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(54) **TOP-LOADING WASHING AND/OR DRYING MACHINE WITH SAFETY MECHANISM**

(57) The present invention is related to a top-loading washing and/or drying machine comprising: a cabinet (C); a drum (10) rotatably mounted within the cabinet (C) about a horizontal axis and having an aperture (12) on its cylindrical side; at least a drum door (14a, 14b) supported by the drum (10) for opening and closing the aperture (12); a safety mechanism (22) supported by the drum (10) and/or by the door (14a, 14b) and configured to selectively lock and unlock the door (14a, 14b). A sensing device is configured to sense a relative position of the door (14a, 14b) with respect to the safety mechanism (22). The sensing device is operatively connected to a control unit to provide a signal indicating a correct closed configuration of the door (14a, 14b).

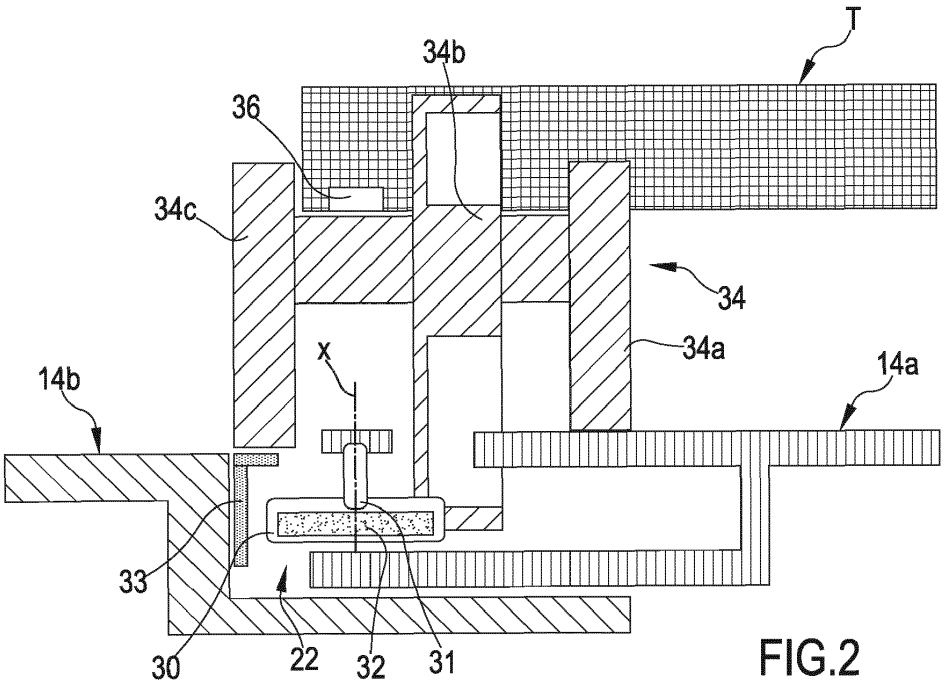

FIG.2

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Description

Field of the art

[0001] The present invention relates to a top-loading washing and/or drying machine comprising a cabinet with a top access, a drum rotatably mounted within said cabinet about a horizontal axis and having an aperture on its cylindrical side, one or two drum door/s supported by the drum for opening or closing said aperture following a predetermined rotation of the drum. In particular the present invention relates to a top-loading washer comprising a tub mounted in the cabinet with an access opening, a perforated drum rotatably mounted within said tub about a horizontal axis and having an aperture on its cylindrical side, one or two drum door/s supported by the drum for opening or closing said aperture following a predetermined rotation of the drum. The top-loading washing and/or drying machine is provided with a safety mechanism to prevent accidental openings of the drum.

State of the art

[0002] In common top loader horizontal axis washing machines, drum can be opened by means of two spring loaded rotating doors. These two doors are connected to the drum wrapper through two hinges (one for each door). When the drum is closed, the two doors edges are overlapped thus allowing their engagement: the lower door is usually provided with two hooks that engage two corresponding slots on the upper door. The action of the springs ensures the correct engagement of the two lids. Furthermore a safety mechanism, usually located on the edge of the two doors, prevents accidental openings of the drum that can occur during the wash cycle. In particular the function of the safety mechanism is to avoid that a pushing force, acting on the lower rotating door towards the inner side of the drum, could lead to the disengagement of the two rotating doors. Said force can be caused by impact of the tumbling drum with the water contained inside the sump or by a piece of laundry caught with the lower door. The safety mechanism is generally done with a spring loaded pushbutton or slider which denies the disengagement of the lower rotating door when pushed inward.

[0003] A failure in the engagement of the safety mechanism can occur due to a not correct drum doors closing operation performed by the user or by an automatic system or to a damage to the mechanical components of the safety mechanism. Document EP1992728 discloses a top-loading washing machine comprising: a tub having a top opening; a drum fitted in a manner such that it can rotate about a substantially horizontal axis inside the tub; at least one door secured to said drum for allowing access to the inside of the drum. The washing machine further comprises a safety device associated with the tub and/or the drum, which allows a control unit to detect an open/closed condition of the door when said drum is rotating inside the tub. The safety device of the cited document comprises a first element on the tub and a second element on the door and it is configured to detect a distance between such two elements.

Object of the invention

[0004] The Applicant observed that the known top-loading washing machine suffer from some drawbacks.

[0005] Indeed, the safety device of the cited document EP1992728 cannot provide any information regarding the correct engagement of the safety mechanism.

[0006] Further, in case of top-loading washing machines provided with an automatic system for the opening and closing said doors (with doors rotating inwards and/or sliding doors), a safety device like the one disclosed in EP1992728 cannot assure that the doors are properly closed and/or that the safety mechanism is correctly engaged. Further, in the case of a drum with sliding door/s, no mechanical mechanism is able to prevent the drum rotation if the closing routine is not successful.

[0007] It is the main object of the present invention to overcome the above-mentioned drawbacks by providing a sensing system which ensures the detection of the correct doors closure.

[0008] Another object of the present invention is to provide a sensing system which ensures the detection of the correct engagement of the safety mechanism. Another object of the present invention is to provide these detections both in manual and automated systems for opening/closing the door/s.

Summary of the invention

[0009] The Applicant has found that such objectives can be obtained by a sensing system designed to detect if the components of the drum door closure system of the top-loading washing and/or drying machine are in their correct position.

[0010] More specifically, according to one aspect, the present invention relates to a sensing device implemented in the top-loading washing and/or drying machine and configured to sense a relative position of the door/s of the drum with respect to the safety mechanism in order to provide a signal indicating a correct closed configuration of said door/s.

[0011] According to an aspect, the present invention relates to a top-loading washing and/or drying machine with a safety mechanism comprising: a cabinet; a drum rotatably mounted within said cabinet about a horizontal axis and having an aperture on its cylindrical side; at least a drum door supported by the drum for opening and closing said aperture; a safety mechanism supported by the drum and/or by said at least a door and configured to selectively lock and unlock said at least a door; a control unit; a sensing device configured to sense a relative position of said at least a door with respect to at least the safety mechanism; wherein the sensing device is oper-

atively connected to the control unit to provide a signal indicating a correct closed configuration of said at least a door.

[0012] The Applicant verified that the invention allows to check the proper relative position of the drum door/s and the engagement of the safety mechanism in a simple and reliable way.

[0013] The present invention, in at least one of the aforesaid aspects, can have one or more of the preferred characteristics that are described hereinbelow.

[0014] Preferably, the at least a door comprises at least a first engaging portion configured to cooperate with a corresponding second engaging portion of another door or of the drum. Preferably, the first engaging portion comprises at least a hook and the second engaging portion comprises at least a slot for the hook or viceversa. The engaging portions keep the drum door/s in the closed configuration and the safety mechanism locks the door/s in this configuration.

[0015] Preferably, said at least a door comprises two doors, preferably an upper door and a lower door, wherein the safety mechanism operates between a first edge of the upper door and a second edge of the lower door. Preferably, the lower door is hinged to the drum. Preferably, the upper door is hinged to the drum. Preferably, the upper door is slidably supported by the drum.

[0016] Preferably, the sensing device comprises a first element mounted on the drum or on said at least a door, a second element part of the safety mechanism, wherein the first element and the second element creates a sensing circuit.

[0017] Preferably, the sensing circuit is closed and the control unit receives said signal when said least a door is in the correct closed configuration.

[0018] Preferably, the sensing device further comprises a third element connected to the cabinet, wherein the third element forms part of the sensing circuit together with the first element and the second element.

[0019] Preferably, the sensing circuit is closed and the control unit receives said signal when the drum is in a predefined position.

[0020] Preferably, the third element is mounted on a tub surrounding the drum. Preferably, the third element is mounted on an actuation device mounted on the tub. The actuation device is moveable at least between a first position in which the actuation device is spaced from said at least a door and a second position in which the actuation device pushes against said at least a door to disengage the engaging portions when said at least a door is unlocked.

[0021] Preferably, the sensing circuit comprises a signal source, a transmitting means and a receiver sensor. Preferably, the third element comprises the receiver sensor. Preferably, the third element further comprises also the signal source. Preferably, the first element and/or the second element comprises the signal source. Preferably, the first element and/or the second element comprises transmitting means.

[0022] The target is to create a sensing circuit such that when one of the drum door components is not in the correct position or not present the signal generated by the source cannot receive the sensing receiver.

[0023] Preferably, the receiver sensor is mounted on the cabinet and close to the drum, preferably on the tub, preferably on the actuation device. Since the receiving sensor is connected through cables to the control unit, it is advisable to place it on the cabinet instead of on the rotating drum.

[0024] Preferably, the safety mechanism comprise a latch pivoted to said at least one door or to the drum.

[0025] Preferably, said latch is rotatable between an engaged position, in which the latch locks said at least one door to the drum or one door to another door, and a disengaged position, in which said at least one door is spaced form the drum or one door is spaced form the other door.

[0026] Preferably, the second element is mounted on or is part of the latch.

[0027] Preferably, the sensing circuit is closed when the latch is in the engaged position, in which the first element is close to the second element, and the drum is in an angular position in which the third element is close to the first and second element. Preferably, the latch is rotated between the engaged position and the disengaged position by an automatic system. Preferably, the latch is rotated between the engaged position and the disengaged position by the actuation device.

[0028] Preferably, the sensing circuit is a magnetic circuit.

[0029] Preferably, one among the first, second and third element comprises a magnet, one among the first, second and third element comprises a ferromagnetic body, one among the first, second and third element comprises a magnetic sensor connected to the control unit.

[0030] Preferably, the magnetic sensor is connected to the cabinet. Preferably, the magnetic sensor is mounted on the actuation device. Preferably, the magnetic sensor is mounted on a terminal end of the actuation device. Preferably, the ferromagnetic body is mounted on said at least a door or on the drum. Preferably, the magnet is mounted on the safety mechanism. Preferably, the magnet is mounted on the latch.

[0031] Preferably, the sensing circuit is an optical circuit.

[0032] Preferably, one among the first, second and third element comprises a source of light and a photodetector connected to the control unit, one among the first, second and third element comprises an optical element such as a mirror, one among the first, second and third element comprises another optical element such as a reflector.

[0033] Preferably, the source of light is connected to the cabinet. Preferably, the photodetector is connected to the cabinet. Preferably, both the source of light and the photodetector are connected to the cabinet. Preferably, the source of light and the photodetector are mount-

ed on a terminal end of the actuation device. Preferably, the mirror is mounted on said at least a door or on the drum. Preferably, the reflector is mounted on the safety mechanism. Preferably, the reflector is mounted on the latch.

[0034] Preferably, the source of light is a LED, preferably a UV (ultraviolet) LED. Preferably, the photodetector is made of fluorescent material. Preferably, the photodetector is a phototransistor.

[0035] Preferably, the sensing circuit is an RFID circuit.

[0036] Preferably, one among the first, second and third element comprises an RFID chip connected to the control unit, one among the first, second and third element comprises an RFID tag with a switch, one among the first, second and third element comprises an actuator configured to act on the switch.

[0037] Preferably, the RFID chip is connected to the cabinet. Preferably, the RFID tag is mounted on said at least a door or on the drum. Preferably, the actuator is mounted on the safety mechanism. Preferably, the switch is a tactile switch and the actuator is configured to press said tactile switch. Preferably, the switch is a magnetic switch sensor and the actuator comprises a magnet.

Brief description of the drawings

[0038] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

Fig. 1 is a schematic view of a portion of the drum of an assembly tub and drum of a washing machine according to the invention;

Fig. 2 is a schematic view of a portion of the drum doors and of the safety mechanism according to the present invention in a correct closed configuration;

Figures 2a-2d are perspective views of an actuation device used with the drum of figure 1;

Fig. 3 is a variant of the portion of figure 2 wherein the safety mechanism is unlocked;

Fig. 4 is the portion of figure 3 wherein the doors are not properly closed;

Fig. 5 is a schematic view of another embodiment of the portion of the drum doors and of the safety mechanism according to the present invention;

Fig. 6 is a schematic view of another embodiment of the present invention in a correct closed configuration;

Fig. 7 is a schematic view of the embodiment of Fig. 6 wherein the safety mechanism is unlocked;

Fig. 8 is a schematic view of another embodiment of the present invention in a correct closed configuration;

Fig. 9 is the portion of figure 8 wherein the safety mechanism is unlocked;

Fig. 10 is the portion of figure 8 wherein the doors are not properly closed;

Fig. 11 is a schematic view of another embodiment of the present invention in a correct closed configuration;

Fig. 12 is the portion of figure 11 wherein the safety mechanism is unlocked.

Detailed description of the preferred embodiments of the invention

[0039] Referring now to the annexed drawings, in Fig. 1 reference numeral 1 designates a top loading washer W, according to the present invention. Anyway, the present invention may be implemented in top loading washing and/or drying machines.

[0040] A drum 10 of the top loading washer W comprises a stainless steel cylindrical wrapper 10a provided with a rectangular drum aperture 12 provided with a door 14. The drum 10 is rotating within a plastic tub T mounted, with the interposition of known dampers, within a cabinet C. Such cabinet is provided with a lid L for closing the access opening towards the drum 10.

[0041] The door 14 of the drum 10 comprises a sliding part 14a and a rotating flap 14b whose rotation is allowed only towards the inside of the drum 10 by abutting parts of the drum (not shown). A spring (not shown) urges the rotating flap 14b towards the position shown in figure 1.

[0042] The structural continuity of the drum mantle is guaranteed during the spin extraction by the chain formed by a hinge rod H of the rotating flap 14b, the flap 14b itself, hooks 16 (schematically represented) of the flap 14b engaging corresponding slots 18 of the sliding part 14a, the sliding part 14a itself and a connecting rod 20 (figure 1) of the sliding part 14a. During the operation of the washer, the hooks 16 of the small rotating flap 14b are engaged in a couple of corresponding slots 18 in the sliding part 14a.

[0043] A first edge of the rotating flap 14b opposite the hinge rod H of the flap 14b carries the hooks 16 and a second edge of the sliding door 14a presents the slots 18. A third edge of the sliding door 14a opposite the second edge is slidably carried by the wrapper 10a of the drum 10.

[0044] As shown in figure 1, the rotating flap 14b is placed in an innermost radial position with respect to the outermost sliding door 14a. As shown in figures 1 to 4, the first edge of the rotating flap 14b is placed under the second edge of the sliding door 14a.

[0045] A safety mechanism 22 is present to prevent accidental opening of the flap 14b during the tumbling of the drum 10 and to ensure a correct closure at the end of the loading / unloading sequence. The hooks 16 keep the flap 14b in the closed configuration and the safety mechanism 22 locks the flap 14b in this configuration. In the embodiment of figures 1 to 4, the safety mechanism 22 comprises a latch 30 pivoted, through a pin 31, to the second edge of the sliding door 14a. The latch 30 is shaped like a bar. The pin 31 and the rotation axis X of

the latch 30 are radially oriented with respect to the drum 10. The pin 31 is hinged to the sliding door 14a and the latch 30 hangs below the pin 31. The latch 30 carries a magnet 32 which is embedded into its rod.

[0046] The safety mechanism 22 comprises a ferromagnetic body 33 jointed to the flap 14b. The ferromagnetic body 33 is L shaped and protrudes from the flap 14b towards the sliding door 14a. When the hooks 16 of the flap 14b are correctly engaged into the slots 18 of the sliding door 14a (not shown in figures 2 to 4), the latch 30 lies under the protruding part of ferromagnetic body 33 and the rotation of the flap 14b towards the inside the drum 10 is prevented by the interaction of said latch 30 and said protruding part of ferromagnetic body 33.

[0047] In the variant of figure 3 and 4, the latch 30 lies under a protruding part of the flap 14b instead of under the L shaped ferromagnetic body 33.

[0048] An actuation device 34 is mounted on the tub T close to an opening of the tub T itself. The device of figure 2 is an electromechanical device. The preferred actuation device 34 is a rotating member with a complex cam shaft supported by the tub T and operated by a motor M. The rotating axis of the rotating member 34 is oriented substantially tangentially with reference to the wrapper 10a of the drum 10. The motor M of the rotating member 34 is controlled in a way that the position is well determined at every relevant step of the correct opening sequence.

[0049] In a preferred solution, on the rotating member 34 there are three different cams 34a, 34b and 34c.

[0050] In figures 2a-2d there are shown different views the rotating member 34 with the cam set capable to manage the operations necessary to open the drum 10. The cam 34b has an internal profile rather than an external one.

[0051] In the starting position of the opening sequence (after the correct positioning of the drum) flat sides of the cam set are facing the drum 10. Therefore there is neither interference nor engagement and the drum 10 is free to rotate. In fact the drum 10 just reached this position rotating freely.

[0052] The opening sequence is as follows:

> The rotating member 34 starts to rotate and cam 34a pushes down the sliding door 14a and through it also the swiveling flap 14b that is below. This limited rotation of the sliding door14a is allowed since such part of the door 14 is configured to slide in side guides of side walls of the drum 10 that have a predetermined width larger that the thickness of the sliding door 14a.

[0053] Continuing the rotation, the cam 34b of the rotating member 34 engages on its inside a protrusion 35 on the sliding door 14a. This will prevent further movement downwards. At the same time, it opens the safety mechanism 22 by pushing against the latch 30 and making it rotate about the rotation axis X of the pin 31 (figures 3 and 4).

[0054] As the cam 30c starts to push down the rotating flap 14b to disengage it from the sliding part 14a, the safety device 22 is completely open and the sliding part 14a is kept in position (both horizontally and vertically) by the cam 30b.

[0055] Now the drum can be rotated to the load/unload position. The cam 30b keeps firmly in position the sliding part 14a of the drum door 14 allowing the opening of the drum. Now the washer can be unloaded safely.

[0056] When a new washing cycle has to be started, the user loads the washer drum 10 that is in the open status. The drum 10 must be now closed again before starting any other operation of the washing machine. First, the motor M rotates the drum 10 in a direction that is the opposite of the opening direction. Before the rotating door 14b touches the sliding door 14a, a couple of profiles, not shown, on the rotating door drives such flap 14b to move down (towards the centre of the drum 10) in a way that allows the correct positioning of the hooks 16 right below the corresponding slots 18 and below the cam 34c.

[0057] The flap 14b is now kept down by the cam 34c. In the following step the rotating member 34 rotates in the opposite direction than when opening, making the reverse series of operation. The cam 34c releases the flap 14b, allowing the engagement of the hooks 16, the cam 34b releases the sliding door 14a and the safety mechanism 22, preventing any accidental opening and at last the cam 34a frees the sliding door 14a allowing the normal rotation of the drum 10 so that the washing cycle cab be started.

[0058] A sensing device is configured to sense a relative position of the rotating flap 14b, of the safety mechanism 22 carried by the sliding door 14a and of the actuation device 34 mounted on the tub T.

[0059] The sensing device is operatively connected to a control unit, not shown, of the washer W to provide a signal indicating a correct closed configuration of the doors 14a, 14b. The control unit may then send an alert and/or stop the operation of the washer W.

[0060] The sensing device comprises a first element mounted on the drum 10 or on said at least a door 14a, 14b, a second element part of the safety mechanism 22 and a third element connected to the cabinet C. The first element, the second element and the third elements creates a sensing circuit. The sensing circuit comprises a signal source, a transmitting means and a receiver sensor. Preferably, the sensing circuit is closed when the latch 30 is in the engaged position, in which the first element is close to the second element, and the drum 10 is in an angular position in which the third element is close to the first and second element.

[0061] If the washer W is working, the sensing circuit is closed and provides a signal to the control unit each time the first and second elements on the drum 10 pass under the third element on the tub T. If the washer W is not working, the sensing circuit provides a continuous

signal to the control unit if the angular position of the drum 10 is such to place the first and second elements under the third element on the tub T.

[0062] The sensing device of the embodiment of figure 2 comprises the magnet 32 in the latch 30, the ferromagnetic body 33 jointed to the flap 14b and a magnetic sensor 36 (such as a hall sensor or a magnetoresistive sensor) embedded into the tub T. The magnetic sensor 36 is operatively connected to the control unit. Ferromagnetic elements (preferably of iron or ferrite) are placed on the surface of the actuation device 34 in order to optimize the gathering of the magnetic flux generated by the magnet 32. When the doors 14a, 14b are closed correctly, the magnetic flux from the magnet 32 is collected by the ferromagnetic body 33, then by a ferromagnetic element, not shown, on the front cam 34c. The magnetic flux is driven to the shaft of the actuation device 34 where the sensor 36 can read the signal. In order to close the circuit, the magnetic flux is lead, through a ferromagnetic element on the middle cam 34b, from the sensor 36 to the magnet 32.

[0063] A different magnetic circuit is proposed in the variant of figures 3 and 4. The sensing device of the embodiment of figures 3 and 4 comprises the ferromagnetic body 33 in the latch 30, the magnet 32 jointed to the flap 14b and the magnetic sensor 36 embedded into the tub T. The magnet 32 generates a magnetic flux which goes through the ferromagnetic body 33 embedded into the latch 30. Then the flux is directed towards the magnetic sensor 36 (fixed to the tub 1) by means of a second ferromagnetic element, not shown, assembled on the middle cam 34b. In case the latch 30 is not engaging the rotating door 14b, see Fig. 4, then the proper interface between the magnet 32 and the safety latch ferromagnetic body 33 is missing and no signal can be detected by the sensor 36.

[0064] In the different embodiment of Figures 5, 6 and 7, the actuation device 34 is not a cam shaft but a simpler linear actuator with an extensible rod 37 which allows to reach an area inside the tub T close to the drum 10. The rod 37 extends along a radial direction with respect to the drum 10. The latch 30 and the L shaped ferromagnetic body 33 are substantially identical to the elements of the embodiment of figure 2. The magnetic sensor 36 is mounted on a terminal end of the rod 37. The magnetic sensor 36 is embedded inside a cut out in the rod 37 and interfaces with the lower door 14b when the rod 37 has reached its maximum travel. The upper surface of said ferromagnetic body 33 is positioned and large enough to correctly interface with the magnetic sensor 36. The lower door 14b is a rotating flap. The upper door 14a may be a sliding door or a rotating door.

[0065] When the safety mechanism 22 is engaged, the magnetic flux generated by the magnet 32 is collected by the ferromagnetic body 33 and directed towards the sensor 36. The signal read by the sensor 36 allows the detection of the doors closure to the control unit. In the configuration shown in figure 6, the latch 30 is rotated of 90° and the safety mechanism 22 is not engaged. In this condition, the magnet 36 is not interfacing with the ferromagnetic body 33 and the magnetic flux collected by the sensor 36 is much lower. In the configuration shown in figure 7, the rotating flap 14b is not correctly engaged with the upper door 14a and the ferromagnetic body 33 is not able to direct the magnetic flux towards the sensor 36.

[0066] In the different embodiment of Figures 8, 9 and 10, the sensing circuit is an optical circuit. The actuation device 34 is similar to the one of figures 5, 6, 7. The sensing device of this embodiment comprises a source of light 38 and the photodetector 39 connected to the control unit. The source of light 38 and the photodetector 39 are mounted on a terminal end of the rod 37. The source of light may be a LED (light emitting diode), the photodetector may be a phototransistor. The LED 38, mounted on a printed circuit board 40, is embedded inside the rod 37 together with a beam splitter 41 that reflects the light from the LED 38 towards the lower door 14b. A mirror 42 is mounted on the lower door 14b. A reflector 43 is mounted on the latch 30.

[0067] When the rod 37 has reached its maximum travel, the reflected light is driven towards the mirror 42 positioned on the lower door 14b. A low air gap between the rod 37 and the lower door 14b corresponds to a low light diffusion, which allows the reflection by means of the mirror 42 of an higher amount of light (radiant flux) towards the reflector 43. Said reflector 43 is positioned inside the latch 30 and has the function to reflect incident light back to the mirror 42 only when the safety mechanism 22 is engaged, i.e. correctly aligned with the rest of the optical circuit. On the way back, light reflected by the mirror 42 is driven towards the beam splitter 41 and finally is collected by the photodetector 39.

[0068] In the configuration shown in figure 9, the latch 30 is rotated of an angle which does not allow to the safety mechanism 22 to be engaged. In this condition, the reflector 43 on the latch 30 is not interfacing with the mirror 42 on the lower door 14b and no LED light can be collected by the photodetector 39.

[0069] In the configuration shown in figure 10, the lower door 14b is missing and the optical circuit is open, so no signal is read by the photodetector 39.

[0070] In a variant, not shown, of the embodiment of figures 8, 9, 10, the source of light 38 is an UV (ultraviolet) LED and the reflector 43 on the latch 30 is made of fluorescent material. The fluorescent material absorbs photons form the UV light spectrum and emits in the visible spectrum. This visible wavelength is then captured by the photodetector 39. This solution ensures that the signal detected by the photodetector 39 is generated by the target reflector 43 located on the latch 30 and is not the consequence of an unwanted reflection occurred along the light path.

[0071] In the different embodiment of Figures 11 and 12, the sensing circuit is an RFID circuit.

[0072] Radio Frequency Identification (RFID) is a tech-

nology that uses radio waves to automatically identify objects without any contact. The most common method of identification is to store a unique serial number that identifies an object on a microchip that is attached to an antenna. The combined antenna and microchip are called "RFID transponder" or "RFID tag" and work in combination with an "RFID reader". The reader's antenna is used to transmit radio frequency energy which is collected by the tag's antenna and used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader. The reader receives the modulated waves and converts them into digital data.

[0073] Referring to figure 11, a RFID reader chip 100 is located inside the tub T and it is connected to the control unit. Radio waves emitted by the reader's antenna 101 are collected by the RFID tag 102 positioned on the drum lower door 14b. The RFID tag 102 includes a circuit switch 103, such as a tactile switch, which interfaces with the latch 30 of the safety mechanism 22. The latch 30 is an actuator acting on the tactile switch 103.

[0074] When the drum doors 14a, 14b are correctly closed and the safety mechanism 22 is engaged, the latch 30 is pressing against the RFID tag 102, thus closing the tag switch 103. Once the tag switch 103 is closed, then the tag circuit composed by the tag's antenna 105 and the tag's chip 104 is closed: the energy from the RFID reader 100 is converted by the tag's antenna 105 into electricity that can power up the microchip in the tag 104. The tag 104 is then able to send back the stored information by modulating the reader's electromagnetic waves.

[0075] In the configuration depicted in figure 12, the safety mechanism 22 is not engaged and the tag switch 103 is not activated by the latch 30. In this condition, the tag's circuit is open and radio waves from tag reader 100 can not be processed and sent back to the reader 100.

[0076] As an alternative solution to the tag switch 103, the tag's circuit can be interrupted by a magnetic switch sensor (such as a hall sensor) driven by the rotation movement of a magnet embedded inside the latch 30.

[0077] The top-loading washing machine with a safety mechanism described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea. It is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements.

[0078] It can therefore be easily understood that the present invention is not limited to the above-described top-loading washing machine but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. A top-loading washing and/or drying machine with a safety mechanism comprising:

   a cabinet (C);
   a drum (10) rotatably mounted within said cabinet (C) about a horizontal axis and having an aperture (12) on its cylindrical side;
   at least a drum door (14a, 14b) supported by the drum (10) for opening and closing said aperture (12);
   a safety mechanism (22) supported by the drum (10) and/or by said at least a door (14a, 14b) and configured to selectively lock and unlock said at least a door (14a, 14b);
   a control unit;
   a sensing device configured to sense a relative position of said at least a door (14a, 14b) with respect to at least the safety mechanism (22);
   wherein the sensing device is operatively connected to the control unit to provide a signal indicating a correct closed configuration of said at least a door (14a, 14b).

2. The machine of claim 1, wherein the sensing device comprises a first element mounted on the drum (10) or on said at least a door (14a, 14b), a second element part of the safety mechanism (22), wherein the first element and the second element creates a sensing circuit, wherein the sensing circuit is closed and the control unit receives said signal when said least a door (14a, 14b) is in the correct closed configuration.

3. The machine of claim 2, wherein the sensing device further comprises a third element connected to the cabinet (C), wherein the third element forms part of the sensing circuit together with the first element and the second element, wherein the sensing circuit is closed and the control unit receives said signal when the drum (10) is in a predefined position.

4. The machine of claim 3, wherein the third element is mounted on a tub (C) surrounding the drum (10), optionally on an actuation device (34) mounted on the tub (T).

5. The machine of claim 2, 3 or 4, wherein the sensing circuit comprises a signal source (32; 38; 100), a transmitting means (33; 42, 43) and a receiver sensor (36; 39; 102).

6. The machine of claim 3, 4 or 5, wherein the sensing circuit is a magnetic circuit, wherein one among the first, second and third element comprises a magnet (32), one among the first, second and third element comprises a ferromagnetic body (33), one among

the first, second and third element comprises a magnetic sensor (36) connected to the control unit.

7. The machine of claim 6, wherein the magnetic sensor (36) is connected to the cabinet (C), wherein the ferromagnetic body (33) is mounted on said at least a door (14a, 14b) or on the drum (10), wherein the magnet (36) is mounted on the safety mechanism (22).

8. The machine of claim 3, 4 or 5, wherein the sensing circuit is an optical circuit, wherein one among the first, second and third element comprises a source of light (38) and a photodetector (39) connected to the control unit, one among the first, second and third element comprises an optical element (42), one among the first, second and third element comprises another optical element (43).

9. The machine of claim 8, wherein the source of light (38) and the photodetector (39) are connected to the cabinet (C), wherein the optical element (42) is mounted on said at least a door (14a, 14b) or on the drum (10), wherein the other optical (43) is mounted on the safety mechanism (22).

10. The machine of claim 3, 4 or 5, wherein the sensing circuit is an RFID circuit, wherein one among the first, second and third element comprises an RFID chip (100) connected to the control unit, one among the first, second and third element comprises an RFID tag (102) with a switch (103), one among the first, second and third element comprises an actuator configured to act on the switch (103).

11. The machine of claim 10, wherein the switch (103) is a tactile switch and the actuator is configured to press said tactile switch (103).

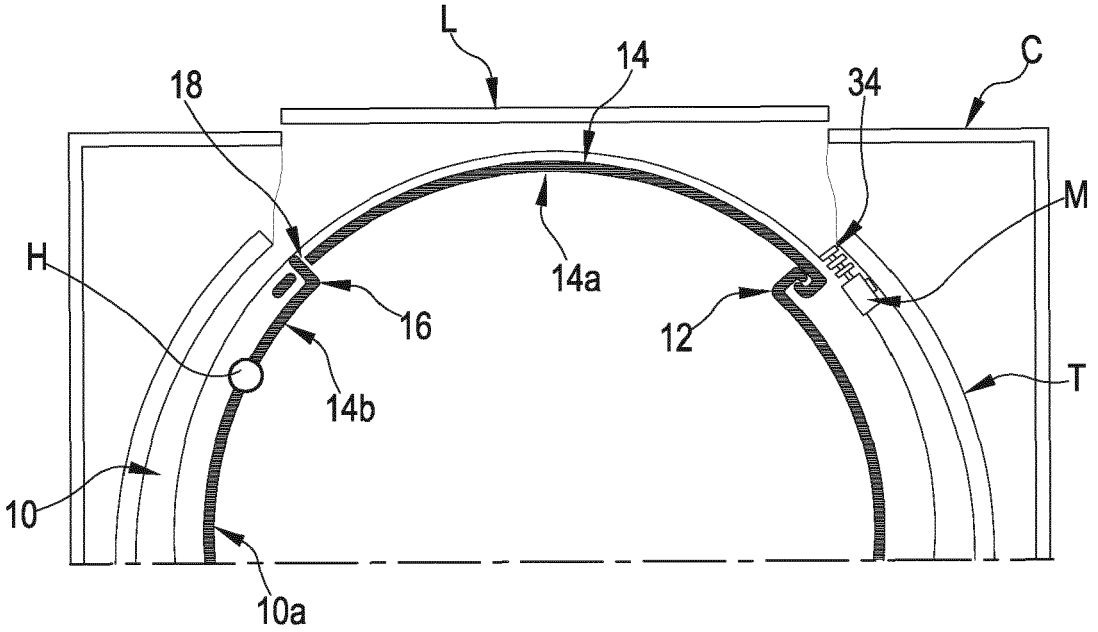
12. The machine of claim 10, wherein the switch (103) is a magnetic switch sensor and the actuator comprises a magnet.

13. The machine of any of claims 10 to 12, wherein the RFID chip (100) is connected to the cabinet (C), wherein the RFID tag (102) is mounted on said at least a door (14a, 14b) or on the drum (10), wherein the actuator is mounted on the safety mechanism (22).

14. The machine of any of the preceding claims, wherein the safety mechanism (22) comprise a latch (30) pivoted to said at least one door (14a, 14b) or to the drum (10); wherein said latch (30) is rotatable between an engaged position, in which the latch (30) locks said at least one door (14a, 14b) to the drum (10) or one door (14a, 14b) to another door (14a, 14b), and a disengaged position, in which said at least one door (14a, 14b) is spaced form the drum (10) or one door (14a, 14b) is spaced form the other door (14a, 14b).

15. The machine of claim 14 when depending on any of claims from 2 to 13, wherein the second element is mounted on or is part of the latch (30).

FIG.1


L
14
C
18
34
M
H
14a
16
12
14b
T
10
10a

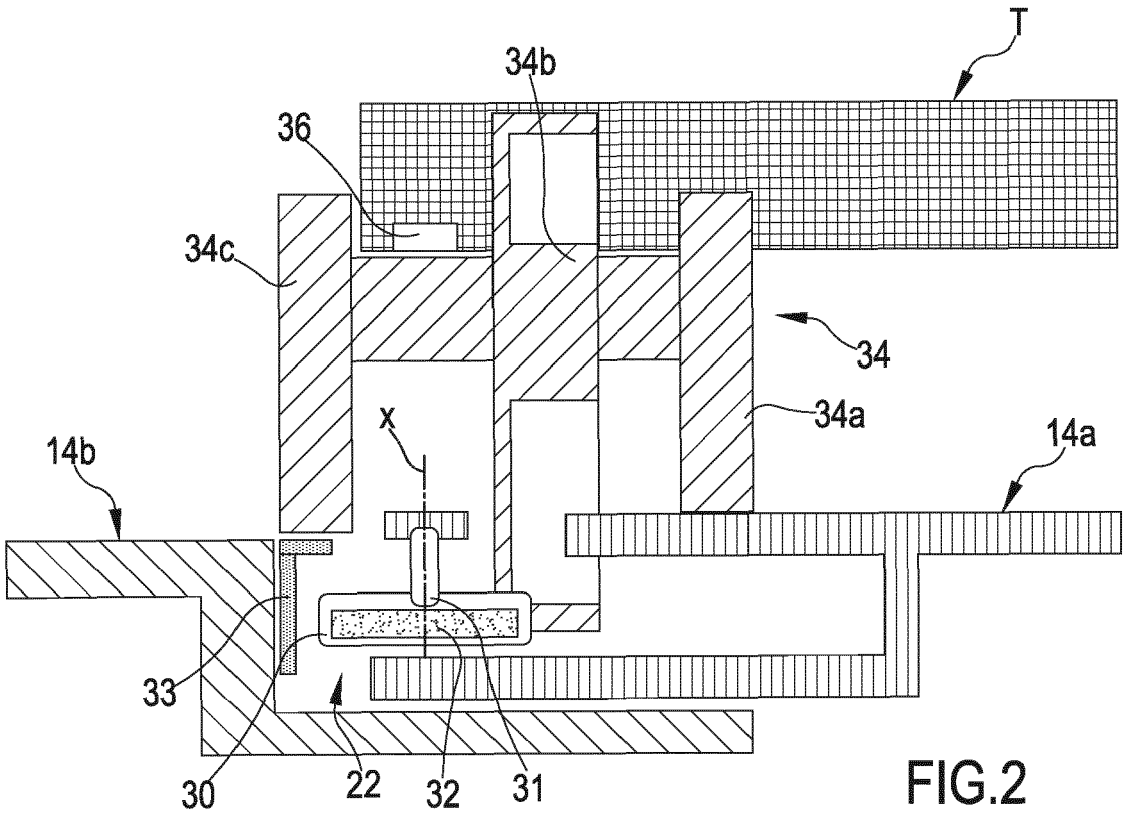

T
34b
36
34c
34
34a
14a
14b
X
33
30
22
32
31

FIG.2

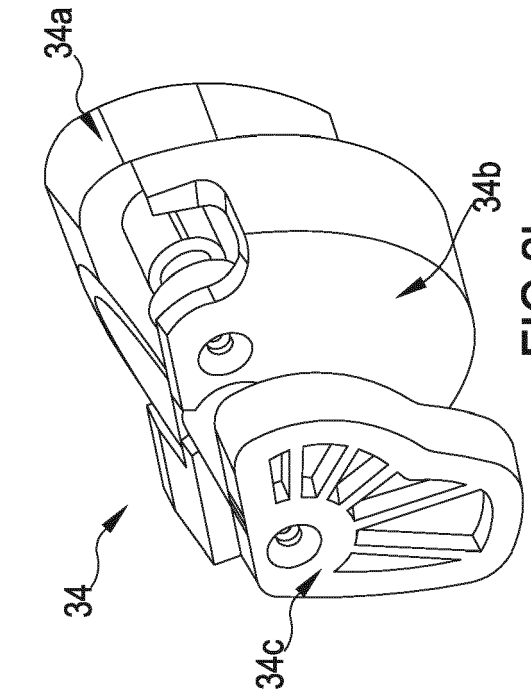


FIG.2b

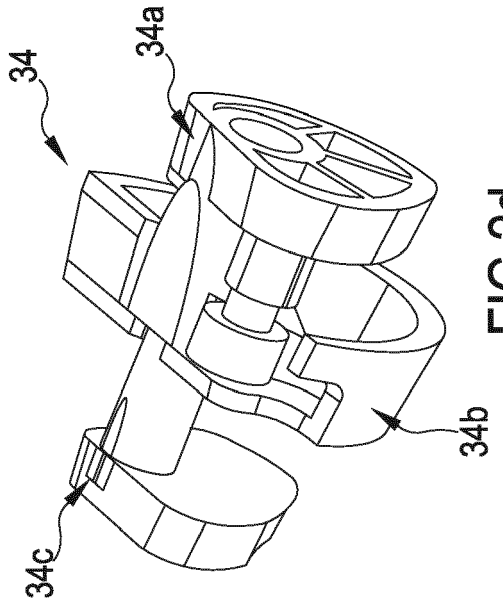


FIG.2d

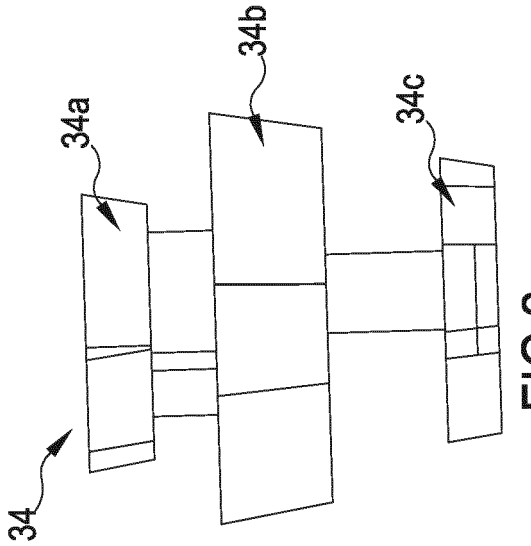


FIG.2a

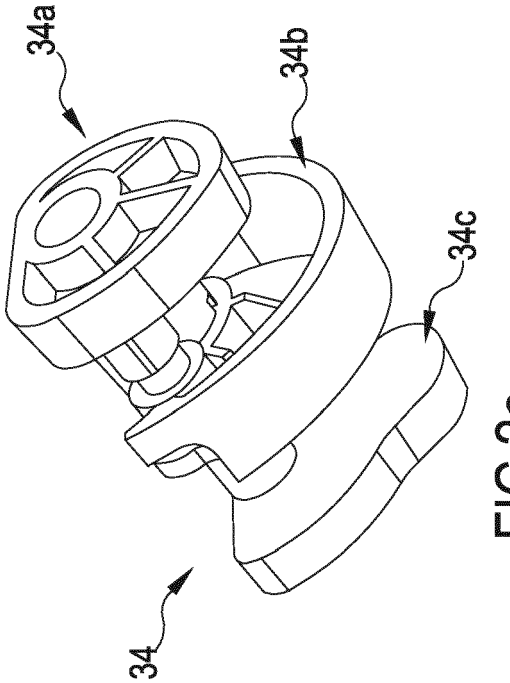
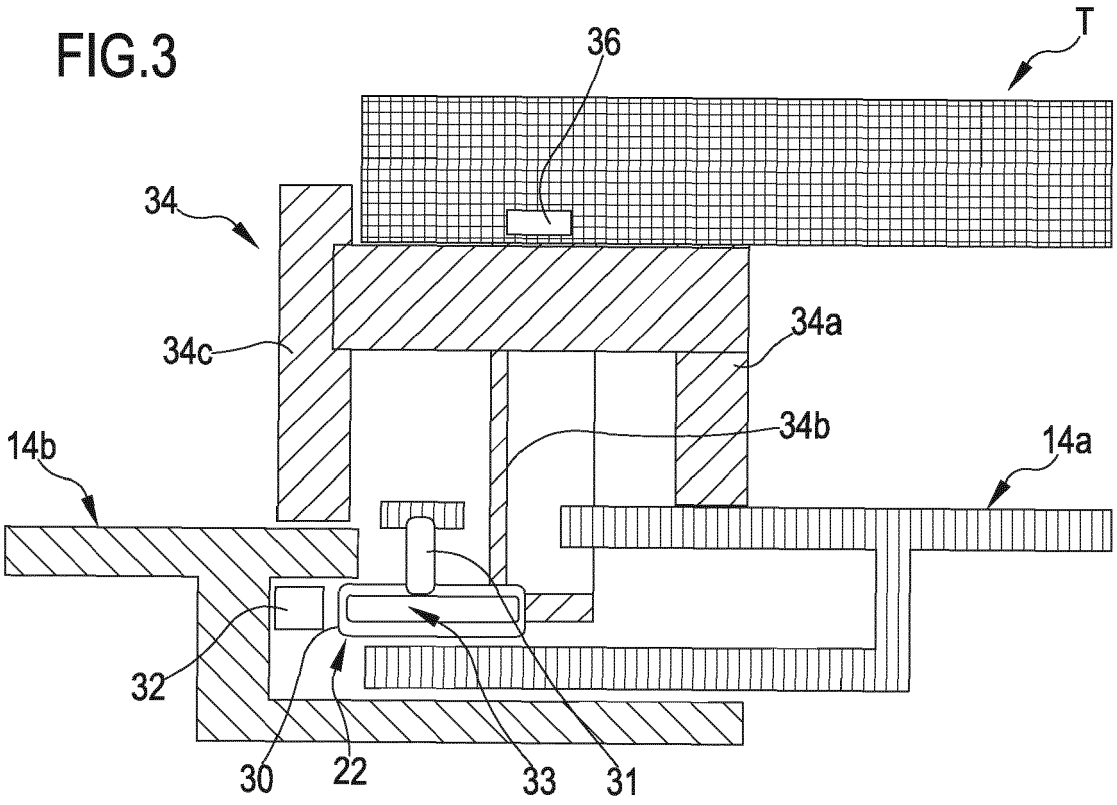


FIG.2c

FIG.3


T
36
34
34c
34a
34b
14b
14a
32
30
22
33
31

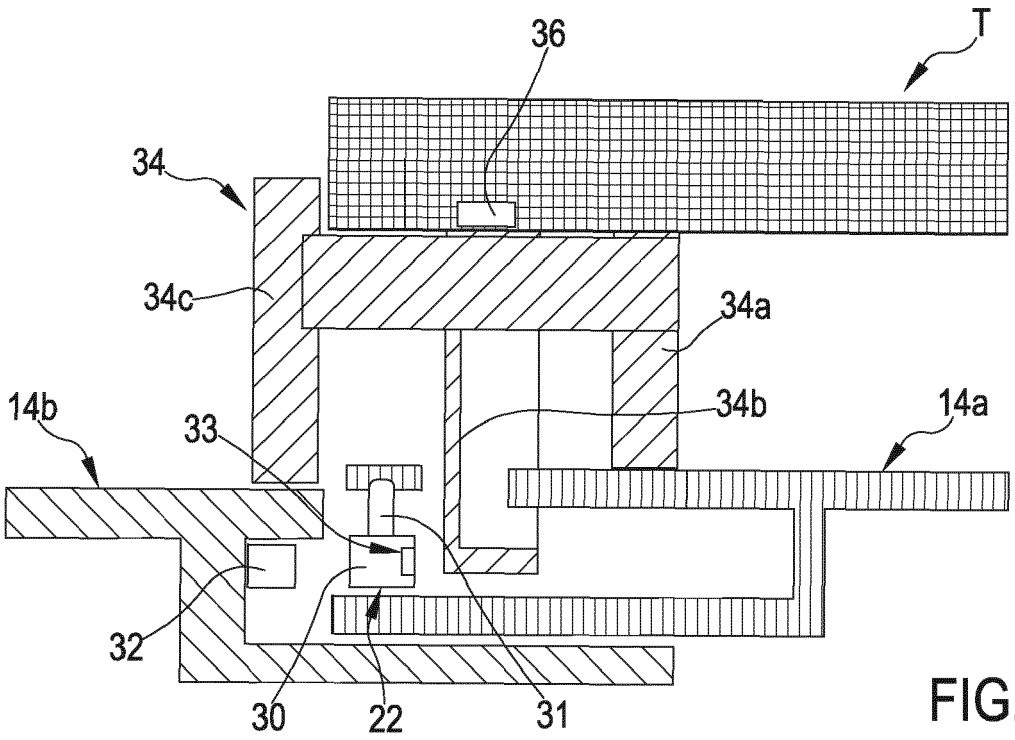

T
36
34
34c
34a
34b
14b
14a
33
32
30
22
31

FIG.4

FIG.5

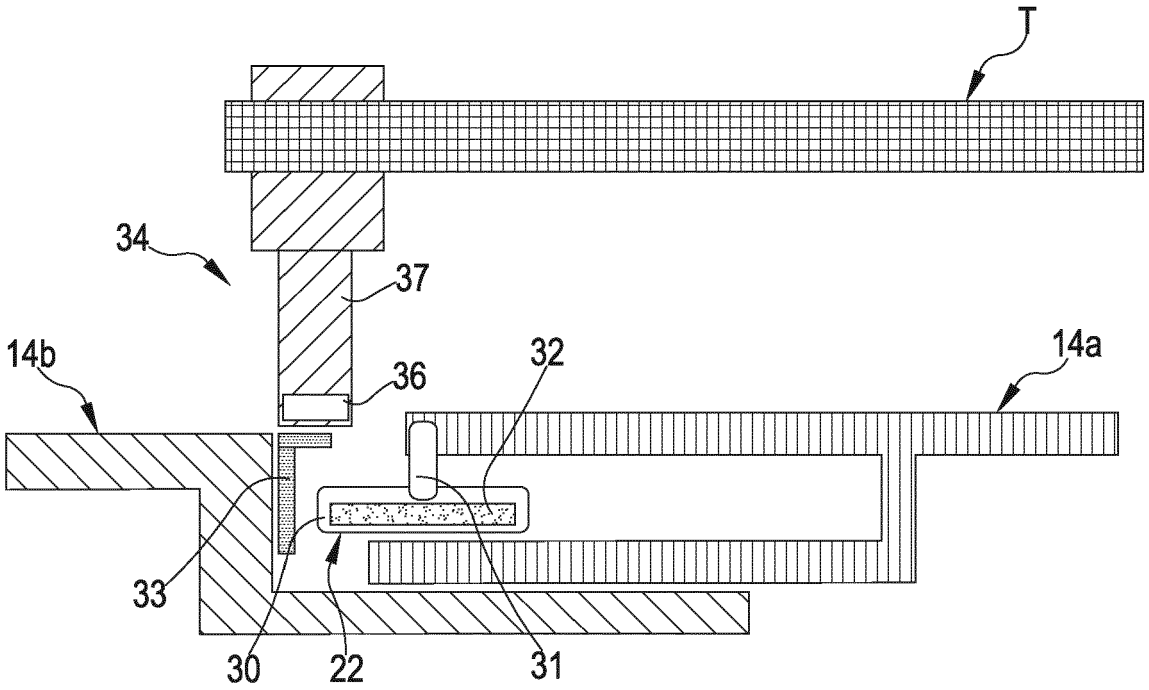


FIG.6

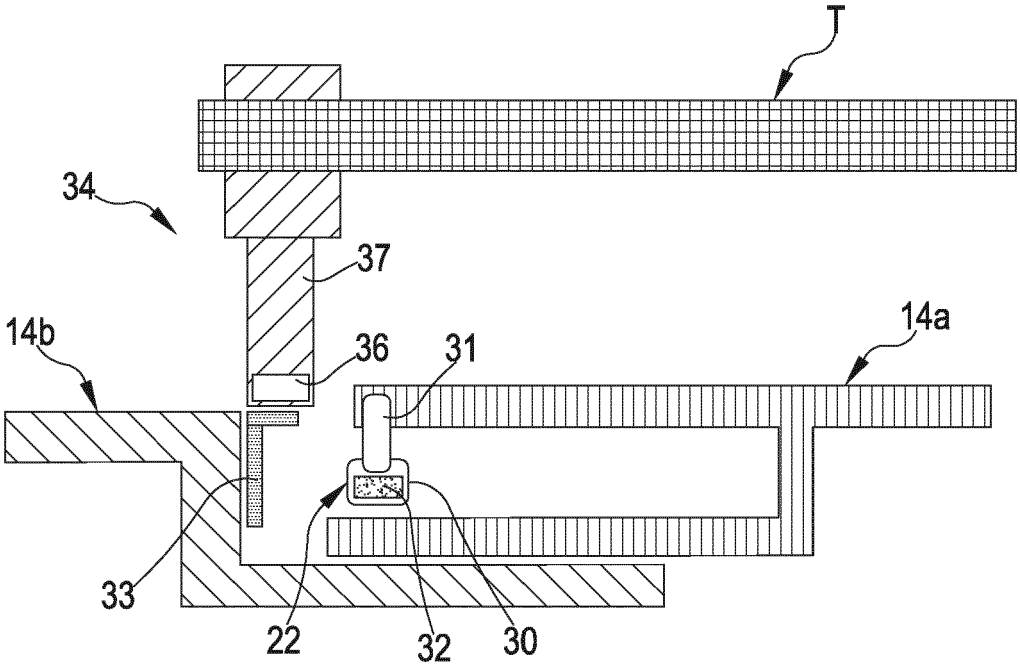


FIG.7

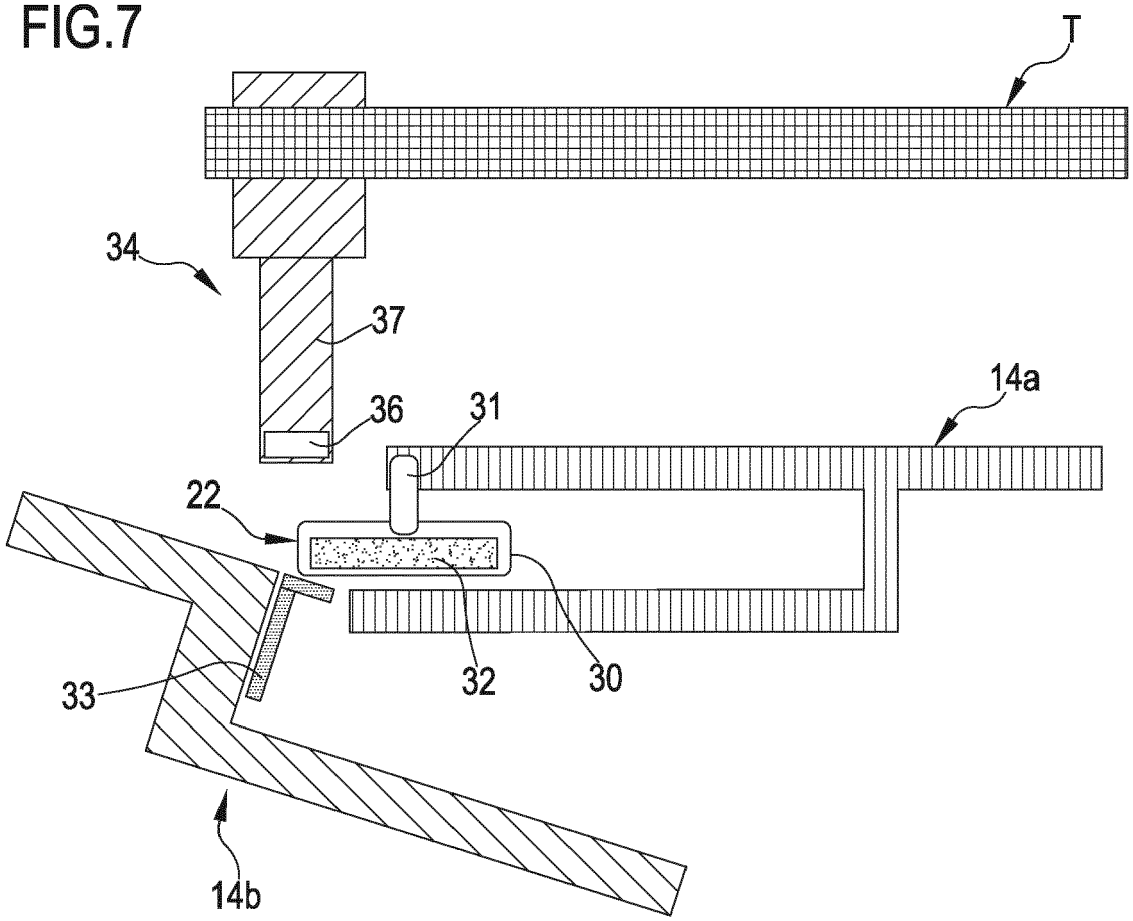

T
34
37
14a
36
31
22
32
30
33
14b

FIG.8

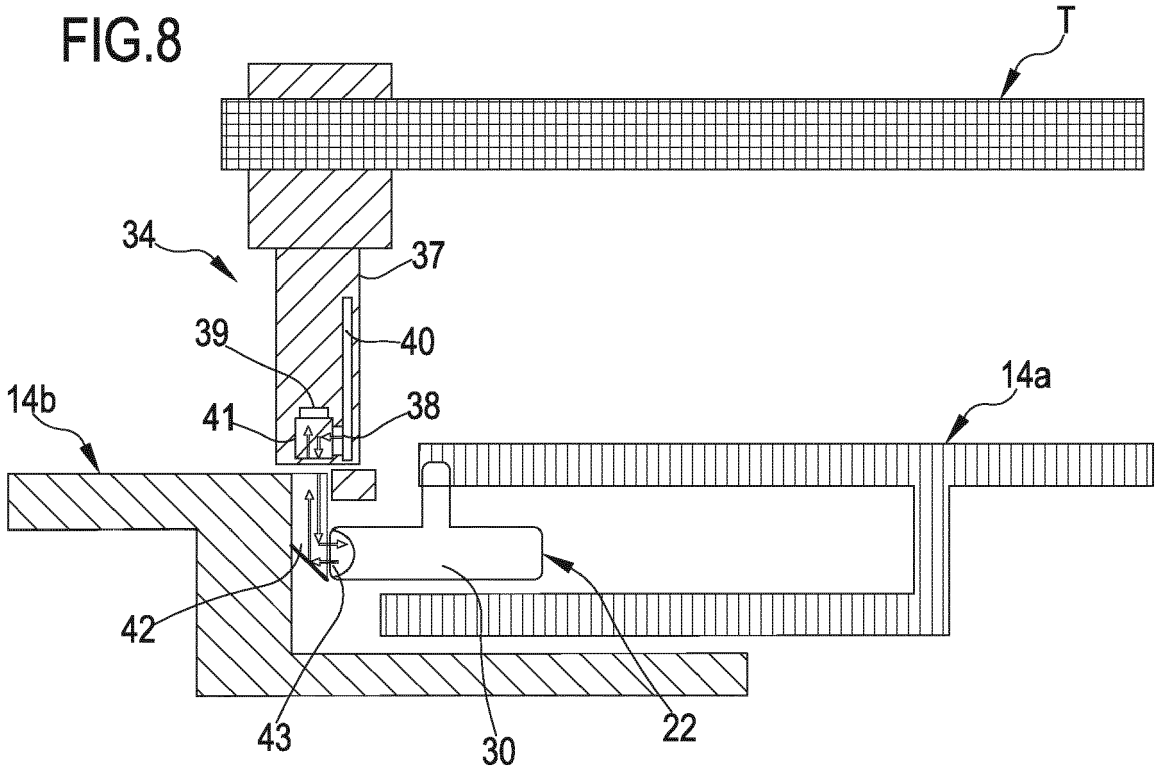
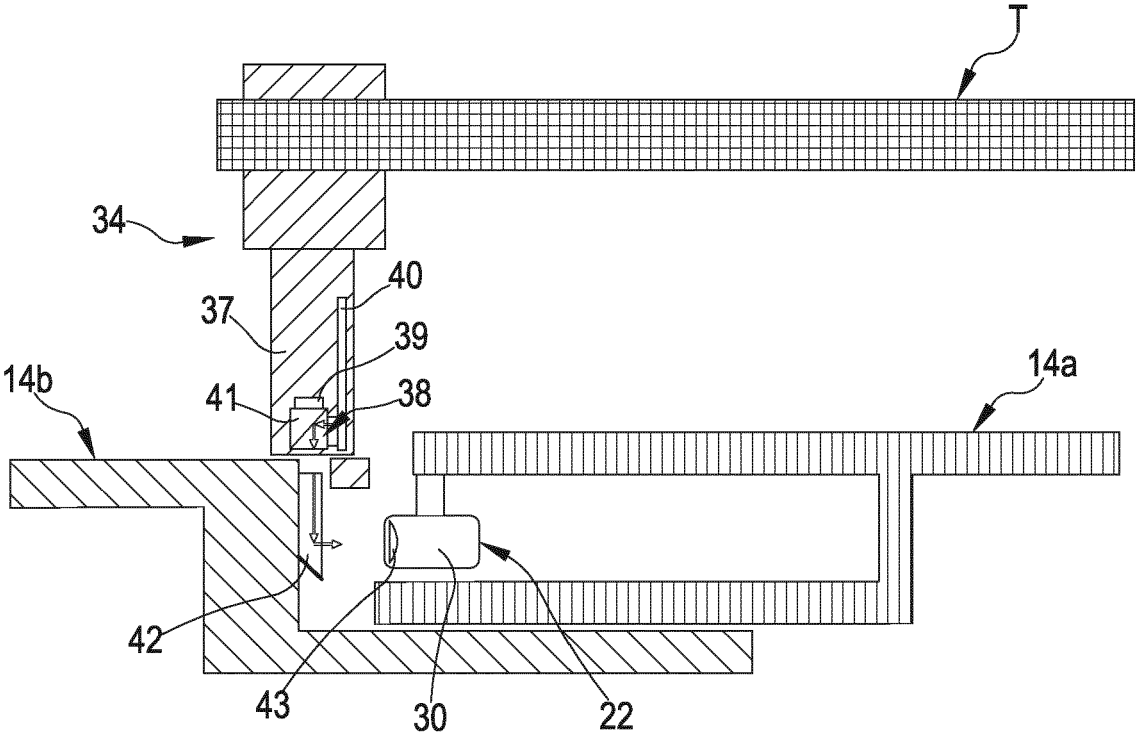

T
34
37
39
40
14a
14b
41
38
42
43
30
22

FIG.9



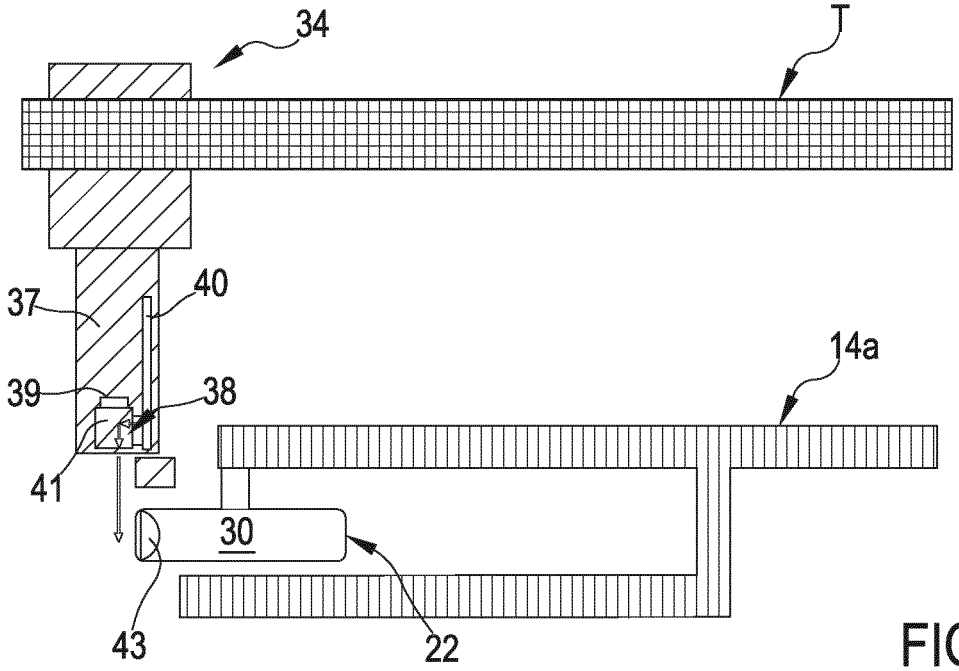
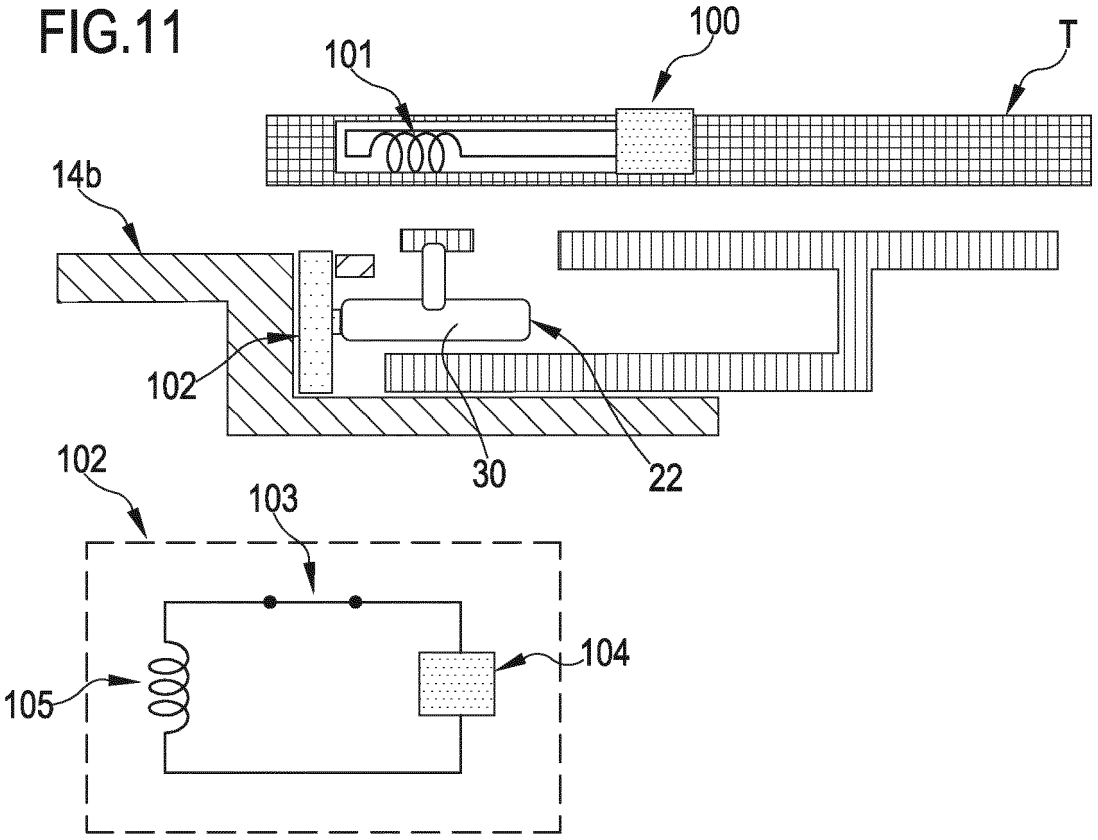


FIG.10

FIG.11


101
100
T
14b
102
30
22
102
103
104
105

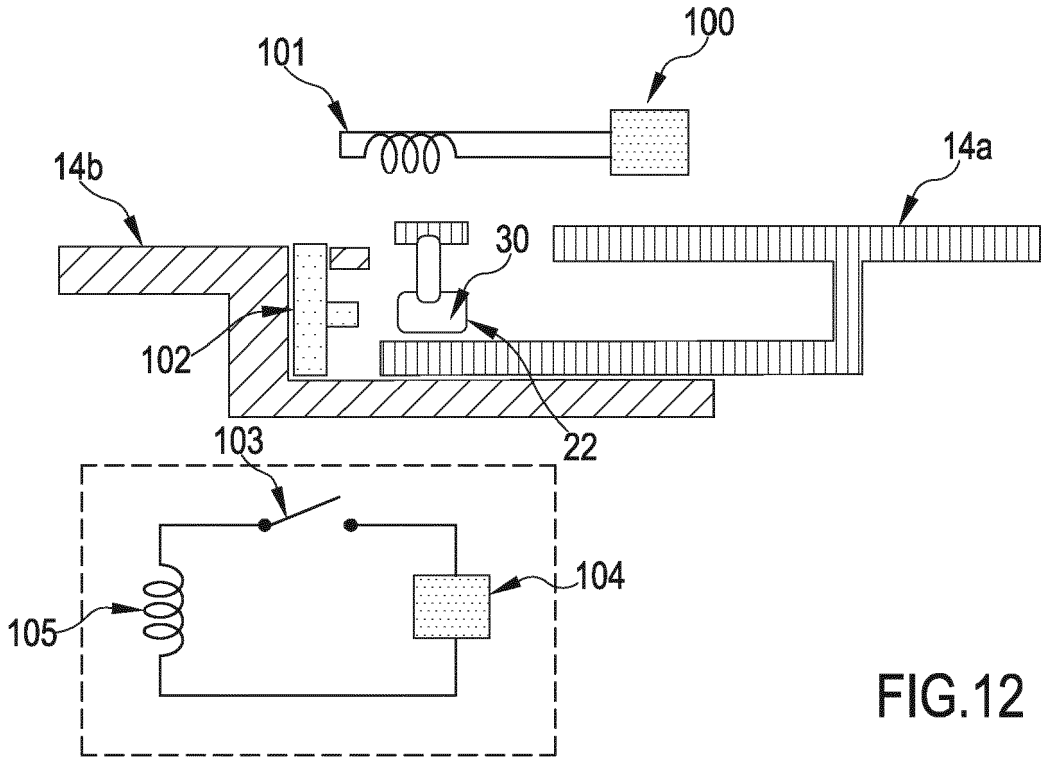

101
100
14a
14b
30
102
22
103
104
105

FIG.12

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 3599

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 A	CZ 28 601 U1 (ALLIANCE LAUNDRY CE S R O [CZ]) 16 September 2015 (2015-09-16) * page 1, line 1 - page 3, line 30 * * figures 1-4 *	1-7,14, 15 8-13	INV. D06F37/28 D06F37/10 ADD.
X,D	EP 1 992 728 A2 (INDESIT CO SPA [IT]) 19 November 2008 (2008-11-19) * figures 1, 2 * * paragraph [0016] - paragraph [0026] *	1-6	D06F25/00 D06F37/42 D06F58/02
X	EP 2 184 392 A1 (DANUBE INTERNAT [FR]) 12 May 2010 (2010-05-12) * paragraph [0003] - paragraph [0019] * * figures 1-8 *	1-5	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 December 2016	Bermejo, Marco

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12-12-2016

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- EP 1992728 A **[0003] [0005] [0006]**