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(54) **Laundry washing machine**

(57) A laundry washing machine (1) having a wash tub (2), and an automatic device (3) for dispensing and metering at least one laundering product drawn from a respective container (11) containing a sufficient amount of product for numerous wash cycles; wherein the device

(3) has at least one inlet (5) for the product, a water circuit (4) closed by the tub (2), and product metering means (6) interposed between the inlet (5) and the circuit (4) to inject a measured amount of product into the circuit (4) when water flows along the circuit (4).

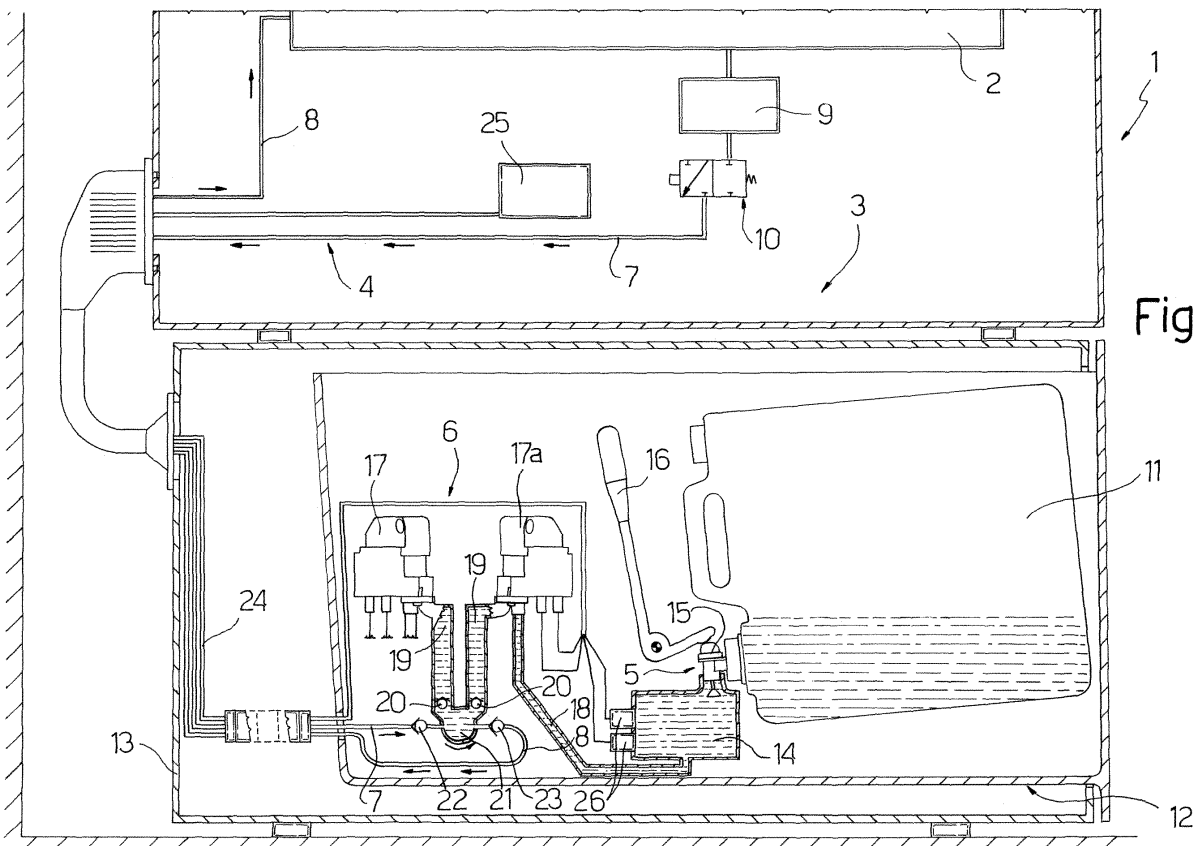


Fig. 2

## Description

**[0001]** The present invention relates to a laundry washing machine.

**[0002]** More specifically, the present invention relates to a laundry washing machine of the type comprising a device for automatically dispensing and metering at least one laundering product.

**[0003]** At present, washing machines of the above type are practically only used professionally, on account of the highly complex design of the automatic product dispensing and metering device, which makes the machine both expensive and difficult to use.

**[0004]** It is an object of the present invention to provide a laundry washing machine featuring an automatic product dispensing and metering device, and which, at the same time, is straightforward, economical, and particularly suitable for home use.

**[0005]** According to the present invention, there is provided a laundry washing machine as claimed in Claim 1 and, preferably, in any one of the Claims depending directly or indirectly on Claim 1.

**[0006]** A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows an operating block diagram of a preferred embodiment of the machine according to the present invention;

Figure 2 shows a schematic detail of the Figure 1 machine;

Figure 3 shows an operating block diagram of a variation of the Figure 1 machine;

Figure 4 shows a schematic detail of the Figure 3 machine.

**[0007]** With reference to Figures 1 and 3, number 1 indicates as a whole a laundry washing machine comprising a wash tub 2 housing a perforated revolving laundry drum (not shown); and an automatic dispensing and metering device 3 for feeding measured quantities of laundering products, e.g. detergent, softener, freshener, etc., into tub 2.

**[0008]** More specifically, device 3 comprises a water circuit 4 closed by tub 2; two inlets 5 for respective products; and metering means 6, which are interposed between inlets 5 and circuit 4, and, as explained in detail below, inject measured quantities of products into circuit 4, when water flows along circuit 4, to feed a water-product mixture into tub 2. For this purpose, circuit 4 comprises a delivery branch 7 extending from tub 2 to metering means 6 to supply metering means 6 with wash water from tub 2; and a return branch 8 extending from metering means 6 to tub 2 to feed a water-product mixture into tub 2. Circuit 4 also comprises a pump 9 located along delivery branch 7 to pump water from tub 2 along circuit 4 via a solenoid valve 10, which is located along delivery branch 7, downstream from pump 9, and is activated by

an external signal as a function of the programmed wash cycle.

**[0009]** Each inlet 5 is defined by a fast-fit connector to a respective container 11, which may be replaceable, as in the Figure 1 and 2 embodiment, or refillable, as in the Figure 3 and 4 embodiment. In both cases, containers 11 are housed in a pull-out drawer 12 formed in a base 13 of machine 1.

**[0010]** More specifically, with reference to the Figure 1 and 2 example, drawer 12 houses two side by side containers 11 (only one shown in Figure 2) defined, in the example shown, by respective disposable cans of enough product for numerous wash cycles. Each inlet 5 (only one shown in Figure 2) is defined by the mouth of a respective tank 14 connectable to relative container 11 by a tap 15, the inlet of which is connected in fluidtight manner to an opening in container 11, before container 11 is placed inside drawer 12, and the outlet of which is connected in fluidtight manner to the mouth of tank 14 to connect container 11 to tank 14.

**[0011]** Tap 15 comprises a spring-operated valve normally set to a closed position (not shown), and which is set to an open position (shown in Figure 2) by means of an external lever 16 hand-operated by the user once tap 15 is connected to tank 14, so container 11 can be connected and disconnected easily, with no leakage, and the product can be gravity-fed into tank 14 only after tap 15 is inserted through inlet 5.

**[0012]** As shown in Figure 2, metering means 6 are housed, together with container 11 and tank 14, inside drawer 12, and comprise, for each inlet 5, a pump 17 (Figure 2 shows pumps 17 of both containers 11); an intake conduit 18 connecting the inlet of pump 17 to relative tank 14; and a feed conduit 19 connecting the outlet of pump 17 to a mixer 21 via a one-way valve 20.

**[0013]** Mixer 21, to which both feed conduits 19 of relative pumps 17 are connected, defines a portion of circuit 4 connecting the outlet of delivery branch 7 to the inlet of return branch 8, and communicates on one side with delivery branch 7 via a one-way valve 22 to receive water from tub 2, in use, and on the other side with return branch 8 via a one-way valve 23 to feed a water-product mixture into tub 2.

**[0014]** Pumps 17 are controlled, as described below, by a central control unit 25 housed in a main body of machine 1 over base 13, and connected to pumps 17 by a multipole cable 24, which, together with delivery branch 7 and return branch 8, extends from the main body of machine 1 to base 13 through an outside sleeve, and through an extensible member located inside base 13 and outside drawer 12 to permit extension of cable 24 and branches 7 and 8 when drawer 12 is pulled out of base 13.

**[0015]** For each tank 14, device 3 comprises two optical level sensors 26 connected to central control unit 25 by multipole cable 24.

**[0016]** Operation of machine 1 will now be described, as of the instant in which, on the basis of the programmed

cycle of machine 1, a measured quantity of product, e.g. detergent, is to be added to the laundry. At this point, while a known external hydraulic circuit (not shown) feeds wash water into tub 2, an electric command, activated by the timer of machine 1, opens valve 10 and operates pump 9, which pumps water from tub 2 into circuit 4 at a high enough pressure to open valves 22 and 23 so the water flows through mixer 21. As the water flows through mixer 21, valves 20 of respective feed conduits 19 prevent it from flowing into feed conduits 19 to respective pumps 17.

**[0017]** Once water is circulating inside circuit 4, central control unit 25 activates the pump 17 connected to the detergent container 11 (hereinafter indicated 17a for the sake of clarity). When pump 17a is activated, detergent is drawn from tank 14 along relative intake conduit 18 and injected along relative feed conduit 19 into mixer 21 at a high enough pressure to open valve 20.

**[0018]** Inside mixer 21, the detergent mixes with the circulating water to form a water-detergent mixture, and is fed along return branch 8 into the laundry inside tub 2.

**[0019]** The detergent is metered automatically, by central control unit 25 controlling the operating time of pump 17a determined by central control unit 25 on the basis of the programmed cycle parameters, e.g. type and quantity of laundry, type of wash cycle, etc.

**[0020]** Consequently, after a given time lapse corresponding to the amount of detergent to be used in the wash, central control unit 25 stops pump 17a, thus cutting off detergent supply to mixer 21.

**[0021]** After a further given time lapse, during which pump 9 continues pumping water along circuit 4 to remove all traces of detergent from mixer 21 and to flush circuit 4, pump 9 is also stopped, valve 10 is closed, and water no longer flows along circuit 4.

**[0022]** When container 11 runs out and the product level inside tank 14 falls, sensors 26 transmit respective signals to central control unit 25, which disables respective pump 17 until container 11 is changed, and preferably also lights up a "no-product" alarm signal on a display of machine 1.

**[0023]** For the sake of clarity, the above example is limited to feeding a measured quantity of only one product, i.e. detergent, into tub 2.

**[0024]** If the wash program calls for using two products simultaneously, however, central control unit 25 is designed to operate pumps 17 of product tanks 14 simultaneously or successively, and to keep each pump 17 operating for the time taken to dispense the required amount of the relative product.

**[0025]** In the variation shown in Figures 3 and 4, the two containers 11 housed inside drawer 12 are two refillable tanks (only one shown in Figure 4), each of which contains enough product for numerous wash cycles, is housed inside a support 27 integral with base 13, and has a tilting lid 28 to enable the user to top up the product.

**[0026]** At the bottom, each container 11 has a tubular opening 29, which, when the container 11 is housed in

support 27 (Figure 4), is inserted partly inside the initial portion of a channel 30 formed in support 27 and defining said inlet 5 for the product inside container 11.

**[0027]** Each opening 29 has a ball valve, which, when the container is housed in support 27 (Figure 4), is held in an open position by a pin integral with support 27, and, when the container is detached from support 27 (not shown), e.g. for cleaning, closes opening 29 to prevent product leakage from the container.

**[0028]** As shown in Figure 4, for each inlet 5, metering means 6 comprise a hydropneumatic metering device 31, in turn comprising a cylinder 32, and a piston 33 slid by compressed air inside cylinder 32. More specifically, cylinder 32 is closed at one end, and, at the opposite end, is fitted through in fluidtight sliding manner with the rod of piston 33, an end portion of which, integral with the rod, mates in fluidtight manner with the lateral wall of cylinder 32, and divides cylinder 32 internally into a first chamber communicating with the delivery side of a compressor 34, and a closed second chamber housing a spring 35 compressed between the closed end of cylinder 32 and the end portion of piston 33.

**[0029]** At the opposite end, piston 33 has an end portion, which mates in fluidtight sliding manner with the lateral wall of a tubular member to define, inside the tubular member, a variable-volume chamber 36, which, as explained in detail below, stores the measured amount of product drawn from container 11 by hydropneumatic metering device 31, pending injection into circuit 4.

**[0030]** More specifically, chamber 36 communicates, on one side, with channel 30 via a one-way valve 37 only allowing product flow into chamber 36, and, on the other side, with mixer 21 via a feed channel 38 and a one-way valve 39 only allowing outflow of the product from chamber 36.

**[0031]** As shown in Figures 3 and 4, compressor 34 is housed in the main body of machine 1, and is connected to each hydropneumatic metering device 31 by a respective tube 40 to selectively feed compressed air to relative cylinders 32 via a three-position solenoid valve 41.

**[0032]** This variation of machine 1 operates in the same way as machine 1 described with reference to Figures 1 and 2, with the exception of the metering mode adopted.

**[0033]** That is, once pump 9 is operated and water begins to circulate in circuit 4, an external command activates compressor 34, which feeds compressed air to cylinder 32 of container 11 of the product to be dispensed, e.g. detergent, so as to overcome the resistance of spring 35, slide piston 33 inwards of cylinder 32, and so increase the volume of chamber 36 and form a sufficiently low pressure inside chamber 36 to open valve 37 and feed the product into chamber 36.

**[0034]** Since the amount of product drawn is proportional to the volume of chamber 36 and, therefore, to the travel of piston 33, automatic metering, in this case, is a function of the position of piston 33 inside cylinder 32.

**[0035]** When compressor 34 is deactivated, spring 35

pushes piston 33 outwards, thus rapidly reducing the volume of chamber 36 and expelling the product from the chamber at a high enough pressure to open valve 39 and feed the product into mixer 21.

**[0036]** To conclude, it should be pointed out that, in the above embodiments, the number of inlets 5 is purely indicative. In fact, as will be clear from the above description, in both embodiments, each metering means 6 - be it a pump 9 or a hydropneumatic metering device 31 - is associated with a respective container 11, and operates regardless of the presence or number of other metering means 6. As such, operation of machine 1 as described above also applies, regardless of whether device 3 comprises only one inlet 5 for one container 11, or more than two inlets 5 for respective containers 11.

### Claims

1. A laundry washing machine comprising a wash tub (2), and an automatic dispensing and metering device (3) for dispensing and metering at least one laundering product drawn from a respective container (11) containing a sufficient amount of product for numerous wash cycles; the machine (1) being **characterized in that** said dispensing and metering device (3) comprises an inlet (5) for the product; a water circuit (4) closed by the tub (2); and product metering means (6) interposed between the inlet (5) and the circuit (4) to inject a measured amount of product into the circuit (4) when water flows along the circuit (4).
2. A machine as claimed in Claim 1, wherein the inlet (5) is defined by a fast-fit connector to the container (11).
3. A machine as claimed in Claim 1 or 2, wherein the circuit (4) comprises a mixer (21) communicating with an outlet of the product metering means (6) via first valve means (20; 39); and a delivery branch (7) and a return branch (8), which are connected to each other at one end by the tub (2), and at the other end by the mixer (21).
4. A machine as claimed in Claim 3, wherein the first valve means comprise a first one-way valve (20; 39) calibrated to allow the product into the mixer (21).
5. A machine as claimed in Claim 3 or 4, wherein the delivery branch (7) and the return branch (8) communicate with the mixer (21) via second valve means (22, 23).
6. A machine as claimed in Claim 5, wherein the second valve means (22, 23) comprise a second one-way valve (22) calibrated to allow water flow to the mixer (21); and a third one-way valve (23) calibrated to allow outflow of a water and product mixture from the mixer (21).
7. A machine as claimed in one of Claims 3 to 6, wherein the dispensing and metering device (3) comprises a first pump (9) along the delivery branch (7).
8. A machine as claimed in Claim 7, wherein the dispensing and metering device (3) comprises a two-position valve (10) located along the delivery branch (7), downstream from the first pump (9).
9. A machine as claimed in one of the foregoing Claims, wherein the metering means (6) comprise a second pump (17) having an inlet communicating with the container (11), and an outlet communicating with the circuit (4).
10. A machine as claimed in Claims 3 and 9, wherein the first valve means (20) are located between the mixer (21) and the outlet of the second pump (17) to allow the product into the mixer (21).
11. A machine as claimed in Claim 9 or 10, wherein the container (11) is a disposable container; and the metering means (6) comprise a product tank (14); the tank (14) having a mouth defining said inlet (5) and communicating, in use, with the relative container (11).
12. A machine as claimed in Claim 11, wherein a tap (15) is fitted to the inlet (5) to connect the container (11) in fluidtight manner to the tank (14).
13. A machine as claimed in Claim 12, wherein the tap (15) has a valve normally set to a closed position, and which can be set manually to an open position.
14. A machine as claimed in Claim 13, and comprising a hand-operated lever (16) for moving the valve into the open position.
15. A machine as claimed in any one of Claims 9 to 14, wherein the second pump (17) is time-controlled.
16. A machine as claimed in one of Claims 1 to 8, wherein the metering means (6) comprise a hydropneumatic metering device (31).
17. A machine as claimed in Claim 16, wherein the hydropneumatic metering device (31) comprises a compressor (34); a cylinder (32); and a piston (33) sliding inside the cylinder (32) and comprising a first end portion, which is fitted in fluidtight manner to the cylinder (32) and divides the cylinder (32) internally into a first chamber communicating with an outlet of the compressor (34), and a second chamber housing a return spring (35) of the piston (33).

- 18.** A machine as claimed in Claims 3 and 17, wherein the piston (33) comprises a second end portion outside the cylinder (32) and defining a movable wall of a variable-volume chamber (36) interposed between the container (11) and the mixer (21). 5
- 19.** A machine as claimed in Claim 18, wherein the variable-volume chamber (36) communicates with the container (11) via a calibrated fourth one-way valve (37), which allows intake of the product by suction into the variable-volume chamber (36), when the volume of the variable-volume chamber (36) is increased by displacement of the piston (33). 10
- 20.** A machine as claimed in Claim 18 or 19, wherein the first valve means (39) are located between the mixer (21) and the variable-volume chamber (36) to allow into the mixer (21) the product expelled from the variable-volume chamber (36) when the volume of the variable-volume chamber (36) is reduced by return displacement of the piston (33). 15  
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- 21.** A machine as claimed in any one of the foregoing Claims, and comprising at least two inlets (5) connected to respective metering means (6). 25
- 22.** A machine as claimed in Claims 3 and 21, wherein said at least two metering means (6) are connected in parallel to the mixer (21). 30
- 23.** A machine as claimed in any one of the foregoing Claims, and comprising a pull-out drawer (12) housing the container (11) .
- 24.** A machine as claimed in Claim 23, wherein the drawer (12) also houses at least part of said metering means (6). 35

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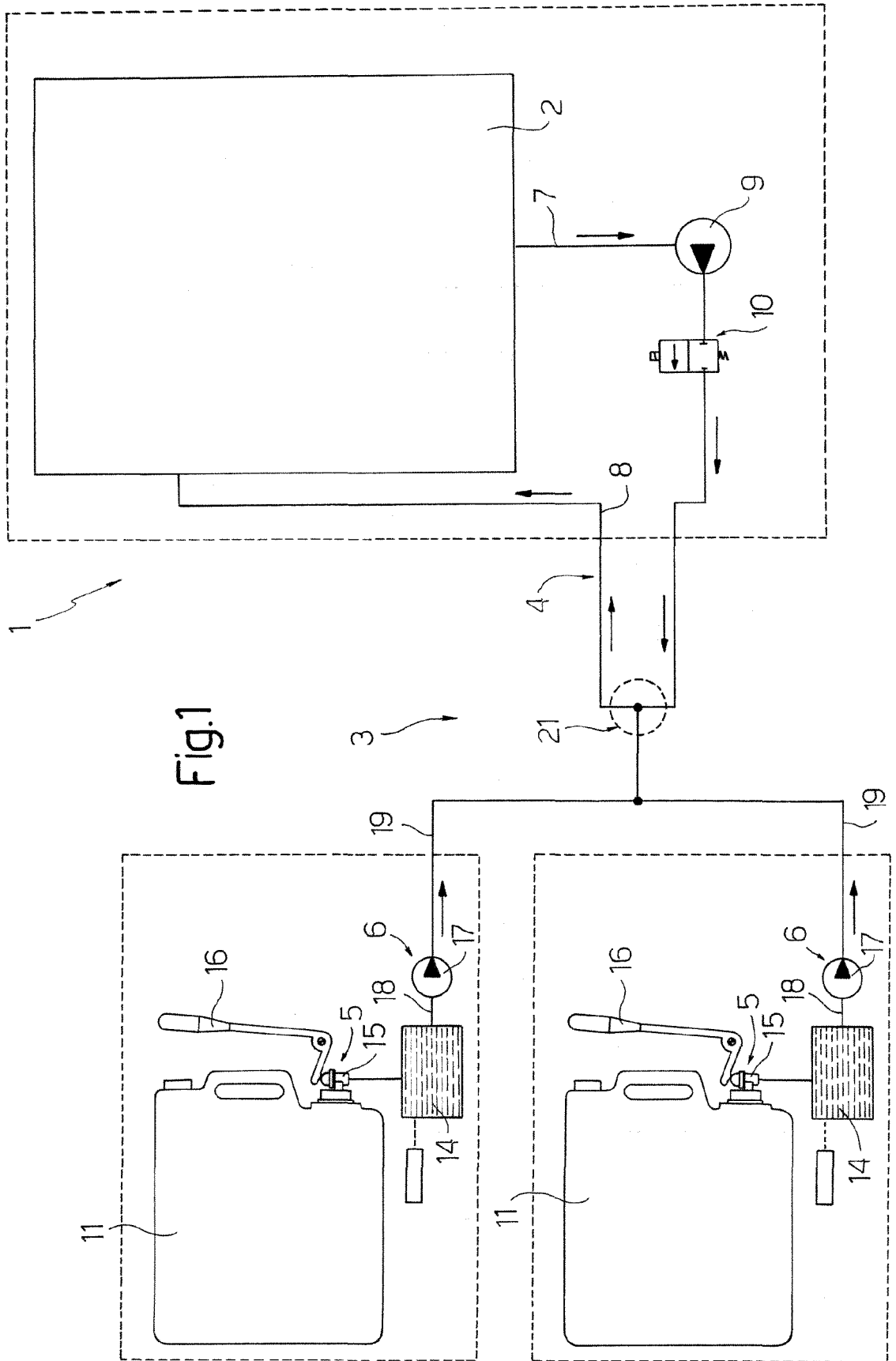
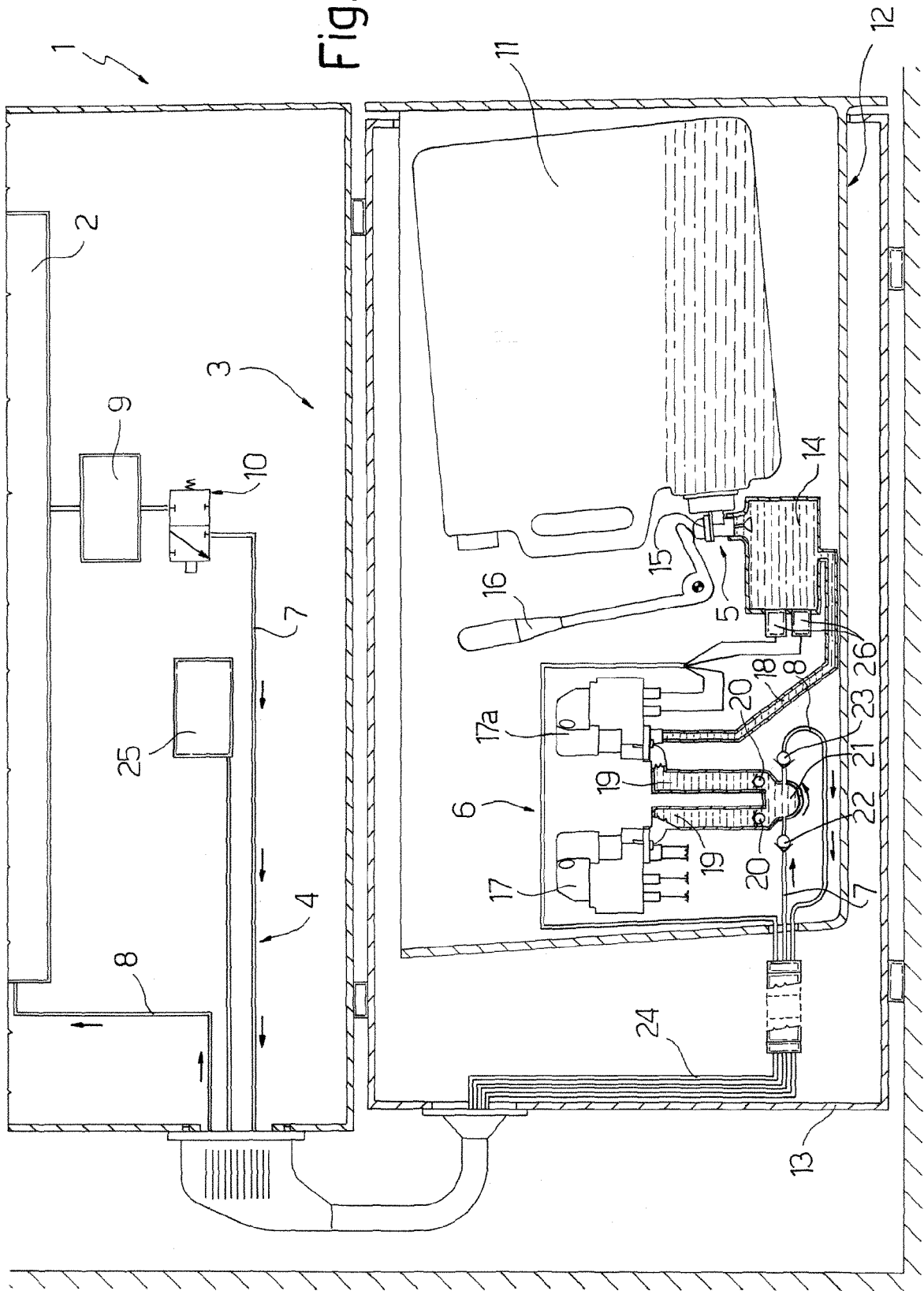


Fig.1



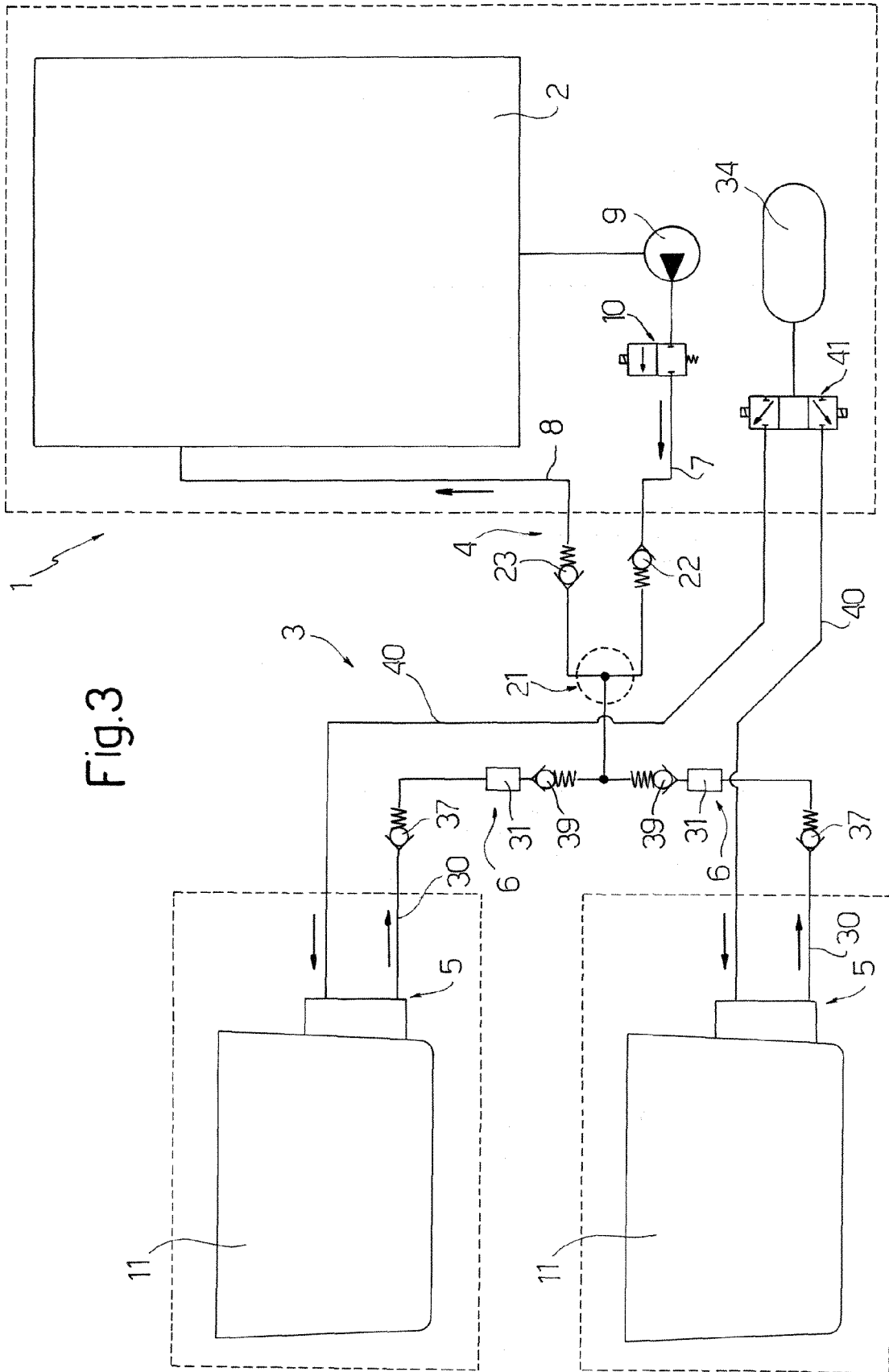
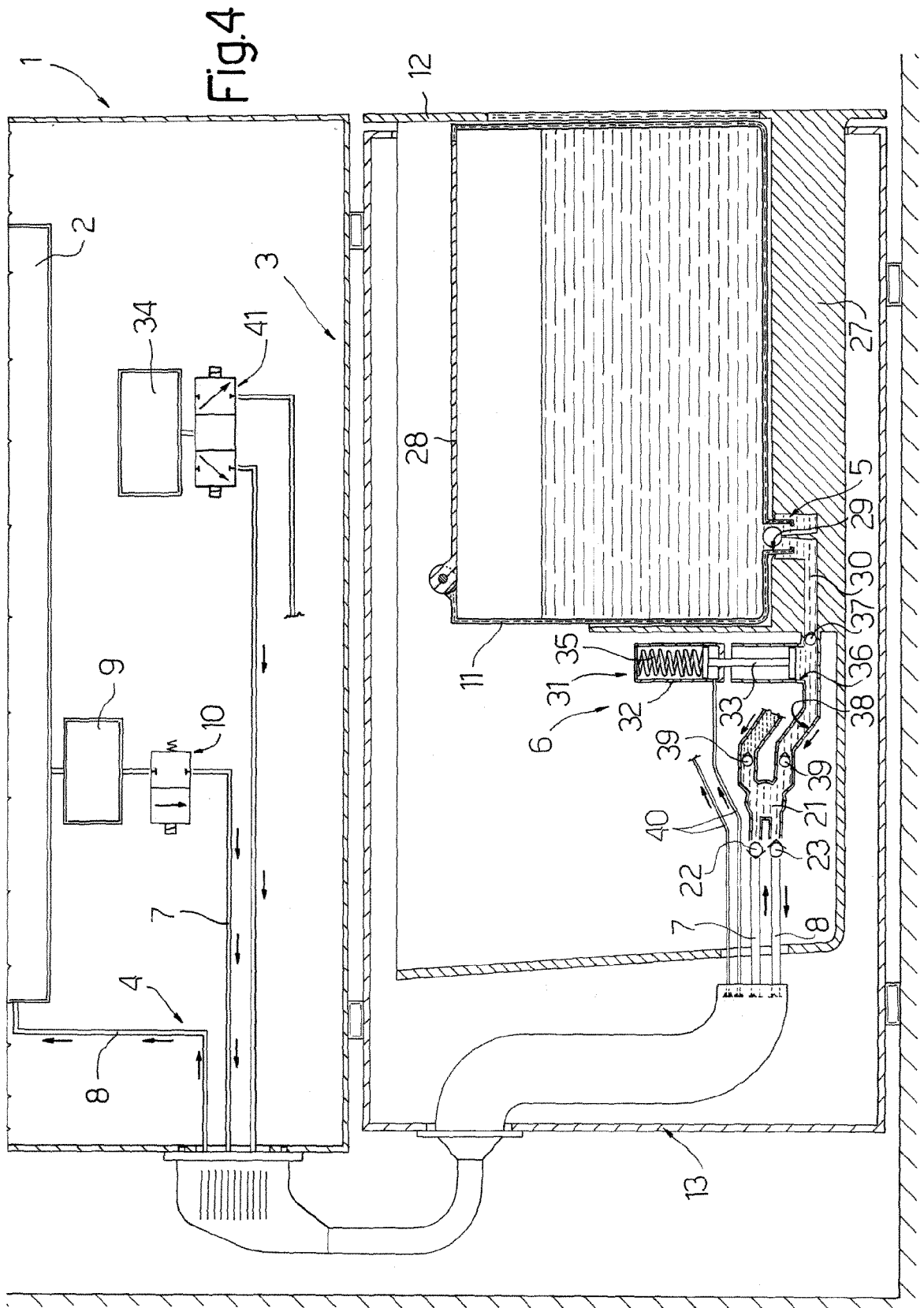


Fig.3





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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		10 November 2007	DIAZ, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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