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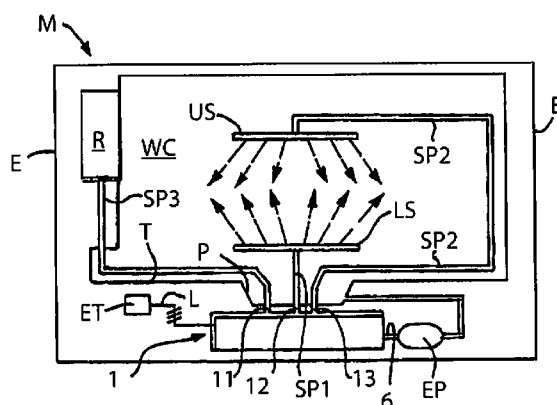
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(54) **Title:** WASHING MACHINE COMPRISING A STORAGE RESERVOIR

**Fig. 1**

(57) **Abstract:** The washing machine (M) comprises a support casing (E) in which at least one washing chamber (WC) is defined; a feeding device (EP) arranged for supplying a pressurized washing liquid; a user hydraulic circuit (SP1, SP2) arranged for delivering an amount of said liquid into the washing chamber (WC); a storage reservoir (R) arranged for containing an amount of said liquid; and a distribution valve assembly (1). The distribution valve assembly (1) comprises: a valve body (2-4) having an inlet (6), which is hydraulically connected to said feeding device (EP), at least one delivery outlet (12, 13), which is hydraulically connected to said user hydraulic circuit (SP1, SP2), and a storage outlet (11), which is hydraulically connected to the storage reservoir (R) through the storage hydraulic circuit (SP3); a valve system (14, 24) arranged for at least partially allowing and interrupting the liquid communication among the inlet (6), the delivery outlet (12, 13), and the storage outlet (11); and an actuating device (20, 31) arranged for controlling said valve system (14, 24).

TITLE: "Washing machine comprising a storage reservoir"

DESCRIPTION

Technical field

5 The present invention is relative to a washing machine comprising a storage reservoir.

Technological background

10 In the technical field, washing machines, especially dishwashers, are used, which are provided with a respective storage reservoir, adapted to receive an amount of washing liquid.

15 The use of a storage reservoir communicating in a controlled manner with a feeding device for supplying a pressurized liquid (such as a motor pump) has the advantage to allow an amount of washing liquid available in the washing tank to be stored during a washing cycle, so as to be used later in the same washing cycle or in a following washing cycle.

20 By way of example, the above-mentioned reservoir can be used for at least partially storing the washing liquid available in the washing chamber during the last rinse phase of a washing cycle. In this way, the liquid stored in the reservoir can be used for a watering process during the initial phases of a following washing cycle. As a matter of fact, in the last rinse phase, the washing liquid is substantially "clean" with respect to the washing liquid that normally circulates in the tank during the initial phases of the washing cycle, when the dishes contained in the tank are substantially "dirty".

30 Thanks to this solution, the total amount of liquid used to perform a washing cycle in the washing machines is significantly reduced.

Though, the washing machines of the known type that use a storage reservoir of the type described above are affected by some drawbacks.

One drawback consists in the fact that, in order to
5 fill the storage reservoir, the outlet of the motor pump typically presents a fork, in which, on the one hand, a feeding duct or branch is provided, which leads the pressurized washing liquid to a distribution valve assembly, adapted to perform the so-called "alternate
10 washing" (i.e. selectively supplying a liquid flow to one or to the other impeller), and, on the other hand, a storage duct or branch is provided, in which the pressurized washing liquid is supplied to the storage reservoir. This solution requires, therefore, a branching
15 in correspondence to the outlet of the motor pump, which causes the structure of the ducts arranged between the motor pump, the distribution valve assembly and the storage reservoir to be very complex.

A further drawback consists in the fact that a further
20 solenoid valve is generally provided between the motor pump and the storage reservoir, so as to allow and avoid, at least partially and in a controlled manner, the inflow of washing liquid to the storage reservoir. This solution involves significant changes to be made to the control
25 device of the washing machine, whose circuit configuration is caused to become more complex, so as to allow a further electric component, which is separate from and independent of the other ones, to be handled.

Summary of the invention

30 Object of the present invention is to provide an improved washing machine, which, at the same type, can be produced in a simple and economic fashion.

A further object of the present invention is to allow the use of the storage reservoir in a washing machine, causing at the same time the structure of the ducts arranged between the motor pump, the distribution valve assembly and the storage reservoir to remain as simple as possible.

A further object of the present invention is to allow the use of the storage reservoir in a washing machine, causing the circuit configuration of the control device to remain as simple as possible and keeping at the same time the number of independent electric components to be handled as low as possible.

According to the present invention, these and other objects are reached by means of a washing machine defined in the appended main claim.

The appended claims are an integral part of the technical teachings provided in the following description with reference to the present invention.

Brief description of the drawings

Further features and advantages of the present invention will be best understood upon perusal of the following detailed description, which is provided by way of example and is not limiting, with reference to the accompanying drawings, which specifically illustrate what follows:

- figure 1 is a schematic representation of a washing machine according to an explanatory embodiment of the present invention;
- figure 2 is a prospective view of a distribution valve assembly of the washing machine shown in figure 1;
- figure 3 is an exploded prospective view of the valve assembly according to figure 2;

- figures 4-7 are cross-section views of a distribution valve assembly according to figures 2 and 3, which is shown in a rest or stand-by condition and in three sequential operating conditions; and

- 5 - figures 8 and 9 are cross-section views of the distribution valve assembly according to the previous figures, which is shown, again, in a rest or stand-by condition and in a different operating condition respectively.

10 **Detailed description of the invention**

In figure 1, M indicates, as a whole, a washing machine according to an explanatory embodiment of the present invention. By way of example, machine M is a dishwasher.

- 15 Said machine M comprises, in a known manner, a support casing E, in which a washing chamber WC is defined. In the embodiment shown, washing chamber WC is delimited by a washing tank T, which is comprised in support casing E. A lowered sump P is defined in the central area of the bottom
20 of washing tank T.

Machine M comprises a motor pump EP, which, in use, sucks up the washing liquid from sump P and feeds it to a distribution valve assembly, which is indicated, as a whole, with number 1. Said valve assembly 1 controls the
25 coupling between motor pump EP and two distinct hydraulic circuits.

A first user hydraulic circuit, in the embodiment shown, comprises two user pipes SP1 and SP2, which are connected, in a known manner, to two spray impellers LS and
30 US, namely a lower spray impeller and an upper spray impeller respectively.

The second storage hydraulic circuit comprises a

storage pipe SP3, which connects a storage union or outlet 11 of distribution valve assembly 1 to a storage reservoir R.

Storage reservoir R is preferably mounted on the side 5 of the washing chamber, for example on washing tank T. In the embodiment shown, reservoir R is arranged in the hollow space obtained between support casing E and washing tank T.

In the embodiment shown in figures 2-9, as explained more clearly hereinafter, distribution valve assembly 1 is 10 adapted to selectively feed a flow of washing liquid to user hydraulic circuit SP1, SP2 or to storage hydraulic circuit SP3.

Furthermore, in the embodiment shown, when said distribution valve assembly 1 couples motor pump EP to user 15 hydraulic circuit SP1, SP2, said distribution valve assembly 1 is also adapted to control the manner in which the washing liquid is fed to impellers LS, US associated therewith, so as to activate, during a washing cycle, the combined feeding of a flow of liquid to both impellers and, 20 alternately, the feeding of a flow of liquid selectively to one or the other impeller.

Preferably, distribution valve assembly 1 is connected and operatively controlled by an electronic programmer ET, to which it is connected by means of a multi-wire line L.

25 In the embodiment shown, distribution valve assembly 1 is substantially similar to the one disclosed in the Italian patent application no. TO2001A000943, which is owned by the Applicant, published on April 6, 2003 and subsequently granted with the patent granting number 30 1331684.

With reference to figure 2 and to the following figures, distribution valve assembly 1 comprises a valve

body 2, which, in the embodiment shown, substantially comprises a cup-shaped body 3, which is substantially L-shaped, and a lid 4 associated therewith with a corresponding shape, said elements being coupled to one another with the interposition of a shaped sealing gasket 5 (figure 3).

In the embodiment shown, cup-shaped body 3 presents an end branch 3a with an inlet union 6, which is connected to the outlet of motor pump EP.

10 A skew diaphragm 7, in which an outlet opening 8 is obtained, is preferably arranged inside body 3, downstream of inlet union 6.

Preferably, the inner area of valve body 2 is divided by skew diaphragm 7 into a first chamber 9, which is 15 comprised between inlet union 6 and said diaphragm, and a second chamber 10.

Advantageously, in a lateral wall portion of end 3a of cup-shaped body 3, the valve body presents a storage union or outlet 11, which communicates with chamber 9.

20 Preferably, in the portion of lid 4 that faces chamber 10, the valve body presents two further delivery unions or outlets 12 and 13, which communicate with said chamber 10.

As shown in figure 1, storage union 11 of distribution valve body 1 is connected to storage hydraulic circuit SP3 25 associated with storage reservoir R, whereas delivery unions 12 and 13 are connected to user hydraulic circuit SP1, SP2, which preferably ends in spray impellers LS and US.

30 Chamber 9 of distribution valve body 1 houses a main shutter, which, as a whole, is indicated with 14. Preferably, main shutter 14 comprises a plate-shaped portion 15, from whose face a curved shank 16 projects,

which presents, at its free end, a transverse pin 17 (see, in particular, figure 3).

In the embodiment shown, plate-shaped portion 15 of main shutter 14 presents, on one side, a sealing gasket 18 (figure 3) and, on the other side or face, a sealing gasket 19. By means of said gaskets, plate-shaped portion 15 of main gasket 14 is adapted to selectively close in a fluid-tight manner the inlet opening of storage union 11 and, respectively, opening 8 obtained in skew diaphragm7.

A control member 20, which is substantially shaped as a disc, is preferably mounted in chamber 10 of the valve body in a rotatable manner. A cam groove 21, which has a substantially oval shape, is obtained on the face of said member that, in the embodiment shown, faces lid 4, and extends around the rotation axis of member 20. Advantageously, the lateral wall or outer edge of groove 21 presents an interruption or opening 22 (see, in particular, by way of example, figures 6, 7 and 9) in a portion of said groove that reaches the periphery of control member 20

According to the embodiment shown, control member 20 is integrally connected to a stem 23, which preferably is coaxial to the axis of said control member and, at its free end, is advantageously fixed to a movable shutter device 24. Said shutter device 24, as described below, is adapted to cooperate with delivery unions 12 and 13 - namely to selectively block them. Preferably, shutter device 24 is a rotary shutter 24, which can be operated so as to rotate by means of an associated motor 31.

As shown in figure 3, cup-shaped body 3, on the opposite side of lid 4, is preferably connected to a shaped support body 25, which houses a reduction gear consisting of a plurality of gear wheels 26-30. By means of said

reduction gear, stem or shaft 23 of control member 20 and of associated shutter 24 can be advantageously coupled to shaft 31a of motor 31, which is fixed to support body 25 (figure 3). By way of example, motor 31 is a synchronous electric motor. Motor 31, in the embodiment shown, is fixed to support body 25 and its shaft 31a extends through said body 25 so as to mesh with input gear wheel 26 of the reduction gear.

Preferably, washing machine M comprises a sensor system, which is adapted to provide signals indicating the position of shutter device 24. More preferably, the sensor system comprises a cam member 29, which is caused to rotate by motor 31 and presents a coded profile, and (at least) a mobile feeler member 32, which is associated with cam member 29 and cooperates with said coded profile.

In the embodiment shown by way of example, the cam member is a gear wheel 29 of the reduction gear described above and the coded profile is a shaped periphery belonging to said gear wheel 29. The periphery of gear wheel 29 presents, in particular, four peripheral sectors, which radially project and present respective input edges that are angularly equally spaced apart, and respective differentiated angular extensions (figure 3). The periphery of gear wheel 29, with the profile described above, is associated with the above-mentioned feeler member 32.

Preferably, the sensor system comprises, furthermore, a pair of output contacts 33, 34, which, in the embodiment shown, are fixed to support body 25 and are connected to electronic programmer ET. Each time feeler 32 engages the periphery of one of said projecting sectors of gear wheel 29, it causes output contacts 33 and 34 to be connected to one another. When, on the other hand, feeler 32 engages an

area in between said projecting sectors, contacts 33 and 34 are decoupled from one another.

Preferably, a further contact 35, which is also fixed to support body 25, allows - together with contact 34 - an electric current to be supplied to synchronous motor 31.

In the embodiment shown, the cam profiles of gear wheel 29 described above, together with the associated feeler 32, allow an item of information on the instant position of cam member 20, of associated shutter 24, and, as explained below, of main shutter member 14 to be made available for electronic programmer ET.

Plate-shaped portion 15 of main shutter member 14 is advantageously connected to a permanent magnet, which, in figure 3, is indicated with number 36. A similar permanent magnet 37 is fixed to lid 4 in a predetermined position.

At rest, distribution valve assembly 1 assumes the configuration shown in figure 4. In this condition, main shutter member 14 is held in an intermediate position between the inlet opening of storage union 11 and opening 8 obtained in skew diaphragm 7, expediently due to the effect of the mutual attraction of magnets 36 and 37. Plate-shaped portion 15 of main shutter 14, for example, extends at approximately 10° from the inlet opening of storage union 11. Furthermore, transverse pin 17 of curved appendage 16 of main shutter member 14 extends inside oval cam groove 21 of control member 20, in correspondence to its lateral opening 22, close to the periphery of said control member 20. Shutter 24 is arranged in an intermediate position between delivery unions 12 and 13.

Starting from the rest or stand-by position shown in figure 4, distribution valve device 1 can assume two different operating conditions based on whether, during the

operation, motor pump EP coupled to its inlet union 6 is activated first or electric motor 31 associated with control member 20 is activated first.

In the first case, the operation of distribution valve assembly 1 develops in the manner shown in figures 4-7. When pump EP is activated first by electric motor 31, it sends a flow of pressurized liquid into chamber 9 of valve assembly 1 and said pressurized liquid causes main shutter 14 to move from the rest position shown in figure 4 to the operating position shown in figure 5, in which it obstructs storage union 11. In the position shown in figure 5, end pin 17 of main shutter 14 is radially disengaged from cam groove 21 of control member 20. In this condition, the liquid entering valve assembly 1 through inlet union 6 reaches chamber 10 through opening 8 obtained in skew diaphragm 7 and, from said chamber, it can flow through delivery unions 12 and 13 according to manners that are controlled by means of rotary shutter 24, which is activated by electric motor 31, which, in turn, is activated with a delay with respect to the motor pump.

It has to be noted that, after the disengagement of pin 17 from cam groove 21 of member 20, the rotation of the member itself does not influence the position of main shutter 14, which remains in the position shown in figure 5 as long as pump EP is activated.

In the embodiment shown, in the condition shown in figure 5, rotary shutter 24 obstructs the first delivery union 12 and does not interfere with the second delivery union 13. The liquid flow coming from motor pump EP flows through the second user pipe SP2 and, thus, reaches upper spray impeller US of machine M.

Subsequently, following the further rotation of

control member 20 caused by electric motor 31, the device reaches the condition shown in figure 6, in which shutter 24 frees both delivery unions 12 and 13. The liquid flow fed by motor pump EP flows through both user pipes SP1 and SP2 and, then, can reach both spray impellers LS and US of machine M.

The further rotation of control member 20 causes the device to assume the condition shown in figure 7, in which rotary shutter 24 closes the second delivery union 13 and the liquid flow coming from motor pump EP is fed only to user pipe SP1 leading to the lower impeller of machine M through the first delivery union 12.

The further rotation of control member 20 brings rotary shutter 24 back to the position shown in figure 4 and the operation proceeds in a cyclic manner as described above as long as the motor pump and electric motor 31 are kept in an activated state.

The first operating mode described above, which is actuated by means of the early activation of motor pump EP with respect to the activation of electric motor 31, is used to activate the dish washing phases.

The second operating mode of distribution valve assembly 1, on the other hand, is actuated by means of the early activation of electric motor 31 with respect to the activation of the motor pump, always starting from the rest condition shown in figure 4.

This second operating mode will now be described with reference to figures 8 and 9. For a better understanding of the figures and for an easier reference to the figures themselves, figure 8 corresponds to figure 4 and shows distribution valve assembly 1 in the rest or stand-by condition. If, starting from this condition, electric motor

31 is activated first, end pin 17 of main shutter 14 is engaged and held in oval cam groove 21 of control member 20, which is caused to rotate by motor 31. Consequently, main shutter 14 is caused to rotate in a anticlockwise direction, with reference to figure 8, and reaches the operating position shown in figure 9, in which it obstructs opening 8 obtained in skew diaphragm 7, thus separating chambers 9 and 10 from one another. Chamber 9, however, can freely communicate with storage union 11. Electric motor 31, after an initial activation that is sufficient to cause the rotation of main shutter 14 towards the position of figure 9, is deactivated. The liquid flow fed by motor pump EP enters chamber 9 of distribution valve assembly 1 and flows out through storage union 11. The liquid flow fed, therefore, can flow through storage pipe SP3 and then reach storage reservoir R, which is arranged on the side of washing tank T (see figure 1).

The second operating mode described above is actuated in some phases of the dish washing cycle, so as to store, in reservoir R, an amount of liquid that is adapted to be delivered in following phases or - preferably - in following washing cycles. This second operating mode ends with the deactivation of motor pump EP.

When the liquid contained in storage reservoir R has to be delivered into washing chamber WC, control member 20 is duly activated so that the liquid can flow out, by gravity, through storage hydraulic circuit SP3 and into distribution valve assembly 1, so as to finally flow out through the first and/or second user hydraulic circuit SP1, SP2.

By mere way of example, at the end of the second operating mode, control member 20 can remain in the

condition shown in figure 9, in which main shutter 14 is held by control member 20 itself in a position in which it keeps opening 8 of skew diaphragm 7 obstructed. In this manner, the liquid contained in storage reservoir R cannot
5 flow back to chamber 10 in order to be subsequently led into washing chamber WC through user hydraulic circuits SP1 and SP2.

On the contrary, in order to deliver the liquid contained in storage reservoir R into washing chamber WC,
10 control member 20 can be activated so as to free outlet opening 8 and, at the same time, the first delivery union 12 and/or the second delivery union 13. In any case, means that are an alternative to the one described above can be conceived and/or produced for the purpose of controlling
15 the flow of the liquid contained in storage reservoir R and returning from storage hydraulic circuit SP3 towards user hydraulic circuits SP1, SP2.

In the embodiment shown, storage reservoir R substantially has the shape of a rectangular parallelepiped
20 and this shape is expediently flat. Preferably, reservoir R is manufactured with a plastic material, for example by means of extrusion or molding.

Naturally, the principle of the present invention being set forth, the embodiments and the implementation
25 details can be widely changed with respect to what described above and shown in the drawings as a mere way of non-limiting example, without in this manner going beyond the scope of protection provided by the accompanying claims.

CLAIMS

1. Washing machine (M) comprising

a support casing (E) in which at least one washing chamber (WC) is defined;

5 a feeding device (EP) arranged for supplying a pressurized washing liquid;

a user hydraulic circuit (SP1, SP2) arranged for delivering an amount of said liquid into said washing chamber (WC);

10 a storage reservoir (R) arranged for containing an amount of said liquid; and

a distribution valve assembly (1) comprising:

- a valve body (2-4) having an inlet (6), which is hydraulically connected to said feeding device (EP), at least one delivery outlet (12, 13), which is hydraulically connected to said user hydraulic circuit (SP1, SP2), and a storage outlet (11), which is hydraulically connected to said storage reservoir (R) through a storage hydraulic circuit (SP3),

20 - a valve system (14, 24) arranged for at least partially allowing and interrupting the liquid communication among said inlet (6), said at least one delivery outlet (12, 13), and said storage outlet (11), and

- an actuating device (20, 31) arranged for controlling said valve system (14, 24).

2. Machine according to claim 1, wherein said user hydraulic circuit comprises at least one pair of separate user pipes (SP1, SP2); said valve body (2-4) comprising, furthermore, at least one pair of delivery outlets (12, 13), which are hydraulically connected to said user pipes (SP1, SP2); said valve system (14, 24) being arranged for at least partially allowing and interrupting the flow of

liquid, coming from said inlet (6), to said delivery outlets (12, 13).

3. Machine according to claim 2, wherein said valve system comprises a movable shutter device (24) capable of selectively blocking said first and second delivery outlet (12, 13).

4. Machine according to claim 3, wherein said shutter device comprises a rotary shutter (24) which is operable so as to rotate by means of an associated motor (31).

5. Machine according to any of the previous claims, wherein said valve body (2-4) has a chamber (9) into which said inlet (6) leads and with which said storage outlet (11) and said at least one delivery outlet (12, 13) are capable of communicating; said valve system comprising a main shutter (14) which is movable in the valve body (2-4) and is capable of assuming a first and a second operating position, in which it interrupts and allows, respectively, the liquid flow directed towards said at least one delivery outlet (12, 13), and in at least one of which it opens said storage outlet (11); said main shutter member (14) being associated to said actuating device (20, 31), which is arranged for controlling its position.

6. Machine according to claim 5, wherein said valve body has a second chamber (10), to which said chamber (9) is connected through an intermediate outlet (8) and from which said first and second delivery outlet (12, 13) branch off.

7. Machine according to claim 5 or 6, wherein said main shutter (14) is capable of assuming a first and a second operating position, in which it selectively closes said intermediate outlet (8) and said second storage outlet (11) respectively; said main shutter (14) being capable of assuming an intermediate rest position between said operating

positions; said main shutter (14) being associated to an actuating device (20, 31) capable, when it is activated, to cause the main shutter (14) to move from the rest position to the first one of said operating positions; said main shutter (14) being able, furthermore, to move from the rest position to the other or second operating position due to the pressure of a liquid flow fed to said inlet (6) of the valve body (2-4), so that, in use, the valve assembly (1) is capable of coupling said feeding device (EP) to the storage hydraulic circuit (SP3) or to said user hydraulic circuit (SP1, SP2) based on whether, at the beginning of the operation, said feeding device (EP) or said actuating device (31, 20) is activated first.

8. Machine according to claim 7, wherein means (36, 37) are provided, which are capable of stabilizing the main shutter (14) in said intermediate rest position.

9. Machine according to claim 7 or 8, wherein said actuator device comprises a rotatable control member (20), which is associated to said motor (31) and capable of being coupled to said main shutter (14), when the latter is arranged in said rest position, and to determine the passage to said first operating position due to an initial activation of said motor (31) prior to the activation of said feeding device (EP).

10. Machine according to claim 9, wherein said control member (20) has a cam groove (21), which is partially laterally open at the periphery of said control member (20) at an opening (22), in which an appendage (17) of the main shutter (14) can be engaged, when the latter is arranged in said rest position.

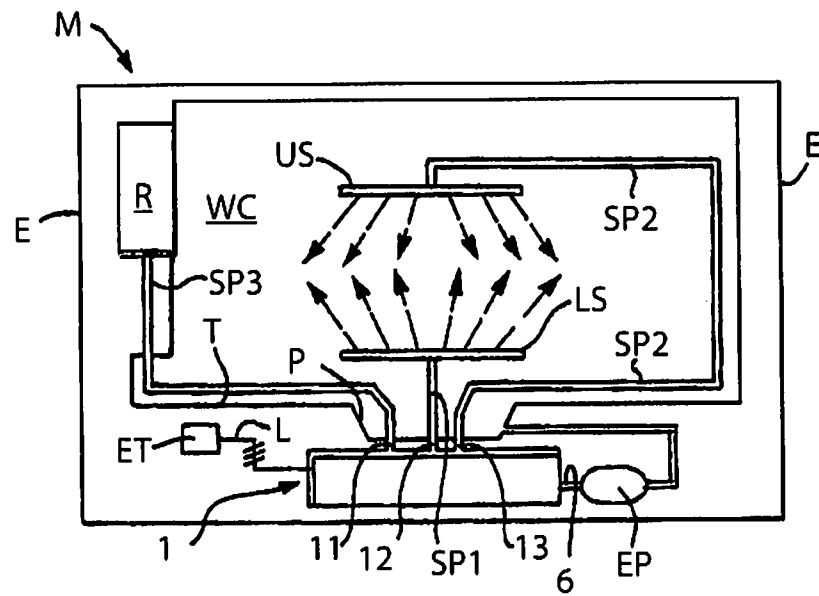


Fig. 1

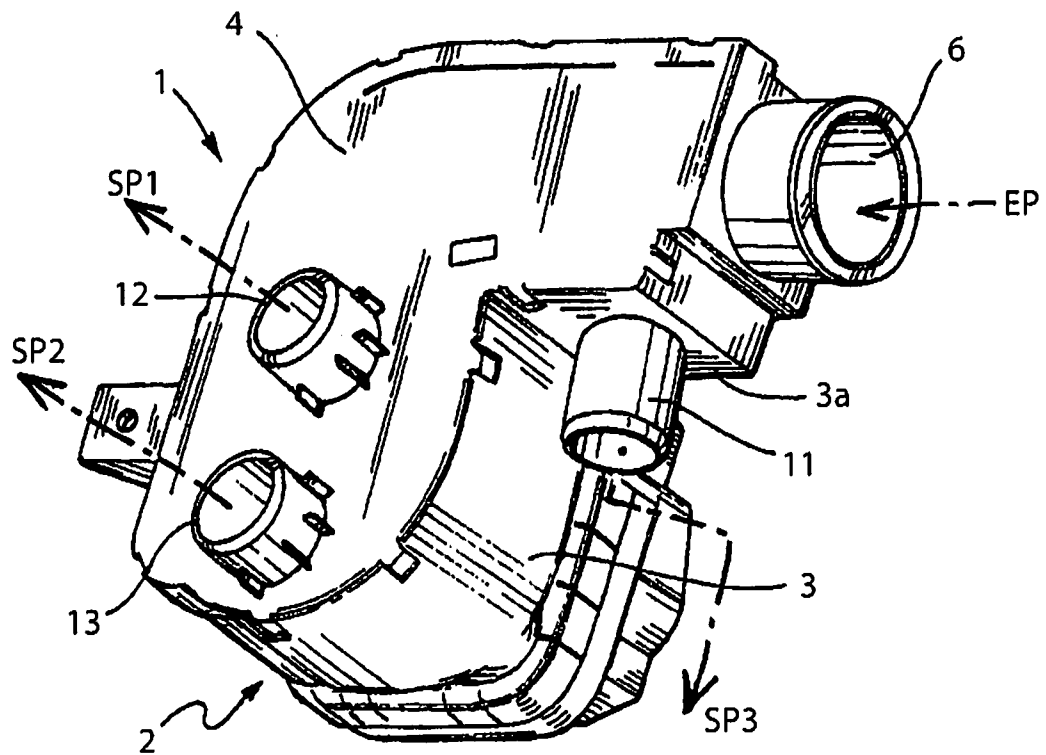


Fig. 2

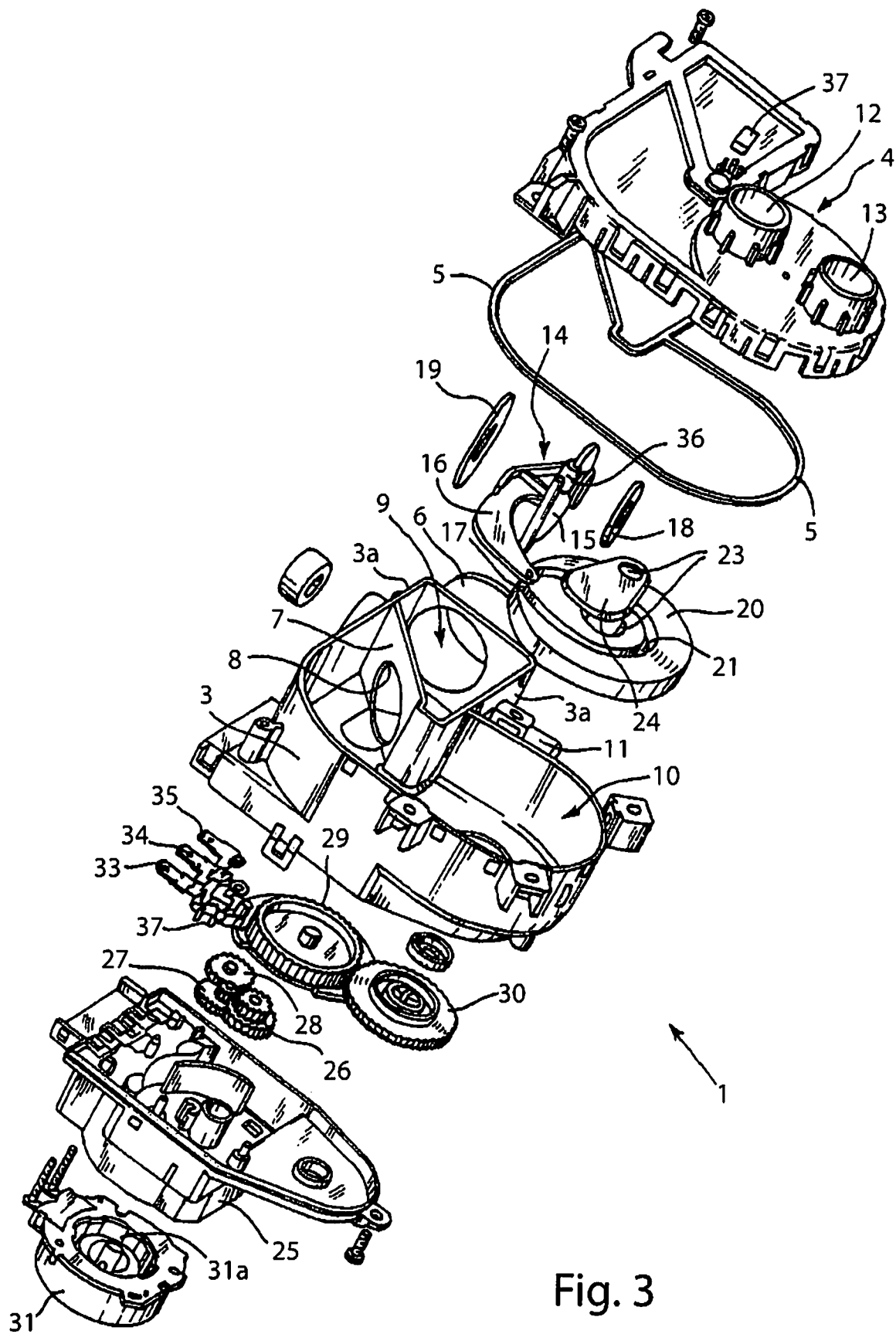


Fig. 3

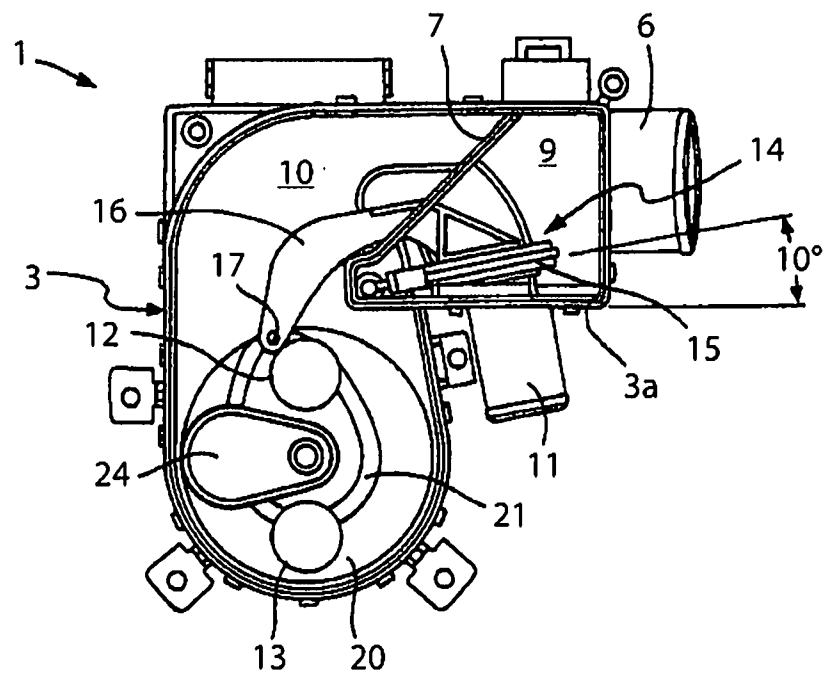


Fig. 4

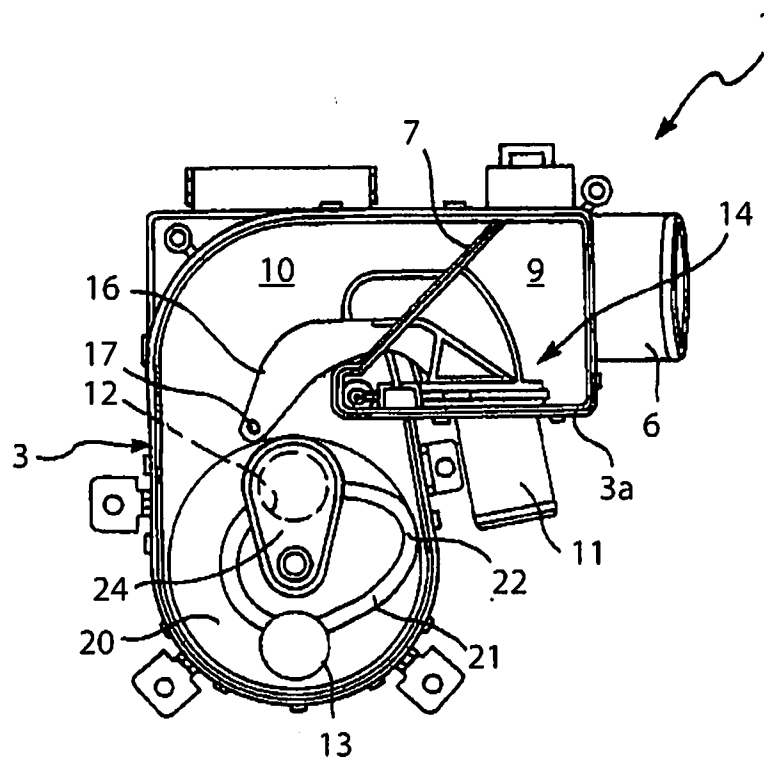


Fig. 5

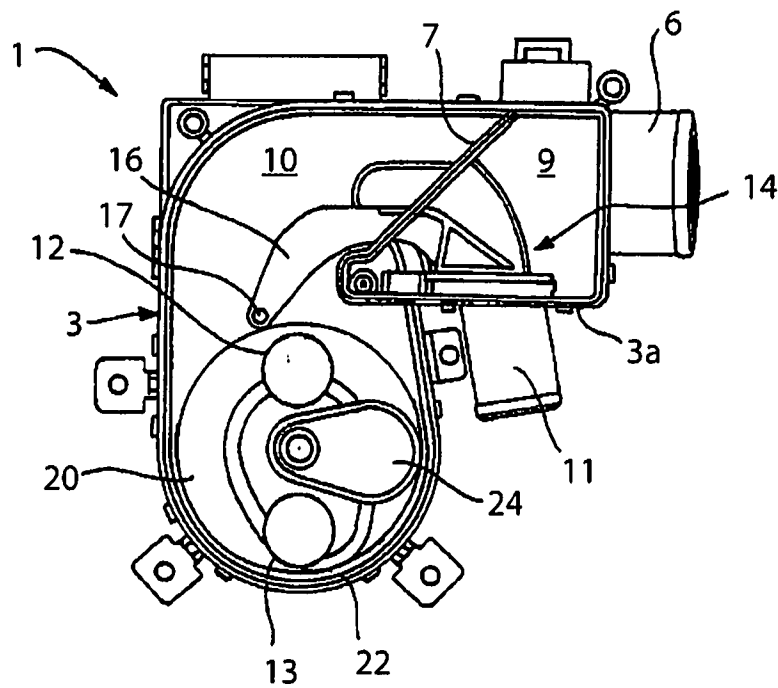


Fig. 6

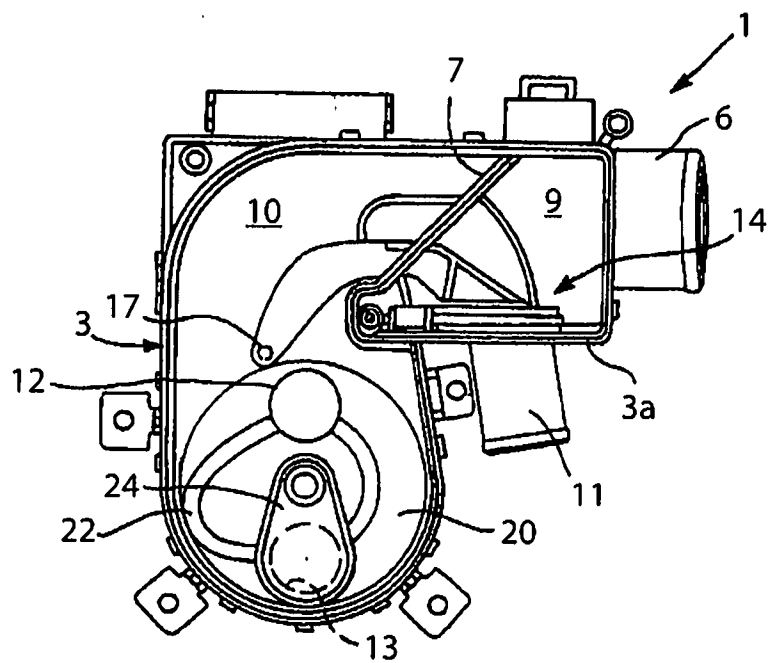


Fig. 7

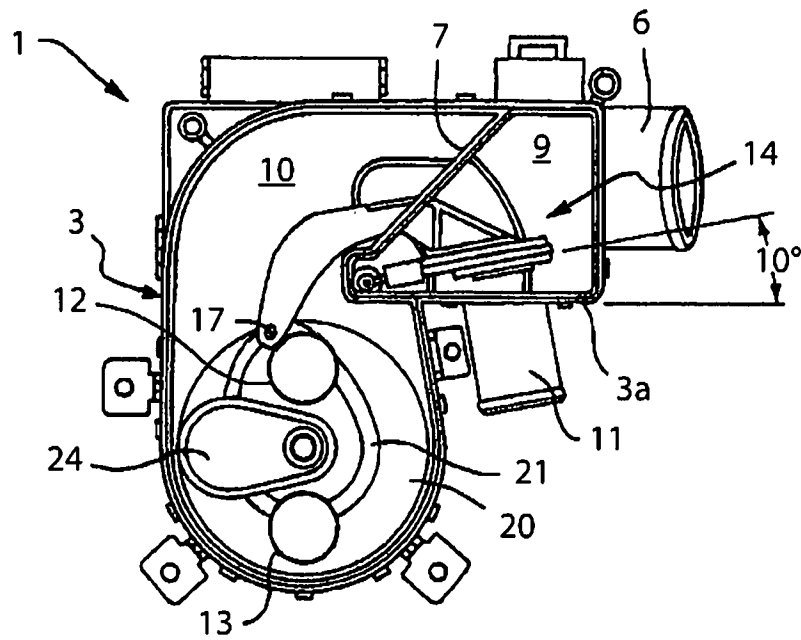


Fig. 8

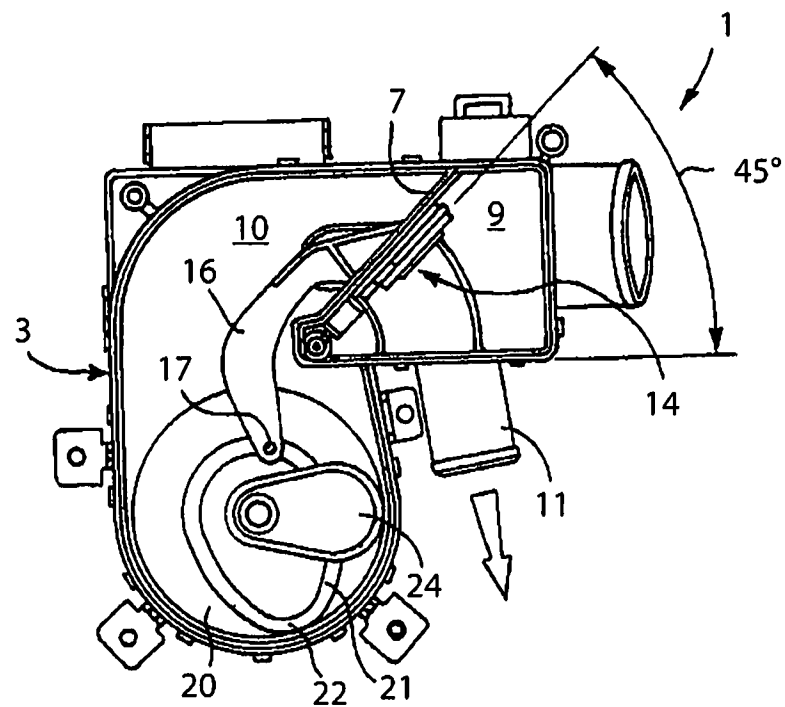


Fig. 9