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(54) **A WASHING AND/OR DRYING MACHINE**

(57) A washing and/or drying machine (102) includes a body portion (104), a drum assembly (106), and a biasing element (124) suspending the drum assembly (106) from the body portion (104). The washing and/or drying machine (102) also includes an arrangement (128)

constructed and arranged to cause an indication to be provided to a user in response to the biasing element (124) stretching beyond a predetermined threshold length.

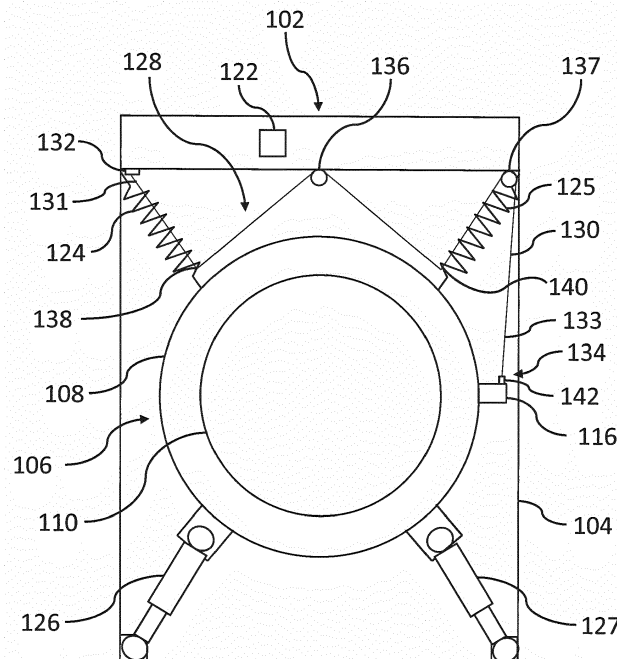


Figure 2

Description

Technical Field

[0001] The present disclosure relates to a washing and/or drying machine.

Background

[0002] Washing machines are used for washing washable items, including garments such as clothes. Typically a user can select a suitable washing cycle via an interface on a front face of the washing machine. The interface usually includes a number of control knobs and/or buttons. A drying machine, also known as a tumble dryer, is operable to dry items such as garments placed therein. Some washing machines have both washing and drying functionality.

Summary

[0003] According to a first aspect disclosed herein, there is provided a washing and/or drying machine comprising: a body portion; a drum assembly; a biasing element suspending the drum assembly from the body portion; an arrangement constructed and arranged to cause an indication to be provided to a user in response to the biasing element stretching beyond a predetermined threshold length.

[0004] The indication may inform the user that the biasing element suspending the drum assembly has failed or stretched beyond an acceptable limit. Failure or excessive stretching of the biasing element can result in imbalance of the drum assembly, which may compromise safety and/or can result in reduced washing performance. The indication provided to the user can prompt the user to have their washing and/or drying machine serviced in order to check whether the biasing element is fit for purpose. A faulty biasing element can then be replaced so that the washing and/or drying machine can return to operating at a high performance level.

[0005] According to an example, the arrangement is constructed and arranged to physically engage the biasing element.

[0006] According to an example, the arrangement comprises one or more wires or one or more cables.

[0007] According to an example, the arrangement comprises one or more pulleys for supporting movement of the one or more wires or the one or more cables.

[0008] According to an example, the one or more pulleys are fixed to the body portion.

[0009] According to an example, a first end of the arrangement is fixed to a first component of the washing and/or drying machine, and a second end of the arrangement is attached to a second component of the washing and/or drying machine.

[0010] According to an example, the first component comprises one of: the body portion; the biasing element;

the drum assembly.

[0011] According to an example, the second component comprises a circuit breaker.

[0012] According to an example, the second component comprises a component of a door of the washing and/or drying machine.

[0013] According to an example, the second component comprises a component of a lock of the door.

[0014] According to an example, the indication comprises disabling locking of the door of the washing and/or drying machine.

[0015] According to an example, the biasing element is a helical spring and the arrangement passes through an interior of the helical spring.

[0016] According to an example, the indication comprises activating an alarm.

[0017] According to an example, the alarm comprises one of more of: an audible alarm; a haptic alarm; a visual alarm.

Brief Description of the Drawings

[0018] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a perspective view of a washing and/or drying machine according to an example;

Figure 2 shows schematically a front cross-sectional view of the washing and/or drying machine shown in Figure 1, in which a biasing element has not failed or stretched beyond an excessive amount; and

Figure 3 shows schematically a front cross-sectional view of the washing machine shown in Figure 2, in which a biasing element has failed or stretched beyond an excessive amount.

Detailed Description

[0019] The present disclosure has applicability to clothes washing machines, drying machines (also known as tumble dryers) and to combination washing and drying machines. These may be termed washing and/or drying machines. For convenience, the term "washing machine" is used below, but the disclosure applies equally to drying machines and to combination washing and drying machines.

[0020] A washing machine drum assembly can become imbalanced during use. This imbalance may cause excessive noise during operation of the washing machine and may result in sub-standard washing of items by the washing machine, or may cause damage to a cabinet or compartment in which the washing machine is located.

[0021] There are a number of different causes of drum

assembly imbalance and modern washing machines are manufactured with mechanisms to try to either prevent drum imbalance, or mitigate its effect. For example, the drum assembly is typically connected to a body of the washing machine in a way that allows a small degree of damped movement of the drum assembly relative to the body. This is useful if the drum assembly imbalance has been caused by an unbalanced washing load within the drum. However, these mechanisms can fail over time due to, for example, manufacturing defects, wear and tear, or because of the forces applied to the drum when the drum is loaded with a laundry by a user. Therefore, a user may not notice that the drum assembly of their washing machine has become imbalanced.

[0022] Figure 1 schematically shows a washing machine 102 according to an example. The washing machine 102 includes a body portion or chassis 104 and a drum assembly 106. The drum assembly 106 includes a drum housing 108 supporting a drum 110. The drum 110 is arranged to hold one or more garments or items of a washing load to be washed. Washing detergent and/or fabric softener may also be placed directly in to the drum 110. Alternatively washing detergent and/or fabric softener may be placed in to a tray or holder 112 arranged for this purpose. Access to the drum 110 is controlled by a door 114. When the door 114 is in an open position, the drum 110 can be accessed from outside of the washing machine 102. When the door 114 is in a closed position, the drum 110 is inaccessible from outside of the washing machine 102. The door 114 includes a lock 116 so that the door can be locked into its closed position to prevent it from being opened (for example during a washing cycle). A user interface 118 is provided which enables a user to select one or more washing parameters and/or settings. A display 120 is also provided which outputs information to a user of the washing machine 102. For example information displayed on the display 120 may be information regarding options selected via the user interface 118, information regarding a washing cycle in progress such as time remaining etc. In this example, the washing machine 102 also includes a controller 122. The controller 122 includes a memory and a processor. The controller 122 is configured to control operations of the washing machine 102.

[0023] The washing machine 102 also includes a suitable power connection 115 enabling the washing machine 102 to be connected to an electricity supply such as mains electricity, as well as a suitable inlet 117 and outlet 119 for water. These aspects are known per se and, for conciseness, are not discussed further.

[0024] In one example, the washing machine 102 is instead a drying machine (also known as a tumble dryer). In another example, the washing machine 102 is instead a combination washing and drying machine.

[0025] Figure 2 schematically shows an example in which the drum assembly 106 is connected to the body portion 104 by at least one biasing element. In this example, the drum assembly 106 is suspended from the

body portion 104 by two biasing elements, namely first biasing element 124 and second biasing element 125. In another example, a single biasing element 124 may be used. Each biasing element 124, 125 may be a type of mechanical device that can absorb shock, such as a helical spring.

[0026] In the example of Figure 2, one end of the first biasing element 124 is attached to the body portion 104, and the other end of the first biasing element 124 is attached to a part of the drum assembly 106, e.g. to the top of the drum housing 108. This configuration lets the first biasing element 124 dampen movement of the drum assembly 106 relative to the body portion 104 as the drum assembly 106 moves in response to the drum 110 being spun during a spin cycle. In the example of Figure 2, the second biasing element 125 is similarly connected to drum assembly 106.

[0027] The drum assembly 106 may also be held by other types of supports. In this example, the drum assembly 106 is also supported by one or more dampers, in this example a first damper 126 and a second damper 127. In another example, a single damper 126 may be provided.

[0028] In the example of Figure 2, one end of the first damper 126 is attached to the body portion 104, and the other end of the first damper 126 is attached to a part of the drum assembly 106, e.g. to the bottom of the drum housing 108. This configuration lets the first damper 126 dampen movement of the drum assembly 106 relative to the body portion 104 as the drum assembly 106 moves in response to the drum 110 being spun during a spin cycle. In the example of Figure 2, the second damper 127 is similarly connected to drum assembly 106.

[0029] The washing machine 102 includes an example of an arrangement 128 that is constructed and arranged to cause an indication to be provided to a user in response to a biasing element of the washing machine 102 stretching beyond a predetermined threshold length. Stretching beyond a predetermined threshold length may also encompass failure of the biasing element e.g. snapping of the biasing element. In the example of Figure 2 this could be one or more of the first and second biasing elements 124, 125 each stretching beyond a predetermined threshold length. Of course, in an example comprising a single biasing element 124, then this could be the single biasing element 124 stretching beyond a predetermined length. Likewise, where there are three or more biasing elements then this could be any one or more of the three or more biasing elements stretching beyond a predetermined length.

[0030] In the example of Figure 2, the arrangement 128 is constructed and arranged to physically engage with the first and second biasing elements 124, 125. Therefore, movement of the first and second biasing elements 124, 125 may also effect movement of part of the arrangement 128. According to some examples movement of the first and second biasing elements 124, 125 beyond a predetermined amount will effect move-

ment of the arrangement 128.

[0031] The arrangement 128 may include one or more wires or one or more cables. In this example, the arrangement 128 includes a cable 130. In another example, the arrangement 128 may include a plurality of wires or a plurality of cables connected together. In another example, the arrangement 128 may include a plurality of link-

[0032] The cable 130 has a first end 131 and a second end 133. In this example, the first end 131 of the cable 130 is anchored to a first component of the washing machine 102. The first end 131 of the cable 130 may be fixed to any suitable component of the washing machine 102. In this example, the first component is an anchor point 132 provided on the body portion 104. In another example, the first component is a part of the drum assembly 106, e.g. an anchor point provided on the drum housing 108. In a further example, the first component is a biasing element, such as the first biasing element 124 or the second biasing element 125.

[0033] In the example of Figure 2, the second end 133 of the cable 130 is attached to a second component of the washing machine 102. The second component may be a circuit breaker 134. In this example, the second component is a circuit breaker 134 provided in the door lock 116. In another example, the second component may be a different component of the door lock 116. In a further example, the second component may be a different component of the door 114.

[0034] The circuit breaker 134 may include a mechanical part such as a pin or a plug. A voltage can be supplied to the circuit breaker (e.g. 5V). When the pin is physically removed from a corresponding socket, the voltage is no longer sensed and the circuit breaker 134 is triggered.

[0035] In the example of Figure 2, the cable 130 passes through an interior of the first and second biasing elements 124, 125. As one or more of the first and second biasing elements 124, 125 stretches beyond a predetermined length, the cable 130 is engaged or contacted by the extending biasing element 124 and/or 125 and the cable 130 is put under tension.

[0036] In use, the first and second biasing elements 124, 125 extend and contract during use of the washing machine 102 as they damp movement of the drum assembly 106 relative to the body portion 104. Therefore, although in this example the cable 130 is fixed to the anchor point 132 at one end and to the circuit breaker 134 at the other end, the cable 130 has a length that is sufficient to allow the biasing elements 124 to extend and contract normally, within a predetermined threshold range.

[0037] In the example of Figure 2, the arrangement includes one or more pulleys 136, 137 for supporting the cable 130 above the drum assembly 106. The one or more pulleys 136, 137 are provided in order to maintain a sufficient level of tension in the cable 130, for example to prevent the cable 130 from contacting with the drum assembly 106. The one or more pulleys 136, 137 also

facilitate movement of the cable 130 as the first and second biasing elements 124, 125 stretch. In this example, the one or more pulleys 136, 137 are attached to the body portion 104. In this example, a first pulley 136 is attached to the body portion 104 at a position that is the midpoint between the first and second biasing elements 124, 125. In this example, a second pulley 137 is attached to the body portion 103 at a position that is adjacent the second biasing element 125.

[0038] As discussed above, the first and second biasing elements 124, 125 elastically extend and contract during normal use of the washing machine 102. However, over time, a biasing element 124 and/or 125 may deform and stretch beyond its elastic limit due to wear and tear. In this situation the drum assembly 106 will become imbalanced, which may cause excessive noise and can result in reduced washing performance. The arrangement 128 is constructed and arranged to cause an indication to be provided to a user in response to at least one of the biasing elements 124, 125 stretching beyond a predetermined threshold length.

[0039] In Figure 2 both of the biasing elements 124 are being stretched to an extent that is within their operating limit and to a length that is below a predetermined threshold length. An edge 138 of the first biasing element 124 and an edge 140 of the second biasing element 125 are engaged with the cable 130. The cable 130 is also engaged with the first pulley 136 and the second pulley 137. This configuration transfers any force applied to each biasing element 124, which may be caused by the weight of the drum assembly 106, to the cable 130. Since one end of the cable 130 is fixed to the anchor point 132 and the other end of the cable is connected to the circuit breaker 134, the force applied to the cable 130 tensions the cable 130 and pulls it taut. In the example of Figure 2 each of the biasing elements 124, 125 is within their elastic limit, and the arrangement 128 is constructed and arranged such that the cable 130 is therefore not pulled to an extent that the cable 130 breaks the circuit breaker 134. That is, in some examples it may be considered there is still some slack in the cable 130.

[0040] As one (or both) of the biasing elements 124, 125 stretches beyond its normal operating limit, the cable 130 is put under increasing tension due to engagement with the biasing elements 124, 125. When a biasing element stretches beyond a predetermined threshold limit such that it may become deformed, for example due to wear and tear, the increased degree of tension that the cable 130 is put under causes the cable 130 to trigger the circuit breaker 134, as is shown in Figure 3. In this particular example, the circuit breaker 134 is activated by the cable 130 pulling a pin 142 from a hole or socket of the circuit breaker 134.

[0041] When the arrangement 128 is installed into the washing machine 102 (e.g. at a factory), the length of the cable 130 is selected or calibrated so that the tension in the cable 130 does not trigger the circuit breaker 134 under normal operating conditions as the drum 110 spins

within the drum housing 108. For example, the cable 130 may have a degree of flex, which allows for expected movement of the drum assembly 106.

[0042] In response to the circuit breaker 134 being triggered, an indication is provided to a user so that the user knows that one of the biasing elements 124 has stretched beyond its elastic limit and therefore that the drum assembly 106 may be imbalanced.

[0043] In one example, the indication includes activating an alarm for alerting a user. In this example, the washing machine 102 includes an alarm 134. Additionally or alternatively, the washing machine 102 may be communicatively connected to an external alarm, for example over Wi-Fi or via a wired connection. In one example, the alarm 134 may include an audible alarm, such as a buzzer or a siren. In another example, the alarm 134 may include a haptic alarm (e.g. a tactile alarm) such as a vibration motor. In a further example, the alarm 134 may include a visual alarm such as a warning message (e.g. "Imbalance Error") or warning light being displayed on the display 120. In one example, the alarm may include a warning message transmitted over a wireless connection to a user equipment (such as a user's mobile phone) for display on a display of the user equipment. The warning message may be transmitted over a shared Wi-Fi connection. In some examples, the alarm may include two or more of an audible alarm, a haptic alarm and a visual alarm.

[0044] Additionally or alternatively, the indication may include disabling the lock 116 (e.g. preventing locking of lock 116). The door lock 116 may be mechanically or electronically disabled from operating. For example, the door lock 116 may be prevented from locking so that the user cannot lock the door 110 and therefore the user cannot use the washing machine 102. In one example, triggering the circuit breaker 134 physically prevents the door lock 116 from operating. For example, the triggered circuit breaker 134 may block a first component of the door lock 116 (e.g. a catch) in order to stop the first component of the door lock 116 from being able to engage with a second component of the door lock 116 (e.g. a slot).

[0045] In the example of Figure 2, the controller 122 is configured to control the provision of the indication to the user in response to one of the first and second biasing elements 124, 125 being stretched beyond a predetermined threshold length. When the controller 122 receives an input from the circuit breaker 134 indicating that the circuit breaker 134 has been triggered, the controller 122 causes the indication to be output to the user.

[0046] An advantage of the described arrangement is that an indication will be output to a user when a biasing element suspending the drum assembly 106 from the body portion 104 mechanically fails or is no longer fit for proper use. In this situation, the drum assembly 106 may be imbalanced. The indication prompts the user to have the washing machine 102 repaired so that the broken biasing element can be replaced. This means that the washing machine 102 is maintained to continue operat-

ing at a high performance level and ensures that user safety is not compromised.

[0047] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

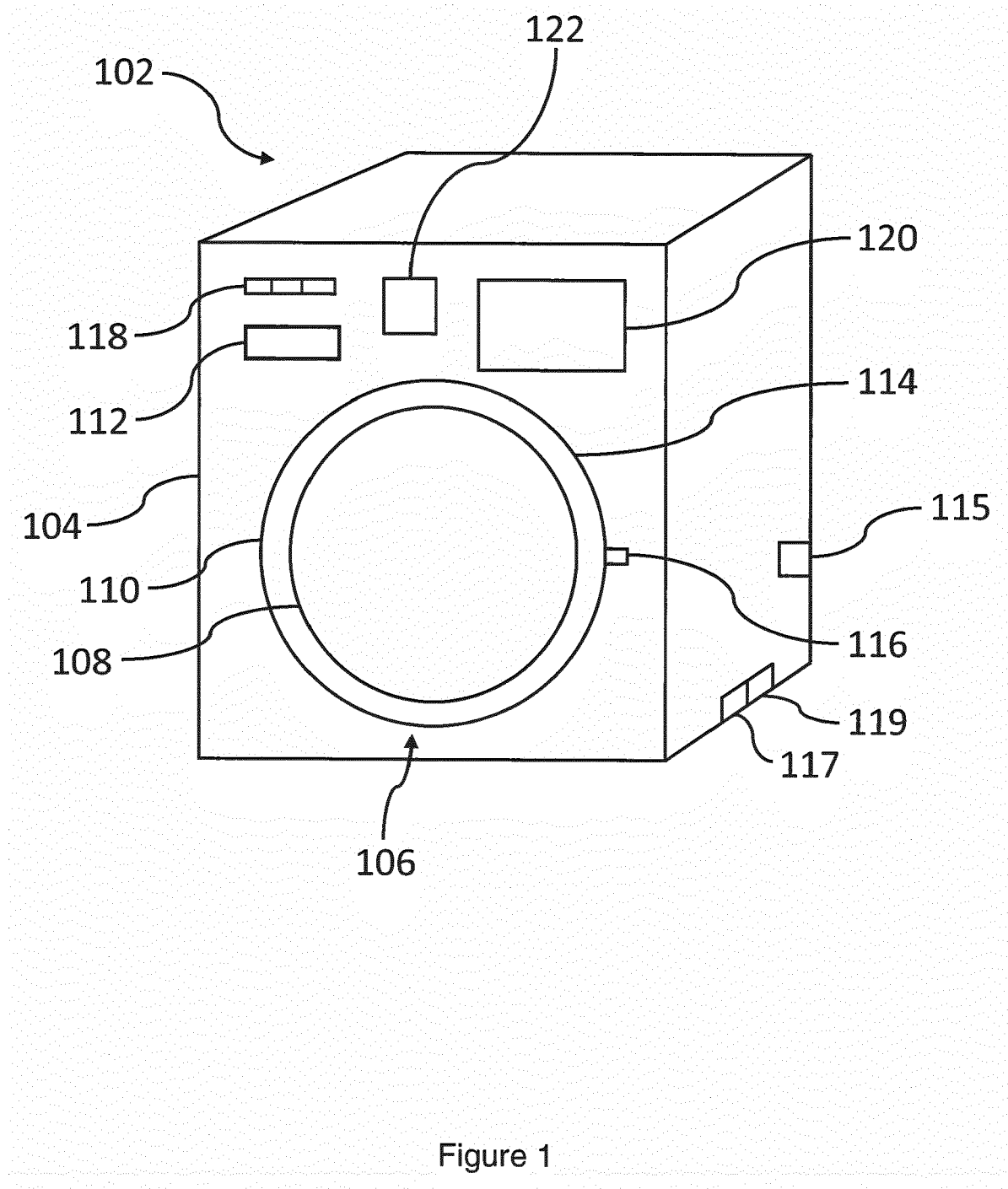
[0048] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0049] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A washing and/or drying machine comprising:

- a body portion;
a drum assembly;
a biasing element suspending the drum assembly from the body portion;
an arrangement constructed and arranged to cause an indication to be provided to a user in response to the biasing element stretching beyond a predetermined threshold length.
2. A washing and/or drying machine according to claim 1, wherein the arrangement is constructed and arranged to physically engage the biasing element.
3. A washing and/or drying machine according to claim 1 or claim 2, wherein the arrangement comprises one or more wires or one or more cables.
4. A washing and/or drying machine according to claim 3, wherein the arrangement comprises one or more pulleys for supporting movement of the one or more wires or the one or more cables.
5. A washing and/or drying machine according to claim 4, wherein the one or more pulleys are fixed to the body portion.
6. A washing and/or drying machine according to any of the preceding claims, wherein a first end of the arrangement is fixed to a first component of the washing and/or drying machine, and a second end of the arrangement is attached to a second component of the washing and/or drying machine.
7. A washing and/or drying machine according to claim 6, wherein the first component comprises one of: the body portion; the biasing element; the drum assembly.
8. A washing and/or drying machine according to claim 6 or claim 7, wherein the second component comprises a circuit breaker.
9. A washing and/or drying machine according to any of claims 6 to 8, wherein the second component comprises a component of a door of the washing and/or drying machine.
10. A washing and/or drying machine according to claim 9, wherein the second component comprises a component of a lock of the door
11. A washing and/or drying machine according to claim 9 or claim 10, wherein the indication comprises disabling locking of the door of the washing and/or drying machine.
12. A washing and/or drying machine according to any of the preceding claims, wherein the biasing element
- is a helical spring and the arrangement passes through an interior of the helical spring.
13. A washing and/or drying machine according to any of the preceding claims, wherein the indication comprises activating an alarm.
14. A washing and/or drying machine according to claim 13, wherein the alarm comprises one of more of: an audible alarm; a haptic alarm; a visual alarm.
15. A washing and/or drying machine according to any preceding claim, wherein the biasing element comprises a first biasing element and a second biasing element.



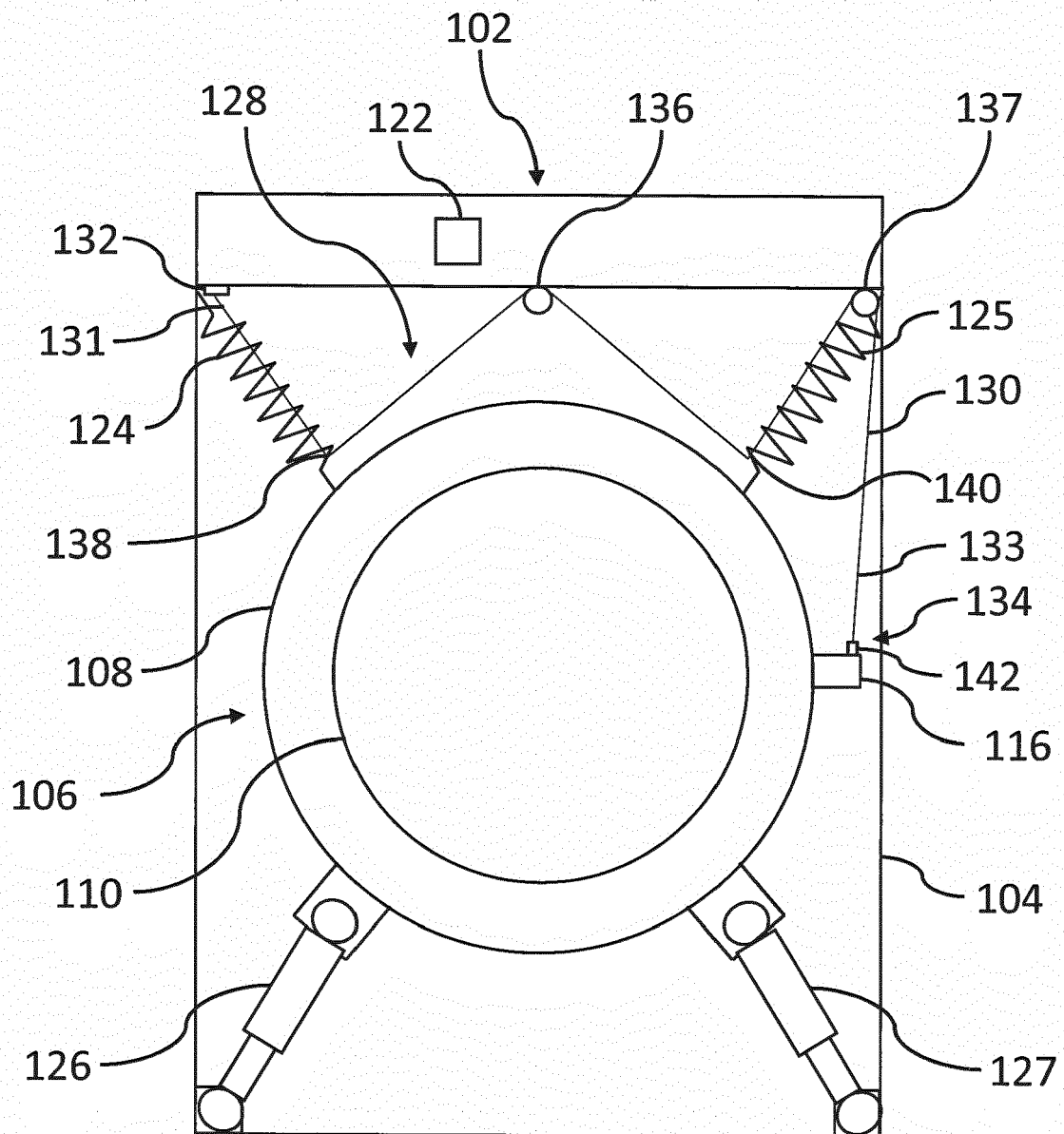


Figure 2

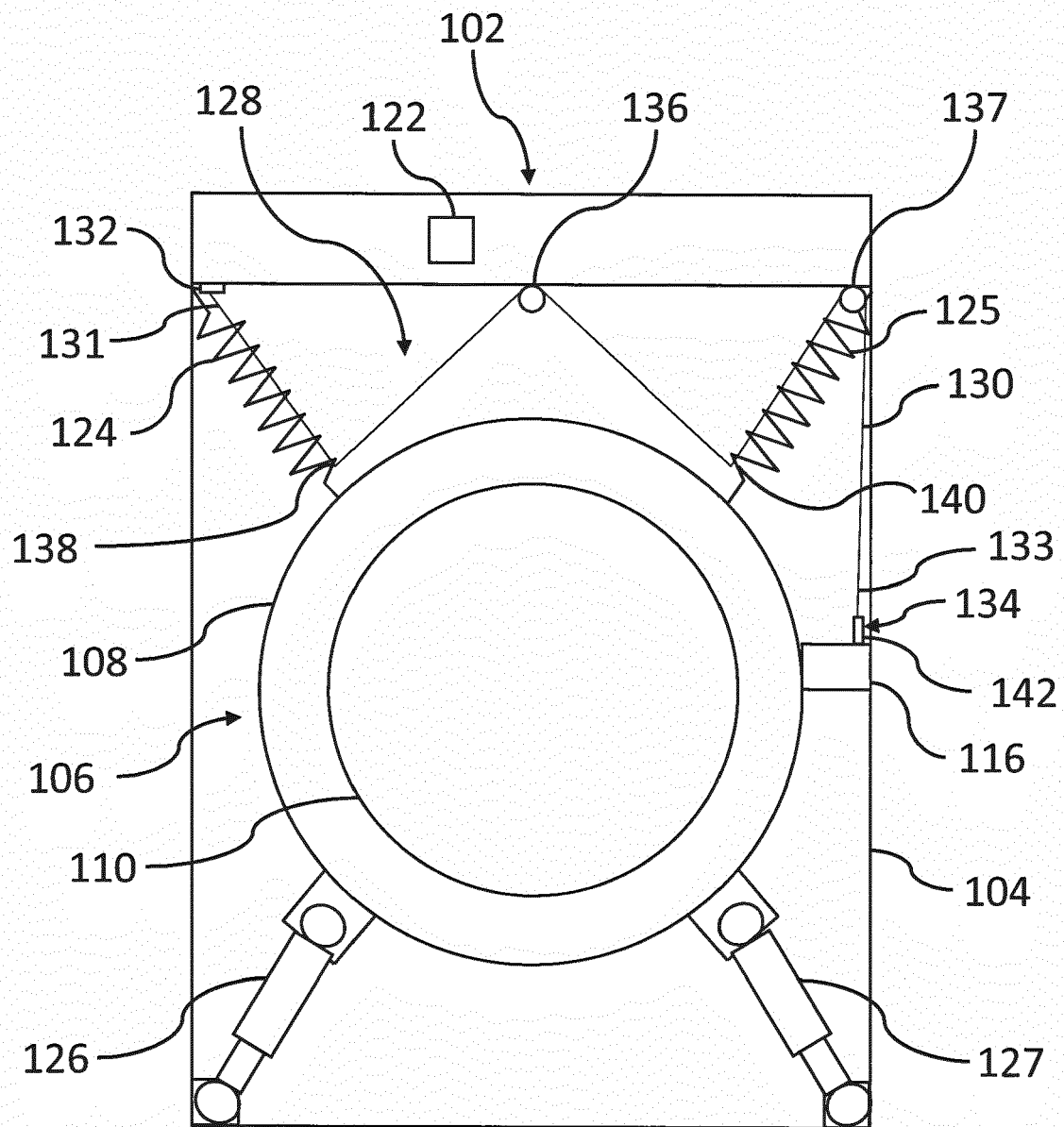


Figure 3



EUROPEAN SEARCH REPORT

Application Number
EP 19 16 5606

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The present search report has been drawn up for all claims			
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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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