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(54) **A drum type washing machine with a system for fixing the washing unit during transportation**

(57) A drum type washing machine comprises a cabinet (12), a tub (14) arranged inside the cabinet and a drum (16) rotatably mounted in the tub, and a plurality of

inflatable bags (30) disposed between the cabinet and the tub for fixing the tub in a predetermined position during transportation.

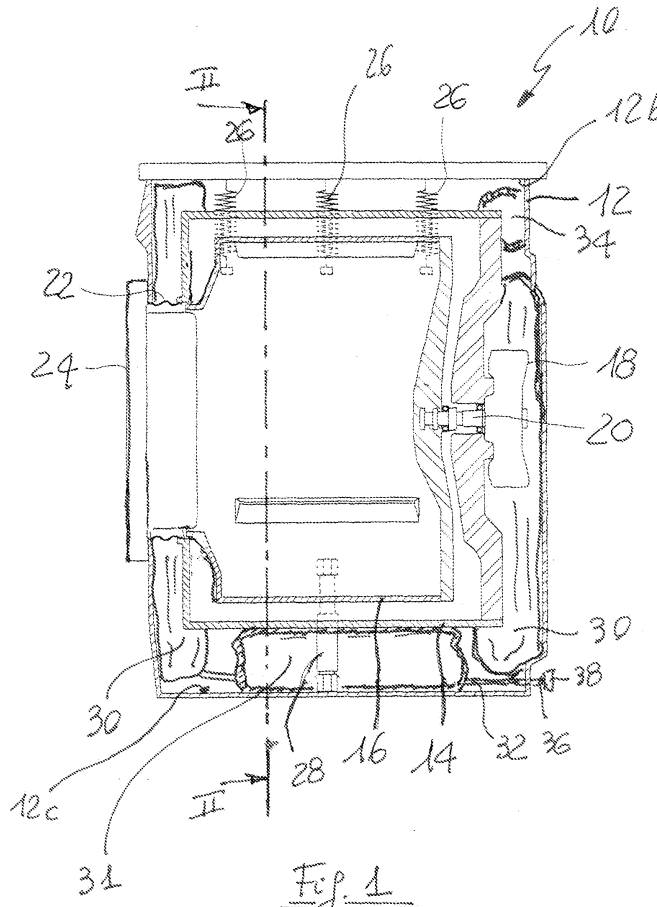


Fig. 1

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Description

[0001] The present invention relates to a drum type washing machine comprising a cabinet, a tub arranged inside the cabinet and a drum rotatably mounted in the tub.

[0002] It is well known in the art of washing machines the need of avoiding damages to the machine when it is transported from the factory to the shop and from the shop to the home of the final customer. These damages, including dents into the visible parts of the washing machine, can be caused by an undesired movement of the tub inside the cabinet. The tub is suspended in the cabinet by means of supporting springs and dampers, and these are designed only for suspending the tub in a normal configuration of use, and not for instance for supporting the tub in a horizontal configuration of the machine (which may happen during transportation).

[0003] Therefore, in order to solve the above problem, transport fixation bolts and transport brackets to stiffen the cabinet for the shock load transmitted by the transport fixation bolts are needed in the machines according to the state of the art. The addition of bolts, plastic spacers and brackets to the structure of the machines (which after transportation are no longer used), does increase the overall cost and complexity of the known washing machines. Moreover the user has to perform a not very easy manual operation for removing the bolts before using the machine. If the user forgets to remove fixing bolts, the rigid fixing of the tub can cause severe damages to the washer which can require the intervention of the service or even the replacement of the machine.

[0004] It is an object of the present invention to provide a washing machine of the type mentioned at the beginning of the description which does not present the above problems, which is easy to be manufactured and used and which presents an overall cost lower than the known machines.

[0005] According to the invention, this object is reached thanks to the features listed in the appended claims.

[0006] The technical solution according to the present invention presents inflatable devices which replace the traditional transport fixation bolts and transport brackets to stiffen the cabinet for the shock load transmitted by the transport fixation bolts. With the term "inflatable devices" we mean any device which can assume a deflated configuration and an inflated configuration; such devices can comprise rubber bellows, flexible bags or the like. In the inflated configuration the inflatable devices can exert a predetermined force on components lying nearby, like parts of the cabinet and the washing unit (i.e. tub). Other advantages can derive from the use of the inflatable air bellows or bags as auxiliary elements of the damper/spring system for tub suspension (which allows reducing the cost of the suspension system), or they can even replace completely such damper and springs.

[0007] According to another feature of the present in-

vention, the inflatable bags can be provided with air pressure sensors for providing signals related to degree of drum unbalance during spinning to a control unit of the machine.

[0008] Further advantages and features of a washing machine according to the present invention will become clear from the following detailed description, with reference to the appended drawings in which:

- figure 1 is a side sectional view of a washing machine according to the invention;
- figure 2 is a section along line II-II of figure 1;
- figure 3 is a section along line III-III of figure 2; and
- figure 4 is a simplified control diagram according to a further embodiment of a washing machine according to the invention.

[0009] With reference to the drawings, a washing machine 10 comprises a cabinet 12, a tub 14 arranged in the cabinet 12 for storing washing water and detergent, a drum 16 rotatably mounted in the tub 14 for washing and dehydrating the laundry and a driving motor 18 positioned at the rear side of the tub and connected to the drum 16 by a driving shaft 20. An inlet 22 for loading or unloading the laundry is formed at the front side of the cabinet 12, and a door 24 for opening and closing the inlet 22 is provided at the front side of the machine 10.

[0010] A plurality of supporting springs 26 are installed between the upper portion of the tub 14 and the upper inner wall of the cabinet 12, and a plurality of dampers 28 are installed between the lower portion of the tub 14 and the lower inner wall of the cabinet 12, thereby supporting the tub 14 with buffering.

[0011] According to the invention, between vertical corners 12a of the cabinet and the tub 14 there are placed four inflatable elongated bags 30 which are connected together by means of a common piping system 32. The bags 30 are fixed to the cabinet 12 by means of double sided adhesive tape or by mean of any other fastening device. According to another embodiment of the invention, a fifth inflatable bag 31 is placed between a bottom surface 12c of the cabinet and the tub 14. This inflatable bag 31 is preferably used for preventing the wash unit from dropping during transport and for avoiding an over-stress of the spring/damper system of the washing unit. A sixth inflatable elongated bag 34 can be placed between the tub (14) and an upper rear corner 12b of the cabinet 12.

[0012] All the inflatable bags are connected, by means of the piping system 32, with a feeding nozzle 36 placed preferably in the rear portion of the machine and which can be closed by a plug 38 or by a welded portion of the pipe (not shown).

[0013] Therefore, at the end of the production line the bags 30 and 34 are inflated to a predetermined pressure level, preferably comprised between 0,1 and 0,5 bar, more preferably between 0,2 and 0,4 bar, for instance at 0,3 bar, in order to fix the position of the tub 14 with re-

spect to the cabinet and therefore avoiding any dangerous relative movement. Then the nozzle 36 is closed (or the corresponding plastic pipe is closed by welding) and the machine can be transported safely.

[0014] When the user has to use the machine for the first time, he has only to remove the plug 38 or to cut the corresponding portion of the piping system 32 in order to deflate the bags 30 and 34.

[0015] In case the washing machine has to be transported again, the user or the person of the service can pressurize again the bags, for instance by means of a normal bicycle pump (in this case the nozzle 36 is provided with a usual bicycle tire valve).

[0016] Test carried out by the applicant have shown that air inflatable bags with sufficient strength to overcome the stress during the transport shocks can be made of polyethylene film having a thickness of 300 μm or more. These bags have passed the standard transport shocks applied in the shipping laboratory of the applicant. Of course other materials can be used, for instance rubber bags or bags of multilayered flexible material (textile + rubber) typically used for inflatable boats.

[0017] The applicant has experienced only slight deformations on the top rear bracket and the top front bracket of the cabinet (after pressurization of the bags) which have been easily overcome by more stampings inside the brackets to get more stiffness against bending. The best results have been obtained with only four vertical corner air bags 30 shaped so that they can fix the wash unit to all the four lateral sides of the cabinet.

[0018] The inflatable bags are then mounted during the assembly process of the washing machine into the empty cabinet without wash unit (tub + drum). The bags are then fixed to the side panels of the appliances with double sided adhesive tape.

[0019] The inflatable bags are connected with the pipe system 32. Over this pipe system they are inflated at the end of the assembly process of the washing machine and the pipes are closed by one or more plugs or by permanent welding. These pipe end or ends are accessible at the outside of the appliance. The customer has to open the plug(s) or cut the welding line(s) to deflate the inflatable bags. The inflatable bags remain in the appliance for the total life time. There is the possibility to inflate them again for further transport of the appliance.

[0020] According to a further embodiment of the present invention (figure 4), the pressure inside the inflatable bags 30 and 31 can be controlled by an electrical pump 40 driven by the control unit 42 of the appliance. This solution, in which a pressure sensor 44 provides signals to the control unit 42 of the machine 10, can be used not only for transportation purposes, but also for partially or totally replacing the elements of the tub suspension system (springs 26 and dumper 28). Of course the level of pressure inside the inflatable bags for this purpose is lower than the pressure level for safe transportation purpose, and can be comprised between 0,05 and 0,2 bar, depending also of the dimensions, material

and shape of the bags. The changing of the pressure of the inflatable bags has shown that it is possible to tailor such pressure to different spinning speeds.

[0021] Another use of the inflatable bags is the control of the unbalance, particularly during spinning at high speed. By providing the inflatable bags with pressure sensors 44 it is possible to derive pressure signals to the control unit 42 which are related to the degree of unbalance in the rotating drum. The pressure of the inflatable bags 30 can be controlled also through an electrical relief valve 48.

Claims

1. A drum type washing machine (10) comprising a cabinet (12), a tub (14) arranged inside the cabinet (12) and a drum (16) rotatably mounted in the tub (14), **characterized in that** it comprises at least one inflatable device (30, 34) disposed between the cabinet (12) and the tub (14).
2. A drum type washing machine according to claim 1, wherein the inflatable devices are inflatable bags (30, 31, 34).
3. A drum type washing machine according to claim 2, wherein it comprises four inflatable bags (30) placed between vertical corners (12a) of the cabinet (12) and the tub (14).
4. A drum type washing machine according to claim 3, wherein it comprises a further inflatable bag (31) interposed between a bottom surface (12c) of the cabinet (12) and the tub (14).
5. A drum type washing machine according to claim 3 or 4, wherein it comprises a further inflatable bag (34) interposed between an upper rear horizontal corner (12b) of the cabinet (12) and the tub (14).
6. A drum type washing machine according to any of the preceding claims, wherein the inflatable bags (30, 31, 34) are fixed to the cabinet (12) with double sided adhesive tape.
7. A drum type washing machine according to any of the preceding claims, wherein all inflatable bags (30, 31, 34) are connected through a pipe system (32).
8. A drum type washing machine according to claim 7, wherein the pipe system (32) presents a plug (38) or a welded portion which is adapted to be removed or cut by the user, particularly at the end of machine transportation.
9. A drum type washing machine according to any of the preceding claims, wherein the inflatable bags

(30, 31, 34) are adapted to be inflated at a pressure comprised between 0,1 and 0,5 bar.

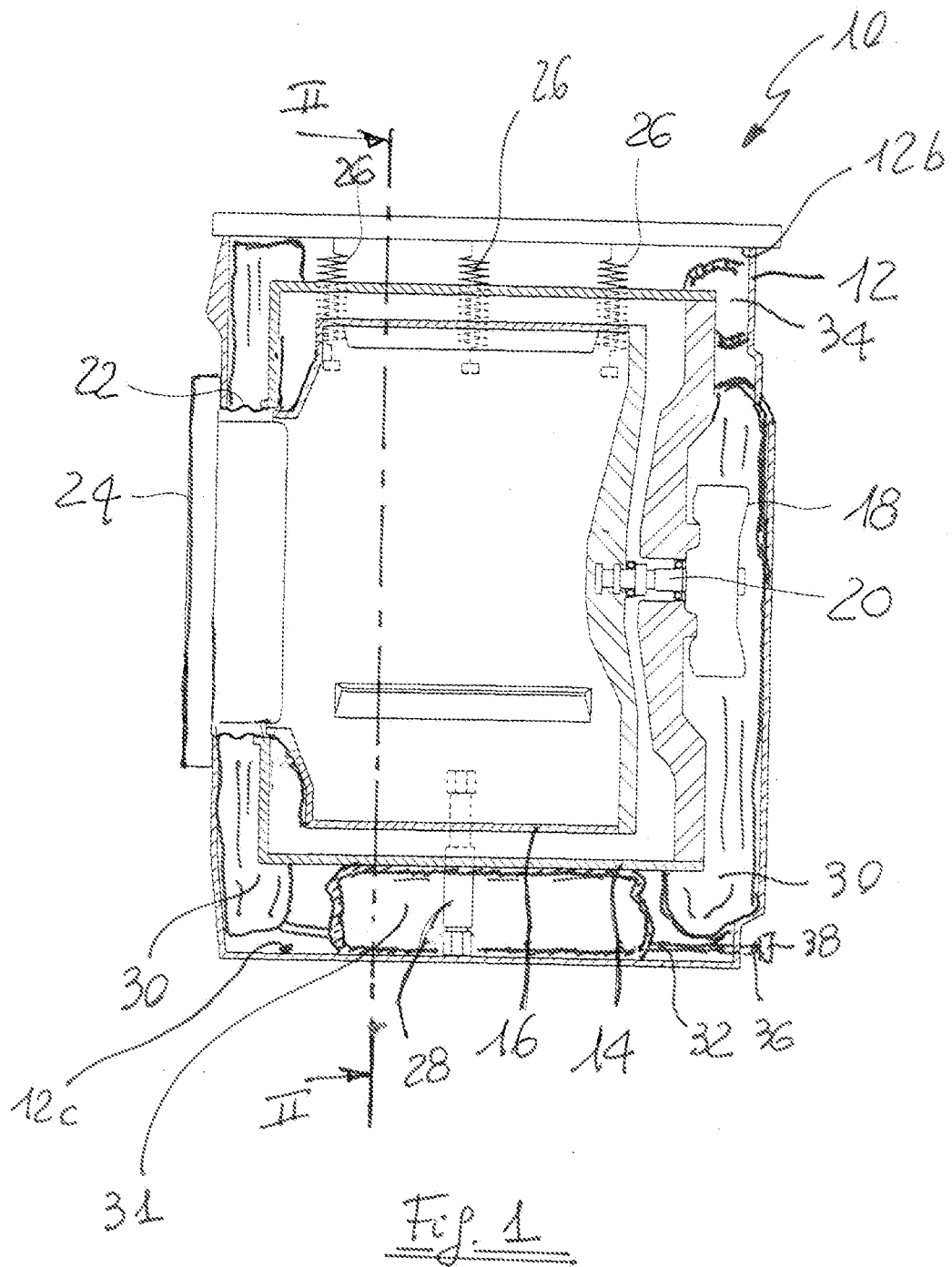
10. A drum type washing machine according to claim 9, wherein the inflatable bags (30, 31, 34) are adapted to be inflated at a pressure comprised between 0,2 and 0,4 bar. 5
11. A drum type washing machine according to any of the preceding claims, wherein the inflatable bags (30, 31, 34) are made of polyethylene film having a thickness higher than 300 μ m. 10
12. A drum type washing machine according to any of claims 1-7, wherein the inflatable bags (30, 31, 34) are adapted to be used, when inflated at a predetermined pressure level, as a suspension system for the tub. 15
13. A drum type washing machine according to claim 12, wherein said predetermined pressure level is comprised between 0,005 and 0,2 bar. 20
14. A drum type washing machine according to any of claims 1-7, wherein at least one inflatable bag (30, 31, 34) is provided with an air pressure sensor (44) connected to a control unit (42) of the machine for drum unbalance detection purposes. 25
15. A drum type washing machine according to any of claims 12-14, wherein the inflatable bags are connected to a pump (40) controlled by the control unit (42) of the machine and adapted to pressurize the inflatable bags (30, 34) at a predetermined pressure level depending on the phase of the working program of the washing machine (10). 30 35

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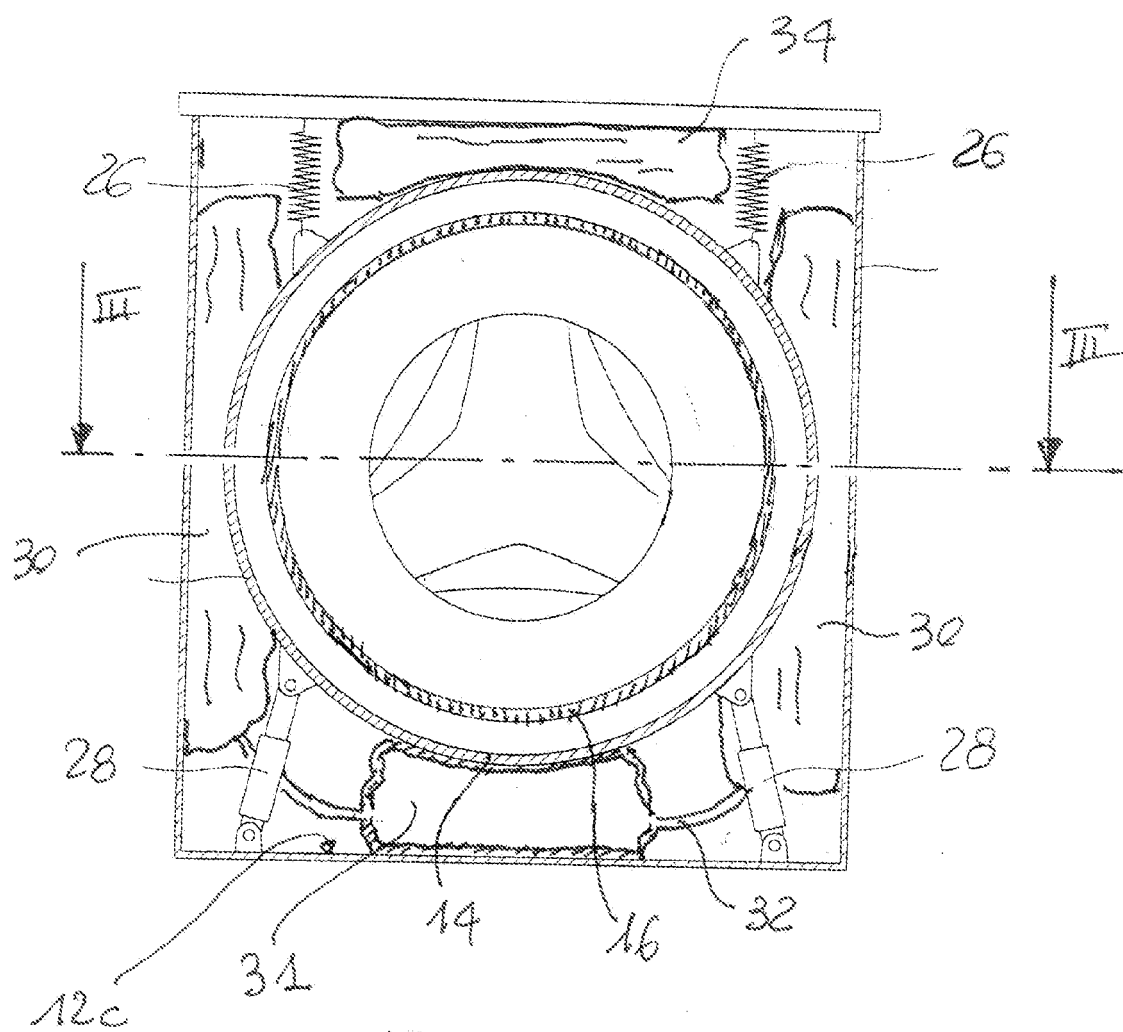
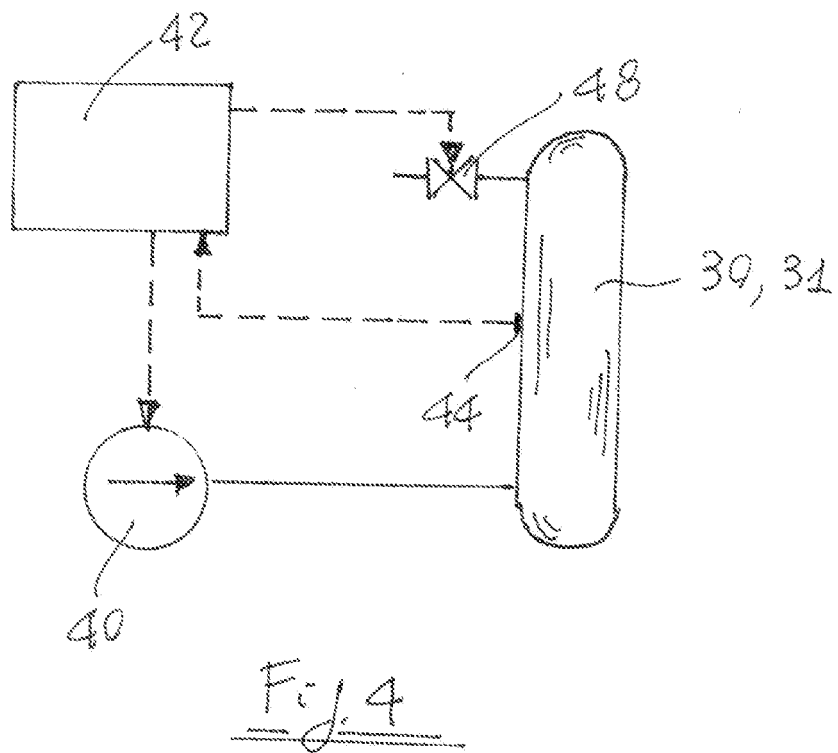
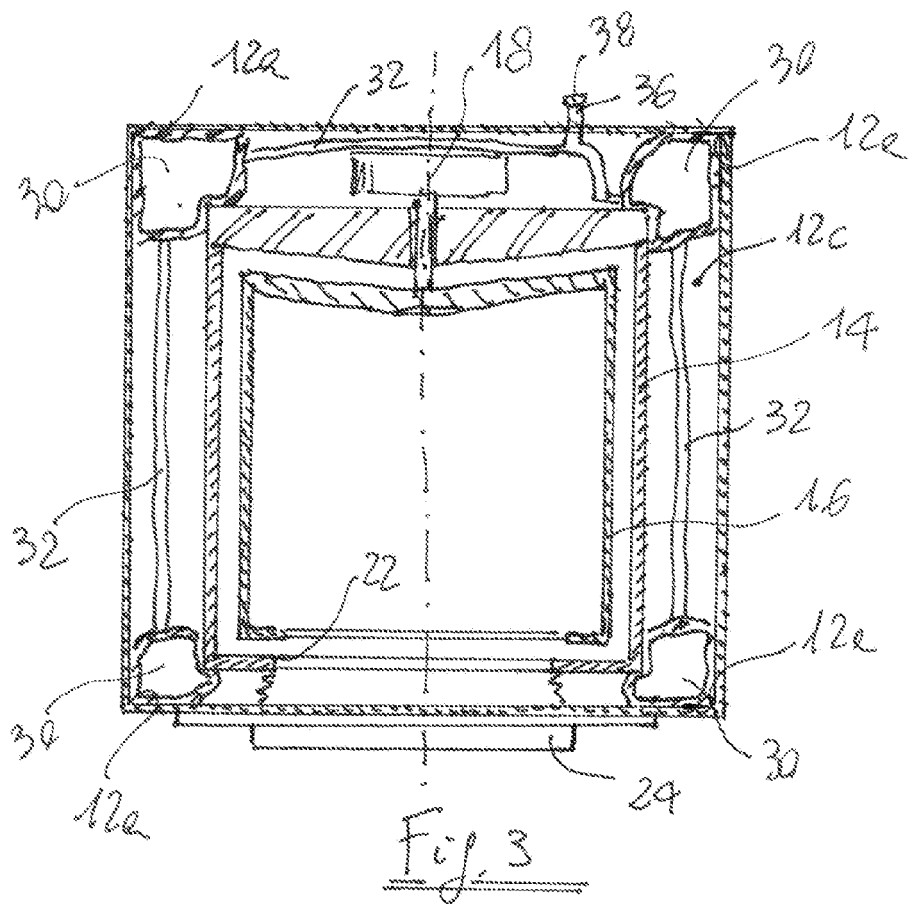


Fig. 2





EUROPEAN SEARCH REPORT

Application Number
EP 10 16 3548

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 25 31 265 A1 (LICENTIA GMBH) 27 January 1977 (1977-01-27) * page 4, line 15 - page 5, line 8; figures * -----	1,2,12	INV. D06F39/00
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			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 November 2010	Examiner Stroppa, Giovanni
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 16 3548

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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08-11-2010

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