A fluid pump system has a housing having a housing cover removably connected to a housing base. A plurality of fluid pump assemblies are inside of the housing. Each fluid pump assembly has an electric motor operatively connected to a fluid pump. Each fluid pump has a fluid inlet extending through a wall of the housing to an exterior of the housing and a fluid outlet extending through the wall of the housing to the exterior of the housing. An electrical component inside of the housing is electrically connected to each electric motor. The electrical component has an electrical connector extending through a wall of the housing to connect to a source of electrical power. The fluid pump system can dispense three different fluids, such as two detergents and a fabric softener in a laundry machine.
LAUNDRY PUMP SCHEMATIC

120 VAC
60 HZ

T1
1. COM
2. (VOIDED)
3. MTR 1
4. MTR 2
5. MTR 3

T2
1. COM
2. CW
3. MTR 1 (DETERGENT)
4. CCW
5. MTR 2 (DETERGENT)

MTR 1, 2 & 3 = SYNCHRONOUS MOTOR, IMPEDANCE PROTECTED
T1 = .187 PITCH RIGHT ANGLE HEADER, 5 POS
T2 = .187 PITCH RIGHT ANGLE HEADER, 3 POS
C1 = 1.5 MFD, 350 V CAP

FIG. 16
FLUID PUMP SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation-in-part of co-pending application Ser. No. 11/197,381 filed Aug. 5, 2005, incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to fluid pump systems. In an embodiment, the present invention relates to a fluid pump system for laundry machines. The fluid pump system has a plurality of fluid pumps for dispensing fluids, for example, two detergents and a fabric softener. The invention also relates to peristaltic pumps. In an embodiment, a small peristaltic pump dispenses liquid detergent into a dish washing machine. In embodiments of the present invention the peristaltic pumps are snap-fit together.

[0004] 2. Discussion of the Prior Art

[0005] Peristaltic pumps are well known in the prior art and may be defined as pumps which produce pulse-like contractions that propel matter along inside a tube.

[0006] In FIG. 1, there is shown a prior art device.

[0007] Inside a casing 10, there is a pump 12 in which a triangular rotor 14 rotates to compress a flexible rubber tube 16 against a curved wall 30 at points A and B. These points A and B change along the length of the tube 16 as the rotor 14 rotates around its central axis 18. Three pins 20 hold three rollers 22 at tips X, Y, and Z of the rotor 14 while four screws 24 hold front and back portions of the casing 10 together. The tube 16 has an inlet suction branch 16C and an outlet delivery branch 16D. Arrows 1 and O indicate the direction of flow of liquid detergent into and out of the tube 16. A clear, hard plastic cover 26 with a tab 28 allows a user to view and to have access to the interior of the casing 10 in order to replace or repair any parts of the pump 12 and the rotor 14 which may break.

[0008] One disadvantage of this prior art device is that the constant vibration of an industrial washing machine in which it is used tends over time to cause the screws 24 to work loose from the casing 10, thus causing the pump 12 inside to fail. Also, the constant vibration causes the pins 20 holding the rollers 22 in the rotor 14 to work loose and push up against the cover 26 until the cover 26 pops off. Once again the pump 12 fails. Thus, it is a problem in the prior art to develop a peristaltic pump which is resistant to constant vibrations that eventually caused earlier devices to become loose and fail.

SUMMARY OF THE INVENTION

[0009] In an embodiment, the present invention can be summarized as a small screwless peristaltic pump which is resistant to constant vibrations caused by a machine to which it is attached so that the pump does not become loose and fall apart. In another embodiment, the present invention can be summarized as a fluid pump system having a plurality of fluid pumps inside of a housing. The fluid pump system can be used to dispense fluids, such as two detergents and a fabric softener, for a laundry machine.

[0010] An advantage of the present invention can be to hold the pump together without screws when the pump is used in low torque and low vibration operations.

[0011] Another advantage of the present invention can be to support a motor onto a rear casing portion of the housing.

[0012] Another advantage of the present invention can be to make the pump, its internal rollers and a flexible tube impervious to deleterious ingredients contained in liquid detergent.

[0013] Another advantage of the present invention can be that only a predetermined amount of the liquid detergent enters the pump because the synchronous motor, as controlled electronically, meters the detergent to prevent waste in the dish washing machine.

[0014] Yet another advantage of the present invention can be to provide new fluid pump systems.

[0015] Another advantage of the present invention can be to provide a fluid pump system having a plurality of fluid pumps for dispensing a plurality of fluids, for example two detergents and a fabric softener in a laundry machine.

[0016] Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the figures. The features and advantages may be desired, but are not necessarily required to practice the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention and its other advantages may be best understood by reference to the accompanying drawings and the subsequent detailed description of the preferred embodiments.

[0018] FIG. 1 is a front elevation view of a known prior art device.

[0019] FIG. 2 is an exploded front perspective view of a first embodiment of the invention.

[0020] FIG. 3 is an exploded front perspective view of a rotor and rollers inside the first embodiment.

[0021] FIG. 4 is a top end view of a portion of a casing of the first embodiment.

[0022] FIG. 5 is a front inside elevational view of a back portion of the casing of the first embodiment.

[0023] FIG. 6 is an assembled perspective view of the first embodiment.

[0024] FIG. 7 is an exploded rear perspective view of a second embodiment of the invention.

[0025] FIG. 8 is an exploded front perspective view of a rotor and rollers inside the second embodiment.

[0026] FIG. 9 is a perspective view of a fluid pump system according to the present invention.

[0027] FIG. 10 is a perspective view of the fluid pump system of FIG. 8 with a housing cover removed.

[0028] FIG. 11 is a top plan view of the fluid pump system of FIG. 10.

[0029] FIG. 12 is a perspective view of a housing base of the fluid pump system of FIG. 9.

[0030] FIG. 13 is a top plan view of the housing base of FIG. 12.

[0031] FIG. 14 is a bottom plan view of the housing base of FIG. 12.

[0032] FIG. 15 is a perspective view of a fluid outlet of the fluid pump system of FIG. 9.

[0033] FIG. 16 is an electrical schematic diagram of the fluid pump system of FIG. 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] There are at least two basic preferred embodiments of the peristaltic pump: a first embodiment for low torque and
low vibration operations; and a second embodiment for high torque and high vibration operations. An embodiment of the fluid pump system is described following the descriptions of the peristaltic pump.

[0035] In FIG. 2, the first embodiment is illustrated. There is a small plastic peristaltic pump 112 contained in a main housing which has a front casing portion 100 and a cover or a rear casing portion 110. The front casing portion 100 and the rear casing portion 110 are snap-fitted together in a manner described below. A bracket 164 attaches the main housing containing the pump 112 to a dish washing machine (not shown). An electrical plug 174 allows alternating current to be carried through wires 176 from an activator (not shown) when it is switched on by a user who desires to wash a load of dishes. Upon activation, an inlet suction branch 106 brings a predetermined amount of liquid detergent flowing from a reservoir (not shown) in a direction I into a flexible rubber U-shaped tube 116 held in place at an inlet to the pump 112 by a U-shaped inlet channel 104 integrally formed on a top surface of the front casing portion 100. Inside the pump 112, there is a plurality of plastic rollers 122 on tips X, Y and Z of a triangular plastic rotor 114 confined between the front casing portion 100 and the rear casing portion 110. The rollers 122 compress the flexible tube 116 at equally spaced intervals against an interior side of a curved wall 130. Although three rollers 122 are shown, a manufacturer may choose to use more or less rollers, for example, four or two rollers instead. Nevertheless, three rollers 122 are preferred. The rollers 122 are rolled along the flexible tube 116 as they are rotated by the rotor 114 which is turned by an output shaft 118 extending from a synchronous gear motor 132. Ears 166 project from opposite sides of the motor 132. Bosses 142 on an outer periphery of the front casing portion 100 extend through hollow cylindrical sleeves 144 into upper and lower holes in the ears 166 and are ultrasonically heated until they melt to spot weld the motor 132 to the rear casing portion 110.

[0036] As seen in FIG. 2, only a predetermined amount of the liquid detergent enters the pump 112 because the synchronous motor 132 meters the detergent to prevent waste in the dish washing machine. The amount of liquid is predetermined by the signal sent to the motor 132 which then turns its shaft 118 and the rotor 114 mounted thereon a predetermined number of times.

[0037] The motor 132 is rated at 120 volts of alternating current (AC) at 60 hertz (Hz). The rated current is 0.05 amps and the rated speed is 20 revolutions per minute (rpm), plus or minus 10%.

[0038] Pulse-like contractions are produced inside the flexible tube 116. These contractions propel the liquid detergent in spurts along the inside of the flexible tube 116 held in place at an outlet from the pump 112 by a U-shaped outlet channel 108 until the liquid detergent is dispensed by being squirited out of an outlet delivery branch 160 in a direction O into the dish washing machine (not shown). The U-shaped outlet channel 108 is formed integrally on a top surface of the front casing portion 100.

[0039] Instead of the metal pins used in the prior art device shown in FIG. 1, the pump 112 in FIG. 2 is secured together against the constant vibrations of the dish washing machine by three types of plastic devices for snap-fitting the front casing portion 100 together with the cover or rear casing portion 110. The first type is a C-shaped groove (not shown) in a circular recess 135 into which a C-shaped tongue 136 is inserted. In an alternate embodiment, at least a pair of straight grooves and a mating pair of straight tongues 136 may be used. The second type of plastic device is a trio of square, open-ended boxes 138 into which a trio of springy, plastic clip pairs 140 are inserted. At least two of these boxes 138 and clip pairs 140 are needed for the front casing portion 100 and the rear casing portion 110 to be snap-fitted together. The third type of plastic device is the pair of bosses 142 on each side of the front casing portion 100. The bosses 142 are inserted through the pair of hollow cylindrical sleeves 144. In an alternate embodiment, only one boss 142 and one sleeve 144 may be used. Note that the groove in the recess 135, the boxes 138 and the bosses 142 are positioned on an outer periphery of the front casing portion 100 while the tongue 136, the clip pairs 140 and the sleeves 144 are positioned on an outer periphery of an interior wall of the rear casing portion 110. However, in an alternate embodiment, the groove in the recess 135, the boxes 138 and the bosses 142 may be positioned on the rear casing portion 110 while the tongue 136, the clip pairs 140 and the sleeves 144 may be positioned on the front casing portion 100.

[0040] In FIG. 3, the triangular rotor 114 for low torque and low vibration operations is illustrated. The rotor 114 and its rollers 122 are exploded apart to show how they are connected together. A front face 146 of the rotor 114 has formed integrally on its inner side three stepped male inserts 148. A rear face 150 has formed integrally on its inner side three aligned cylindrical barrels 152 with which the male inserts 148 mate. Each roller 122 has a cylindrical bore 156 through its center along its longitudinal axis 158. Note that a dowel 154 is mounted inside the rotor 114 and aligns the plurality of mated inserts 148 and barrels 152 around a central D-shaped bore 172. A single central large cylindrical barrel 170 carries the dowel 154 and surrounds the D-shaped bore 172 through which the shaft 118 of FIG. 2 with its D-shaped cross section passes in order to rotate the rotor 114.

[0041] In FIG. 3, the rotor 114 is assembled in the following manner. First, the rollers 122 are slipped onto the barrels 152. Second, the inserts 148 are plugged into the bores 156 of the barrels 152 so that the mated inserts 148 and the barrels 152 carry the rollers 122. Simultaneously, the dowel 154 is inserted into a bore (not shown) made in the inner side of the front face 146. The dowel 154 with its mating hole (not shown) are designed to make a foolproof orientation to ensure that the center hole (where the motor shaft gets inserted) with the D flat on the two halves, part 150 and part 146 are always on the same plane. The two halves, part 146 and part 150 are then pressed together with an interference fit to complete the assembly. In another embodiment, an ultrasonic welding tool (not shown) can be used to fuse the inserts and the barrels together. However, care should be taken so that too much heat is not applied in order to prevent the rollers 122 on the barrels 152 from being deformed.

[0042] In FIG. 4, there is shown a top end view of the front casing portion 100 which functions as part of the main housing for both the first and second embodiments. The U-shaped inlet channel 164 secures an entrance for the flexible tube (not
shown) while the U-shaped outlet channel 108 secures an exit for the flexible tube. A top of one box 138 is also seen. In the first embodiment for low torque and low vibration operations, a pair of bosses 142 on each side, of which only the top boss 142 is seen, is insertable through the pair of hollow cylindrical sleeves 144 on each side shown in FIG. 5 on the interior wall of the front casing portion 110. In FIG. 4, the bracket 164 attaches the front casing portion 100 to the dish washing machine (not shown). The front casing portion 100 is secured to the rear casing portion 110 of FIG. 5 by the trio of clip pairs 140 which are inserted into the boxes 138 of FIG. 4, of which only one box 138 is shown in FIG. 4. Likewise, in FIG. 5, the circular tongue 136 arranged on the interior wall of the rear casing portion 110 is inserted into the groove (not shown) in FIG. 4, but see the back of the groove in the recess 135 illustrated in FIG. 2. In FIG. 5, an opening 162 through the center of the rear casing portion 110 allows the output shaft 118 seen in FIG. 2 to extend therethrough to engage with and drive the rotor 114 of FIG. 3.

[0043] In FIG. 6, the pump 112 is shown to be assembled with the motor 132. The operation of the pump 112 and the motor 132 in this first embodiment may be understood by following the path of movement of the liquid therethrough. Note that the liquid may be other than a detergent. Initially, the motor 132 is turned on when it receives a signal through the wires 176 of the plug 174 to meter the flow of liquid in the direction I into the inlet suction branch 106 which leads to the flexible tube 116 that is held securely by the U-shaped inlet channel 104. To prevent waste of liquid detergent in the dish washing machine, the signal energizes the motor 132 to turn its shaft 118 seen in FIG. 2 a predetermined number of times depending upon whether a small, medium or large amount of detergent is needed to clean the load in the dish washing machine. A predetermined amount of the liquid then enters the pump 112 where the rollers 122 of FIGS. 2 and 3 intermittently compress the flexible tube 116 so that the even flow of the liquid is converted into pulsating liquid. These liquid pulses exit the pump 112 through the flexible tube 116 that is held securely by the U-shaped outlet channel 108. The liquid is then squirted out of the outlet delivery branch 160 in the direction O into the dish washing machine (not shown). While the rotor 114 of FIGS. 2 and 3 is driven by the motor 132, the pump 112 is seen in FIG. 6 to be held together by the front casing portion 100 and the rear casing portion 110 which are secured by the two clip pairs 140 in the two boxes 138. Another clip pair 140 in its box 138 is hidden from view. The pairs of sleeves 144 on the rear casing portion 110 and the pairs of bosses 142 on the front casing portion 100 stuck therein are also hidden from view. In this first embodiment for low torque and low vibration operations, the grooves in the recess 135 and its mating tongue 136 of FIG. 2 are not illustrated in FIG. 6 because they are hidden inside the front casing portion 100 and the rear casing portion 110, respectively. The bracket 164 is shown for attaching the entire assembly to the dish washing machine (not shown).

[0044] Note in FIG. 2 that there are no screws holding the pump 112 together with its housing which includes the front casing portion 100 and the rear casing portion 110. Also, in this first embodiment for low torque and low vibration operations, there are no screws supporting the motor 132 onto the exterior wall of the rear casing portion 110. Note further that the pump 112, the rollers 122 and the tube 116 are all impervious to deleterious ingredients contained in the liquid detergent.

[0045] In FIG. 7, the second embodiment for high torque and high vibration operations is illustrated. The pump 112 is contained in the main housing which has the front casing portion 100 and the cover or rear casing portion 110. The front casing portion 100 and the rear casing portion 110 are snap-fitted together in the manner described below. The bracket 164 is formed integrally with a side of the front casing portion 100 and attaches the main housing containing the pump 112 to the dish washing machine (not shown). The electrical plug 174 allows alternating current to be carried through the wires 176 from the activator (not shown) when it is switched on by a user. Upon activation, the inlet suction branch 106 brings a predetermined amount of liquid detergent flowing from a reservoir (not shown) in the direction I into the flexible tube 116 held in place at the inlet to the pump 112 by the U-shaped channel 104 integrally formed on the top surface of the front casing portion 100. Inside the pump 112, there is a plurality of rollers 122 on tips X, Y and Z of the rotor 114 confined between the front casing portion 100 and the rear casing portion 110. The rollers 122 compress the flexible tube 116 at equally spaced intervals against the interior side of the curved wall 130. The rollers 122 are rolled along the flexible tube 116 as they are rotated by the rotor 114 which is turned by the output shaft 118 (not shown but see FIG. 2) extending from the motor 132. Ears 166 of which only one is seen in FIG. 7, project from opposite sides of the motor 132. Screws 168 are inserted into upper holes in the ears 166, extend through the upper sleeves 144 on the rear casing portion 110 and pass through holes 178 in the front casing portion 100 where the screws 168 are secured at their ends by bolts 182 of which only one is shown. The bosses 142 extend from the front casing portion 100 through the lower sleeves 144 into the lower holes in the ears 166 and are ultrasonically heated until they melt to spot weld the motor 132 to the rear casing portion 110. Of course, in an alternate embodiment, the screws 168 may be inserted into the lower holes in the ears 166 and the bosses 142 may be extended through the upper holes in the ears 166 to achieve the same result. Note that this combination of screws 168 and bosses 142 is intended for high torque and high vibration operations.

[0046] Pulse-like contractions are produced inside the flexible tube 116 as the rotor 114 rotates the rollers 122 along the curved wall 130 to compress the tube 116. These contractions propel the liquid detergent in spurts along the inside of the tube 116 which is held in place at the outlet from the pump 112 by the U-shaped channel 108 until the liquid detergent is dispensed by being squirted out of the delivery branch 160 in the direction O into the dish washing machine (not shown). The channel 108 is formed integrally on a top surface of the front casing portion 100.

[0047] Instead of the metal pins used in the prior art device shown in FIG. 1, the pump 112 in FIG. 7 is secured together against the constant vibrations of the dish washing machine by three types of plastic devices for snap-fitting the front casing portion 100 together with the cover or rear casing portion 110. The first type is the C-shaped groove 134 into which the C-shaped tongue 136 is inserted. The tongue 136 is not shown in FIG. 7, but see FIG. 10. As an alternate embodiment, at least a pair of straight grooves 134 and a mating pair of straight tongues 136 may be used. The second type of plastic device is the trio of square boxes 138 into which a trio of springy clip pairs 140 are inserted. Only one pair of the clips 140 is seen in FIG. 7. At least two of these boxes 138 and clip pairs 140 are needed for the front casing portion 100 and
the rear casing portion 110 to be snap-fitted together. The third type of plastic device is the pair of bosses 142, one on each side of the front casing portion 100. The bosses 142 are inserted through the lower sleeves 144 into the lower ears 166 on the motor 132. Note that the groove 134, the boxes 138 and the bosses 142 are positioned on an outer periphery of the front casing portion 100 while the tongue 136 (not shown in FIG. 7 but see FIG. 2), the clip pairs 140 and the sleeves 144 are positioned on an outer periphery of an interior wall of the rear casing portion 110. However, in an alternate embodiment, the groove 134, the boxes 138 and the bosses 142 may be positioned on the rear casing portion while the tongue 136 of FIG. 2, the clip pairs 140 and the sleeves 144 may be positioned on the front casing portion 100. An ultrasonic welding rod (not shown) is applied to three areas on the exterior wall of the rear casing portion 110 where the bosses 142 are inserted through the lower sleeves 144 into the lower holes in the ears 166 in order to heat and melt each boss 142 into its aligned lower sleeve 144 and lower hole of the ear 166 so that the boss 142, the sleeve 144 and the ear 166 are fused together. Thus, the pump 112 is not jarred apart by the constant vibrations caused by the dish washing machine.

In this second embodiment shown in FIG. 7, there is a skirt 180 at least partially surrounding the sleeves 144 on each side of the rear casing portion 110 to form a recessed area into which the ears 166 may fit so as to prevent wobbling of the motor 132 when it is activated. There are also skirts 180 in the first embodiment for low torque and low vibration operations. However, the skirts 180 are not seen in the first embodiment because FIG. 2 is a front perspective view which hides the skirts 180.

In FIG. 8, the triangular rotor 114 for high torque and high vibration operations is illustrated. Three T-shaped supports 184 reinforce the rotor 114 against high torque and high vibrations. In the first embodiment shown in FIG. 3 for low torque and low vibration operations, there are no T-shaped supports 184 reinforcing the rotor 114.

In FIG. 8, the rotor 114 and its rollers 122 are exploded apart to show how they are connected together. The front face 146 of the rotor 114 has formed integrally on its inner side three stepped male inserts 148. The rear face 150 has formed integrally on its inner side three aligned cylindrical bore 152 with which the male inserts 148 mate. Each roller 122 has a cylindrical bore 156 through its center along its longitudinal axis 158. The dowel 154 is mounted inside the rotor 114 and aligns the plurality of male inserts 148 and barrels 152 around the central D-shaped bore 172. The single central large cylindrical barrel 170 carries the dowel 154 and surrounds the D-shaped bore 172 through which the shaft 118 of FIG. 2 with its D-shaped cross section passes in order to rotate the rotor 114.

In FIG. 8, the rotor 114 is assembled in the following manner. First, the rollers 122 are slipped onto the barrels 152. Second, the inserts 148 are plugged into the bores 156 of the barrels 152 so that the mated inserts 148 and the barrels 152 carry the rollers 122. Simultaneously, the dowel 154 is inserted into a bore (not shown) made in the inner side of the front face 146. The dowel 154 with its mating hole (not shown) are designed to make a foolproof orientation to ensure that the center hole (where the motor shaft gets inserted) with the D flat on the two halves, part 150 and part 146 are always on the same plane. The two halves, part 146 and part 150 are then pressed together with an interference fit to complete the assembly. In another embodiment, an ultrasonic welding tool (not shown) can be used to fuse the inserts and the barrels together. However, care should be taken so that too much heat is not applied in order to prevent the rollers 122 on the barrels 152 from being deformed.

Referring to FIGS. 9-16 an embodiment of a fluid pump system according to the present will now be described. The illustrated embodiment of the fluid pump system will be described in terms of a fluid pump system for a laundry machine. However, the present invention is not limited to laundry machines.

Referring to FIG. 9, the fluid pump system 200 has a housing 202. The housing 202 has a housing cover 204 removably connected to a housing base 206 by a pair of screws 208. Only the right side screw 206 is shown and the left side also has a screw 208 which is not shown. The housing 202 is generally closed on all sides and has fluid and electrical connections through walls of the housing 202 which are described below. The fluid pump system 200 can be easily mounted inside of a laundry machine and can dispense three different fluids, such as two different detergents and a fabric softener.

Referring also to FIGS. 10 and 11 in which the housing cover 204 has been removed, the fluid pump system 200 has three fluid pump assemblies 210, 212, 214 inside of the housing 202. The fluid pump assemblies 210, 212, 214 can be peristaltic pumps as described above or other fluid pumps if desired. The first peristaltic fluid pump assembly 210 has a flexible tube 216 and a fluid inlet 218 and a fluid outlet 220. The fluid inlet 218 and the fluid outlet 220 extend through a wall 222 of the housing base 206 to an exterior or the housing 202. The fluid inlet 218 and the fluid outlet 220 are shown as hose barb connections, but can be any suitable fluid connections as desired. The second peristaltic fluid pump assembly 212 also has a flexible tube 224 and a fluid inlet 226 and a fluid outlet 228. Similarly, the third peristaltic fluid pump assembly 214 also has a flexible tube 230 and a fluid inlet 232 and a fluid outlet 234. The fluid inlets 226 and 232 and the fluid outlets 228 and 234 also extend through the wall 222, or another wall, of the housing base 206 to the exterior of the housing 202. The fluid inlets 226 and 228 and the fluid outlets 228 and 234 are also shown as hose barb connections, but can be any suitable fluid connections as desired. Wire ties 236 or other fasteners can be used to secure the flexible tubes 216, 224, 230 to their respective fluid inlets 218, 226, 232 and fluid outlets 220, 228, 234. The fluid outlets 220, 228, 234 are further described below with reference to FIG. 15.

Each one of the three fluid inlets 218, 226, 232 can be fluidly connected to a separate source of fluid (not shown). For example, the fluid inlet 218 for the first fluid pump assembly can be connected to a first source of detergent, the fluid inlet 226 for the second fluid pump assembly can be connected to a second source of detergent, and the fluid inlet 232 can be connected to a source of fabric softener in a laundry machine. The fluid outlets 220, 228, 234 can be fluidly connected to the washing compartment in the laundry machine to dispense the detergents and fabric softener to wash soiled articles.
Referring also to FIGS. 12-14, further details of the housing base 206 are shown. The housing base 206 has first, second and third fluid pump mounting locations 242, 244, 246. The first fluid pump assembly 210 is mounted to the housing base 206 at the first fluid pump mounting location 242. Similarly, the second and third fluid pump assembly 212, 214 are mounted to the housing base at the second and third fluid pump mounting locations 244, 246, respectively. Screws 248 (FIGS. 10 and 11) can be used to mount the fluid pump assemblies 210, 212, 214 at their respective fluid pump mounting locations 242, 244, 246. The first fluid pump assembly 210 is mounted to the first fluid pump mounting location 242 by placing the fluid pump 240 in the first fluid pump space 242 and then securing it in place with screws 248. The motor 238 extending in a direction away from the housing base 206, i.e. an upward vertical direction. The motor 238 is positioned vertically above the fluid pump 240. The fluid pump 240 is vertically below the motor 238, if the fluid pump 240 leaks fluid, the leaking fluid will drip or flow downward and not contact the electrical motor 238. Referring to FIGS. 11-13, two screws 248 extend through mounting tabs 250 and 252 of the fluid pump 240 and into screw holes 254 and 256 to secure the first fluid pump assembly 210 to the first fluid pump mounting location 242 of the housing base 206. The second and third fluid pump assemblies 212, 214 are similarly mounted to the second and third fluid pump mounting locations 244, 246, respectively, of the housing base 206. As can be seen in FIG. 11, adjacent mounting tabs 250, 252 have corresponding contours or shapes that allow adjacent fluid pump assemblies to be nested or positioned close together. This allows for a more compact fluid pump system 200.

Referring to FIGS. 11-13, the housing base 206 has a fluid collection area 258 adjacent the fluid pump mounting locations 242, 244, 246. The fluid collection area 258 can collect fluids, if any, that leak from the fluid pump assemblies 210, 212, 214. A plurality of drain holes 260 through a wall 262 of the housing base 206 allows fluid in the fluid collection area 258 to drain from the fluid pump system 200.

The fluid outlet 220 of FIGS. 9-11 for the first peristaltic fluid pump assembly 210 is shown in greater detail in FIG. 15. The fluid outlet 220 in FIGS. 228, 234 for the second and third peristaltic fluid pump assemblies, respectively, are the same as the fluid outlet 220. The fluid outlet 220 has a 90° elbow shape. Hose barbs 264, 266 are provided opposite ends of the fluid outlet 220 for fluid connection to flexible tubes. The fluid outlet 220 has a slide guide 268 for guiding the fluid outlet 220 in a back and forth sliding movement. The slide guide 268 has a first guide slot 270 in a first wall 272. A second guide slot 274 is provided in the second wall 276 if desired.

Referring also to FIGS. 12 and 13, the housing base 206 has recesses 278, 280, 282, 284, 286, 288 on the outside of the wall 222. The housing base 206 also has tabs 290, 292, 294 projecting from the wall 222 adjacent the recesses 278, 282, 286, respectively. Referring also to FIGS. 9-11, the fluid outlet 220 is shown positioned in the housing base 206 with the hose barb 266 fluidly connected to the flexible tube 216. The hose barb 266 is located in the recess 278 of the wall 222 of the housing base 206. The tab 290 is positioned in the first guide slot 270 (FIG. 15) of the first wall 272. Accordingly, the first wall 272 of the fluid outlet 220 is resting on and supported by the tab 290. Referring to FIG. 11, when the first peristaltic fluid pump assembly 210 operates, the peristaltic fluid pump 240 rotates counter-clockwise as viewed in FIG. 11. Operation of the peristaltic fluid pump 240 may tend to stretch the flexible tube 216 away from the peristaltic fluid pump 240. The stretching flexible tube 216 pushes the fluid outlet 220 away from the peristaltic fluid pump 240. The fluid outlet 220 slides on the tab 290 via the slide guide 268 (FIG. 15). More specifically, the first guide notch 270 in the first wall 272 of the fluid outlet 220 slides on the tab 290. As the flexible tube 216 retracts as it slides back on the tab 290. Accordingly, the fluid outlet 220 is free to slide back and forth as the flexible tube 216 stretches and retracts. The free sliding movement of the flexible tube 216 and the fluid outlet 220 can prolong the operational life of the flexible tube 216 and reduce failure of an otherwise constrained flexible tube 216.

Referring to FIG. 15, the second guide notch 274 in the second wall 276 of the fluid outlet 220 does not slide on the tab 290 because the second wall 276 would stop the sliding movement of the fluid outlet 220 when, and if, the second wall 276 contacts the inside surface of the wall 222 of the housing base 206 (FIG. 11). Thus, the second guide notch 274 is not needed for the slide guide 268. However, the tab 290 could be extended from the wall 222 to the inside of the housing base 206 such that the second guide notch 274 also slides on the tab 290. Also, structures allowing movement of the fluid outlet 220 other than the structures illustrated and described herein can be used with the present invention. The fluid outlets 228, 234 operate the same as the fluid outlet 220 described above. Referring to FIGS. 11 and 12, the fluid inlets 218, 226, 232 have walls positioned in the recesses 280, 284, 288, respectively, and are constrained in their positions and do not slide back and forth. Alternatively, the fluid inlets 218, 226, 232 and be configured to slide back and forth if desired.

Referring to FIGS. 10 and 11, the fluid pump system 200 has an electrical component 296 inside of the housing 202. The electrical component 296 is electrically connected to the three electric motors 238 to supply electrical power to the electrical motors 238. The electrical component 296 can be a PC board. The electrical component 296 is mounted to the housing base 206 by sliding the PC board into a slot 298 in a projection 300. Referring also to FIG. 9, the electrical component 296 has an electrical connector 302 extending through a wall 204 of the housing 202 to the exterior of the housing 206. The electrical connector 302 can be connected to an electrical power source to supply electrical power to the fluid pump assemblies 210, 212, 214 to pump fluids as desired. Referring to FIGS. 10-12, the projection 300 for the electrical component 296 has a cut-out 306 to avoid interference with the fluid outlet 234 when the fluid outlet 234 slides back and forth.

FIG. 16 shows an example of electrical schematic diagram of the fluid pump system 200. The electrical component of FIGS. 9-11 described above can be a PC board 308 of FIG. 15. The PC board 308 has 5 position header T1 which can be the electrical connector 302 of FIGS. 9-11 described above. The header T1 can be connected to an electrical circuit 310 external to the fluid pump system 200 to supply electrical power to three pump motors MTR 1, MTR 2, MTR 3. The PC board 308 also has three preset headers T2, T2, T2. Each one of the headers T2 is wired to one of the pump motors MTR 1, MTR 2, MTR 3. Position 1 of the header T1 is a common lead which is connected to position 2 of the header T2 connected to the MTR 1 and to position 2 of the header T2 connected to the MTR 2 and to position 2 of the header T2 connected to the MTR 3. Position 2 of the header T1 is not
used. Position 3 of the header T1 is connected to position 3 of the header T2 connected to the MTR 1. Position 4 of the header T1 is connected to position 3 of the header T2 connected to the MTR 2. Position 5 of the header T1 is connected to position 3 of the header T2 connected to the MTR 3. A capacitor C1 is provided between position 1 and position 2 of each one of the headers T2, T2, T2 is not used.

[0064] The external electrical circuit 310 can be a controller of a laundry machine, for example. The external electrical circuit 310 selectively supplies power to the appropriate positions 1-5 of the header T1. The electrical power is then supplied to the positions 1-2 of the desired header T2, T2, T2 to operate the desired pump motor MTR 1, MTR 2, MTR 3. Electrical power is supplied to positions 2 and 3 of header T2 connected to the MTR 1 drives the MTR 1 clockwise CW when facing the motor shaft. Similarly, electrical power supplied to positions 2 and 3 of header T2 connected to the MTR 2 drives the MTR 2 clockwise CW when facing the motor shaft, and electrical power supplied to positions 2 and 3 of header T2 connected to the MTR 3 drives the MTR 3 clockwise CW when facing the motor shaft. The pump motor MTR 1, MTR 2, MTR 3 receiving the power operatively drives its fluid pump to pump fluid. In a laundry machine application, the pump motor MTR 1 may dispense a first detergent, the pump motor MTR 2 may dispense a second detergent, and the pump motor MTR 3 may dispense a fabric softener. The position 3 of the headers T2, T2, T2 could be used to drive the MTR 3 clockwise CW when facing the motor shafts if desired. However, in a laundry machine application reverse operation of the fluid pumps by driving the motors MTR 1, MTR 2, MTR 3 counterclockwise is not needed.

[0065] Referring to FIGS. 11 and 13, the fluid pump system 200 can be easily mounted to, for example, a laundry machine. The housing base 206 has a mounting tab 312 with mounting holes 314. Screws through the mounting holes 314 can be used to mount the fluid pump system 200 to a desired location. Of course, any other suitable structure can be used to mount the fluid pump system.

[0066] It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

The invention is claimed as follows:

1. A fluid pump system comprising:
a housing having a housing cover removably connected to a housing base;
a plurality of fluid pump assemblies inside the housing, each fluid pump assembly having an electric motor operatively connected to a fluid pump;
each fluid pump having a fluid inlet extending through a wall of the housing to an exterior of the housing and a fluid outlet extending through the wall of the housing to the exterior of the housing; and
an electrical component inside of the housing and electrically connected to each electric motor, the electrical component having an electrical connector extending through a wall of the housing to the exterior of the housing.
2. The fluid pump system of claim 1, wherein the housing base has a plurality of fluid pump mounting locations inside of the housing;
the fluid pump of each fluid pump assembly is mounted to the base at one of the fluid pump mounting locations; and
the electric motor of each fluid pump assembly is positioned vertically above the fluid pump.
3. The fluid pump system of claim 1, wherein the electrical component is a circuit board having a common lead electrically connected to all of the electric motors and having separate power leads each power lead electrically connected to one electrical motor.
4. The fluid pump system of claim 1, wherein each fluid pump is a peristaltic pump, comprising:
a front casing portion;
a rear casing portion;
a plurality of open-ended boxes on one of the front and rear casing portions;
a plurality of spring clip pairs on the other of the front and rear portions, each one of the spring clip pairs being snap-fitted with a corresponding one of the open-ended boxes;
a rotor confined between the front casing portion and the rear casing portion, the rotor having a triangular shaped front face having three tips and a triangular shaped rear face having three tips, each tip of the front face aligned with a corresponding tip of the rear face, the rotor having a roller mounted at each aligned front and rear face tip; and
a flexible tube compressed by the rollers.
5. The fluid pump system of claim 4, further comprising:
a tongue on one of the front and rear casing portions and a mating recess in the other one of the front and rear casing portions, the tongue extending into the recess and forming a seal.
6. The fluid pump system of claim 4, further comprising:
a plurality of mated inserts and barrels formed integrally on the rotor and carrying the rollers.
7. The fluid pump system of claim 6, further comprising:
a dowel mounted inside the rotor and inserted into a bore such that the plurality of mated inserts and barrels are aligned with each other.
8. The fluid pump system of claim 4, further comprising:
a reinforcement T-shaped support on at least one of the front and rear faces of the rotor.
9. The fluid pump system of claim 4, further comprising:
a barrel having a motor shaft bore on one of the front and rear faces of the rotor;
a first support reinforcement portion extending from the barrel in a first direction and being connected to the one of the front and rear faces; and
a second support reinforcement portion extending from the first support reinforcement portion in a second direction and being connected to the one of the front and rear faces.
10. The fluid pump system of claim 9, wherein the first and second support reinforcement portions form a generally T-shape.
11. The fluid pump system of claim 4, wherein each fluid pump is a peristaltic pump, comprising:
a front casing portion;
a rear casing portion;
a rotor positioned between the front casing portion and the rear casing portion and having a plurality of rollers;
a plurality of spaced-apart open-ended boxes on one of the front and rear casing portions;
a plurality of corresponding spaced-apart spring clip pairs on the other of the front and rear portions, each one of the spring clip pairs snap-fitted with a corresponding one of the open-ended boxes;
an elongated tongue extending longitudinally along one of the front and rear casing portions; and
an elongated recess extending longitudinally along the other one of the front and rear casing portions;
wherein the elongated tongue extends into the elongated recess forming a seal.

12. The fluid pump system of claim 1, wherein the housing base has a fluid drain passage through a wall of the housing for allowing fluid leaking from a pump assembly to drain from inside of the housing to outside of the housing.

13. The fluid pump system of claim 1, wherein the fluid outlet is slidably mounted to the housing and is slidable relative to the fluid pump.

14. The fluid pump system of claim 1, wherein the fluid outlet has a guide notch and the fluid pump system further comprises a tab positioned in the guide notch;
wherein the fluid outlet slides back and forth along the tab.

15. A laundry machine fluid pump system, comprising:
a housing having a housing cover removably connected to a housing base;
a plurality of fluid pump assemblies inside of the housing, each fluid pump assembly having an electric motor operatively connected to a fluid pump;
each fluid pump having a fluid inlet extending through a wall of the housing to an exterior of the housing for fluid connection to a source of fluid;
each fluid pump having a fluid outlet extending through the wall of the housing to the exterior of the housing for supplying fluid to a wash compartment of the laundry machine; and
an electrical component inside of the housing and electrically connected to each electric motor, the electrical component having an electrical connector extending through a wall of the housing to the exterior of the housing for connection to a source of electrical power in the laundry machine.

16. The laundry machine fluid pump system of claim 15, wherein the plurality of fluid pump assemblies comprises a first fluid pump assembly for pumping a first detergent, a second fluid pump assembly for pumping a second detergent, and a third fluid pump assembly for pumping a fabric softener.

17. The laundry machine fluid pump system of claim 15, wherein each fluid pump is a peristaltic pump, comprising:
a front casing portion;
a rear casing portion;
a plurality of open-ended boxes on one of the front and rear casing portions;
a plurality of spring clip pairs on the other of the front and rear portions, each one of the spring clip pairs being snap-fitted with a corresponding one of the open-ended boxes;
a rotor confined between the front casing portion and the rear casing portion, the rotor having a triangular shaped front face having three tips and a triangular shaped rear face having three tips, each tip of the front face aligned with a corresponding tip of the rear face, the rotor having a roller mounted at each aligned front and rear face tips; and
a flexible tube compressed by the rollers.

18. The laundry machine fluid pump system of claim 15, wherein the fluid outlet is slidably mounted to the housing and is slidable relative to the fluid pump.

19. The laundry machine fluid pump system of claim 15, wherein the fluid outlet has a guide notch and the fluid pump system further comprises a tab positioned in the guide notch;
wherein the fluid outlet slides back and forth along the tab.

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