

[54] MIXER FOR ALGAE PONDS

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[58] Field of Search 210/170, 221, 523, 525, 210/530, 242, 219; 137/236; 261/92

[56] **References Cited**

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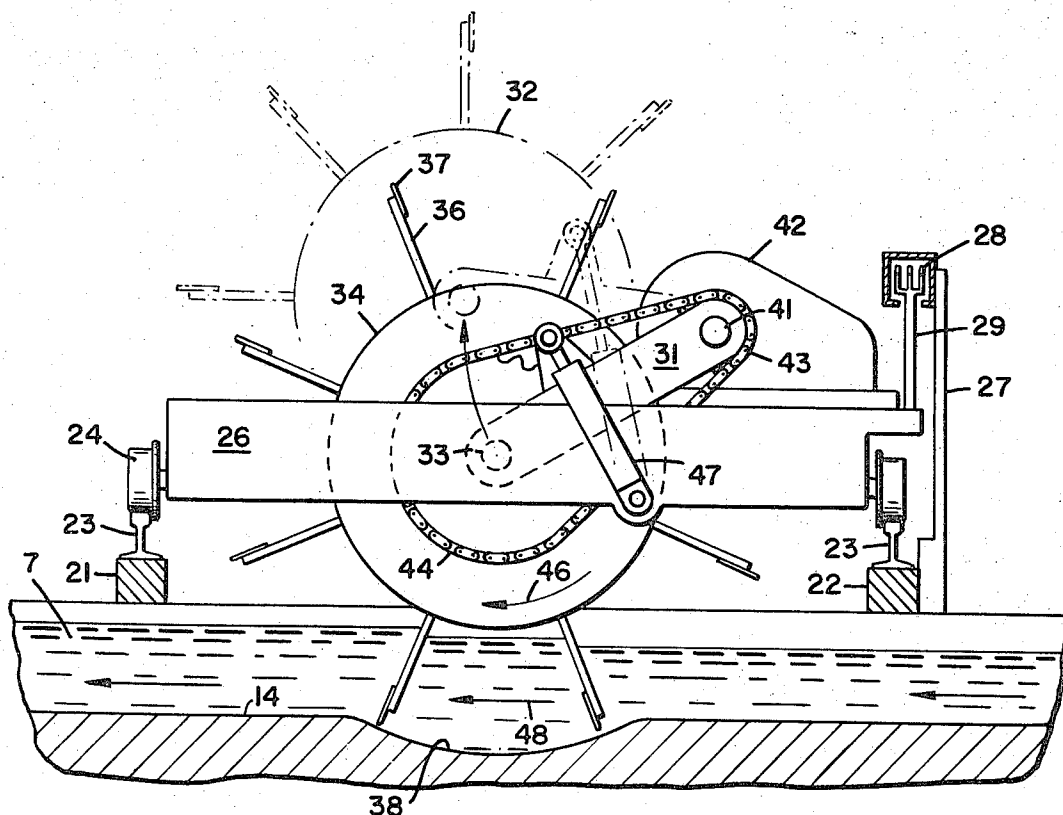
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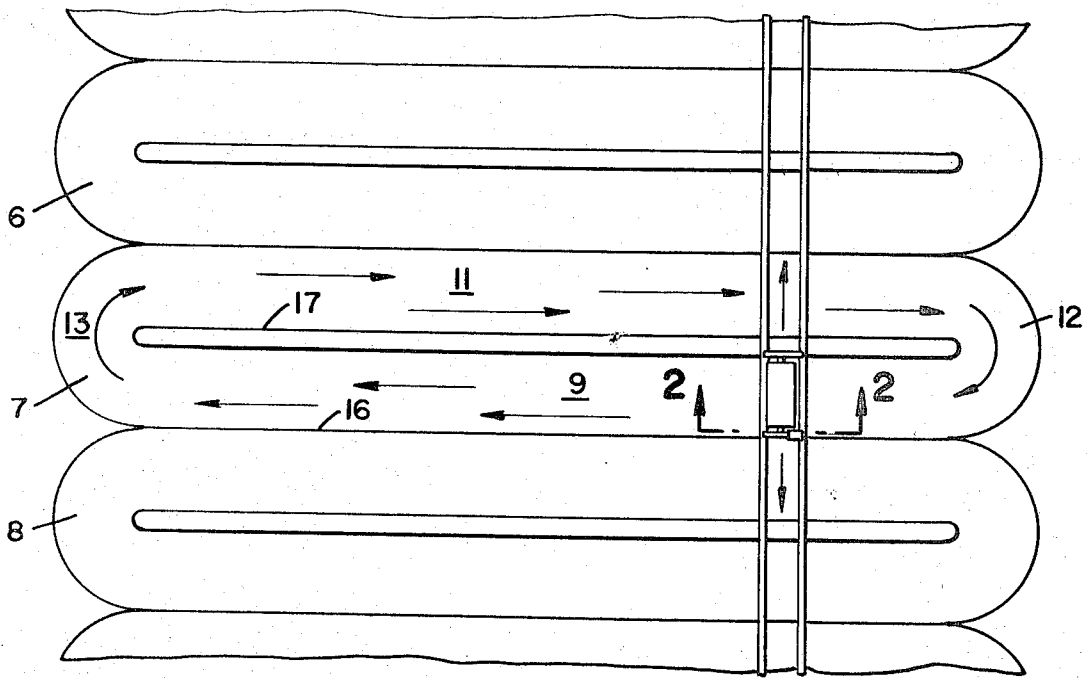
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[57] **ABSTRACT**

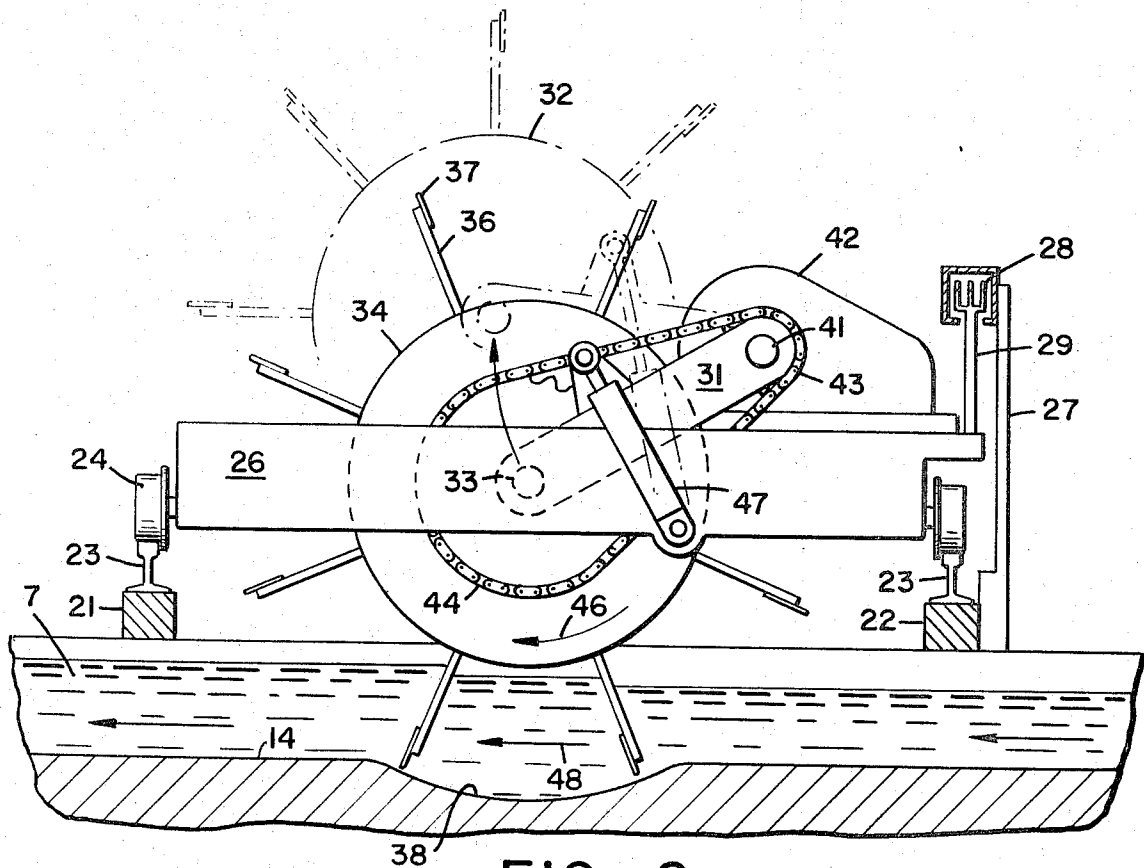
A mixer for algae ponds having a number of adjacent channels includes a support extending across the channels with a carriage successively movable on the support to different locations above the individual channels. A paddle wheel dipping into the channels in a lowered position is mounted on the carriage and is appropriately rotated by a motor thereon. The paddle wheel can be raised and lowered during transfer of the carriage from a position over one channel to a position over another channel and is effective to produce circulation or flow in each of the channels when it is active therein.

3 Claims, 2 Drawing Figures





FIG_1



FIG_2

MIXER FOR ALGAE PONDS

Treatment plants using the effect of sunlight on algae in ponds must be relatively shallow because the sunlight does not penetrate very far into the pond. There is a tendency for the algae to become obscured, or to sink and thus not to use the sunlight well and not to maintain a rapid growth rate. Stirring helps overcome these difficulties but the usual pumping devices have relatively small inlets and outlets compared to pond width and for efficiency must have long inlets and outlets. This is wasteful of ground area and is expensive. Consequently, the usual practice for shallow algae ponds with mixing, also called high rate ponds, is to use propeller or axial flow type pumps discharging through a transverse headwall, with a flap valve or siphon to prevent backflow. The hydraulic losses with this arrangement are high and result in unfavorable pumping energy costs. Where there are many ponds, the provision of individual pumping machinery is also quite expensive.

It is therefore an object of the invention to provide an inexpensive and simple mixing arrangement for treatment ponds.

Another object of the invention is to provide a mixing device that can be used on several ponds.

A further object of the invention is to provide a mixing device not requiring long transition sections or high energy losses.

Other objects of the invention, together with the foregoing, are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. 1 is a plan, portions being broken away, showing diagrammatically a mixer for algae ponds pursuant to the invention; and

FIG. 2 is a cross section, to an enlarged scale, showing part of the structure of FIG. 1, the plane of section being indicated by the line 2—2 of FIG. 1.

In the treatment of various sorts of efflux, usually from waste plants, and for improving the character of various materials discharged into water courses and the like, it has become important to utilize algae and comparable organisms in ponds. In one form of treatment area the liquid material is introduced into and withdrawn from adjacent algae-containing ponds or loops, such as 6, 7 and 8. Parallel flow operation is appropriate for large treatment plants, to avoid ponds that are too large for effective and efficient mixing. A multiplicity of ponds also permits inoculation or recirculation between ponds to establish and maintain desirable algal populations. As an example, a pond 7 is formed into channels or runs 9 and 11 having end bends 12 and 13 defined on the pond bottom 14 by boundary walls 16 and 17. The walls not only define the runs 9 and 11 but likewise are utilized as appropriate supports for a pair of beams 21 and 22 that span the adjacent ponds 6, 7 and 8 and can extend over a distance of many hundreds of feet so as to overlie a large number of ponds like the ponds 6, 7 and 8. The beams are adequately supported on the walls 16 and 17 without elaborate foundations or bracing so that the cost involved is relatively low. Small intermediate posts may be used between beams 21 and 22 and the bottom 14 if necessary to reduce the beam span for wide ponds.

Mounted on the beams 21 and 22 are rails 23 supporting the wheels 24 of a carriage, generally designated 26. The carriage includes an appropriate frame-

work and propulsion mechanism so that the carriage can be propelled along the rails to overlie any one of the runs 9 or 11 of the adjacent ponds 6, 7 and 8, the length of the carriage being somewhat longer than the width of an individual run or channel. Preferably, the propulsion machinery for the carriage is electrical. There is afforded on one of the beams such as 22 a series of uprights 27 carrying electrical conductors 28 appropriately shielded. Brushes 29 are in sliding contact therewith and furnish power and control signals to the machinery on the carriage.

Mounted on the carriage 26, preferably by means of a pair of arms 31, is a paddle wheel 32. This wheel includes a rotary shaft 33 journaled in the arms 31 and carrying disks 34. Between the disks extend paddles 36 disposed radially and carrying flexible sealing blades 37 at their radially outer ends. The radial depth of the various paddles 36 is substantially equal to the depth of the pond 7 and in fact is slightly greater since preferably the bottom 14 in each of the ponds in a linear array across the whole group is formed with an arcuate section 38 of slightly greater depth than the usual depth of the pond. The depth is preferably sufficient to cause a following paddle to reach the arcuate section before the preceding paddle has left the arcuate section, to provide nearly positive displacement. Sufficient head can be developed with a minor amount of leakage to force the fluid around a long pond loop.

The paddle wheel shaft 33 is raised and lowered so as to raise and lower the paddle wheel. For this reason the arms 31 are at their opposite ends journaled on a projecting shaft 41 extending from a drive mechanism 42, or on an independent shaft (not shown) supported from the carriage 26 having the same axis of rotation. The drive mechanism is preferably electrically propelled, and rotates the shaft 41. The shaft carries a sprocket engaged with a chain 43 also trained around a sprocket 44 joined to one of the disks 34 so that the paddle wheel is rotated in the direction of the arrow 46 in Fig. 2.

The arms 31 are interrelated with the carriage for movement about the shaft 41 by the provision of expansible devices 47 in the nature of hydraulic cylinders and pistons appropriately pivoted to the carriage 26 and to the arms 31. If desired, the expansible members can be operated by air rather than hydraulically and as a further alternative, electrical screw jacks can be substituted for the hydraulic members. In any case, operation of the devices 47 lowers the shaft 33 so that the paddle wheel is positioned, as shown in full lines in FIG. 2 with the paddles substantially adjacent the bottom of the pond and particularly with the flexible members 37 very nearly in contact with the curved bottom 38 so that very nearly a positive displacement arrangement is afforded yet minor obstructions cause no harm.

By operation of the jacking mechanism 47, the paddle wheel can be raised from the solid line position shown in FIG. 2 to the dotted line position shown therein. The vertical component of the paddle wheel travel is sufficient so that the lowermost paddles are high enough to clear the various walls 16 and 17.

In the operation of this structure, the carriage 26 is moved on the rails 23 by the propulsion mechanism until the carriage is substantially over one of the runs such as 9. The paddle wheel drive is then energized and the paddle wheel, being lowered so as virtually to contact the curved bottom 38, is effective to move the

material in the channel in the direction of the arrow 48 in FIG. 2, it being noted that the level of the fluid is raised as the paddle wheel works upon it and so flows throughout the circuit and is mixed. However, the rate of rotation of the paddle wheel is sufficiently slow so that there is no excessive turbulence or energy loss above that which is desired for the normal stirring or mixing of the material.

In practice the paddle wheel in one location or pond or channel is operated for a predetermined time, for example, one half-hour in a particular pond. This produces a complete circulatory movement throughout the loop and in both of the channels 9 and 11 thereof for a sufficient time so that the entire contents are stirred and agitated and are maintained in a homogeneous fashion. Following that the paddle wheel is raised by operation of the mechanism 47 and the carriage is advanced to overlie the corresponding channel in the next pond 6 or 8. Thereupon the paddle wheel is lowered into substantial engagement with the depressed curved bottom portion thereof and the pumping or circulation or agitation is continued in the next adjacent channel for a predetermined time.

It has been found that agitation or circulation of the liquid periodically; say, four times a day and for about 30 minutes each is adequate to maintain an optimum culture rate in a pond of the sort disclosed. Thus, by operating for 24 hours it is feasible with but one stirring or mixing or pumping mechanism to take care of up to about 10 channels, allowing for shifting from one channel to the next. The cost of the necessary equipment is much less than it would be were each of the channels permanently afforded its own pump and circulating system.

What is claimed is:

1. A mixer for algae ponds comprising a plurality of adjacent parallel flow channels separated by upstanding walls;

a support extending transversely across said channels, over said walls,

a carriage selectively movable along said support to positions over each of said channels;

a paddle wheel device mounted on said carriage in a position to extend into a channel over which said carriage is positioned and being rotatable about an axis transverse to said channels;

means on said carriage for rotating said paddle wheel to induce liquid in said channels to flow therealong;

each of said channels having a concavely curved bottom surface portion extending transversely thereof parallel to said axis and substantially conforming to the periphery of said paddle wheel; and

means constructed and arranged to raise said paddle wheel from a position in a channel to a height above said walls whereby to permit moving said carriage from one channel to another with said paddle wheel moving over said walls.

2. A mixer as defined in claim 1 wherein said last-named means comprises means for raising said paddle wheel relative to carriage.

3. A mixer as defined in claim 1 wherein said last-named means comprises arms interconnecting said paddle wheel and said carriage for relative movement with a vertical component, and means for so moving said arms.

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