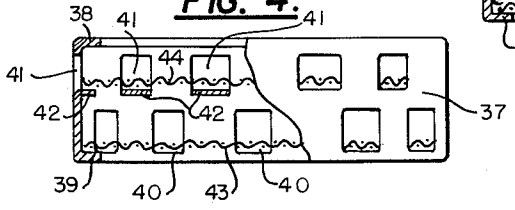


FIG. 5.

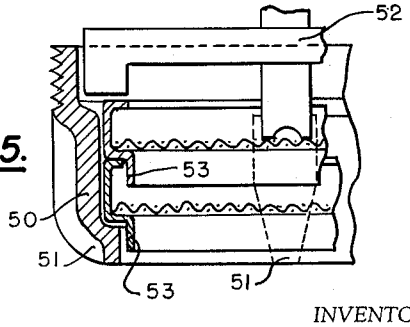
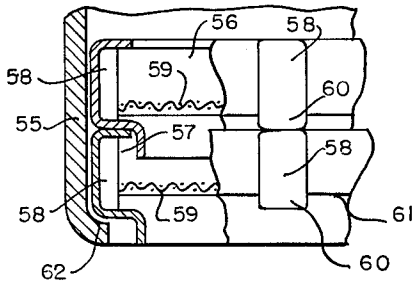


FIG. 6.



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FRAMED MOVABLE SCREENS FOR USE IN AERATOR DEVICES

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12 Claims. (Cl. 239—432)

The present invention relates to devices for aerating water, and is more particularly concerned with improved screen structures adapted for use in such devices.

Various water aerators or fluid mixing devices of types known heretofore embody wire mesh screens for mixing purposes; and one such structure is shown for example in my prior Patent No. 2,210,846, issued August 6, 1940, for: "Fluid Mixing Device." It has been the practice heretofore to provide such screens with a frame device for covering the rough edges of the screen and/or for providing a spacing between plural screens when such plural screens are superposed on one another. The provision of frame devices of types suggested heretofore results in an appreciable reduction in the effective mixing area provided by the screens.

The present invention serves to obviate the foregoing difficulties, and is particularly concerned with improved screen structures for use in water aerators or fluid mixing devices, which screen structures are framed by shells so arranged that they do not materially reduce the fluid mixing area presented by the screens themselves. The screen structures are movable within said shells, with the shells and screens being so disposed with respect to one another that the shell can be placed within an aerator casing, whereafter the screen moves to a desired position within the shell under the combined force of gravity and applied fluid pressures.

This movable characteristic of the screens is an important feature of the present invention, in that it permits the shell framing the screens to provide a relatively large spacing between superposed screens without appreciably cutting down the mixing area of the screen or screens; and the movable screens which are characteristic of the present invention further permit, in several embodiments of the invention, the shells to be placed within an aerator casing in either of two positions, whereupon the screens will move to a desired predetermined position relative to the casing itself.

It is accordingly an object of the present invention to provide a framed screen unit for use in water aerator or fluid mixing devices, which framed unit decreases very little the effective air-water mixing area of the screen or screens employed.

Another object of the present invention resides in the provision of a framed screen unit comprising a framing shell having a floating or movable screen or screens therein, whereby said screens move or gravitate to the lowest part of the framing shell when the unit is placed in a horizontal position.

A further object of the present invention resides in the provision of a screening unit which is framed with a shell structure of very thin material whereby plural such units may be superposed to effect a desired relatively large spacing between screens without simultaneously cutting down the effective mixing area of the screens to any appreciable extent.

A still further object of the present invention resides in the provision of an improved framed screen unit for use in water aerator devices which employs a shell so arranged as to have only limited contact with the inner wall of the aerator body or casing, thereby to prevent the cementing of the screen unit to the casing by calcium deposits collecting on the interior of the casing.

A still further object of the present invention resides in the provision of an improved framed screen unit for use in water aerator or fluid mixing devices, which is more easily cleanable than units suggested heretofore.

A further object of the present invention resides in the provision of an improved framed screen unit comprising a shell having a movable or floating screen therein, so arranged and constructed that the overall unit may be placed within an aerator body in either of two positions without affecting either the operation of the aerator or the relative spacing between components of the aerator, whereby the aerator itself may be more readily assembled and disassembled than has been the case heretofore.

Still another object of the present invention resides in the provision of an improved screen unit for use in water aerator or fluid mixing devices, which screen unit comprises a shell having a floating or movable screen therein, and also having openings in the wall of the shell for the admission of air to the region of said movable or floating screen.

A still further object of the present invention resides in the provision of an improved framed screen unit so constructed that plural such units can be disposed in nested relation in an aerator or fluid mixing body.

Still another object of the present invention resides in the provision of a framed screen unit having lateral projections whereby a spacing is provided between the inner wall of an aerator body and said framed screen unit when the said unit is placed within said aerator body.

A further object of the present invention resides in the provision of improved framed screen units employing movable screens so constructed and arranged that plural superposed screen units can be placed within a shorter aerator body for a given spacing between screens than has been the case heretofore.

In providing for the foregoing objects and advantages, the present invention contemplates the provision of a water aerator or fluid mixing device comprising a casing having an improved mixing screen unit or units therein. Each said mixing screen unit preferably comprises a thin walled shell of appreciable height in relation to the height of the screen surface itself, having a screen structure movably disposed therein.

The screen surface is trapped within but not fastened to any portion of the framing shell whereby said screen surface is permitted to move or float within the shell under the combined forces of gravity and applied fluid pressures. As a result, the screen surface tends to move to the lowermost portion of the shell when the screening unit is placed horizontally within an aerator casing. When plural such units are superposed, therefore, the thin walled shells framing each screen serve to space the screens from one another by a predetermined fixed spacing which can be relatively large without cutting down the effective mixing area of each screen; and by the same token, due to the movable or floating nature of the individual screens, each unit can be placed in either of two positions within the aerator casing without affecting the relative spacing between the actual mixing surfaces presented by the screens.

The shells utilized in each of the aforementioned units can have one or more flat screens therein; or can in the alternative, as will be described, have at least one dished screen surface therein. In either event, the screens are movable whereby the advantages already described can be achieved. The shells moreover can be provided with one or more openings in the side walls thereof for the admission of air to the region of the mixing screen or screens. Instead of providing such side openings, however, either the framing shells and/or the aerator casing can be provided with depressions or projections to assure that portions of the framing shells are spaced from the

inner wall of the aerator casing, whereby air, admitted for example adjacent the discharge end of the aerator, can pass upward between the framing shells and casing body to enter each shell adjacent the mixing screen surface or surfaces carried therein.

The foregoing objects, advantages, construction and operation of the present invention will become more readily apparent from the following description and accompanying drawings, in which:

FIGURE 1A is a cross-sectional view of an improved aerator employing novel movable framed screens constructed in accordance with one embodiment of the present invention.

FIGURE 1B is a view taken on line 1B—1B of FIGURE 1A.

FIGURE 1C is a detail view of a portion of a typical unit of the type employed in FIGURE 1A.

FIGURE 1D is a detail view of a screen mesh of the type preferably employed in the practice of the present invention.

FIGURE 2 illustrates a modified screen unit constructed in accordance with the present invention.

FIGURE 3 illustrates a screen unit constructed in accordance with a further modification of the present invention.

FIGURE 3A illustrates an alternative form of dished screen such as may be employed in the present invention.

FIGURE 4 illustrates a screen unit constructed in accordance with still another modification of the present invention.

FIGURE 5 illustrates screen units constructed for nested superposition in accordance with still another modification of the present invention; and

FIGURE 6 illustrates a still further embodiment of the present invention.

The present invention is related to my prior copending application Serial No. 560,299, filed January 20, 1956, for: "Fluid Mixing Devices"; and of my prior copending application Serial No. 639,782, filed February 12, 1957, now abandoned, for: "Unframed Foraminous Structures for Fluid Mixing Devices."

Referring to FIGURES 1A through 1C, it will be seen that an improved aerator constructed in accordance with the present invention comprises a casing **10** having an outlet end **11** defined by an outlet ring **12** interconnected with the body **10** by a plurality of lateral arms **13**. The elements **10**, **12** and **13** are integral with one another; and the outlet ring **12**(arms **13**, and body **10** preferably comprise a single stamping.

The interior of the casing **10** preferably includes a diaphragm **14** of the type previously described in my prior copending application Serial No. 640,859, filed February 18, 1957, for: "Improvements in Water Aerators." The particular form of diaphragm represented by **14** in FIGURE 1A comprises a body which may be formed of a material such as polyethylene, and defines three substantially concentric rows of openings **15** as well as ring-like projections **16** which partially close the inlet ends of a plurality of tubular chambers **17**. The several chambers **17** may have a diameter of approximately one mm., and a height of approximately 3.5 mm.; and the restricted apertures defined between the openings **15** and the partial closing rings **16** may be 0.50 or 0.75 mm. The diaphragm **14** further includes a plurality of feet **18** spaced about the periphery thereof; and there are preferably eight feet **18** so spaced. The feet **18** support the diaphragm **14**, as shown in FIGURE 1A, on the upper edge of a mixing screen unit **19** which is in turn supported on a further mixing screen unit **20** carried on the outlet ring **12** of the device.

Each of the units **19** and **20** comprises a framing shell **21** (see FIGURE 1C) which is constructed of fairly thin material, e.g. it may be approximately 0.25 mm. thick. The shell has a height A (see FIGURE 1C) which is approximately 3 mm., and also defines a pair of laterally extending lips having an edge dimension B of approximately 0.5 mm. adapted to support a screen mesh **22** thereon. The overall shell **21** is, therefore, of hollow annular shape, and defines relatively large substantially circular upper and lower openings disposed substantially coaxial with the casing **10**.

The screen mesh employed in the units of FIGURES 1A through 1C are of the type shown in FIGURE 1D; and in particular are preferably of the type wherein the several junctures of the screen wires are welded, soldered, or otherwise rigidly interconnected to one another; and similar such screens are preferably employed in the other embodiments of the present invention, to be described hereinafter. The screens themselves are preferably of 40 x 40 mesh, and employ wire having a diameter of 0.009 inch.

Each of the shells **21** defines a plurality of lateral protrusions **23** which are spaced about the screening unit as shown in FIGURE 1B. The several protrusions **23** assure that the screening unit is concentrically positioned within the aerator casing **10** when said unit is placed therein; and also assures that the screen units **19** and **20** contact the inner wall of casing **10** at only limited portions thereof. This limited contact tends to assure that the screening units will not become cemented in place due to the accumulation of calcium deposits on the interior of the aerator; and also provides a passage for air to the interior of each unit, whereby air may pass from air inlets **24** provided adjacent the discharge end of the aerator upward between the protrusions **23** and then between the legs **18** to the region downstream of diaphragm **14**.

The screen surface **22** is not rigidly fastened within its associated shell **21**. As a result, when the units **19** and **20** are placed in the shell **10**, as illustrated in FIGURE 1A, the screens **22** are adapted to move freely, or preferably with very slight friction, under the force of gravity and of applied fluid pressure, to the lowermost position in each shell **21**. The two screens **22** in the units **19** and **20**, respectively, are accordingly maintained in predetermined spaced relation to one another during operation of the aerator, with each screen being supported adjacent its peripheral edge by the small overlap portion B defined by the framing shell associated therewith.

In practice, as mentioned previously, the overlapping shell edge B has a dimension of only one-half mm., and this should be compared with framing structures suggested heretofore, wherein the overlapping shell edge ordinarily has a dimension of about 1 mm. The space between the shells **19**—**20** and the inner wall of aerator body **10** (i.e. the radial spacing between protrusions **23**) is preferably not less than 1 mm. in an aerator having an inner diameter of 21 mm.; and the shells each have an outlet opening **25** (and a similar, oppositely disposed inlet opening) which is approximately 17.5 mm. in diameter. It will be noted from FIGURE 1 that the outlet ring **12** is of slightly smaller diameter than the discharge outlet **25** of the shells **19** and **20**, thereby to assure the roundness and coherency of the stream issuing from the overall aerator; and in practice, the outlet ring **12** has a discharge diameter of approximately 17 mm.

It will be noted that the shells **19** and **20** are each symmetrical, in that they provide upper and lower openings similar to **25** of substantially the same diameter, and they also provide lips such as B adjacent both the upper and lower edges thereof. Inasmuch as the screen contained in each shell is relatively freely movable therein, each shell **21** can be placed in the aerator unit in either of two positions, inverted relative to one another, in which event the screen surface will move to the proper lower position in the shell to assure that the several screens are properly spaced from one another.

The particular areator shown in FIGURE 1A employs a casing wherein the air inlet is adjacent the discharge end of the casing. In the alternative, the casing may take the form shown in FIGURE 2, wherein a casing **26** is pro-

vided with air inlets **27** in the side walls thereof. When this form of casing is employed, the mixing screen units **28** and **29**, while otherwise constructed in accordance with the discussion already given in reference to FIGURES 1A through 1C, need not have the protrusions **23**. Such protrusions may be provided, however, in which event a screening unit of the type described in FIGURE 1C can be employed in an aerator casing of the type shown in FIGURE 2 in order to secure the advantages of limited contact between the framed screen unit and the inner wall of the casing. In the arrangement of FIGURE 2 the screen surfaces are again freely movable within their associated shells, and are supported at a lowermost position within said shells by an in-turned lip (analogous to lip B), as illustrated in FIGURE 2.

It will be noted that in the arrangements of FIGURES 1A and 2 (as well as in any of the other embodiments to be described), the diaphragm **14** (or **14***a* in FIGURE 2) may include a depending leg **30** (**30***a* in FIGURE 2) which is adapted to be disposed closely adjacent to or rest upon the screen in the uppermost screening unit. The leg **30**, or **30***a*, while optional in nature, tends to assure that at least the upstream screen is in correct position when the overall unit is assembled for operation. Even without such legs, however, the screens will, as mentioned previously, tend to gravitate or be moved to proper position during operation of the device.

The screening units described thus far admit air adjacent the circular openings thereof, analogous to **25**. In the alternative, the screening unit may have the shell thereof provided with one or more openings in the side walls of the shell for the admission of air; and structures of this latter type are shown in FIGURES 3 and 4. Referring first to FIGURE 3, it will be seen that the shell **31** again has upper and lower annular lips **32** and **33** adapted to support screen surfaces; and the shell **31** further defines a plurality of lateral openings **34** for the admission of air. The unit of FIGURE 3 has two screens therein, with one of these screens **35** being substantially flat in configuration, and with the other of these screens **36** being of dished configuration so that the screens **35** and **36** are spaced from one another within shell **31**, as illustrated.

A unit of the type shown in FIGURE 3 may thus be substituted for two units such as **28**—**29** of FIGURE 2, or **19**—**20** of FIGURE 1A; and again, the unit of FIGURE 3 can be placed in either of two positions within an appropriate aerator body, in which event the two screen units, properly spaced from one another, will gravitate or be moved to the lowermost position within the shell, while at the same time assuring proper spacing between the screen surfaces themselves as well as between those screen surfaces and the diaphragm.

When a unit of the type shown in FIGURE 3 is employed in a casing of the type shown in FIGURE 2, the dimensions for the shell **31** may be so chosen that the uppermost portions of each of the lateral apertures overlies the air inlets **27**; and in such an event the diaphragm, such as **14** (or **14***a*), need not be provided with legs **18** (or **18***a*), but can rest directly on the uppermost edge of the shell **31**.

The particular form of dished screen **36** shown in FIGURE 3 includes, as illustrated, an upper substantially horizontally disposed portion and an annular screen portion extending downwardly about the periphery of said upper part for spacing the screens **35** and **36** from one another. The side portion of the dished screen **36** tends to interfere with ready cleaning of the device; and in order to facilitate cleaning of the overall screen unit, an alternative form of dished screen, such as that shown in FIGURE 3A, can be employed. This latter form of dished screen, which may be substituted for the dished screen **36** of FIGURE 3, comprises a screen surface **36***a*, corresponding to the upper portion of dished screen **36**, and includes a plurality of screen extensions **36***b*, **36***c* and **36***d*, extending from the main screen surface **36***a* in spaced relation to one another.

The several extensions **36***b*, **36***c* and **36***d* can be bent downwardly with respect to the plane of screen portion **36***a* after the screen unit has been formed, whereby projections **36***b*, **36***c*, **36***d* form a plurality of spaced legs extending in the same direction from the main screen surface **36***a*. When such a dished screen structure is placed upon a further screen (such as **35** of FIGURE 3) the legs **36***b*, **36***c* and **36***d* act to space the screen surface **36***a* from this further screen (such as **35**) and at the same time the spacings between the several legs **36***b*, **36***c* and **36***d* permit ready cleaning of the overall unit.

An alternative form of plural screen unit is shown in FIGURE 4. This unit again comprises a shell **37** having upper and lower annular lips **38** and **39** performing a function similar to the upper and lower lips of the unit already described, depending upon which direction the unit is placed in the aerator casing. The side walls of the shell **37** define two rows of windows or openings **40** and **41**; and the row of windows **41** further defines in-turned lips **42**. As a result of this structure, one screen surface **43** can be supported upon the lowermost lip **39** of the shell **37**, while the other screen **44** is supported on the in-turned lips **42** defined by the windows **41**. When the unit is inverted, the screen **44** will be supported on lip **38** while the screen **40** will be supported again on lips **42**, whereby the unit is, as before, reversible in nature, without affecting the spacing between the screens and between those screens and the other portions of the aerator. It will be noted that when the arrangement of FIGURE 4 is employed, the dishing considerations of the screen **36** in FIGURE 3 need not be employed; and as a result, the unit of FIGURE 4 can again be cleaned more readily and better than the unit of FIGURE 3.

FIGURE 5 illustrates another embodiment of the present invention, wherein the framed movable screen structures of the present invention are so constructed and arranged that they may be superposed in nested relation to one another. The unit of FIGURE 5 employs a casing **50** having a plurality of protrusions **51** defined therein for centering the nested screen units. Air enters the device between the several protrusions **51** and then passes upward to the region downstream of the diaphragm **52**. The screening units themselves are generally of the type already described in reference to FIGURE 2, except that each unit includes a downwardly extending skirt **53** adapted to nest that unit within the adjacent edge of another unit, as illustrated in FIGURE 5.

Another form of nesting arrangement is shown in FIGURE 6. In this particular arrangement, the casing **55** is not provided with protrusions or indentations similar to **51** (of FIGURE 5); and accordingly, the framing shells for the nested screening units **56** and **57** are provided with protrusions **58** which are somewhat analogous to the protrusions **23** already described in reference to FIGURE 1B. The protrusions **58** differ from protrusions **23**, however, in that they continue below the level of the screens **59**, as shown at **60**. This modified construction is employed to assure that the lower edge **61** of the lower screening unit will not come so close to the shoulder **62** of the aerator discharge opening as to prevent the admission of air to the interior of the casing, as desired.

I claim:

1. A mixing unit for use in a water aerator comprising first and second annular lips disposed in spaced substantially parallel relation to one another, said lips being interconnected by a side wall extending therebetween whereby said lips and side wall define a hollow annular shell having upper and lower substantially circular openings, and mixing screen means in said shell having a thickness less than the distance between said lips, said mixing screen means being substantially freely movable in said shell between said first and second lips, the outer diameter

of said mixing screen means being larger than the diameter of said upper and lower openings and smaller than the largest inside diameter of said shell, said mixing screen means being always supported on one of said pair of lips in freely spaced relation to the other of said pair of lips and being adapted to gravitate toward one or the other of said annular lips for support thereon at a position adjacent one or the other of said circular openings depending upon the position of said shell.

2. A mixing unit as defined in claim 1 in which said mixing screen means consists of a single screen.

3. A mixing unit as defined in claim 1 in which said mixing screen means comprises at least one screen.

4. A mixing unit as defined in claim 1 in which said mixing screen means comprises superposed screens.

5. A mixing unit as defined in claim 1 in which the mixing screen means comprises superposed screens interconnected at their peripheries.

6. A mixing unit as defined in claim 1 in which one of said lips after extending inwardly then extends downwardly to form an outlet skirt.

7. A mixing unit as defined in claim 1 in combination with a second such unit fastened to and located on the downstream side of the first unit.

8. A pair of mixing units as defined in claim 7 in which spaced portions of the side wall of one of the units have been punched inwardly to form a lip separating the two units as well as to form an air inlet.

9. A mixing unit as defined in claim 1 in which said side wall has spaced lateral protrusions to center the unit in the aerator and provide air passageways between the protrusions.

10. A mixing unit for use in a water aerator comprising a round screen element, a cylindrical tube having a diameter slightly larger than that of the screen element and a height substantially greater than the thickness of said screen element, said screen being positioned within the tube, and lips extending inwardly from the upper and lower ends of the tube to retain the screen within the tube, said screen element being the only one in said tube, whereby the screen element is substantially freely movable within the tube between the lips at the opposite ends of the tube.

11. A mixing unit as defined in claim 10 in which the width of said lip is smaller than the height of said cylindrical tube.

12. A mixing unit as defined in claim 10 in which said cylindrical tube has spaced lateral protrusions to center the unit in the aerator and provide air passageways between the protrusions.

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