

[54] **HYDROTHERAPY AGITATOR WITH PROVISION FOR RAPID DISASSEMBLY AND REASSEMBLY**

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[52] U.S. Cl..... 128/66, 4/180, 4/182, 415/201, 417/424

[51] Int. Cl..... **A61h 9/00**

[58] Field of Search..... 417/424; 415/201; 128/66; 4/180, 182

[57] **ABSTRACT**

A hydrotherapy agitator having a suspension bracket and a motor mounted thereon, a downwardly extending support tube with an impeller housing attached at the bottom thereof, a drive shaft within the support tube connecting the motor shaft with an impeller in the housing, an apertured bottom plate for the housing, and an air tube and a water control rod mounted respectively between the suspension bracket and impeller housing, is provided with means for rapidly disassembling and reassembling the parts normally immersed during use, so that effective sterilization of internal as well as external surfaces of the parts is facilitated.

8 Claims, 12 Drawing Figures

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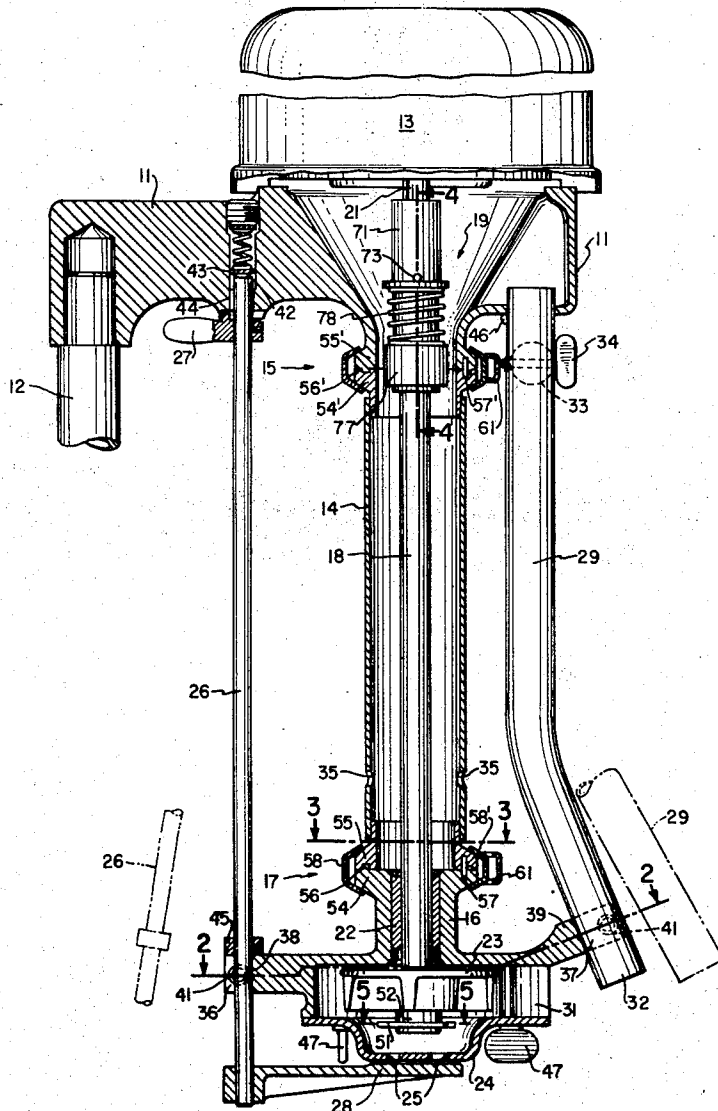


FIG. 1

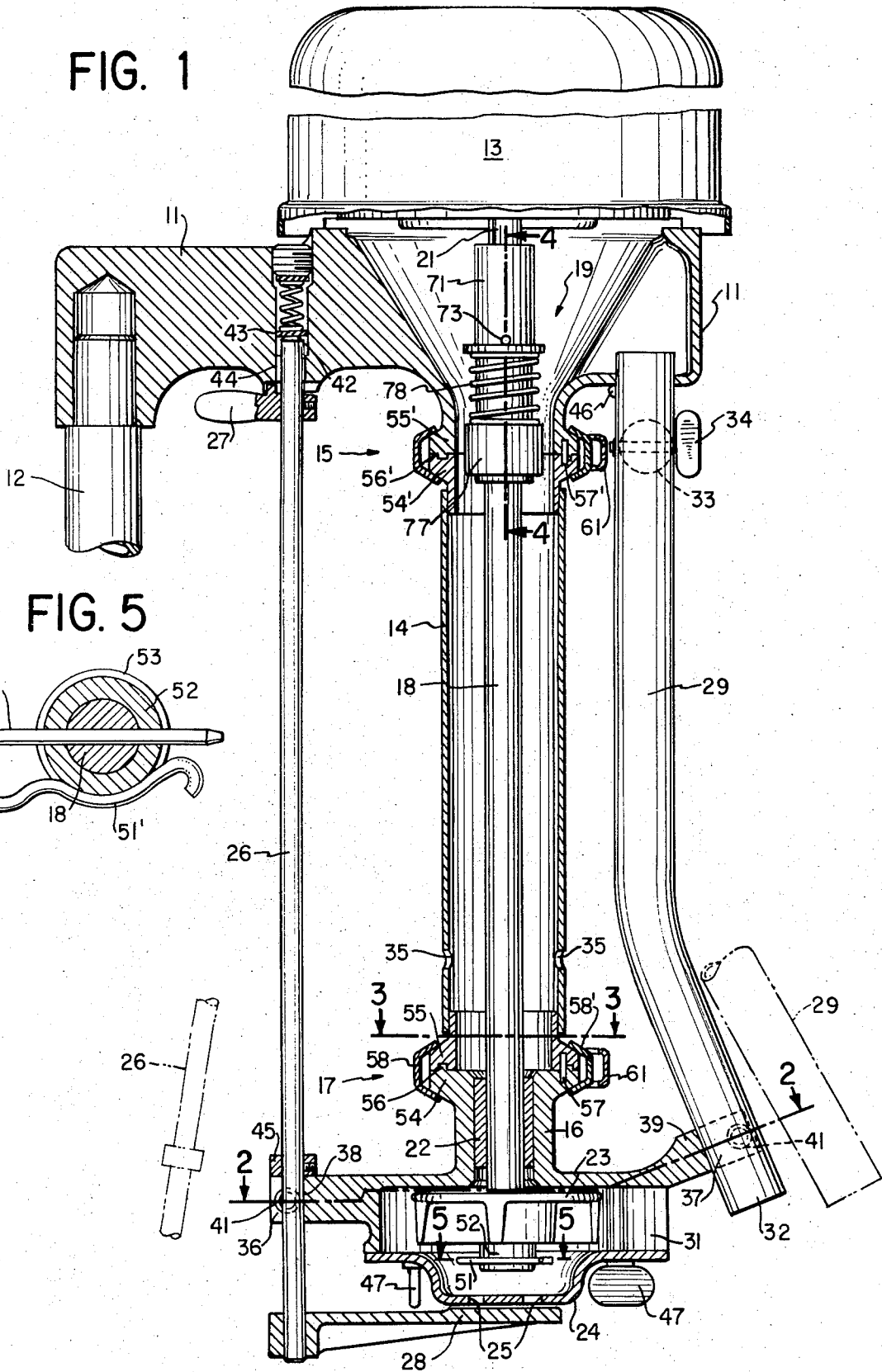


FIG. 2

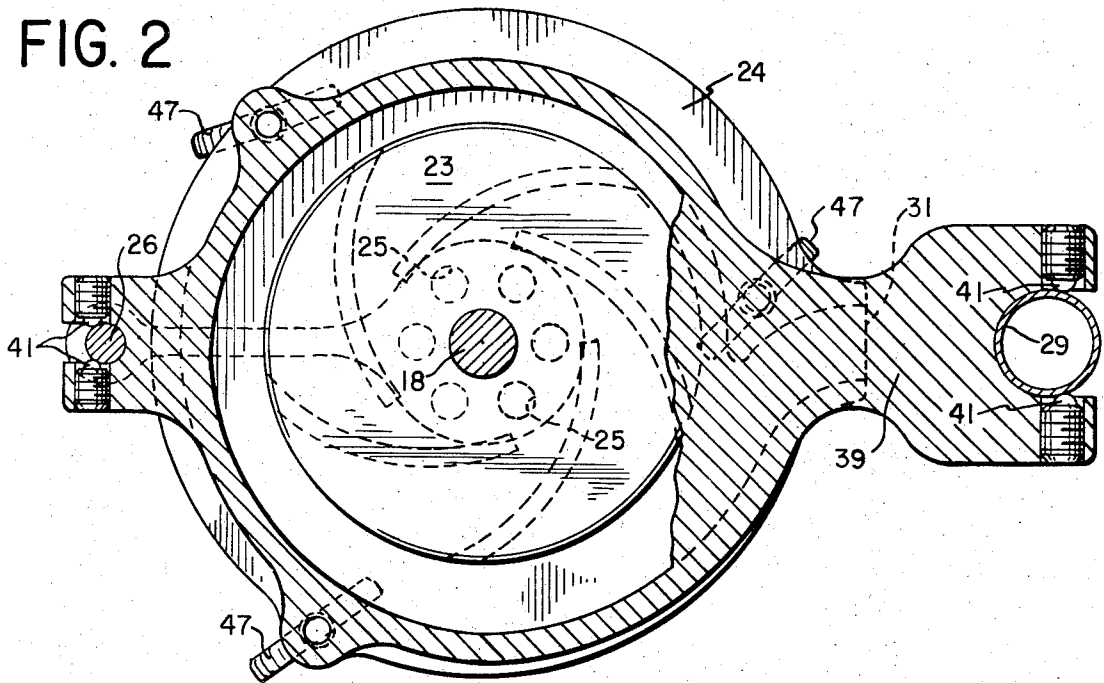


FIG. 9

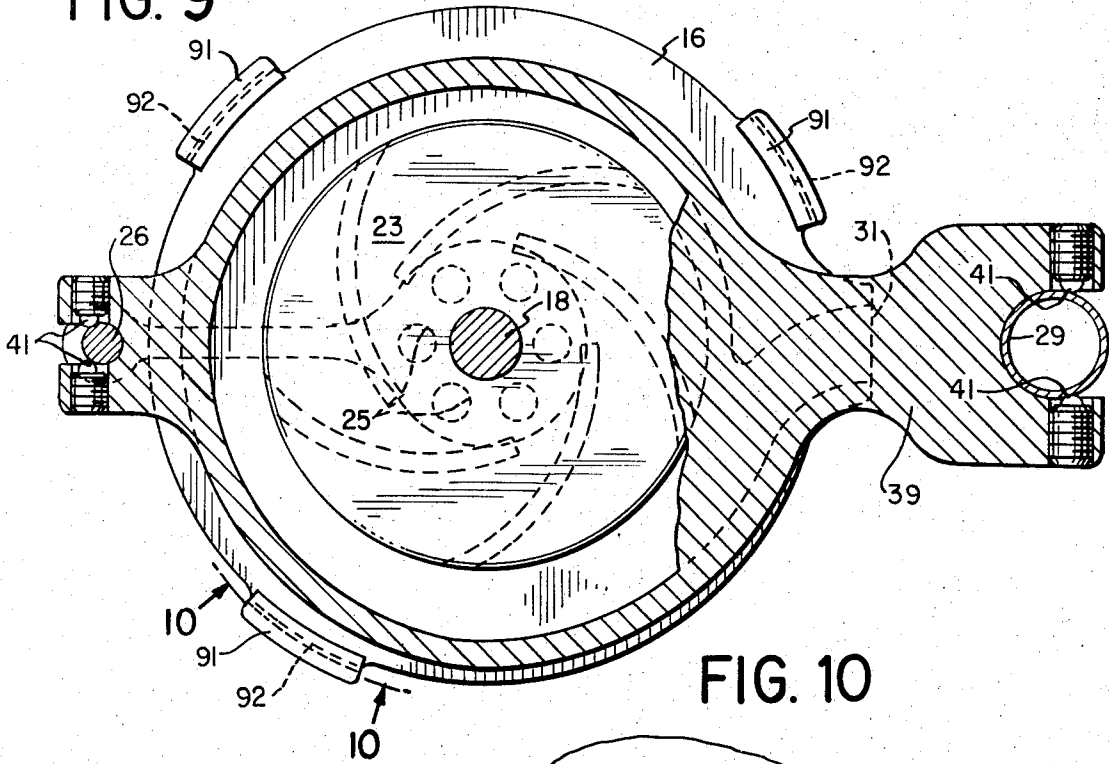


FIG. 10

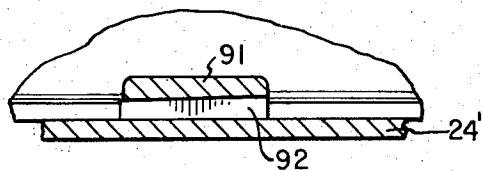


FIG. 3

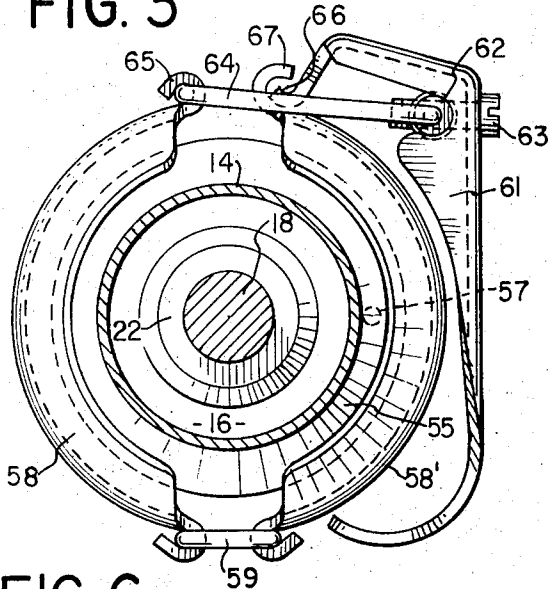


FIG. 4

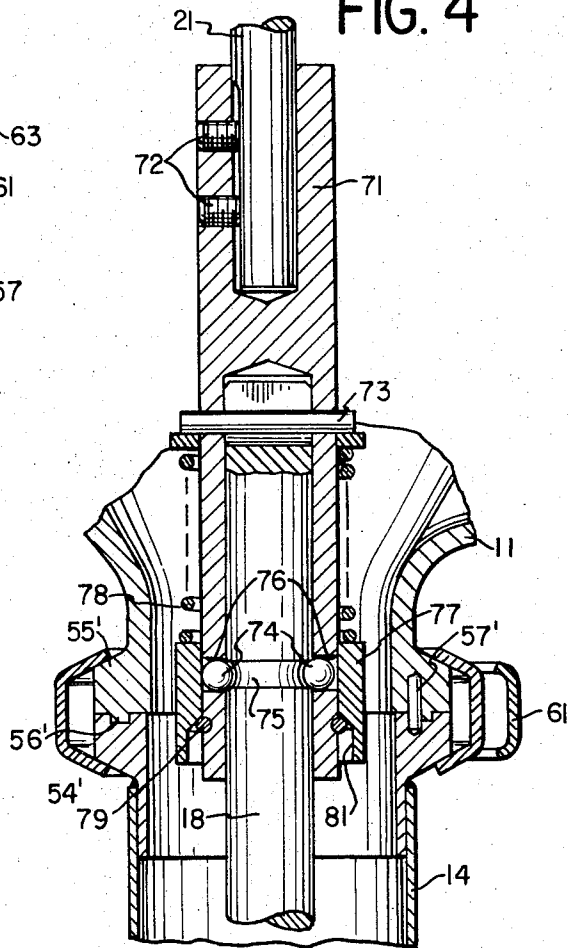


FIG. 6

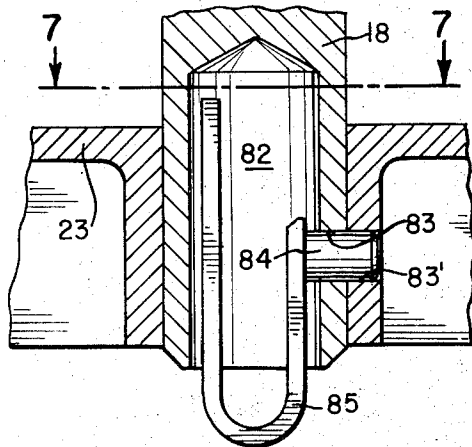


FIG. 8

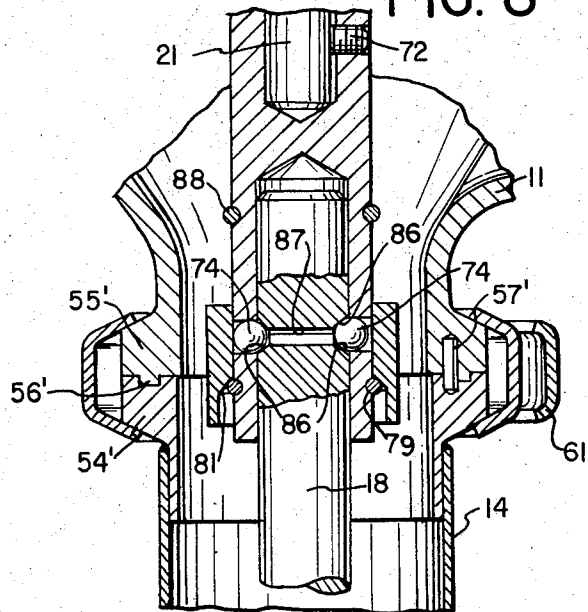


FIG. 7

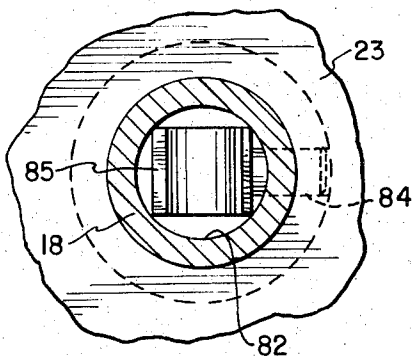


FIG. 11

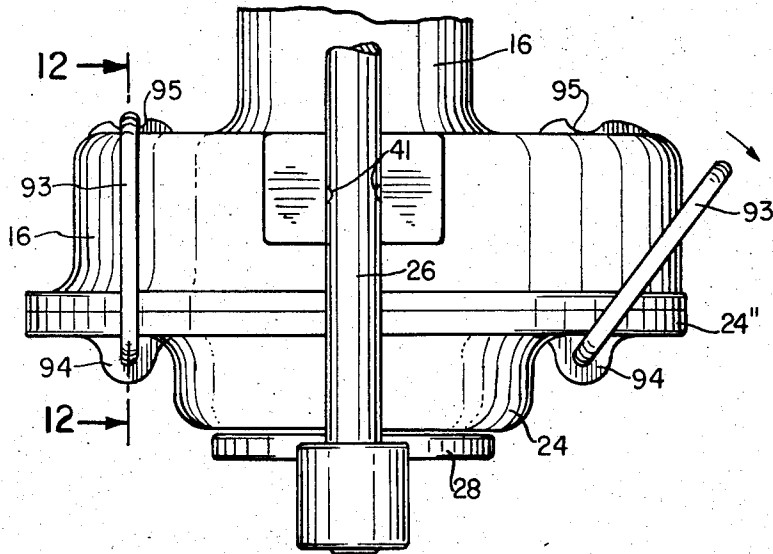
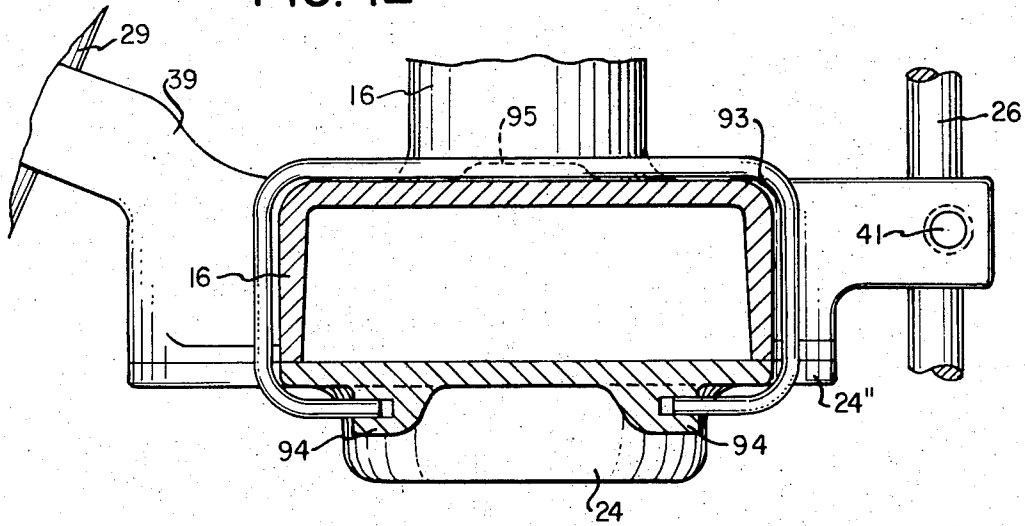


FIG. 12



HYDROTHERAPY AGITATOR WITH PROVISION FOR RAPID DISASSEMBLY AND REASSEMBLY

BACKGROUND OF THE INVENTION

Hydrotherapy agitators are known which include a suspension bracket with a motor mounted therein, a downwardly extending support tube attached to the bracket, an impeller housing attached to the bottom of the support tube, a drive shaft within the support tube connected to the motor shaft and an impeller within the impeller housing, and an apertured bottom cover for the impeller housing which admits water to the impeller. A bearing in the impeller housing supports the lower end of the drive shaft. An air tube is supported alongside the support tube by the suspension bracket and impeller housing, to aerate the water issuing from the impeller housing. A rotatable water control rod is supported alongside the support tube by the suspension bracket and impeller housing and carries a throttle plate at the lower end thereof which controls the amount of water entering the apertured bottom plate of the impeller housing.

Commonly the various parts are assembled at the factory in such a manner that considerable time and skill would be required to disassemble and reassemble the various component parts. In particular, the support tube must be sufficiently rigid to provide adequate support for the impeller housing, air tube and water control rod, and is commonly press fitted to the suspension bracket and impeller housing with the aid of orienting fixtures, and further secured with set screws. Other parts are commonly held in place by screws, retaining members, etc.

One use of hydrotherapy agitators is in the treatment of open wounds, lesions, etc. where sterilization of the parts normally immersed during use is required. Adequate sterilization of existing agitators is difficult and time-consuming, particularly the interior of the parts and bearing areas where microorganisms such as bacteria, staphylococcus, etc. may become lodged, and complete sterilization may be impractical.

The present invention is directed to the provision of means for rapidly disassembling and reassembling the parts of the agitator normally immersed during use, so that both external and internal surfaces may be conveniently and adequately sterilized, in a simple manner such that little mechanical skill is required and the operations can be performed manually without the need for tools and with little danger of loss of parts, yet without impairment of the rigidity and other operational characteristics of the apparatus.

BRIEF SUMMARY OF THE INVENTION

In accordance with the invention a pair of separable cooperating flanges are provided on the suspension bracket and top of the support tube, and another pair on the impeller housing and bottom of the support tube. Each pair of cooperating flanges includes means for establishing a predetermined concentric and angular relationship therebetween. Preferably a mating annular tongue and groove establishes concentricity, and a locating pin establishes the proper angular relationship. Each pair of flanges are held together by manually operable quick-acting clamp means, such as a spring override clamp. Thus the support tube and impeller housing are readily separable from the suspension

bracket and from each other, but form a strong rigid structure when assembled.

Manually operable means are provided for removably attaching the apertured bottom cover to the impeller housing, preferably by self-retained means such as self-retained thumb screws, wedge lugs or self-retained spring clips. Manually operable means removably attaches the impeller to the bottom of the drive shaft, preferably a spring-retained pin. Manually operable means removably attach the air tube and the water control rod to the impeller housing, respectively. Preferably spring clip means are employed. Advantageously the impeller housing has respective slotted sections for receiving the tube and the rod, and spring-pressed balls are mounted in respective slotted sections.

Advantageously the top of the drive shaft is removably attached to the motor shaft so that it also can be removed for sterilization. Preferably a spring-pressed collar and ball arrangement is employed for this purpose, as described hereinafter.

With this construction all parts normally immersed during use can readily be taken apart so that the interior as well as the exterior surfaces can be adequately sterilized, and then the parts conveniently reassembled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation, partly in cross-section, of a presently preferred embodiment of the invention;

FIG. 2 is a cross-section of the impeller housing taken along the line 2—2 of FIG. 1;

FIG. 3 is a detail of the arrangement for clamping together the support tube and impeller housing, taken along the line 3—3 of FIG. 1;

FIG. 4 is a detail of the arrangement for removably attaching the drive and motor shafts, and also the clamping of the support tube and suspension bracket, taken along the line 4—4 in FIG. 1;

FIG. 5 is a detail of the attachment of the impeller to the drive shaft, taken along the line 5—5 of FIG. 1;

FIG. 6 is a detail of an alternative means for attaching the impeller to the drive shaft;

FIG. 7 is a view taken along the line 7—7 of FIG. 6;

FIG. 8 is a detail of an alternative to the arrangement of FIG. 4;

FIG. 9 shows an alternative arrangement for removably attaching the bottom cover to the impeller housing;

FIG. 10 is a detail taken along the line 10—10 of FIG. 9;

FIG. 11 shows a further alternative for removably attaching the bottom cover; and

FIG. 12 is a view taken along the line 12—12 of FIG. 11.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Referring to FIG. 1, a suspension bracket 11 is provided with suitable means including tube 12 for mounting the agitator on the wall of a tank, etc. Motor 13 is mounted on bracket 11. A support tube 14 is removably clamped to bracket 11 at 15 and extends downwardly therefrom. An impeller housing 16 is removably clamped to the bottom of the support tube at 17. Drive shaft 18 is removably attached at 19 to the motor shaft 21, and is journaled in bearing 22 mounted in the im-

PELLER HOUSING. An impeller 23 is removably attached to the bottom of the drive shaft 18. A bottom cover 24 is removably attached to the impeller housing, and has a series of holes 25 for the entry of water.

A water control rod 26 alongside support tube 14 is rotatably mounted in the bracket 11 and the impeller housing 16. Handle 27 is attached to the rod near the top thereof, and a throttle plate 28 is attached at the bottom. By turning the rod, throttle 28 covers, or partially or wholly uncovers the holes 25, thereby controlling the flow of water into the impeller housing. An air tube alongside the support tube 14 is slidably mounted in bracket 11 at the top thereof, and removably attached at the bottom to the impeller housing.

In operation, motor 13 drives the impeller 23 through drive shaft 18 and a stream of water issues from the outlet 31 of the impeller housing. The flow of water is controlled by the position of vane 28. As the stream of water flows past the inclined lower end 32 of the air tube, a suction is produced which draws air through the tube to aerate the issuing stream. The degree of aeration can be controlled by a butterfly valve 33 in the tube, actuated by knob 34. Holes 35 admit water into tube 14 to lubricate bearing 22 during use. This overall operation is known and need not be described in further detail.

Considering now the means for rapidly disassembling and reassembling the parts of the agitator normally immersed during use, these will be described in the order of their disassembly. Control rod 26 and air tube 29 are held in place on the impeller housing 16 by respective spring clip structures 36, 37. As best seen in FIG. 2, extensions 38 and 39 of the impeller housing are slotted, and spring-pressed balls 41 are mounted in the sides of the slots to hold the respective rod and tube in place. Other types of spring clips could be employed if desired. However the ball structures are presently preferred since the slotted sections may be machined to fit the rod and tube, and the balls then engage the respective member just past the diameter thereof so that proper positioning is assured.

The upper end of rod 26 enters a bore 42 in the suspension bracket and bears against a spring-pressed disk 43. The inlet 44 of the bore has a slightly smaller diameter than disk 43 so that the disk is retained when the rod is removed. A collar 45 is affixed to the rod just above slotted section 38 to establish the proper position when the rod is in place. The rod can easily be removed by pulling its lower end out of the slot, as indicated in phantom, and then pulling it downward out of bore 42.

The upper end of air tube 29 slides into a hole in bracket 11, and a projection 46 establishes its proper position. The tube is removed by pulling it out of slotted section 39, as shown in phantom, and then downward.

As shown in FIGS. 1 and 2, bottom plate 24 is attached to the impeller housing by thumb screws 47. Three thumb screws are here shown, and are preferably asymmetrically located to avoid the possibility of improper orientation when attached by an unskilled technician. Advantageously the thumb screws are loosely retained in the bottom plate when it is removed, so that they cannot be lost, as by making the shank of the screw and hole in the plate of smaller diameter than the thread. The initial portion of the tapped holes in the housing may be untapped and slightly larger in diame-

ter than the screw thread, to facilitate quick insertion in proper position for tightening.

As shown in FIGS. 1 and 5, the impeller 23 is attached to the lower end of drive shaft 18 by a spring-retained pin 51. A hub 52 on the impeller has holes therethrough mating with a transverse bore in the shaft through which the pin is passed. Spring portion 51' of the pin engages in a groove 53 of the shaft. Thus the pin can be easily removed and reinserted, but establishes a firm driving connection when in place.

After the impeller has been removed, the impeller housing can be removed. As shown in FIGS. 1 and 3, the impeller housing 16 and the support tube 14 are provided with cooperating tapered flanges 54, 55, the latter being welded or otherwise affixed to the tube. Mating concentric tongue and groove 56 establishes the proper concentric relationship, and locating pin 57 establishes the proper angular relationship. A quick-acting clamp holds the flanges firmly together during use. In the specific embodiment the clamp is of known override type, and comprises two arcuate channeled clamping members 58, 58' hinged by a rectangular loop 59. Lever 61 carries a cylindrical member 62 adjustably held in place by screw 63. An elongated loop 64 is mounted at one end in member 62 and at the other end in an overturned lip 65 on clamping member 58. A curved lip 66 on the lever 61 interlocks with a curved lip 67 on clamping member 58'. With proper adjustment of screw 63, the inherent springiness of the clamp components holds the clamp securely in place.

FIGS. 1 and 3 show the clamp in clamping position. The channel members 58, 58' mate with the tapered sides of the flanges 54, 55 so that the flanges are firmly held together by the mating surfaces and the spring-pressure exerted on the channel members. By pulling out lever 61, lips 66, 67 disengage and the clamp can be removed. This allows the impeller housing 16 to be detached from support tube 14.

As shown in FIGS. 1 and 4, the upper end of tube 14 and the adjacent portion of the support bracket 11 are provided with similar tapered flanges 54', 55', a concentric tongue and groove 56' and pin 57', held together by a clamp in the same manner as described above. It will be noted that by establishing the proper concentric and angular relationships at both the top and bottom of the support tube, the impeller housing 16 is properly oriented with respect to the support bracket 11. Also, the flanges with clamps therearound form a strong supporting structure even though easily disassembled and reassembled. Index marks (not shown) may be placed on the flanges adjacent pins 57 and 57' to facilitate angular orientation during assembly.

After removing tube 14, the drive shaft 18 can be detached. The preferred attachment means is shown in FIGS. 1 and 4. A shaft coupler 71 is firmly attached to the motor shaft 21 by set screws 72. A bore in the coupler receives the upper end of drive shaft 18. A slot 70 in the upper end of the drive shaft engages with a cross pin 73 affixed in coupler 71 to form a driving connection. The shaft is held in place by a pair of balls 74 engaging in groove 75 of the shaft. The balls are freely mounted in holes 76 in the coupler 71. A collar 77 is biased by compression spring 78 to the position shown, and holds the balls in groove 75 so that the shaft cannot move longitudinally. Ring 79 on the coupler provides

a stop for the collar. The lower portion 77' of the collar has a larger inside diameter. Thus by manually pushing the collar upward, the balls 74 are free to move outward, thereby releasing the drive shaft. The inner ends of holes 76 are slightly smaller in diameter than the balls, so that the balls cannot fall out.

To reinsert the shaft, collar 77 is pushed upward and the shaft inserted until the slot therein engages pin 73. Index marks (not shown) may be placed on the shaft and coupler to facilitate orientation. The collar may be released during or after the insertion so that the balls are pressed into groove 75 when the shaft is fully inserted. A taper 81 facilitates the action.

With the parts disassembled as described above, they may be sterilized and then replaced in the reverse order.

Referring to FIGS. 6 and 7, an alternative means for removably attaching the impeller 23 to the drive shaft 18 is shown. The lower end of the shaft is counter-bored at 82, and matching holes 83, 83' bored in the wall of the counterbore and the hub of the impeller. Pin 84 is attached to folded spring 85. In the position shown, the pin is firmly held in place by the spring to form a driving connection. By pushing pin 84 slightly inward, the impeller may be pulled off the shaft, or pushed thereon.

FIG. 8 shows an alternative arrangement for removably attaching the top of the drive shaft 18 to the motor shaft 21. Instead of using a pin and slot for the driving connection, as shown in FIG. 4, the balls 74 enter recesses 86 in shaft 18. The recesses are conveniently formed by boring the shaft transversely at 87, and countersinking the ends of the bore to receive the balls. Collar 77 functions as in FIG. 4, but is here shown as dropping by gravity into the position shown. A ring 88 on coupling 71' limits the upward movement of the collar. The collar may be spring biased as in FIG. 4 if desired.

FIGS. 9 and 10 show an alternative means to that shown in FIG. 2 for attaching the bottom plate to the impeller housing. Here the bottom plate 24' has three overturned cam lugs 91 which mate with cam lugs 92 projecting from the bottom of the impeller housing 16. The mating surfaces are inclined at a small angle so that a small turn releases or attaches the bottom plate. Preferably the cam lugs are asymmetrically spaced around the plate, to facilitate proper orientation.

FIGS. 11 and 12 show a further alternative for attaching the bottom plate. Here spring loops 93 are rotatably mounted in lugs 94 on the bottom plate 24'. When attached, the spring loops engage in grooves 95 on the impeller housing, as shown at the left in FIG. 11. To remove the plate, the spring loops are pulled off as shown at the right in FIG. 11.

From the foregoing description it will be evident that all parts of the agitator normally immersed during use can easily be removed for sterilization. When taken apart, interior as well as exterior surfaces are exposed so that adequate sterilization is possible. Closely adjacent surfaces such as between the shaft and the bearing 22, and between the impeller hub and shaft, are wholly exposed for sterilization. After sterilization, the parts can be readily reassembled by simple manual operations.

The invention has been described in connection with a presently preferred embodiment and certain alternatives have been described. It will be understood that

other changes in the detailed design are possible within the spirit and scope of the invention.

I claim:

1. In a hydrotherapy agitator including a suspension bracket and a motor mounted thereon, a downwardly extending support tube attached to said bracket, an impeller housing attached at the bottom of said support tube, a drive shaft within said support tube connected at the top to the motor shaft and at the bottom to an impeller within said impeller housing, said impeller housing including a bearing for rotatably mounting said drive shaft near the lower end thereof, an apertured bottom cover for said impeller housing, an air tube alongside said support tube mounted on said bracket at the top thereof and attached to said impeller housing near the bottom thereof, and a rotatable water control rod alongside said support tube mounted on said bracket at the top thereof and mounted on said impeller housing near the bottom thereof, means for rapidly disassembling and reassembling parts of the agitator normally immersed during use which comprises

- a. a pair of separable cooperating flanges on said bracket and top of the support tube,
- b. a pair of separable cooperating flanges on said impeller housing and bottom of the support tube,
- c. each pair of flanges including means for establishing a predetermined concentric and angular relationship therebetween,
- d. manually operable quick-acting clamp means for removably holding each pair of said flanges firmly together,
- e. manually operable means for removably attaching said bottom cover to the impeller housing,
- f. manually operable means for removably attaching said impeller to the lower end of said drive shaft,

g. and manually operable means for removably attaching said air tube and said water control rod to said impeller housing, respectively.

2. Apparatus according to claim 1 in which each pair of said flanges has a concentric tongue and mating groove for establishing said concentric relationship, and a locating pin for establishing said angular relationship.

3. Apparatus according to claim 2 in which the upper and lower surfaces of each pair of flanges are tapered, and said quick-acting clamp means includes arcuate channeled members substantially mating with said tapered flanges and spring-pressed thereagainst.

4. Apparatus according to claim 1 including manually operable means for removably attaching the top of said drive shaft to said motor shaft.

5. Apparatus according to claim 4 in which said means for removably attaching said drive shaft to the motor shaft comprises groove means near the top of said drive shaft, a coupling member attached to the motor shaft, ball means carried by said coupling member for engaging said groove means of the drive shaft, and a spring-pressed collar carried by said coupling member and longitudinally movable thereon for engaging said ball means with said groove means in the spring-pressed position thereof and releasing the ball means when moved to the opposite position thereof.

6. Apparatus according to claim 1 in which said air tube and water control rod are each slidable into said suspension bracket, and including respective stop means for longitudinally locating said tube and rod in

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operative relationship with said bracket and impeller housing when in their respective attached conditions, said means for removably attaching said tube and rod to the impeller housing being respective spring clip means.

7. Apparatus according to claim 6 in which said impeller housing has respective slotted sections for re-

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ceiving said tube and said rod, and said respective spring clip means comprise spring-pressed balls mounted in respective slotted sections.

8. Apparatus according to claim 1 in which said means for removably attaching said impeller to the drive shaft comprises a spring-retained pin.

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