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54 **Self-cleaning device for hydro-massage appliances.**

57 A device for self-cleaning of a hydromassage appliance wherein the centrifugal hydro-massage pump has its suction port connected to the drainage hole of the bath-tub and its delivery port connected to the drainage conduit of the mains by means of a discharge valve, comprising a cleaning water supply conduit connected to the mains and including a

valve, a device for sensing the water level in the bath-tub and for controlling the hydro-massage pump, a partial interception device included in the delivery conduit of the pump, a device for operating said cleaning water inlet valve and a device for operating said discharge valve.

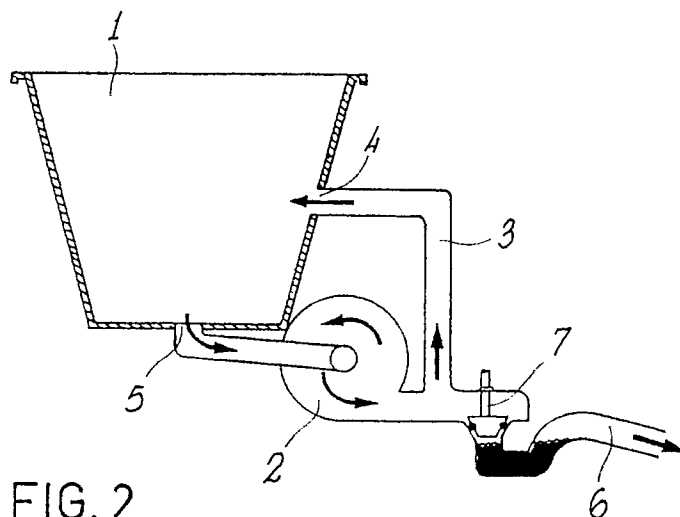


FIG. 2

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SELF-CLEANING DEVICE FOR HYDRO-MASSAGE APPLIANCES

This invention relates to a device for self-cleaning of a hydro-massage appliance. More particularly, this invention relates to an accessory device provided in a hydro-massage appliance in order to perform an automatic washing cycle for cleaning of the bath-tub as well as of all conduits of the appliance.

It is well known that the hydro-massage appliances that are recently becoming largely popular also as domestic equipment, raise hygienic type problems to a certainly higher extent than conventional bath-tubs. Any residual organic matter which forms during a hydro-massage treatment subsequently precipitates, when the appliance is emptied, not only upon the walls of the bath-tub, but also upon the internal surfaces of the conduits, of the pump and of the outlet nozzles that cannot be accessed to for manual cleaning, whereby not only obstructions are created but also an optimum environment is formed favourable (from a temperature, humidity and presence of nutritive substances view point) to proliferation of possibly pathogenic fungi and bacteria. Furthermore, any backwater forming in the conduits, in the bends, in the joints and particularly within the pump of any commercial hydro-massage appliance additionally enhances the development of microorganism colonies.

The hydro-massage appliance manufacturers generally suggest that, for cleaning purposes, the appliance operation be started with clean water, but it is apparent that, with such a solution, a noticeable water amount is wasted without a suitable disinfection effect being achieved. In particular, the conduits through which air is supplied to the outlet nozzles are not cleaned, even if they are amenable to be contaminated as well, due to the fact that they can also be flooded by the bath-tub water,

Addition of disinfectant agents to the water is also suggested, but the mere contact of the disinfectant agent with the deposits does not guarantee removal thereof, because the water laps the surfaces of the deposits but it has not a sufficient energy level to remove them. In addition, the disinfectant agent itself is anyway a contamination source, it has its own cost and could be inactive in respect of particular germ species.

The most popular hydro-massage appliances are broadly arranged as it is shown in Figure 1, to which reference will subsequently be made: the hydro-massage pump draws up the water from the bottom of the bath-tub and drives it into the supply conduit and through the outlet nozzles provided in the bath-tub wherefrom a mixture of water and air is supplied into the bath-tub. The drainage hole is independent and conventionally connected to the

conduits of the mains. By such arrangement, the bath-tub and the appliance as a whole are emptied under gravity by means of the drainage hole of the bath-tub and this means that the presence of any counterslope easily entails the occurrence of back-water zones within the appliance.

In addition, the pump is usually arranged laterally of the bath-tub, with an upwardly oriented delivery port, which unavoidably inhibits the scroll to be completely emptied. Aiming at avoiding such a drawback, it has also been proposed to provide the pump with a small discharge hole in its bottom section so as to enable it to be completely emptied by opening a valve. Such a discharge port, however, can be easily occluded, since water (and the residuals contained in it) pass therethrough by simple drainage effect.

Lastly, it is also to be noted that, as a negative consequence of the usual arrangement of the hydro-massage supply nozzles along the whole perimeter of the bath-tub (regardless of any evaluation of its rationality from a view point of the hydro-massage effects), conduits of noticeable extensions and consequently noticeable surfaces exposed to contact with the residuals and subject to deposit formation are required.

A more rational arrangement of a hydro-massage is the one shown in Figure 2: the pump is arranged between the drainage hole of the bath-tub and the connection joint with the drainage mains, so that the water is drawn through the drainage hole of the bath-tub. By this arrangement, when the discharge valve is closed, the pump drives the water in a loop passing through the hydro-massage appliance, but, when the valve is open, the water is drained through the pump.

Furthermore, if the pump is arranged with its delivery conduit at the bottom and horizontally extended, it can be completely emptied upon drainage of the bath-tub. No problem exists in priming the pump when the bath-tub contains water, because the pump is connected to the drainage port of the bath-tub and, therefore, it is immediately filled with water. By this reason, the pump is conveniently arranged below the minimum level in the bath-tub, so that it is completely filled-up.

A further rational choice from a hygienic point of view consist in minimizing the surfaces exposed to being wet, in particular by arranging the hydro-massage nozzles in more closely spaced positions and where they are more effective from a view point of the hydro-massage effects.

Besides the adoption of the above-mentioned measures, it is anyway necessary that, if hygiene is to be assured, a specific cleaning cycle be pro-

vided in the hydro-massage appliance, which should not merely consist of a standard hydro-massage cycle with clean or suitably additivated water, since such an operation, as above said, would be time consuming and expensive as well as ineffective.

It is an object of this invention, therefore, to provide a device to be assembled in hydro-massage appliances for enabling an automatic cleaning cycle to be carried to clean all appliance components subject to become dirty, with small water consumption and in relatively short times, but with such a power that the removal also of the most resistant deposits is guaranteed.

The device should be incorporated with the appliance and the operation thereof should be started, as soon as the hydro-massage treatment is over and the bath-tub is emptied, by means of a simple manual control.

Having this object in mind, this invention provides for equipping a hydro-massage appliance having its drainage hole connected with the delivery port of the pump with a set of additional components that enable a cleaning cycle to be performed by means of forced circulation of water in all water as well as air conduits, and with a noticeably smaller water amount with respect to the amount which should be needed to completely fill-up the bath-tub.

It should be apparent that, in view of the pressure under which the water is delivered from the nozzles when the hydro-massage appliance is operating, it would be impossible to operate the hydro-massage appliance when the water level in the bath-tub is lower than the level of the nozzles: should the jet be ejected in air rather than under the water, squirts of water would be ejected everywhere. In view of the above, a device for self-cleaning has been set-up, wherein the washing or cleaning water is forcedly circulated in the appliance by means of the pump, but wherein the water flowrate is reduced (partialized) with respect to the standard hydro-massage water flow-rate, in order that the jets ejected by the nozzles be less violent and the appliance be operated with a water level in the bath-tub lower than the nozzle level, i.e. with a strongly reduced water amount.

While the appliance is operating with partialized delivery flow-rate of the pump and with a reduced amount of water in forced circulation between the bath-tub and the water distribution and supply conduits, the device according to the invention controls the aperture of the discharge valve, so that the cleaning water is little by little disposed by forced drainage under the action of the pump, rather than merely by gravity.

Aiming at cleaning also the air distribution network, that comprises an inlet port for suction of air

through the over-flow hole of the bath-tub, a distributor and a number of small tubes starting from the distributor and each reaching a delivery nozzle, the device according to this invention is provided with a junction for independent connection to the mains, including a valve for controlling the inlet of cleaning water into the appliance and connected to the air distribution networks. When the valve is open, the inlet of cleaning water is caused to reach the bath-tub both through the small air tubes and the delivery nozzles and through the over-flow hole.

The above described cleaning of the air conduits is performed by the device in an independent operation cycle which is carried out before the pump start and the water conduit cleaning cycle. The whole cycle is carried out automatically.

It is therefore a specific object of this invention to provide a device for self-cleaning of a hydro-massage appliance wherein the centrifugal hydro-massage pump, that drains away the water from the bath-tub in order to drive it through two or more conduits external to the bath-tub itself and as many hydro-massage nozzles, has its intake port connected to the drainage hole of the bath-tub and its delivery port connected to the drainage conduit of the mains by means of a discharge valve, characterized in that it comprises a cleaning water inlet conduit connected to the mains, including a valve and also connected downstream thereof to the hydro-massage air delivery mains for inlet of cleaning water into the bath-tub through the air conduits and the hydro-massage nozzles as well as through the overflow hole of the bath-tub, a device for sensing the water level in the bath-tub and for controlling the hydro-massage pump that, during the cleaning step, starts the pump as soon as the water level reaches a predetermined level lower than the level of the nozzles and stops it as soon as, upon drainage, the water level falls under a predetermined minimum value; a partial interception device included in the delivery conduit of the pump, said device being normally open and, during the cleaning step, being operated so as to partially intercept the water flow delivered by the pump as soon as the pump is started; a device for operating said cleaning water inlet valve, adapted to control its opening at the begin of the cleaning step and its closure when said partial interception device partially intercepts the delivery flow of the pump; as well as a device for operating said discharge valve, adapted to control its opening when said partial interception device partially intercepts the delivery flow of the pump.

As above-mentioned, in the hydro-massage appliance including the device according to this invention the pump is preferably arranged under the bottom level of the bath-tub with horizontally extended downwardly depending delivery conduit.

Furthermore, the above-mentioned partial interception device, when all water has been drained, is preferably operated so as to be reset to its open position, while the above-mentioned discharge valve operating device is also adapted to control its partial opening at the begin of the cleaning step.

According to the preferred embodiments of this invention and as it will be apparent by referring to the drawings, said operating device for the cleaning water inlet valve consists of a stem connected to the shutter and cooperating with a cam spindle, said operating device for the discharge valve is formed by lever means pivotally connected to the shutter and cooperating with said cam spindle, as well as by a flexible cable connected to the shutter for manual control, and said partial interception device acting upon the delivery flow of the pump is a throttle valve, hinged on the same axis of the cam spindle and controlled, therefore, either by the rotative movements of the cam spindle or by the pressure of the water flow intercepted by the throttle valve.

An eccentric counterweight connected to a flexible cable for manual control is integral with the cam spindle.

Again in a preferred embodiment of this invention, said device for sensing the water level in the bath-tub and for controlling the pump is a pressure switch wherein the sensed water level in the bath-tub is converted into a gas pressure signal and whereby the pump operation is started upon the pressure exceeding a predetermined limit, while the pump operation is stopped upon the pressure falling under a predetermined limit.

The flexible cables for manual control are preferably connected to a control knob arranged upon the overflow hole of the bath-tub and selectively switchable over three positions of hydro-massage, discharge and cleaning, respectively.

In a rational arrangement of the device according to this invention, all of the components, with exclusion of the above-mentioned device for sensing the water level in the bath-tub and for controlling the pump, are incorporated in a single block attached to the delivery section of the pump and connected to the supply conduits of the hydro-massage nozzles, to the drainage conduit as well as to the mains for inlet of the cleaning water and to the distribution network of the hydro-massage air.

It will be appreciated that a self-cleaning device according to the broadest embodiment of this invention can also be manufactured by using components other than the heretofore mentioned ones, provided that they perform the same functions. For instance, in stead of the throttle valve as well as of the other two mentioned valves solenoid operated valves can be used and suitable circuitry can be

substituted for the mentioned mechanical operation system based upon a cam spindle.

This invention will be now illustratively described by referring to a preferred embodiment shown in the various figures of the enclosed drawings, wherein:

Figure 1 shows a schematic arrangement of a conventional type of hydro-massage appliance;

Figure 2 shows the schematic arrangement of an improved hydro-massage appliance;

Figure 3 shows a perspective general view of a hydro-massage appliance of the type shown in Figure 2, provided with a self-cleaning device according to the invention;

Figure 4 shows a general perspective view of the device of Figure 3;

Figures 5, 6 and 7 show, in partial cross-section perspective view, the positions of the device members during the operation cycles of: hydro-massage, cleaning 1. step, cleaning 2. step, respectively.

In Figures 1 and 2, reference numeral 1 designates the bath-tub, 2 designates the centrifugal pump, 3 designates the water supply conduits, 4 designates the nozzles, 5 designates the drainage hole of the bath-tub and 6 designates the drainage conduit. As it can be noted, in the arrangement of Figure 1, the drainage route is completely independent of the hydro-massage circulation system, while, in the arrangement of Figure 2, the drainage conduit controlled by valve 7 is connected to the delivery port of the pump and the re-cycled hydro-massage water is intaken by the pump through the drainage hole of the bath-tub. The advantages of this arrangement have already been discussed above.

In Figure 3, wherein a hydro-massage appliance as proposed according to this invention is shown, components corresponding to Figures 1 and 2 are designated by the same reference numerals. Furthermore, it is possible to identify the pump motor 8, the intake conduit 9 of the pump, connected to the drainage hole 5 of the bath-tub, the downwardly arranged horizontally extended delivery conduit 10, the water distributor 11, by which the water coming from the pump is distributed to the various water supply conduits 3, the air distributor 12 by which the air sucked through the overflow hole 13 is supplied to the air conduits 14 connected to the nozzles 4.

Numeral 15 designates the overflow conduit by which the excess water is discharged into the drainage conduit 6 through valve 16.

The components of the self-cleaning device can be better identified in Figure 4, wherein reference numeral 17 designates the connection to the delivery conduit of the pump; along the route of the water, within block 18, a throttle valve (designated

by 19 in Figures 5 to 7) is arranged to shut the water flow during the cleaning cycle. Numeral 20 designates the connection for the inlet of the cleaning water, while the related valve (designated by 21 in Figures 5 to 7) is housed in block 22; the route of the inlet conduit of the cleaning water includes, downstream of the valve, the elbow fitting 23 that is connected to a small tube (designated by 24 in Figure 3) by which the cleaning water is supplied to the air distributor 12.

A discharge valve 7 (shown in cross-section view in Figures 5 to 7) is arranged under the return spring 25; screw 26 is part of the clamp by which the flexible cable (27 in Figure 3) for manual control of the drainage aperture is gripped. As it can be seen in Figure 3, the manual control can be operated by means of a knob that is located upon the overflow hole 13 within the bath-tub. Such a control knob is shown (reference numeral 28) in a corner of each of Figures 5-7, positioned according to the respective cycles shown in the Figures.

Counterweight 29 is furthermore identifiable in Figure 4, in phantom, connected to the end of a cam spindle 30 (partially shown). Said spindle, (as it can be more clearly seen in subsequent Figures) is coaxial and integral with the hinge of the throttle valve and it controls by its rotative movements either the aperture of the cleaning water inlet valve 21 or the aperture of the discharge valve 7.

In order to describe the operation of the device according to the invention, reference is now made to Figure 5 illustrating the device in the hydro-massage cycle (knob 28 in corresponding position). As it can be noted, the throttle valve 19 is completely open and the discharge valve 7 is completely closed. In this position of the cam spindle 30, the contact element 31 pivotally connected to the stem 32 of the cleaning water inlet valve 21 is in a such position that valve 21 is maintained in closed condition (due to the action of the return spring 33) and, therefore, no water can be admitted into the appliance (or emitted therefrom, because valve 7 is closed). The water merely circulates as shown by the arrows, thereby exploiting the hydro-massage action.

At the end of the treatment and upon switching the pump off, the water is to be drained away and to this effect the knob is rotated to the position marked "drainage"; such a rotation causes the cable 27 to be stretched and the discharge valve 7 to be opened so that the water is drained through the pump 2. In view of the position of the pump and of the drainage conduit, no residual water remains in the appliance, thereby reducing as above said the possibility of microorganism development.

When a cleaning cycle is to be effected (Figure 6), knob 28 is rotated to the corresponding related

position: this causes the flexible cable 34 to be stretched (Figure 3), said cable being connected to counterweight 29 by means of a clamp arranged in hole 35; the cam spindle 30 rotates and this rotation causes the contact element 31 and the stem 32 to be lifted up and the cleaning water inlet valve 21 to be opened. The water is admitted through connection 20 and by passing through valve 21, the elbow fitting 23 and the small tube 24 it runs through the air distribution network according to the schematic arrows of Figure 6, thereby cleaning all internal surfaces. This first route of the cleaning water can be better observed in Figure 3: upon passing through the small tube 24, the water enters into the air distributor 12 and from the distributor 12 it passes through the small air supply tubes 14 and it flows into the bath-tub through nozzles 4. In addition, the water flows from said distributor 12 to the air inlet slot provided in the overflow hole and designated by 36 in Figure 6: the water flows into the bath-tub also through this passage.

The rotation of the spindle also causes the throttle valve 19 to be positioned in the sloping position shown in Figure 6, as well as the discharge valve 7 to be slightly opened, due to the fact that the shutter controlled by lever 37 pivotally connected thereto has been slightly lifted up. Lever 37, structurally formed with two parallel wings, has a bracket 38 positioned between its two wings at its end opposed to the one at which it is pivoted to the shutter of the valve 7; the bracket 38 runs upon eccentric wheel (not shown) mounted upon spindle 30 and in view of this a rotation of said spindle to the position shown in Figure 6 causes the discharge valve 7 to be partially opened.

As a consequence of this, a portion of the water admitted into the bath-tub through the air conduits is drained away thereby dragging away the first residuals. Obviously the aperture of the valves is such that the water inlet rate is greater than the outlet one.

When the water in the bath-tub reaches a predetermined level, lower than the level of the nozzles, the second cleaning step shown in Figure 7 is started by operation of the pressure switch designated by 39 in Figure 3. This device is connected to conduit 40 communicating with the drainage hole 5 of the bath-tub. When the water level in conduit 40 rises (as it rises in the bath-tub 1) the air trapped in the small tube 41 of the pressure switch 39 is compressed. When the pressure exceeds a predetermined level, the pressure switch triggers the control action.

Such control action causes the pump 2 to be started (Figure 7); the pressure of the water driven by the pump causes the throttle valve 19 to be closed and only a small port is left between the internal walls of the conduit and the edge of the

shutter, so that the flow rate of the water running through said port is very small. The water running through the distributor 11 and the conduits 3 cleans them and enters into the bath-tub through nozzles 4 in the form of a not-submersed jet with a much reduced power with respect to the standard jet of a hydro-massage treatment.

At the same time, the rotation of the throttle valve 19 and of the cam spindle 30 causes the cleaning water inlet valve 21 to be closed (element 31 has passed beyond the peak point of the eccentric profile on the spindle and the stem 32 has been displaced downwardly) and the discharge valve 7 to be completely opened (the lever 37 has been totally lifted up).

As a consequence of the above, while the pump causes the cleaning water to be recirculated, the water inlet into the appliance is stopped and the drainage step is started; the water level in the bath-tub gradually lowers and the head of the pump decreases, while the throttle valve 19 is slowly lifted up under action of the counterweight 29. The spindle 30 gradually rotates backwardly, but this neither causes the water inlet valve 21 to be re-opened, nor the discharge valve 7 to be re-closed. In fact, the profile of element 31 pivoted on the stem is such that, when the spindle rotates backwardly, element 31 rotates about its pivot without lifting the stem 32 and the shape of the lever 37 is such that, upon being completely lifted up, it is restrained in this position and it can no more return back.

At the end of the second cleaning step, upon the bath-tub being nearly completely emptied, the pressure switch 39 senses that the water level has lowered beyond a predetermined minimum value (for inst. 1 cm from bottom) and switches the pump off. The residual water flows under gravity action through the still open drainage hole.

If it is desired that the discharge valve 7 be closed at the end of the cleaning step, it is sufficient that the control knob 7 be rotated to its "drainage" position because this action causes the lever 37 to be disengaged. When the control knob is rotated to its "hydro-massage" position, the valve 37 can freely be closed.

It should be evident from the preceding description that the actuation of the self-cleaning device is extremely simple and that its operation entails a reduced water and time consumption, while in the meantime a vigorous and complete cleaning of the appliance is assured.

This invention has been described under specific reference to some preferred embodiments thereof, but it should be understood that those skilled in the art can make changes and/or modifications without departing from the scope thereof.

Claims

1. A device for self-cleaning of a hydro-massage appliance wherein the centrifugal hydro-massage pump, that drains away the water from the bath-tub in order to drive it through two or more conduits external to the bath-tub itself and as many hydro-massage nozzles, has its suction port connected to the drainage hole of the bath-tub and its delivery port connected to the drainage conduit of the mains by means of a discharge valve, characterized in that it comprises a cleaning water inlet conduit connected to the mains, including a valve and also connected downstream thereof to the hydro-massage air delivery mains for inlet of cleaning water into the bath-tub through the air conduits and the hydro-massage nozzles as well as through the overflow hole of the bath-tub wherefrom air is drawn up during the hydro-massage treatment, a device for sensing the water level in the bath-tub and for controlling the hydro-massage pump that, during the cleaning step, starts the pump as soon as the water level reaches a predetermined level lower than the level of the nozzles and stops it as soon as, upon drainage, the water level falls under a predetermined minimum value; a partial interception device included in the delivery conduit of the pump, said device being normally open and, during the cleaning step, being operated so as to partially intercept the water flow delivered by the pump as soon as the pump is started; a device for operating said cleaning water inlet valve, adapted to control its opening at the begin of the cleaning step and its closure when said partial interception device partially intercepts the delivery flow of the pump; as well as a device for operating said discharge valve, adapted to control its opening when said partial interception device partially intercepts the delivery flow of the pump.
2. A device according to claim 1, wherein said centrifugal pump of the hydro-massage appliance is arranged under the bottom of the bath-tub and has an inferiorly positioned horizontally extending delivery conduit.
3. A device according to claim 1 or 2, wherein said partial interception devices when the water has been completely drained, is operated so as to return to its open position.
4. A device according to claims 1-3, wherein said discharge valve operating device is also adapted to control its partial aperture when the cleaning step is started.
5. A device according to any of claims 1-4, wherein said cleaning water inlet valve operating device is formed by a stem connected to the shutter and cooperating with a cam spindle.
6. A device according to claim 5, wherein the discharge valve operating device is formed by lever

means pivotally connected to the shutter and cooperating with said cam spindle, as well as by a flexible cable connected to said shutter for manual control.

7. A device according to claim 5 or 6, wherein said device for partial interception of the delivery flow of the pump consists of a throttle valve hinged upon the same axis of said cam spindle and thereby controlled either by the rotative movements of said cam spindle or by the pressure of the water flow intercepted by said throttle valve.

8. A device according to any of claims 5-7, wherein an eccentric counterweight connected to a flexible cable for manual control is integral with said cam spindle.

9. A device according to any of claims 1-8, wherein said device for sensing the water level in the bath-tub and for controlling the pump is pressure switch wherein the water level in the bath-tub is translated into a gas pressure signal and wherein the start command of said pump is generated by said pressure rising beyond a predetermined limit value, while the stop command for said pump is generated by said pressure decreasing under a predetermined limit value.

10. A device according to claims 6 or 8, wherein said flexible cables for manual control are connected to a control knob arranged on the overflow hole of the bath-tub and selectively positionable to any of three positions of hydro-massage, drainage and cleaning.

11. A device according to any of the preceding claims wherein all of the components, with exclusion of said device for sensing the water level in the bath-tub and for controlling the pump, are assembled into a single block arranged downstream of the pump and connected to said hydro-massage nozzle supply conduits, to said drainage conduit as well as to said mains for inlet of the cleaning water and to the hydro-massage air distribution network.

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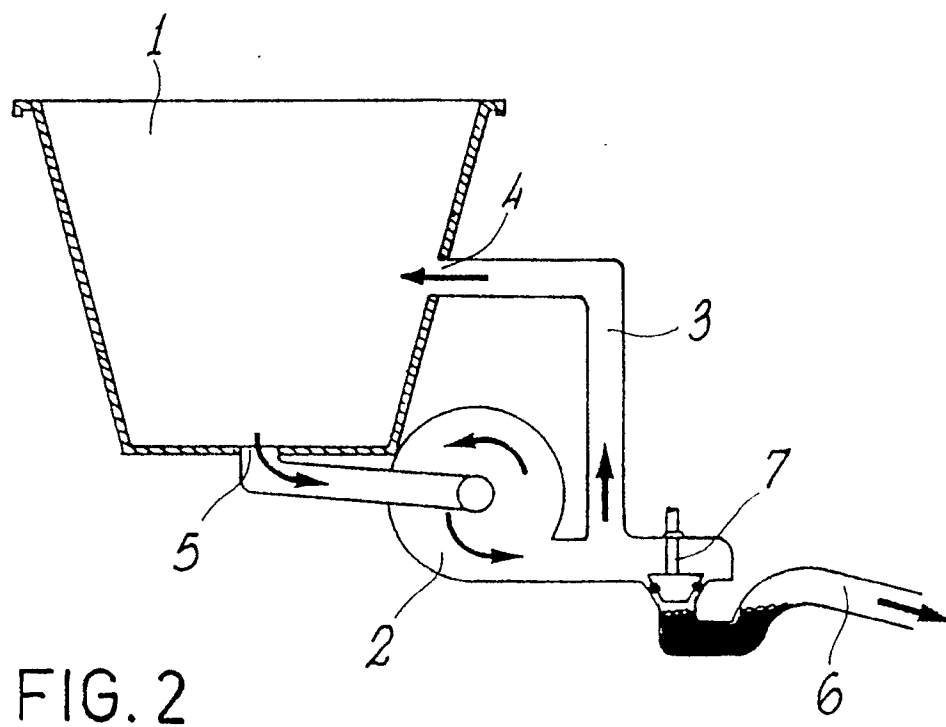
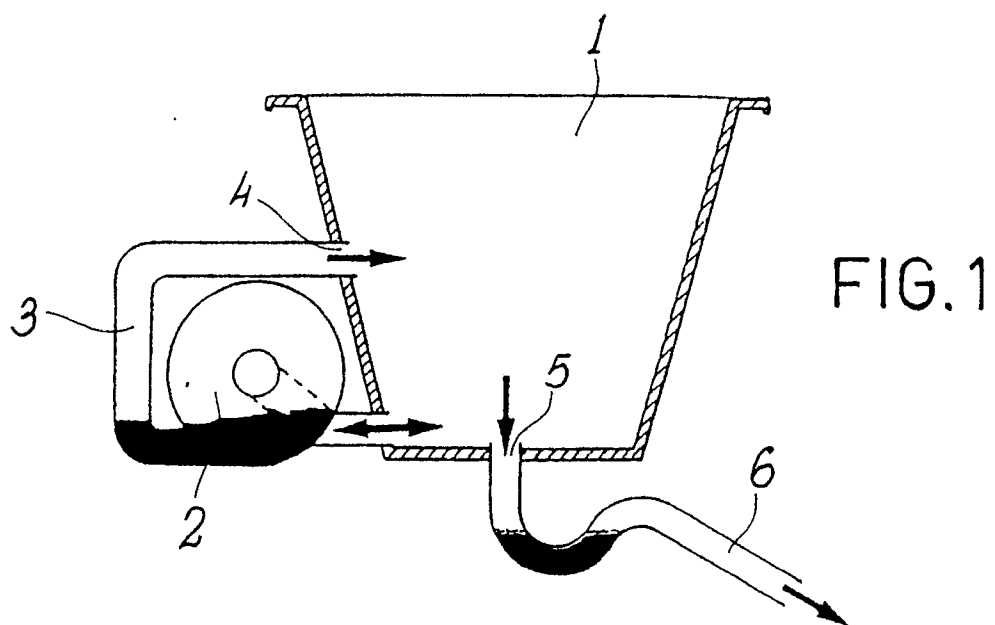
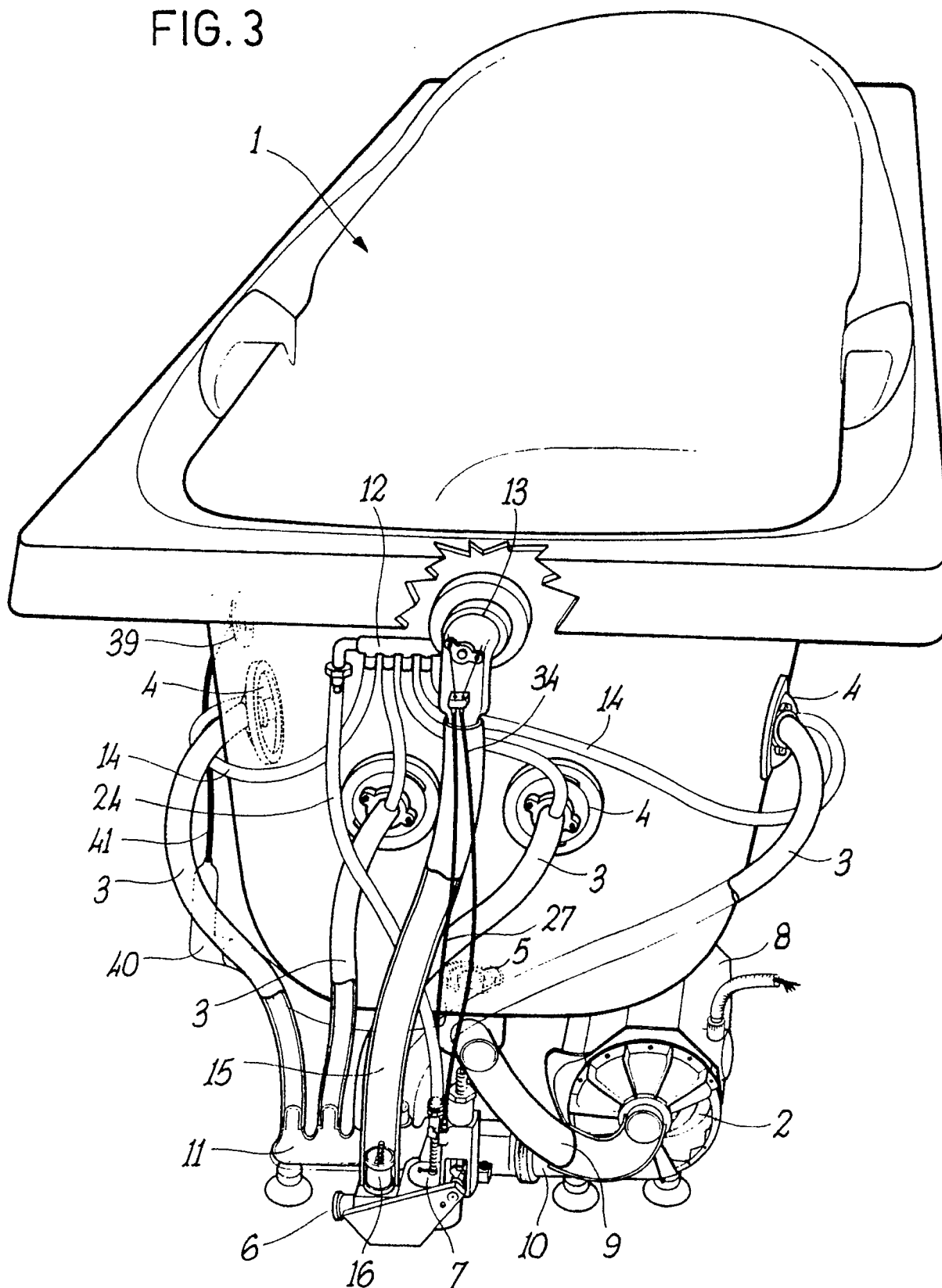


FIG. 3



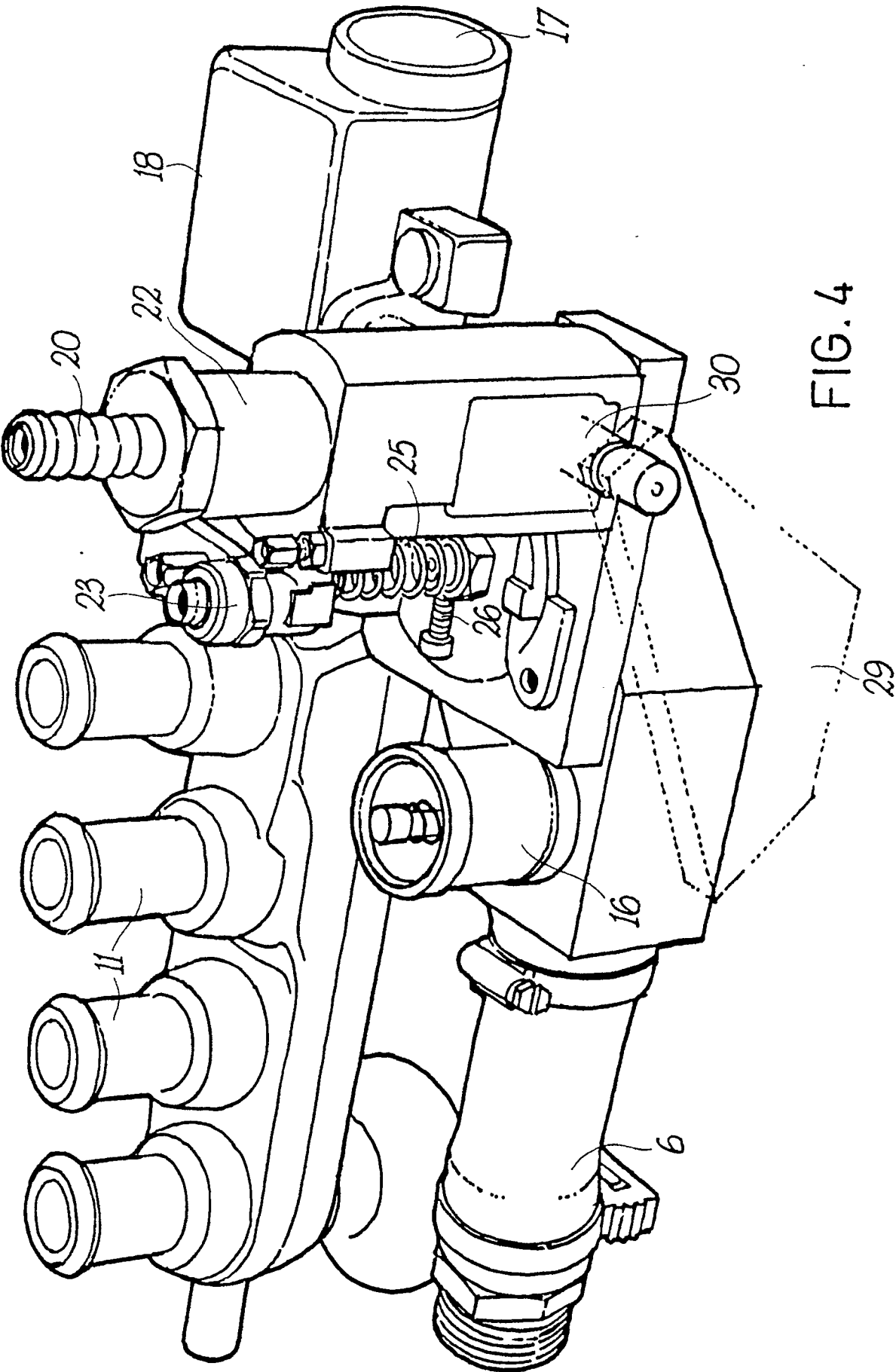


FIG. 4

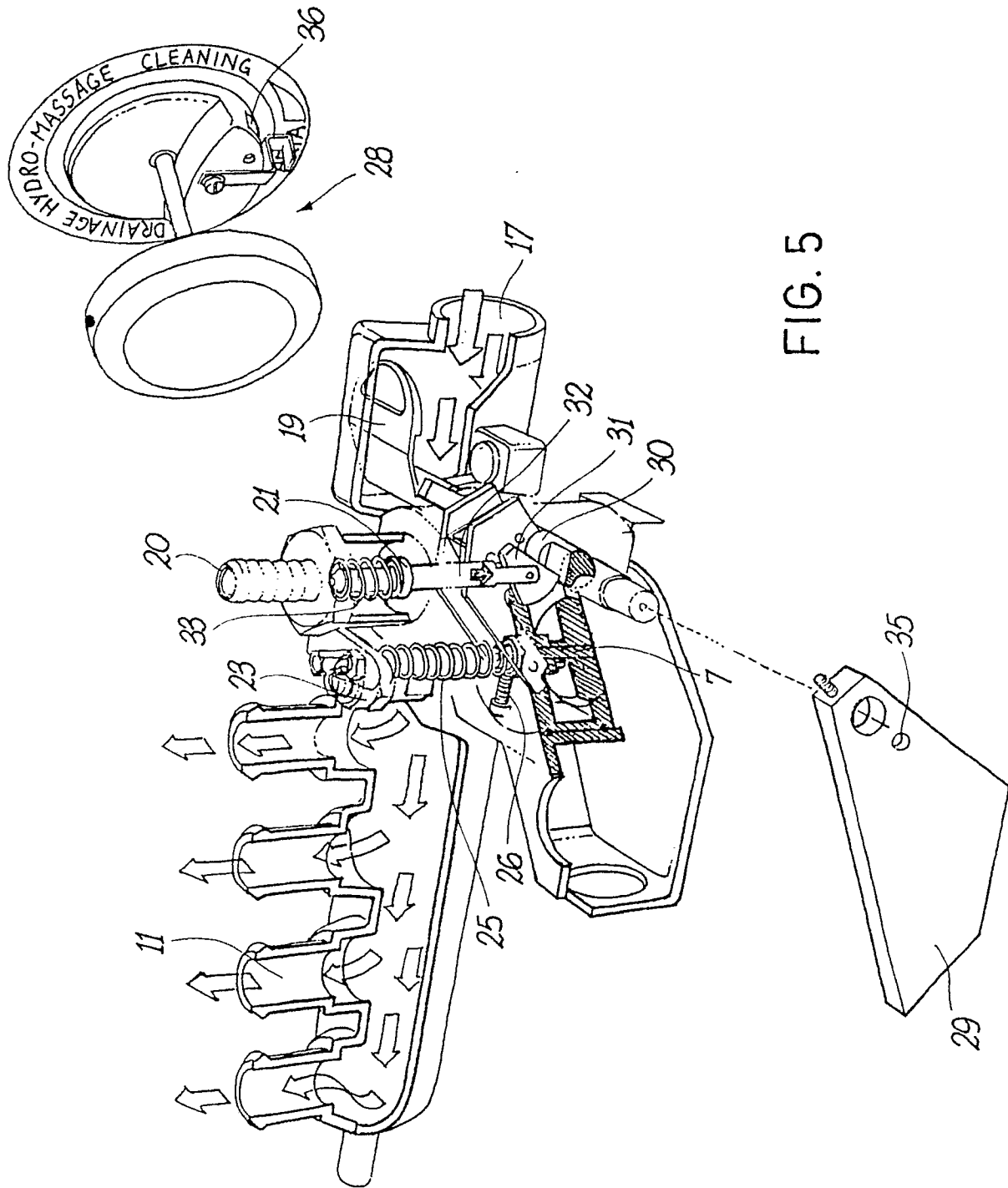


FIG. 5

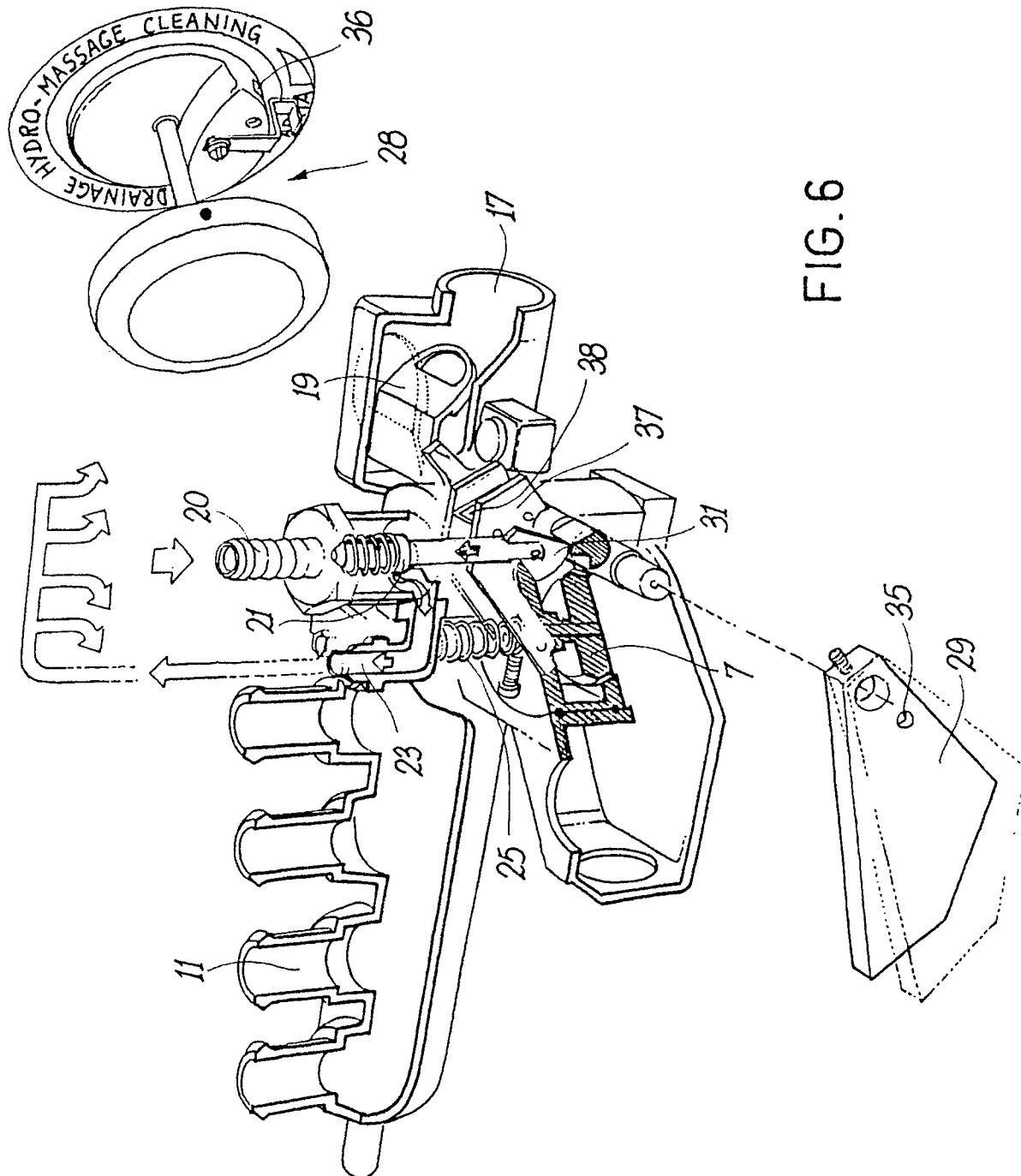


FIG. 6

