



(12) **EUROPEAN PATENT APPLICATION**

(21) Application number : **94850057.4**

(51) Int. Cl.⁵ : **D06F 37/02, D06F 37/26,
D06F 39/12**

(22) Date of filing : **20.04.94**

(30) Priority : **22.04.93 SE 9301353**

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(43) Date of publication of application :
26.10.94 Bulletin 94/43

(84) Designated Contracting States :
DE FR GB

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(54) **Arrangement in a washing machine.**

(57) A laundry washing machine comprises a cabinet (10) having side walls (13,14), top and bottom walls (15,16), a back piece (12) and a front piece (11). In the front piece (11) an opening (19) is provided for a door (18) arranged to close an opening in a tub, said tub with a drum, rotatably journaled in the tub, and a drive motor for the drum forming an assembly (17) which is free-swingingly suspended in the cabinet by means of spring means and vibration damping means such that an annular gap (36) is formed around the door (18) between the cabinet (10) and the tub. Sound damping means are provided for reducing noise which escapes from the machine and which is generated by the machine when operating. The sound damping means comprises a sound trap of the labyrinth type (20,21,22,23 ; 25,26,27,28) disposed in the annular gap (36) around the door (18). Preferably, the sound trap comprises a sound absorbent (31) disposed in a part of the sound trap facing the interior of the cabinet.

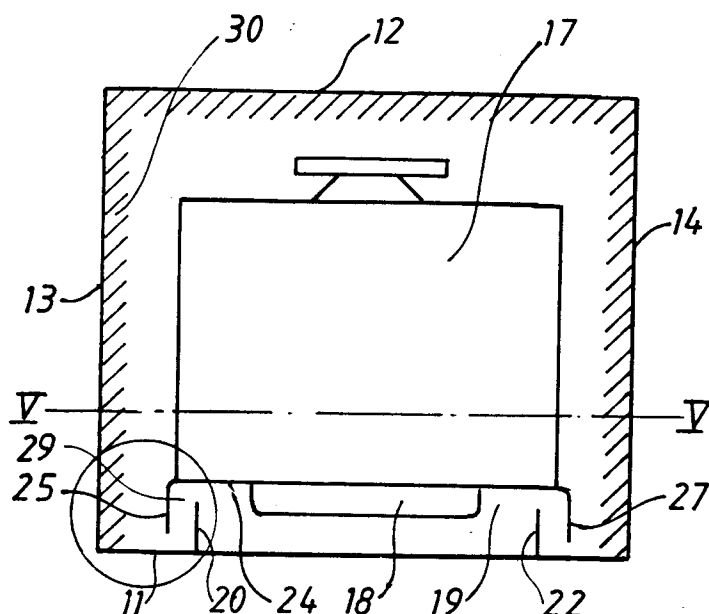


Fig. 2

The present invention relates to laundry washing machines of the kind comprising a cabinet having side walls, top and bottom walls, a back piece and a front piece, wherein the front piece has an opening for a door provided for the closure of an opening in a tub, said tub together with a drum, rotatably journaled therein, and a drive motor, provided for rotating of said drum, forming an assembly which by means of spring means and vibration damping means is free-swingingly suspended in the cabinet such that adjacent to the front piece, between the cabinet and the tub an annular gap is formed which surrounds the door.

In a laundry washing machine of the kind referred to above the assembly constitutes a free-swinging unit which is completely disconnected from the rest of the cabinet. In order to have access to the drum contained in the tub and supporting the laundry to be washed, in the usual way, a door is provided and in this type of machine the door is arranged to close directly an opening in the tub. In a machine of this type a corresponding opening is provided in the cabinet just in front of the door and adjacent to the opening the space between the front piece and the tub must be of sufficient size to permit the latter, when the machine is operating, to move without contacting the cabinet. Suitably, the distance amounts to a few centimeters and, at least, the distance should amount to 3 cm.

In another common type of laundry washing machine the door is disposed on the front piece of the cabinet and the opening in the tub is connected to the opening in the front piece by means of an annular gasket, usually a flexible bellows made of rubber. In this embodiment no annular gap is present which, like in the embodiment described above, connects the interior of the machine to the surrounding atmosphere involving problems caused by escaping noise.

For the purpose of reducing noise generated during the operation of the machine and present mainly in the range from a couple of hundred Hertz and up to about 3.000 Hertz it has been suggested that a sound absorbent be disposed on the inside of the cabinet. For example, a viscous elastic material can be used which is sprayed onto the interior walls of the cabinet, preferably the front piece and the side walls. Such a washing machine is described in the publication JP-A-63197495.

Even when this technique is used in a washing machine of the kind referred to above noise can escape in a forward direction through the annular gap between the tub and the front piece. Hence, it is an object of the invention to find a solution which prevents noise from escaping through the gap mentioned or which, at least to a substantial extent, reduces the level of such noise.

The object indicated is achieved in a laundry washing machine which includes the characterizing features stated in claim 1. Preferred embodiments are given in the appending sub-claims.

The invention will now be described more in detail in connection with an embodiment and with reference to the accompanying drawings, in which:

Fig. 1 shows a front view of a laundry washing machine according to the invention;

Fig. 2 shows a section along the line I-I in fig. 1;

Fig. 3 shows a detail view of the area marked by a ring in Fig. 2 in a first modified embodiment;

Fig. 4 shows a detail view of the area marked by a ring in Fig. 2 in a second modified embodiment; and

Fig. 5 shows a detail view of the area disposed below the dashed line V-V in Fig. 2 in a third modified embodiment.

In Figs. 1 and 2 a laundry washing machine is shown which comprises a cabinet 10 having a front piece 11, a back piece 12, side walls 13, 14, a cover 15 and a base plate 16. In the usual way, the cabinet contains a tub, a laundry supporting drum rotatably disposed inside the tub and a drive motor for rotating the drum. The last-mentioned parts form an assembly 17 which, in a way not discussed in detail, is free-swingingly suspended in the cabinet by means of spring means and vibration damping means.

The washing machine is of the kind which comprises a door 18 directly closing an opening in the tub by which access is given to the interior of the drum and the laundry disposed there. In order for the assembly to be able to perform the movements required during operation of the machine an opening 19 is provided in the front piece and adjacent to the opening the distance between the front piece 11 and the assembly 17 has been selected such that also large swinging movements are permitted without the assembly contacting the cabinet. At rest, a common value of the distance between the front piece (11) and the assembly 17 is about 30 mm. Parts 20, 21, 22, 23 of the front piece have been bent into the opening 19, which is of rectangular shape, forming a frame. A rectangular metal plate 24 is fixed to front of the tub and has an opening for the door 18. In addition, the plate 24 is provided with edge portions 25, 26, 27, 28 which have been bent to form a corresponding frame arranged to cooperate with the frame disposed on the front piece for the forming of meander-shaped passages 29 interconnecting the interior of the cabinet and the ambient atmosphere. The passages are disposed above, below and at both sides of the opening 19. In principal, the passages are identical and, hence, it will be sufficient to describe one of them and the passage chosen is situated in the area marked by a ring in Fig. 2. Naturally, as an alternative the plate 24 with the edge portions 25, 26, 27, 28 can be made of plastics material.

For the damping of airborne noise, generated inside the cabinet of the washing machine, the walls of the

machine cabinet are covered with layers of sound damping material, for example mineral wool. By the cooperating frames 20, 21, 22, 23 and 25, 26, 27, 28, respectively, the passages formed around the opening 19 have been given the shape of a meander or a labyrinth and in this way damping takes place of the noise otherwise escaping directly to the ambient atmosphere. In order to further increase the sound damping effect, as appears in Figs. 3 and 4, suitably a sound absorbent 31 is fixed on the front piece 11 so as to completely fill the space between a frame forming wall 20, 21, 22, 23 and the associated side wall, such as the side wall 13 in Figs. 3 and 4. Like the layers 30 the sound absorbent 31 may consist of mineral wool.

In a modified embodiment according to Fig. 3 the bent edge portions of the plate 24 on the tub, such as edge portion 25a, may have a relatively limited extension and the wall portions forming the frame may consist of a flexible strip 32 made of plastics material or rubber and provided with an enlarged edge 32a having a slot-shaped recess 33 into which the edge portion 25a is arranged to be introduced.

In another modified embodiment according to Fig. 4 the edge portions, such as edge portion 20a bent from the front piece and forming the frame, may have a length which is reduced as compared to the embodiment of Figs. 1 and 2. The edge portions may be provided with a mainly perpendicularly bent end 20b arranged to be inserted in a slot-shaped recess 34 provided in an enlarged end portion 35a of a flexible strip 35 made of plastics material or rubber. The embodiments according to Figs. 3 and 4 permit that the gap 36 required in the meander-shaped passages around the opening 19 due to the movement of the assembly 17 can be reduced as the flexible strip can resiliently fold back upon a possible contact with adjacent machine parts on the assembly 17.

In a further modified embodiment, shown in Fig. 5, the number of wall portions 25c, 25d and 20c, 20d, respectively, on the frames forming the meander-shaped passages have been doubled, lengthening the passage and making it even more difficult for the noise to pass to the surrounding atmosphere. The number of bendings provided in the meander-shaped sound-trap has to be weighed against the drawback caused by the increased outer dimensions of the cabinet that might be needed.

Claims

1. Laundry washing machine comprising a cabinet (10) having side walls (13,14), top and bottom walls (15,16), a back piece (12) and a front piece (11), wherein in the front piece (11) an opening (19) is provided for a door (18) arranged to close an opening in a tub, said tub together with a drum, rotatably journaled in said tub, and a drive motor, provided for rotating the drum, forming an assembly (17) which is free-swingingly suspended in the cabinet (10) by means of spring means and vibration damping means such that at the front piece (11), between the cabinet (10) and the tub an annular gap (36) is formed which surrounds the door (18), sound damping means being provided for reducing the noise escaping from the machine and generated by the machine when operating, **characterized** in that the sound damping means comprise a sound trap of the labyrinth type (20,21,22,23; 25,26,27,28) provided in the annular gap (36) surrounding the door (18).
2. Washing machine according to claim 1, **characterized** in that the labyrinth sound trap (20,21,22,23; 25,26,27,28) comprises wall portions (25,20 etc.) which extend mainly parallelly and define a meander-shaped sound passage (29) extending from the interior of the machine, via the annular gap (36) and to the ambient atmosphere.
3. Washing machine according to claim 2, **characterized** in that the front piece (11) is provided with bent-in portions (20,21,22,23) which are disposed around the opening (19) in the front piece to form a first frame, mainly square in shape, another frame (25,26,27,28) being provided on the tub outside of and surrounding the first frame (20,21,22,23) to form the labyrinth sound trap.
4. Washing machine according to claim 2 or claim 3, **characterized** in that the space between the two parallel wall portions (25,20 etc.) amounts to at least 30 mm.
5. Washing machine according to any of claims 2-4, **characterized** in that the sound passage is a meander-shaped labyrinth sound trap formed by a plurality of parallelly disposed wall portions (25c,25d; 20c,20d etc.).
6. Washing machine according to any of the preceding claims, **characterized** in that the sound trap comprises a sound absorbent (31).

7. Washing machine according to claim 6, **characterized** in that the sound absorbent (31) comprises a layer of sound absorbing material fixed to the front piece (11) such that it extends from the frame (20,21,22,23) provided on the front piece (11) and surrounding the opening (19) to the corresponding adjacent wall (25 etc.) of the cabinet (10).
- 5 8. Washing machine according to any of claims 3-7, **characterized** in that the frame disposed on the tub is formed by bent edge portions (25a etc.) of relatively small length, a flexible strip (32) being secured to the respective edge portion (25a) forming a wall portion of the labyrinth sound trap.
- 10 9. Washing machine according to any of claims 3-8, **characterized** in that the front piece (11) is provided with bent-in edge portions (20a etc.) of relatively small length, a flexible strip (35) being secured to the respective edge portion (20a etc.) forming a wall portion of the labyrinth sound trap.
- 15 10. Washing machine according to claim 8 or claim 9, **characterized** in that the flexible strip (32;35) is provided with an enlarged end portion (32a;35a) having a slot-shaped recess (33;34) arranged to cooperate with the bent edge portion (25a;20b).

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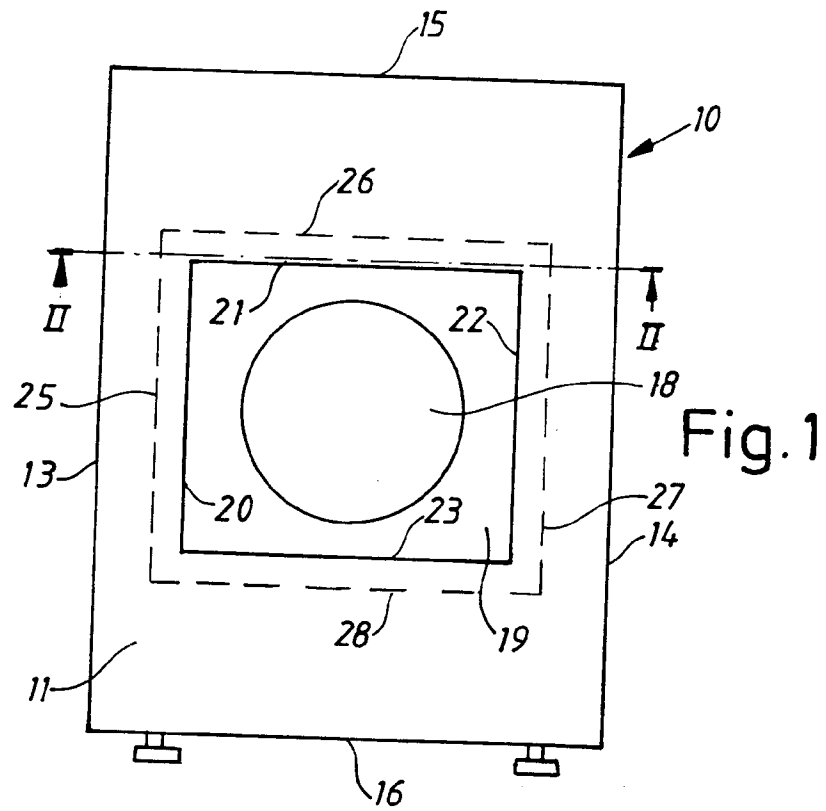


Fig. 1

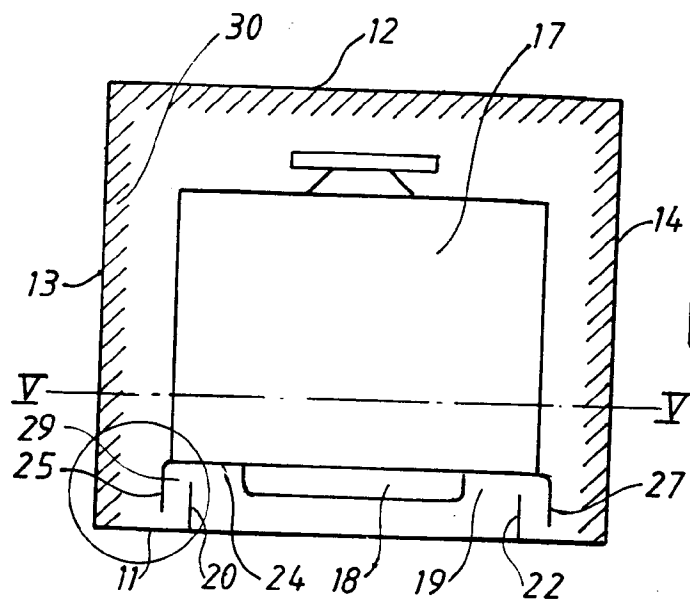


Fig. 2

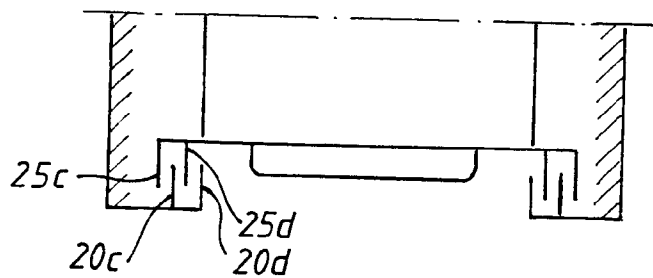


Fig. 5

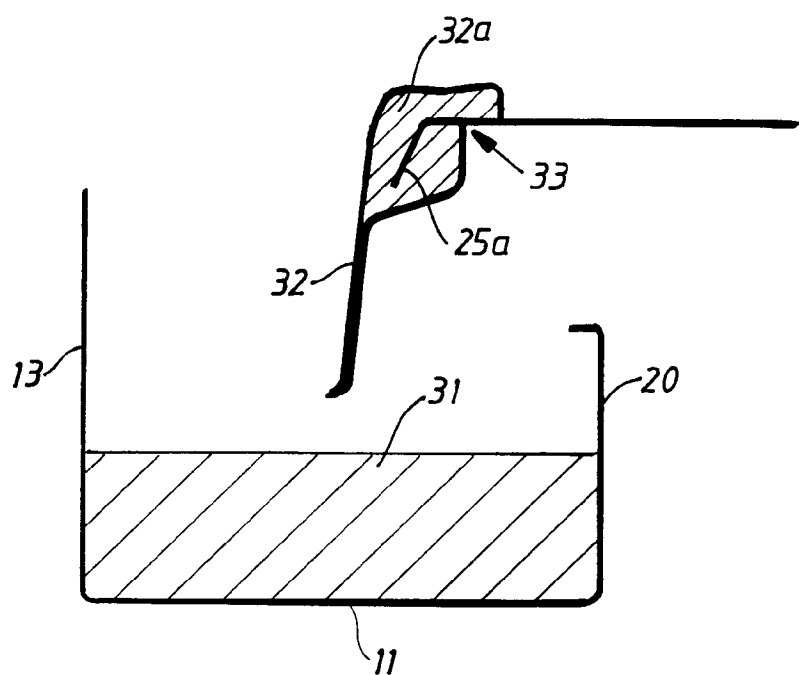


Fig. 3

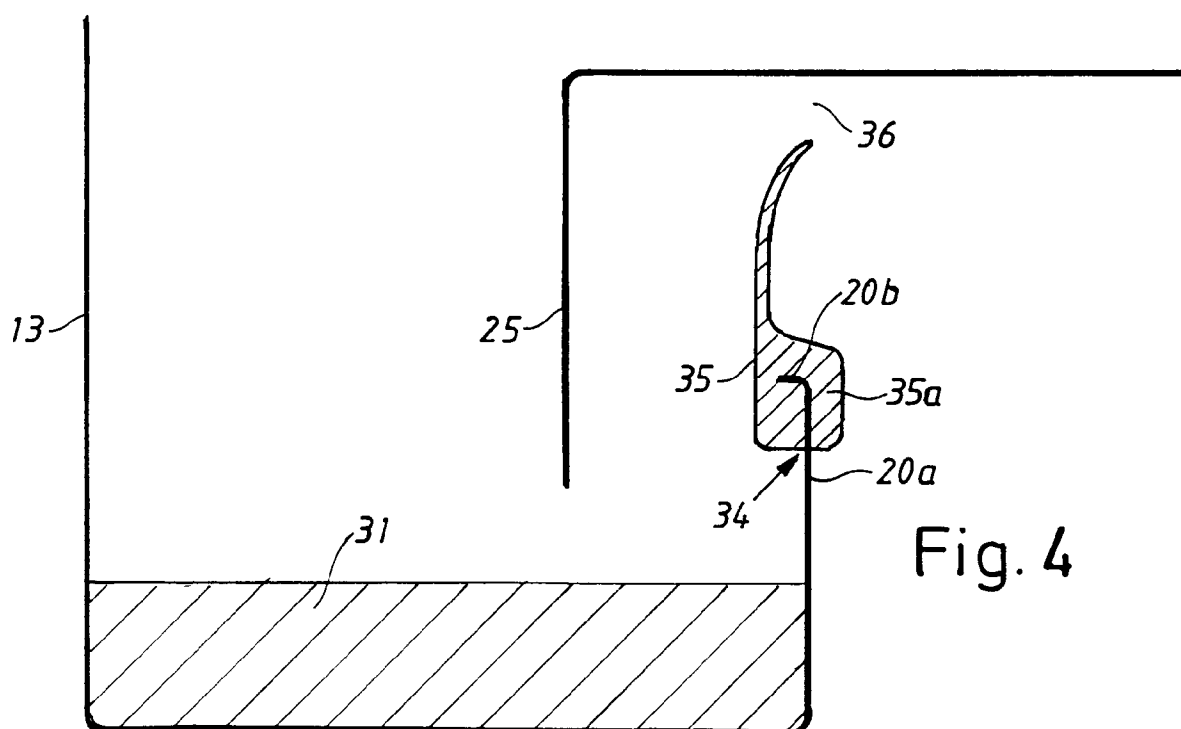


Fig. 4



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 85 0057

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 106 (C-694) & JP-A-01 310 696 (MATSUSCHITA ELECTRIC IND. CO. LTD.) 14 December 1989 * abstract * * figures 7,9, detail 16 * ---	1	D06F37/02 D06F37/26 D06F39/12
A	PATENT ABSTRACTS OF JAPAN vol. 15, no. 282 (C-850) (4810) & JP-A-03 097 498 (MATSUSHITA ELECTRIC IND. CO. LTD.) 23 April 1991 * abstract * * figure 1 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			D06F
The present search report has been drawn up for all claims			
Place of search STOCKHOLM		Date of completion of the search 14 July 1994	Examiner PRESTO HANS
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