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Kurtz

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[54] **EASILY DISASSEMBLED AND CLEANABLE HYDROTHERAPY PUMP**

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[52] **U.S. Cl.** **128/66,** 4/180
[51] **Int. Cl.** **A61h 9/00**
[58] **Field of Search** 128/66; 4/180

[56] **References Cited**

UNITED STATES PATENTS

2,237,436	4/1941	Ille	128/66 X
3,060,892	10/1962	Schantz	128/66 X
3,302,640	2/1967	Jacuzzi	128/66
3,325,829	6/1967	Hotz	128/66 UX

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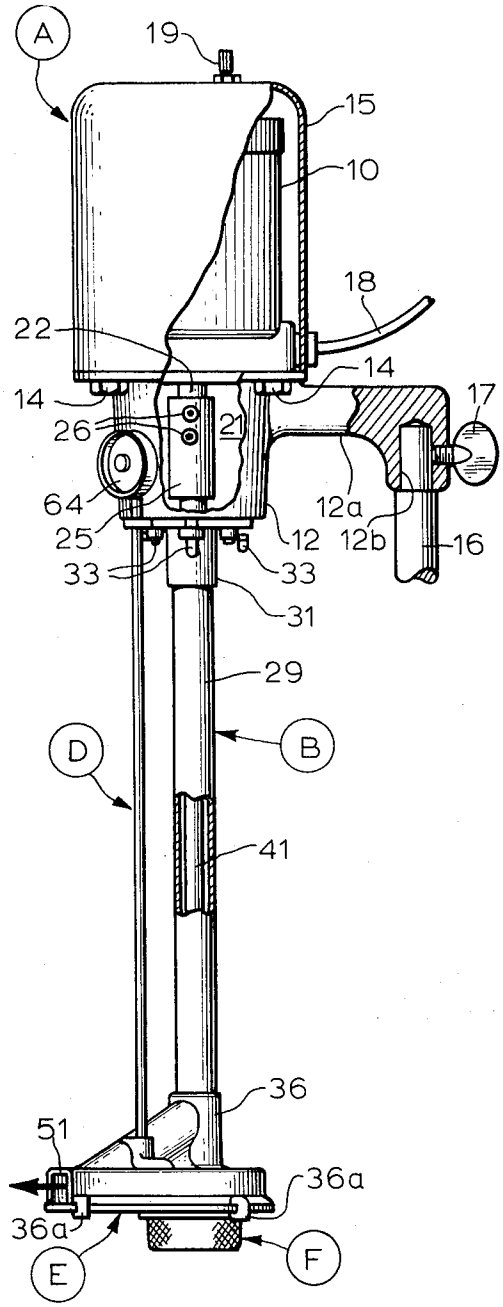
[57] **ABSTRACT**

The disclosed hydrotherapy pump, which is used to effect water agitation in a whirlpool tank, may be quickly and easily disassembled without the aid of any tools, after which all of the water-contacting surfaces will be exposed to permit simplified brush cleaning and sterilizing.

8 Claims, 7 Drawing Figures



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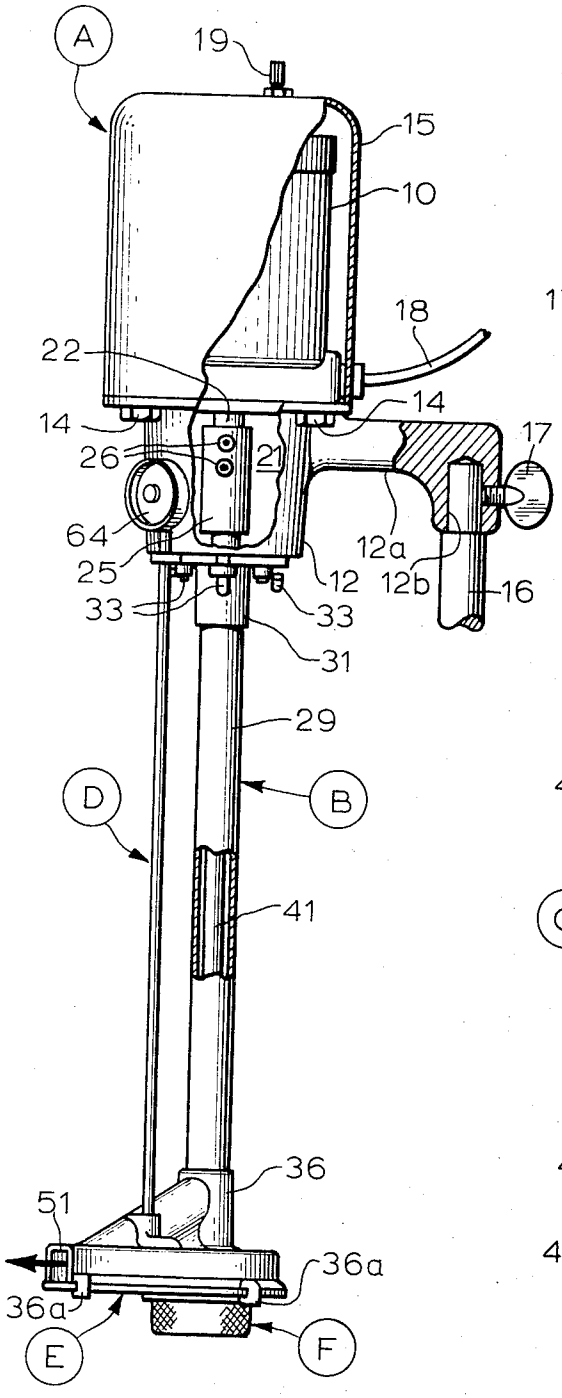


FIG. 1

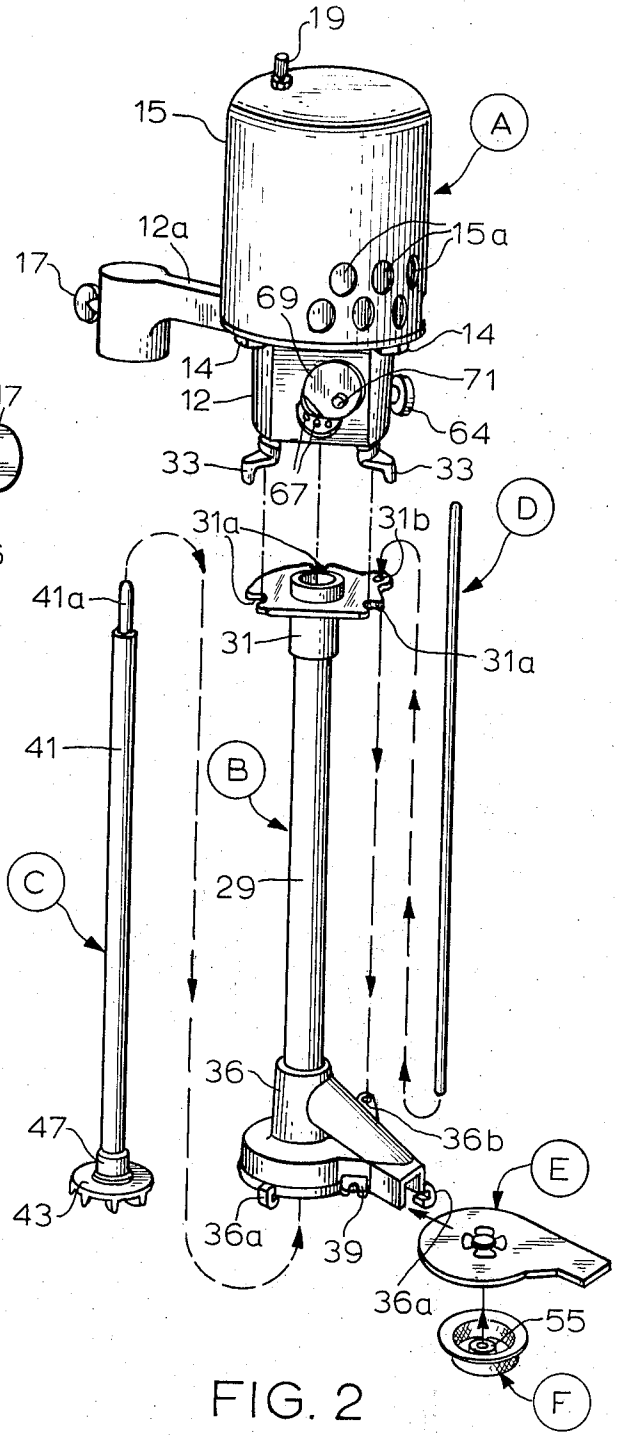


FIG. 2

FIG. 3

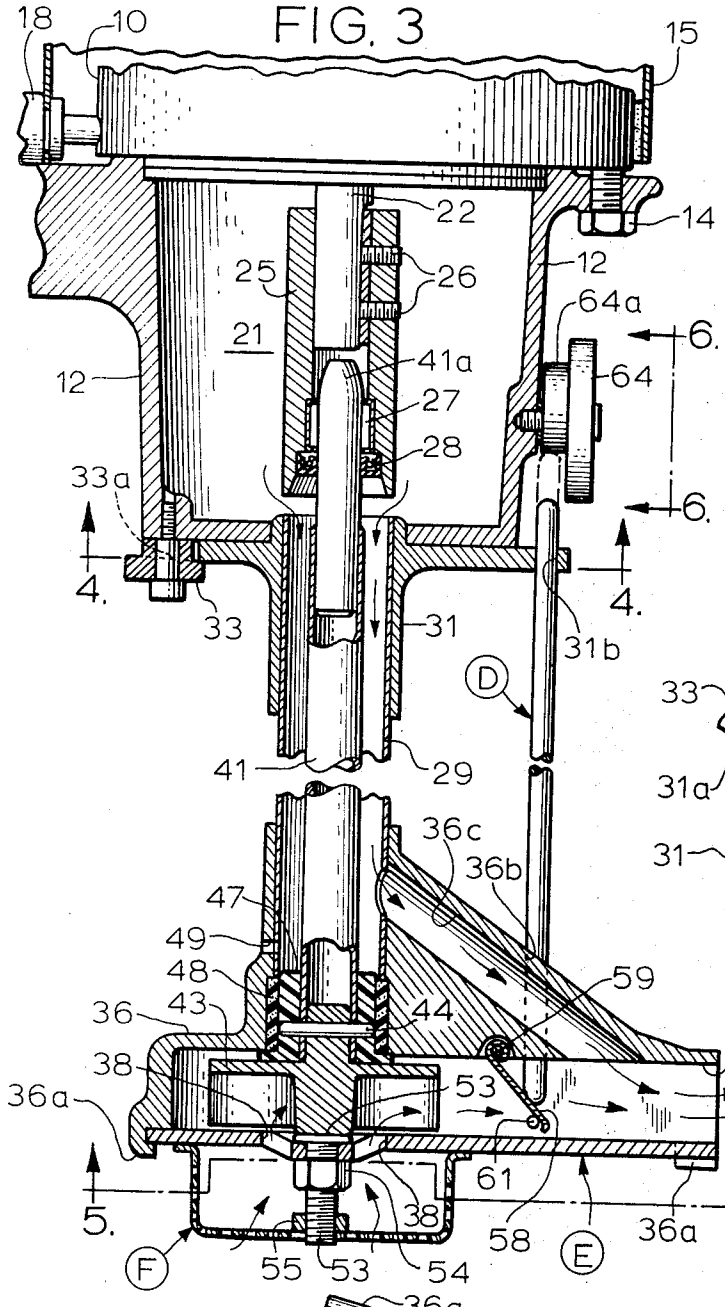


FIG. 6

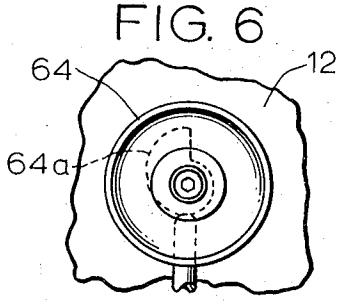


FIG. 4

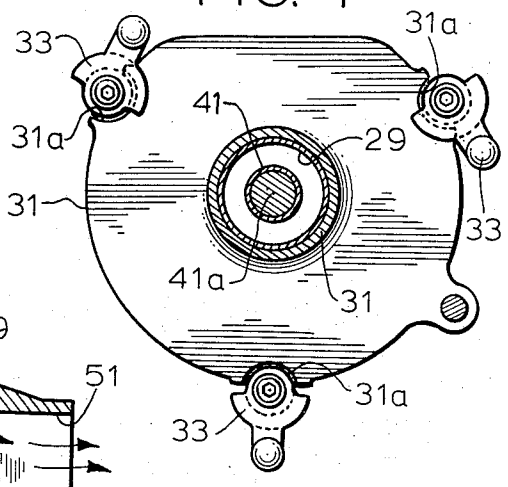


FIG. 7

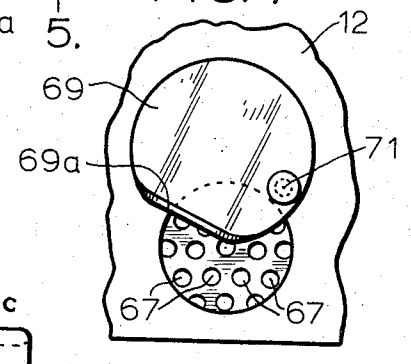
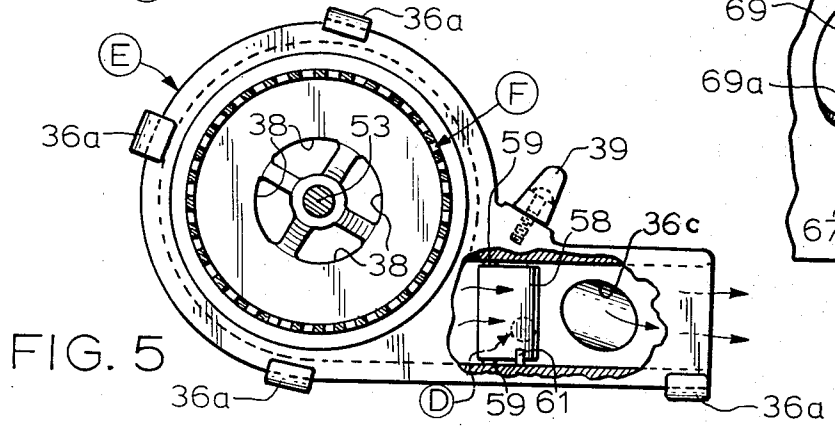


FIG. 5



EASILY DISASSEMBLED AND CLEANABLE HYDROTHERAPY PUMP

The required water agitation in a whirlpool tank of a hydrotherapy treatment system is usually achieved by a pump that circulates the water and simultaneously injects air into it. Hydrotherapy treatments are customarily given to burn patients and if such a patient has any open wounds, which may be the case when the burns are severe, it is imperitive that all of the elements and hardware in contact with the water be sterilized beforehand so that the patient treated will not become infected by bacteria. Hence, all of the water-contacting surfaces of a hydrotherapy pump must be thoroughly cleaned and sterilized before the pump is used to treat any patient who is vulnerable or susceptible to infection-causing bacteria.

Cleaning and sterilizing are accomplished by disassembling the pump so that the water-contacting surfaces are sufficiently exposed to allow brush cleaning. Complete sterilizing cannot be effected unless the surfaces can actually be brushed. Soaking in a germ-killing solution is not enough. Unfortunately, sterilization of the hydrotherapy pumps developed heretofore can be achieved only with great difficulty and it is a time consuming process. In fact, many of the pumps in use cannot be completely brush cleaned and cannot be completely sterilized.

The present hydrotherapy pump, on the other hand, is uniquely designed with low-cost, light-weight parts and may, without using any tools whatsoever, be quickly disassembled or knocked down to expose all of the water-contacting surfaces for easy brush cleaning and sterilization.

SUMMARY OF THE INVENTION

The hydrotherapy pump of the invention comprises a motor subassembly including an electric motor mounted on a base support and having a rotor with its axis of rotation vertically oriented. There is a vertically disposed hollow support tube, and means for removably connecting the upper end of the support tube to the base support such that the tube is coaxial with the rotor and depends downwardly from the base support. An open-bottomed pump housing is affixed to the lower end of the support tube, and a cover plate is removably connected to the bottom of the pump housing. The pump housing-cover plate combination defines interconnected pumping and mixing chambers, an inlet communicating with the pumping chamber and an outlet communicating with the mixing chamber. A vertically oriented drive shaft is rotatable mounted within and is coaxial with the support tube and has its upper end removably coupled to the rotor, an annular-shaped channel being provided between the drive shaft and the internal wall of the hollow support tube. An impeller is affixed to the lower end of the drive shaft and is rotatable within the pumping chamber to pump water from the inlet and through the mixing chamber to the outlet. A passageway extends from the base support and through the annular-shaped channel in the support tube and through part of the pump housing to the mixing chamber in order that air may be drawn into the mixing chamber and injected into the pumped water discharged at the outlet.

DESCRIPTION OF THE DRAWINGS

The features of the invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with further advantages and features thereof, may best be understood, however, by reference to the following description in conjunction with the accompanying drawings in which:

FIG. **1** is a side view, partially broken away, of a hydrotherapy pump constructed in accordance with one embodiment of the invention;

FIG. **2** is a perspective, exploded view of the pump of FIG. **1** and illustrates the manner in which the parts of the pump are assembled together;

FIG. **3** is a partial sectional view of the pump of FIG. **1**;

FIG. **4** is a sectional view taken along the plane of section line **4—4** in FIG. **3**;

FIG. **5** is a sectional view taken along the plane defined by section line **5—5** in FIG. **3**;

FIG. **6** is a fragmentary view taken along line **6—6** in FIG. **3**; and

FIG. **7** is a fragmentary view of a portion of the pump.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

As illustrated in FIG. **2**, the pump is designed to be easily knocked down or dismantled to isolate or separate from each other the subassemblies or elements depicted by the encircled reference letters A–F. All of the pump parts, except those in subassembly A, will be in contact with the water in a whirlpool tank and must be sterilized.

More specifically, the motor subassembly, designated by reference letter A, includes an electric motor **10** which is mounted on a base support **12** by a plurality of bolts **14.** Preferably support **12** constitutes an aluminum casting. Motor **10** is oriented so that its rotor will have a vertical axis of rotation. A motor cover or housing **15** covers and may be screwed to motor **10.** A series of openings **15***a* are provided in housing **15** to permit air flow to the motor for cooling purposes.

Extension arm **12***a* of base support **12** terminates in an inverted bore **12***b* (see FIG. **1**) to permit mounting of the base support to an appropriate holding device, such as an upright pipe **16,** only a portion of which is shown for illustrative purposes in FIG. **1.** Base support **12** may be rigidly and tightly secured to pipe **16** by turning thumb screw **17.** Pipe **16** would be located outside of the whirlpool tank but immediately adjacent to one of the tank walls. In this way, motor subassembly A will be supported above the water level in the tank so that subassemblies or elements B,C,D,E and F will extend downward into and will be in contact with the water. Electrical power is supplied to motor **10** via a pair of conductors in line cord **18** and under the control of a manually operated on-off switch **19.** Motor subassembly A will be above and out of contact with the water at all times. Hence, it may remain in position relatively permanently.

Base support **12** is shaped to provide a cavity or chamber **21** into which the shaft **22** for the motor's rotor extends, as is best seen in FIGS. **1** and **3.** A sleeve or collar **25** is secured to shaft **22** by a pair of set screws **26.** A roller clutch **27** and a rubber-coated oil seal **28**

are mounted within sleeve **25** for reasons to be explained.

The elements of subassembly B (see particularly FIG. **2**) are rigidly affixed to one another and the entire subassembly is removably connected to base support **12.** More specifically, subassembly B comprises a vertically disposed hollow support tube **29** which is terminated at its upper end by a flange **31** having three cutaway notches **31***a* that facilitate rapid assembly to and disassembly from base support **12.** Three captivated, finger-movable, quick-release fastening devices **33** cooperate with notches **31***a* to attach flange **31** to base support **12.** Each fastening device **33** takes the form of a turn cam rotatable over 360° and having an inclined cam surface (see surface **33***a* in dashed construction in FIG. **3**) that may be rotated or turned so that it wedges or locks flange **31** to base support **12.** As viewed in FIG. **4,** the two uppermost turn cams **33** are shown rotated to their closed or locking position, while the lowermost turn cam **33** is in its open or unlocking position. Of course, before flange **31** can be secured to base support **12** all three turn cams **33** must be swung to their unlocking position.

An open-bottomed pump housing **36** is rigidly secured to the lower end of hollow support tube **29** and a cover plate E is removably connected to the bottom of that housing. Quick attachment and disattachment of the cover plate is permited by forming a plurality of hook-shaped depending portions **36***a* on housing **36.** A captivated, finger-movable, quick-release fastening device **39,** in the form of a wing nut, serves to lock the cover plate in position. To assemble the plate to housing **36,** wing nut **39** must first be rotated to its position shown in FIG. **2,** whereupon plate E would be slid into hooks **36***a*. Wing nut **39** must then be rotated 90° to its position illustrated in FIG. **5.**

The subassembly denoted by reference letter C in FIG. **2** is calculated to be quickly assembled to or disassembled from the pump. It includes a drive shaft **41** which is primarily hollow except for its solid bullet-shaped or chamfered end portion **41***a*. A pin **44** rigidly secures the lower end of drive shaft **41** to an impeller **43.**

In order to attach subassembly C to the pump, cover plate E must, of course, be removed from housing **36.** Drive shaft **41** is then inserted into housing **36** and pushed up through support tube **29** until bullet-shaped end **41***a* extends through roller clutch **27** to the position shown in FIG. **3.** Rubber-coated oil seal **28** serves to guide the drive shaft into the required position. Clutch **27** is of the type that frictionally connects to the drive shaft so that the rotation of rotor shaft **22** is directly transfered to drive shaft **41.** Suitable bearings **47** and **48** are fixed to shaft **41** and housing **36** respectively so that drive shaft **41** will be rotatably mounted within support tube **29.** Opening **49** (see FIG. **3**) extends through housing **36** and tube **29** and allows water to flow between the bearing surfaces so that those surfaces will be water lubricated. Preferably, bearing **47,** which rotates with shaft **41,** is cylindrical shaped and made of plastic, while the internal wall of fixed bearing **48** (which may be made of rubber) is octagon shaped. With this arrangement, bearing wear is minimized and the water flowing between the bearing surfaces effects automatic centering of drive shaft **41.**

Impeller **43** may be of conventional configuration in order that when it is rotated by electric motor **10** water is drawn into the impeller through an inlet in cover plate E, provided by a series of four openings **38,** and pumped out at the outlet **51** formed by housing **36** and cover plate E. Subassembly F constitutes a strainer or filter through which the water must flow to reach the pump inlet. Strainer F attaches to cover plate E via a plastic stud **53.** Specifically, stud **53** is secured to plate E by a plastic nut **54.** The top surface of stud **53** serves as a bearing surface for the rotating impeller **43.** Strainer F has a threaded portion **55** that threads onto the lower end of stud **53.**

The water discharge rate is controlled by an adjustable flapper valve or gate **58** located in the path of the water discharged by impeller **43.** More particularly, valve **58** is pivotably mounted in housing **36** by means of a pin **59** and is adjustable to any position between the two extreme positions shown respectively in full line and dashed line construction in FIG. **3.** A stop **61,** fixed to housing **36,** determines one of the extreme positions. A vertically oriented and vertically movable control rod D extends through apertures **31***b* in flange **31** and **36***b* in housing **36.** A manually adjustable cam **64,** rotatably mounted on base support **12,** controls the vertical positioning of rod D. By manipulating cam **64,** cam surface **64***a* (see FIG. **6**) permits rod D to move vertically between the two extreme positions shown respectively in full and dashed line construction in FIG. **3.** When cam **64** is positioned as shown in FIG. **3,** the water discharged by impeller **43** forces valve **58** to its fully open position (shown in dashed construction) so that a maximum volume of water is pumped out at outlet **51.** As valve **58** pivots to its open position, rod D will be pushed upwardly to its position shown in dashed line construction. If cam **64** is then rotated about 180° counter-clockwise (as viewed in FIG. **6**), cam surface **64***a* will push rod D downwardly to its full line position in FIG. **3** and this will cause valve **58** to pivot to its full line position, as a consequence of which the water discharge rate at outlet **51** will be minimized. Of course, varying the discharge rate alters the amount of water agitation introduced in the whirlpool tank.

Air must also be injected into the discharged water in order that the water circulated in the tank also contains air bubbles which are necessary to achieve optimum hydrotherapy. In accordance with a feature of the invention, the required air is delivered to the discharged water by way of a path which includes the annular space surrounding drive shaft **41** within support tube **29.** Air enters cavity **21** (within base support **12**) through a series of apertures **67** and then flows downwardly through support tube **29** since the annular space surrounding shaft **41** communicates with cavity **21.** A channel or passage **36***c* is formed in housing **36** to couple the air passageway in tube **29** to the chamber in housing **36** through which the pumped water passes just prior to exiting at outlet **51.** Air is drawn or entrained into the discharged water by venturi action. The amount of air bubbles injected into the water is controlled by varying the opening into cavity **21** and this is accomplished by a manually positionable door **69** which is pivoted about a pivot pin **71.** A portion **69***a* of the door is bent to provide a tab to be gripped to ease the task of manually adjusting the door. Pin **71** also serves to hold door **69** against base support **12** with a sufficient amount of friction so that once the door is positioned to an optimum setting it will remain there.

It is thus apparent that housing **36,** when bottomed by cover plate E, effectively provides a pumping chamber in which impeller **43** rotates and a mixing chamber through which the pumped or discharged water flows before it emerges at outlet **51,** and in which mixing chamber air is drawn or introduced through passage **36***c*.

After each use of the pump, and particularly when patients with open wounds are treated, the pump should be disassembled and all of the water-contacting surfaces should be brush cleaned and sterilized. As already explained, the subassemblies denoted by the reference letters B–F may rapidly be knocked down or separated from each other in the manner illustrated in FIG. **2.** Note that all of the surfaces in contact with the water will be sufficiently exposed to permit easy brush cleaning and sterilization. With drive shaft **41** removed from support tube **29,** ample space will now exist within the tube to allow a brush to be rapidly passed therethrough.

The invention provides, therefore, a unique low-cost, light-weight, easily dismantled and cleanable hydrotherapy pump.

While a particular embodiment of the invention has been shown and described, modifications may be made, and it is intended in the appended claims to cover all such modifications as may fall within the true spirit and scope of the invention.

I claim:

1. An easily disassembled and cleanable hydrotherapy pump for agitating water in a whirlpool tank comprising:

a motor subassembly including an electric motor mounted on a base support and having a rotor with its axis of rotation vertically oriented;

a vertically disposed hollow support tube;

means for removably connecting the upper end of said support tube to said base support such that said tube is coaxial with said rotor and depends downwardly from said base support;

an open-bottomed pump housing affixed to the lower end of said support tube;

a cover plate removably connected to the bottom of said pump housing, the pump housing-cover plate combination defining interconnected pumping and mixing chambers and having an inlet communicating with the pumping chamber and an outlet communicating with the mixing chamber;

a vertically oriented drive shaft rotatably mounted within and coaxial with said support tube and having its upper end removably coupled to said rotor, an annular-shaped channel being provided between said drive shaft and the internal wall of said hollow support tube;

and an impeller affixed to the lower end of said drive shaft and rotatable within said pumping chamber to pump water from said inlet and through said mixing chamber to said outlet,

a passageway being provided from said base support and through the annular-shaped channel in said support tube and through part of said pump housing to said mixing chamber in order that air may be drawn into said mixing chamber and injected into the pumped water discharged at said outlet.

2. A hydrotherapy pump according to claim **1** in which said support tube is connected to said base support by means of a plurality of captivated, finger-movable, quick-release fastening device to facilitate rapid assembly and disassembly.

3. A hydrotherapy pump according to claim **1** in which said cover plate is connected to said pump housing by means of at least one captivated, finger-movable, quick-release fastening device to facilitate rapid assembly and disassembly.

4. A hydrotherapy pump according to claim **1** in which said drive shaft is connected to said rotor by means of a clutch affixed to the rotor's shaft.

5. A hydrotherapy pump according to claim **1** and including an adjustable flapper valve within said housing for controlling the water discharge rate.

6. A hydrotherapy pump according to claim **5** in which said flapper valve is controlled by a vertically oriented rod, the upper end of which is positioned by an adjustable cam mounted on said base support.

7. A hydrotherapy pump according to claim **1** and including means for controlling the amount of air injected into the discharged water.

8. A hydrotherapy pump according to claim **7** in which said base support provides a cavity which communicates with the annular-shaped channel in said hollow support tube, and in which the air injected into the discharged water flows into said cavity through an adjustable opening in said base support.

* * * * *