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(54) WASHING MACHINE DOOR LOCKING AND SEALING MECHANISM

(57) A washing machine (1) comprising a washing drum (2) for holding clothes while the clothes are being washed, and a locking door (3) for allowing access through an opening (4) in a cabinet wall (5) of the washing machine (1) to inside of the washing drum (2) for putting or taking out the clothes, wherein the locking door (3) of the washing machine (1) comprising a tubular air bagel (6) having a perimeter and is affixed to the locking door (1) on a side (19) facing the washing drum (2), such that when the locking door (3) is closed and the tubular air bagel (6) is expanded to be in an expanded position (7), the tubular air bagel (6) compresses the locking door (3) and the cabinet wall (5) of the washing machine (1) for locking the washing machine (1), and when the tubular air bagel (6) compresses to be in a normal position (8), the washing machine (1) is unlocked.

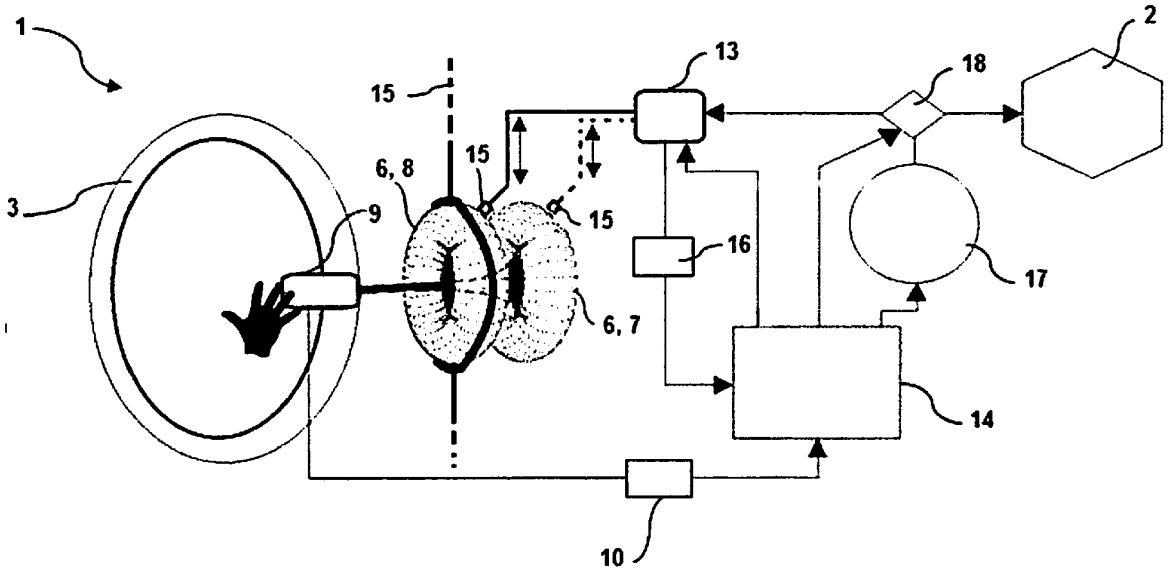

Fig. 3

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Description

[0001] This invention refers to a washing machine according to claim 1, which provides an efficient and long-lasting door locking and sealing mechanism.

Background of the Invention

[0002] Generally, most of the washing machine models include a mechanical door switch for effectuating closing and opening of the door of the washing machine. When the door is closed or opened, a mechanical switch is contacted or non-contacted and a microcontroller can sense the door state for allowing further usage of the washing machine accordingly. Also, frame of the door contains a plastic, circular shape material, i.e., a gasket for preventing water leakage when the machine is performing the washing function. These types of washing machine cause two problems separately. First one is that the mechanical switch can cause electrical arc while opening or closing, and can be damaged in the course of time due to the mechanical friction. The second problem is with respect to the gasket of the frame of the door plastic. This gasket sticks with the help of vacuum to the cabin wall of the washing machine and prevents the liquid to leak. This gasket is damaged in the course of time due to regular opening and closing of the door for using the washing machine. These two parts of the washing machine door are weak parts.

[0003] Chinese Patent No. CN2639340 discloses a single-row airbag bidirectional inclined type of a washing machine, which comprises a washing machine main body, a washing machine base located under the main body of the washing machine, a damping airbag arranged between the washing machine main body and the washing machine base, characterized in that the outer cylinder of the washing machine main body, the front cover of the main body of the washing machine is also tapered with the outer cylinder of the tapered outlet; an inflatable sealing device is arranged in the door of the washing machine; the base of the washing machine is composed of the lower base and the inclined base; and a tilting base is arranged between the base and the inclined base, which comprises a single row of inclined airbags arranged on the left and right sides, the lower end hinged to the front and rear sides of the lower base and the upper and the rear ends are hinged with the inclined base, hook hinge front and rear cylinder.

[0004] UK Patent Application No. GB890947 discloses a washing and spin-drying machine having a perforated drum, has a latch-bolt on the frame door kept in the locked position by fluid under pressure. The source of fluid pressure is coupled with the latch bolt and is opened up only when the bolt is in door-holding position and when a control member is in position to energize the drum-rotation means.

[0005] Chinese Patent Publication No. CN201586655 discloses a hopper cleaning machine equipped with an inflatable sealing device, which comprises a machine body, a door body, and a lock and a sealing device which are arranged between the machine body and the door body. The machine body and the door body are connected via a hinge, and the lock is formed by a lock handle and a locking piece. The machine is mainly characterized in that the door body is formed by wrapping stainless steel plates on the outside of a door body frame, and a machine body frame is arranged on the periphery of a door of the machine body; a sealing groove is manufactured on the outer side of the periphery of the door body frame, an inflatable sealing ring is mounted inside the sealing groove, and a sealing working face of the inflatable sealing ring is in a large arc inwardly concave shape in natural state; and an inflation switch is mounted on the machine body frame. The inflatable sealing ring is inflated by an air source in sealed state, the sealing working face of the inflatable sealing ring projects towards the machine body frame direction and realizes sealing with the same without adding pressure on the lock, the lock has the advantages of being light and convenient in opening, fine in sealing performance and the like, and the machine is suitable in pharmaceutical container washing equipment.

Object of the Invention

[0006] It is therefore the object of the present invention to overcome shortcomings of the known washing machines due to mechanical door lock and gasket of the door frame, and to provide an efficient and long lasting locking and sealing mechanism for a washing machine door.

Description of the Invention

[0007] The before mentioned object is solved by a washing machine according to claim 1.

[0008] A washing machine comprising a washing drum for holding clothes while the clothes are being washed, and a locking door for allowing access through an opening in a cabinet wall of the washing machine to inside of the washing drum for putting or taking out the clothes, wherein the locking door of the washing machine comprising a tubular air bagel having a perimeter and is affixed to the locking door on a side facing the washing drum, such that when the locking door is closed and the tubular air bagel is expanded to be in an expanded position, the tubular air bagel compresses the locking door and the cabinet wall of the washing machine for locking the washing machine, and when the tubular air bagel compresses to be in a normal not expanded position, the washing machine is unlocked.

[0009] This provides a mechanism for locking the locking door of the washing machine due to the pressure exerted by the tubular air bagel onto the cabinet wall after being in expanded position. Additionally, in the expanded position, the tubular air bagel does not leave any space for water to seep out of the opening via the locking door.

[0010] Further preferred embodiments are subject-matter of dependent claims and/or of the following specification parts.

[0011] According to a preferred embodiment of the washing machine, the washing machine comprises a user input device adapted to provide an input for locking or unlocking the locking door of the washing machine, and based on the input the tubular air bagel is adapted to move into the expanded position to normal position, and vice-versa.

[0012] This embodiment is beneficial as it provides an automatic and regulated mechanism for locking and unlocking the lockjing door by the usage of the user input device.

[0013] According to a further embodiment of the washing machine, the user input device is a touch sense device or a gesture recognition device, and is adapted to receive the input based on a specific finger movement onto the touch sense device or recognized by the gesture recognition device.

[0014] This embodiment is helpful, as it provides an user friendly mechanism for locking and unlocking the locking door.

[0015] According to another embodiment of the invention, the specific finger movement for locking the locking door is a movement of thumb along with at least one of the fingers of one hand together at same time in same direction representative of pushing the locking door.

[0016] This embodiment is beneficial, as it makes usage of the user input device easier and simple, which requires less effort for learning the functionality provided by the user input device.

[0017] According to a further embodiment of the washing machine, the user input device is attached to the locking door at the other side of the locking door which is not facing the washing drum when closed.

[0018] This embodiment is beneficial, as it provides a convenient location for using the user input device.

[0019] According to a preferred embodiment of the washing machine, the tubular air bagel is made of a composite material comprising elastic plastic.

[0020] This embodiment is beneficial, as it provides a suitable material for the tubular air bagel, so that it can be timely inflated or deflated to be in expanded position or the normal not expanded position.

[0021] According to another embodiment of the device, the tubular air bagel is of variable thickness at various parts of the tubular air bagel, in such a way that the thickness of the material shall be lesser at the parts where the tubular air bagel is compressing the locking door against the cabinet wall when being in the expanded position.

[0022] This embodiment is beneficial, as it provides a further efficient mechanism for locking and sealing the locking door.

[0023] According to a further preferred embodiment of the washing machine, the washing machine comprises an air pump for pumping in air into the tubular air bagel for expanding the tubular air bagel into the expanded position or sucks in air from the tubular air bagel to compress from the expanded position to the normal position.

[0024] This embodiment is beneficial, as it provides for easy way for pumping in and pumping out air from the tubular air bagel.

[0025] According to another embodiment of the washing machine, the washing machine comprises a microcontroller adapted to receive the input and to process the input, and to accordingly actuate the air pump for expanding or compressing the tubular air bagel.

[0026] This embodiment is beneficial, as it provides a further automatic and precise mechanism for locking and unlocking of the locking door. Use of microcontroller reduces manual and mechanical intervention in locking and unlocking of the locking door, hence the locking mechanism further becomes error free with less false positives.

[0027] According to a further preferred embodiment of the washing machine, the washing machine comprises an air duct attached to the tubular air bagel and the air moves into and moves out of the tubular air bagel through the air duct when the air duct connects to the air pump, wherein the microcontroller is adapted to receive a feedback from the air pump based on the connection of the air duct to the air pump and raise an alarm if there is a fault in connection between the air duct and the air pump.

[0028] This embodiment is beneficial, as it provides a mechanism to identify, if the air pump is properly connected to the tubular air bagel. If the connection is improper, the microcontroller shall identify it due to the feedback received from air pump, and shall accordingly alarm the user of the washing machine.

[0029] According to another embodiment of the washing machine, the washing machine comprises a motor for providing a driving power, and a switch adapted to switch the driving power either to the air pump for pumping in or out the air with respect to the tubular air bagel or to the washing drum for performing the washing function onto the clothes.

[0030] This embodiment is beneficial, as it provides for a cost-effective way for locking and unlocking the locking door, as this embodiment eliminates requirement for any additional driving source for pumping the air into or out of the tubular air bagel.

[0031] According to a further embodiment of the washing machine, the microcontroller is adapted to trigger the switch to switch the driving power to the air pump when the microcontroller receives the input from the user input device relating to locking or unlocking of the locking door, and to switch the driving power to the washing drum when the locking door is locked.

[0032] This embodiment is beneficial, as it provides an automatic handling of the switch and reduces the requirement for any human intervention for handling the switch to change driving direction of the motor.

[0033] Further benefits, goals and features of the present invention will be described by the following specification of the attached figures, in which components of

the invention are exemplarily illustrated. Components of the devices and method according to the inventions, which match at least essentially with respect to their function, can be marked with the same reference sign, wherein such components do not have to be marked or described in all figures.

[0034] The invention is just exemplarily described with respect to the attached figure in the following.

Brief Description of the Drawings

[0035]

Fig. 1A illustrates a front side of the locking door of the washing machine.

Fig. 1B illustrates a back side of the locking door which shall be facing a washing drum of the washing machine, when a tubular air bagel is in normal position.

Fig. 1C illustrates the back side of the locking door which shall be facing the washing drum of the washing machine, when the tubular air bagel is in expanded position.

Fig. 2A illustrates an intersection of the locking door area of the washing machine, when the tubular air bagel is in expanded position.

Fig. 2B illustrates the intersection of the locking door area of the washing machine, when the tubular air bagel is in normal position.

Fig. 3 illustrates a schematic diagram of the washing machine explaining one of the embodiment of the invention.

Detailed Description of the Drawings

[0036] The present invention focuses on providing a locking mechanism for a door of a washing machine, which eliminates the requirement of traditional mechanical switches, and also provides an efficient sealing mechanism, which eliminates requirement for traditional gasket which is used for sealing the door of the washing machine for any outflow of the water, and any air leak inside a washing drum, when the washing machine is being used for washing the clothes.

[0037] Fig. 1A-1C illustrates a locking door 3 of the washing machine with prominent elements of the locking door 3 used for locking and sealing the locking door 3 when the washing machine 1 is about to be used or being used for washing the clothes.

[0038] Fig. 1A shows a front side of the locking door 3 of the washing machine, which is the other side 20 of the locking door 3 other than the one facing the washing drum. The locking door shown is circular whose central part is made of see-through glass which allows a user to see inside of the washing drum, so that the user can notice the movements of clothes inside the drum. The locking door 3 also includes the user input device 9. The user of the machine can provide an input on the user input device 9 for locking or unlocking of the locking door 3.

[0039] Fig. 1B illustrates a side 19 of the locking door 3 which shall be facing the washing drum of the washing machine, when a tubular air bagel 6 is in normal position 8. The tubular air bagel 6 is having a perimeter and is affixed to the locking door 3 on the side 19 facing the washing drum. The tubular air bagel 6 is affixed around the central see through region, so as to provide view through the see-through glass unrestricted. When the locking door 3 is not expanded, it remains in the normal position 8, which is a resting position of the tubular air bagel 6. An air duct 15 is also provided through which the air can be filled in and compressed out of the tubular air bagel 6.

[0040] Fig. 1C illustrates the side 19 of the locking door which shall be facing the washing drum of the washing machine, when the tubular air bagel 6 is in expanded position 7. When the air is filled into the tubular air bagel 6 through the air duct 15, the tubular air bagel 6 expands to be in expanded position 7. The tubular air bagel 6 compresses the locking door 3 and the cabinet wall of the washing machine for locking the locking door 3, and when the tubular air bagel 6 compresses to be in a normal position 8, the locking door 3 is unlocked.

[0041] FIG 2A-2B explains about expanding of the tubular air bagel 6 to be in expanded and compressed form.

[0042] Fig. 2A illustrates an intersection of the locking door area of the washing machine, when the tubular air bagel 6 is in expanded position. The figure shows the locking door 3 which is closed and locked. The locking door 3 is locking access to an opening 4 of the washing machine, which further provide access to inside of the washing drum. The tubular air bagel 6 is in expanded position 7, and compressing the locking door 3 and a cabinet wall 5 of the washing machine. To provide a strong and efficient locking, the tubular air bagel 6 is of variable thickness at various parts of the tubular air bagel 6, in such a way that the thickness of the material shall be lesser at the parts where the tubular air bagel 6 is compressing the locking door 3 against the cabinet wall 5 when being in the expanded position 7. In an alternate embodiment, the tubular air bagel 6 is of uniform thickness at every part for providing locking and unlocking mechanism for the locking door 3.

[0043] Fig. 2B illustrates the intersection of the locking door area of the washing machine, when the tubular air bagel 6 is in normal position 8. The figure shows the locked door 3 closed, however in the unlocked position. When an input is received on the user input device 9, the tubular air bagel 6 moves from the expanded position to the normal position 8. When the user input device 9 receives input for locking the locking door 3 from a user,

the tubular air bagel 6 expands to the expanded position 7 as in Fig. 2A.

[0044] Fig. 3 illustrates a schematic diagram of the washing machine 1 explaining one of the embodiment of the invention.

[0045] The washing machine 1 includes a washing drum 2 used for washing the clothes. Access to the washing drum 2 is through an opening in a cabinet wall 5 of the washing machine 1. For using the washing machine 1, a locking door 3 of the washing machine 1 should be closed and locked to disallow access to the washing drum 1 when the washing machine is being used. Further, for the purpose of cleanliness and efficiency, the locking door 3 should also be sealed to make it leak proof for air or liquid leak from inside of the washing drum 2 to outside, or vice-versa.

[0046] To help out with the locking and sealing functionality, traditionally used mechanical door switches and gasket of the door is replaced with a tubular air bagel 6. The tubular air bagel 6 has a perimeter and is affixed to the locking door 3 on a side facing the washing drum 2. The perimeter of the tubular air bagel 6 should not restrict see through view of the locking door, and hence the perimeter of the tubular air bagel should be greater than perimeter of the see-through part of the locking door 3. When the locking door 3 is closed and the tubular air bagel 6 is expanded to be in an expanded position 7, the tubular air bagel 6 compresses the locking door 3 and the cabinet wall 5 of the washing machine 1 for locking the locking door 3, and when the tubular air bagel 6 compresses to be in a normal position 8, the locking door 3 is unlocked.

[0047] The washing machine also includes a user input device 9 which receives an input 10 for either locking or unlocking of the locking door 3, and based on the input 10 the tubular air bagel 6 expands into the expanded position 7 from the normal position 8, and compresses to the normal position 8 from the expanded position 7. In one embodiment, the user input device 9 is a touch sense device or a gesture recognition device, and receives the input 10 based on a specific finger movement onto the touch sense device or recognized by the gesture recognition device. In one embodiment, where the specific finger movement for locking the locking door 3 is movement of thumb along with at least one of the fingers of one hand together at same time in same direction representative of pushing the locking door 3.

[0048] The user input device 9 is attached to the locking door 3 at the other side of the locking door 3 which is not facing the washing drum 2 when closed. In an alternate embodiment, the user input device 9 need not be a part of the locking door 3, rather it can be provided at any other part of the washing machine 1, or the user input device 9 can be a remote device which can provide the input 10 remotely through any communication means.

[0049] The tubular air bagel 6 is made of a composite material comprising elastic plastic, and can have variable thickness at different parts of the tubular air bagel 6, as well as uniform thickness at all parts of the tubular air bagel 6. Variable thickness of the tubular air bagel 6, where the thickness is more towards exterior with respect to interior parts of the bagel, provides better pressure exertion onto the locking door 3, which means better locking and sealing of the locking door 3. In an alternate embodiment, the tubular bagel 6 can be of any other material which can efficiently and effectively compress and expands for providing locking and sealing functionality of the locking door 3.

[0050] The washing machine 1 also includes an air pump 13 for pumping in air into the tubular air bagel 6 for expanding the tubular air bagel 6 into the expanded position 7 or sucks in air from the tubular air bagel 6 to compress from the expanded position 7 to the normal position 8. In an alternate embodiment, the air pump 13 need not be provided, rather the expansion and compression of the tubular air bagel 6 can be provided through any other mechanism known in the art.

[0051] The washing machine 1 also includes a microcontroller 14 which receives the input 10 and processes the input 10, and if the input 10 is for locking the locking door 3, the microcontroller 14 actuates the air pump 13 for expanding the tubular air bagel 6, and if the input 10 is for unlocking the locking door 3, the microcontroller 14 actuates the air pump 13 for compressing the tubular air bagel 6 from the expanded position 7 to the normal position 8. In one embodiment, the microcontroller is not required, rather the air pump 13 can be handled manually by a user for expanding or compressing the tubular air bagel 6.

[0052] The washing machine 1 also includes an air duct 15 which is attached to the tubular air bagel 6. When the tubular air bagel 6 is expanded, the air is filled into the tubular air bagel 6 via the air duct, and when the tubular air bagel 6 is to be compressed, the air is moved out of the tubular air bagel 6 via the air duct 15. In one embodiment, the air duct 15 is not required, rather the expansion and compression of the tubular air bagel 6 is carried out with other known technologies in prior art which do not require transition of air into or from the air pump 13. The microcontroller 14 receives a feedback 16 from the air pump 13 based on the connection of the air duct 15 to the air pump 13 and raise an alarm if there is a fault in connection between the air duct 15 and the air pump 13. For this process, in one embodiment, the power consumption or torque of air pump 13 is read from microcontroller 14. If air pump works with lower than nominal torque or power value, the locked door 3 is not locked and air pump pumping is in vain. So, user is warned as door is open, and pumping is stopped. If the locked door 3 is closed by user, power consumption or torque value of the air pump 13 is equal the its nominal values and system can understand the locked door 3 is locked.

[0053] The washing machine 1 further includes a motor 17 for providing a driving power and a switch 18 which switches the driving power either to the air pump 13 for pumping in or out the air with respect to the tubular air

bagel 6 or to the washing drum 2 for performing the washing function onto the clothes. In one embodiment, a separate motor can be provided for the air pump 13, and the motor 17 for the washing function shall purely be used for driving the washing drum 2.

[0054] The microcontroller 14 triggers the switch 18 to switch the driving power to the air pump 13 when the microcontroller 14 receives the input 10 from the user input device 9 relating to locking or unlocking of the locking door 3, and to switch the driving power to the washing drum 2 when the locking door 3 is locked. In an alternate embodiment, the switch 18 can be manually handled, where a user can manually turn the switch 18 to switch the driving force of the motor 17 between the air pump 13 and the washing drum 2.

[0055] Thus, the present invention provides an efficient mechanism for locking the door and making it leak free during the washing function. Also, it removes previous elements being used in washing machine for locking the door which is the mechanical door switch and the gasket for ant-leak functionality, which are prone to mechanical defects. The washing machine 1 of the current disclosure includes a washing drum 2 for holding clothes while the clothes are being washed, and a locking door 3 for allowing access through an opening 4 in a cabinet wall 5 of the washing machine 1 to inside of the washing drum 2 for putting or taking out the clothes, wherein the locking door 3 of the washing machine 1 comprising a tubular air bagel 6 having a perimeter and is affixed to the locking door 3 on a side 19 facing the washing drum 2, such that when the locking door 3 is closed and the tubular air bagel 6 is expanded to be in an expanded position 7, the tubular air bagel 6 compresses the locking door 3 and the cabinet wall 5 of the washing machine 1 for locking the washing machine 1, and when the tubular air bagel 6 compresses to be in a normal position 8, the washing machine 1 is unlocked.

List of reference numbers

[0056]

1 washing machine
2 washing drum
3 locking door
4 opening of the cabinet wall
5 cabinet wall
6 tubular air bagel
7 expanded position
8 normal position
9 user input device
10 input
11 higher thickness part of the tubular air bagel
12 lower thickness part of the tubular air bagel
13 air pump
14 microcontroller
15 air duct
16 feedback
17 motor
18 switch
19 side of the locking door facing the washing drum
20 other side of the locking door

Claims

1. A washing machine (1) comprising a washing drum (2) for holding clothes while the clothes are being washed, and a locking door (3) for allowing access through an opening (4) in a cabinet wall (5) of the washing machine (1) to inside of the washing drum (2) for putting or taking out the clothes, wherein the locking door (3) of the washing machine (1) comprises:

- a tubular air bagel (6) having a perimeter and being affixed to the locking door (3) on a side (19) facing the washing drum (2), such that when the locking door (3) is closed and the tubular air bagel (6) is expanded to be in an expanded position (7), the tubular air bagel (6) compresses the locking door (3) and the cabinet wall (5) of the washing machine (1) for locking the locking door (3), and when the tubular air bagel (6) compresses to be in a normal position (8), the locking door (3) is unlocked.

2. The washing machine (1) according to the claim 1, the washing machine (1) comprises:

- a user input device (9) adapted to provide an input (10) for locking or unlocking the locking door (3) of the washing machine (1), and based on the input (10) the tubular air bagel (6) is adapted to move into the expanded position (7) to normal position (8), and vice-versa.

3. The washing machine (1) according to the claim 2, wherein the user input device (9) is a touch sense device or a gesture recognition device, and is adapted to receive the input (10) based on a specific finger movement onto the touch sense device or recognized by the gesture recognition device.

4. The washing machine (1) according to the claim 3, wherein the specific finger movement for locking the locking door (3) is movement of thumb along with at least one of the fingers of one hand together at same time in same direction representative of pushing the locking door (3).

5. The washing machine according to any of the claims 2 to 4, wherein the user input device (9) is attached to the locking door (3) at the other side (20) of the locking door (3) which is not facing the washing drum (2) when closed.

6. The washing machine (1) according to any of the claims 1 to 5, wherein the tubular air bagel (6) is made of a composite material comprising elastic plastic.

7. The washing machine (1) according to any of the claims 1 to 6, wherein the tubular air bagel (6) is of variable thickness at various parts of the tubular air bagel (6), in such a way that the thickness of the material shall be lesser at the parts where the tubular air bagel (6) is compressing the locking door (3) against the cabinet wall (5) when being in the expanded position (7).

8. The washing machine (1) according to any of the claims 1 to 7 comprising

- an air pump (13) for pumping in air into the tubular air bagel (6) for expanding the tubular air bagel (6) into the expanded position (7) or sucks in air from the tubular air bagel (6) to compress from the expanded position (7) to the normal position (8).

9. The washing machine (1) according to any of the claims 1 to 8 comprising:

- a microcontroller (14) adapted to receive the input (10) and to process the input (10), and to accordingly actuates the air pump (13) for expanding or compressing the tubular air bagel (6).

10. The washing machine (1) according to the claim 9 comprising:

- an air duct (15) attached to the tubular air bagel (6) and the air moves into and moves out of the tubular air bagel (6) through the air duct (15) when the air duct (15) connects to the air pump (13),

wherein the microcontroller (14) is adapted to receive a feedback (16) from the air pump (13) based on the connection of the air duct (15) to the air pump (13) and raise an alarm if there is a fault in connection between the air duct (15) and the air pump (13).

11. The washing machine (1) according to any of the claims 9 or 10 comprising

- a motor (17) for providing a driving power; and
- a switch (18) adapted to switch the driving power either to the air pump (13) for pumping in or out the air with respect to the tubular air bagel (6) or to the washing drum (2) for performing the washing function onto the clothes.

12. The washing machine (1) according to the claim 11, wherein the microcontroller (14) is adapted to trigger the switch (18) to switch the driving power to the air pump (13) when the microcontroller (14) receives the input (10) from the user input device (9) relating to locking or unlocking of the locking door (3), and to switch the driving power to the washing drum (2) when the locking door (3) is locked.

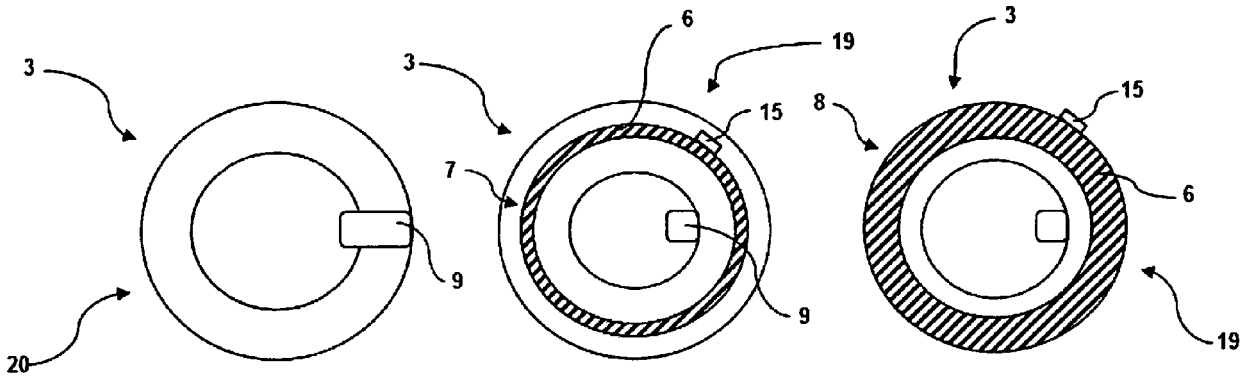

Fig. 1A Fig. 1B Fig. 1 C

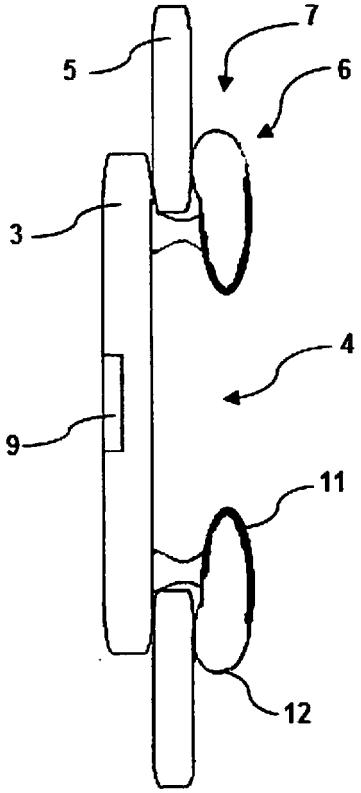

Fig. 2A

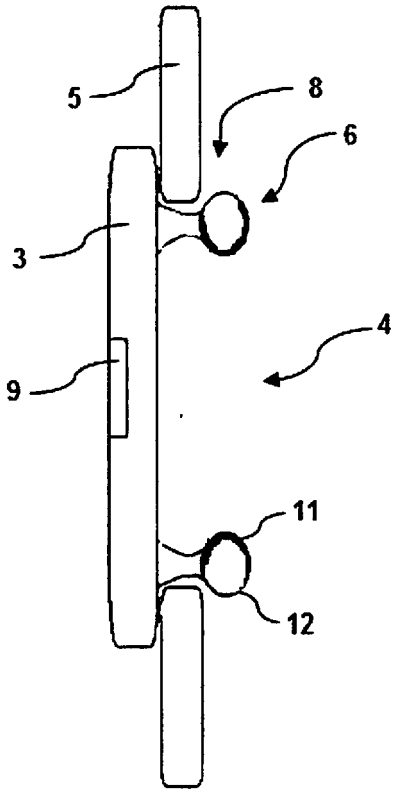

Fig. 2B

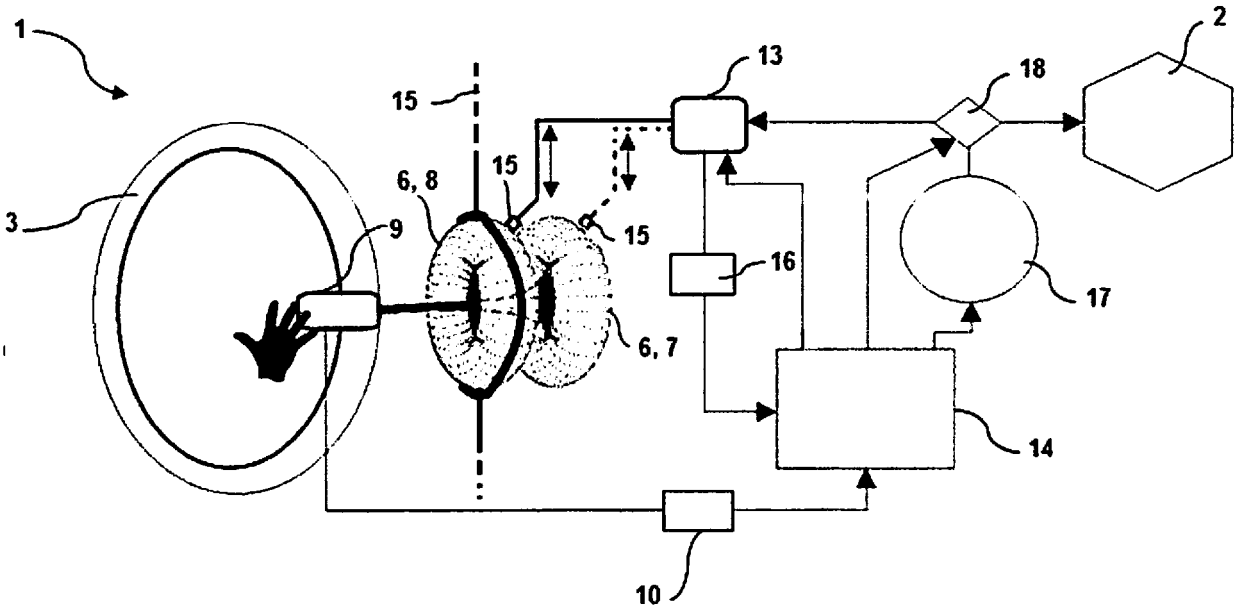

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 0755

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	US 2015/361690 A1 (HINTZ MICHAEL K [US] ET AL) 17 December 2015 (2015-12-17) * paragraphs [0016] - [0042]; figure 1 * -----	1	INV. D06F37/10 D06F37/26 D06F37/28
A	CN 204 403 367 U (TIANJIN TIANBO KEDA SCIENCE & TECHNOLOGY CO LTD) 17 June 2015 (2015-06-17) * figures 1-5 * -----	1,8-10	
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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	5 September 2017	Kising, Axel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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