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Huisman et al.

[11] **3,744,774**

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[54] **DEVICE FOR AERATING LIQUIDS**

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[30] **Foreign Application Priority Data**

Mar. 17, 1970 South Africa 1789

[52] **U.S. Cl.** **261/92,** 239/224

[51] **Int. Cl.** **B01f 3/04**

[58] **Field of Search** 241/92, 296, 297; 261/92

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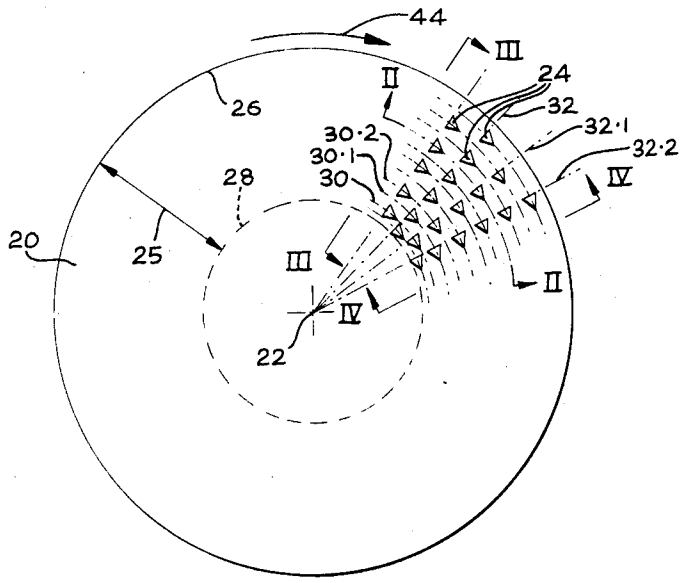
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[57] **ABSTRACT**

The present invention provides for a device for aerating liquids such as sewage. The device includes a rotatable disc-like member having protruding formations adapted to draw air into the liquid to be aerated during rotation of the member when partly immersed in the liquid.

4 Claims, 11 Drawing Figures



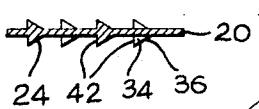


FIG. 2

FIG. 1

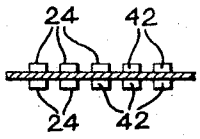


FIG. 3

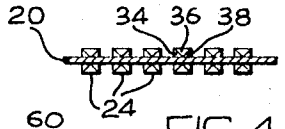


FIG. 4

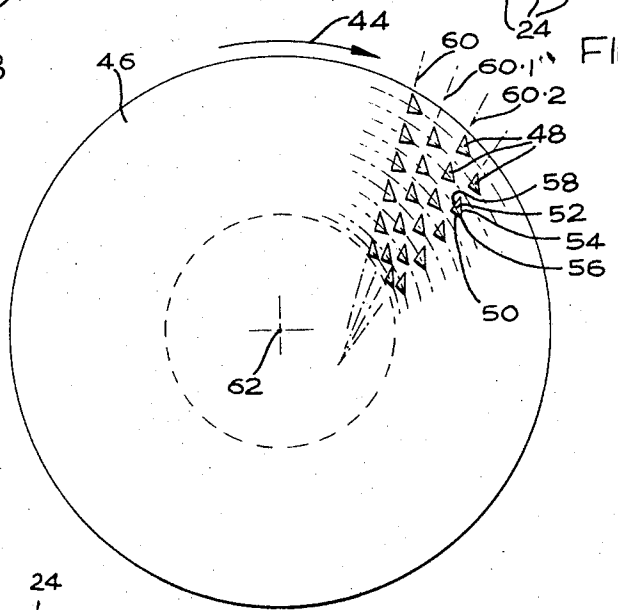


FIG. 6

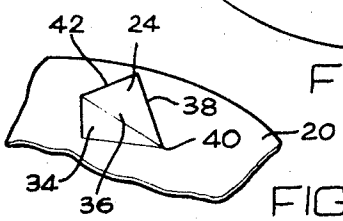


FIG. 5

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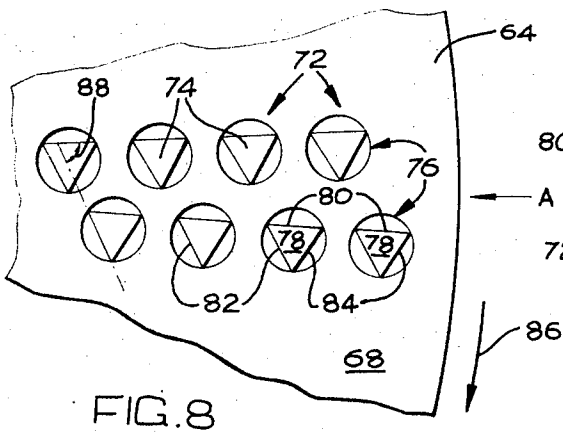


FIG. 8

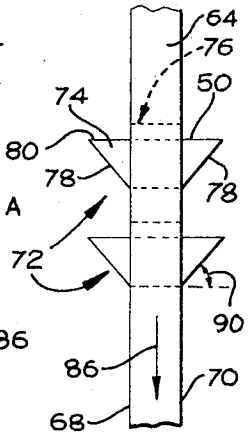


FIG. 9

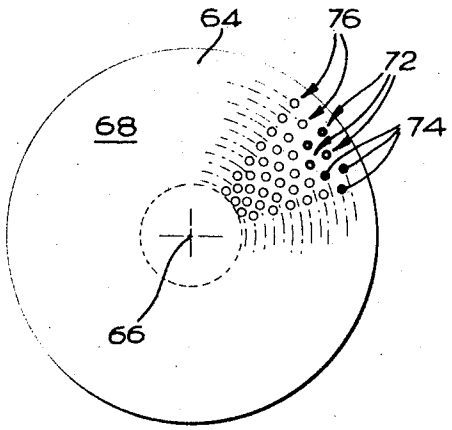


FIG. 7

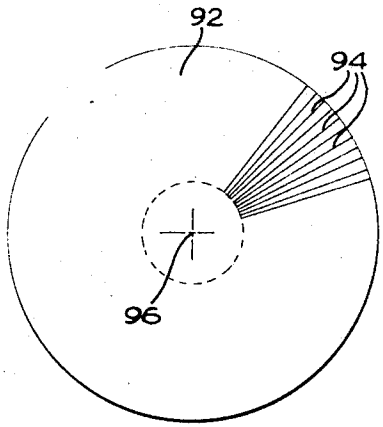


FIG. 10

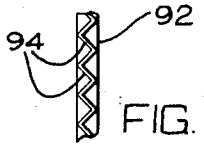


FIG. 11

DEVICE FOR AERATING LIQUIDS

BACKGROUND OF THE INVENTION

This invention relates to a device for aerating liquids.

According to the invention a device for aerating liquids includes a rotatable disc-like member having protruding formations adapted to draw gas into a liquid during rotation of the member when partly immersed in the liquid.

The protruding formations may take several forms. In one form, the formations may be nodules standing proud of the surface of the disc-like member. The nodules may be of convergent shape converging from a blunt base to an apex. The convergent surface may have a plurality of flat intersecting faces.

If desired, the nodules may be so arranged on the surface of the disc-like member that they converge in the direction of rotation of the disc-like member. This arrangement causes liquid to be deflected away from the disc-like member by each nodule as it strikes the surface of a liquid during rotation of the member. Thereby a gas bubble is formed and trapped behind each nodule.

By carefully arranging the spacing of the nodules, a substantial gaseous zone may be formed between the surface of the disc-like member and a liquid in which it rotates and may subsist for at least some depth below the surface of the liquid. The formation of such a gaseous zone is advantageous in the treatment of foul liquids such as sewage to oxygenate such liquids.

The nodules may be provided on a face of the disc-like member transverse to its rotational axis. Alternatively, or in addition, the formations may be provided on the peripheral surface of the disc-like member.

In another form, the protruding formations may be undulating formations which may extend radially. In this form, the circumferential cross-sectional profile of the disc-like member may be undulating.

The liquid may be a foul liquid such as sewage. Accordingly the invention extends also to the treatment of foul liquids such as sewage by employing a device according to the invention.

The invention is described below with reference to the accompanying drawings, in which:

FIG. 1 shows a side view of one embodiment of a rotatable disc-like member for aerating liquids;

FIG. 2 shows a section on line II—II of FIG. 1;

FIG. 3 shows a section on line III—III of FIG. 1;

FIG. 4 shows a section on line IV—IV of FIG. 1;

FIG. 5 shows a three-dimensional view on an enlarged scale of a part of the disc-like member and of one of the nodules of FIG. 1;

FIG. 6 shows a side view of another embodiment of a rotatable disc-like member for aerating liquids;

FIG. 7 shows a side view of another embodiment of a rotatable disc-like member for aerating liquids;

FIG. 8 shows on an enlarged scale a part of the surface of the disc-like member shown in FIG. 7;

FIG. 9 shows an end view of the part of the disc-like member shown in FIG. 8 when viewed in the direction of arrow A;

FIG. 10 shows a side view of another embodiment of a disc-like member for aerating liquids; and

FIG. 11 shows an end view of part of the disc-like member shown in FIG. 10.

Referring to FIGS. 1 to 5, the disc-like member 20 is rotatable about a rotational axis 22. Means for mounting and rotating the disc-like member are not shown but could for example include a shaft fast with the disc-like member and co-axial with the rotational axis 22. Alternatively, it could include cheekplates between which the disc-like member may be clamped.

On the flat faces of the disc-like member 20 are provided projecting nodules 24 standing proud of the faces. The nodules are provided along a circumferential band 25 demarcated by the periphery 26 and the dotted line 28. Only a few nodules are shown in the drawings but it will be understood that the nodules are provided along the entire band 25.

The nodules 24 are arranged in radially spaced circumferential rows 30, 30.1, 30.2, etc., and in circumferentially spaced radial rows 32, 32.1, 32.2, etc. intersecting each other at the rotational axis 22.

As will be apparent from FIG. 1 as well as from FIGS. 2 to 5, each nodule 24 has a convergent shape comprising three intersecting flat faces 34, 36 and 38 diverging away from an apex 40 to a flat face 42. The shapes of the nodules converge in the direction of rotation of the disc-like member as indicated by arrow 44.

The nodules 24 are integral with the disc-like member 20 for example by being moulded of a metal such as aluminum or a synthetic plastic material.

In use, the disc-like member 20 is mounted so that its rotational axis 22 is horizontal to permit it to rotate in a vertical plane. The disc-like member is partly immersed in a liquid to be aerated such as sewage and is rotated in the direction of arrow 44. The convergent shape of each nodule 24 permits streamlined entry of the nodule into the liquid, while the trailing face 42 causes suction which traps an air bubble behind the face 42. The air bubble is drawn into the liquid and thereby aerates the liquid. As the air bubble is drawn deeper into the liquid it may eventually be released from the face 42 due to the changed position of the face 42. Upon being released the bubble floats into the path of the nodule following behind the face 42. This nodule breaks up the air bubble into a number of smaller bubbles, whereby a larger contact area is formed between the air and the surrounding liquid and whereby absorbtion of the oxygen in the diffused air bubbles by the liquid is facilitated.

Referring to FIG. 6, there is shown a disc-like member 46 very similar to the disc-like member 20 of FIG. 1. The differences are that the nodules 48 are not of a symmetrical shape like the nodules 24 but have unequal faces 50, 52 and 54 diverging from an apex 56 to a transverse flat face 58. Furthermore, the rows 60, 60.1, 60.2, etc. are eccentrically disposed with respect to the rotational axis 62 unlike the rows 32, 32.1, 32.2, etc. which intersect each other at the rotational axis 22. Apart from these differences the construction and operation of the disc-like members 46 and 20 are identical.

Referring to FIGS. 7 to 9, the disc-like member 64 is adapted to rotate about a rotational axis 66 by means of a shaft, cheekplates, clamps or the like (not shown). The disc-like member 64 has faces 68 and 70 on which are provided radially and circumferentially spaced nodules indicated generally by reference numeral 72.

The nodules 72 are shown in greater detail in FIGS. 8 and 9. The nodules comprise inserts 74 fitted in holes 76, for example by means of an adhesive material. The inserts 74 are of a triangular cross-section and have sloping faces 78. Thus, each protruding part of the in-

serts 74 has four faces 78, 80, 82 and 84. The face 80 is square or rectangular while the faces 78, 82 and 84 are triangular.

The inserts 74 are so mounted in the holes 76 that the faces 78, 82 and 84 converge from the face 80 in the direction 86 of rotation of the member 64.

In use, the disc-like member 64 is mounted for rotation in a substantially vertical plane, i.e. with the rotational axis 66 horizontal. The member 64 is partly immersed in a liquid which is to be aerated. When the disc-like member is rotated in the direction of arrow 86, the nodules 72 strike the surface of the liquid and cause turbulence. Thereby air bubbles are trapped behind the faces 80 and are drawn into the liquid. In this way the liquid is aerated. By arranging the nodules 72 to converge away from the faces 80 into the direction of rotation 86, friction between the elements and the liquid is reduced. In addition, it facilitates the trapping of air bubbles behind the faces 80.

The holes 76 are arranged in rows inclined to each other at angles 88 which may be about 60°. The spacing between the nodules 72, the diameter of the holes 76 and the thickness of the disc-like member 64 may be about equal. The faces 78 may be inclined at angles 90 which may be about 30° to 60°.

If desired, some inserts 74 may be omitted from the holes 76. In this arrangement the disc-like member 64 will include the combination of bare holes 76 without inserts and holes 76 with inserts 74 as shown in FIG. 7. The bare holes 76 also trap air bubbles when the holes enter the liquid and thereby assist in the aeration of the liquid.

FIGS. 10 and 11 show another form of disc-like member 92. The member 92 has circumferentially spaced undulating radial formations 94. The circumferential cross-sectional profile of the member 92 is undulating, and the member 92 is adapted to rotate about a rotational axis 96.

The disc-like members 20, 46, 64 and 92 may be used in the treatment of sewage to aerate the sewage.

We claim:

1. A gas-liquid contact element comprising a rotatable disc-like member having protruding formations on two faces transverse to its rotational axis adapted to draw air into a liquid during rotation of the member when partly immersed in the liquid, the protruding formations being nodules standing proud of the surface of the disc-like member and each nodule having a convergent shape comprising a plurality of intersecting flat faces and converging in the direction of rotation of the disc-like member from a blunt base to an apex so that during rotation of the disc-like member an air bubble is drawn into the liquid by the blunt base of each nodule during movement of the nodule from the air into the liquid.

2. A device according to claim 1, in which the nodules are arranged in circumferential rows concentric with the rotational axis of the disc-like member, the apices of the nodules in any one circumferential row trailing the blunt bases of the nodules in that row during rotation of the disc-like member.

3. A device according to claim 1, in which the nodules are arranged in radial rows intersecting each other at the rotational axis of the disc-like member, the nodules in adjacent radial rows being circumferentially staggered from each other.

4. A device according to claim 1, in which in addition to protruding formations there are provided apertures through the disc-like member, the disc-like member being apertured and the protruding formations being provided in the form of inserts mounted in some of the apertures, the remaining apertures being left open.

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