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(54) **AUTOMATIC WASHING MACHINE WITH A DOOR OPENING AT AN ANGLE**

(57) The patent application relates to an automatic washing machine with a door opening at an angle, for household and community use, the door (19) of which, when opened, swings out at an angle from the machine frame (1) of the washing machine around a horizontal shaft towards the user, thereby the loading opening of the drum (6) becomes easily accessible. The essence of the solution according to the invention is that the tub (5) containing the drum (6) is connected to a tub frame (3), the tub frame (3) is connected to the lower part of the machine frame (1) by a shaft, the door (19) of the washing machine is above the shaft connection, fixed to the outer side of the tub frame (3), thus when the door (19) is opened, the door (19), the tub frame (3) and the drum (6) swing out together from the machine frame (1). The operation of the washing machine is controlled by an electronic panel (12).

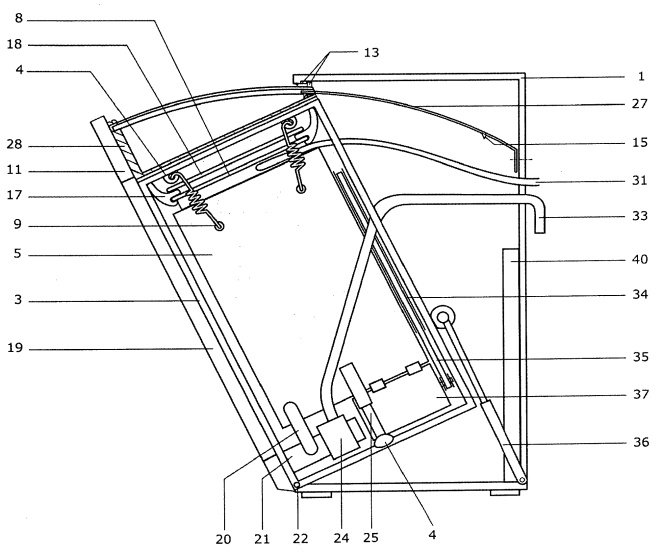

Figure 2

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Description

[0001] The patent application relates to an automatic washing machine with a door opening at an angle, for household and community use, the door of which, when opened, swings out at an angle from the machine frame of the washing machine around a horizontal shaft towards the user, thereby the loading opening of the drum becomes easily accessible.

[0002] In the past decades, with the development of automatic washing machines, the washing of laundry has become easier for users. Many washing machines are available commercially, they can be divided into two main types in terms of the loading of the laundry into the drum: front loading and top loading washing machines. Front loading washing machines require a lot of space for opening the door, furthermore the loading and unloading of the laundry involves bending on the part of the user. Top loading washing machines do not require extra space for opening the door in addition to the floorspace they occupy, however, this type of washing machine cannot be built in under e.g. a kitchen counter.

[0003] Solutions to this problem have already been provided, for example, European Patent No. EP1365056 relates to a front-loading clothes washing and/or drying machine comprising a supporting and containing structure with a front wall containing a loading aperture covered by a door. The door is connected to the supporting structure by at least one pivoting arm positioned next to one side of the door and connected, by a first end, rotatably to the door and, by a second end, rotatably to the supporting structure. The pivoting arm brings about the movement of the door between a closed position and an open position. When the pivoting arm moves the door to an open position, the loading aperture is completely open.

[0004] A disadvantage of this solution is that the loading of the laundry into the drum and the unloading of the washed laundry from the drum is just as cumbersome as in the case of traditionally opening front loading washing machines.

[0005] Patent application No. US20150121970 relates to a drum type washing machine including a housing, an internal housing in the housing, and a withdrawable drum in the internal housing making it more comfortable for the user to load laundry into or unload laundry from the drum. This solution requires an oversized counterweight, and laundry is loaded from the top, similarly to top loading washing machines.

[0006] An object of the invention is to provide an automatic washing machine that requires little space even with its door open, and allows the customization of operation and appearance as much as possible, as well as comfortable use. The loading or unloading of laundry into or from the drum puts little physical load on the user, as there is no need to bend down so low as in the case of the known front loading washing machines.

[0007] Another object of the invention is to allow the building in of the washing machine into a specific space, e.g. into a row of kitchen furniture or under a kitchen counter. If the colour of the original door does not suit the user, it can be easily replaced with a door of appropriate colour or quality matching that of the kitchen or bathroom furniture.

[0008] Another object of the invention is to develop washing machine operating software that, in addition to the known washing programme settings (loading weight, temperature, washing, pre-washing, rinsing, spinning), allows the customization of the use of the washing machine and the recognition of clothes or washing nets loaded into the drum, equipped with a unique identifier, a short-range passive RFID (Radio Frequency IDentification) label, and the setting and performance of a specific washing programme corresponding to the label.

[0009] In order to achieve the above objects, the door and with it the drum should swing out at an angle from the housing of the washing machine towards the user, making the loading opening of the drum and the detergent dispenser easily accessible to the user. This is solved by connecting a frame, a tub frame to the machine frame of the washing machine by a shaft, connecting a tub containing a drum to the inner part of the tub frame, and fixing a door to the outer part of the tub frame, by fixing the door to that side of the tub frame where the frame of the washing machine and the tub frame are connected by a shaft. Furthermore, the water space of the washing machine should be properly sealed.

[0010] By opening the door, the door, the tub frame, the tub, and the drum in the tub swing out from the frame of the washing machine together, forming a unit. The door fixed to the tub frame and the washing unit (drum, tub, motor, drive belt, pulley) mounted within the tub frame swing out together towards the user in such a way that the loading opening of the drum faces the user at an angle of about 25 degrees compared to the vertical plane of the machine frame. This allows the most comfortable loading and unloading of the laundry possible (without bending), and requires the least space possible even with the door open.

[0011] In order to achieve the objects set out above, in addition to the structural design of the washing machine, software is also required to control the operation of the washing machine. Thus the invention relates to an automatic washing machine, the supporting structure of which is a machine frame, on which the outer cover of the housing is mounted: two side panels, a top panel, and a door, as well as a control front panel above the door, forming a unit with the door. A tub containing a drum is in a separate frame, a tub frame. The lower part of the tub frame towards the door is connected to the lower part of the machine frame by a horizontal shaft or shafts. The tub is located in the tub frame, connected to the tub frame by suspension springs and shock absorbers. The drum is in the tub, connected to a drum shaft. A drive motor with a drive belt and a pulley, water inlet valves, a washing water drain pipe and a washing water

pump, a debris filter and a heater, that is the usual parts of a washing machine, are mounted within the tub frame. The tub edge is surrounded by a wide sealing skirt ensuring the watertight sealing of the wobbling tub during operation. Above the tub edge there is a loading opening decor frame, covering the sealing skirt. The water space of the washing machine is covered by a closing panel located above the tub, which ensures that no water leaves the tub or the water space during washing.

[0012] The door is held in the open position by electromagnetic limit stops. In the solution according to the invention one electromagnetic limit stop is located on the upper, inner part of the machine frame, and the other electromagnetic limit stop on the upper part of either the water space closing element or the tub frame.

[0013] A detergent and softener dispenser is mounted in the plane of the tub edge. Water is let in, and the detergent and softener are washed into the washing water from the detergent and softener dispenser by means of the water inlet valves located on the upper part of the tub. Washing water or rinsing water is drained by a pump through a washing water outlet pipe connected to the bottom of the tub. A heater for heating the water, and temperature and water level sensors are installed in the lower part of the tub.

[0014] The main units of an electronic panel equipped with a touch screen, built into the control front panel, are a heavy current and a light current panel, a processor with event-driven software, a RFID (Radio Frequency IDentification) label reader and a speaker.

[0015] The electronic control tasks controlled by the electronic panel are: operation of the motor and the washing water pump, regulation of the temperature of the washing water, operation of the water inlet valves, operation of the electromagnetic door lock and the electromagnetic limit stops, displaying information on the touch screen, analysis and performance of the commands received via the touch screen and the washing programmes, as well as evaluation of the signals from the sensors located on certain parts of the washing machine, troubleshooting, data storage, and management of Internet or NFC (Near Field Communications) communication.

[0016] The software and the RFID reader allow the recognition of clothes equipped with an RFID label, or washing nets equipped with an RFID label, and the setting and performance of a specific washing programme corresponding to the given label.

[0017] In the solution according to the invention, when the door is closed, the machine frame and the tub frame - door plane are parallel to each other, the electromagnetic door lock locks the door under power, the springs are prestressed. Then the drum is inaccessible.

[0018] When the door is opened, the electromagnetic door lock is in a released state. Then the door and the tub frame, together with the washing unit, swing out from the machine frame around a door and tub frame rotation shaft by means of springs to an angle of about 25 degrees compared to the vertical plane, until the electromagnetic limit stops come into contact. When the electromagnetic limit stops come into contact, the software locks the stops, securing the door against accidental closing during loading. The springs are in a non-prestressed state. Then the loading opening of the drum is accessible.

[0019] A balance weight is built into the back part of the machine frame, which can be e.g. a cement-based slab or a sealable plastic water balloon to be filled by the user before using the washing machine for the first time.

[0020] In a preferred embodiment the tub frame is connected to the lower part of the machine frame by a shaft, thus when the door is opened, the door fixed to the outer part of the tub frame and the tub mounted within the tub frame swing out from the machine frame together. In this embodiment, the closing panel equipped with sealing at its two ends is curved, it is fixed to the machine frame, and covers a curved water space closing element fixed to the upper part of the tub frame. One electromagnetic limit stop is located on the upper, inner part of the machine frame, and the other electromagnetic limit stop on the upper part of the water space closing element. There are guide grooves for the closing panel firmly fixed to the machine frame on the two sides of the water space closing element, in which the closing panel slides when the door is moving. The control front panel of the washing machine is connected on the one hand to the water space closing element, and on the other hand to the door fixed to the tub frame.

[0021] In another preferred embodiment the tub frame is again connected to the lower part of the machine frame by a shaft, thus when the door is opened, the door fixed to the outer part of the tub frame and the tub mounted within the tub frame swing out from the machine frame together. In this embodiment the closing panel covering the water space is flat, and is directly above the tub edge and the loading opening decor frame. The closing panel and the machine frame are connected to each other by a closing panel moving element, the movement of which is controlled by a closing panel moving element motor. When the door is opened, the closing panel is lifted from the tub and remains fixed to the machine frame. The electromagnetic limit stops are mounted on the inner part of the machine frame and the upper part of the tub frame.

[0022] In a further preferred embodiment the tub frame is again connected to the lower part of the machine frame by a shaft, thus when the door is opened, the door fixed to the outer part of the tub frame and the tub mounted within the tub frame swing out from the machine frame together. In this embodiment the closing panel is connected by hinges to the loading opening decor frame. When the door is opened, the user opens the closing panel manually to gain access to the loading opening of the drum. The electromagnetic limit stops are mounted on the inner part of the machine frame and the upper part of the tub frame.

[0023] The automatic washing machine according to the invention is described in detail with reference to the

following figures, but without being limited thereto:

Figure 1: shows a side view of the structural design of the washing machine according to the invention, with the door in the closed position;

Figure 2: shows a side view of the structural design of the washing machine according to the invention, with the door in the open position;

Figure 3: shows a perspective view of the structural design of the washing machine according to the invention and the outer cover of the housing, with the door in the closed position;

Figures 4 a-c: show side views of the connection of the closing panel of the washing machine according to the invention to the water space closing element, with the door both in the closed and the open position, as well as a schematic view thereof;

Figures 5 a-c: show side views of the connection of the closing panel of the washing machine according to the invention to the closing panel moving element, with the door both in the closed and the open position, as well as a schematic view thereof;

Figures 6 a-c: show side views of the connection of the closing panel of the washing machine according to the invention by hinges, with the door both in the closed and the open position, as well as a schematic view thereof.

[0024] Figure 1 shows the structural design of the washing machine, with the door in the closed position. The supporting structure of the washing machine is a machine frame 1, within which there is a tub frame 3. The lower front part of the tub frame 3 is connected to the lower front part of the machine frame 1 by a horizontal door and tub frame rotation shaft 22. A tub 5 is connected by four suspension springs 9 to the upper part of the tub frame 3. The suspension springs 9 are connected to lugs 4 fixed to the tub frame 3. The tub 5 contains a drum 6 mounted on a drum shaft 7. A water inlet pipe 32 is connected, via bores under a tub edge 8, through water inlet valves 31 to a detergent dispenser 30 built into the loading opening of the tub 5 in the plane of the tub edge 8.

[0025] A washing water drain pipe 33 is connected to a washing water pump 24 through a debris filter 21. A shock absorber element 25 is connected to lugs 4 fixed to the tub frame 3. A motor 37 mounted on the lower part of the tub frame 3 drives the drum 6 by a drive belt 35 on a pulley 34 mounted at the end of the drum shaft 7. The lower outer edges of the machine frame 1 are equipped with adjustable legs 23, ensuring that the washing machine is adjusted to be level. There are springs 36 between the machine frame 1 and the tub frame 3, fixed to them. A balance weight 40 is screwed to the back part of the machine frame 1.

[0026] There is a water space closing element 28 above the tub frame 3, covered from above by a closing panel 27 equipped with sealing 15. The water space closing element 28 is held firmly above the tub frame 3 by the closing panel 27 fixed to the machine frame 1. An electromagnetic limit stop 13 is located on the upper, inner part of the machine frame 1, and another electromagnetic limit stop 13 on the water space closing element 28. A sealing skirt 17 is installed around the tub edge 8 of the tub 5, on top of which is the water space closing element 28, which has guiding grooves along its two edges for the closing panel 27. There is a loading opening decor frame 18 above the tub edge 8. There is an electromagnetic door lock 10 on the upper part of the machine frame 1. A detergent and softener dispenser 30 is located under the tub edge 8, on the outer part thereof. There is a door 19 on the front part of the tub frame 3, fixed by screws from the direction of the tub frame 3.

[0027] The control front panel 11 of the washing machine is also fixed to the tub frame 3, it is located above the door 19, forming a unit with it. The control front panel 11 includes a control electronic panel 12 and an associated operator touch screen.

[0028] Figure 2 shows the structural design of the washing machine, with the door in the open position, then the tub frame 3, together with the elements mounted within it and the water space closing element 28 and the door 19 fixed to it, swings out from the machine frame 1 around the door and tub frame rotation shaft 22, thus the door of the loading opening of the drum 6 and the detergent and softener dispenser 30 become directly accessible. The tilted tub frame 3 is held firmly by the electromagnetic limit stops 13 located below the front edge of the machine frame 1 and on the upper part of the water space closing element 28, the closing panel 27 remains in its original position, firmly fixed to the machine frame 1, it is not movable.

[0029] Figure 3 shows well that the tub frame 3, with the water space closing element 28 fixed to it, fits into the machine frame 1, where the water space closing element 28 is covered by the curved closing panel 27. It shows well the lugs 4 fixed to the upper and lower parts of the tub frame 3, and the door and tub frame rotation shafts 22 connecting the tub frame 3 to the machine frame 1, the electromagnetic limit stops 13, a cross member 2 strengthening the front side of the tub frame 3, as well as the springs 36 between the machine frame 1 and the tub frame 3.

[0030] The figure also shows the cover mounted on the machine frame 1. The door 19 and the control panel 11 are on the front side of the machine frame 1, there are side panels 41 on the two sides, and a top panel 42 on the top. There is no cover on the back side of the machine frame 1, the back side is a balance weight 40.

[0031] Figure 4 shows the curved water space closing element 28, which, together with the closing panel 27 equipped with sealing 15 sliding in its grooves, fixed to

the machine frame 1, implements the closing of the water space when the door 19 is in the closed position. When the door 19 is opened, the water space closing element 28 slides out from below the closing panel 27, making accessible the loading opening of the washing machine.

[0032] In the embodiment shown in Figure 5 the machine frame 1 and the closing panel 27 equipped with sealing 15 are connected to each other by a closing panel moving element 43, which closing panel moving element 43 is turned by a closing panel moving element motor 44, and the closing panel 27 and the closing panel moving element 43 are flexibly connected to each other. The electromagnetic limit stops 13 are located on the inner part of the machine frame 1 and the upper part of the tub frame 3.

[0033] In response to an 'open the door' command issued by the user, first the closing panel 27 covering the loading opening decor frame 18 is lifted from the loading opening decor frame 18 by the closing panel moving element 43 turned by the closing panel moving element motor 44, then the control electronics releases the door lock 10, opening the door 19 and making the loading opening of the drum 6 accessible.

[0034] In the embodiment shown in Figure 6 the closing panel 27 equipped with sealing 15 is connected by hinges to the loading opening decor frame 18. When the door 19 is opened, the user opens the closing panel 27 manually to gain access to the loading opening of the drum 6. The electromagnetic limit stops 13 are located on the inner part of the machine frame 1 and the upper part of the tub frame 3.

[0035] The automatic washing machine according to the invention is used and operated as follows: the user presses the touch screen of the washing machine for 3 seconds to indicate his/her intention of washing, then the software of the washing machine wakes up from the sleeping (stand by) mode, and in response to the 'open the door' command displayed on the touch screen the door opens. By releasing the electromagnetic door lock of the washing machine, the door with the tub frame and the washing unit mounted within it is automatically, slowly opened towards the user by means of the springs fixed to the machine frame and the tub frame, until the stops come into contact. When the door is opened, the electromagnetic limit stops close to stabilize the open position. When the door is opened, the loading opening of the drum and the detergent and softener dispenser become accessible to the user. The user places the laundry into the drum, closes the drum, fills the detergent and softener dispenser, then manually closes the door of the washing machine until the electromagnetic door lock clicks, in such a way that before closing it he/she touches the touch screen with his/her thumb to release the electromagnetic limit stops. When the door is opened, only the limit stop release function is available on the touch screen. The closing of the door is confirmed by a beep, then the washing programmes programmed into the software appear on the touch screen, the user selects one of them, changes any associated washing parameters on the touch screen, if necessary, approves the changes, confirms the start of the washing programme on the touch screen, and the washing programme is performed.

[0036] If the user collects the laundry by type into different washing nets equipped with an electronic label, for washing it the user shall close the opening of the net and hold the electronic label to the touch screen of the washing machine - with its door in the default closed position. Behind the control front panel an electronic label reader forming a part of the electronic panel confirms the recognition of the label of the washing net by a beep, the programme pre-set for the label of the washing net appears on the display, if the user accepts it (does not overwrite it), the door of the washing machine opens, the washing net can be loaded into the drum through the loading opening, and the washing starts.

[0037] If the label reader of the washing machine detects an unknown label, requests the user via a message displayed on the screen to enter a name for the label and set the programme corresponding to the name. For this the software offers the pre-programmed washing programmes, the washing parameters associated with them can be changed by the user at will, at his/her own risk, or accepted without change. When the acceptance is confirmed, the memory of the processor stores the washing programme corresponding to the label, and will always perform this pre-set washing programme for the washing net equipped with this label, until the user changes the settings for the label.

[0038] The software of the washing machine according to the invention is also suitable for recognizing RFID labels containing washing parameters, integrated - by the manufacturer, or subsequently by the user - directly into the washing label of the clothes. When the door is closed, the software offers on the screen the most appropriate washing programme on the basis of the labels.

[0039] The machine signals the end of the washing programme - whether or not a washing net is used - by a beep, or by sending a message, if it is connected to the Internet. At the end of the programme, the door either automatically opens or remains closed, as set by the user, and then the door of the washing machine is opened by the user by touching the screen. If it is connected to the Internet, the door can be opened, and the washing of previously loaded laundry can be started remotely, by means of a mobile phone application.

[0040] For community use, the operator of the washing machine can assign a name to the label belonging to a washing net, in order to identify the user of the washing net. Then the software of the washing machine can collect the washing data by label (washing frequency, energy and water consumption, etc.) and periodically transmit it to the operator of the washing machine for further processing, in order to calculate the washing costs. When used for community use, for starting the washing the user shall be required to enter on the touch screen a verification code associated with his/her label - in order to pre-

vent the misuse of his/her label.

[0041] The solution according to the invention is especially ideal for community use, as a name can be assigned to the electronic label of washing nets, and the washing done using these washing nets can be collected, added up and invoiced, even over the Internet.

[0042] In the event of a power failure the electromagnetic door lock is released and the door of the washing machine is automatically opened by means of the prestressed springs. After the end of the power failure, for resuming the washing programme, the user needs to close the door of the washing machine manually and approve the resumption of the programme on the control panel. The control electronics of the washing machine includes an internal power source, allowing it to remember where the washing programme was interrupted.

Claims

1. An automatic washing machine for household and community use, the housing of which is covered by a door (19), side panels (41) and a top panel (42) and contains a machine frame (1), a tub (5) with a tub edge (8) containing a drum (6), a loading opening decor frame (18) above the tub edge (8), furthermore it contains a motor (37) with a drive belt (35) and a pulley (34), water inlet valves (31), a washing water pump (24), a debris filter (21), a shock absorber element (25), a heater, and a closing panel (27) covering the water space, furthermore it contains a control front panel (11) above the door (19) in the continuation of the door (19), with a built-in control electronic panel (12) including a touch screen and equipped with a RFID label reader,
characterized in,
that the main units of the electronic panel (12) are a heavy current and a light current panel, and a processor with event-driven software; the tub (5) is connected to a tub frame (3), the door (19) is fixed to the front side of the tub frame (3), and the lower part of the tub frame (3) is connected to the lower part of the machine frame (1) by a door and tub frame rotation shaft (22), furthermore it contains at least two electromagnetic limit stops (13), with one electromagnetic limit stop (13) located on the upper, inner part of the machine frame (1), there is an electromagnetic door lock (10) on the upper part of the machine frame (1), which locks the door (19) when the door (19) is closed, when the door (19) is opened, the electromagnetic door lock (10) releases the door (19), and it swings out with the tub frame (3) at an angle from the machine frame (1) around the door and tub frame rotation shaft (22) until the electromagnetic limit stops (13) come into contact, and the loading opening of the drum (6) mounted within the tub frame (3) held firmly by the electromagnetic door stops (13) becomes accessible.

2. The automatic washing machine according to claim 1, **characterized in that** the tub (5) is connected by suspension springs (9) to lugs (4) fixed to the upper part of the tub frame (3).

3. The automatic washing machine according to any of claims 1 or 2, **characterized in that** a balance weight (40) is built into the back part of the machine frame (1).

4. The automatic washing machine according to any of claims 1 to 3, **characterized in that** a sealing skirt (17) is installed around the tub edge (8) of the tub (5).

5. The automatic washing machine according to any of claims 1 to 4, **characterized in that** the closing panel (27) is firmly fixed to the machine frame (1) and covers a water space closing element (28), which water space closing element (28) is located above the tub frame (3), the closing panel (27) is equipped with sealing (15), one electromagnetic limit stop (13) is located on the machine frame (1), the other on the upper part of the water space closing element (28), and there are guide grooves for the closing panel (27) on the two sides of the water space closing element (28).

6. The automatic washing machine according to any of claims 1 to 4, **characterized in that** the closing panel (27) is directly above the loading opening decor frame (18), and the closing panel (27) is flexibly connected to the machine frame (1) by a closing panel moving element (43), the movement of the closing panel moving element (43) is controlled by a closing panel moving element motor (44), one electromagnetic limit stop (13) is located on the inner part of the machine frame (1), and the other electromagnetic limit stop (13) on the upper part of the tub frame (3).

7. The automatic washing machine according to any of claims 1 to 4, **characterized in that** the closing panel (27) is connected by hinges (45) to the loading opening decor frame (18), one electromagnetic limit stop (13) is located on the inner part of the machine frame (1), and the other electromagnetic limit stop (13) on the upper part of the tub frame (3).

8. The automatic washing machine according to claim 1, **characterized in that** the door (19) is replaceable.

9. The automatic washing machine according to claim 1, **characterized in that** it can be built in under an existing kitchen counter or into a row of bathroom furniture.

10. The automatic washing machine according to claim 1, **characterized in that** the operating software allows the identification of clothes, washing nets

equipped with a unique identifier, a label, and the performance of a specific washing programme corresponding to it, as well as the analysis, collection and transmission of washing parameters, as needed.

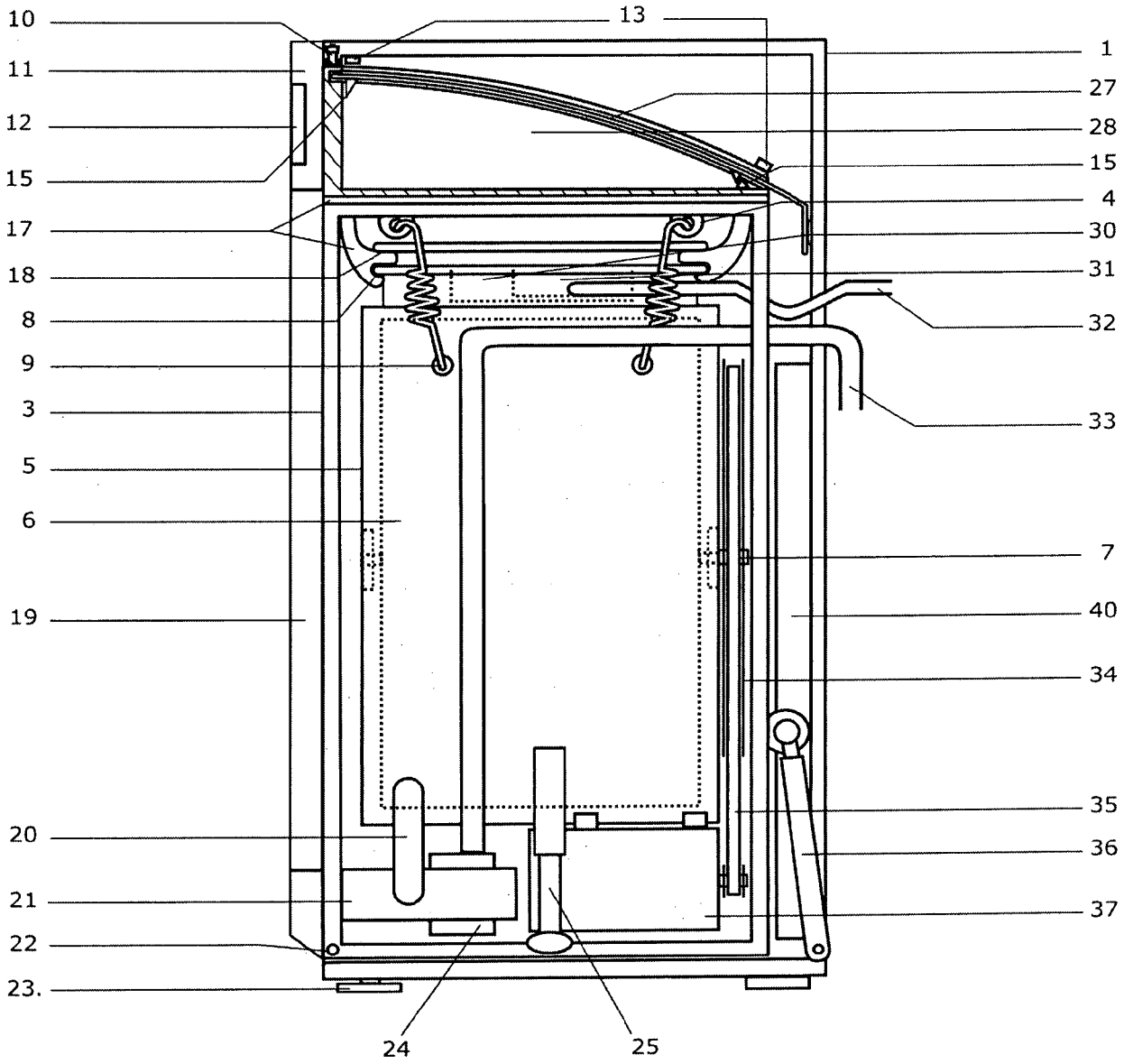
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Figure 1

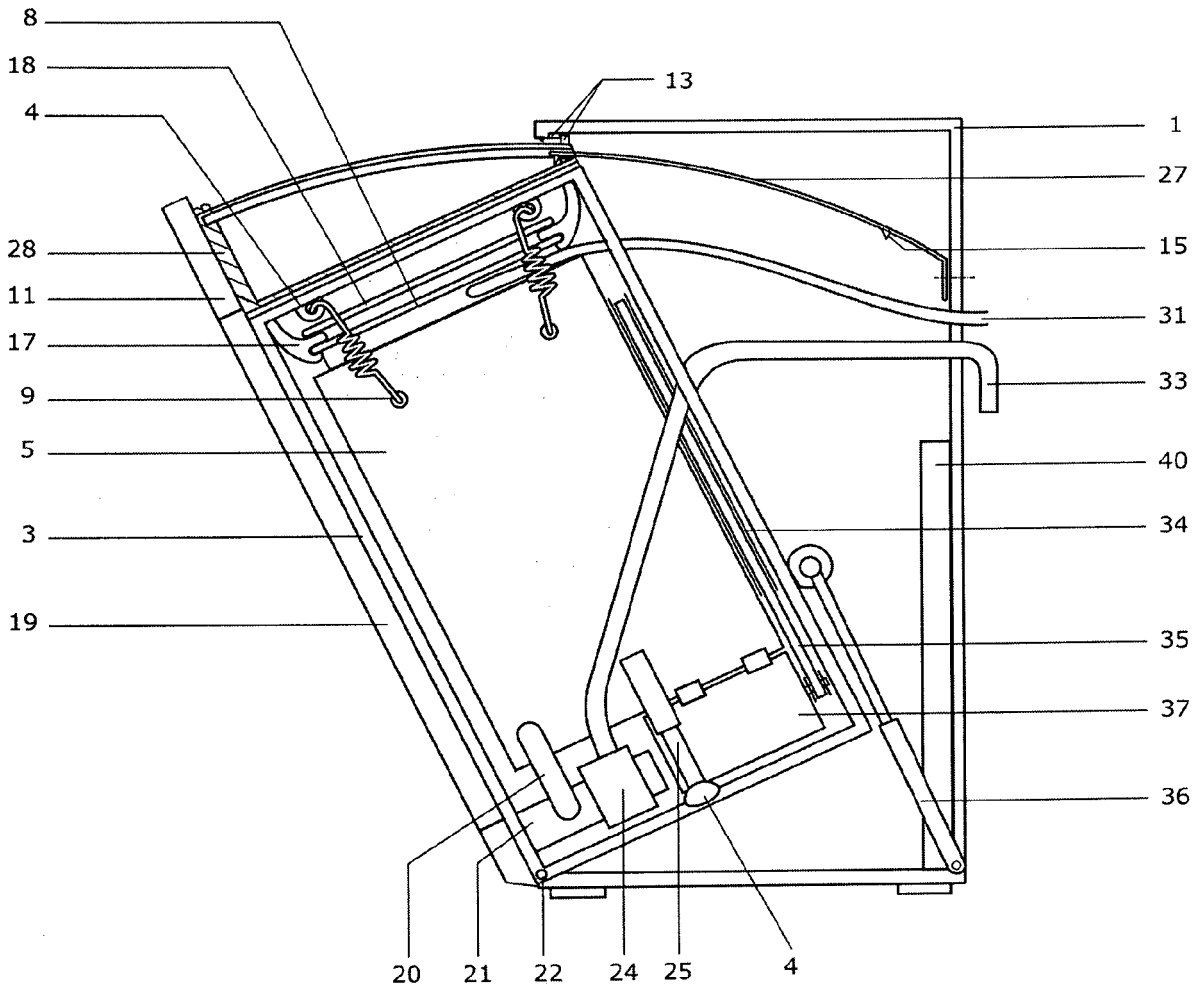


Figure 2

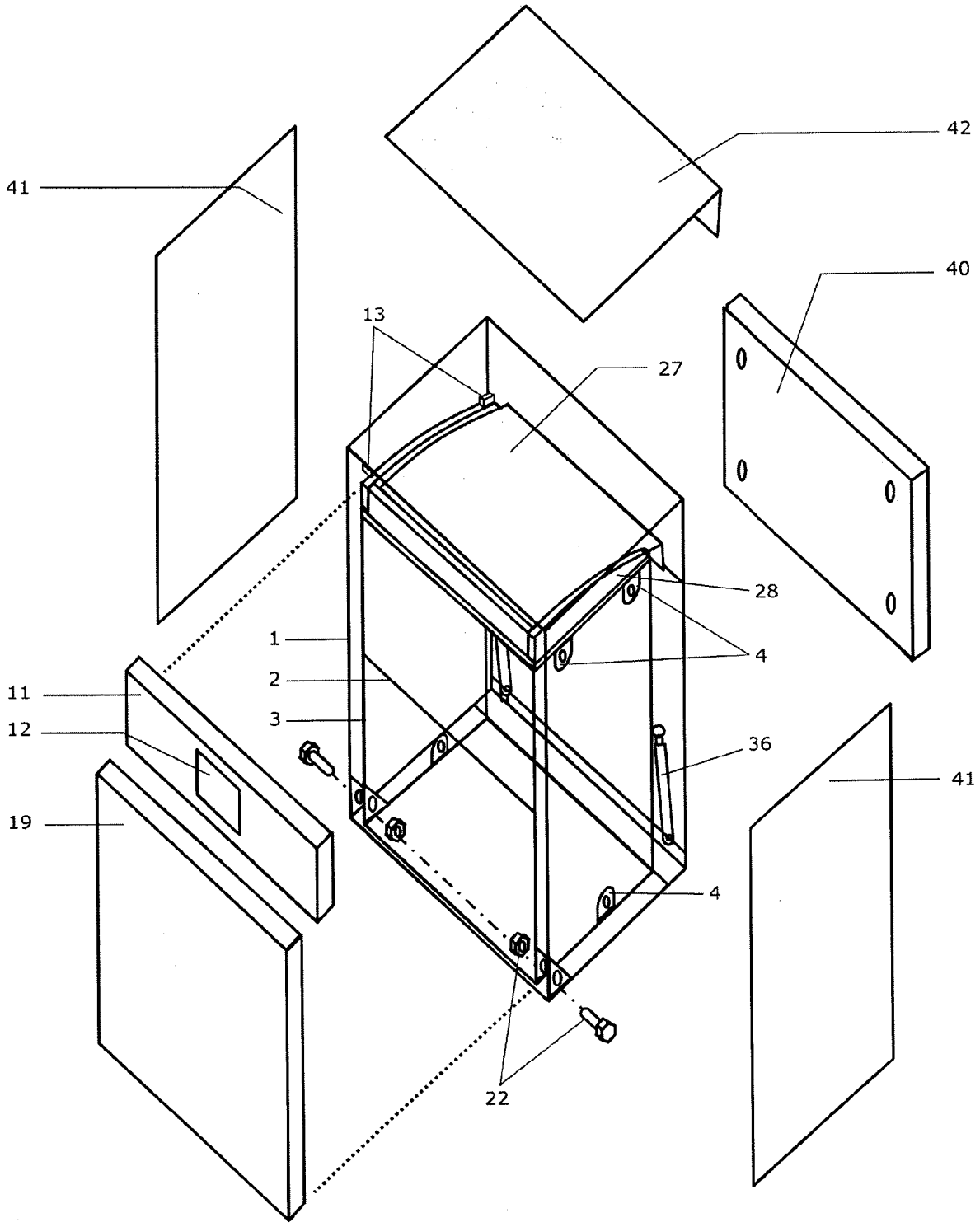


Figure 3

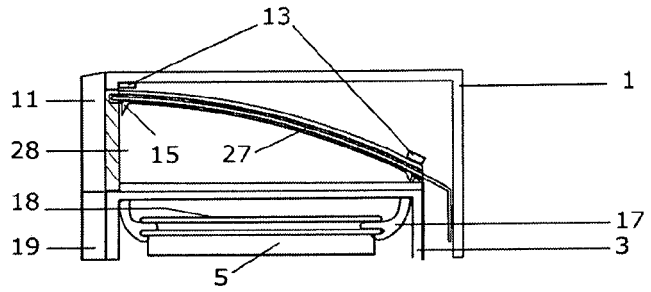


Figure 4a

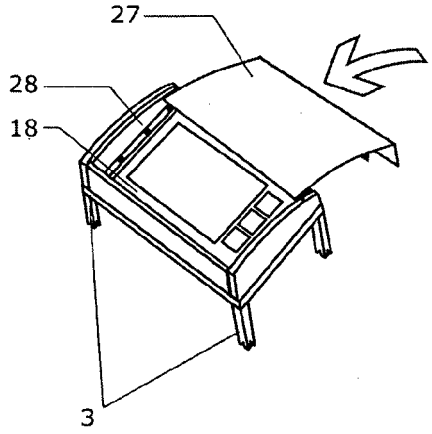


Figure 4c

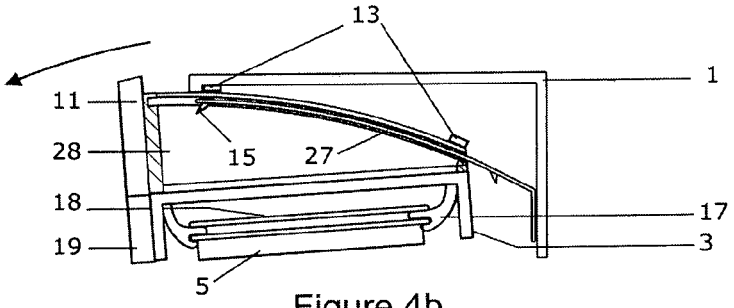
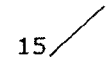


Figure 4b



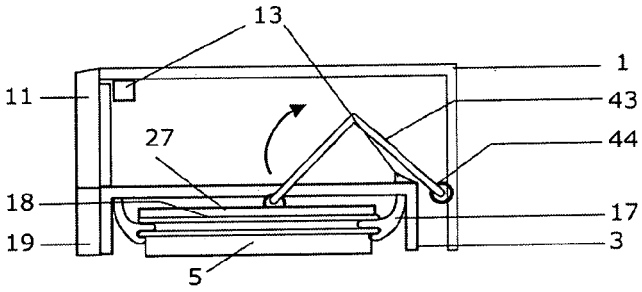


Figure 5a

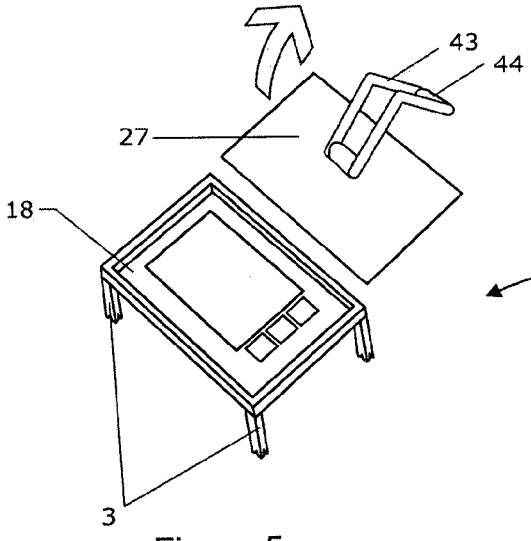


Figure 5c

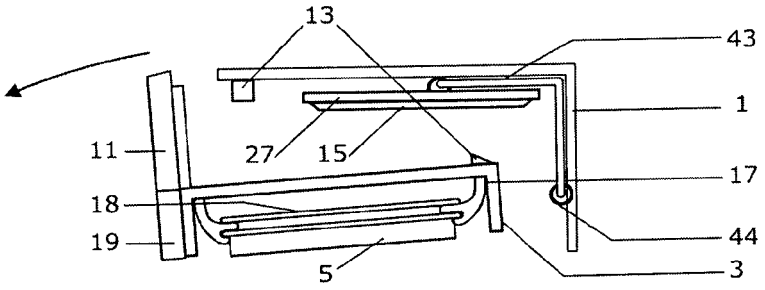


Figure 5b

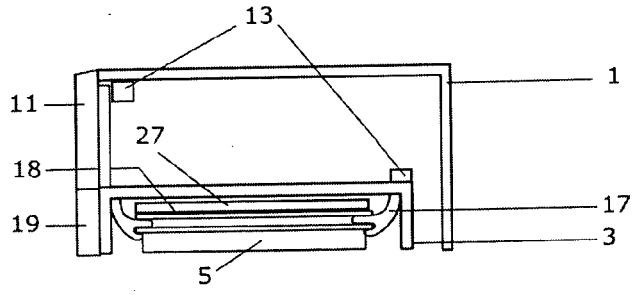


Figure 6a

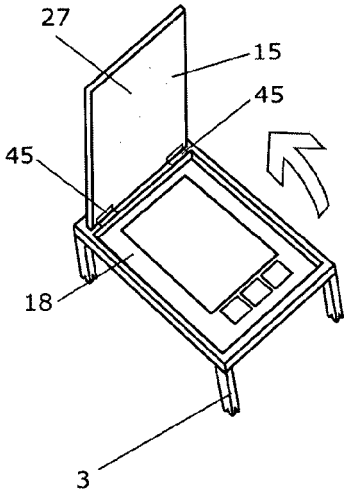


Figure 6c

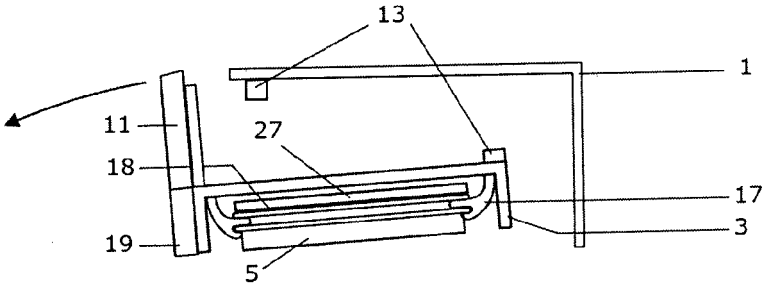


Figure 6b

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EUROPEAN SEARCH REPORT

Application Number
EP 18 00 0990

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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	15 May 2019	Diaz y Diaz-Caneja

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