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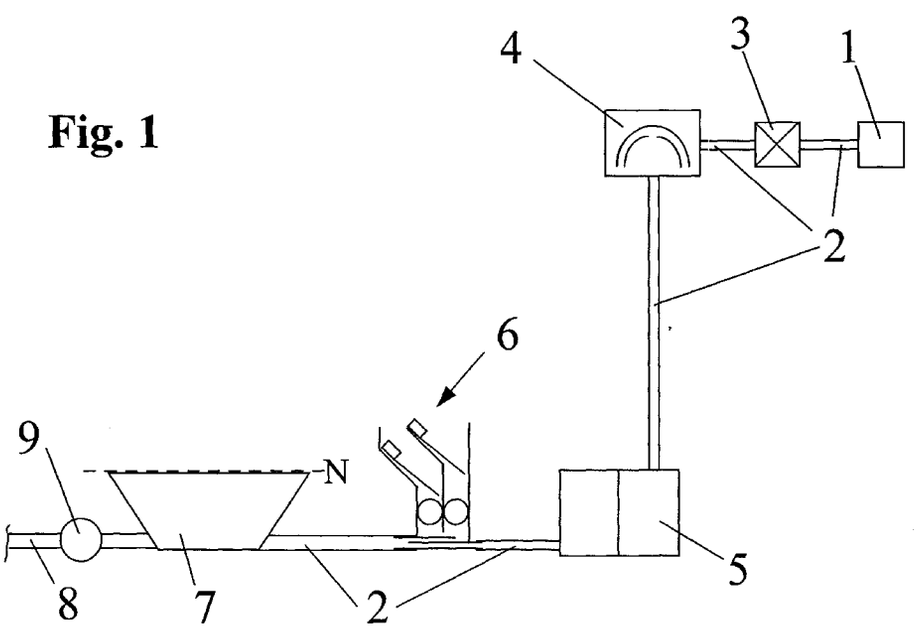
(54) **Device for the liquid supply and dosage in a domestic washing machine tub, in particular a dishwashing machine**

(57) A device for the supply and dosage of liquid in the tub (7) of a domestic washing-machine, in particular a dishwasher, is described, of the type in which the dosage is realized by detecting the liquid level inside the tub (7), said device (6, 6A, 6B, 6C) comprising detection means which operate on the basis of the quantity of liquid supplied to the tub (7), said detection means comprising at least a first float (17A, 17B, 17A") for causing a switching of a first electric contact (18A) for stopping the liquid supply to the tub (7). According to the invention, said first float (17A, 17B, 17A") is housed in a first chamber (16A) delimited in a body (11) of said device (6, 6A, 6B, 6C), said body(11) being located outside the tub (7) and hydraulically connected to it in a way that a gradual raising of the liquid level in the tub (7) determines a consequent raising of the first float (17A, 17B, 17A") in the first chamber (16A), which occurs gradually until causing said switching of the first contact (18A), the switching threshold of said first contact (18A) corresponding to the achievement of a predetermined liquid level in the tub (7).

Fig. 1



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Description

[0001] The present invention refers to a device for the supply and dosage of liquid in the tub of a domestic washing machine, in particular a dishwasher.

[0002] It is known that dishwashers comprise a wash tub, on whose bottom is collected the water from the mains required for the washing of the crockery; to this purpose, the machine has a washing or recirculating pump, to supply said water collected on the tub bottom to one or more spraying elements.

[0003] Dosage of the water required for the washing can be performed in several ways.

[0004] The simpliest solution is to provide a timed opening of a solenoid valve controlling the water inlet in the wash tub; however, such a method, practically given up by now, may prove very poorly accurate, as it does not consider the always possible pressure changes in the water supply mains and the consequent changes in the flowrate of the solenoid valve.

[0005] At present, the most spread solution substantially due to saving reasons, is to obtain the washing water dosage through an electropneumatic pressure switch which, through an air trap, is apt to detect the water level directly inside the wash tub, so as to ensure a control principle for the solenoid valve charging the water from the mains.

[0006] However, though this method is cost-saving, it requires a very accurate calibration (which is therefore expensive during the manufacturing stage) of the pressure switch: considering, in fact, that the wash tub has a rather extended section, even a change of a few millimeters of the water level in the tub may be converted into an dosage error of several liters of water. Now, this is against the requirement of having machines with consumptions strictly under control.

[0007] Moreover, as time goes by, the electromechanical pressure switch tends to loose its accuracy with a consequent water inlet which is higher than the strictly required; on the other hand, recalibration of the pressure switch on washing machines being already installed is quite a critical operation, so that its replacement seems to be preferable; as a result, a water intake and dosage error is passively accepted in most instances.

[0008] Additionally, since the air trap required for the operation of the pressure switch is located practically inside the wash tub, it may determine a malfunction of the system due to soil particles depositing right in correspondence with the air trap itself.

[0009] Other solutions presently given up are also known, wherein the water level is detected directly inside the wash tub through a mushroom float, whose shaft is apt to cause the switching of an electric contact; anyway, operation of this float is negatively influenced by the soil particles that may be present in the wash tub, which may even cause the float to become jammed up.

[0010] According to other known solutions, the water level to be reached inside the wash tub is predetermined through the proper height positioning of a siphon, so that as soon as a tiny amount of water exceeds the bending of the siphon itself, a detection device will immediately cause the water supply solenoid valve to stop.

[0011] However, also these supply and dosage devices have some drawbacks due to their location inside the wash tub or adjacent to it, as this may cause a malfunction caused by the heat developing inside the tub, or to soil particles depositing right inside the siphon or in line with the detection device. A further issue for such solutions is that, in order to obtain the desired level adjustment of the water inside the tub, it is necessary to change the height position of the siphon, resulting in a critical complex operation.

[0012] Configuration of the floats employed in such solutions, i.e. either cylindrical or parallelepipedon, may also lead to a lack of detection accuracy as they are subject to frictions. Such floats, in fact, tend to adhere to or eventually become embedded in the walls of the relevant housing chamber, as well as to collect soil particles.

[0013] Since the supply of a higher water amount than required is against the requirements of consumption (water also has to be heated for washing purposes), in the instance of high-range washing machines the pressure-switch system is replaced with solutions wherein water dosage is performed outside the wash tub.

[0014] Accordingly, solutions are known where the dishwashing machine is provided with a metering tank, connected through a by-pass to supply pipe which let water to the wash tub, so as to have one portion of the water from the mains reaching the tub directly and a portion reaching said tank.

[0015] The metering tank has a reduced water capacity with respect to the water required for washing and contains a float level sensor; the sensor operates over a small amount of water, which is proportional to the amount supplied to the tub; upon reaching the level predetermined for the tank it will cause the water inlet solenoid valve to be closed. In other words, the level sensor operates over a water fraction supplied to the tub, which fills a small size tank so as to minimize detection faults.

[0016] However, also this system is not free from detection faults due to possible discrepancies in the flowrate distribution in the by-pass pipe supplying the metering tank; in addition, this system appears to be quite expensive with respect to the previous ones.

[0017] Other supply and dosage systems are also known, which provide a repeated water supply to one or more tanks, whose capacity equals a fraction of the capacity required for washing; also in this instance, at least one tank has a float level sensor of cylindrical or parallelepipedon configuration to control the usual inlet solenoid valve; water supply to the wash tub occurs by subsequent transfers of the tank contents into the tub itself.

[0018] Said systems may require long times to obtain the water supply required for washing and their manu-

facture is anyway complex and expensive to obtain.

[0019] Moreover, the last two systems described above have the drawback of requiring a considerable moulding accuracy of the tank body, so as to obtain seats for the level sensors and fastening them therein.

[0020] Substantially, the known dosage solutions presently employed can be classified in two classes according to the detection system employed:

- systems with detection means operating over the whole liquid amount supplied to the tub, i.e. where the dosage is executed by detecting the liquid level directly inside the wash tub; such systems are advantageous from a standpoint of their manufacturing low-cost, but disadvantageous from a standpoint of dosage accuracy and reliability;
- systems with detection means operating over a reduced portion of the water amount required for washing, i.e. where dosage is executed outside the wash tub; such systems are advantageous from a standpoint of their dosage accuracy and reliability, but disadvantageous from a standpoint of their manufacturing costs.

[0021] It is the object of the present invention to provide a device for the supply and dosage of liquid in the tub of a domestic washing machine, in particular a dishwasher, wherein the liquid dosage is obtained by detecting the liquid level inside the wash tub, which has a simple and compact manufacture, and therefore low manufacturing costs, so as to achieve a higher dosage accuracy, improved employment reliability, easier low-cost manufacture and calibration during production, with respect to the known solutions adopting a similar philosophy.

[0022] A further object of the present invention is to provide a device for the supply and dosage of liquid in the tub of a domestic washing machine, in particular a dishwasher, which can also be easily calibrated prior to its incorporation in the machine, if required.

[0023] Such aims are reached, according to the present invention, by a device for the supply and dosage of liquid in the tub of a domestic washing machine, in particular a dishwasher, having the features of the annexed claims, which form an integral part of the present description.

[0024] Further aims, features and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 schematically represents a portion of the hydraulic circuit of a washing machine, particularly a dishwasher, using a device for liquid the supply and dosage of liquid according to the teaching of the present invention;
- Fig. 2 represents a schematic section of a device according to the present invention, in a possible first embodiment;
- Fig. 3 represents a schematic section of a device according to the present invention, in a possible second embodiment;
- Fig. 4 represents a schematic section of a device according to the present invention, in a possible third embodiment;
- Fig. 5 represents a schematic a section of a device according to the present invention, in a possible fourth embodiment;
- Fig. 6 schematically represents a portion of the hydraulic circuit of a washing machine, in particular a dishwasher, according to a possible fifth embodiment of the present invention.

[0025] Fig. 1 schematically represents a portion of the hydraulic circuit of a washing machine obtained according to the teaching of the present invention; in the example being represented in the figure, the invention is applied to a dishwashing machine.

[0026] In this figure, reference 1 indicates a connector to the water mains (such as a tap) to which a supply pipe 2 for the mains water to the dishwasher is connected; on this pipe 2 a solenoid valve 3 is located for controlling the mains water inlet to the dishwasher; on the pipe 2, downstream of the solenoid valve 3, an anti-reflux device 4, generally known as *air-breaker,* and a softener device 5 are assembled in series. It should be appreciated that the softener device 5 may not be absolutely required for a dishwasher, if water hardness in the area where the latter is installed has a low degree.

[0027] Devices 3, 4 and 5 are of known manufacture and operation, so they will not be further described in detail.

[0028] Downstream the softener device, always on the pipe 2, a dosage device 6 is inserted, for the washing liquid, being manufactured according to the features of the present invention; exiting from the device 6, the pipe 2 reaches the wash tub of the machine, indicated with 7; the tub 7 is equipped with a drain pipe 8, on which is located a suitable drain pump 9.

[0029] As it can be seen, the device 6 is located outside the wash tub 7, and in a remote position with respect the latter.

[0030] The tub 7 is also in communication with a proper wash pump, supplying one or more spraying elements with the liquid collected on the bottom of the tub 7; also the above spraying elements and the wash pump are not represented in Fig. 1 as their manufacture and operation are commonly known.

[0031] Figure 2 shows a possible first embodiment of the dosage device 6.

[0032] Such a device 6 comprises a body 11 made of plastic material, which may be formed for example by two polypropylene shells, being hot blade welded.

[0033] In the lower portion of the body 11 an inlet connector 12 and outlet connector 13 are present, for connecting the device 6 to the pipe 2; as it can be seen, the

connector 12 has a smaller section with respect to the connector 13.

[0034] Two conduits 14 and 15 are defined between said two connectors; the conduit 14 connects the connector 12 directly to the connector 13, whereas the conduit 15 connects the connector 13 directly with the portion of the device 6 laying above it.

[0035] Two chambers 16A and 16B are defined in the body 11, both communicating with the conduit 15 in their lower section.

[0036] References 17A and 17B indicate two floats (shown in two different working positions), made from a polymer, inserted in the chambers 165A and 16B, respectively, and apt to slide inside them; according to a significant point of the present invention, floats 17A and 17B are manufactured like balls or spheres, for example made from polypropylene or blown tumbled polystyrene.

[0037] References 18A and 18B indicate two electric micro-switches, whose type and operation are commonly known, each one housed in the upper section of chambers 16A and 16B.

[0038] Micro-switches 18A and 18B have respective control rods 19A and 19B, which are apt to be moved by the balls 17A and 17B, which tend to raise up to the chambers 16A and 16B during the water inlet steps in the wash tub 6, as it will be further detailed.

[0039] As it can be seen, micro-switches 18A and 18B are in an off-centred position with respect to the chambers 16A and 16B and the relevant balls 17A and 17B; the length of the control rods 19A and 19B is chosen for allowing an easy operation of the relevant micro-switches.

[0040] References 20A and 20B indicate lower stoppers, which are defined on the walls of the body 11, whereon the balls 17A and 17B can rest when no water is present in the chambers 16A and 16B.

[0041] As it can be seen in the example shown above, the ball 17A and the micro-switch 18A are provided to control the liquid level supplied to the tub 7, while the ball 17B and the micro-switch 18B are provided for safety purposes, should the first micro-switch 18A fail to operate. To this purpose, as it can be noticed, the micro-switch 18B and its associated rod 19B are placed at a higher height, i.e. at a switch-in level which is higher with respect to the position and operation threshold of the micro-switch 18A and its associated rod 19A.

[0042] In the example represented in Fig. 2, the micro-switch 18B is firmly fastened to the body 11, i.e. without any possibility of changing its position with respect to the chamber 16B, which fact is perfectly compatible with its safety function.

[0043] On the contrary, according to a significant point of the present invention, the micro-switch 18A is associated to the body 11 in such a way to let its working position, and consequently its operation threshold, be either adjusted or calibrated with extreme ease and precision.

[0044] Such a calibration system comprises a support 21, integral with the micro-switch 18A, the latter being able to slide in a vertical direction within the chamber 16A, and a worm screw 22; the support 21 and the screw 22 are housed in suitable seats defined in the body 11.

[0045] As it can be seen, the support 21 has an appendix 21A engaged to the threading of the screw 22; therefore, by rotating the screw 22 it is possible to determine a change in the vertical position of the support 21 and consequently of the micro-switch 18A with its associated control rod 19A.

[0046] According to the above, it is clear that, by operating the screw 22, the height of the micro-switch 18A can be finely adjusted and its operation threshold calibrated accordingly; such a calibration can be easily performed automatically through a special machinery, also on a manufacturing line.

[0047] Operation of the machine illustrated in Fig. 1 is as follows.

[0048] When the dishwasher user starts a wash cycle according to the known procedures, a programmer device or timer (not represented for simplicity's sake) controls the opening of the solenoid valve 3.

[0049] Water from the mains enters the softener 5 after overcoming the air breaker 4. Water exiting the softener 5, i.e. filtered and softened, is conveyed to the inlet connector 12 of the device 6 and flows through the conduit 14 to the outlet connector 13 of said device.

[0050] Then, the water can flow further on along the pipe 2 and reach the wash tub 7, which is gradually filled.

[0051] The gradual increase of the water level in the tub 7 is transferred, by virtue of the section of the connector 13 and the conduit 15 also to the chambers 16A and 16B, for their consequent gradual filling; such a filling also determines a gradual raising of the ball 17A within the chamber 16A, starting from the time when the water level in the latter overcomes the stoppers 20A.

[0052] Water supply to the tub 7 goes on until the ball 17A comes in contact with the rod 19A and displace it of a pre-set angle, thus causing the micro-switch 18A to switch (this transitory stage is represented in Fig. 2).

[0053] This switching represents a control signal for stopping the water supply of the inlet solenoid valve 3, i.e. closing it. Therefore, under this condition, the tub is filled up to a predetermined water level, which depends on the operation threshold determined by the position of the micro-switch 18A.

[0054] Moreover, the function of said control signal is to let the electric motor of the programmer or timer to start again, which during the water inlet step is typically at standstill, so as to enable the execution of the subsequent steps as provided by the wash cycle.

[0055] Should the micro-switch 18A fail to operate, due for instance to a likely malfunction, water will still be supplied to the tub 7 and determine a further level raising in the chambers 16A and 16B; in this event, when the water level in the chamber 16B exceeds the stoppers 20B, then also the ball 17B will start to be raised up-

wards.

[0056] Water supply to the tub 7 goes on until the ball 17B will come in contact with the rod 19B and displace it, thus causing the micro-switch 18B to switch. Also in this event, such a switching generates a signal, i.e. a water supply stop, which is apt to close the intake solenoid valve 3. Such a signal can eventually also be used to control the operation of the pump 9 in Fig. 1, so as to discharge the excess water from the tub 7 or operate a second solenoid valve eventually provided for safety reasons along the pipe 2. Finally, such a signal may also be used to actuate a visual and/or acoustical indication for the user.

[0057] Therefore, the function of the micro-switch 18B operation is to hinder the water level in the tub 7 from exceeding a predetermined safety limit, as defined by the operation threshold of the micro-switch 18B itself, in order to avoid a possible flooding.

[0058] As it can be realized, upon discharging the wash liquid from the tub 7, the water level inside the chambers 16A and 16B will gradually go down as long as the whole liquid amount is not fully discharged.

[0059] This will determine a gradual lowering of the balls 17A and 17B towards their initial position at rest on the lower stoppers 20A and 20B, with a consequent "resetting" of the micro-switch 18A (and eventually of the micro-switch 18B, if the above discharge occurs following a safety operation of the device).

[0060] Said "resetting" of the micro-switches following a water discharge is not necessarily such to automatically enable a new opening of the solenoid valve 3, since the latter is anyway also submitted to the control of the dishwasher programmer.

[0061] It is also underlined how the Fig. 2 represents a situation where both balls 17A and 17B operate simultaneously on rods 19A and 19B; however, it should be remembered that such a condition is solely illustrated by way of example of the actuation principle of both micro-switches 18A and 18B, and that this situation will only occur in the practice in the event of a main control system failure.

[0062] Finally, it is important to point out how in a preferred embodiment of the present invention the operating point of micro-switches 18A and 18B as well as the micro-switches themselves (but not the control rods end), are placed at a higher height with respect to the water overflow level (N - Fig. 1), i.e. the highest level over which water can flow out from the tub 7 in the event of a failure of the supply and dosage system, or of the solenoid valve 3.

[0063] Therefore, by having the micro-switches 18A and 18B placed on a high position, using balls 17A and 17B of significant dimensions (preferably with a diameter in the order of 18-30 mm) and selecting rods 19A and 19B of a certain length, live parts (i.e. the micro-switches themselves) can be spaced apart from the water supplied to the device 6 and also avoid that a likely overflow water from the tub 7 may come in contact with them.

[0064] To this purpose, it will be appreciated how the operation point of the micro-switches may be advantageously further upraised, through the simple provision of more than one ball inside each chamber 16A and/or 16B (see for example the embodiment represented in Fig. 4).

[0065] Moreover, according to a significant point of the present invention, the ball shape of both floats 17A and 17B determines frictions within the respective sliding chambers 16A and 16B, which are by far smaller with respect to the floats of a substantially cylindrical or parallelepipedon configuration used so far in the known dosage devices, as explained initially, thus reducing any fault or jam-up risks; for the same reasons, the ball shape of the floats according to the present invention ensures a consistent thrust on the micro-switch actuation rods.

[0066] Thanks to its intrinsic features, the ball structure also avoids possible alterations of the float external configuration (the so-called "warping"), which may occur in the known devices due to their extended use.

[0067] A substantial advantage of the floats ball configuration is their "self-cleaning" capability; in other words, during their motional steps, such ball floats tend naturally to rotate around their geometrical centre and consequently become free from likely soil deposits on them.

[0068] Fig. 3 represents a possible variant embodiment of the water supply and dosage device according to the present invention, which is indicated as a whole with reference 6A; in this figure the same reference numbers of the previous figures are used to indicate technically equivalent elements.

[0069] A substantial difference of the embodiment configuration shown in Fig. 3 with respect to the one shown in Fig. 2 is that in this specific instance the chamber 16A does not directly communicate with the conduit 15, and consequently with the wash tub 7.

[0070] As it can be seen, in fact, the bottom of the chamber 16A is delimited by a special wall P, located at a higher height than the conduit 15.

[0071] On the contrary, a siphon S is provided to connect the chamber 16A with the chamber 16B, the latter communicating directly through the conduit 15 with the tub 7 (it should be noticed that the areas of the body 11 indicated with A have no function for the purposes of the present invention).

[0072] The presence of the siphon S proves to be useful in the instance of washing machines, particularly dishwashing machines, equipped with the so-called "dynamic" water supply or dosage systems, i.e. equipped with a re-circulating pump being activated before the water supply from the mains has ended.

[0073] In such applications, for a device according to the previous embodiment shown in Fig. 2, the start of the re-circulating pump operation may cause water level fluctuations in the tub, and potentially also in the cham-

bers 16A and 16B.

[0074] As it can be realized, such level fluctuations (substantially due to a non perfectly consistent flow-rate of the re-circulating pump) may determine alternate upwards and downwards displacements of the ball 17A, with consequent alternate switching of the micro-switch 18A, which could entail a casual operation of the inlet valve 3, also after a first stop of the water supply.

[0075] Such operation faults can be avoided by eliminating the fluctuations of the ball 17A, i.e. placing a siphon S between the chamber 16B and the chamber 16A.

[0076] It should be noticed that the chamber 16B, which is provided for safety functions and to operate at a decidedly abnormal level, can remain connected directly to the wash tub.

[0077] In the instance of the embodiment shown in Fig. 3, when water is supplied to the tub 7 as described above, a gradual raising of the water level is also reached in the chamber 16B; a portion of the water also enters the lower mouth S1 of the siphon and raises up in it. The siphon S will prime or trigger (i.e. the water exceeds its bending) upon reaching a level X in the wash tub, so that from said instant of the water inlet onward, the water itself may overflow through the siphon from the chamber 16B to the chamber 16A, with a minimum mixing or turbulence degree in the chamber 16A itself.

[0078] For the rest, as it can be realized, the operation of the embodiment shown in Fig. 3 is similar to the operation of Fig. 2; a gradual raising of the water level in the chamber 16A will cause a gradual raising of the ball 17A, until it determines operation of the micro-switch 18A through the motion of the rod 19A; as it can be intuitively realized, the presence of the siphon will avoid any level changes that could lead to an intermittent operation.

[0079] On the contrary, in the event of a failure of the micro-switch 18A, a gradual raising of the water level in the chamber 16B determines a gradual raising of the ball 17B, until it will cause the micro-switch 18B to operate through the motion of the rod 19B.

[0080] In the instance of the embodiment suggested in Fig. 3, when the wash liquid is discharged from the tub 7, the siphon S - which is primed - will recall the water present in the chamber 16A as long as the water in the chamber itself does not reach the level of the upper mouth S2 of the siphon S. Anyway, to ensure a complete emptying of the chamber 16A, a suitable gauged passage, not represented in the figure for simplicity's sake, is provided on the chamber bottom.

[0081] Fig. 4 shows a possible third embodiment of the water supply and dosage device according to the present invention, which is indicated as a whole with reference 6B; in this figure the same reference numbers of the previous figures are used to indicate technically equivalent elements. Among other things, it can be noticed that the position of the part being operative under normal conditions and the position of the part which operates should the standard control fail, are inverted with respect to the Figs. 2 and 3.

[0082] In the embodiment of Fig. 4, the chamber 16A has a wall P on its bottom, wherein two balls are inserted, indicated with 17A' and 17A".

[0083] In this embodiment the chamber 16A communicates with the conduit 15 through a passage T having a high pressure drop, i.e. having a reduced section and a certain length development. In principle, the operation of the device 6B shown in Fig. 4 is substantially analogous to the operation of the device 6 shown in Fig. 2, but with a significant additional feature in that the passage T allows dampening likely water level fluctuations, as previously mentioned with reference to the so-called "dynamic" water supply or dosage systems.

[0084] Therefore, the embodiment shown in Fig. 4 appears even more advantageous than the one represented in Fig. 3, inasmuch as it ensures a higher operation accuracy, since a siphon may not allow an adequate priming consistency, for instance in the presence of air bubbles or turbulence, or soil particles, such as oil or grease drops from the wash tub, which would impair priming or at least priming repeatibility of a siphon.

[0085] Provision of the passage T in direct communication with the conduit 15 also allows for an improved cleaning of the chamber 16A, since the likely soil particles present in it tend to exit the passage T itself by gravity.

[0086] The device 6B shown in Fig. 4 also offers the great advantage of a less critical manufacturing process, considering that siphon production usually entails some repeatibility problems during the hot blade welding steps to obtain them.

[0087] It is pointed out that in the embodiment shown in Fig. 4, micro-switches 18A and 18B are not equipped with their relevant position adjustment means 21-22, but it is obvious that these can be easily provided, if required.

[0088] Fig. 5 shows a further possible embodiment according to the present invention, wherein the safety function of the device, indicated as a whole with 6C, is obtained through a membrane device; also in this figure the same references of the previous figures are used to indicate technically equivalent elements.

[0089] According to this embodiment, in the body 11 of the device 6C a first chamber 30 communicates with the pipe 2 through the connectors 12 and 13, i.e. with both the water mains and the wash tub 7; as it can be seen in Fig. 5, both connectors 12 and 13 are represented with a front section (i.e. differing from the representations in the previous figures), but it should be remembered that their configuration and the one of the conduits between them (14 and 15, Figures and 3) are similar to the one already described.

[0090] Reference S indicates a first siphon, which is apt to put the chamber 30 in communication with a chamber 16A housing a ball 17A, which is apt to cause switching of a micro-switch 18A equipped with its own

control rod 19A; as in the instance of the previous figures, the micro-switch 18A has position adjustment means 21-22; the micro-switch 18A performs a control function of the liquid level in the tub.

[0091] Reference SS indicates a second siphon, which is apt to put the chamber 30 in communication with a chamber 31 acting as an air trap for a safety function device. Such a safety device is of the type with a membrane, such as, but not necessarily, a pressure switch (not shown in the figure).

[0092] Reference 32 indicates a first connector to connect the air trap 31 to the above safety device through a small pipe (not shown).

[0093] Reference 33 indicates a second connector, closed with known means, such as a plug, to be used for discharging the water eventually contained in the air trap 31; such an operation should be performed by qualified technical personnel, since a condition where water is present inside the air trap 31 will only occur following an improper operation of the micro-switch 18A, as it will be further detailed.

[0094] Reference 34 indicates an air intake, which is required to let the water overflow from the chamber 30 to the air trap 31 when the water level inside the siphon SS reaches a level LS. Finally, reference 35 indicates a passage acting as a water outlet from the chamber 16A, should the level in it exceed the level LSS defined by a weir 36.

[0095] As further detailed, the passage 35 represents a further safety should also the above safety device fail to work.

[0096] Operation of the device 6C shown in Fig. 5 is as follows.

[0097] During water inlet according to the various procedures described above, water from the softener device 5 enters the device 6C through the connector 12 and flows through the connector 13 to the wash tub 7.

[0098] As the water level gradually increases in the tub 7, also the level inside the chamber 30 and within the siphon S will raise through the connector 13.

[0099] Once the overflow level of the siphon S has been reached, water can also overflow in the chamber 16A, so as to lift the ball 17A until it causes operation of the micro-switch 18A through the rod 19A, similarly to the examples previously described with reference to Figs. 2, 3 and 4.

[0100] As mentioned, operation of the micro-switch 18A takes place upon achievement of the desired water level inside the tub 7 and its switching causes the solenoid valve 3 to close. Should the micro-switch 18A fail to operate, i.e. the solenoid valve 3 remains open, the water level inside the tub 7 will further raise; as the water inside the tub 7 gradually increases, the level inside the chamber 30 and within the siphon SS will also increase through the connector 13.

[0101] Once the overflow level LS of the siphon SS has been reached, water can also flow in the air trap 31, where it will compress the air contained therein with a consequent actuation of the above membrane safety device (through the connector 32 and the small pipe connected to it), which causes the solenoid valve 3 to close.

[0102] Following such an improper operating situation, there will be some water inside the air trap 31, which should be evacuated; as mentioned above, water evacuation is performed through the connector 33, preferably by qualified personnel.

[0103] Should also the membrane safety device fail to operate, the water level will further increase inside the tub 7and, consequently, also in the chamber 16A.

[0104] Such a condition goes on until the level LSS is reached, over which the water exceeds the weir 36 and can flow in the passage 35, where it is directed towards the bottom of the washing machine, far apart from any electric components; in particular, water outflow through the passage 35 can be conveyed to a collecting tray to be provided in the lower part of the washing machine, wherein a suitable water detection sensor can be placed, which is apt to cause the closure of a further safety solenoid valve operating on the mains water supply pipe to the machine.

[0105] As to the drain steps under normal operating conditions, the device 6C operates substantially like the device shown in Fig. 3; to this purpose it will be appreciated that also in the instance of Fig. 4 a suitable gauged passage, not shown in the figure for simplicity's sake, may be provided on the bottom of the chamber 16A to perform water discharge.

[0106] The siphon S shown in Fig. 5 can be advantageously replaced by an arrangement similar to the one represented in Fig. 4, in which case the chamber 16A would be equipped with a bottom wall P and a high pressure drop passage T.

[0107] Finally, it should be noticed that the embodiment of Fig. 5, where a pressure switch or a similar membrane device acting as a safety function is used, is perfectly compatible with the low-cost and precision purposes related to the present invention.

[0108] The use of a membrane device for safety purposes, in fact, does not determine any cost increases with respect to the known solutions based on the use of pressure switches, where in fact at least two pressure switches are usually required, one for dosage and the other for safety purposes.

[0109] Moreover, the membrane device according to the embodiment of Fig. 5 does not require a high precision calibration (i.e. an expensive one), right in view of the fact of not being provided to perform a liquid dosage, but simply detect an improper operating condition.

[0110] The features of the present invention are clear from the above description; in particular, a device for the supply and dosage of the wash liquid in the tub of a domestic washing machine has being described, specifically a dishwasher, where the dosage is obtained by detecting the liquid level present inside the tub; such a device comprise detection means operating over the

whole amount of liquid supplied to the tub, and such detection means comprise at least a float for causing the switching of a relevant electric contact, in order to stop the liquid supply to the tub; according to the present invention, the float is housed in a chamber delimited in the device body, which is placed outside the tub; the device body is hydraulically connected to the tub so that a gradual raising of the liquid level in the tub will determine a gradual upraising of the float in the relevant chamber, until it causes the switching of the electric contact, where the switching threshold of said contact corresponds to the achievement of a predetermined liquid level inside the tub.

[0111] The float has preferably a spherical configuration, and is manufactured for example with a polymer, such as polypropylene or blown tumbled polystyrene; advantageously, specific means are provided for adjusting the position of the electric contact and consequently its switching threshold.

[0112] In a preferred embodiment of the invention, the hydraulic connection means between the chamber containing the float and the tub are apt to dampen likely oscillations in the liquid level, especially in the event of a liquid supply while the wash pump is in operation. The device may comprise several chambers to house their respective floats, as well as several floats operating in one same chamber.

[0113] From the above description also the advantages of the present invention are clear. In particular, the following points are highlighted:

- simple operation, since the dosage of the water in the tub is based on the use of floats and micro-switches;
- simple manufacture, since the device comprises components having a high repeatibility in the manufacturing process, with a long mechanical life, i.e. ball floats and micro-switches usually warranted for thousands of switching cycles; similarly, the body of the device according to the present invention is obtained through a simple thermoplastic moulding or hot blade welding operation;
- compactness and reduced overall dimensions;
- detection reliability, since the spherical configuration of the float has frictions inside the relevant chambers which are by far smaller with respect to the floats employed in the known solutions, thus reducing any error or jamming risks; for the same reasons, the spherical configuration of the float warrants a consistent thrust on the actuation rod of the relevant micro-switch;
- the spherical configuration avoids possible alterations to the external float shape (the so-called "warping") following its extended use, thanks to the specific characteristics proper of the ball configuration;
- the spherical configuration allows a "self-cleaning" of the floats which, during their moving steps tend naturally to rotate around their geometrical centre, and consequently to become free from likely soil deposits on them;
- for the above reasons it is possible to house more than one float in one same chamber, which is not recommended in the instance of cylindrical or parallelepiped floats according to the known state of the art, due to reliability reasons;
- spherical structures suitable for the use in the device according to the present invention are common and easy to find on the market, i.e. they are low-cost items.

[0114] It is obvious that many changes are possible for the man skilled in the art to the device for the supply and dosage of liquid in the tub of a domestic washing machine, particularly a dishwasher, described above by way of example, without departing from the novelty spirit of the innovative idea.

[0115] For instance, the idea of providing a passage and a safety weir, such as indicated with 35 and 36 in Fig. 5, can be easily provided also in the instance of the embodiments represented in Figs. 2, 3 and 4.

[0116] A further possible embodiment is represented in Fig. 6, where the reference numbers of the previous figures are used to indicate technical elements equivalent to the ones already used. According to this embodiment, a by-pass 2A is provided on the supply pipe 2, upstream of the device 6 according to the present invention.

[0117] Such a by-pass 2A engages into a special pipe 40 between both chambers 16A and 16B, whose purpose is to warrant a preliminary direct washing of the balls 17A and 17B before they start operating for water dosage, as well as of the chambers 16A and 16B themselves. As previously described, the device according to the present invention is in fact directly connected to the tub through the pipe 2, so that some leftovers washed away from the crockery during washing and not retained by the usual re-circulation filters may possibly reach the chambers housing the balls 17A and 17B.

[0118] According to the suggested embodiment, when water supply is started, a first portion of water, i. e. the portion flowing through the above by-pass pipe 2A and the relevant pipe 40, reaches the device 6 before the remaining portion of water flowing through the main path of the pipe 2 reaches the wash tub.

[0119] Through the holes in the areas indicated with 40A and 40B, said first portion of water will generate suitable directed outlet jets, to perform a preliminary washing of the balls 17A and 17B and the relevant chambers 16A and 16B.

[0120] Also in the continuing operation, the outlet jets from said holes in the area 40B will perform their washing function during the whole water supply step, ensuring the removal of likely leftovers, but without opposing the raising of the balls themselves.

[0121] A further possible embodiment of the invention

may have the aim of avoiding the need of fixed times to perform the water discharge from the wash tub, in the instance of machines equipped with an electromechanical programmer.

[0122] In this connection it is known for some washing machines, such as dishwashers, to be equipped with electromechanical programming devices, which are well known and do not need a more detailed description here. However, to the purposes of the suggested embodiment, it is useful to remember that electromechanical programmers usually comprise an electric motor, which when it is supplied starts cams rotation through suitable gear-reducer and/or ratched gears; said cams usually consist of plastic disks, whose external profile is configured to open/close electric contacts, which enable/disable the various internal devices of the machine and consequently their relevant functions.

[0123] As to the discharge steps of the dirty water from the tub, it is common practice to supply the programmer motor for a pre-set time (at the design stage) to allow water discharge from the tub through the relevant pump (9, Fig. 1).

[0124] However, into practice, it may happen that such a pre-set time lasts longer than strictly necessary for discharge, so as to ensure a safety margin, with a consequent total extension of the wash cycle (above all considering that during a normal washing many discharge steps are performed).

[0125] In other instances, on the contrary, the pre-set supply time for the motor may not last enough to warrant a complete discharge, for instance due to chokings on the discharge pipe or other causes, determining anyway a slower water evacuation from the tub; in this instance, since a discharge step is usually followed by a water supply step, there will be the risk of supplying clean water to the tub with a portion of dirty water still present in it.

[0126] The suggested embodiment has the function of avoiding the need of imposing supply pause intervals having a fixed time to an electromechanical programmer, for water discharge purposes, in order to overcome the above drawbacks.

[0127] According to this embodiment, the device provided by the present invention can be equipped with an additional chamber containing a ball float with a relevant micro-switch, whose operation is inverse to the previously mentioned micro-switches, i.e. apt to switch when nearly no more water is left in the relevant chamber.

[0128] In this instance, the additional ball should have enough specific gravity to switch said micro-switch - from the open contact to the closed contact - when there is no water present and consequently in virtue of its weight; as a result, in the practice the ball weight should be able to displace downwards a control lever of said micro-switch, having a special configuration.

[0129] Therefore, as regards the suggested embodiment, when water enters the additional chamber during a supply step, the ball raises up and causes the micro-switch to switch from the closed contact to the open contact; the opening status of such a contact may then be used at the start of a water discharge step, in order to stop the electric supply to the programmer motor.

[0130] On the contrary, when during a discharge step a lower water level is determined in the additional chamber, the ball reaching a pre-set height causes the micro-switch to switch, from the open contact to the closed contact, so as to supply further the programmer motor for the prosecution of the wash program.

[0131] Therefore, as it can be realized, if suitable means apt to detect a substantial lack of water within said chamber are available, it is possible to discharge the water with the programmer motor at standstill up to a nearly complete emptying of the tub; thus the discharge duration can be obtained for the time strictly required, which is actually a function of the discharge pump flow-rate and likely chockings or obstructions in the drain piping of the dishwasher or domestic environment.

[0132] Should a total obstruction of the discharge pipe or a fault to the discharge pump occur, the wash program stops since the timer operation is "blocked" due to its lack of electric supply. It is obvious that instead of an additional chamber and ball, the above aims can also be achieved through the use of the same ball used for the dosage (17A, Figures. 2-4), which in this instance would be provided to cause the switching of two micros-witches, i.e. an "upper" micro-switch apt to detect the achievement of the desired supply water level (i.e. entirely similar as indicated in the Figs. 2-4), and a "lower" micro-switch, operating inversely to the first one, which is apt to detect a lowering of the water level down to a level being next or coincident to the complete emptying of the tub.

Claims

1. Device for the supply and dosage of liquid in the tub (7) of a domestic washing-machine, in particular a dishwasher, of the type in which the dosage is realized by detecting the liquid level inside the tub (7), said device (6, 6A, 6B, 6C) comprising detection means which operate on the basis of the quantity of liquid supplied to the tub (7), said detection means comprising at least a first float (17A, 17B, 17A") for causing a switching of a first electric contact (18A) for stopping the liquid supply to the tub (7), characterized in that said first float (17A, 17B, 17A") is housed in a first chamber (16A) delimited in a body (11) of said device (6, 6A, 6B, 6C), said body(11) being located outside the tub (7) and hydraulically connected to it in a way that a gradual raising of the liquid level in the tub (7) determines a consequent raising of the first float (17A, 17B, 17A") in the first chamber (16A), which occurs gradually until causing said switching of the first contact (18A), the switching threshold of said first contact

(18A) corresponding to the achievement of a predetermined liquid level in the tub (7).

2. Device, according to claim 1, characterized in that said first float (17A, 17B, 17A") has a spherical shape and in particular is made from a polymer, such as polypropylene or blown tumbled polystyrene.

3. Device, according to claim 1, characterized in that means (21, 22) are provided for adjusting the position of said first contact (18A) and consequently its switching threshold, said means comprising in particular a movable support (21) for said first contact (18A) and means (22) for changing the position of said support (21), said support (21) and said position changing means (22) being housed in relevant seats delimited in said body (11).

4. Device, according to claim 1, characterized in that said body (11) is interposed on a liquid supply line to the tub (7).

5. Device, according to claim 1, characterized in that hydraulic connection means (T, S, 2, 12-15) are provided between said chamber (16A) and said tub (7), for dampening possible oscillations in the liquid level, namely in the case of liquid supplies while a wash pump in operation, said means comprising in particular a high pressure drop passage (T) for the liquid and/or a bottom wall (P) of said first chamber (16A) wherefrom said passage (T) and/or a siphon depart.

6. Device, according to claim 5, characterized in that the hydraulic connection means (T, S, 2, 12-15) between said chamber (16A) and said tub (7) comprise an inlet connector (12) and an outlet connector (13) in the lower part of said body (11), for its connection to said supply line (29), the outlet connector (12) having specifically a smaller section with respect to the inlet connector (13).

7. Device according to the previous claim, characterized in that at least two conduits (14, 15) are defined between said connectors (12, 13), wherein a first conduit (14) puts said inlet connector (12) in direct communication with said outlet connector (13) and a second conduit (15) puts said outlet connector (13) in direct communication with the upper section of the device, wherein said first chamber (16A) is defined.

8. Device, according to at least one of the previous claims, characterized in that at least a second chamber (16B) is provided in said body (11) for housing at least a second float (17B) for causing the switching of a second electric contact (18B), said second chamber (16B) being hydraulically connected to the tub (7) in a way that a gradual raising of the liquid level in the tub (7) determines a consequent raising of the second float (17B) in the second chamber (16B), which occurs gradually until said switching of the second contact (18B) occurs, the switching threshold of said second contact (18B) corresponding to the achievement of a predetermined second liquid level in the tub (7), said second float (17B) having in particular a spherical shape and where said second chamber (16B), said second float (17B) and said second contact (18B) are in particular provided for safety reasons, should said first contact (18A) fail, the switching threshold of said second contact (18B) being at a higher height with respect to the switching threshold of said first contact (18A).

9. Device, according to one or more of the previous claims, characterized in that at least one of said contacts is configured as a micro-switch (18A, 18B), having a control rod (19A, 19B) apt to be motioned by said float (17A, 17B).

10. Device, according to one or more of the previous claims, characterized in that at least one of said contacts (18A, 18B) is located in an off-centred centre position with respect to the relevant chamber (16A, 16B) and relevant float (17A, 17B).

11. Device, according to one or more of the previous claims, characterized in that stoppers (20A, 20B) are provided in at least one of said chambers (16A, 16B), on which a relevant float (17A, 17B) can rest if there is no water in the chamber itself.

12. Device according to one or more of the previous claims, characterized in that at least two spherical floats (17A', 17B') are provided in one same chamber (16A, 16B).

13. Device, according to claim 1, characterized in that a second chamber (31) is provided, which is in hydraulic communication with said first chamber (16A), acting as an air trap for a membrane safety device, a siphon (SS) being in particular provided for the hydraulic connection of said first chamber (16A) to said second chamber (31).

14. Device, according to at least one of the previous claims, characterized in that said first chamber (16A) has an outlet conduit (35), wherefrom the liquid exceeding a safety level inside said first chamber (16A) can outflow, said safety level being defined by a weir (36) of said first chamber (16A), said conduit (35) being apt to direct the liquid exceeding said weir (36) away from any electric components of the washing machine.

15. Device, according to the previous claim, characterized in that said conduit (35) conveys the water to a collecting tray, particularly being provided in the lower part of the washing machine where a water detection sensor is provided, which is apt to close a safety valve operating on the supply pipe of the water mains to the machine.

16. Device, according to claim 1, characterized in that means (2A, 40, 40A, 40B) are provided to perform a preliminary washing of said floats (17A, 17B; 17A', 17A") and their relevant chambers (16A, 16B) before liquid flowing from said tub (7) enters them, said means comprising in particular a by-pass pipe (2A) from said supply line.

17. Device, according to claim 1, characterized in that sensor means are provided to avoid the imposition of fixed times for performing the liquid discharge from said tub (7).

18. Device, according to the previous claim, characterized in that said sensor means comprise an additional chamber equipped with an additional float to actuate a relevant additional electric contact, the additional float being apt to determine the switching of the additional contact when no more liquid is substantially present in said additional chamber, said additional float having in particular a specific gravity being sufficient for determining the switching of said additional contact.

19. Device, according to claim 1, characterized in that said float is apt to cause the switching of two different electric contacts, particularly a contact apt to detect the achievement of a first predetermined liquid level in said tub (7) and a contact, which operates inversely to the first one, for detecting the liquid level decrease down to a point next to or coincident which a lack of liquid in said tub (7).

20. Device, according to one or more of the previous claims, characterized in that said contacts (18A, 18B) are located at a higher height with respect to the overflow level (N) of said liquid from said tub (7).

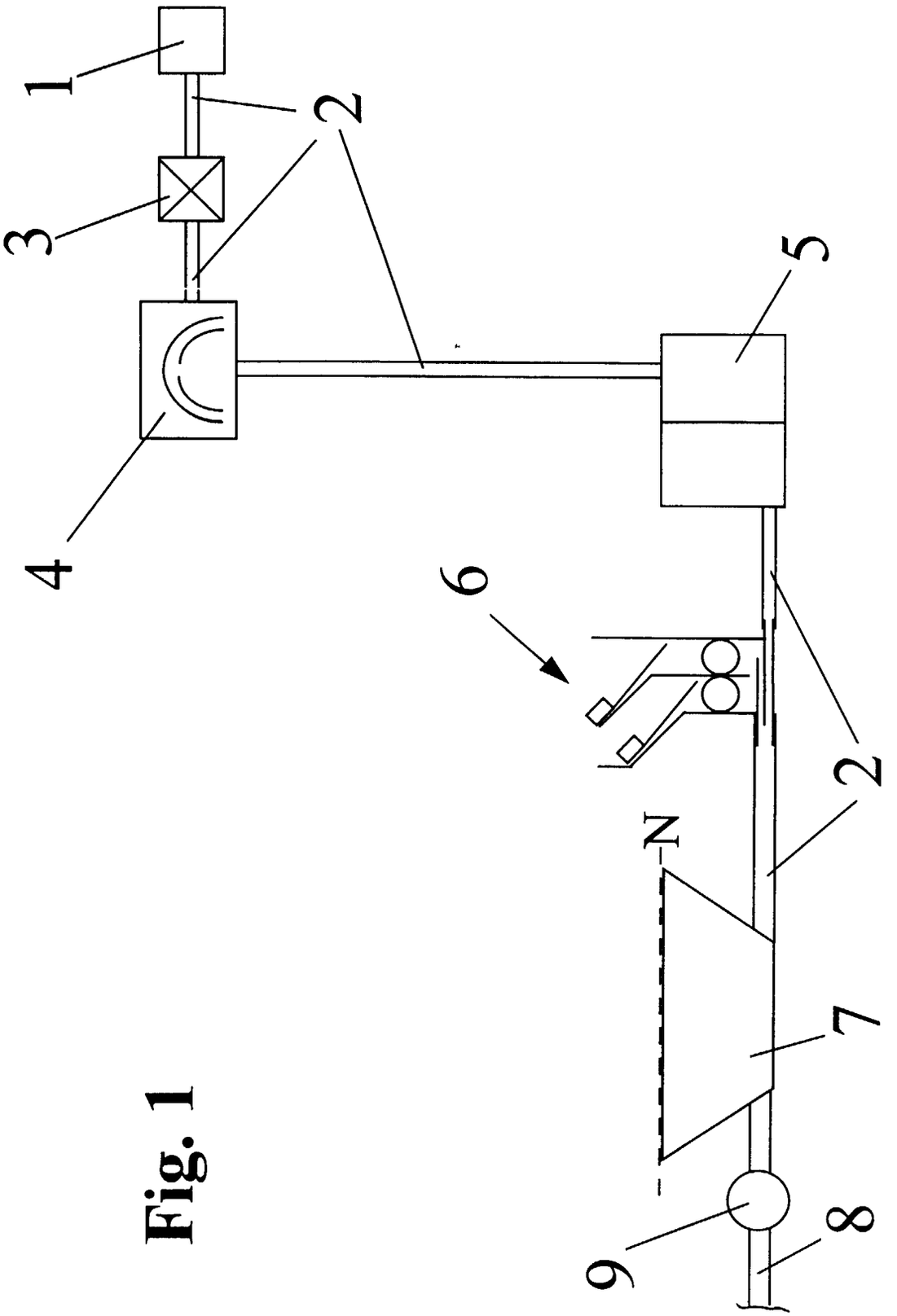
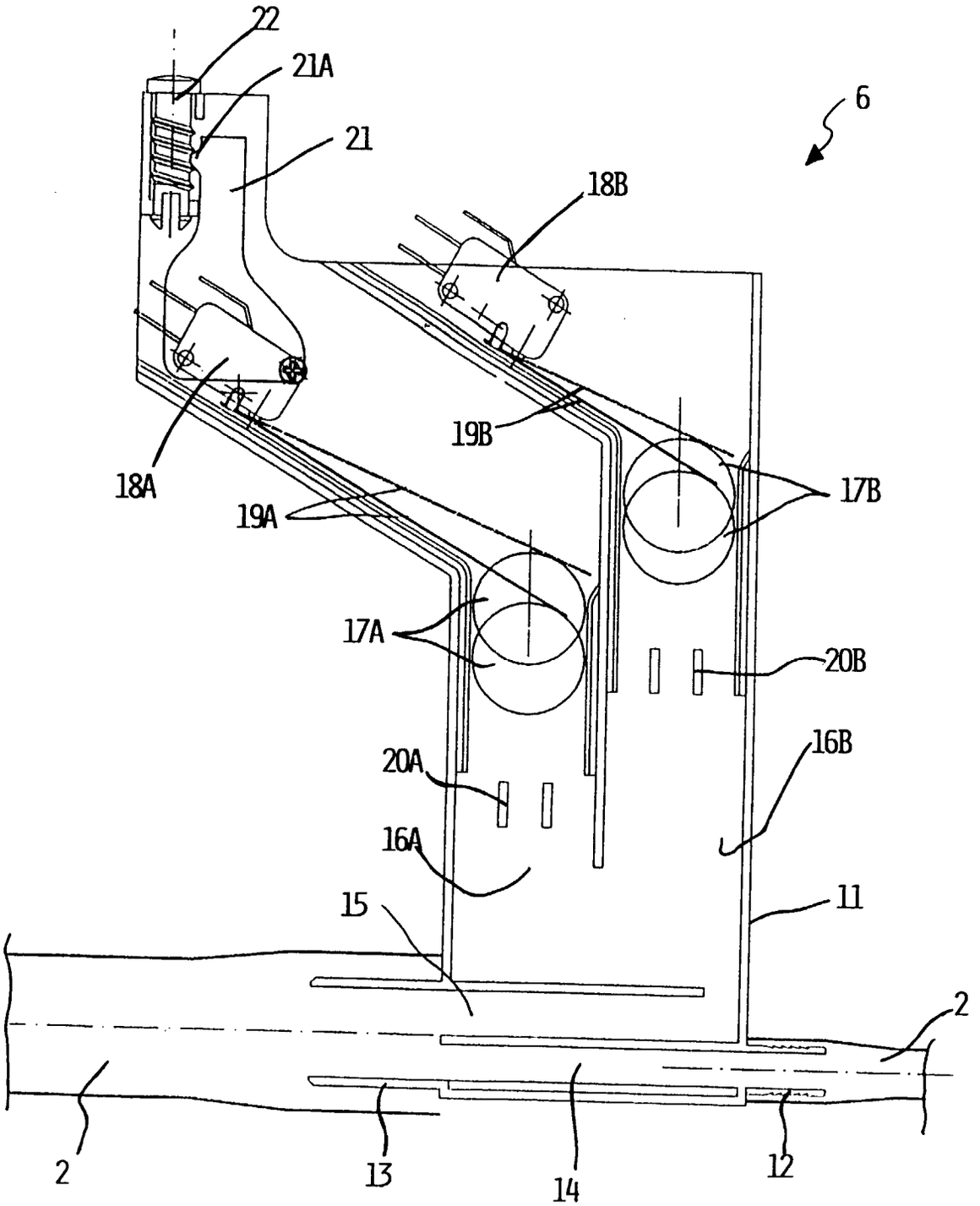


Fig. 1

FIG. 2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21A
21
6
18B
19B
18A
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17B
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20A
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15
11
2
2
13
14
12

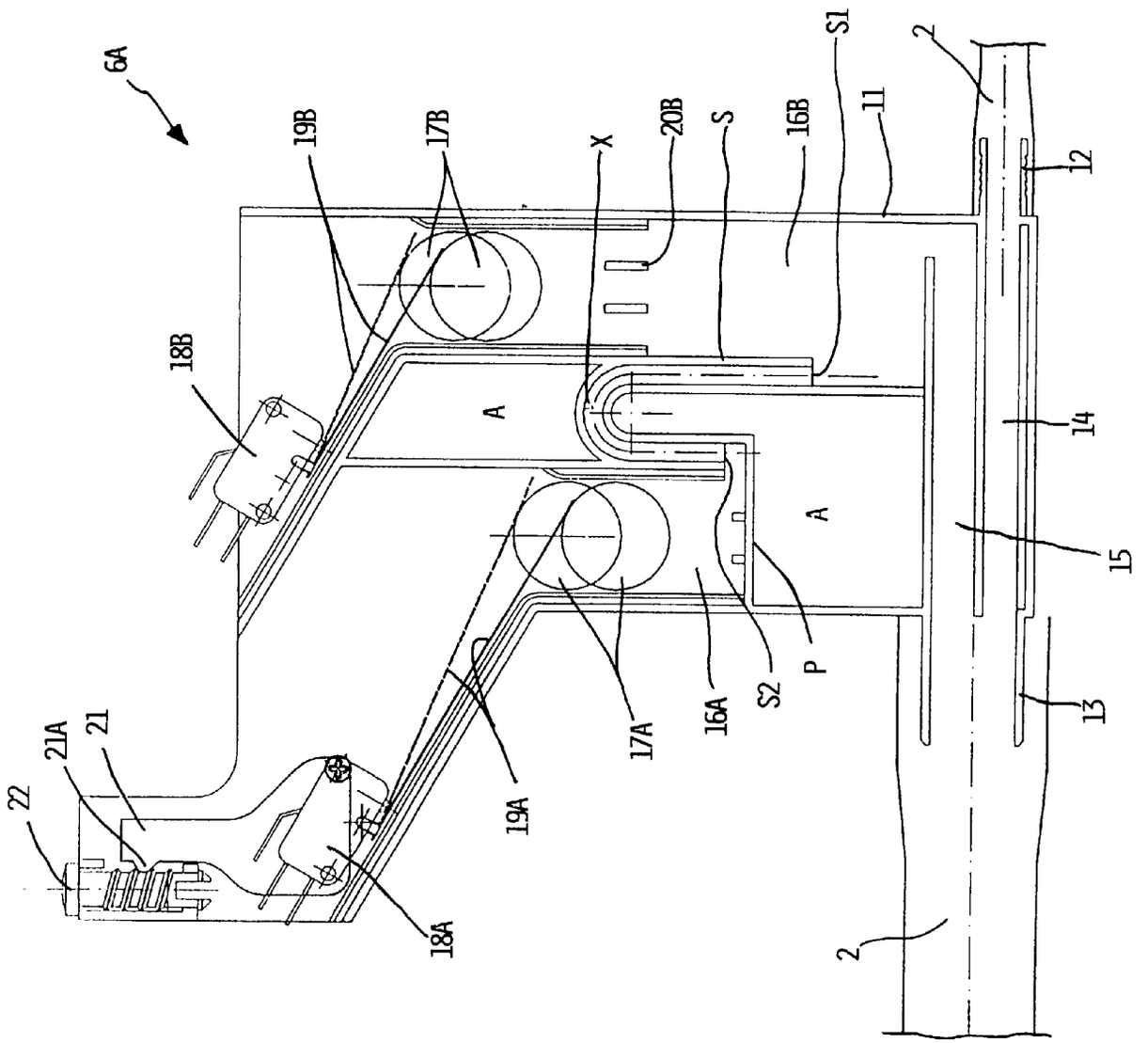

6A
19B
17B
X
20B
S
16B
S1
11
2
12
18B
A
14
A
15
P
S2
16A
17A
19A
13
22
21A
21
18A
2

FIG. 3

FIG. 4

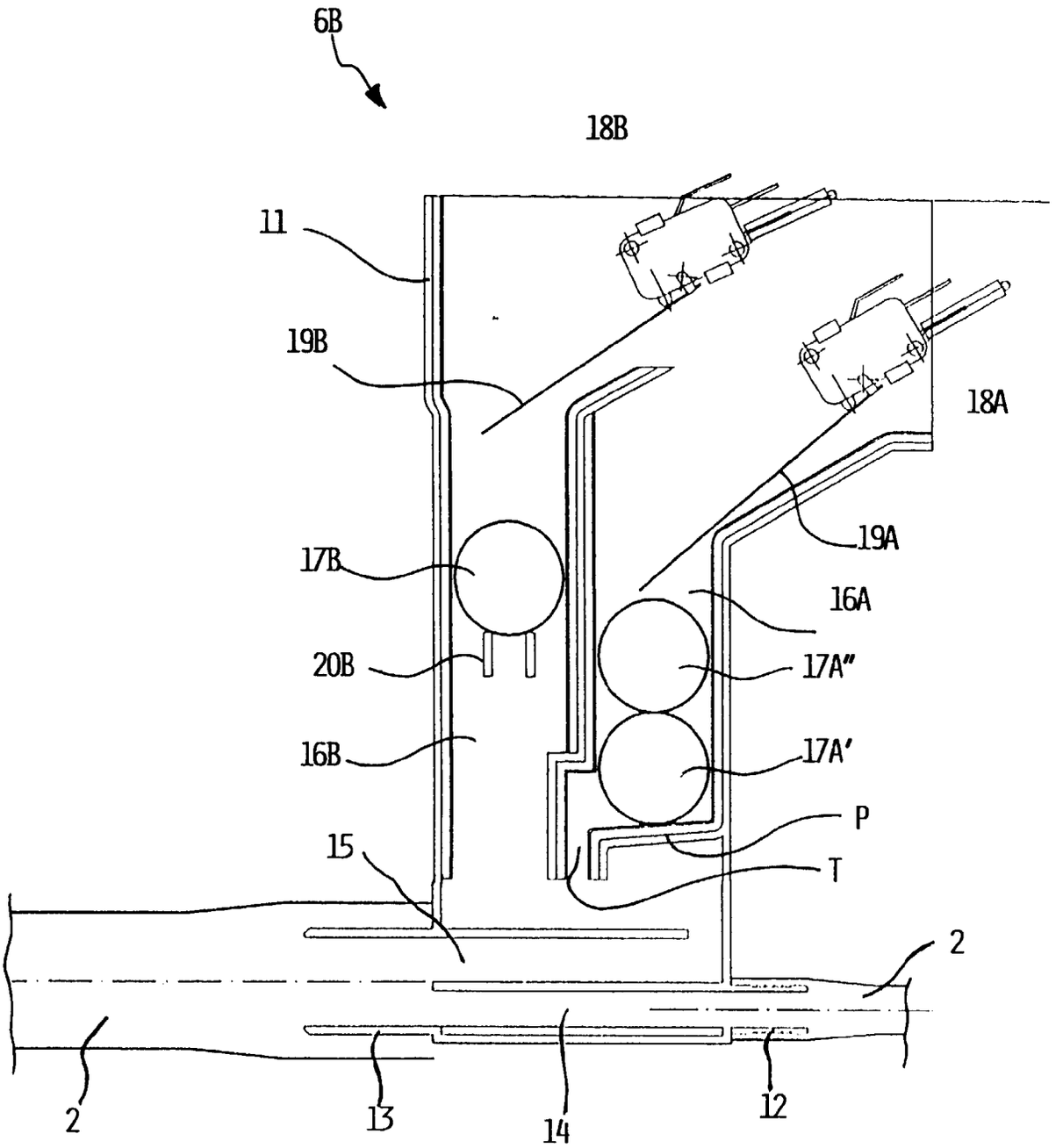
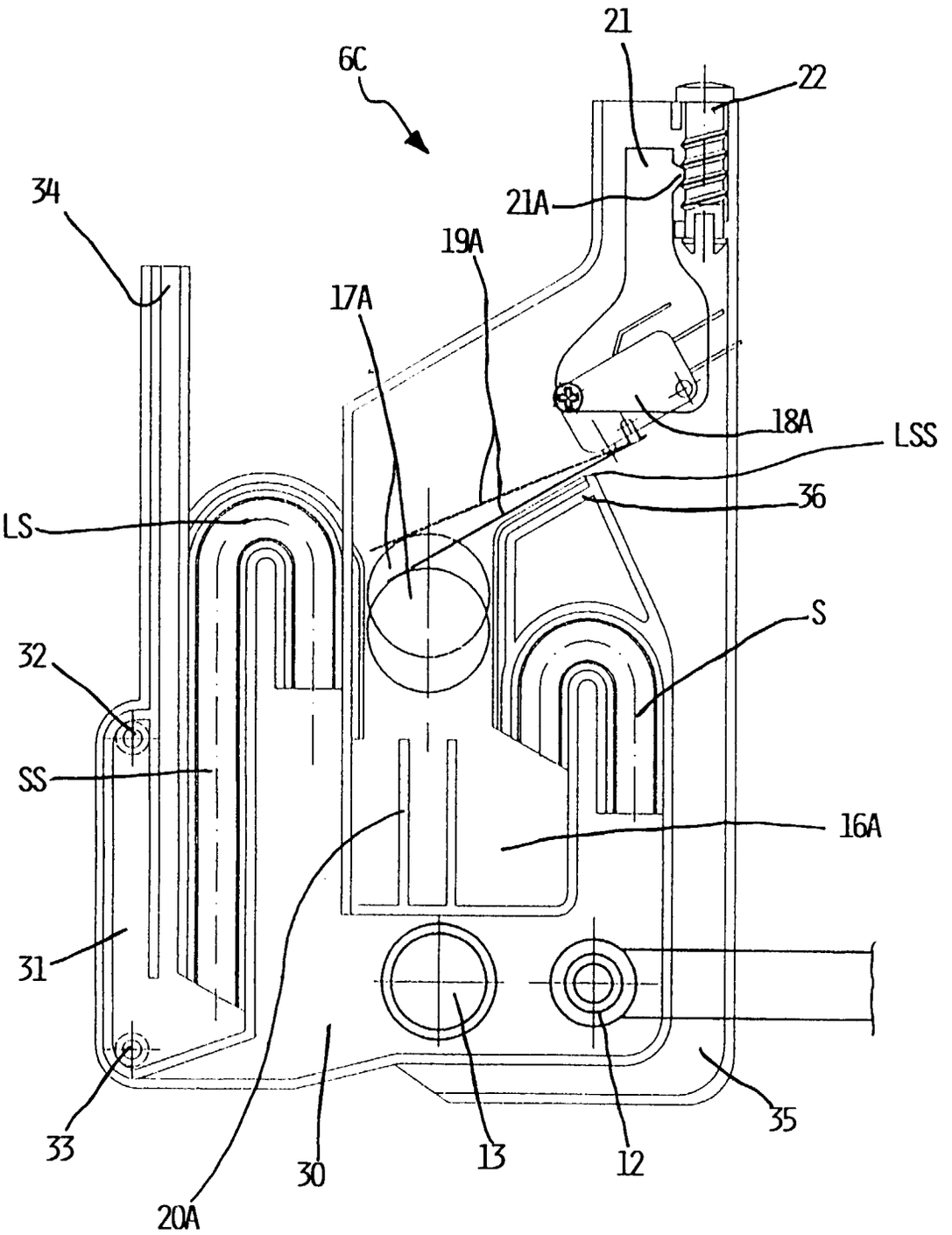


FIG. 5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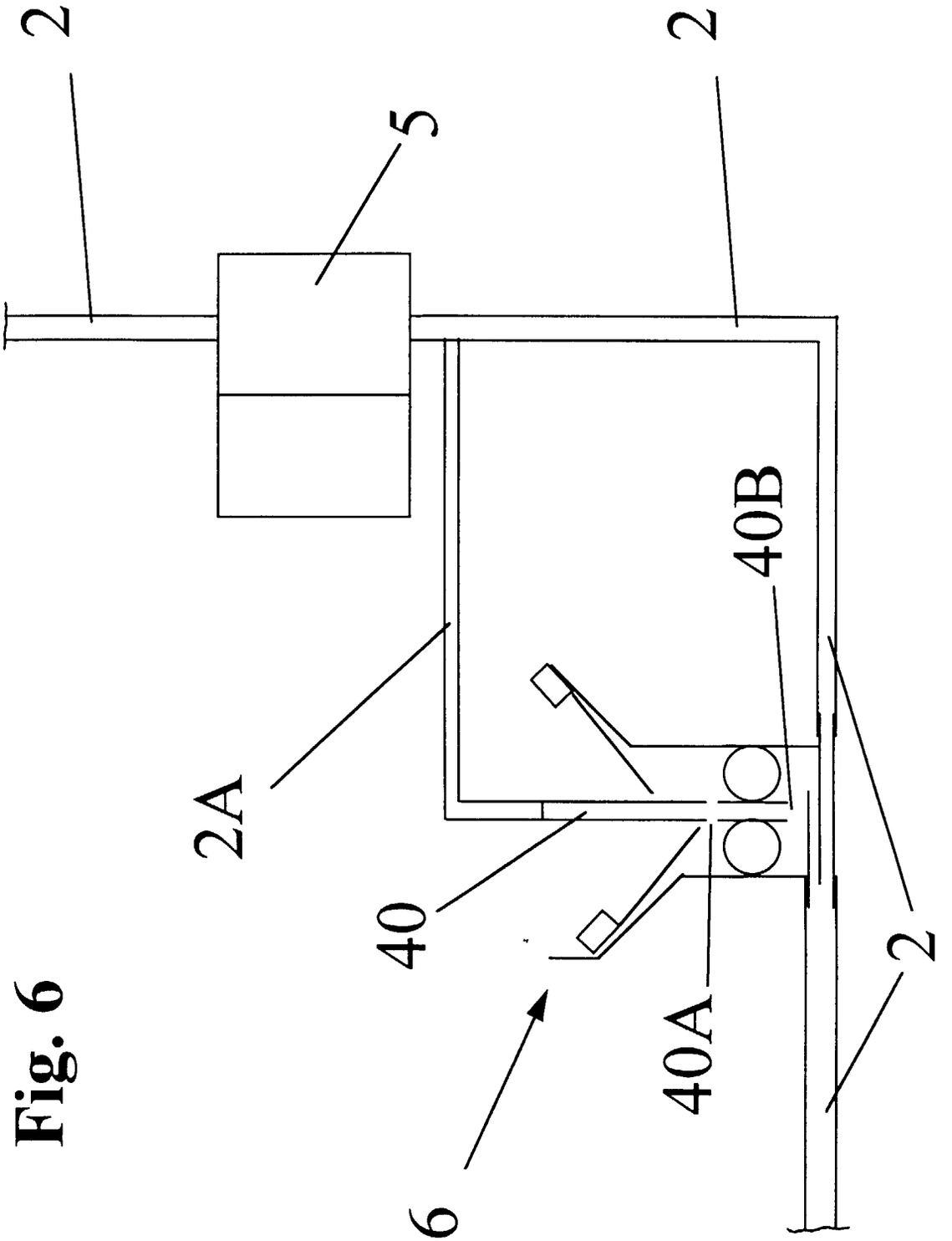

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 6464

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MUNICH	2 August 1999	Laue, F

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