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(54) **Laundry washing machine**

(57) A laundry washing machine (1) having a safety lock device (7) being fixed to the first wall (3) aligned with the first opening (9), and having a latch element (11) between an unlock position in which said latch element (11) does not engage the catch element (8), and a lock position in which said latch element (11) engages the catch element (8) fitted into the first through opening (9); the manual release of the door (4) from the machine casing (2) being subordinated to the movement of said latch element (11) from the lock position back to the unlock position and the safety lock device (7) also having an

axially movable lock pin (15), which is movable between an extracted position in which the lock pin (15) engages the body of the latch element (11) to prevent the latch element (11) from returning into its unlock position, and a withdrawn position in which the lock pin (15) does not engage the body of the latch element (11) and allows free movement of the latch element (11); the first wall (3) of the casing having a safety through opening (17) by which to insert an emergency-opening tool (18) inside the machine casing (2) to force the lock pin (15) from the extracted position to the withdrawn position.

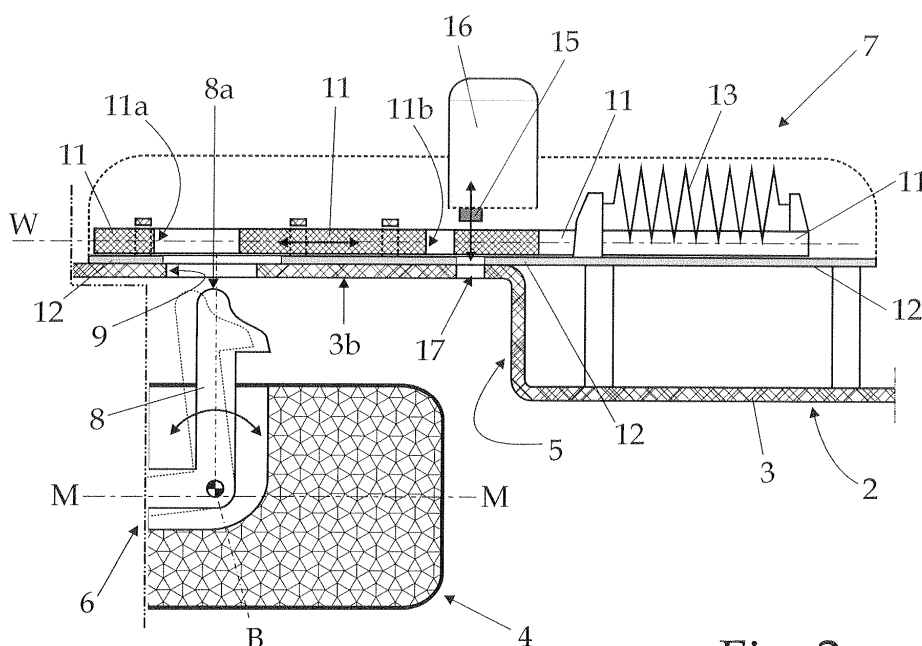


Fig. 2

Description

[0001] The present invention relates to a laundry washing machine.

[0002] More specifically, the present invention relates to a front-loading home laundry washing machine, to which the following description refers purely by way of example.

[0003] As is known, front-loading home laundry washing machines generally comprise a substantially parallelepiped-shaped outer box casing resting on the floor; a substantially bell-shaped washing tub which is suspended in floating manner inside the casing, directly facing a laundry loading and unloading opening formed in the front wall of the casing; a door hinged to the front wall of the casing to rotate to and from a closing position in which the door rests completely against the casing to close the opening in the front wall of the casing and watertight seal the washing tub; a revolving drum for housing the laundry to be washed, and which is housed inside the washing tub to rotate about its longitudinal axis; and, finally, an electric motor assembly for rotating the revolving drum about its longitudinal axis inside the washing tub.

[0004] In addition to the above, modern front-loading home laundry washing machines also comprise a manually-operated door lock device designed to selectively lock the door to the machine casing when the door is in the closing position, and an electrically-operated safety lock device designed to selectively prevent the manually-operated door lock device from releasing the door from the machine casing when the revolving drum is rotating and/or the washing tub is filled with water.

[0005] More specifically, in modern front-loading home laundry washing machines, the manually-operated door lock device consists of a hooked catch element or lever which projects from the outer frame of the door towards the front face of the machine casing, and is hinged to the door frame so as to enter into a corresponding through opening formed in the front wall of the machine casing, next to the laundry loading and unloading opening, and there firmly engage the machine casing; a torsion spring designed to keep the hooked catch element in a position substantially perpendicular to the plane of the door frame, so that the distal end of the catch element rests on the edge of the machine casing; and of a door handle connected mechanically to the hooked catch element to allow the user to tilt the hooked catch element manually to release the distal end of the catch element from the machine casing.

[0006] The electrically-operated safety lock device is fixed to the front wall of the machine casing, inside the casing, is substantially aligned with the through opening in the front wall, and comprises a plate-like latch element fitted in axially sliding manner to a supporting frame fixed rigidly to the machine casing. The latch element extends and is movable on a plane substantially tangent to the portion of the front wall of the machine casing where the

through opening is formed, and has a second through opening sized to be engaged by the distal end of the hooked catch element.

[0007] The electrically-operated safety lock device also comprises a spring member designed to keep the latch element in an unlock position in which the through opening in the latch element is substantially aligned with the through opening in the front wall of the machine casing; and a first electrically-operated linear actuator which, on command of the washing machine electronic central control unit, temporarily counteracts the elastic force of the spring member, and moves the latch element, in its plane, from the unlock position to a lock position, in which the latch element engages the hooked catch element like a guillotine to prevent manual tilt of the hooked catch element.

[0008] In modern front-loading home laundry washing machines, the electrically-operated safety lock device also comprises a safety lock pin extending perpendicularly to the latch element lying plane; and a second electrically-operated linear actuator (e.g. a PTC bimetallic thermal switch) for moving the safety lock pin axially on command of the washing machine electronic central control unit.

[0009] More specifically, the latch element body has a through hole which is aligned with the safety lock pin when the latch element is in the lock position preventing manual tilt of the hooked catch element, and the second actuator moves the safety lock pin axially between an extracted position in which the safety lock pin engages the through hole in the latch element body, thus preventing the latch element from returning to the unlock position, and a withdrawn position in which the safety lock pin does not engage the latch element body, thus allowing free movement of the latch.

[0010] Obviously, the second actuator moves the safety lock pin into the extracted position when the laundry washing machine starts the washing cycle, thus locking the latch element in the position preventing manual tilt of the hooked catch element, and moves the safety lock pin back into the withdrawn position with a given time delay after the machine completes the washing cycle, or the washing cycle is stopped in advance by the user.

[0011] The major drawback of the electrically-operated safety lock device described above lies in the fact that, in the event of the safety lock pin accidentally remaining in the extracted position because of electric power failure or mechanical jamming, there is no way of opening the door other than forcing both the manually-operated door lock device and the electrically-operated safety lock device, thus incurring repairing costs.

[0012] It is the aim of the present invention to provide a laundry washing machine designed to eliminate the aforementioned drawbacks posed by the electrically-operated safety lock device.

[0013] According to the present invention, there is provided a laundry washing machine as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

[0014] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a front view of a front-loading laundry washing machine in accordance with the teachings of the present invention;

Figures 2 and 3 show a section view, with parts removed for clarity, of the door closing system of the Figure 1 laundry washing machine in two different operating configurations;

Figure 4 shows a section view, with parts removed for clarity, of a first variation of the Figure 2 and 3 door closing system;

Figure 5 shows a section view, with parts removed for clarity, of a second variation of the Figure 2 and 3 door closing system.

[0015] With reference to Figure 1, number 1 indicates as a whole a laundry washing machine comprising a preferably, though not necessarily, parallelepiped-shaped outer box casing 2 resting on the floor; a substantially bell-shaped washing tub (non shown) suspended in floating manner inside the casing, directly facing a laundry loading and unloading opening 3a formed in a main wall 3 of casing 2; a revolving drum (non shown) for housing the laundry to be washed, and which is housed inside the washing tub to rotate about its longitudinal axis; and a door 4 hinged to main wall 3 of the casing to rotate to and from a closing position in which door 4 rests on the outer face of wall 3 to close opening 3a and watertight seal the washing tub of the washing machine.

[0016] More specifically, with reference to Figures 2 and 3, opening 3a is formed in the flat bottom of a substantially sink-shaped seat 3b formed in the outer face of wall 3, and door 4 is shaped to fit inside seat 3b in the closing position, and to define within seat 3b an annular recess 5 of given width.

[0017] More specifically, in the example shown, laundry washing machine 1 is a front-loading washing machine, so opening 3a is formed in the front face of casing 2, and door 4 is hinged in known manner to front wall 3 of the casing to rotate about a preferably, though not necessarily, vertical axis A to and from a closing position (Figures 2 and 3) in which door 4 rests on the bottom of seat 3b to close opening 3a and watertight seal the washing tub of the washing machine.

[0018] With reference to Figures 1, 2 and 3, washing machine 1 also comprises a manually-operated door lock device 6 designed to selectively lock door 4 to casing 2 when door 4 rests on the bottom of seat 3b in the closing position; and an electrically-operated safety lock device 7 designed to selectively prevent door lock device 6 from releasing door 4 from casing 2, e.g. when the revolving drum rotates and/or the washing tub is filled with water.

[0019] Door lock device 6 comprises a hooked catch element or lever 8 which projects from the outer frame of door 4 towards front wall 3 of casing 2, and enters into

a corresponding through opening 9 formed in front wall 3 of casing 2, next to opening 3a. More specifically, hooked catch element 8 is hinged to the frame of door 4 to swing about a transverse axis B preferably, though not necessarily, parallel to vertical axis A, so the hooked distal end 8a of catch element 8 goes beyond front wall 3 through opening 9, and rests onto the inner face of wall 3 to secure door 4 firmly to casing 2.

[0020] In addition to the above, door lock device 6 also comprises a spring element (non shown) designed to keep catch element 8 in a rest position, wherein catch element 8 is substantially perpendicular to plane M of the door frame - i.e. locally perpendicular to the bottom surface of seat 3b - to enable the hooked distal end 8a of catch element 8 to engage the edge of casing 2 defining opening 9; and a door handle 10 which is hinged to the door frame, on the opposite side of plane M with respect to catch element 8, and is mechanically connected to catch element 8 to allow the user to tilt catch element 8 manually to release the hooked distal end 8a of catch element 8 from the edge of front wall 3, i.e. from the edge of casing 2.

[0021] With reference to Figures 2 and 3, safety lock device 7 is fixed to the inner face of front wall 3, i.e. inside machine casing 2, is substantially aligned with through opening 9 in front wall 3, and comprises a preferably, though not necessarily, plate-like latch element 11 fitted in axially sliding manner to a supporting frame 12 rigidly fixed to front wall 3 of machine casing 2. Latch element 11 extends and is movable on a plane W substantially tangent to the flat bottom of seat 3b in front wall 3, and has a preferably, though not necessarily, rectangular through opening 11a sized to be engaged by the distal end 8a of catch element 8.

[0022] Safety lock device 7 also comprises a spring member 13 which is interposed between frame 12 and latch element 11 and is designed to keep latch element 11 in an unlock position (Figure 2) in which through opening 11a is substantially aligned with through opening 9 in front wall 3, thus allowing free entrance of the hooked distal end 8a into opening 9 and free tilting of catch element 8.

[0023] More specifically, with reference to Figure 2, through opening 11a of latch element 11 is dimensioned to partially cover, when latch element 11 rests in the unlock position, the through opening 9 in front wall 3, so that the distal end 8a of catch element 8, to cross opening 9, is obliged to move latch element 11 sideways on supporting frame 12 overcoming the elastic force of spring member 13.

[0024] In addition to the above, spring member 13 is designed to be less rigid than the spring element of door lock device 6, so that the spring element of door lock device 6 can counteract the elastic force of spring member 13 when the hooked distal end 8a of catch element 8 crosses through opening 9, and keep catch element 8 in the rest position to enable the hooked distal end 8a of catch element 8 to engage the edge of casing 2.

[0025] With reference to Figure 3, when engaged to the edge of casing 2 defining opening 9, the hooked distal end 8a of catch element 8 also moves latch element 11 sideways on plane W from its unlock position to a lock position in which latch element 11 engages catch element 8 in guillotine-fashion, and the release of the hooked distal end 8a of catch element 8 from the edge of front wall 3 is subordinated to the movement of latch element 11 from the lock position (Figure 3) back to the unlock position (Figure 2).

[0026] With reference to Figures 2 and 3, safety lock device 7 also comprises a lock pin 15 extending substantially perpendicular to plane W of latch element 11; and an electrically-operated linear actuator 16 for moving lock pin 15 axially on command of the washing machine central control unit or on direct command of the user.

[0027] More specifically, the body of latch element 11 has a through lateral notch or a through hole 11b which is aligned with lock pin 15 (Figure 3) when latch element 11 is in the lock position and prevents the manually-operated tilting of hooked catch element 8; and linear actuator 16 moves lock pin 15 axially between an extracted position (Figure 3) in which lock pin 15 engages the lateral notch or hole 11b in the body of latch element 11, thus preventing latch element 11 from returning to the unlock position, and a withdrawn position (Figure 2) in which lock pin 15 does not engage the body of latch element 11, thus allowing free movement of the latch element.

[0028] Linear actuator 16 is a commonly known washing machine part and therefore not described in detail.

[0029] Unlike known laundry washing machines, front wall 3 of machine casing 2 has, on the bottom of annular recess 5, an additional through hole or slot 17 which is aligned with lock pin 15 of safety lock device 7, and directly communicates with the through hole 11b in latch element 11 (Figure 3) when latch element 11 is in the lock position for preventing manual tilt of catch element 8.

[0030] In other words, through hole 17 in front wall 3 is aligned with lock pin 15, on the opposite side of latch element 11 to lock pin 15.

[0031] Clearly, in a different embodiment, slot 17 may be realized on front wall 3 of machine casing 2, outside of sink-shaped seat 3b, i.e. out of annular recess 5.

[0032] With reference to Figure 3, preferably, though not necessarily, washing machine 1 also comprises a separate emergency-opening tool 18 (namely, an appropriately sized nail or screwdriver), the tip of which is sized to fit easily through hole 17 into casing 2, to engage the end of lock pin 15 and force the axial displacement of lock pin 15 from the extracted position back into the withdrawn position, and so restore latch element 11 to the unlock position. Obviously emergency-opening tool 18 may be replaced by a proper-sized household tool.

[0033] General operation of laundry washing machine 1 is clearly inferable from the above description, with no further explanation required.

[0034] The advantages of the washing machine structure as described above are obvious: through hole 17 in

front wall 3 allows manual displacement of lock pin 15 from the extracted position to the withdrawn position, thus eliminating repair expenses in the event of lock pin 15 remaining in the extracted position due to electric power failure or mechanical jamming.

[0035] Clearly, changes may be made to laundry washing machine 1 as described herein without, however, departing from the scope of the present invention.

[0036] For example, instead of engaging the edge of through opening 9 in front wall 3, the hooked distal end 8a of catch element 8 may engage either the supporting frame 12 or directly the latch element 11 of safety lock device 7 for selectively locking door 4 to machine casing 2.

[0037] Moreover, in a further non-shown variation, laundry loading and unloading opening 3a on front wall 3 may be shaped so as to incorporate through opening 9. In which case, catch element 8 enters into opening 3a, near to the opening edge, and safety lock device 7 is fixed to front wall 3 so that latch element 11 partially protrudes directly into the perimeter of opening 3a for being engaged by the distal end 8a of catch element 8. The distal end 8a of catch element 8 may hook on the edge of casing 2 defining opening 9, or on supporting frame 12 of safety lock device 7, or directly on latch element 11 of safety lock device 7.

[0038] With reference to Figure 4, in a further variation of safety lock device 7, lock pin 15 may have a projecting appendix 15a extending substantially parallel to plane W, so that the distal end of appendix 15a projects from the perimeter of latch element 11. In which case, through hole 17 in front wall 3 is aligned with the distal end of appendix 15a, and the tip of emergency-opening tool 18 rests directly on the distal end of appendix 15a to force lock pin 15 axially from the extracted position back into the withdrawn position. In other words, emergency-opening tool 18 does not penetrate the body of latch element 11 to reach lock pin 15.

[0039] With reference to Figure 5, in a still further variation of safety lock device 7, through hole 17 may be misaligned with lateral notch or through hole 11b, and safety lock device 7 may comprise a rocker arm 20 which extends substantially parallel to latch plane W, is hinged to supporting frame 12 to swing about a rotation axis locally parallel to plane W, and has a first end aligned with the end of lock pin 15, and a second end aligned with through hole 17 in front wall 3. In which case, emergency-opening tool 18 acts on the second end of rocker arm 20, which in turn brings its first end to rest on the end of lock pin 15, and then pushes lock pin 15 back into the withdrawn position.

[0040] To reach the second end of rocker arm 20, emergency-opening tool 18 may or may not penetrate the body of latch element 11, depending on the shape and position of rocker arm 20 with respect to latch element 11.

[0041] Finally, in a different non-shown embodiment, laundry washing machine 1 may be a top-loading wash-

ing machine. In which case, opening 3a would be located on the upper face of casing 2; door 4 would be hinged in known manner to the top wall of casing 3 for rotating about an horizontal axis; and safety lock device 7 would be fixed to the inner face of the top wall of casing 2, i.e. inside the machine casing 2.

Claims

1. A laundry washing machine (1) comprising an outer box casing (2) having a first wall (3) provided with a laundry loading and unloading opening (3a), and a door (4) hinged to said first wall (3) to rotate to and from a closing position in which the door (4) rests on the first wall (3) to close the laundry loading and unloading opening (3a); the laundry washing machine (1) also comprising a manually-operated door lock device (6) designed to selectively lock the door (4) to the machine casing (2) when said door (4) is in the closing position, and an electrically-operated safety lock device (7) designed to selectively prevent the manually-operated door lock device (6) from releasing the door (4) from the machine casing (2); the door lock device (6) comprising a catch element (8) which projects from the door (4) towards the first wall (3); the safety lock device (7) being fixed to said first wall (3) and comprising a latch element (11) movable between an unlock position in which said latch element (11) does not engage the catch element (8) and permits manual release of the door (4) from the machine casing (2), and a lock position in which said latch element (11) engages the catch element (8) projecting from the door (4) in the closing position, and does not permit manual release of the door (4) from the machine casing (2); the manual release of the door (4) from the machine casing (2) being subordinated to the movement of said latch element (11) from the lock position back to the unlock position and the safety lock device (7) also comprising a movable lock element (15) which is movable between a first position in which said lock element (15) engages the body of said latch element (11) to prevent said latch element (11) from returning to the unlock position, and a second position in which said lock element (15) does not engage the body of the latch element (11) and allows free movement of said latch element (11); said laundry washing machine (1) being **characterized in that** said first wall (3) has a safety through opening (17) by which to insert an emergency-opening tool (18) inside the machine casing (2) to force the movement of said lock element (15) from the first position to the second position.
2. A laundry washing machine as claimed in Claim 1, wherein said safety lock device (7) comprises a spring member (13) designed to keep the latch ele-

ment (11) in the unlock position.

3. A laundry washing machine as claimed in Claim 2, wherein the catch element (8) moves the latch element (11) from the unlock position to the lock position while engaging said latch element (11).
4. A laundry washing machine as claimed in any one of the foregoing Claims, wherein said latch element (11) is movable in a plane (W) locally substantially tangent to said first wall (3).
5. A laundry washing machine as claimed in Claim 4, wherein said latch element (11) is a plate-like latch having a through opening (11a) sized to be engaged by the distal end (8a) of the catch element (8).
6. A laundry washing machine as claimed in any one of the foregoing Claims, wherein said movable lock element (15) is an axially movable lock pin (15) which is movable between an extracted position in which said lock pin (15) engages the body of said latch element (11) to prevent said latch element (11) from returning to the unlock position, and a withdrawn position in which said lock pin (15) does not engage the body of the latch element (11) and allows free movement of said latch element (11).
7. A laundry washing machine as claimed in Claim 6, wherein the safety through opening (17) in the first wall (3) is substantially aligned with said lock pin (15), on the opposite side of said latch element (11) to the lock pin (15), so that the tip of said emergency-opening tool (18) rests on the lock pin (15) and forces the lock pin (15) axially from the extracted position back into the withdrawn position.
8. A laundry washing machine as claimed in Claim 7, wherein said lock pin (15) has a projecting appendix (15a), and the safety through opening (17) is aligned with the distal end of said appendix (15a), so that the tip of said emergency-opening tool (18) rests on said projecting appendix (15a) to force the lock pin (15) axially from the extracted position back into the withdrawn position.
9. A laundry washing machine as claimed in Claim 8, wherein the distal end of said appendix (15a) projects from the perimeter of the latch element (11).
10. A laundry washing machine as claimed in any one of Claims 6 to 9, wherein said safety lock device (7) comprises lever means (20) for axially moving said lock pin (15); the safety through opening (17) in the first wall (3) being aligned with said lever means (20), and the tip of said emergency-opening tool (18) acting on said lever means (15a, 20) to force the lock pin (15) axially from the extracted position back into

the withdrawn position.

11. A laundry washing machine as claimed in any one of the foregoing Claims, wherein said laundry loading and unloading opening (3a) is formed on the bottom of a seat (3b) formed in the outer face of said first wall (3); the door (4) being designed to fit inside said seat (3b) when in the closing position, and to define within said seat (3b) an annular recess (5); said safety through opening (17) being formed in said annular recess (5). 5 10

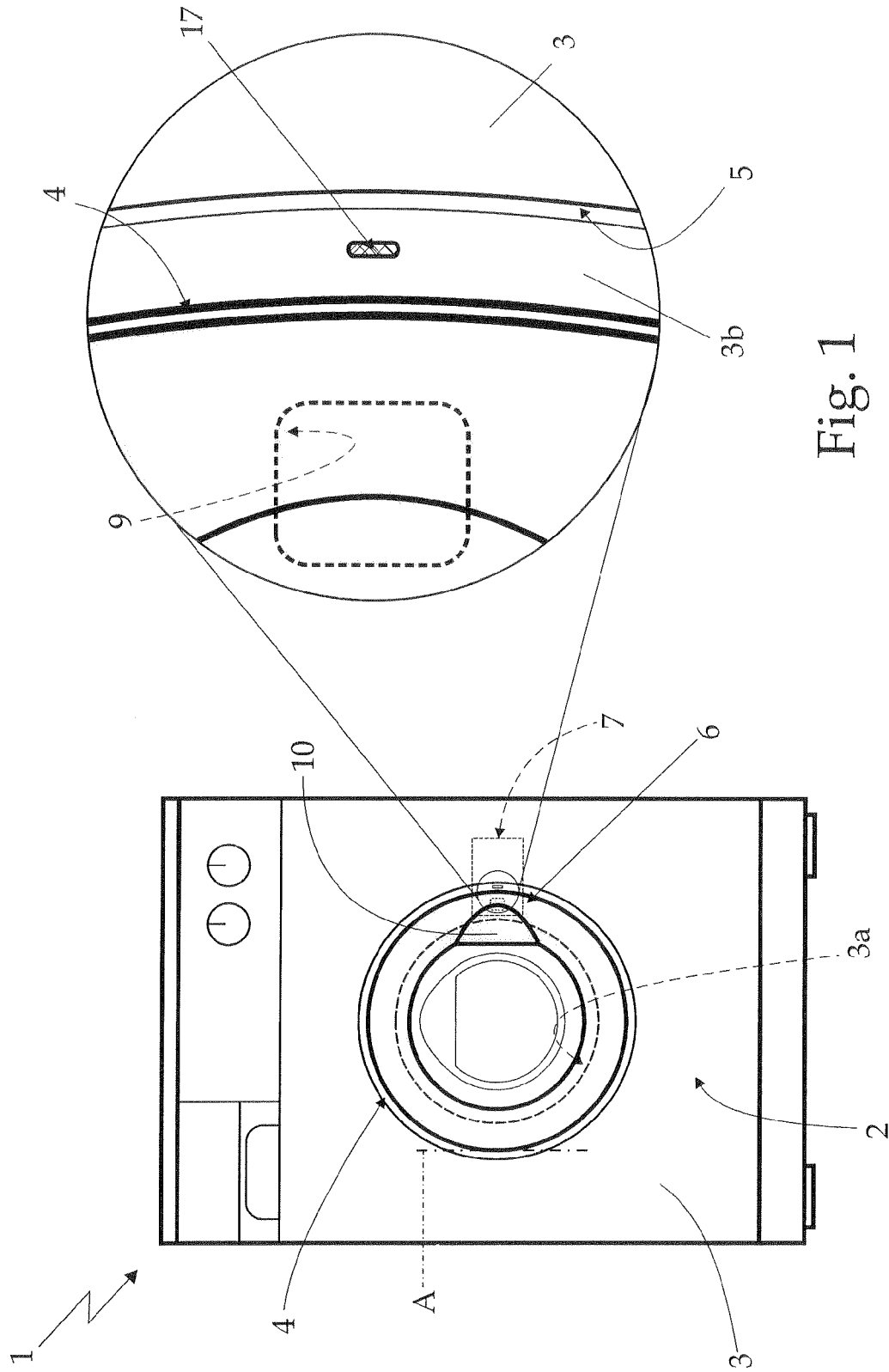
12. A laundry washing machine as claimed in any one of the foregoing Claims, wherein said door lock device (6) comprises a catch element (8) which is provided with a hooked distal end (8a) designed to hook onto the edge of the machine casing (2, 12) or of the latch element (11). 15

13. A laundry washing machine as claimed in Claim 12, wherein the catch element (8) is hinged to the door frame to swing about a transverse rotation axis (B), and the door lock device (6) also comprises a spring element designed to keep the catch element (8) in a rest position in which the hooked distal end (8a) of the catch element (8) is able to engage said latch element (11); and a door handle (10) which is mechanically connected to said catch element (8) to allow the user to manually tilt the catch element (8) to release the hooked distal end (8a) of the catch element (8) from the machine casing (2, 12) or the latch element (11). 20 25 30

14. A laundry washing machine as claimed in any one of the foregoing Claims, wherein said first wall (3) is provided with a second through opening (9) and the catch element (8) projects from the door (4) towards the first wall (3) to enter into said first through opening (9); the safety lock device (7) being fixed to the first wall (3) substantially aligned with said second through opening (9); the catch element (8) moving the latch element (11) from the unlock position to the lock position while entering into said second through opening (9). 35 40 45

15. A laundry washing machine as claimed in Claims 5 and 14, wherein the through opening (11a) of said latch element (11) is substantially aligned with the second through opening (9) in the first wall (3) when the latch element (11) is in the unlock position. 50

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File 1

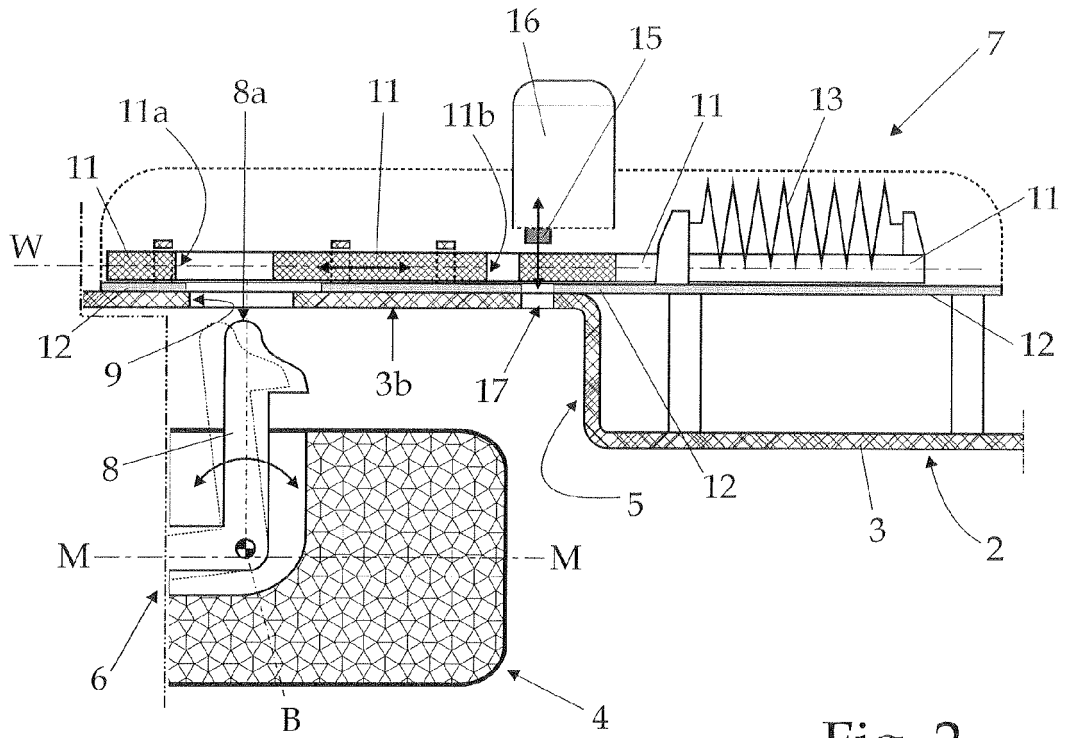


Fig. 2

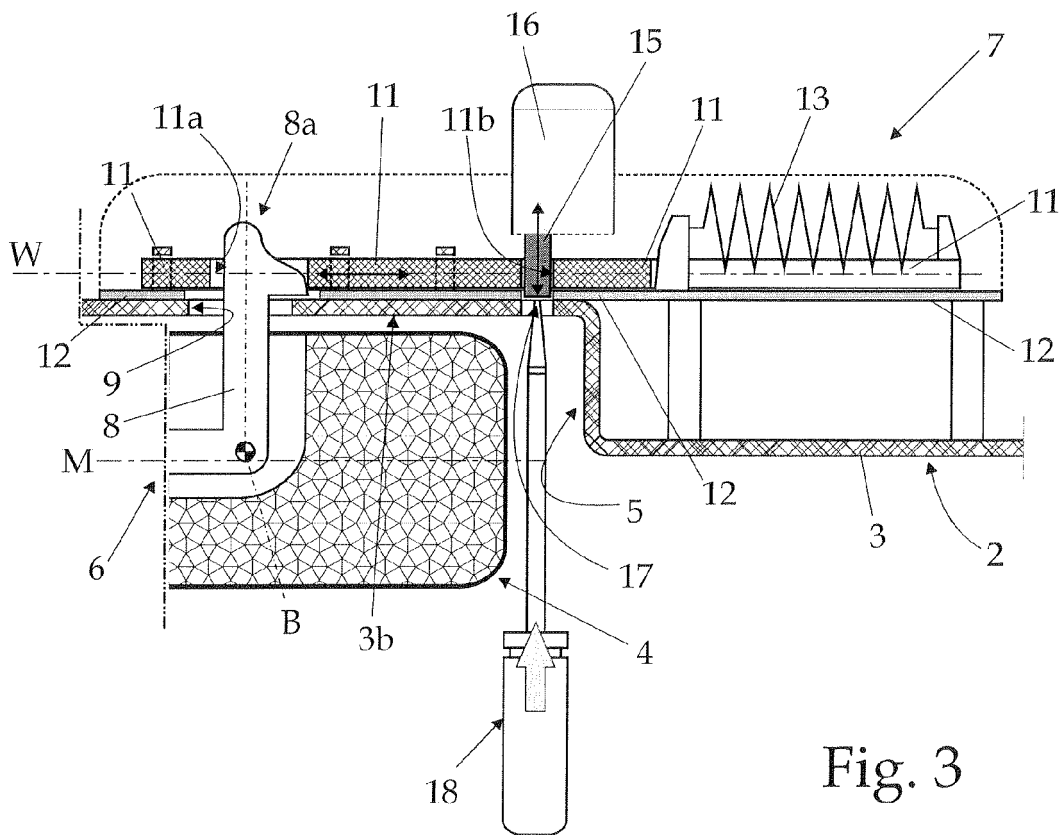


Fig. 3

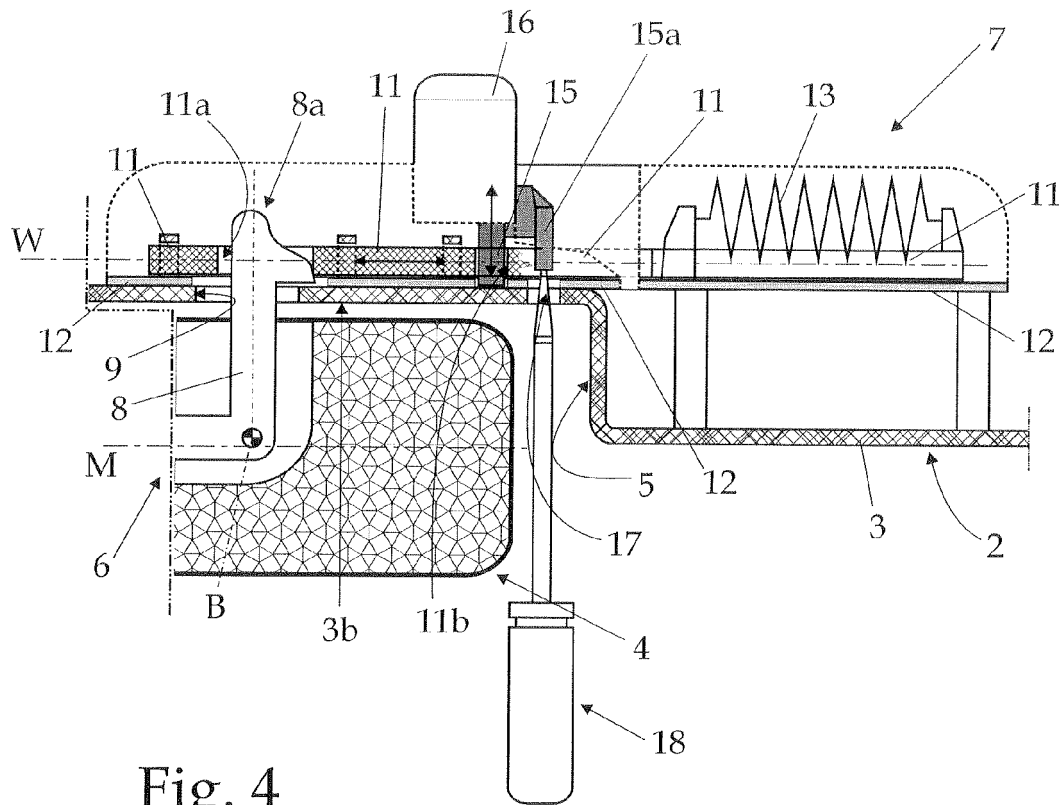


Fig. 4

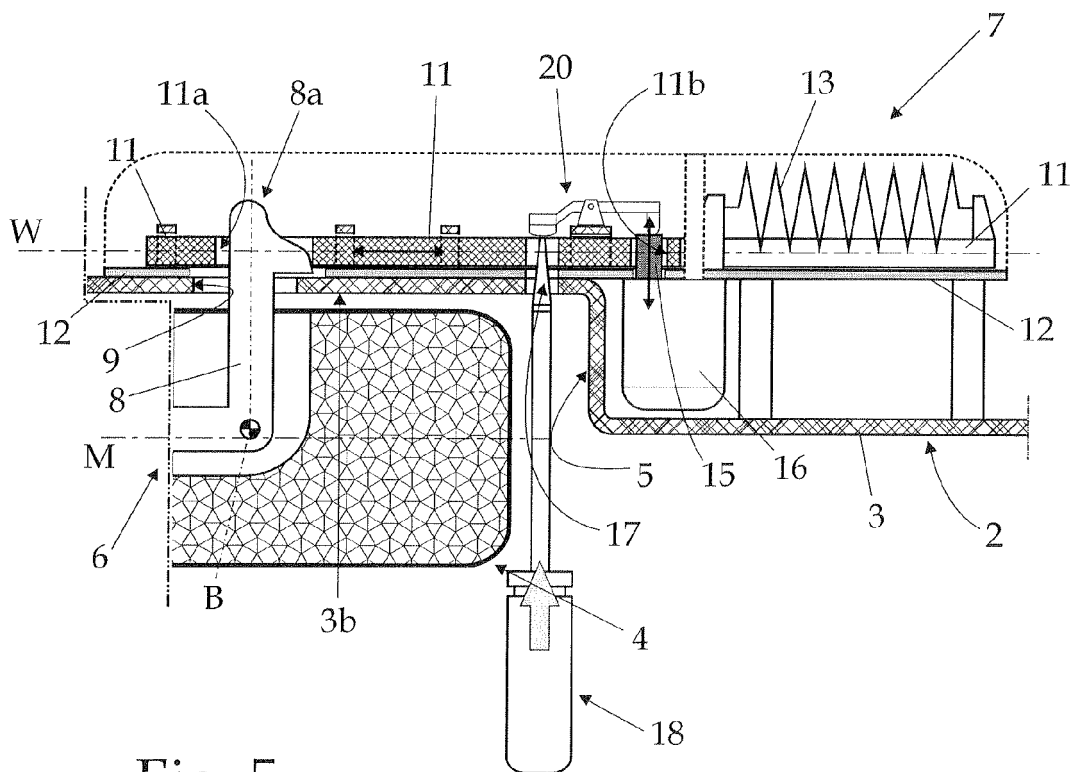


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 08 16 3007

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	DE 88 06 999 U1 (ELLENBERGER & POENSGEN GMBH, 8503 ALTDORF, DE) 28 July 1988 (1988-07-28) * claim 1; figure 1 * -----	1-15	INV. D06F39/14 D06F37/42
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 February 2009	Examiner Dupuis, Jean-Luc
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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