United States Patent

Okada

[15] **3,635,448**

[45] **Jan. 18, 1972**

[54] POOL WITH VORTEX GENERATOR

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[73] Assignee: **Kuritz Water Industries Ltd.**, Higashi-ku, Osaka, Japan

[22] Filed: **June 11, 1969**

[21] Appl. No.: **832,105**

[52] **U.S. Cl.** **259/108**, 4/172.16

[51] **Int. Cl.** **B01f 7/16**

[58] **Field of Search** ..... 259/95, 96, 97, 108, 107, 67, 259/66, 44, 43, 24, 23, 8, 7; 261/84; 417/424, 61; 415/213 A, 143; 61/1 R, 63; 210/219, 512; 239/17, 18; 4/172, 172.11, 172.15, 172.16; 209/144, 211

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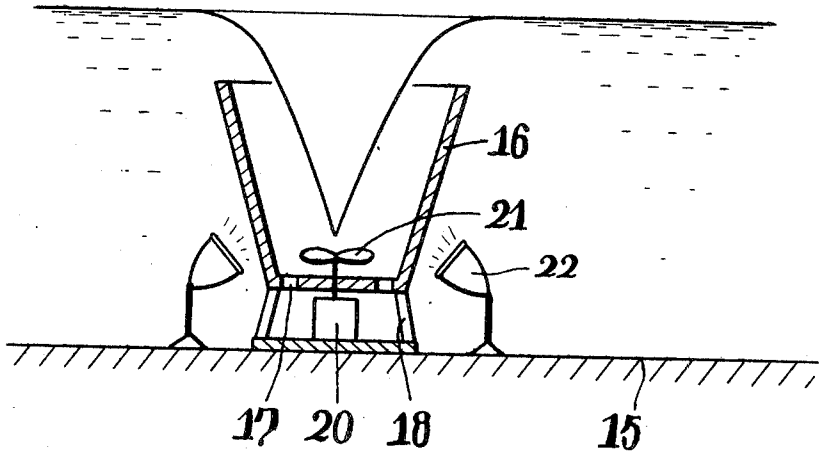
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Assistant Examiner—Alan I. Cantor
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[57] **ABSTRACT**

A pit or hollow vessel formed in the bottom of a pond or pool with a rotor blade arrangement therein for generating a vortex in the pond or pool.

4 Claims, 9 Drawing Figures



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SHEET 1 OF 3

Fig. 1a

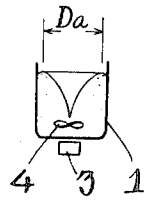


Fig. 1b

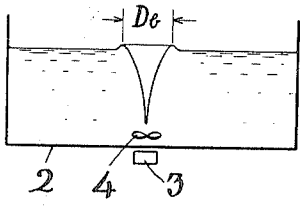


Fig. 1c

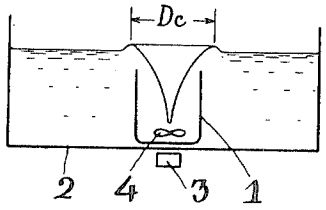


Fig. 6

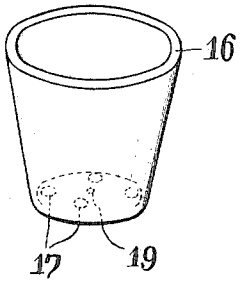


Fig. 4

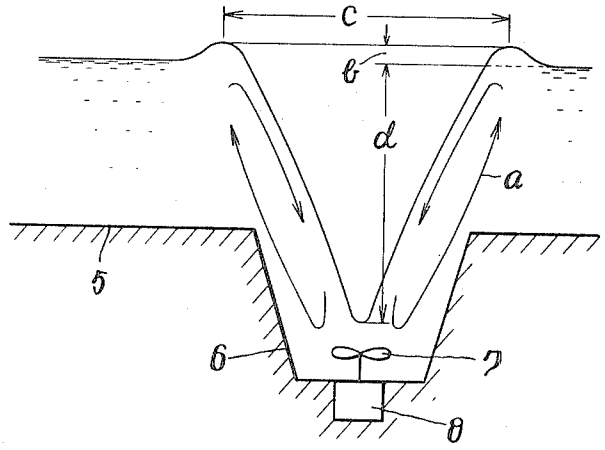
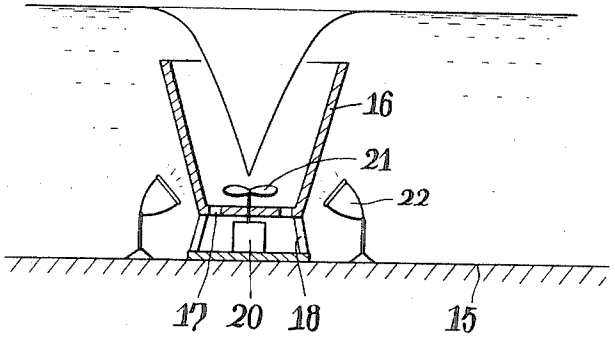


Fig. 5



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Fig. 2

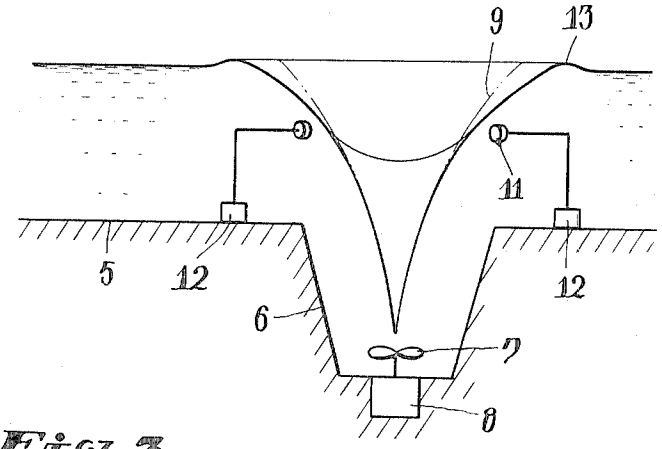
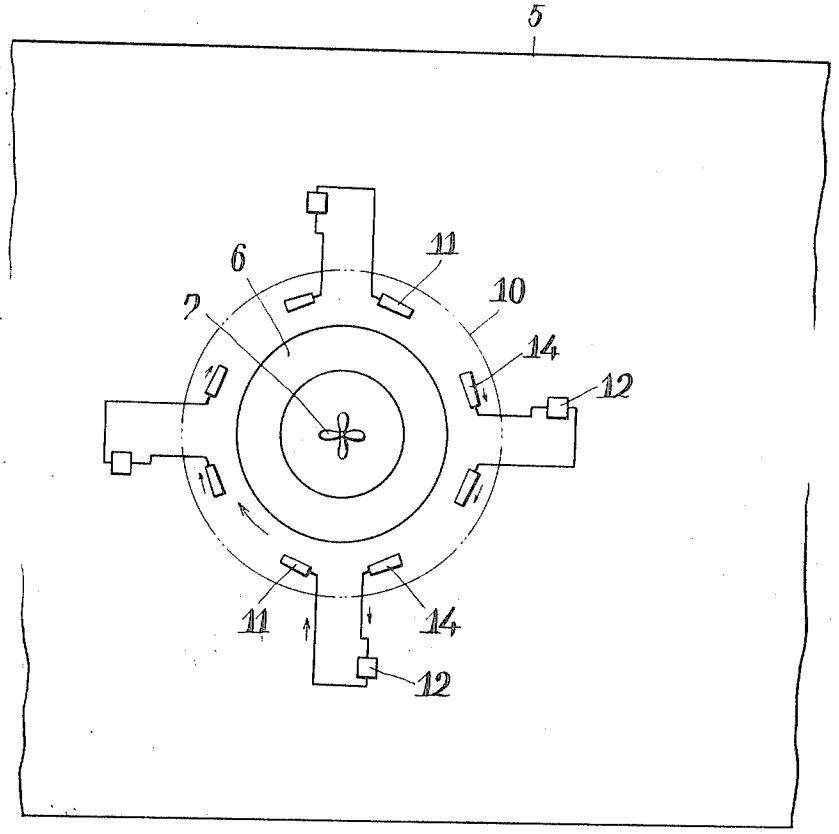


Fig. 3



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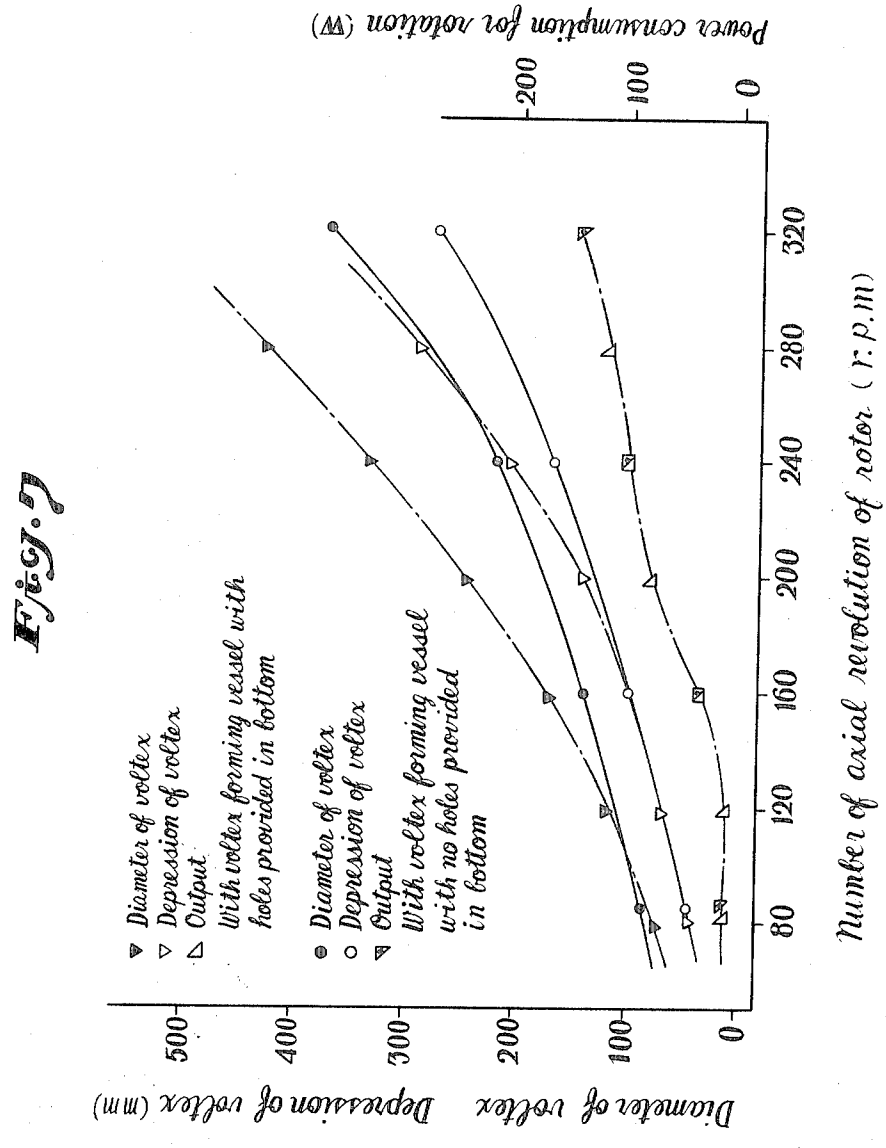


Fig. 7

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POOL WITH VORTEX GENERATOR

This invention relates to a pond or pool with hydraulic vortex generator and more particularly to a pond or pool in which a hydraulic vortex is created to decorate the water surface or the water is made to whirlpool.

Heretofore, circulating pools in channel form in which the water is circulated in one direction along the channel have been known. However, the pond or pool according to this invention differs entirely from said circulating pools in that it is not made in channel form, but is designed to generate a hydraulic vortex upon rotation of an impeller provided at the bottom of the pool.

A primary object of this invention is to provide a pond or pool in which a hydraulic vortex is generated.

Another object of this invention is to provide a pond or pool with vortex generator by a simple modification of any conventional pool.

Other objects and characteristic features of this invention will become apparent from the following detailed description based on the accompanying drawing, wherein:

FIGS. 1(A), (B) and (C) each illustrates a device for creating a vortex;

FIG. 2 is a sectional view showing one embodiment of the pool according to this invention;

FIG. 3 shows a schematic plan view of the pool shown in FIG. 2;

FIG. 4 is a diagram showing the flow of water as the rotor is rotated in the device shown in FIG. 2;

FIG. 5 is a sectional view of another embodiment of the pool according to this invention;

FIG. 6 is a perspective view of one example of the vortex-forming vessel according to this invention; and

FIG. 7 is a graph with curves showing the relationship between number of axial revolutions of the rotor and the diameter and depression of the vortex and the power consumption for rotation.

Referring to FIG. 1, FIG. 1(A) shows a beaker 1, 50 mm. in diameter and 65 mm. high, equipped at the bottom with a rotor 4 which is rotated by a magnetic stirrer 3; FIG. 1(B) shows a tank 2, 300 mm. long, 220 mm. wide and 80 mm. high, equipped at the bottom with a rotor 4 which is rotated by a magnetic stirrer 3; and FIG. 1(C) shows a tank 2 having the same dimensions as in FIG. 1(B) and provided inside with the same type of beaker as in FIG. 1(A).

On condition that, in the above-mentioned three devices, the diameter of the rotor 4 and the speed at which it is rotated by the stirrer 3 are the same, if Da is taken to represent the diameter of a vortex formed on the water surface by rotating the rotor 4 after filling the beaker 1 with water as deep as 60 mm., Db the diameter of a vortex formed on the water surface by rotating the rotor 4 after filling the tank 2 as deep as 70 mm., and Dc the diameter of a vortex formed on the water surface by rotating the rotor 4 at the bottom of the beaker 1 in the tank 2 after filling said tank with water as deep as 70 mm., then the following relation materializes:

$$Da=(3 \text{ to } 4)\times Db=DC$$

As a result of testing, it was found that, if the rotor is merely rotated at the bottom of the pool, then, as is clear from FIG. 1(B), the efficiency is low and that to obtain a large vortex, it is more effective to use a device of the type shown in FIG. 1(C).

Accordingly, this invention is designed so as to provide a pit at the bottom of the pool and rotate the rotor at the bottom of said pit, or to provide a vortex-forming vessel at the bottom of the pool and rotate the rotor in said vessel, thereby making the water in the pool flow in vortex and simultaneously making the vortex on the water surface large in diameter.

In FIG. 2, a pit 6 is formed at the bottom of a square plane pool 5, said pit being provided at the bottom with a bladed rotor 4. This rotor is rotated by an appropriate motor 8 to create a vortex 9 in the water from the bottom of the pit 6 towards the water surface.

The pit 6 is preferably shaped like an inverted cone, as illustrated, whereby the diameter on the water surface of the vortex 9 can be made larger than in the case of a cylindrical shape.

In the pool 5, nozzles 11 are arranged tangentially of an imaginary circle 10 which is made concentric with the vortex 9, so that the water in the pool is jetted out in the same direction as the vortex 9 through said nozzles by pumps 12 to form a larger vortex 13. The diameter of the imaginary circle 10 is made to correspond to the circumference of the vortex 9 at the height of the nozzles 11, and the velocity of circulation of the water jetted out through said nozzles is made equal to the velocity of circulation of the water at said circumference of the vortex 9.

In short, it is aimed to obtain a vortex of larger diameter by providing the nozzles 11 tangentially at the circumference of the vortex 9 to be formed by the rotor 7. Incidentally, in FIG. 2, the nozzles 11 are provided in one stage, but they may be provided in two or more stages, in which case, because the vortex spreads as it ascends, the nozzle groups in the upper stages must be arranged tangentially of imaginary circles of larger diameter. Also, the water intake portions 14 of the pumps 12 are arranged tangentially of the imaginary circle 10 and opposite to the direction in which the vortex 13 moves round, so that the water taken in by the pumps 12 may serve for the formation of a vortex of larger diameter. Further, in FIG. 2, a device for creating vortex by rotating rotor at the bottom of a pit formed at the bottom of a pool is shown, but the same effect is also obtained by disposing a vessel shaped like an inverted cone, in place of forming said pit, at the bottom of a pool and rotating a rotor in said vessel.

In the device shown in FIG. 2, when the rotor is rotated, the water current, as shown in FIG. 4, first descends along the surface of vortex in the direction indicated by an arrow a and then ascends along the sidewall from the bottom of the pit to form a raised portion b on the upper surface of the vortex on the water surface, so it is impossible to obtain a vortex of larger diameter than a fixed one. Moreover, the velocity of the water current increases with the increase in number of revolutions of the rotor, so it is difficult to form a large vortex.

The device shown in FIG. 5 is for forming a still larger vortex. In FIG. 5, at the center of pool 15, a vortex-forming vessel 16 of the type shown in FIG. 6 is fixed with supports 18, said vessel having a plurality of holes 17 made in the bottom. Underneath the vessel 16, there is a submarine motor 20 equipped with a bladed rotor 21, said rotor projecting upwardly through an axial hole 19 made in the center of the bottom of said vessel. As shown in FIG. 6, the vessel 16 is preferably shaped like an inverted cone so that the opening portion is larger in diameter than the bottom. In this structure, when the rotor 21 is rotated, a vortex is generated in the vessel 16, then ascends along the sidewall of said vessel and spreads on the pool.

On the other hand, the water current formed by rotation flows downwardly, as indicated by an arrow a in FIG. 4, and a portion of the water current is discharged to the outside of the vessel 16 through holes 17 made in the bottom of said vessel, so that there is a small water current formed which ascends along the sidewall of said vessel and, accordingly, such raised portion b as in FIG. 4 is not formed on the upper surface of the vortex; thus, it is possible to obtain a vortex of large diameter c and depression d.

A working example using the device shown in FIG. 5 is given hereunder.

The vortex-forming vessel used was shaped like an inverted cone, opening portion diameter 1,000 mm. × bottom diameter 600 mm.× 500 mm. height, and had eight holes of 26 mm. made at equal intervals on the respective 200 mm. and 400 mm. circles on the bottom. The rotor used was equipped with two blades of 200 mm. The vessel mentioned was sunk 55 mm. below the water surface of the pool, and the rotor was rotated. The results were as shown in FIG. 7.

FIG. 7 is a graph with curves showing the relationship between number of axial revolutions of the rotor and the diameter and depression of the vortex formed and the power consumption for rotation, and further shows a comparison with the results obtained by using a vortex-forming vessel of the same type as above but without holes in the bottom. From FIG. 7, it is seen that the use of a vortex-forming vessel having holes in the bottom results in forming a vortex of larger diameter and depression than in the case of a vessel without holes, and that the power consumption for rotation is the same.

Incidentally, in this invention, if the vortex-forming vessel is made of a transparent material and an underwater lighting device 22 such as a lamp or the like is set up near the sidewall of said vessel, then the effect of lighting at night can be produced.

What is claimed is:

1. A large pond with vortex generator for forming a vortex in a portion of the pond comprising a pond, a vortex-forming vessel provided at the bottom of said pond, and a rotary means in said vessel for rotating the water in said pond to generate a vortex.

2. A pond with vortex generator as defined in claim 1, wherein said vortex-forming vessel is shaped like an inverted cone.

3. A large pond with vortex generator for forming a vortex in a portion of the pond comprising a pond, a vortex-forming vessel at the bottom of said pond, said vortex-forming vessel having a plurality of holes made in the bottom thereof, and a rotary means in said vortex-forming vessel for rotating the water in said pond to create a vortex.

4. A pond with vortex generator as defined in claim 3, wherein the vortex-forming vessel is shaped like an inverted cone.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,635,448 Dated January 18, 1972

Inventor(s) Hiroo Okada

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet [73] the name of the assignee should read -- Kurita Water Industries, Ltd. --.

Signed and sealed this 7th day of November 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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