# United States Patent [19]

**Hirshon**

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[45] **Feb. 11, 1975**


[54] **AERATORS WITH DE-ICING MEANS**


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[22] Filed: **Jan. 15, 1974**

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[52] **U.S. Cl.** ..... **261/77,** 210/199, 210/220, 261/120, 261/124, 261/DIG. 75

[51] **Int. Cl.** ..... **B01f 3/04,** C02c 5/04

[58] **Field of Search** ..... 210/199, 220, 221; 261/77, 261/120, 123, 124, DIG. 75



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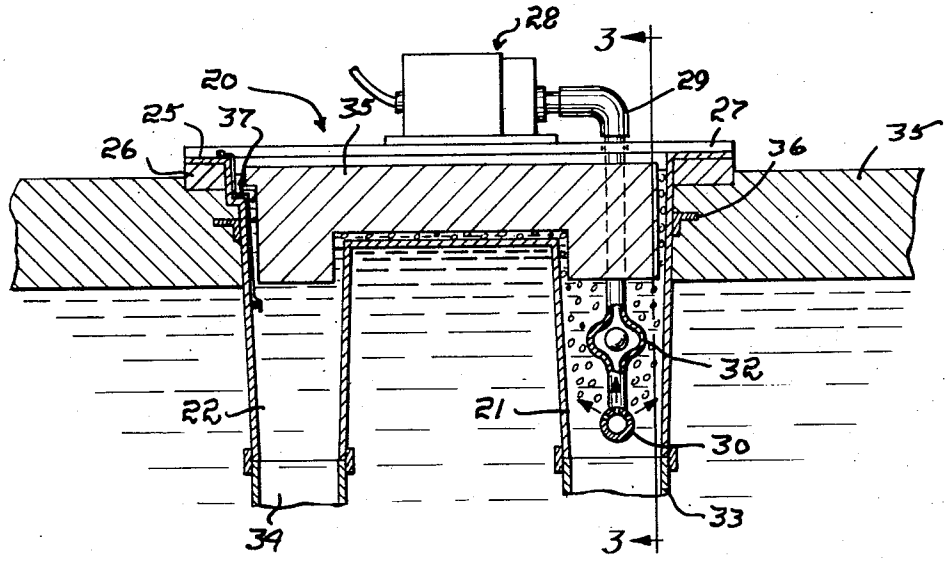
*Primary Examiner*—Charles N. Hart
*Assistant Examiner*—Robert H. Spitzer



[57] **ABSTRACT**

An aerator has inflow and outflow portions, a portion open above the water level with which the upper ends of the inflow and outflow portions are in communication. Means are provided to circulate the water and to aerate it. The undissolved air escapes to the atmosphere as the water flows through the transfer portion. Means are provided within the aerator, should the aerator be restarted after being out of service in cold weather with the water in the transfer portion frozen, to effect communication with the space under the ice with the open air and if normal flow is blocked, to restore such normal flow. In some embodiments, the means require the lifting of the ice, in others, circulation below the ice is provided and, when air lifts are used, a valve-controlled vent may be provided.


**11 Claims, 13 Drawing Figures**



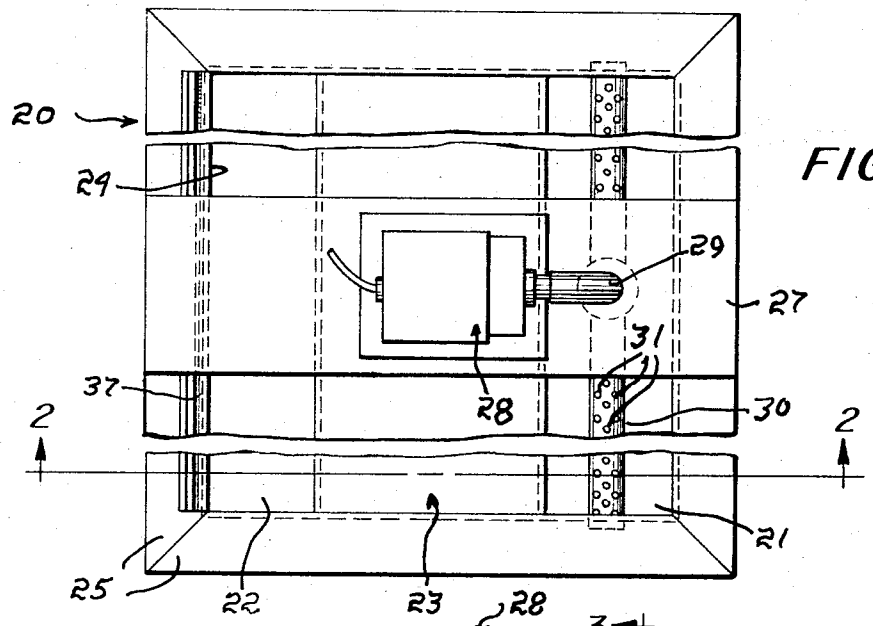



FIG. 1

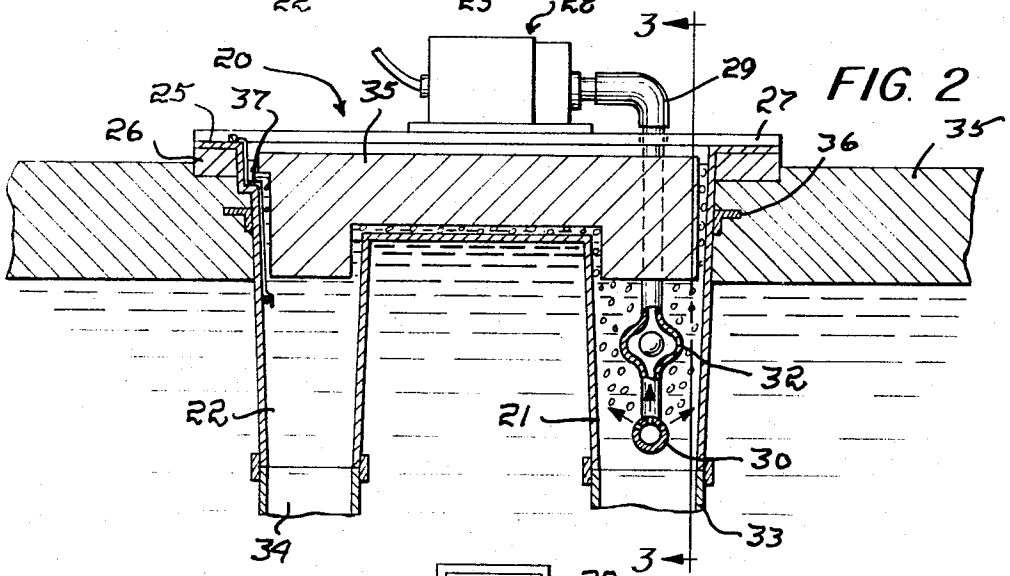



FIG. 2

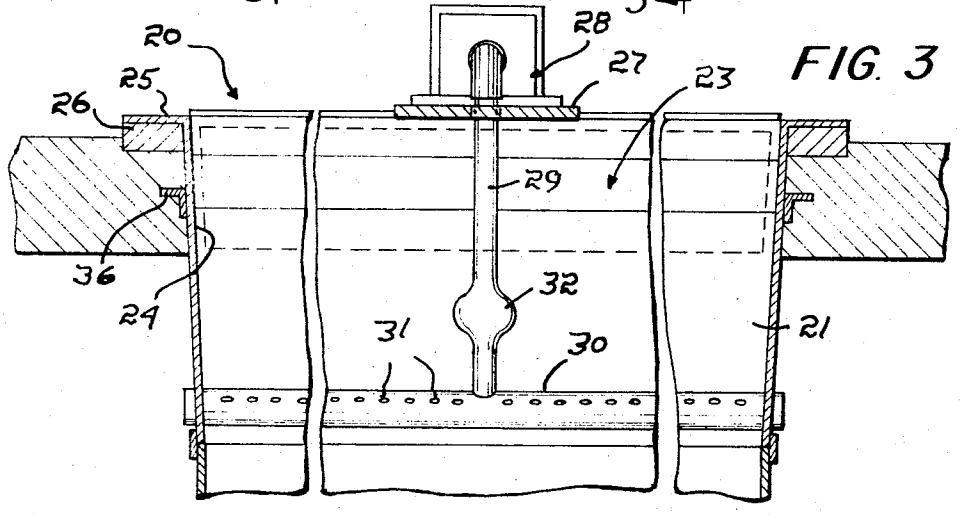



FIG. 3

FIG. 4

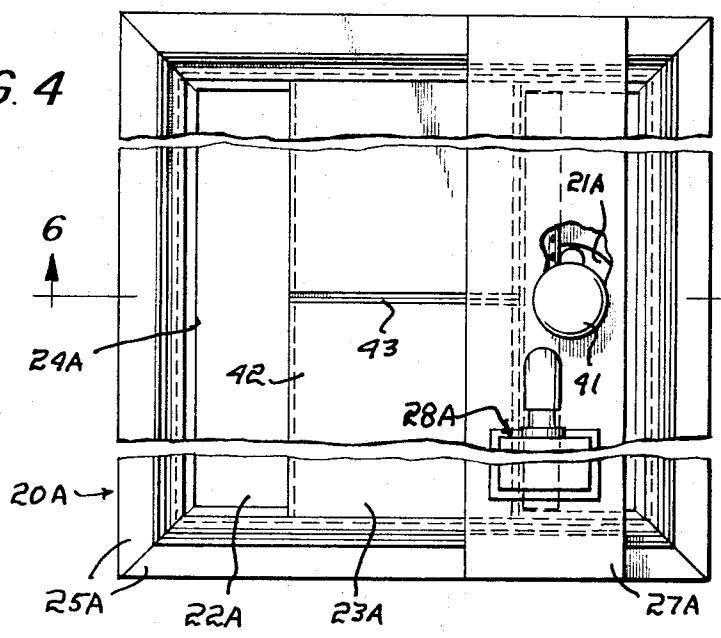



FIG. 5

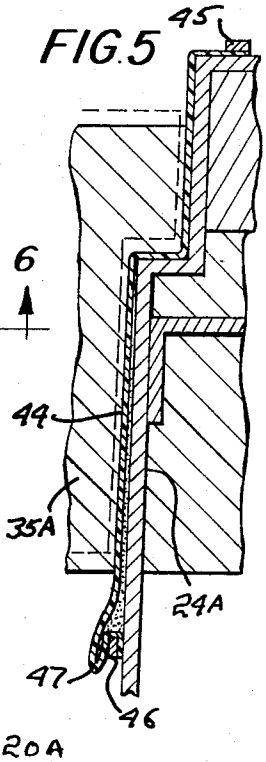



FIG. 6

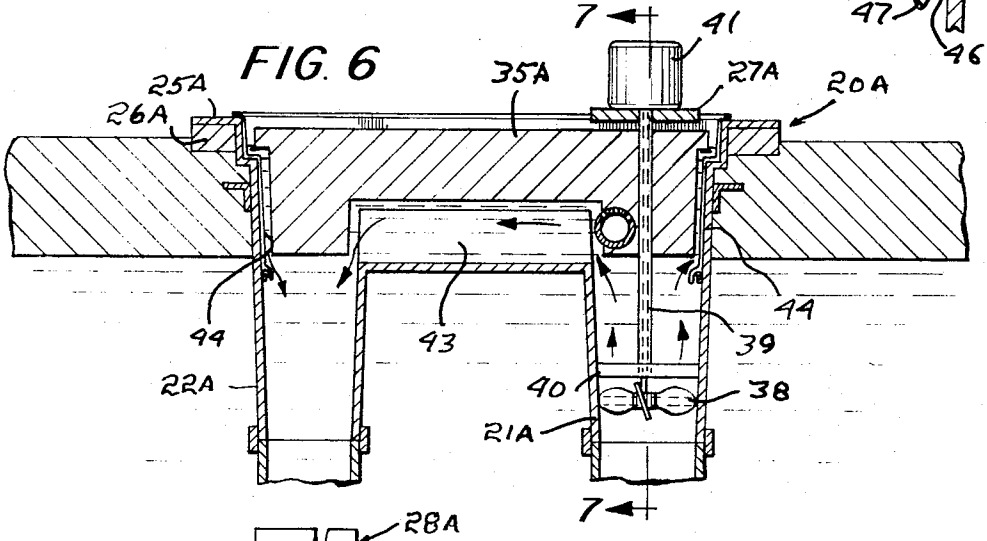



FIG. 7

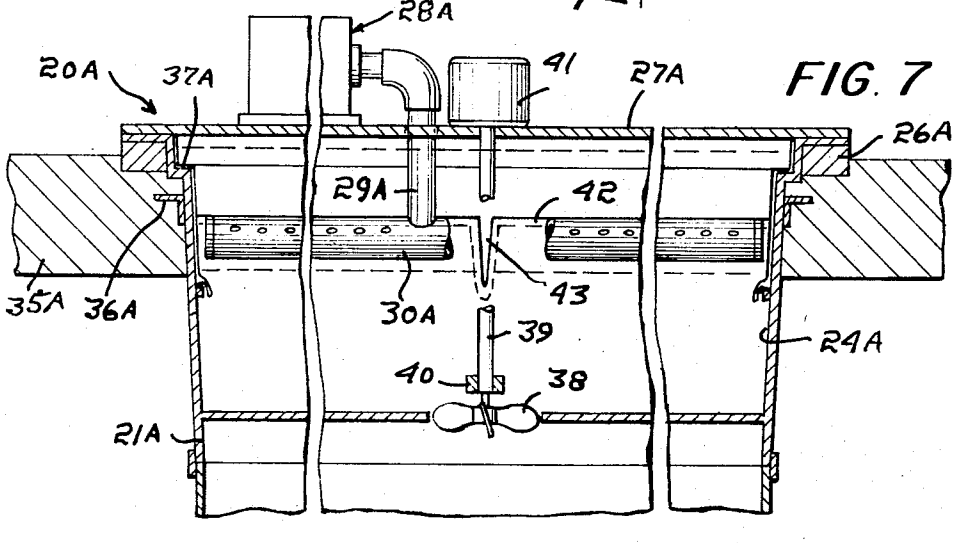


FIG. 8

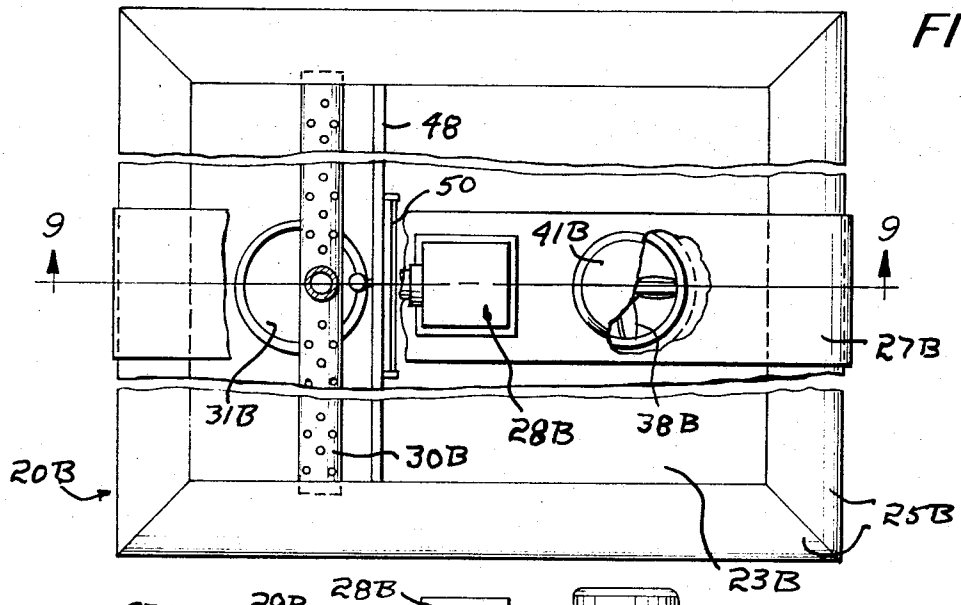



FIG. 9

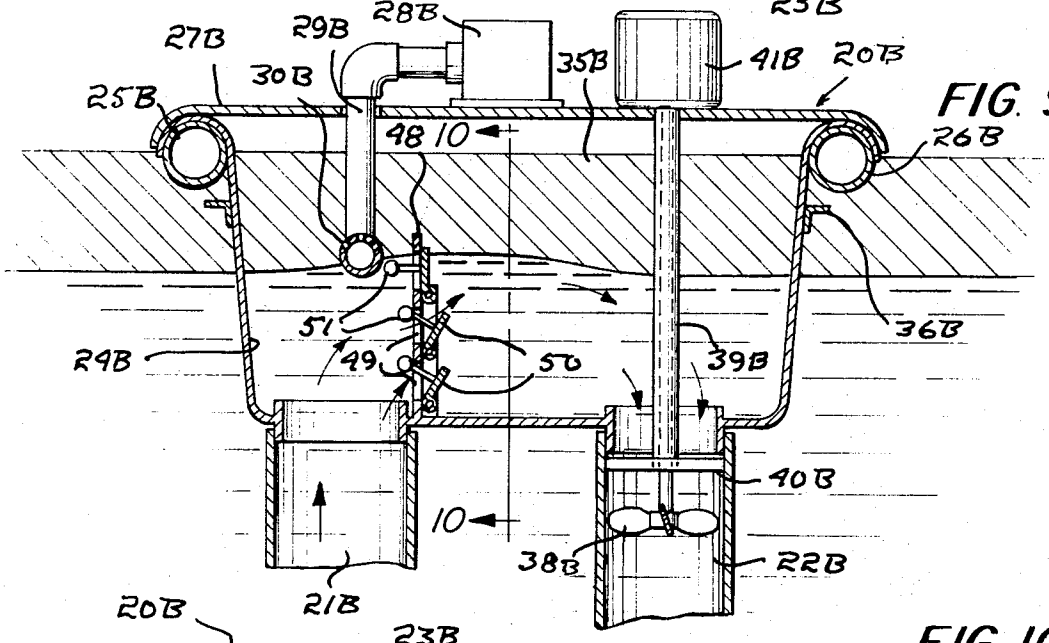



FIG. 10

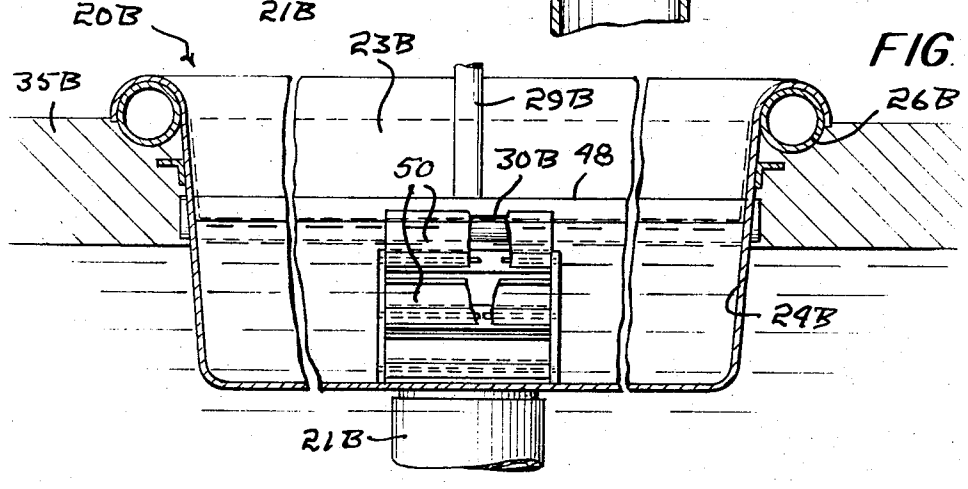


FIG. 11

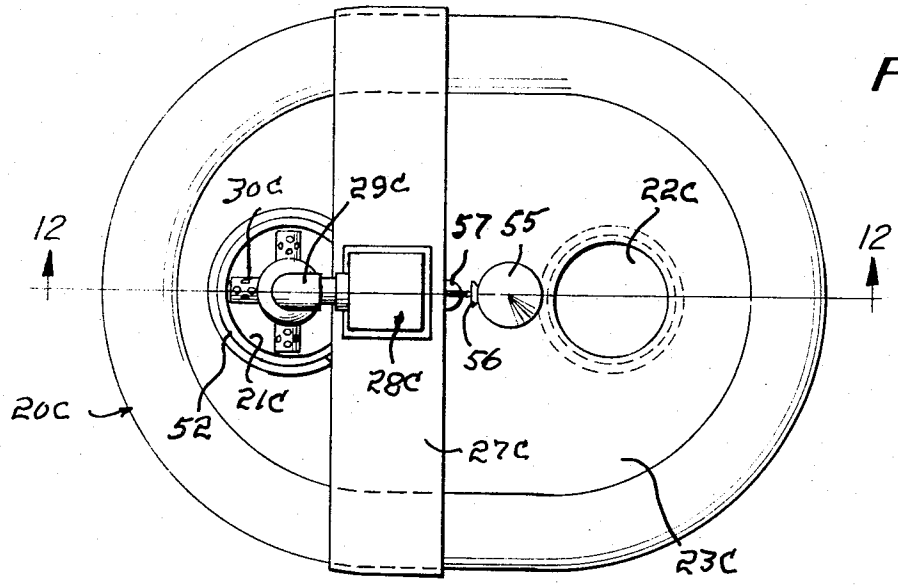



FIG. 12

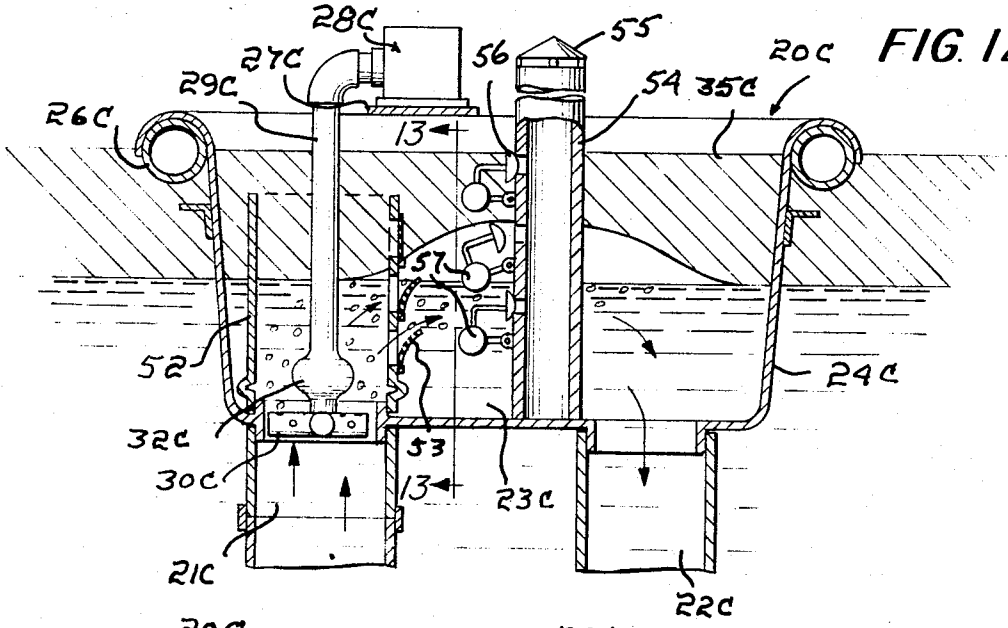
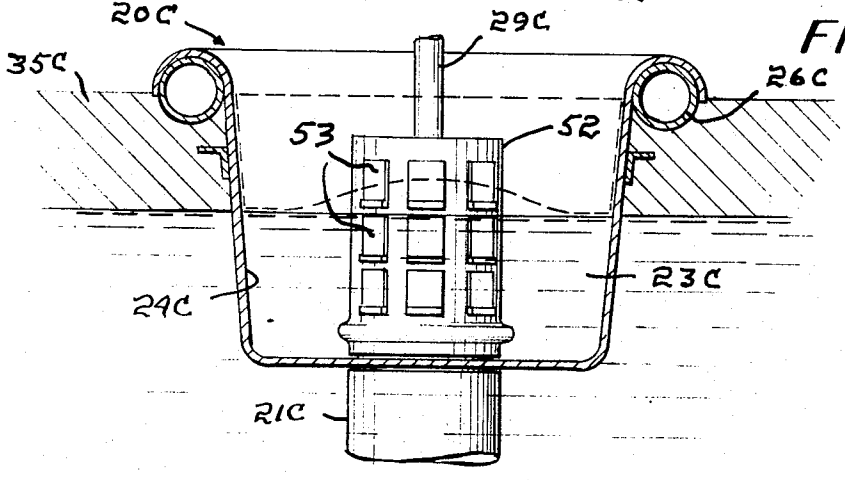



FIG. 13



# AERATORS WITH DE-ICING MEANS

## BACKGROUND OF THE INVENTION

Aerators for lakes, ponds, rivers, and bays such as are disclosed in my co-pending application, Ser. No. 368,724, filed June 11, 1973, now U.S. Pat. No. 3,794,303, that have depending inflow and outflow portions whose upper ends are connected by a transfer portion open to the atmosphere to permit the escape of undissolved air are vulnerable to freeze ups in the event of a power failure.

Two problems exist. In the first place, if the means for circulating and aerating the water is an air lift, operation is blocked if the undissolved air cannot escape from the transfer portion. In the second place, if there is a mechanical circulator below the frost line, the ice may be thick enough to block flow through the transfer portion. With either basis of operation it is, accordingly, necessary, after a freeze, both to provide for circulation of water through the transfer portion and to effect communication between the space under the ice and the atmosphere.

## THE PRESENT INVENTION

The general objective of the present invention is to enable aerators of the type having an upwardly open transfer portion with which inflow and outflow portions are in communication to be started if the escape of air from the transfer portion is blocked by ice and even if the normal transfer of water between the inflow and outflow portions is also ice-blocked.

In accordance with the invention, the objective is provided by employing means operable to effect communication within the wall structure of the aerator between the space below the ice that blocks the inflow of surface water and the open air and also to restore the normal flow.

One particular objective is to attain this objective by providing wall structure with a draft and to utilize air or water under pressure to so lift the ice that the desired ends can be

Another objective of the invention is to provide an aerator with a mechanical circulator below the frost line while permitting the air distributor to be located adjacent the inflow end of the transfer portion and provide the bottom of the transfer portion with a channel of relatively small cross sectional area but of a depth such that it extends below the frost line thereby to ensure flow without the necessity of first lifting the ice mass.

Another objective of the present invention is to provide an aerator with a transfer portion of a depth such that its bottom is below the frost line but with aeration effected at a level above the frost line. A series of valves are provided below the frost line and those open if normal flow is blocked.

Yet another objective of the invention is to provide that the ice need not be melted or freed to permit the escape of air, an objective attained with a transfer portion whose bottom is below the frost line but which has a vent extending from below the frost line and opening above the water level and provided with a series of valves that are normally held closed by floats.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, there are shown preferred embodiments of aerators in accordance with the present invention.



In the drawings

FIG. **1** is a top plan view, broken away to foreshorten the drawing, of an aerator utilizing an air lift to circulate and aerate the water;

FIG. **2** is a section taken approximately along the indicated line **2—2** of FIG. **1**;

FIG. **3** is a section, taken approximately along the indicated line **3—3** of FIG. **2**;

FIG. **4** is a view similar to FIG. **1** but illustrating another embodiment of the invention;

FIG. **5** is a section taken vertically through the wall structure of the aerator showing a construction facilitating the raising of the ice;

FIG. **6** is a section taken approximately along the indicated line **6—6** of FIG. **5**;

FIG. **7** is a section taken approximately along the indicated line **7—7** of FIG. **6**;

FIG. **8** is a view similar to FIGS. **1** and **5** but illustrating a different embodiment of the invention;

FIG. **9** is a section taken approximately along the indicated line **9—9** of FIG. **8**;

FIG. **10** is a section taken approximately along the indicated line **10—10** of FIG. **9**;

FIG. **11** is a plan view of an aerator in accordance with yet another embodiment of the invention;

FIG. **12** is a section taken approximately along the indicated line **12—12** of FIG. **11**; and

FIG. **13** is a section taken approximately along the indicated line **13—13** of FIG. **12.**

## THE PREFERRED EMBODIMENTS OF THE INVENTION

The aerator illustrated by FIGS. **1 – 4** and generally indicated at **20** has a depending inflow conduit portion **21**, a depending outflow portion **22**, and an interconnecting portion **23.** The wall structure **24**, common to the portions **21, 22,** and **23,** includes an outwardly disposed flange **25** overlying the float **26** by which the aerator is supported in a lake, pond, bay, or river with the wall structure preventing the entrance of surface water under normal conditions.

The float **26** also supports a platform **27** on which is mounted an air compressor generally indicated at **28** and including a drive, an electric motor for one example connected to an onshore source or a gasoline engine, not shown, for another example. The compressor **28** has a conduit **29** extending downwardly into the inflow portion **21** and provided with a transversely disposed air distributor or bubble tube **30** having a series of upwardly disposed outlets **31** extending from end-to-end thereof. The air distributor **30** is below that depth of water that could be expected to freeze and the conduit **29** has, also below that depth a check valve **32** operable to block upward water flow if the compressor **28** is not in operation.

Both the inflow and outflow portions may include detachable sections **33** and **34,** respectively, of lengths such that water may be elevated from any selected depth and returned to the same or different depths.

In practice, the bottom of the interconnecting portion is below the water level of the body of water but sufficiently close thereto that the thickness of ice **35** that might be expected in a particular location would block the operation of the aerator if formed within it as

it would if, for example, the air compressor **28** stopped operating.

In the event of a shutdown of the aerator, either intentional or accidental, with ice formed to block its normal operation once the compressor **28** was placed back in service, means are necessary to permit undissolved air to escape. In the embodiment of the invention being described, the result is effected by inclining the wall structure **24** outwardly and upwardly to an extent such that the draft enables air pressure building up under the ice to so lift the ice within the wall structure **24** that air can escape and, if the ice extended to the bottom of the transfer portion **23**, again permit elevated water to flow therethrough and into the outflow portion **22** with the circulating water eroding the ice due to its higher temperature. The wall structure may be provided with a layer of a material that is self-lubricating. In practice, the wall structure **24** is provided with outside flanges **36** to ensure that the aerator becomes and remains anchored in outside ice and has an internal shoulder **37** extending lengthwise of the outflow portion **22** to prevent the ice within the aerator from blocking it in the event the flow of the aerated water was over the top of that ice.

The embodiment of the invention illustrated by FIGS. **4 – 7** is generally similar and, to avoid describing corresponding parts, such are designated by the suffix addition A to the appropriate reference numerals and, for convenience, the air source is omitted.

The aerator **20A** utilizes mechanical means instead of an air lift to effect the circulation of the water upwardly through the inflow portion **21A**, across the transfer portion **23A** and downwardly through the outflow portion **22A**. The mechanical means are shown as an impeller **38** whose shaft rotates within a sealed tube **39** extending downwardly into the inflow portion **21A** and held by a spider **40.** The impeller **38** is driven by a motor or engine **41** mounted on the platform **27A.** While a mechanical circulator could be located in the outflow portion **22A**, it is preferred that it be in the inflow portion **21A** so that, if the operation with the escape of air blocked by ice, the thrust of the water is against the undersurface of the ice.

The air distributor **30A** extends transversely of the inlet portion **21A** adjacent the bottom **42** of the transfer portion **23A** but above the central narrow, V-shaped channel **43** extending from end-to-end thereof and well below the front line.

The wall structure **24A** is shown, see FIG. **5,** as having a plastic liner **44** secured to its upper edge as at **45** and also below the frost line as at **46** with sufficient slack to form a pocket **47** desirably containing graphite or other lubricant to facilitate the sliding of the liner **44** relative to the wall structure.

Assuming that the aerator **20A** is out of service in cold weather, ice might well so form that it would block the air distributor **30A** once air was again delivered thereto. The impeller **38,** being below the ice, and at least some portions of the channel **43** also below the ice, water would circulate under the ice and erode it because of the higher temperature of the circulating water and at the same time, the circulating water would exert a lifting force on the ice with the air distributor **30A** eventually becoming free and a path for the escape of undissolved air also resulting.

The aerator **20B** illustrated by FIGS. **8 – 10** is generally similar to the previously described aerators and like parts are distinguished by the suffix addition B to the appropriate reference numerals.

In this embodiment, the inflow and outflow portions **21B** and **22B**, respectively, are both circular in cross section and an impeller **38B** is located in the outflow portion **22B** with its shaft rotatable within a sealed tube **39B** supported by a spider **40B** and driven by a motor or engine **41B.**

In this embodiment the wall structure **24B** is so dimensioned that the bottom of the transfer portion **23B** and the upper ends of the inflow and outflow portions are well below the frost line. The portion **23B** has, however, a transverse partition **48** requiring normally that the water flow over the top of it and, during its transfer, horizontally and downwardly towards the outflow portion **22B.** The air distributor **30B** is shown as located close to the top of the partition and where it may become frozen in the ice if the aerator **20B** is out of service during winter months.

The partition **48** has, however, see FIG. **9,** a vertically spaced series of ports **49** each provided with a valve **50** yieldably held closed by a weight **51** during the normal operation of the aerator **20B.** In the event, the air distributor **30B** becomes frozen in, once the impeller **38B** was again in operation, the valve or valves **50** below the ice would open permitting the flow of water which, even if not aerated, melts away the ice intil its normal operation is resumed.

In the embodiment of the invention illustrated by FIGS. **11 – 13,** corresponding parts are distinguished by the suffix addition C to the appropriate reference numerals.

The aerator **20C** has its wall structure **24C** ovate and with the transfer portion **23C** so dimensioned that its bottom is well below the frost line. The inflow portion **21C** and the outflow portion **22C** are both shown as of circular section with upper ends spaced from the wall structure **24C.**

The water is circulated by an air lift with the air distributor **30C** located adjacent the junction of the inflow portion **21C** and an extension **52** downwardly through which the air conduit **29C** extends. Desirably both the extension **52** and the conduit **29C** are extendable to permit a degree of elongation thereof and the conduit **29C** is provided with a check valve **32C.** The air distributor **30C** is shown as cruciform.

Normally the flow of water is through the upper end of the extension **52** and the fact that the depth of the transfer portion **23C** is below the frost line is also advantageous in ensuring adequate aeration. Should the normal flow of water be blocked by ice, because of the lack of air, water pressure, once air was again delivered to the air distributor **30C** would force open normally closed valves **53,** shown as flapper valves, which are arranged in vertically spaced rows with each row containing a series of such valves. Air relief is provided by a vent mounted in the transfer portion **23C** and of sufficient height to extend from below the frost line through the ice and expected snow cover and with its upper end protected by a shield **55.** The vent **54** has a vertically spaced series of normally closed valves **56,** each valve **56** shown as of a type normally held closed by a float **57** thereby ensuring continuous venting of the transfer portion **23C** until the ice has been so melted away as to restore the normal basis of operation.

I claim:

1. An aerator for a body of open water such as a lake, pond, river, or bay, where ice formation is to be expected, said aerator being positionable therein and comprising depending inflow and outflow conduit portions, and a portion interconnecting the upper ends of said inflow and outflow portions in part below the surface level of the body of water and with their lower ends so disposed relative to each other as to inhibit substantial circulation therebetween, and also including wall structure extending above the water level to bar the inflow of surface water, means to effect the flow of water upwardly through the inflow portion through said interconnecting portion and downwardly through the outflow portion as a continuous stream and to aerate the circulating water before its entry into the outflow portion, said interconnecting portion being oriented to provide a time delay in the flow of the elevated water into the outflow portion to permit the escape of air therefrom, and means operable in the event the water in the interconnecting portions becomes frozen and when the first named means are in operation to effect communication within the wall structure between the space below the ice and the open air and if the ice has blocked the normal flow of water, to restore said normal flow between the inflow and outflow portions.

2. The aerator of claim 1 in which the wall structure is inclined upwardly and outwardly to provide sufficient draft to facilitate the freeing of the ice as an incident to the operation of the aerator.

3. The aerator of claim 1 in which the wall structure includes transverse, internal, upwardly exposed shoulders below the outside water level operable to hold the ice cake when freed therefrom from blocking flow through the outflow conduit portion if the circulating water flows over its upper surface.

4. The aerator of claim 2 in which the wall structure includes a slip sheet sealed thereto above the water level and below the frost line and so dimensioned as to provide a bag-defining sag.

5. The aerator of claim 4 and a lubricant confined between the sheet and the wall structure.

6. The aerator of claim 1 in which the first named means is an air lift including a supply conduit, the air lift located a distance below the outside water level greater than the maximum expected ice thickness.

7. The aerator of claim 6 in which the inlet of the air lift includes a check valve operable to prevent water from rising therein to a level at which it might freeze if the air supply failed.

8. The aerator of claim 1 in which the first named means includes a mechanical impeller in one of the conduit portions located below the frost line, an air distributor, and the bottom of the transfer portion has a channel extending from end-to-end thereof of a relatively small cross sectional area and of a depth such that the bottom of the channel is below the frost line.

9. The aerator of claim 1 in which the bottom of the transfer portion is below the frost line, the inflow portion opens into the transfer portion above the frost line and includes a wall separating the inflow and transfer portions, the first means includes an air distributor adjacent the upper end of the inflow portion and an impeller in one of the conduit portions, and the wall has a series of vertically spaced and normally closed valves that open if flow over said wall is blocked by ice.

10. The aerator of claim 7 in which the bottom of the transfer portion is below the frost line, the inflow portion includes a section extending upwardly therein and terminating above the frost line and includes a plurality of vertically spaced valves open if the pressure in the inflow section increases as a consequence of a freeze up, and the first means includes an air distributor in the inflow portion below the frost line.

11. The aerator of claim 10 and a vent extending from below the frost line and opening above the water level, and the vent has a series of vertically spaced valves, each valve including a float by which it is held closed if the water in the transfer portion is of appropriate depth.

* * * * *