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(54) Washing or washing/drying machine with recirculation

(57) A washer is described comprising a tub (1) with pit (15) in which the washing liquid is accumulated; a drum rotatably mounted inside the tub and driven into rotation by a motor; a sleeve (M) comprising an intake conduit (T1) that is connected to a filter assembly (5); a pump (P) connected to the filter assembly (5) that sucks the washing liquid, through the intake conduit (T1) and introduces it into a discharge conduit (T3). The sleeve (M) comprises a connection conduit (T2) that is connected to the filter assembly (5) and to a recirculation conduit (A) that is connected to a spray nozzle (B) arranged in the upper section of the tub.

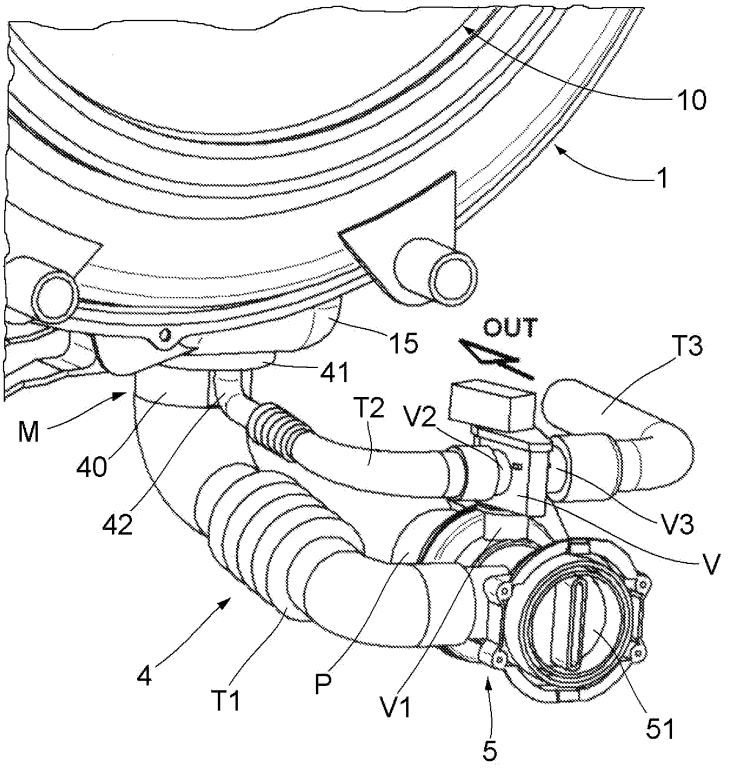

FIG. 1

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Description

[0001] The present patent application for industrial invention relates to washer or washer/dryer with recirculation system. Although specific reference is made to a washer in the following description, it is understood that the invention is also extended to a washer/dryer.

[0002] As it is known, a washer comprises a tub in which a rotary drum is mounted and driven into rotation by an electrical motor. A disc-shaped flange is mounted on the front of the tub, normally known as load opening, which defines an opening through which laundry is loaded into the drum. The tub comprises a cylindrical wall that is open on the front, which is joined with a bottom wall, in such a way to define a chamber in which washing liquid is introduced.

[0003] It must be considered that water with the highest contents of soap is deposited on the lower part of the tub, outside the drum that contains the laundry.

[0004] Recirculation systems are known to increase the washing quality (washing class), which put in communication the lower part with the upper part of the tub by means of suitable recirculation pipes. The water with the highest contents of soap in the lower part of the tub is sucked, by means of a recirculation pump, and sent to the upper part of the tub in order to flow in the drum that contains the laundry. This operation allows for using the soap introduced in the washer completely.

[0005] Such a recirculation system is disclosed in the European patent application EP 0 778 367 in the name of Electrolux Zanussi Elettrodomestici S.p.A. Said patent application also discloses a pressure sensor that detects the water pressure in a recirculation pipe and a controller that sets the rinsing program according to the pressure detected.

[0006] The recirculation systems of the know art are impaired by some drawbacks, which are mainly due to the complexity of components and to the volume of the recirculation pipes that must bring the washing liquid from the lower part to the upper part of the tub. Consequently, such a recirculation system involves a higher cost of the washer.

[0007] Moreover, it must be considered that if a recirculation system is to be mounted, the tub of the washer must be suitably modified, in such a way to provide for an inlet in the upper part for connection of the recirculation pipe. Clearly, a tub provided with recirculation system cannot be used without recirculation system. In any case, the recirculation systems of the known art are difficult to modify.

[0008] GB 1 384 847 discloses a resilient sump for a washing machine made in one piece with inlet ducts for circulation and discharge pumps and a connection for a pressure switch. The sump is made of rubber or p.v.c. and is held within an aperture at the bottom of the tub by a retainer ring.

[0009] The purpose of the present invention is to eliminate the drawbacks of the known art, by devising a washer with recirculation system that can be easily integrated in the tub of the washer, without requiring special structural modifications of the tub.

[0010] Another purpose of the present invention is to provide such a recirculation system that is versatile, inexpensive and simple to make and install.

[0011] These purposes are achieved by the present invention, the features of which are claimed in the independent claim 1.

[0012] Advantageous embodiments are disclosed in the dependent claims.

[0013] The washer or washer/dryer of the invention comprises:

- a tub comprising a basically cylindrical lateral wall joined, by means of a circular connection portion, with a bottom wall and a well, arranged in the lower part of the tub, in which the washing liquid is accumulated; said tub being open in the front to form a load opening (10) on which a window gasket is applied;
- a drum revolvingly mounted inside the tub and driven into rotation by a motor;
- a sleeve fitted to a connection that protrudes from the pit of the tub, said sleeve comprising an intake conduit connected to a filter assembly; and
- a pump connected to said filter assembly that takes the washing liquid through the intake conduit and introduces it into a discharge conduit to drain it outside the washer.

[0014] The sleeve comprises a connection conduit that is connected to the filter assembly and to a recirculation conduit that is connected to a spray nozzle arranged in the upper section of the tub or to a conduit obtained in the window gasket of the load opening, which ends in a spray nozzle arranged in the upper and front part of the tub.

[0015] The advantages of the washer of the invention are evident. In fact, the sleeve, which is provided with two separate conduits: the first conduit (intake conduit) for discharge and the second conduit (connection conduit) for recirculation, allows for easy mount of the recirculation system with minimum volume.

[0016] Additional characteristics of the invention will appear evident from the detailed description below, which refers to merely illustrative, not limiting embodiments, illustrated in the enclosed drawings, wherein:

Fig. 1 is a front perspective view of the recirculation system according to the invention, which shows the front wall of a tub of a washer, partially interrupted;
Fig. 2 is a perspective view as Fig. 1, seen from a different angle to illustrate the base of the tub;
Fig. 2A is an exploded perspective view of the recirculation system of Fig. 2;
Fig. 2B is the same view as Fig. 2A, except in that it shows a different embodiment of the sleeve of the

recirculation system of the invention;
Fig. 3 is a lateral perspective view of the recirculation system of Fig. 1, which shows the back of the tub, partially interrupted;
Fig. 4 is an axial section of the sleeve of the recirculation system according to the invention;
Fig. 5 is an exploded perspective view of a preferred embodiment of a tub that integrates a part of the recirculation system of the invention;
Fig. 6 is a perspective view that shows the tub of Fig. 5 in assembled condition; and
Fig. 7 is a cross-sectional view of a recirculation conduit of the tub of Fig. 6.
Referring to the figures, the washer of the invention comprises a tub,
generally indicated with numeral (1), and a recirculation system, generally indicated with numeral (4).

[0017] The tub (1) comprises a tub body composed of a cylindrical wall (20) (Fig. 3). The cylindrical part (20) of the tub is open on the front (Fig. 1 and 2) and forms a load opening (10) to introduce the laundry. A gasket, known as window, is applied on the load opening 10), which must provide suitable seal on the lid of the washer.

[0018] The cylindrical part (20) of the tub is provided with a circular connection portion (21) that is joined to a bottom wall (2) (Fig. 5). The bottom wall can be reinforced by means of ribs.

[0019] As shown in Fig. 3, a cover (3) is preferably engaged and fitted on the bottom wall to reinforce the tub. The cover (3) is provided with a circular peripheral portion (31) that is advantageously fitted to the peripheral part of the tub body by means of vibration or hot blade welding. Clearly, the cover (3) can be fixed to the tub body also by means of welding, ultrasound welding, gluing or suitable fixing means.

[0020] Advantageously, the cover (3) can have cavities facing the bottom wall of the tub in such a way to form a box-shaped structure.

[0021] According to the embodiment of Fig. 5, the cover (3) comprises a plurality of spokes (3a) that branch off from a central hub (3b) adapted to house a bearing-holder support (SP) that revolvingly supports a shaft of the drum driven into rotation by an electrical motor of the washer.

[0022] Referring to Figs. 1 - 3, a housing (15), generally known as pit (15), is obtained in the lower part of the cylindrical wall (20) of the tub, which collects the washing liquid with the highest contents of soap. A connection (16) protrudes in lower position from the pit (15) (Figs. 2 and 2A), which communicates with the inside of the tub (1) to suck the washing liquid.

[0023] The recirculation system (4) comprises a sleeve (M). The sleeve (M) comprises:

- a flange (41) connected to the connection (16) of the pit (15) of the tub,
- a first pipe or conduit (T1), hereinafter defined as intake conduit (T1), and
- a second pipe or conduit (T2), hereinafter defined as connection conduit (T2).

[0024] The intake conduit (T1) is provided with a cylindrical end section (40) that is coaxially joined with the flange (41). The flange (41) has a higher diameter than the section (40) of the intake conduit (T1).

[0025] The connection conduit (T2) is provided with a cylindrical end section (42) that is peripherally joined with the flange (41).

[0026] As shown in Fig. 4, although they are joined to the flange (41), the end sections (40, 42) of the intake conduit (T1) and connection conduit (T2) respectively generate two non-intercommunicating channels (C1, C2). In fact, when the flange (41) is coupled with the connection (16) of the pit of the tub, the channel (C1) of the intake conduit (T1) communicates with the inside of the tub; instead, the channel (C2) of the connection conduit (T2) communicates with a pipe or recirculation conduit (A) as illustrated below. To allow for communication of the end section (42) of the connection conduit (T2) with the recirculation conduit (A), an eyelet (17) is provided in the connection (16) of the pit, as shown in Fig. 2A.

[0027] Preferably, the sleeve (M) is made in one piece and the conduits (T1, T2) are made of rubber, in such a way to be flexible.

[0028] However, as shown in Fig. 2B, the connection conduit (T2) can be separated from the sleeve (M). In such a case, the flange (41) of the sleeve is peripherally provided with a connection (42') adapted to connect with the end section (42) of the connection conduit (T2).

[0029] The intake conduit (T1) of the sleeve (M) is connected to a filter assembly (5). The filter assembly (5) is provided with a housing body (50) that contains a removable filter (51). The front of the filter (51) is generally in the front lower part of the case of the washer, in such a way to be accessible for the operator who can remove the filter (51) for inspection and maintenance purposes. To that end, the filter (51) is generally screwed into the body (50). The intake conduit (T1) is provided with a free end (44) that is fixed to a connection (52) that protrudes laterally from the body (50) of the filter assembly.

[0030] A pump (P) is provided in the back of the body (50) of the filter assembly, which can be used both to discharge and recirculate the washing liquid.

[0031] A three-way stop valve (V) is provided in the upper part of the body (50) of the filter assembly. The valve (V) has an inlet (V1) connected to the body (50) of the filter assembly and two outlets (V2, V3). A plunger (O) (Fig. 2A) of the valve (V) puts the inlet (V1) into communication with the first outlet (V2) or with the second outlet (V3).

[0032] The connection conduit (T2) has a free end (45) that is connected to the first outlet (V2) of the valve (V).

[0033] The second outlet (V3) of the valve (V) is connected to a third pipe or conduit (T3), hereinafter defined as discharge conduit (T3), which is connected to the drain of the washer externally provided on the case.

[0034] The valve (V) can also be omitted. In such a case, the connection conduit (T2) and discharge conduit (T3) are connected directly with the body (50) of the filter. The pump (P) is disposed in such a way to allow for liquid flow from the intake conduit (T1) to the discharge conduit (T3). However, in such a case a second pump must be provided to allow for liquid flow from the intake conduit (T1) to the connection conduit (T2).

[0035] Advantageously, the intake conduit (T1) and connection conduit (T2) are made in one piece with said sleeve (M).

[0036] Advantageously, the connection conduit (T2) and intake conduit (T1) are parallel and the connection conduit is disposed above the intake conduit, at a short distance, or alongside it, in minimum volume configuration.

[0037] Preferably, the diameter of the connection conduit (T2) is lower than the diameter of the intake conduit (T1). In fact, it must be considered that for the discharge function the pump (P) must have a capacity of approximately 17 l/min. Such a capacity is too high for the recirculation function and creates an excess of foam. To that end, a load loss must be introduced, by making the diameter of the connection conduit (T2) lower than the diameter of the intake conduit (T1).

[0038] Referring to Fig. 3, the end section (42) of the connection conduit (T2) is connected to a pipe or recirculation conduit (A) that follows alongside the periphery of the tub (1) to connect with a spray nozzle (B) disposed in the upper part of the tub and adapted to spray liquid inside the tub. The recirculation conduit (A) can end with a connection that is connected to a conduit obtained in the window gasket, ending with a spray nozzle disposed in the front upper part of the tub.

[0039] According to the embodiment of Fig. 3, the pipe or recirculation conduit (A) comprises:

- a first section (A1) that goes from the second conduit (42) of the flange of the sleeve to the back connection portion (21) of the tub,
- a second section (A2) that follows the connection portion (21) of the tub for an arc of circumference of approximately 80°-120°, and
- a third section (A3) that follows the cylindrical lateral surface (20) of the tub to reach the spray nozzle (B) arranged in the front upper part of the tub. Although Fig. 3 shows a recirculation conduit (A) integrated in the tub (1), it appears evident that the recirculation conduit (A) can be a free pipe separated from the tub (1).

[0040] Figs. 5 - 7 show a preferred embodiment of the recirculation conduit (A), in which the recirculation conduit (A) is disposed between the connection portion (21) of the tub body and the peripheral part (31) of the cover (3).

[0041] A first flange (125) follows the connection portion (21) of the tub body for an arc of circumference of approximately 80°- 120°. The flange (125) is made of a flat plate with arched profile. The arched flange (125) is provided with a first end section (127) that protrudes radially outwards from the connection portion (21) of the tub body and a second end section provided with a hole (128) in communication with a channel (129) obtained on the cylindrical lateral wall (20) of the tub body.

[0042] A second flange (135) complementary to the first flange (125) follows the peripheral portion (31) of the cover for an arc of circumference of approximately 80° - 120°. The flange (135) is made of an arched plate that defines a concave cavity (136) (see Fig. 7). The concave flange (135) is provided with a first end section (137) that protrudes radially outwards from the peripheral portion (31) of the cover and a second end section provided with a cap (138) that covers the hole (128) of the first flange (125).

[0043] The end section (137) of the second flange ends with a shank (7) provided with inlet opening (70). The inlet opening (70) is connected directly to the opening of the end section (42) of the connection conduit, on the flange (41) of the sleeve.

[0044] When the cover (3) is mounted on he back wall (2) of the tub body, the two flanges (125, 126) are mutually coupled, forming a watertight channel (60), as shown in Fig. 7, that is the recirculation channel (A) of the recirculation system (4) that draws soapy water in the lower part of the tub and recirculates it in the upper part of the drum.

[0045] Following is a description of the operation of the recirculation system (4) of the invention.

[0046] When the recirculation cycle is enabled, the valve (V) puts the inlet (V1) into communication with the first outlet (V2) connected to the connection conduit (T2), whereas it closes the second outlet (V3) connected to the drainage conduit (T3).

[0047] The pump (P) sucks the liquid in the pit (15) of the tub (1) through the intake conduit (T1). The liquid is filtered by the filter (51) and introduced under pressure in the connection conduit (T2). Then the liquid reaches the spray nozzle (B) through the recirculation conduit (A) and is sprayed in the front upper part of the tub, thus crossing the drum that revolves inside the tub. When the discharge cycle is enabled, the valve (V) puts the inlet (V1) into communication with the second outlet (V3) connected to the discharge conduit (T3), whereas it closes the first outlet (V2) connected to the connection conduit (T2).

[0048] The pump (P) sucks the liquid in the pit (15) of the tub (1) through the intake conduit (T1). The liquid is filtered by the filter (51) and introduced under pressure in the drainage conduit (T3) to be drained outside the washer. Numerous variations and modifications can be made to the present embodiments of the invention by an expert of the field, while still falling within the scope of the invention as claimed in the enclosed claims.

Claims

1. Washer or washer/dryer machine comprising:

   - a tub (1) comprising a basically cylindrical lateral wall (20) joined with a bottom wall (2) by means of a circular connection portion (21), a pit (15) arranged in the lower part of the tub that contains the washing liquid; the said tub being open in the front to form a load opening (10) on which a window gasket is applied;
   - a drum rotatably mounted inside the tub and driven into rotation by a motor;
   - a sleeve (M) provided with a conduit (40) fitted to a connection (16) that protrudes from the pit (15) of the tub, the said sleeve comprising an intake conduit (T1) connected to a filter assembly (5);
   - a pump (P) connected to the filter assembly (5) that sucks the washing liquid through the intake conduit (T1) and introduces it into a discharge conduit (T3) to discharge it outside the washer;
   characterized in that

   the sleeve (M) comprises a connection conduit (T2) that is connected to the filter assembly (5) and to a recirculation conduit (A) that is connected to a spray nozzle (B) arranged in the upper section of the tub or to a conduit obtained in the window gasket of the load opening (10) that ends in a spray nozzle arranged in the upper and front part of the tub.

2. Machine as claimed in claim 1, **characterized in that** the connection conduit (T2) and the intake conduit (T1) are made in a single piece with the said sleeve (M).

3. Machine as claimed in claim 1 or 2, **characterized in that** the connection conduit (T2) and the intake conduit (T1) are parallel and the connection conduit is arranged above the intake conduit at a short distance or in contact with the intake conduit.

4. Machine as claimed in any of the above claims, **characterized in that** the diameter of the connection conduit (T2) is lower than the diameter of the intake conduit (T1).

5. Machine as claimed in any of the above claims, **characterized in that** it comprises a three-way valve (V) comprising an inlet (V1) connected to the filter assembly (5), a first outlet (V2) and a second outlet (V3) connected respectively to the connection conduit (T2) and the discharge conduit (T3), in which a plunger (O) of the valve (V) puts the inlet (V1) into communication with the first outlet (V2) or with the second outlet (V3).

6. Machine as claimed in any of claims 1 to 4, **characterized in that** it comprises a second pump that takes the liquid from the intake conduit (T1) and introduces it into the said connection conduit (T2).

7. Machine as claimed in any of the above claims, **characterized in that** the recirculation conduit (A) follows and is situated near the periphery of the tub (1).

8. Machine as claimed in claim 7, **characterized in that** the recirculation conduit (A) comprises:

   - a first section (A1) that goes from the second conduit (42) of the flange of the sleeve to the back connection portion (21) of the tub,
   - a second section (A2) that follows the connection portion (21) of the tub for an arc of circle of approximately 80° - 120°, and
   - a third section (A3) that follows the cylindrical lateral surface (20) of the tub to reach the spray nozzle (B) arranged in the upper front part of the tub.

9. Machine as claimed in any of claims 1 to 6, **characterized in that**

   - the tub (1) comprises a cover (3) provided with a circular peripheral portion (31) coupled with the bottom wall (2) of the tub body, in such a way to form a box-shaped structure, and
   - the tub body comprises at least a first flange (125) that is watertightly coupled with at least a second flange (135) provided in the said cover, in such a way to generate said recirculation conduit (A),

   in which the first flange (125) is arranged on the connection portion (21) of the tub body and the second flange (135) is arranged on the said peripheral portion (31) of the cover.

10. Machine as claimed in claim 9, **characterized in that** at least one between the said first flange (125) and the second flange (135) is provided with a concave cavity (136) to define the recirculation conduit (A).

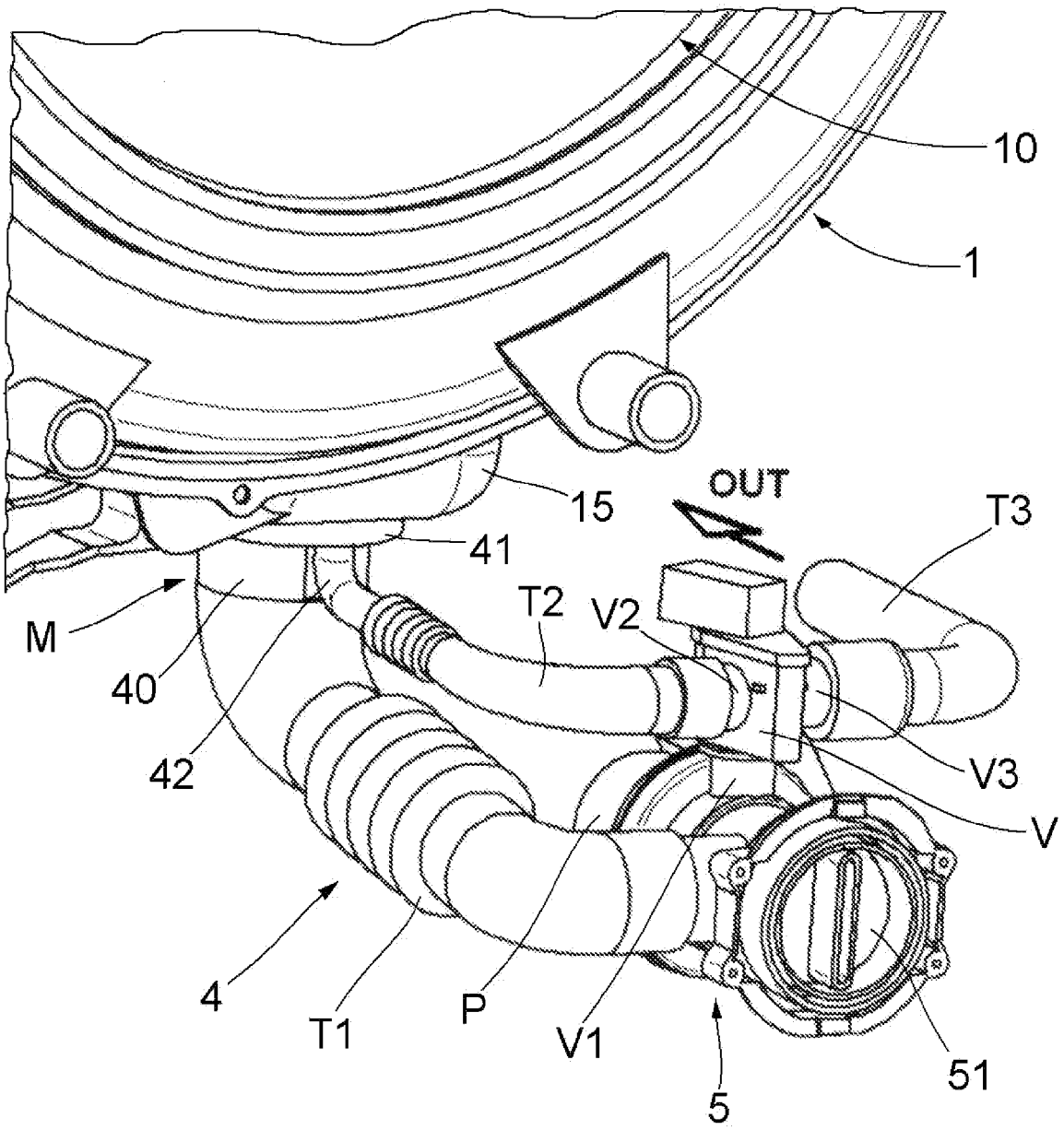

FIG. 1

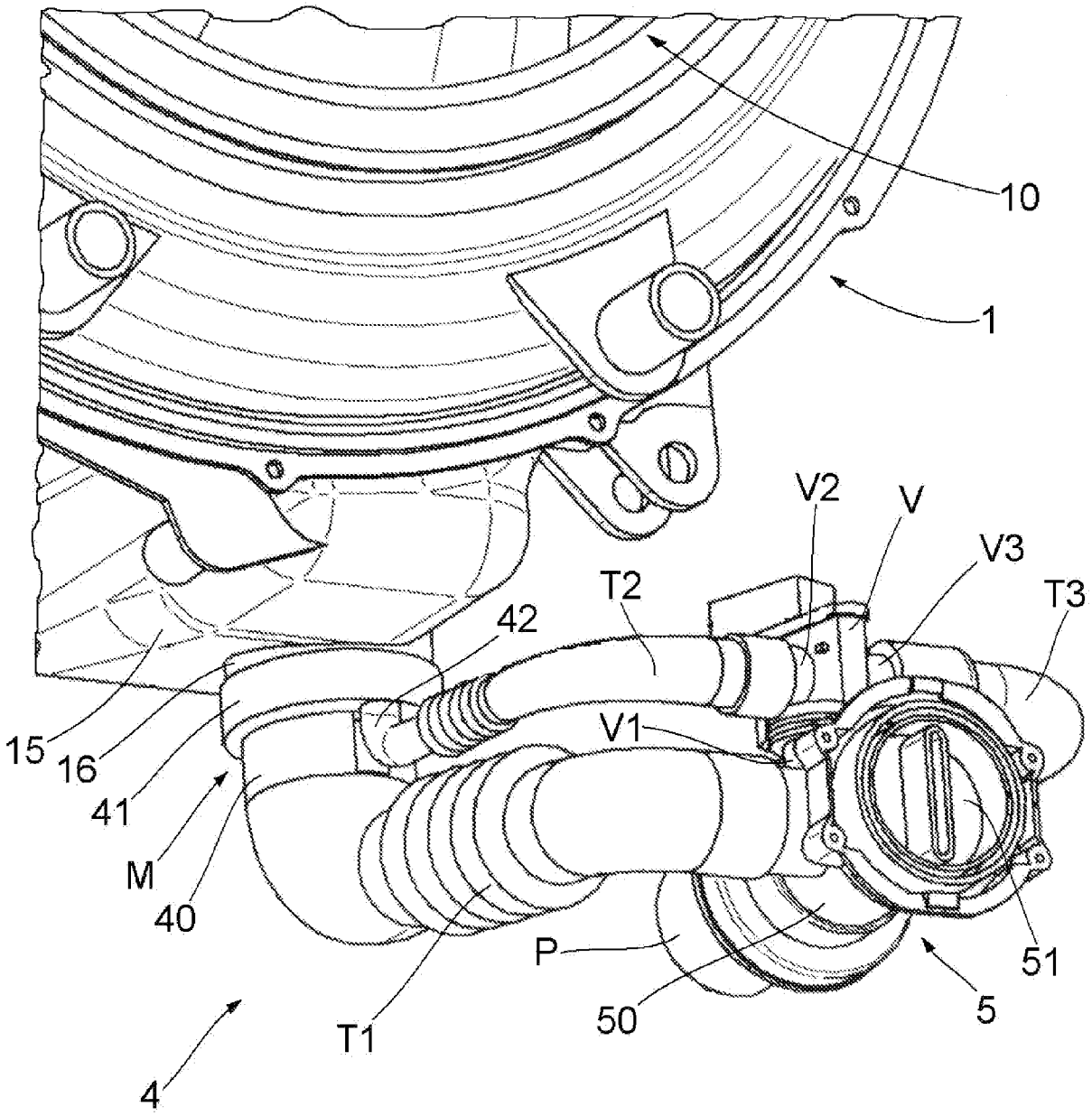

FIG. 2

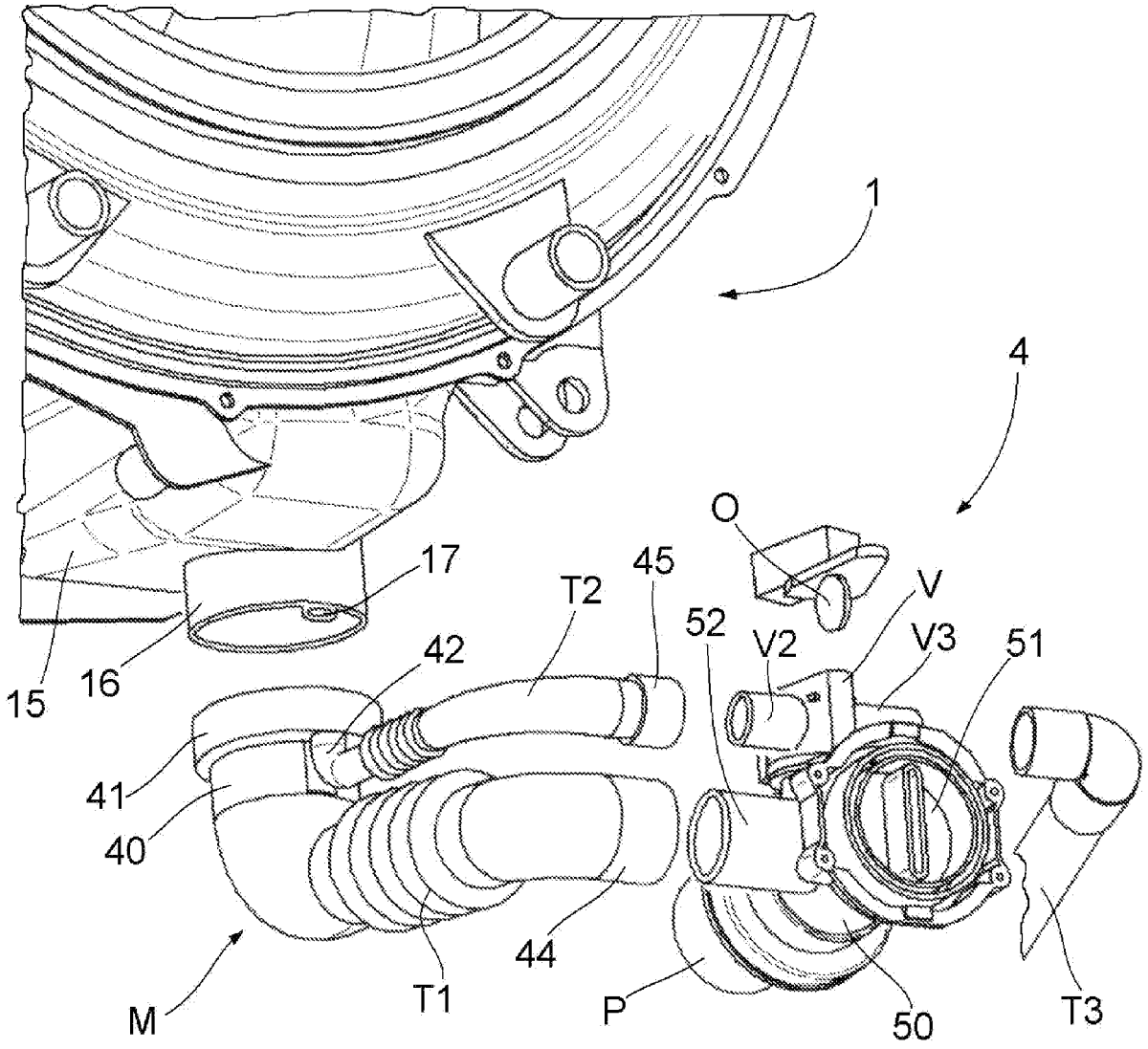

FIG. 2A

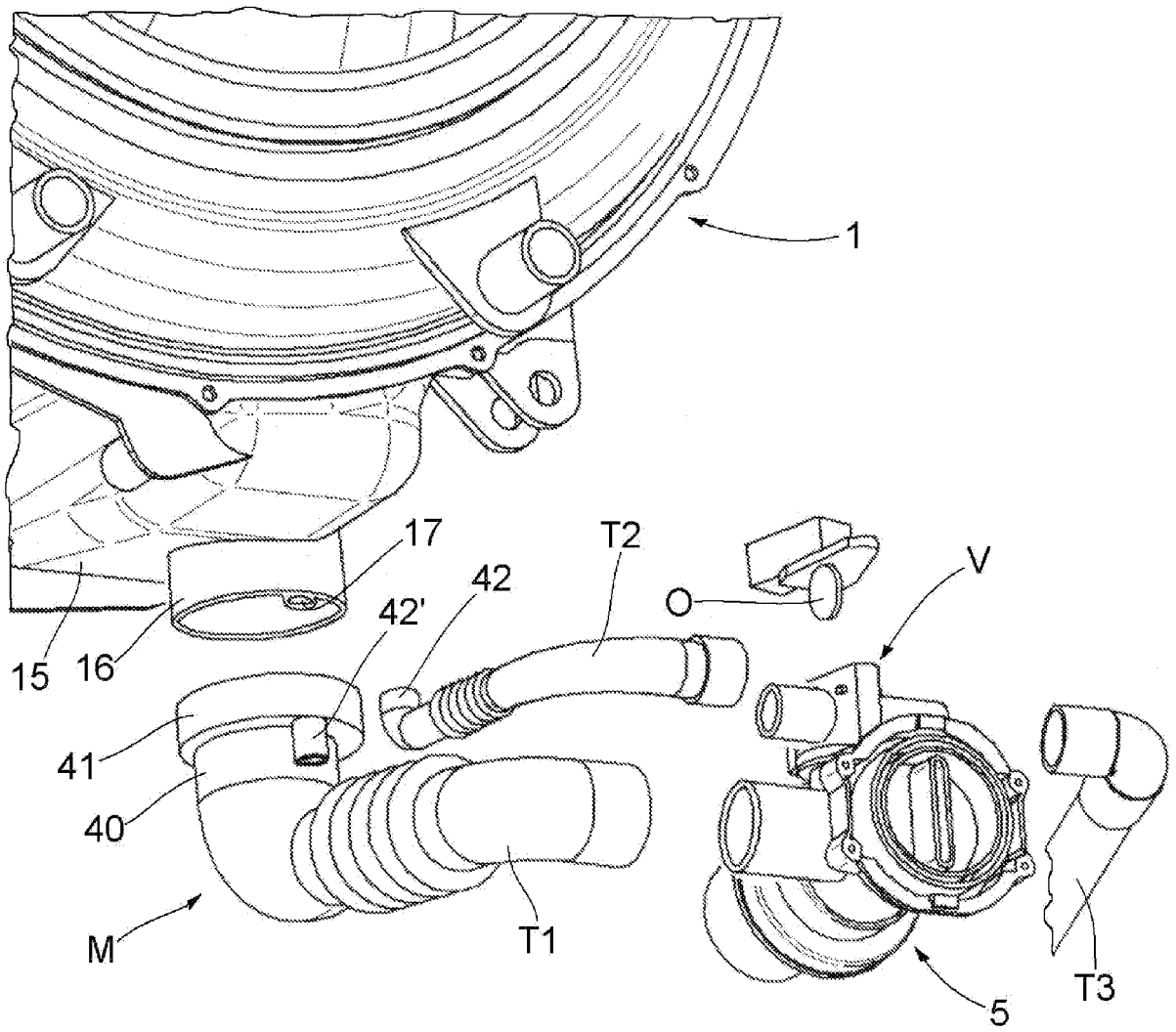

FIG. 2B

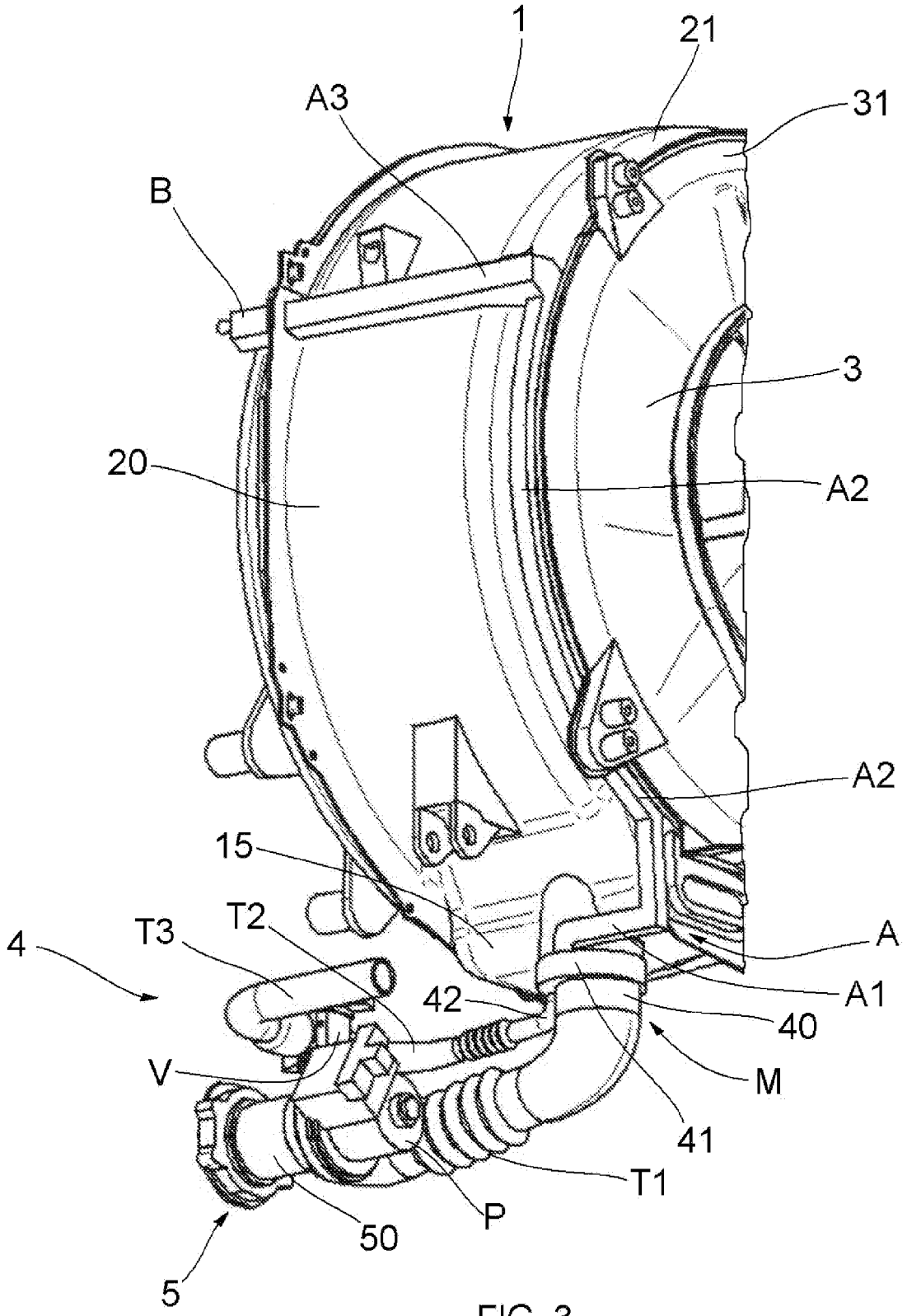

FIG. 3

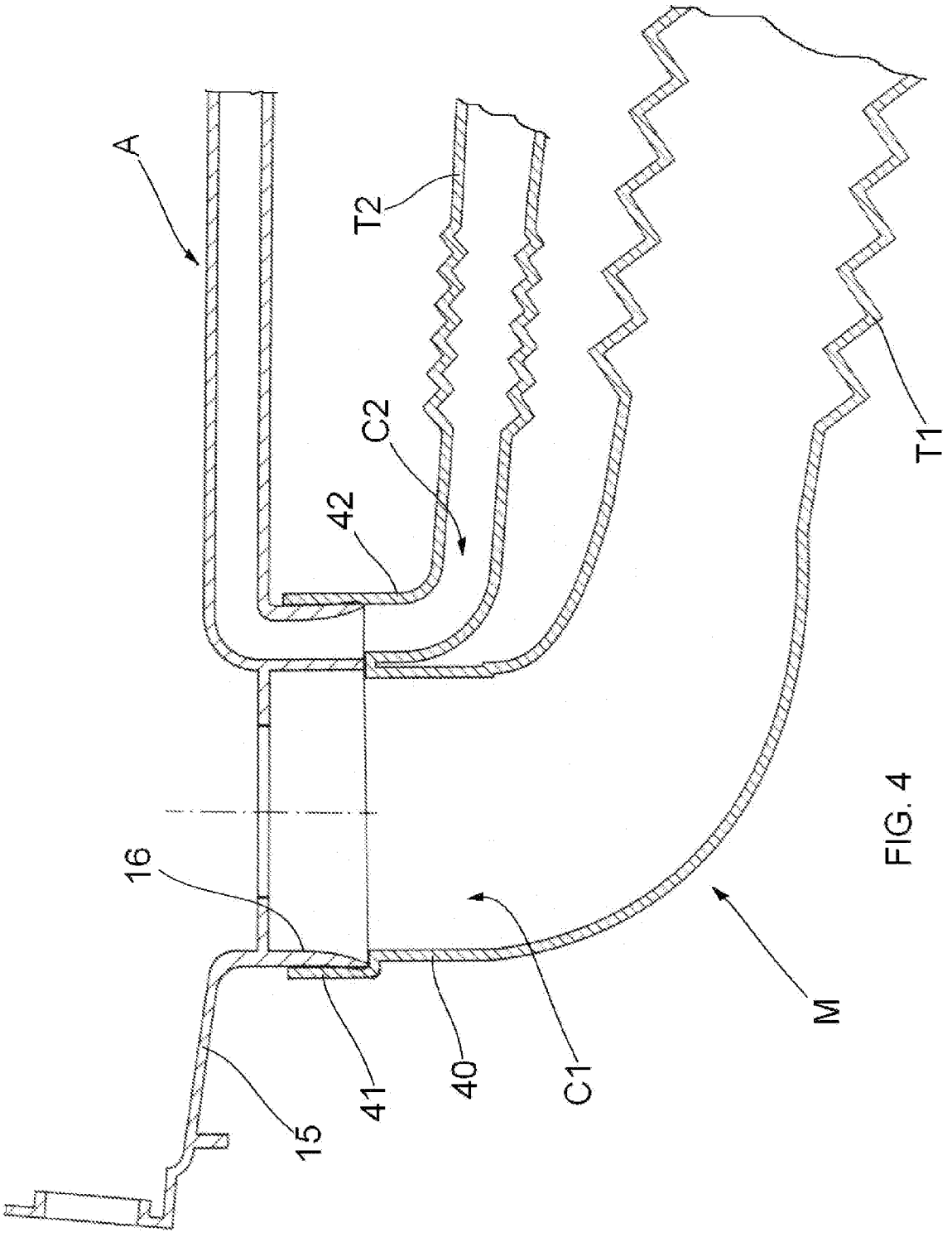

FIG. 4

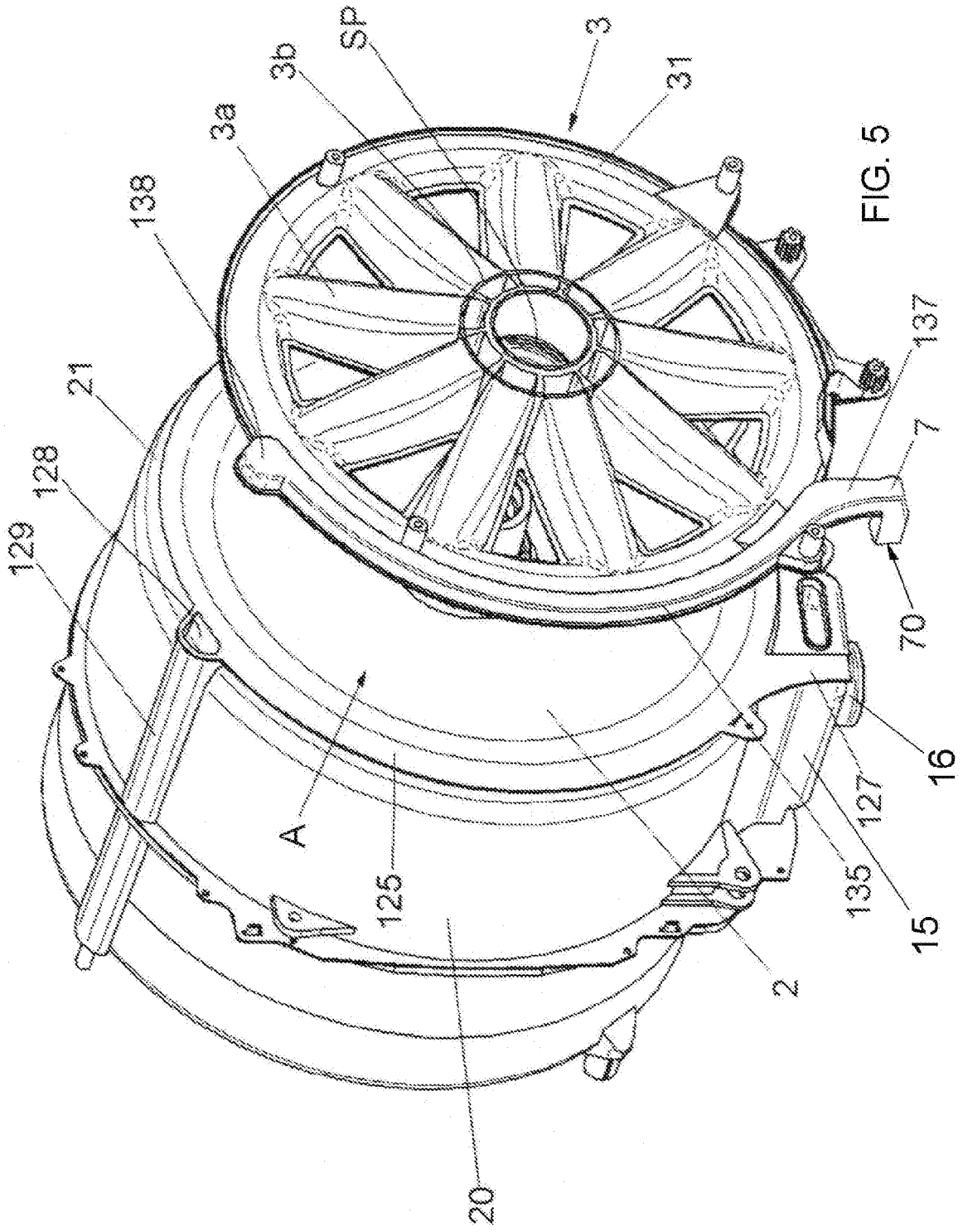

FIG. 5

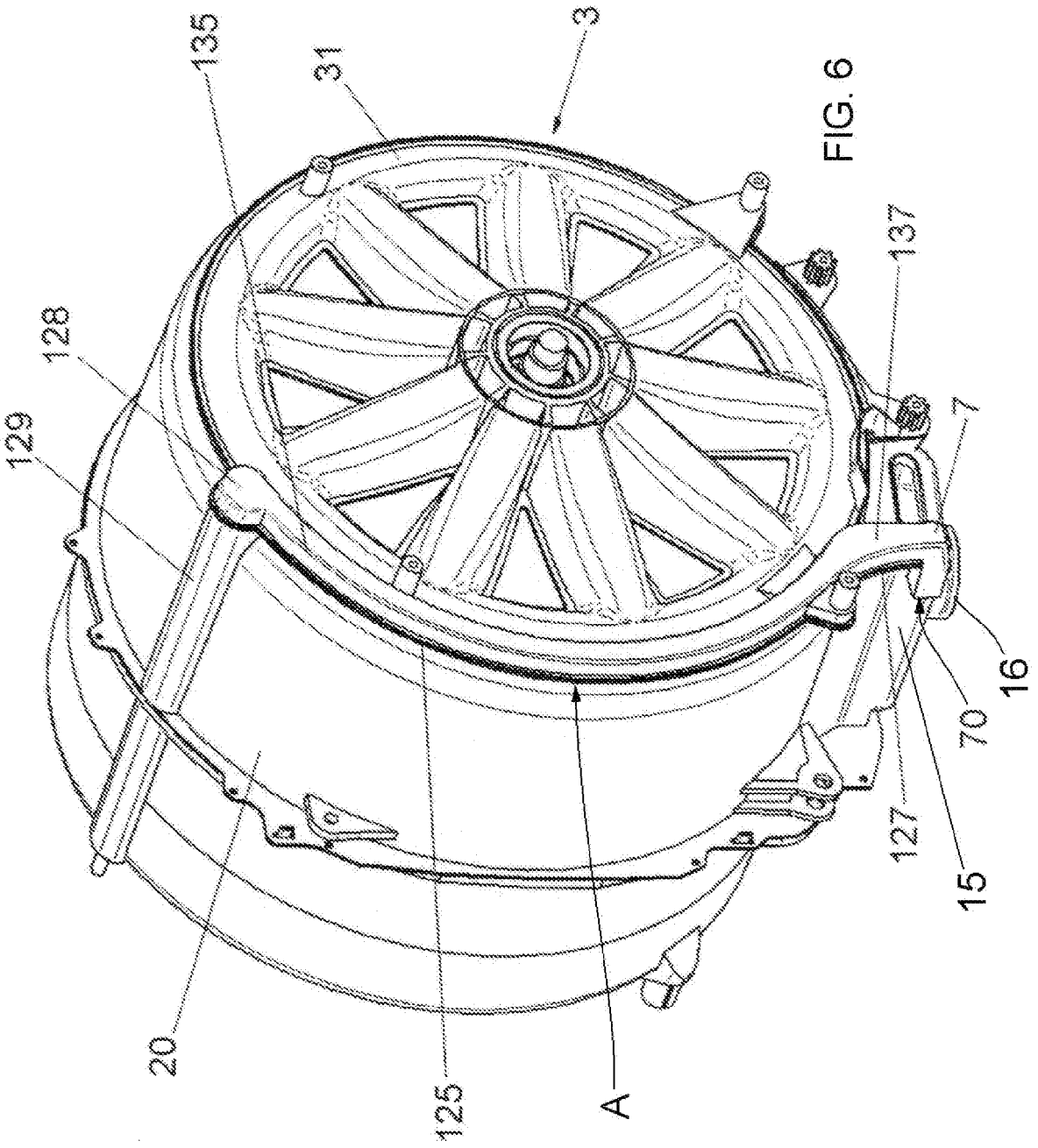

FIG. 6

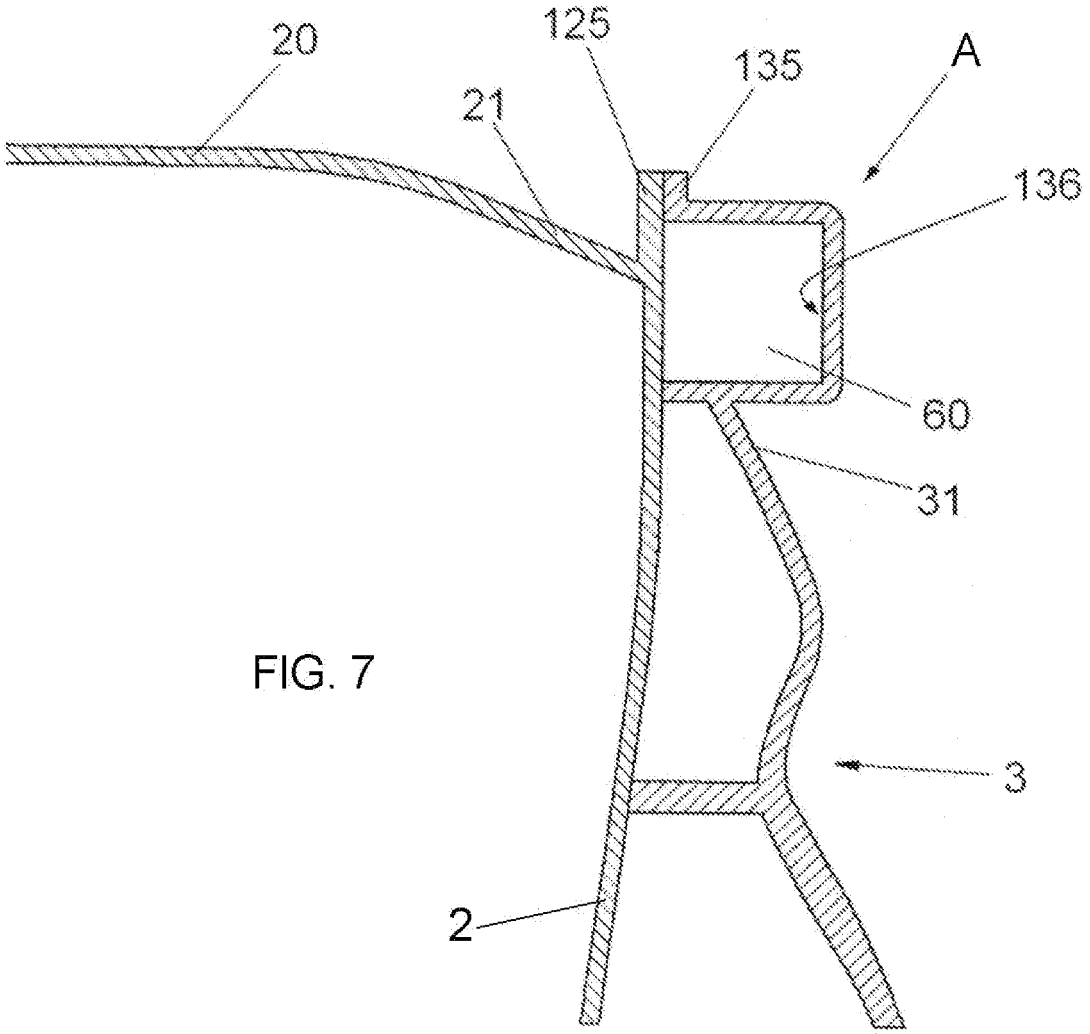

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 6492

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2007/018453 A1 (ITURRALDE AMAIA [ES] ET AL) 25 January 2007 (2007-01-25) * paragraph [0018] - paragraph [0022]; figures 1-3 *	1	INV. D06F39/08 A47L15/42
A	GB 1 384 847 A (ZANUSSI A SPA INDUSTRIE) 26 February 1975 (1975-02-26) * the whole document *	1	
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A	US 2004/007029 A1 (BOLDUAN EDWIN [DE] ET AL BOLDUAN EDWIN [DE] ET AL) 15 January 2004 (2004-01-15) * paragraph [0030] - paragraph [0035]; figures 1-3 *	1	
A	EP 1 319 742 A1 (ELECTROLUX HOME PROD CORP [BE]) 18 June 2003 (2003-06-18) * paragraph [0021] - paragraph [0029]; figures 2-4 *	1	TECHNICAL FIELDS SEARCHED (IPC) D06F A47L
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 September 2010	Fachin, Fabiano

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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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03-09-2010

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