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(54) IMPROVEMENTS IN OR RELATING TO AERATORS

(71) We, SIMON-HARTLEY LIMITED, a British Company, of Etruria Works, Stoke-on-Trent, Staffordshire, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns aerators of the kind (hereinafter termed of the kind referred to) adapted to be rotated in the surface of a liquid for the purpose of agitating and aerating same and particularly, though by no means exclusively, suitable for use in the aeration of sewage liquors in the so called activated sludge process.

It is known that the rate of oxygen transfer can be varied at a given rotational speed by adjusting the depth of immersion of the aerator in the liquid to be aerated.

It is an object of the present invention to provide an aerator of the kind referred to, of a construction permitting a greater range of useful adjustment of depth of immersion when in use and hence range of adjustment of oxygen transfer rate.

According to the present invention an aerator of the kind referred to, comprises a support member in the form of a circular disc which is adapted when the aerator is in use to lie in a horizontal plane and to be rotated about its central vertical axis, a plurality of angularly spaced blades secured to the underside of said member and extending from a central region thereof towards its periphery, characterised in that each said blade is provided with a flange-like formation on its lower edge which extends on both sides of the blade along at least a part of the length of the blade from its outer end towards the centre of the aerator, and in that each blade is provided with a further flange-like formation on at least one side thereof at a position spaced above the lower edge of the blade and which extends from the inner end of the blade towards the outer end thereof.

The invention will be further apparent from the following description with reference to the several figures of the accompanying drawings which show, by way of example

only, various forms of aerator embodying the invention.

Of the drawings:—

Fig. 1 shows a side elevation of one form of aerator;

Fig. 2 shows a plan view of the aerator of Fig. 1;

Fig. 3 shows a cross-section through the aerator on the line III—III of Fig. 2; and

Figs. 4, 5 and 6 show perspective views of modified types of blade which could be incorporated into an aerator otherwise as illustrated in Figs. 1—3 inclusive.

Referring firstly to Figs. 1—3 of the drawings, it will be seen that the aerator includes a support member generally indicated at 10 and comprised by a circular disc which when in use lies in a horizontal plane and which can be rotated by means of a shaft 11 which is secured centrally to the disc 10. Extending downwardly from the underside of the disc 10 at its centre, is a circular boss 12 formed from tube and closed at its lower end by a circular plate 13.

Secured to the underside of the support member 10 are a plurality of angularly spaced blades 15 each disposed in a vertical plane. As best seen from Fig. 2, each of the blades 15 extends tangentially from the periphery to the circular boss 12 to the outer edge of the support member 10. Each blade 15 is profiled as best seen from Fig. 3 so as to have a maximum depth at a position intermediate the boss 12 and outer periphery of the support member 10, the depth of the blade on either side of this position reducing gradually. As also best seen from Fig. 3 the upper edge of each blade 15 extends continuously from the periphery of the support member 10 in contact with the underside thereof to the circular boss 12. Likewise the inner edge of each blade 15 extends continuously downwardly in contact with the periphery of the boss 12 for a distance not substantially less than the depth of the boss 12. The outermost edge of each blade 15 is of substantially less height than the inner edge thereof.

Secured to the lower edge of each blade 15 between the position of maximum depth thereof and the outer end of the blade is

a plate 16 which extends on both sides of the blade normal thereto as clearly seen from Figs. 1 and 2.

A further plate 17 is secured to each blade 15 on one side thereof, and more particularly that side thereof which is intended to be the leading side when the aerator is rotated. The further plate 17 is disposed normal to the plane of the blade 15 and extends from the base region of the inner edge of the blade upwardly and outwardly to meet the underside of the support member 10 at a position inwardly disposed of the periphery of the member 10.

It will be seen that the plate 16, blade 15 and plate 17 define, on the leading side of the blade a scoop of channel cross-section whose cross-sectional area decreases from a maximum at the inner end thereof to a minimum at the outer end thereof.

The construction described above may be modified in various ways.

Thus, as can be seen from Fig. 4, a pair of the further plates 17 may be provided, one being disposed on each side of the blade 15.

Again, as seen from Fig. 5 the plate 17 can extend on one side only of the blade 15, the blade 15 being profiled such that its upper edge coincides with the position of the plate 17 to leave a generally triangular shaped space between its upper edge and the underside of the support member 10.

Yet again, as can be seen from Fig. 6, the plate 17 can extend on both sides of a blade 15 which is profiled as described in connection with the arrangement of Fig. 5.

In use, any of the aerators described may be rotated in the surface of a liquid which is to be agitated and aerated. It will be understood that liquid is thrown outwardly by centrifugal action through the duct or scoop defined on the leading side of each blade with respect to the direction of rotation by the blade 15 and plates 16 and 17 and that air is drawn down the scoop or duct defined on the trailing side of each blade with respect to the direction of rotation and defined by the blade 15, plate 16 and, when present, plate 17. This air is drawn down into the region of maximum turbulence and ensures a good transfer of oxygen to the liquid being aerated.

Tests with aerators having the construction described above, have shown that the rates of oxygen transfer comparable with those obtained with conventional aerators, such as those described in our prior British Patents Nos. 919,467 and 1,263,405 for example, can be achieved at the same power consumption.

We have also observed that with aerators embodying the present invention, there is a lesser tendency for surging of the liquid being aerated to occur with a consequent

tendency for the power input to remain constant during operation.

We have found that with aerators having the construction as described herein, the rate of oxygen transfer can be adjusted by varying the depth of immersion of the aerator in the liquid to be aerated over an extended range compared with conventional aerators.

We have also observed that aerators constructed as described herein, have a better agitating or mixing action than those of conventional construction.

Due to the fact that the blades 15 extend tangentially from the boss 12, different power consumptions and hence rates of oxygen transfer can be obtained by rotating the aerator in opposite directions. It will be understood that when the plate 17 extends on one side only of each blade 15 it is preferred that the aerator be rotated such that the plate 17 is on the leading side of the blade with respect to the direction of rotation.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations such as might readily occur to one skilled in the art, being possible without departing from the scope thereof, as defined by the appended claims.

Thus, for example, the flange-like formation on the lower edge of each blade or the further flange-like formation spaced above the lower edge of each blade may lie in a plane which meets the plane of the blade itself at an inclined angle.

The performance of the invention described and claimed herein involves the use of the invention claimed in our British Patent No. 1,263,405.

WHAT WE CLAIM IS:—

1. An aerator of the kind referred to, comprising a support member in the form of a circular disc which is adapted when the aerator is in use to lie in a horizontal plane and to be rotated about its central vertical axis, a plurality of angularly spaced blades secured to the underside of said member and extending from a central region thereof towards its periphery, characterised in that each said blade is provided with a flange-like formation on its lower edge which extends on both sides of the blade along at least a part of the length of the blade from its outer end towards the centre of the aerator, and in that each blade is provided with a further flange-like formation on at least one side thereof at a position spaced above the lower edge of the blade and which extends from the inner end of the blade towards the outer end thereof.
2. An aerator according to claim 1 wherein a circular boss extends downwardly from the underside of said circular disc at its centre.
3. An aerator according to claim 2

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a plate 16 which extends on both sides of the blade normal thereto as clearly seen from Figs. 1 and 2.

5 A further plate 17 is secured to each blade 15 on one side thereof, and more particularly that side thereof which is intended to be the leading side when the aerator is rotated. The further plate 17 is disposed normal to the plane of the blade 15 and extends from the base region of the inner edge of the blade upwardly and outwardly to meet the underside of the support member 10 at a position inwardly disposed of the periphery of the member 10.

15 It will be seen that the plate 16, blade 15 and plate 17 define, on the leading side of the blade a scoop of channel cross-section whose cross-sectional area decreases from a maximum at the inner end thereof to a minimum at the outer end thereof.

20 The construction described above may be modified in various ways.

Thus, as can be seen from Fig. 4, a pair of the further plates 17 may be provided, one being disposed on each side of the blade 15.

Again, as seen from Fig. 5 the plate 17 can extend on one side only of the blade 15, the blade 15 being profiled such that its upper edge coincides with the position of the plate 17 to leave a generally triangular shaped space between its upper edge and the underside of the support member 10.

Yet again, as can be seen from Fig. 6, the plate 17 can extend on both sides of a blade 15 which is profiled as described in connection with the arrangement of Fig. 5.

35 In use, any of the aerators described may be rotated in the surface of a liquid which is to be agitated and aerated. It will be understood that liquid is thrown outwardly by centrifugal action through the duct or scoop defined on the leading side of each blade with respect to the direction of rotation by the blade 15 and plates 16 and 17 and that air is drawn down the scoop or duct defined on the trailing side of each blade with respect to the direction of rotation and defined by the blade 15, plate 16 and, when present, plate 17. This air is drawn down into the region of maximum turbulence and ensures a good transfer of oxygen to the liquid being aerated.

40 Tests with aerators having the construction described above, have shown that the rates of oxygen transfer comparable with those obtained with conventional aerators, such as those described in our prior British Patents Nos. 919,467 and 1,263,405 for example, can be achieved at the same power consumption.

We have also observed that with aerators embodying the present invention, there is a lesser tendency for surging of the liquid being aerated to occur with a consequent

tendency for the power input to remain constant during operation.

We have found that with aerators having the construction as described herein, the rate of oxygen transfer can be adjusted by varying the depth of immersion of the aerator in the liquid to be aerated over an extended range compared with conventional aerators.

We have also observed that aerators constructed as described herein, have a better agitating or mixing action than those of conventional construction.

Due to the fact that the blades 15 extend tangentially from the boss 12, different power consumptions and hence rates of oxygen transfer can be obtained by rotating the aerator in opposite directions. It will be understood that when the plate 17 extends on one side only of each blade 15 it is preferred that the aerator be rotated such that the plate 17 is on the leading side of the blade with respect to the direction of rotation.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations such as might readily occur to one skilled in the art, being possible without departing from the scope thereof, as defined by the appended claims.

Thus, for example, the flange-like formation on the lower edge of each blade or the further flange-like formation spaced above the lower edge of each blade may lie in a plane which meets the plane of the blade itself at an inclined angle.

The performance of the invention described and claimed herein involves the use of the invention claimed in our British Patent No. 1,263,405.

WHAT WE CLAIM IS:—

105 1. An aerator of the kind referred to, comprising a support member in the form of a circular disc which is adapted when the aerator is in use to lie in a horizontal plane and to be rotated about its central vertical axis, a plurality of angularly spaced blades secured to the underside of said member and extending from a central region thereof towards its periphery, characterised in that each said blade is provided with a flange-like formation on its lower edge which extends on both sides of the blade along at least a part of the length of the blade from its outer end towards the centre of the aerator, and in that each blade is provided with a further flange-like formation on at least one side thereof at a position spaced above the lower edge of the blade and which extends from the inner end of the blade towards the outer end thereof.

125 2. An aerator according to claim 1 wherein a circular boss extends downwardly from the underside of said circular disc at its centre.

3. An aerator according to claim 2

wherein each blade extends tangentially from the periphery of said circular boss.

5 4. An aerator according to any one of claims 1 to 3 inclusive wherein each blade has a maximum depth at a position intermediate its inner and outer ends, the depth of the blade reducing gradually on either side of this position.

10 5. An aerator according to any one of claims 1 to 4 inclusive wherein the upper edge of each blade contacts the underside of the circular disc over the entire length of the blade.

15 6. An aerator according to any one of claims 1 to 4 inclusive wherein the upper

edge of each blade is defined by the position of said further flange-like formation.

7. An aerator according to any preceding claim wherein each said further flange-like formation extends on both sides of the 20 blade.

8. An aerator of the kind referred to substantially as described herein with reference to and as illustrated by either Figs. 1 to 3 inclusive or any one of Figs. 4 to 6 inclusive of the accompanying drawings. 25

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