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Dively

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[54] **AERATING APPARATUS HAVING BALLAST MEANS THEREFOR**

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Related U.S. Application Data

[63] Continuation of Ser. No. 179,871, Sept. 13, 1971, abandoned.

[52] **U.S. Cl.** **239/16**, 261/91

[51] **Int. Cl.** **E03b 9/20**

[58] **Field of Search** ..... 239/16, 17, 22, 23; 261/91, 120, 121; 9/8 R, 8 P; 415/7; 417/61

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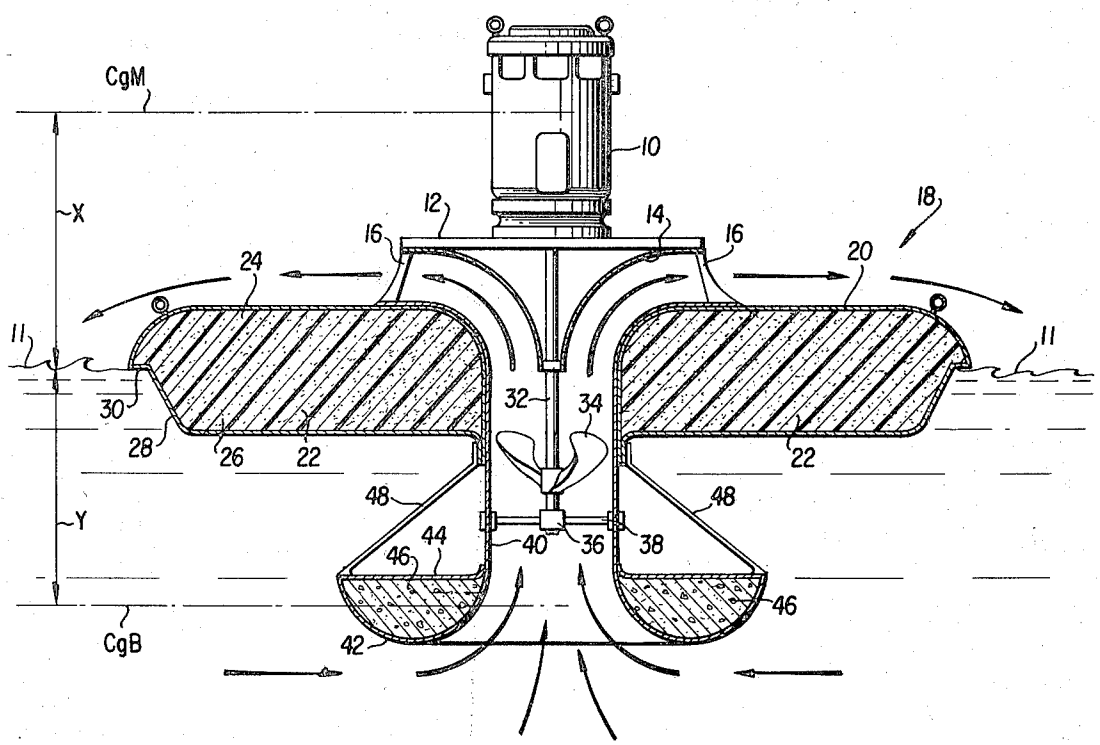
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[57] **ABSTRACT**

An aerating apparatus for use in sewage and industrial waste treatment systems utilizing a top-mounted motor with a submerged ballast means therefor capable of providing a stable unit. The ballast means is combined with means for establishing a low loss fluid flow into a propeller driven by the motor. Water which is lifted by the propeller then engages a deflector means which deflects the water substantially radially of the apparatus in order to be aerated. In a preferred form of the invention, the ballast means is carried by the means utilized to establish the substantially low loss fluid flow and is substantially toroidal in cross section.

8 Claims, 4 Drawing Figures



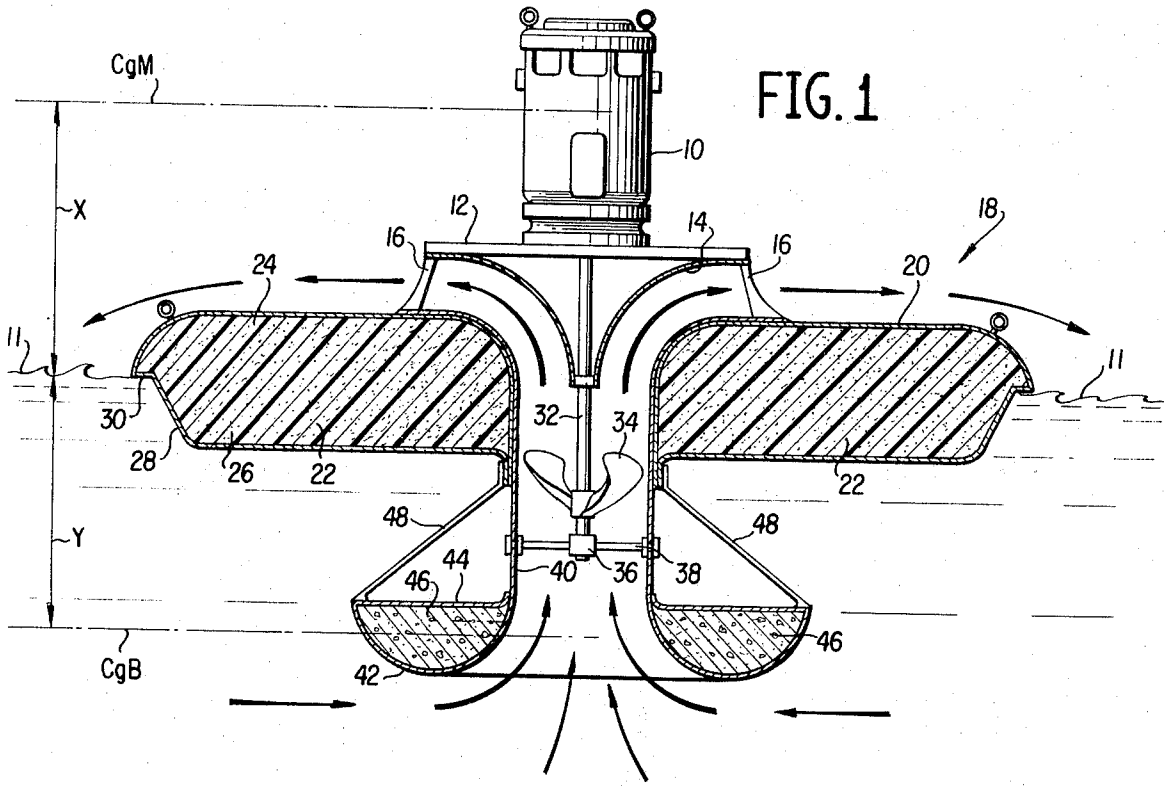


FIG. 1

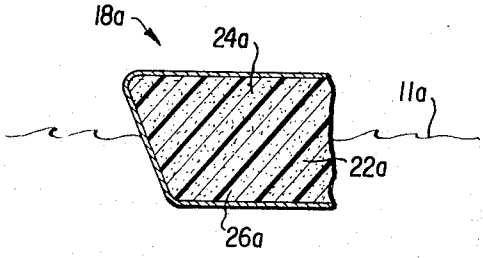


FIG. 2

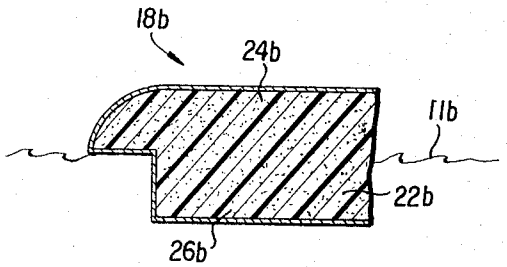


FIG. 3

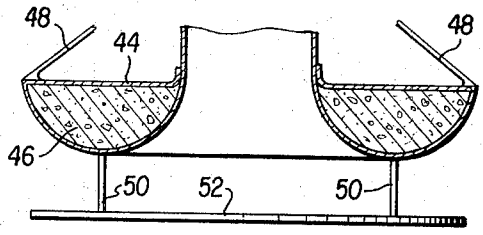


FIG. 4

AERATING APPARATUS HAVING BALLAST MEANS THEREFOR

This application is a continuation application of U.S. Ser. No. 179,871, filed Sept. 13, 1971, now abandoned.

This invention relates to a ballast construction and more particularly to a ballast construction for an aerating apparatus used in sewage and industrial waste treatment systems.

In sewage treatment systems whenever flotation means are used to maintain a propeller of a pumping unit at a substantially constant depth within the liquid of a treating pond or the like, it has been known to mount the motor either above or below the water level. While it is preferred to mount the motor above the water in order to make the cooling of the motor considerably easier, this mode of operation introduces other problems which heretofore have not been effectively solved.

For example, a topside motor mounting makes the unit more unstable and frequently such units enter into progressive oscillation, accumulate ice, and tip over or list. In one known instance, a service mechanic used the float unit as a step but his weight was sufficient to turn over the unit thereby hurling the mechanic into the lagoon where he was drowned.

Fluid attenuators have been used in the past but their usefulness is limited to dampening progressional oscillations and not to the overall stabilization of the unit.

The foregoing difficulties and shortcomings heretofore experienced in prior art devices are effectively overcome in accordance with the present invention wherein a novel ballast construction is added below the flotation assembly so that the effective center of the buoyancy is lowered below the floating line. Therefore, the stability of the unit is greatly increased and the undesirable features of prior units eliminated or greatly alleviated.

In one embodiment of the invention, an intake assembly is designed so as to lower the hydraulic entrance losses to the unit while providing a space for the ballast material. The ballast material can be of any substance having a density greater than water. The greater the density of the ballast material, the lower the quantity required to obtain stability. The lower the ballast is below the floating line, the greater the stability.

In this preferred embodiment of the invention, a very stable unit will result when the distance from the center of gravity of the motor (CgM) and the center of gravity of the ballast (CgB) are nearly equidistant from the floating line and their weights are approximately the same. In general, it is preferred to establish an effective center of buoyancy below the floating line of the flotation means. An economical ballast material is cement, but other materials are also feasible.

A comparable result is possible by appending a ballast to the unit or integrating the ballast as part of an anti-erosion assembly. In this embodiment, it is possible either to increase the weight of the anti-erosion disc itself or to combine an increased weight of the anti-erosion disc with the ballast such as is provided in the preferred embodiment.

The inherent advantages and improvements of the present invention will become apparent upon considering the following detailed description of the invention and by reference to the drawings in which:

FIG. 1 is an elevational view, shown partially in vertical cross section, illustrating a preferred embodiment of the present invention;

FIG. 2 is a fragmentary elevational view illustrating a modified flotation means for the present invention;

FIG. 3 is a fragmentary elevational view illustrating another modified flotation means for the present invention; and,

FIG. 4 is a fragmentary elevational view illustrating a modified ballast means for the present invention.

Referring now to FIG. 1 of the drawings, there is illustrated a top-mounted motor **10** above the surface of the water **11** in a lagoon, treating pond or the like. Motor **10** is suitably affixed to a mounting plate **12** which is supported above a deflector plate **14** which may be parabolic in cross section. Struts or brace members **16** provide a rigid support between the mounting plate **12** and deflector plate **14** with respect to a flotation means indicated generally at **18.** The flotation means **18** has an outer shell **20,** which may be Fiberglas or metal and within which is encased a foamed plastic interior, indicated generally at **22.**

As illustrated in FIG. **1,** the foamed plastic interior **22** has an upper portion **24** and a lower portion **26.** It is preferred that the upper portion **24** be larger than the lower portion **26,** when viewed in vertical cross section, whereby a vertical depression of a portion of the flotation means **18** results in an increased buoyant restoring force at the locus of the depression. The flotation means **18** is shown to be provided with a portion **28** which tapers inwardly from beneath an overhanging lip **30** so as to ensure that as the flotation means is depressed into the water, either by the action of the water or by an imbalance of the unit, the greater the restoring force will become.

FIGS. **2** and **3** illustrate alternate forms for the flotation means indicated generally at **18***a* and **18***b*. In each instance, the upper portions designated **24***a* and **24***b*, respectively, are larger in vertical cross section than lower portions **26***a* and **26***b*, respectively, whereby this increased buoyant restoring force prevails whenever the flotation means **18***a* and **18***b* are pushed deeper into the water designated at **11***a* and **11***b*, respectively. The FIG. **3** form is much preferred to the FIG. **2** form in that the sharp change of section caused by the step is much more effective.

Returning to the description of FIG. **1,** motor **10** drives a shaft **32** which extends downwardly through the mounting plate **12** and deflector plates **14** and which carries a propeller **34** normally positioned beneath the surface of the water in the lagoon or treating pond. The propeller **34** may be provided with an end bearing **36** which is supported by a series of brackets **38** attached to the inside surface **40** of flotation means **18.** The inside surface **40** constitutes an inner skirt for the flotation means **18** and is further provided with an outwardly flaring or curved portion **42** which with the aid of a sealed top **44** provides a receptacle or container for ballast means **46** which is placed therein. The inside surface or skirt **40** of the flotation means **18** provides a low loss entrance for water which is lifted upwardly as a result of the rotation of the screw propeller **34** and, as indicated by the arrows in FIG. **1,** is deflected substantially radially outwardly by the deflector plate **14.**

A series of ballast brace members **48** are attached at one end to the sealed top **44** and at the other end either

to the undersurface of the flotation means **18** or to the inside surface **40** thereof in order to provide adequate suspension for the ballast means **46.** The ballast means is substantially toroidal in cross section and is located as centrally of the unit as possible while still providing a low loss fluid flow entrance to the screw propeller **34.**

In one actual embodiment of the present invention, the weight of the ballast means **46** was made substantially equal to that of the motor **10** and the distance *y* from the surface of the water **11** to the center of gravity of the ballast means (CgB) was made substantially equal to the distance *x* from the surface of the water to the center of gravity of the motor(CgM). In most applications it is preferred to establish an effective center of gravity for the assembly is below the floating line of the flotation means **18.** In this embodiment, the weight of ballast means **46** slightly exceeded the weight of motor **10.**

A modified form of the invention is illustrated in FIG. **4** wherein suspension rods **50** are attached to the lower portion of curved portion **42** for suspending an anti-erosion disc **52** therefrom. The weight of the anti-erosion disc **52** may be increased so as to provide ballast means for the flotation unit. It is possible to make the anti-erosion disc sufficiently heavy either by increasing its thickness or by incorporating a ballast-receiving container therewith so as to provide the sole ballast means for the unit. Alternatively, it is possible to combine the weight of the anti-erosion disc with ballast means **46** to provide the desired ballast for the entire unit. By maintaining the skirt **40** and curved portion **42,** a low loss fluid flow is preserved in this embodiment of the invention.

It is also possible to provide some ballast in the lower portion of the flotation means **18,** i.e., in the lower portion **26** of the flotation means **18.** However, such ballast means in this position is preferably used only to augment the ballast provided at **46** or the ballast provided at **46** plus the weight of the anti-erosion disc **52,** since it is desired to have an effective center of gravity for the entire unit below the floating line of the flotation means **18.**

In the preferred form of the invention such as is illustrated in FIG. **1,** a low loss fluid flow entrance is provided in that the passageway is substantially unobstructed for the water to be lifted by propeller **34** and be deflected by deflection plate **14** substantially radially of the aeration unit in order for the water to be aerated. While the ballast means **46** is preferably cement, other materials heavier than water may be used. Since the ballast receptacle for the ballast means **46** is toroidal, continuous and symmetrical with respect to the longitudinal axis of the entire unit, there are no discontinuities or imbalances such as would be encountered if non-symmetrical weights were suspended from the unit.

While presently preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced within the scope of the claims which follow.

What I claim is:

1. An aerating apparatus comprising:

a. flotation means for supporting said aerating apparatus in a body of water,

b. said aerating apparatus including

1. a motor mounted above said liquid,

2. a propeller driven by said motor with said propeller being immersed in said water in order to lift some of said water to be aerated,

3. and deflector means between said motor and said propeller for deflecting water lifted by said propeller substantially radially of said aerating apparatus,

c. a skirt member surrounding said propeller and extending a substantial distance beneath said flotation means,

1. said skirt member terminating in an outwardly flaring bottom portion which defines a substantially semicircular concave-upwardly, toroidal, ballast receiving means,

i. said outwardly flaring skirt member establishing a substantially low loss fluid flow into said propeller and toward said deflector means,

d. and separately added ballast means received in said substantially semicircular concave-upwardly, toroidal, ballast receiving means a substantial distance beneath said flotation means,

1. said motor having a center of gravity located a given distance above the surface of the water and said ballast means having a center of gravity sufficiently far below the surface of the water to establish an effective center of gravity for the entire aerating apparatus without the use of stabilizing discs below the floating line of said flotation means.

2. A ballast construction for an aerating apparatus as defined in claim **1** wherein said flotation means comprises a receptacle containing a foamed plastic material and having an upper portion which is larger than its lower portion when viewed in vertical cross section whereby the vertical depression of a portion of said flotation means results in an increased buoyant restoring force at the locus of said depression.

3. A ballast construction for an aerating apparatus as defined in claim **1** wherein said ballast means is cement.

4. A ballast construction for an aerating apparatus as defined in claim **1** wherein said ballast means further includes an anti-erosion disc suspended beneath said aerating apparatus.

5. A ballast construction for an aerating apparatus as defined in claim **1** wherein said propeller is mounted on a shaft driven by said motor and wherein said shaft is journaled in a bearing carried by said inner skirt on said flotation means.

6. An aerating apparatus comprising:

a. flotation means for supporting said aerating apparatus in a body of water contained in a treating pond or the like,

b. said aerating apparatus including

1. a motor mounted above said liquid,

2. a propeller driven by said motor with said propeller being immersed in said water in order to lift some of said water to be aerated,

3. and deflector means between said motor and said propeller for deflecting water lifted by said propeller substantially radially of said aerating apparatus,

c. a skirt member surrounding said propeller and extending a substantial distance beneath said flotation means,

1. said skirt terminating in an outwardly flaring bottom portion which defines a substantially semi-

circular concave-upwardly, toroidal, ballast receiving means,

i. said outwardly flaring skirt member establishing a substantially low loss fluid flow into said propeller and toward said deflector means,

d. and separately added ballast means received in said substantially semicircular concave-upwardly, toroidal, ballast receiving means a substantial distance beneath said flotation means,

1. said motor having a center of gravity located a given distance above the surface of the water and said ballast means having a center of gravity sufficiently far below the surface of the water to establish an effective center of gravity for the entire aerating apparatus, without the use of additional ballast means engageable with the bottom of said treating pond or the like, below the floating line of said flotation means.

7. An aerating apparatus comprising

a. flotation means for supporting said aerating apparatus in a body of water contained in a treating pond or the like,

b. said aerating apparatus including

1. a motor mounted above said liquid,

2. a propeller driven by said motor with said propeller being immersed in said water in order to lift some of said water to be aerated,

3. and deflector means between said motor and said propeller for deflecting water lifted by said propeller substantially radially of said aerating apparatus,

c. a skirt member surrounding said propeller and extending a substantial distance beneath said flotation means,

1. said skirt member terminating in an outwardly flaring bottom portion which defines a substantially semicircular concave-upwardly, toroidal, ballast receiving means,

i. said outwardly flaring skirt member establishing a substantially low loss fluid flow into said propeller and toward said deflector means,

d. and ballast means received in said substantially semicircular concave-upwardly, toroidal, ballast receiving means a substantial distance beneath said flotation means,

1. said motor having a center of gravity above the surface of the water and said ballast means having a center of gravity sufficiently far below the surface of the water to establish an effective center of gravity for the entire aerating apparatus, without the use of stabilizing discs or of additional ballast means engageable with the bottom of said treating pond or the like, below the floating line of said flotation means.

8. An aerator apparatus as defined in claim 7 including bracing means to support said ballast receiving means.

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