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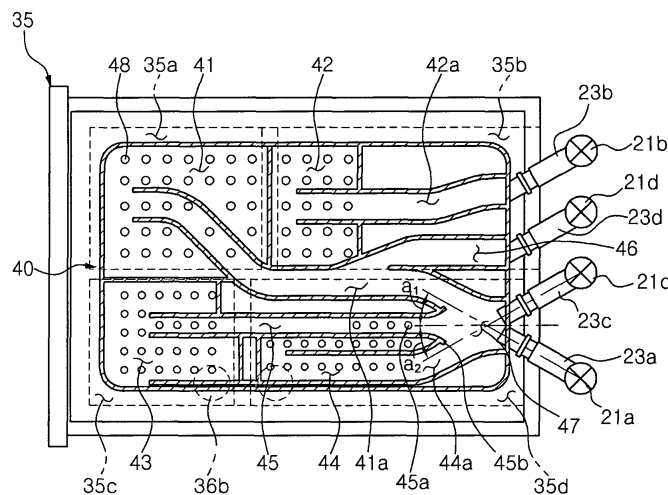
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(54) **Washing machine having detergent supply device**

(57) A washing machine having a detergent supply device (15) for mixing detergent, filled in a detergent container (35), with wash water, and supplying the mixed detergent and wash water into a washing tub (11). The detergent supply (15) device includes a housing (30), a detergent container (35), and water supply chambers (41-44). The housing includes a plurality of inlets (49a-d) connected with respective water supply pipes (23a-d), and an outlet (32) connected with a washing

tub (11). The detergent container (35) is detachably inserted in the housing (30) and includes a plurality of detergent receiving chambers (35a-d). The water supply chambers (41-44) include a plurality of flow channels (41 a, 42a, 44a, 45, 46), and one of the flow channels (45) is adapted to supply wash water, supplied from the inlets, into the detergent receiving chambers while adjusting the pressure of the wash water within a predetermined range.

**FIG. 3**



## Description

**[0001]** The present invention relates to a washing machine, and, more particularly, but not exclusively, to a washing machine having a detergent supply device for mixing detergent, filled in a detergent container, with wash water, and supplying the mixed detergent and wash water into a washing tub.

**[0002]** In general, washing machines are apparatus for washing laundry using frictional force caused by simultaneously agitating the laundry, detergent and wash water, contained in a washing tub, upon receiving driving power of a motor. The washing machines employ a detergent supply device to supply the detergent into a water tub in a mixed state with the wash water during a water supply cycle.

**[0003]** In the case of a drum type washing machine, such a detergent supply device is mounted in an upper front side of a body, and includes a box-shaped housing having an open front surface, and a separable detergent container including a drawer to be pushed into or pulled out of the housing through the open front surface. A rear upper portion of the housing includes inlets for use in the connection of water supply pipes. Through the water supply pipes, the wash water is supplied into the detergent container located in the housing. A bottom rear portion of the housing includes an outlet for use in the connection of a connection pipe. The wash water passes through the detergent container located in the housing, and is supplied into the water tub of the washing machine through the connection pipe.

**[0004]** The detergent container is divided into a plurality of detergent receiving chambers in order to separately sort and receive various different kinds of detergents therein. A bottom surface of the detergent container is inclined downward at a rear side thereof, such that the detergents, received in the detergent container, can smoothly flow toward the outlet of the housing, along with the wash water, during the water supply cycle.

**[0005]** The detergents, which were previously filled in the detergent receiving chambers of the detergent container, flow toward the outlet of the housing after being mixed with the wash water, such that they can be supplied into the water tub in a mixed state with the wash water.

**[0006]** When the pressure of the wash water supplied into the detergent receiving chambers is low, the detergents may be supplied into the water tub in an insufficiently mixed state with the wash water, and thus may remain in the detergent supply device. On the contrary, when the pressure of the wash water supplied into the detergent receiving chambers is high, the wash water collides with the detergents at a high speed, producing detergent bubbles.

**[0007]** For example, when using liquid detergent exhibiting high-viscosity and high-foamability, such as, for example, a rinsing agent, when the pressure of the wash

water supplied into the liquid detergent receiving chambers is low, the wash water may be directly supplied into the water tub without mixing with the rinsing agent, while leaving the rinsing agent in the detergent container. Further, when the pressure of the wash water is high, a great deal of bubbles as stated above may be produced, thereby invading other detergent receiving chambers filled with different kinds of detergents, or being leaked out of the washing machine.

**[0008]** According to a first aspect of the present invention there is provided a washing machine having a detergent supply device, the detergent supply device including a housing having a plurality of inlets connected with respective water supply pipes, and an outlet connected with a washing tub, a detergent container detachably inserted in the housing and including a plurality of detergent receiving chambers, and water supply chambers to adjust a pressure of wash water, supplied from the inlets, within a predetermined range, and to supply the wash water into the detergent receiving chambers.

**[0009]** The water supply chambers may each include a flow channel for leading the wash water from the inlets.

**[0010]** One of the flow channels may include pressure-adjustment holes to discharge the wash water at a flow rate corresponding to a pressure value of approximately 20 psi, the wash water passing through the flow channel, from the flow channel.

**[0011]** A plurality of the water supply chambers may be included corresponding to the respective detergent receiving chambers of the detergent container, and the wash water discharged from the pressure-adjustment holes formed at the flow channel to supply the wash water into one of the detergent receiving chambers may be supplied into another one of the detergent receiving chambers.

**[0012]** The flow channel may communicate with the plurality of the water supply pipes arranged such that water supply directions thereof, intersect each other, and the flow channel may supply the wash water, simultaneously injected from the plurality of the water supply pipes and converged at a predetermined position, into the water supply chambers.

**[0013]** One end of the flow channel may include a flow channel widening portion to supply a part of the converged wash water, exceeding a predetermined flow rate, into the water supply chambers.

**[0014]** The water supply chambers may be positioned in an upper portion of the housing, and the detergent container may be detachably inserted in a lower portion of the housing.

**[0015]** A plurality of the detergent receiving chambers may be defined in the detergent container, and a plurality of the water supply chambers may be positioned above the detergent container to correspond to the respective detergent receiving chambers.

**[0016]** According to a second aspect of the present invention, there is provided a washing machine having

a detergent supply device, the detergent supply device comprising: a housing including an upper and a lower portion coupled with each other and a plurality of inlets connected with respective water supply pipes; a detergent container including detergent receiving chambers, arranged to be slidably inserted into the lower portion and to receive detergent therein; and water supply channels positioned in the upper portion and including flow channels to supply water into the detergent receiving chambers, wherein one of the flow channels includes pressure-adjustment holes to adjust a pressure of the water received from the water supply pipes at a predetermined pressure range.

**[0017]** Embodiments of the present invention provide a washing machine having a detergent supply device which can maintain the pressure of wash water, supplied into detergent receiving chambers, at a predetermined value, thereby preventing detergent from remaining in the detergent receiving chambers when low-pressure wash water is supplied, or from producing bubbles when high-pressure wash water is supplied.

**[0018]** Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

**[0019]** For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

FIG. 1 is a perspective view illustrating an interior of a washing machine in accordance with an embodiment of the present invention;

FIG. 2 is an exploded perspective view illustrating a detergent supply device of the washing machine shown in FIG. 1; and

FIG. 3 is a plan sectional view illustrating flow channels defined in an upper case of the detergent supply device shown in FIG. 2

**[0020]** Reference will now be made in detail to an embodiment of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. An embodiment is described below to explain the present invention by referring to the figures.

**[0021]** FIG. 1 illustrates a drum type washing machine in accordance with an embodiment of the present invention, the washing machine includes a cylindrical water tub 11 installed in a body 10 to contain wash water therein, and a cylindrical washing tub 12 rotatably installed in the water tub 11 and formed at a peripheral wall surface thereof with a plurality of spin-dry holes, a driving motor 13 providing below the water tub 11 to rotate the washing tub 12, installed in the water tub 11, in a forward or reverse direction for performing washing, rinsing and spin-drying operations.

**[0022]** Further, openings are provided at respective corresponding front ends of the body 10, water tub 11 and washing tub 12 to place laundry into the washing tub 12 or remove the laundry from the washing tub 12 through the openings. In order to open or close the openings, a door 14 is installed at the front end of the body 10.

**[0023]** Above the water tub 11 are provided a water supply device 20 and a detergent supply device 15, to simultaneously supply the wash water and detergent into the water tub 11 in a water supply cycle. Below the water tub 11 is further provided a drainage device 16 to forcibly drain the wash water from the water tub 11 after completion of the washing operation. The drainage device 16 includes a drainage pipe 16a, and a drainage pump 16b.

**[0024]** The water supply device 20 includes a plurality of water supply valves 21, which are connectable to an external water supply hose (not shown) to control a supply of water, a plurality of water supply pipes 23 connected between the respective water supply valves 21 and the detergent supply device 15, and a connection pipe 24 to guide the wash water which passes through the detergent supply device 15, into the water tub 11.

**[0025]** In FIGS. 1 and 2, the detergent supply device 15 includes a box-shaped housing 30 having an opening 34 formed at a front end thereof, and a detergent container 35 detachably inserted in the housing 30 through the opening 34. In order to allow the detergent container 35 to be pulled out of the housing 30, like a drawer, at the outside of the body 10, the detergent supply device 15 is mounted at an upper front side of the body

**[0026]** In FIG. 2, the housing 30 of the detergent supply device 15 is formed by coupling an upper case 40 with a lower case 31. The lower case 31 includes an interior space for receiving the detergent container 35, and is opened at front and upper surfaces thereof. The upper case 40 is coupled with the lower case 31 to cover the open upper surface of the lower case 31.

**[0027]** In FIG. 3, the upper case 40 internally defines a plurality of water supply chambers 41, 42, 43 and 44 which are divided by partitions. At a bottom surface of the upper case 40 are perforated a plurality of holes 48 to distribute the wash water, which was supplied into the respective water supply chambers 41, 42, 43 and 44, into the detergent container 35 positioned below the upper case 40. At a rear end of the upper case are perforated a plurality of inlets 49a, 49b, 49c and 49d connected with respective water supply pipes 23a, 23b, 23c and 23d to supply the wash water into the water supply chambers 41, 43 and 44. The upper case 40 further internally defines flow channels, and detailed structure of the flow channels will be explained later with reference to FIG. 3.

**[0028]** The lower case 31 is formed at a rear end of a bottom surface thereof with an outlet 32, and the connection pipe 24 is connected with the outlet 32, such that the water inside the lower case 31 can be supplied

into the water tub 11. The bottom surface of the lower case 31 is inclined downward toward the outlet 32, in order to secure smooth flow of the wash water into the outlet 32. Further, along upper ends of both lateral surfaces of the lower case 31 are installed guide rails 33 to guide the detachment of the detergent container 35.

**[0029]** The detergent container 35 includes an open upper surface, and internally defines a plurality of detergent receiving chambers 35a, 35b, 35c and 35d, which are divided by partitions in order to separately sort and receive several different kinds of detergents.

**[0030]** The detergent receiving chambers are divided into the preliminary washing detergent receiving chamber 35b to receive powder detergent for use in preliminary washing, the powder detergent receiving chamber 35a to receive powder detergent for use in main washing, the rinsing agent receiving chamber 35c to receive liquid rinsing agent, and the bleaching agent receiving chamber 35d to receive liquid bleaching agent. At a rear side of the detergent receiving chambers 35a and 35b, receiving the powder detergent, is defined a discharge opening 36a, and the detergent receiving chambers 35c and 35d, which receive liquid detergent, each include siphons 36b.

**[0031]** Referring to FIGS. 2 and 3, the respective detergent receiving chambers 35a, 35b, 35c and 35d correspond to the respective water supply chambers 41, 42, 43 and 44 defined in the upper case 40, and a bottom surface of the detergent container 35 is inclined downward toward its rear side. When the wash water is supplied into the detergent container 35 through the respective water supply chambers 41, 42, 43 and 44, the different detergents received in the detergent receiving chambers 35a, 35b, 35c and 35d flow toward the outlet 32 of the housing 30 so as to be supplied into the water tub 11 by passing through the discharge opening 36a and the siphons 36b in a mixed state with the wash water.

**[0032]** In FIG. 3, the upper case 40 of the detergent supply device 15 according to an embodiment of the present invention comprises a plurality of the water supply chambers 41, 42, 43 and 44, and at bottom surfaces of the water supply chambers 41, 42, 43 and 44 are formed the water supply holes 48. The water supply chambers are classified into a first water supply chamber 41 which is defined at a position corresponding to the powder detergent receiving chamber 35a, a second water supply chamber 42 which is defined at a position corresponding to the preliminary washing detergent receiving chamber 35b, a rinsing water supply chamber 43 which is defined at a position corresponding to the rinsing agent receiving chamber 35c, and a third water supply chamber 44 which is defined at a position corresponding to the bleaching agent receiving chamber 35d.

**[0033]** As stated above, at the rear end of the upper case 40 are installed the water supply pipes 23a, 23b, 23c and 23d to supply the wash water into the upper case 40. The water supply pipes include a first water

supply pipe 23a, a second water supply pipe 23b shown at an uppermost position of FIG. 3, the hot water supply pipe 23d arranged beside the second water supply pipe 23b in parallel, and a third water supply pipe 23c. The third water supply pipe 23c is located beside the first water supply pipe 23a such that water supply directions thereof intersect each other. As stated above, the respective water supply pipes 23a, 23b, 23c and 23d are opened or closed by respective water supply valves 21a, 21 b, 21c and 21d under the control of a control unit (not shown).

**[0034]** The water supply pipes 23a, 23b, 23c and 23d communicate with the water supply chambers 41, 42, 43 and 44 through a plurality of flow channels 41 a, 42a, 44a, 45 and 46. Both the third water supply pipe 23c and the first water supply pipe 23a, arranged adjacent to each other, supply the wash water such that their water supply directions intersect each other at a flow channel branching portion 47. From the flow channel branching portion 47 are branched the three flow channels, namely, the first flow channel 41 a to supply the wash water into the first water supply chamber 41, the rinsing water supply flow channel 45 to supply the wash water into the rinsing water supply chamber 43, and the third flow channel 44a to supply the wash water into the third water supply chamber 44.

**[0035]** The first flow channel 41 a communicates at one end thereof with the first water supply chamber 41, and the other end of the first flow channel 41a is formed in a straight line corresponding with the water supply direction of the first water supply pipe 23a. The hot water flow channel 46, which communicates with the hot water supply pipe 23d, is merged to a predetermined position of the first flow channel 41 a.

**[0036]** One end of the third flow channel 44a extends to the third water supply chamber 44, and the other end of the third flow channel 44a lays on a straight line with the water supply direction of the third water supply pipe 23c.

**[0037]** One end of the rinsing water supply flow channel 45 is positioned between the end of the first flow channel 41 a, on a straight line with the first water supply pipe 23a, and the end of the third flow channel 44a, on a straight line with the third water supply pipe 23c. The other end of the rinsing water supply flow channel 45 extends to the rinsing water supply chamber 43. An angle ( $a_1$ ) defined between the end of the first flow channel 41 a, near the flow channel branching portion 47, and the end of the rinsing water supply flow channel 45, near the flow channel branching portion 47, is the same as an angle ( $a_2$ ) defined between the end of the third flow channel 44a, near the flow channel branching portion 47, and the end of the rinsing water supply flow channel 45 near the flow channel branching portion 47.

**[0038]** At the end of the rinsing water supply flow channel 45, near the flow channel branching portion 47, is formed a flow channel widening portion 45b such that a diameter of the rinsing water supply flow channel 45

increases toward the flow channel branching portion 47. At a portion of the rinsing water supply flow channel 45, located above the bleaching agent receiving chamber 35d, are formed a plurality of pressure-adjustment holes 45a.

**[0039]** Meanwhile, the second water supply chamber 42, which supplies the wash water into the preliminary washing detergent receiving chamber 35b, communicates with the second water supply pipe 23b through the second flow channel 42a.

**[0040]** Now, the detergent and water supply operations of the washing machine having the above described detergent supply device 15 will be explained with reference to FIGS. 2 and 3.

**[0041]** First, prior to driving the washing machine, the detergent container 35 of the detergent supply device 15 is pulled out of and separated from the housing 30 (as shown in FIG. 1) in order to fill powder detergent, rinsing agent, and bleaching agent in the respective detergent receiving chambers 35a, 35b, 35c and 35d defined in the detergent container 35. Then, the washing machine is driven to initiate a water supply cycle after the detergent container 35 is completely pushed into the housing 30. During the water supply cycle, the wash water, supplied from an external water supply source (not shown) by passing through the water supply valves 21, is supplied into the detergent supply device 15 through the inlets 49a, 49b, 49c and 49d thereof.

**[0042]** The wash water supplied in the detergent supply device 15, according to desired washing courses or programs, passes through at least one of the water supply chambers 41, 42, 43 and 44, thereby being distributed into the respective detergent receiving chambers 35a, 35b, 35c and 35d of the detergent container 35. Then, the wash water is mixed with the detergents in the detergent receiving chambers 35a, 35b, 35c and 35d, and is discharged to the lower case 31 through the outlet 36a or the siphons 36b, and in turn, is supplied into the water tub 11 through the outlet 32 formed at the lower case 31.

**[0043]** That is, in the initial preliminary washing course or program, the wash water is supplied into the second water supply chamber 42 through the second water supply pipe 23b, such that the detergent received in the preliminary washing detergent receiving chamber 35b is first supplied into the water tub 11. In the later main washing course, the wash water is supplied into the first water supply chamber 41 through the hot water supply pipe 23d and the first water supply pipe 23a, such that the detergent received in the powder detergent receiving chamber 35a is supplied into the water tub 11. Then, in order to add the bleaching agent during the rinsing course, the wash water is supplied into the third water supply chamber 44 through the third water supply pipe 23c, such that the bleaching agent received in the bleaching agent receiving chamber 35d is supplied into the water tub 11.

**[0044]** Finally, in order to add the rinsing agent in the

rinsing course, the wash water is injected through both the third water supply pipe 23c and the first water supply pipe 23a, such that the wash water is supplied into the rinsing water supply chamber 43 through the rinsing water supply flow channel 45. Since the flow channel widening portion 45b is formed at the end of the rinsing water supply flow channel 45, even when the first and third water supply pipes 23a and 23c do not inject the wash water on a straight line with the rinsing water supply flow channel 45 due to a difference in water supply pressure, a sufficient amount of the wash water can be supplied into the rinsing water supply flow channel 45.

**[0045]** Since the rinsing water supply flow channel 45 includes the pressure adjustment holes 45a, when the high-pressure wash water flows through the rinsing water supply flow channel 45, a great amount of the wash water is discharged into the bleaching agent receiving chamber 35d through the pressure-adjustment holes 45a, whereas, when the low-pressure wash water flows through the rinsing water supply flow channel 45, only a relatively small amount of the wash water is discharged into the bleaching agent receiving chamber 35d through the pressure adjustment holes 45a. Therefore, the pressure of the wash water reaching the rinsing water supply chamber 43 is adjusted within a predetermined range as the wash water passes through the rinsing water supply flow channel 45, and accordingly, the pressure of the wash water distributed into the rinsing agent receiving chamber 35c is adjusted within the predetermined range.

**[0046]** As stated above, the wash water is discharged into the bleaching agent receiving chamber 35d while passing through the rinsing water supply flow channel 45, therefore the bleaching agent adding course can be simultaneously performed with the rinsing agent adding course, thereby shortening a detergent supply control course, or reducing the amount of the wash water to be supplied through the third water supply pipe 23c in the bleaching agent adding course, resulting in a reduction in detergent supply time.

**[0047]** As is apparent from the above description, a washing machine having a detergent supply device in accordance with an embodiment of the present invention is designed to supply wash water of a predetermined pressure from water supply chambers, thereby preventing detergent from remaining in the detergent receiving chambers or from producing bubbles.

**[0048]** Further, according to embodiments of the present invention, since the water supply pipes simultaneously supply the wash water into the water supply chambers through a flow channel such that their water supply directions intersect each other, and the flow channel is formed at one end thereof with a flow channel widening portion, even when the water supply directions do not exactly coincide with a longitudinal direction of the flow channel, it is possible to prevent an excessively reduced amount of the wash water from being supplied into the water supply chambers.

**[0049]** Although an embodiment of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

**[0050]** Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

**[0051]** All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

**[0052]** Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

**[0053]** The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

## Claims

1. A washing machine having a detergent supply device (15), the detergent supply device comprising:

a housing (30) including a plurality of inlets (49a-d) connected with respective water supply pipes (23a-d), and an outlet (32) connected with a washing tub;

a detergent container (35) detachably inserted in the housing (30) and includes a plurality of detergent receiving chambers (35a-d); and water supply chambers (41-44) each including a flow channel (41a, 42a, 44a, 45, 46) to adjust a pressure of wash water supplied from the inlets, within a predetermined range, and to supply the wash water into the detergent receiving chambers.

2. The washing machine according to claim 1, wherein one of the flow channels (45) comprises pressure-adjustment holes (45a) to discharge the wash water, having a flow rate corresponding to the pressure of the wash water passing through the flow channel,

from the flow channel.

3. The washing machine according to claim 2, wherein the water supply chambers (41-44) are positioned to correspond to the respective detergent receiving chambers (35a-d); and the wash water discharged from the pressure-adjustment holes (45a) formed at the respective flow channel (45) to supply the wash water into one of the detergent receiving chambers, is supplied into another one of the detergent receiving chambers.

4. The washing machine according to any preceding claim, wherein the flow channels (41a, 42a, 44a, 45, 46) communicate with a plurality of the water supply pipes (23a-d) arranged such that water supply directions thereof intersect each other; and the flow channels supply the wash water simultaneously injected from the water supply pipes and converged at a predetermined position, into the water supply chambers.

5. The washing machine according to claim 4, wherein one end of the flow channels (45) comprises a flow channel widening portion (45b) for supplying a part of the converged wash water, exceeding a predetermined flow rate, into the water supply chambers.

6. The washing machine according to any preceding claim, wherein the water supply chambers (41-44) are positioned in an upper portion of the housing (30), and the detergent container (35) is detachably inserted in a lower portion of the housing (30).

7. The washing machine according to claim 6, wherein the water supply chambers (41-44) are positioned above the detergent container (35) to correspond to the respective detergent receiving chambers (35a-d).

8. The washing machine according to any of claims 4-7, further comprising a flow channel branching portion (47) positioned at an intersection of the water supply directions.

9. A washing machine having a detergent supply device (15), the detergent supply device comprising:

a housing (30) including an upper (40) and a lower (31) portion coupled with each other and a plurality of inlets (49a-d) connected with respective water supply pipes (23a-d);

a detergent container (35) including detergent receiving chambers (35a-d), arranged to be slidably inserted into the lower portion (31) and to receive detergent therein; and water supply channels (41-44) positioned in the upper portion (40) and including flow channels (41 a, 42a,

44a, 45, 46) to supply water into the detergent receiving chambers (35a-d), wherein one of the flow channels (45) includes pressure-adjustment holes (45a) to adjust a pressure of the water received from the water supply pipes at a predetermined pressure range.

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FIG. 1

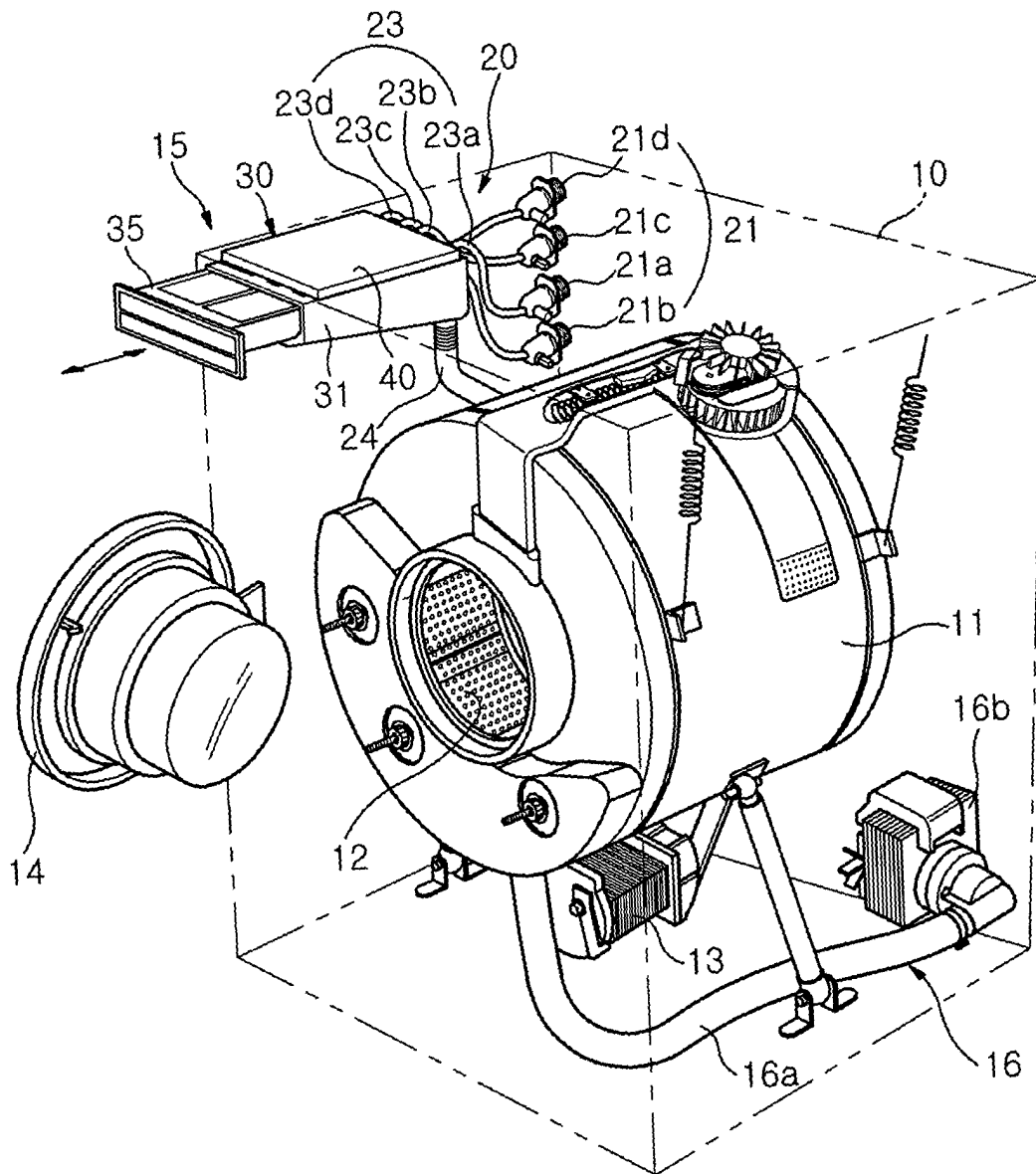




FIG. 2

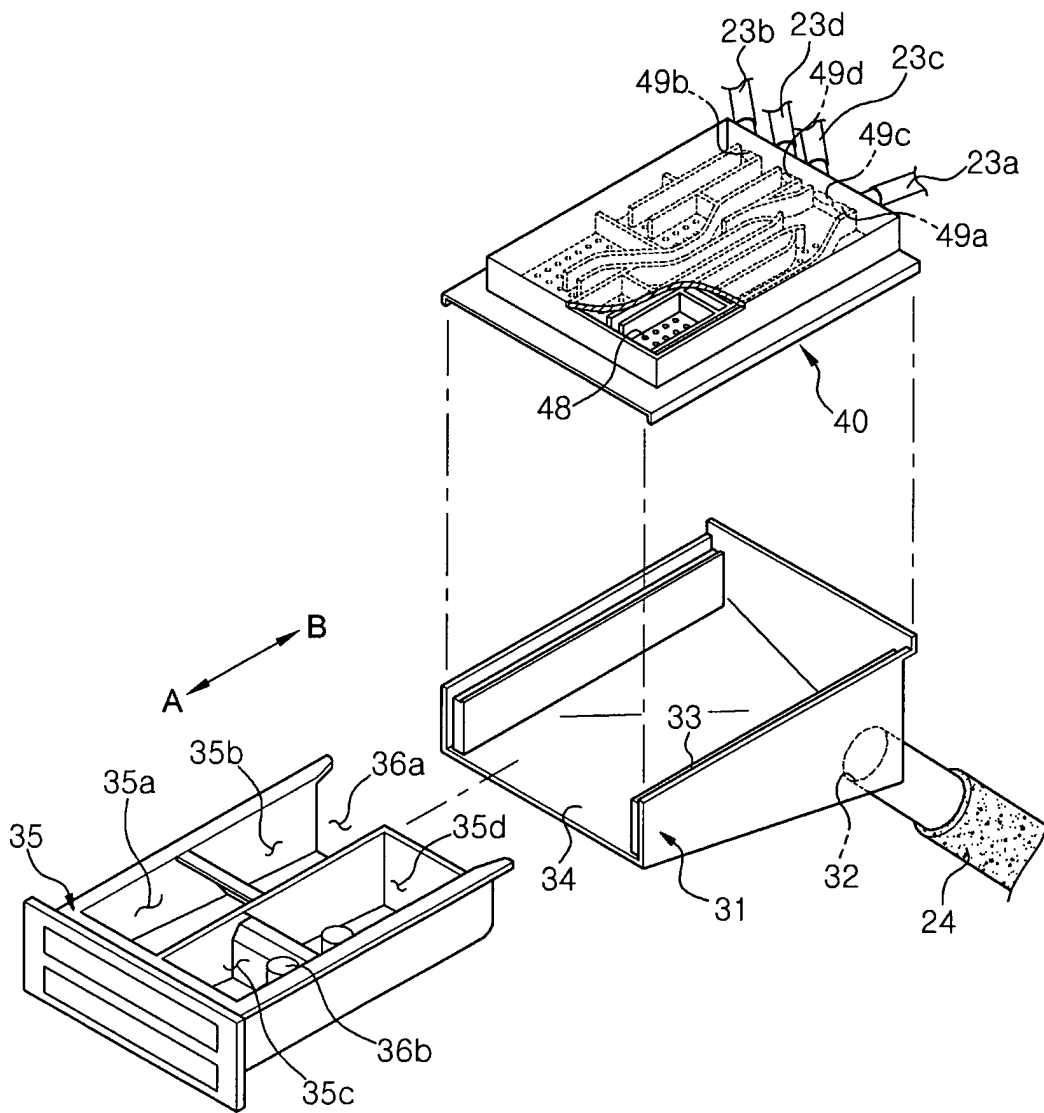
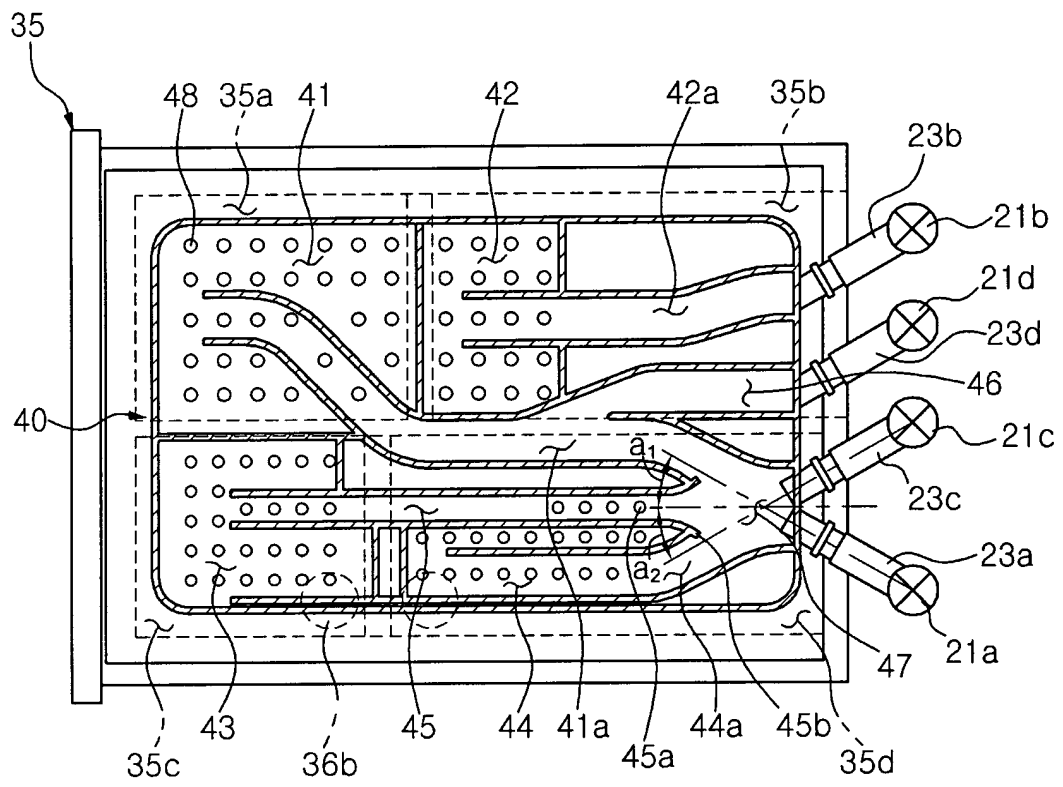


FIG. 3





DOCUMENTS CONSIDERED TO BE RELEVANT			
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Place of search Munich		Date of completion of the search 20 September 2005	Examiner Falkentoft, C
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EPO FORM 1503 03.82 (P04/C01)

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  
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