United States Patent [19]

McGurk

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[54] **FLUID TREATMENT AND DISTRIBUTION SYSTEM**

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[52] **U.S. Cl.** **261/91,** 261/120, 210/242

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

[58] **Field of Search** ..... 210/242; 261/91, 261/36 R, 120

[56] **References Cited**

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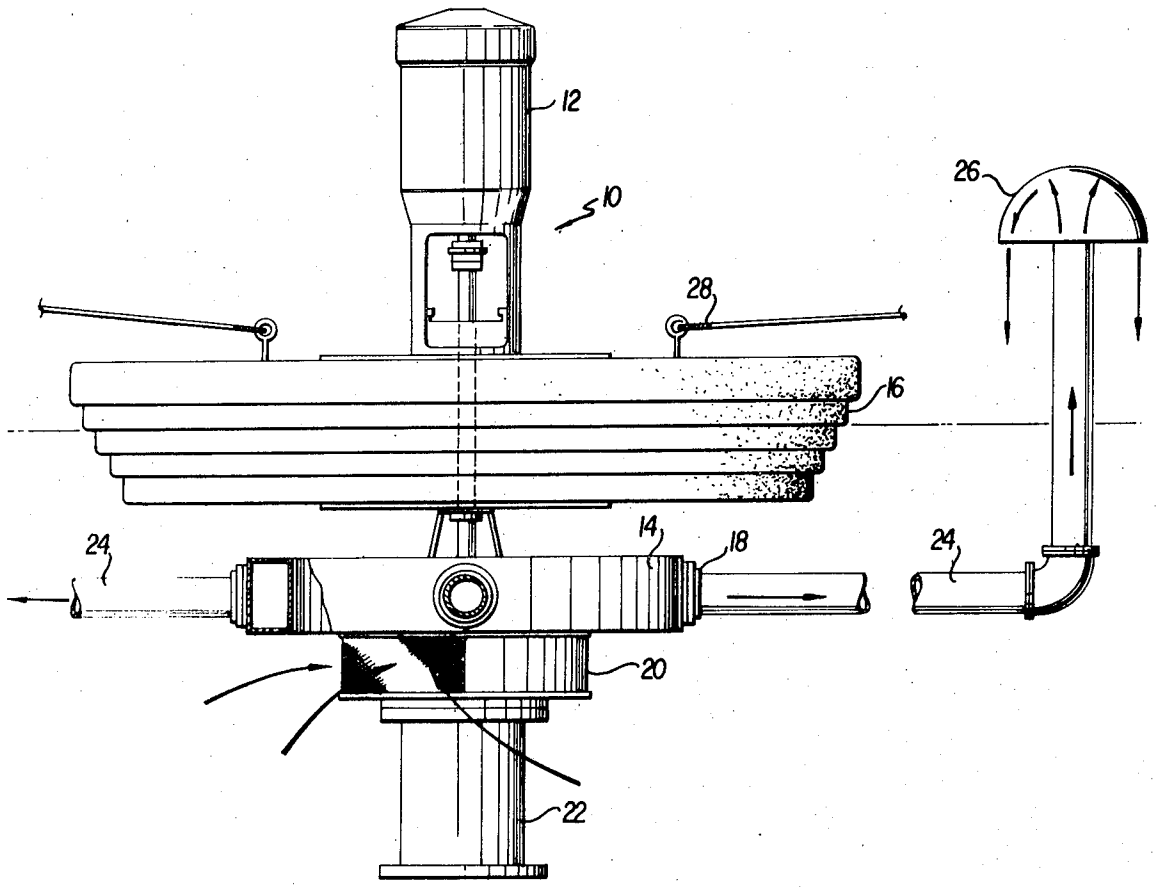
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[57] **ABSTRACT**

A fluid aeration-agitation system featuring a pumping system and a pressure manifold operatively mounted upon a float which is either stationary or mounted for rotation, the manifold being operatively connected to a plurality of pipes each leading to a hollow discharge directing subsurface convection current or to a discharge head being hemispherical in configuration.

7 Claims, 6 Drawing Figures



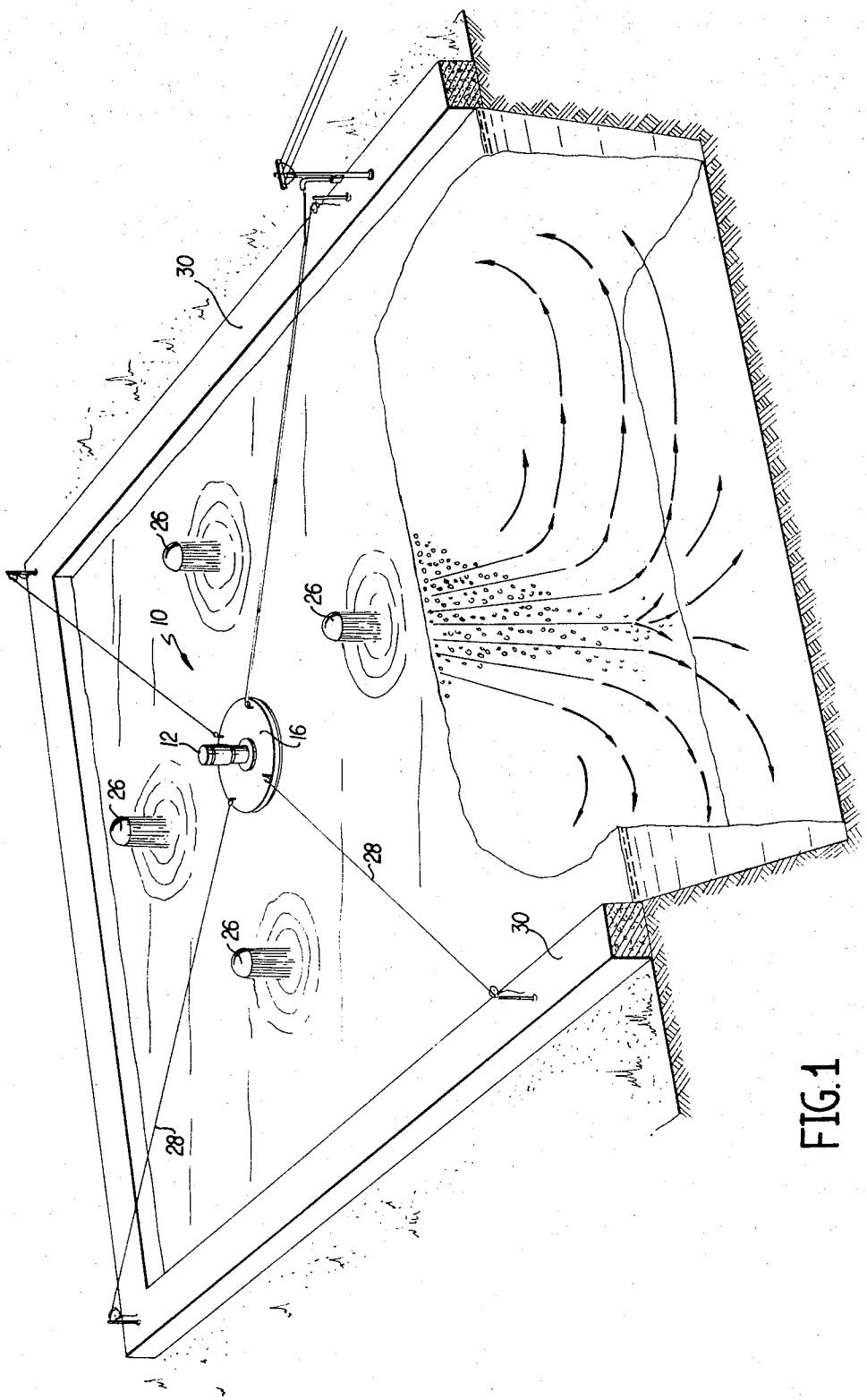


FIG. 1

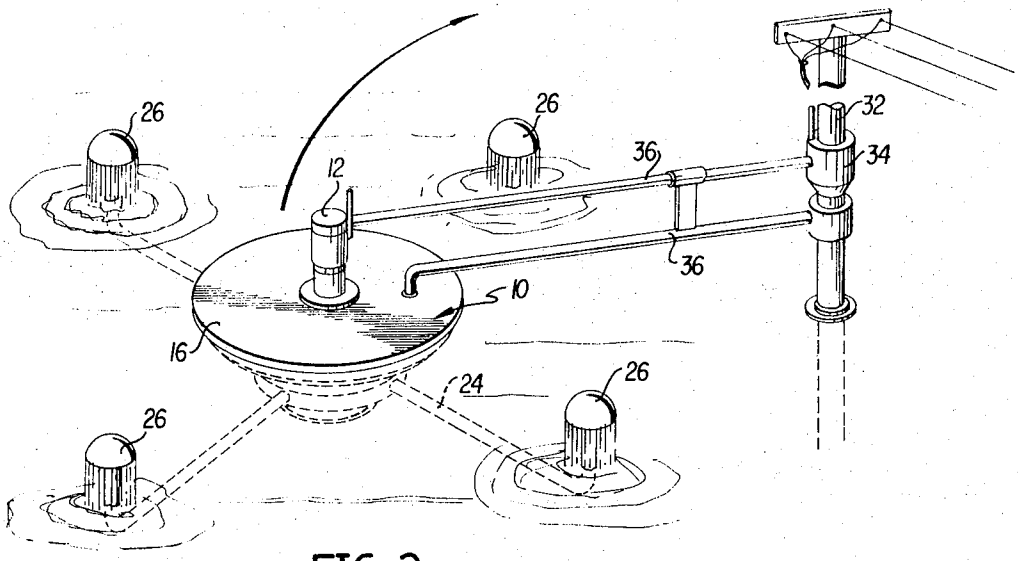


FIG. 2

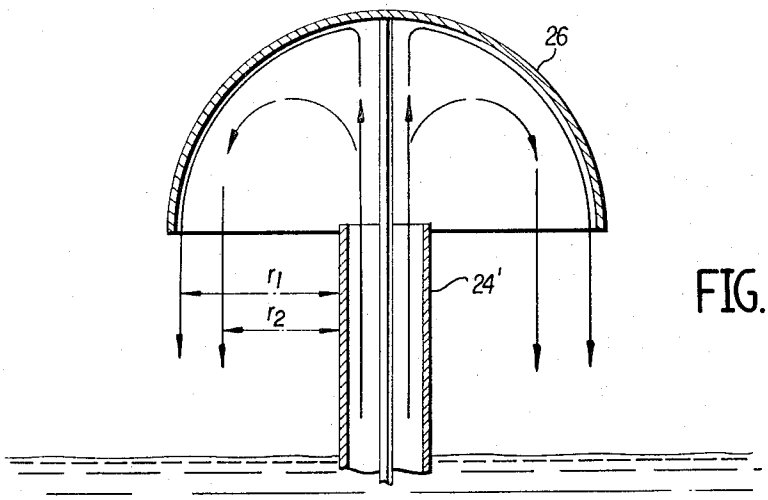


FIG. 4

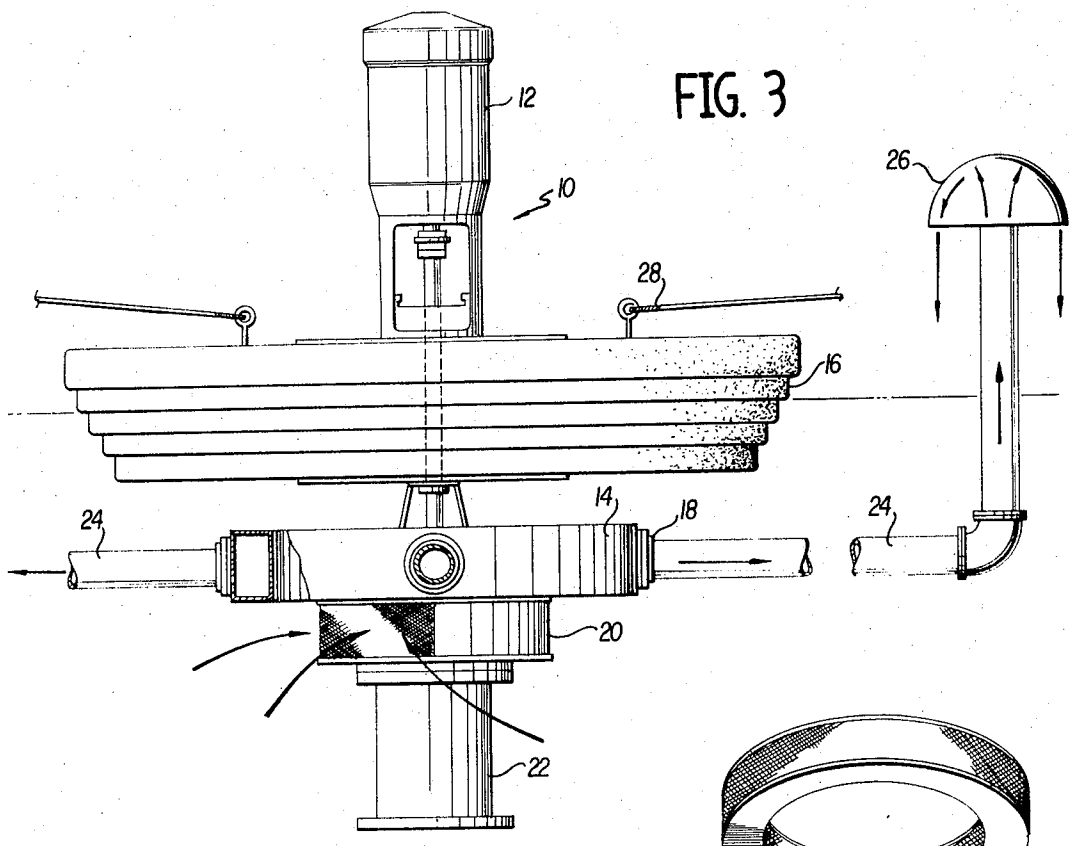


FIG. 3

FIG. 6

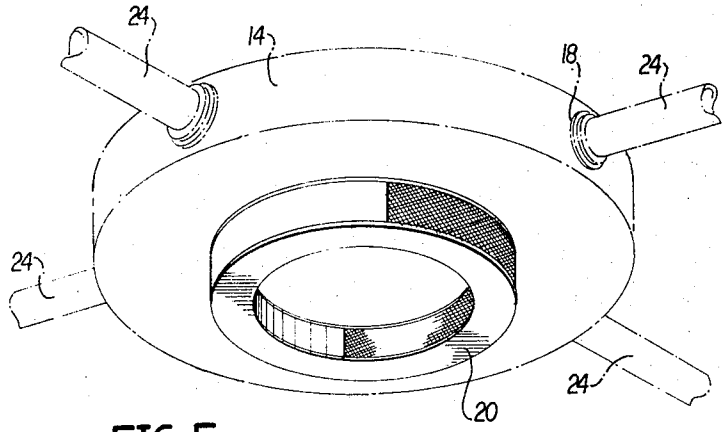


FIG. 5

FLUID TREATMENT AND DISTRIBUTION SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a fluid treatment and distribution system, particularly applicable for the treatment of liquids such as sewage and industrial waste requiring the transfer of oxygen from the atmosphere into the liquid mass of sewage, or subsurface agitation.

Aeration of fluids occurs at peak efficiency when thorough mixing and circulation of the parent fluid body results in the solids contained therein being held in suspension. Previous aeration devices have included propeller-mixer equipment, paddle wheel arrangements and fountain systems. It is usually impossible to accurately rate the efficiencies of such prior art systems. In addition, such known devices usually provide insufficient rates of oxygen transfer per unit volume of fluid moved and thus insufficient fluid aeration. Hence, the therator apparatus may be used as a subsurface agitator and a liquid aerator at the same time. The conventional propeller-mixer equipment has the added disadvantage of causing bottom erosion.

The present invention is designed to overcome these disadvantages while providing flexibility of application as explained in detail hereinafter.

SUMMARY OF THE INVENTION

The present invention is used to circulate fluid in a manner which establishes a convection pattern within a fluid body so as to cause continual fluid turnover from the lower depths to the surface while simultaneously aerating the fluid by transferring oxygen from the atmosphere thereto. With the present invention, the solids are maintained in suspension and exposed to sufficient dissolved oxygen to enhance bacterial attack and decomposition. Quantites of the liquid mass are exposed to impounded or atmospheric oxygen or other soluable gases. Also, predictable and controllable silting patterns for heavier solids are achieved. The foregoing is accomplished with the present invention which is characterized by its simplicity in construction and flexibility of use.

The fluid treatment and distribution system of the present invention is secured to a buoyant float permitting use in different environments such as tanks, ponds, vats and lakes. The aeration-agitation apparatus may be mounted to rotate at different speeds on the surface of the liquid mass. An important feature of the present invention is the shape of the discharge heads which are hollow and hemispherical in configuration. In this manner, the path of the fluid into the atmosphere and its return to the liquid mass is selected to maximize the kinetic energy of the fluid.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a perspective view partially in section depicting use of one embodiment of the aeration-agitation system in a vat;

FIG. 2 is a perspective view illustrating a second embodiment of the aeration-agitation system designed to rotate within the tank or pond;

FIG. 3 is a side elevational view of the subject aeration-agitation apparatus mounted upon a buoyant float;

FIG. 4 is an enlarged cross-sectional view of one of the discharge heads of the subject aeration-agitation system illustrating in particular hollow, hemispherical configuration thereof;

FIG. 5 is a perspective view of the pressure manifold and discharge pipes used in conjunction with a first embodiment intake element; and

FIG. 6 is a perspective view of an alternative embodiment intake element.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The aeration-agitation system of the present invention is designated generally by the reference numeral **10** in FIGS. **1, 2** and **3** and comprises a motor and pump assembly **12** to which is attached a pressure manifold **14.** Such centrifugal pump and manifold construction is well known in the art and needs no further description. The pump and motor assembly **12** is rigidly secured to the upper surface of a buoyant float **16,** while the pressure manifold **14** may be secured to the bottom or the top surface of float **16,** depending on the pump configuration.

The pressure manifold **14** is preferably a hollow-walled toroidal vessel provided with a plurality of equally spaced ports **18** along the outer periphery thereof. The pressure manifold **14** is provided with an intake element **20** which may be provided with access through 360° as illustrated in FIG. **6** or with a directional opening as illustrated generally in FIG. **5.**

A draught tube **22** is positioned below the intake element **20,** the length thereof depending upon the depth of fluid in which the aeration-agitation system is operating.

Attached to ports **18** are a plurality of pipes **24** extending either outwardly or outwardly and then upwardly; outwardly for setting up a convection current in a body of water and outwardly and then upwardly if the discharge is to be used for oxygen transfer. Each of the pipes **24** terminates in a discharge head **26** described in detail hereinafter.

As will now be apparent, the motor and pump assembly **12** draws fluid into the intake element **20** and through the draught tube **22.** From there, the fluid passes into the manifold **14** and exits through the pipes **24.**

Referring now to FIG. **4,** the fluid is ejected under pressure through the end of each pipe **24'** striking the inner surface of the discharge head **26** which is constructed of a rigid, wear-resistant material. Thereafter, the fluid passes downwardly returning to the parent body of fluid. Each of the discharge heads **26** is hollow and hemispherical in configuration, the interior surface thereof being smooth so as to minimize losses in fluid energy.

As will be further apparent from FIG. **4,** a high velocity curtain of water having an outer radius r_1 and an inner radius r_2 is formed at each discharge head **26** as the fluid is being directed back towards the parent body. This so-called high-velocity curtain results in a relatively high proportion of the discharging fluid being exposed to the atmosphere. The high-velocity curtain of water increases the interfacial exposure to atmospheric oxygen, entrapping greater amounts of air, frequently in the form of bubbles. Optimum oxygen transfer per unit volume of water moved is achieved.

The downwardly passing fluid returns to the parent body at an angle of 180° with respect to the fluid ejected toward the inner surface of the discharge head

26. As will be apparent, then, the pressure generated in the present invention is significantly greater than that present where the jet strikes a flat plate positioned perpendicular to the direction of motion.

Furthermore, the actual rating of the present design is more practical than in prior fountain type aerators, submerged propellers or paddle wheel arrangements since the fluid-gas continuity is more predictable at the interface adapting more readily to well known gas absorption formulae.

In the embodiment illustrated in FIG. 1, the aeration-agitation system 10 is securely tethered by lines 28 which are secured at one end to the float 16 and at the other end to the walls 30 of the vat. In this manner, uniform convection patterns are created.

Alternatively, as illustrated in FIG. 2, the aeration-agitation system 10 is mounted for rotation about pole 32. Appropriate electrical power means are mounted within the casing 34 for rotating arms 36 to which the aeration-agitation system 10 is attached.

I claim:

1. A treatment and distribution system for a body of fluid, comprising:

a pump;

a manifold assembly operatively connected to said pump including a fluid intake and provided with at least one opening;

a buoyant float together with means mounting said pump and manifold thereto;

at least one fluid outlet conduit operatively connected to said opening, the outlet of said conduit extending out of the body of fluid; and

discharge head means hemispherical in configuration and operatively connected to said conduit in a manner such that fluid ejected from said conduit strikes the inner concave surface thereof and is returned in the opposite direction along a curtain into the body of fluid.

2. A fluid treatment and distribution system as in claim 1, including a plurality of openings in said manifold, a conduit connected to each of said openings and a discharge head connected to each of said conduits.

3. A fluid treatment and distribution system as in claim 1, including means mounting said pump, manifold, float, conduit and discharge head for rotation within the body of fluid.

4. A fluid treatment and distribution system as in claim 1, including means mounting said pump, manifold, float, conduit and discharge head in stationary position with respect to the body of fluid.

5. A fluid treatment and distribution system as in claim 1, including interchangeable means for varying the depth below said fluid intake at which fluid is withdrawn.

6. A fluid treatment and distribution system as in claim 5, said means varying the depth including a draught tube.

7. A fluid treatment and distribution system as in claim 1, said manifold being toroidal in configuration.

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