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(54) **LAUNDRY MACHINE**

(57) A laundry machine (100) for treating laundry items is proposed. The laundry machine (100) comprises a cabinet (105) for accommodating components necessary for the operation of the laundry machine (100), a washing tub (107) comprising a rotatable drum for containing laundry items, the washing tub (107) being enclosed by the cabinet (105) such that it can be moved in a floating manner inside said cabinet, at least one suspension element (111) comprising a first portion (220a,111a; 320a,111a) associated to the cabinet (105) and a second portion (220b,111c; 111c) associated to the washing tub (107) for movably coupling the tub (107) with the cabinet (105) of the laundry machine (100), and a load sensing device (200; 300) for measuring a physical value related to the weight of laundry items provided in

the washing tub (107), wherein the load sensing device (200; 300) comprises a device first member (210; 310) comprising a first sensor element (215; 315) and a device second member (235; 335) comprising a second sensor element (235b; 335b). The load sensing device (200; 300) is coupled with the at least one suspension element (111) with the device first member (210; 310) associated to the first portion (220a,111a; 320a,111a) of said suspension element (111) and with the device second member (235; 335) associated to the second portion (220b,111c; 111c) of the suspension element (111) or *vice-versa*. Thereby, the change of length of the suspension element (111) causes the change of distance between said first and the second sensor elements.

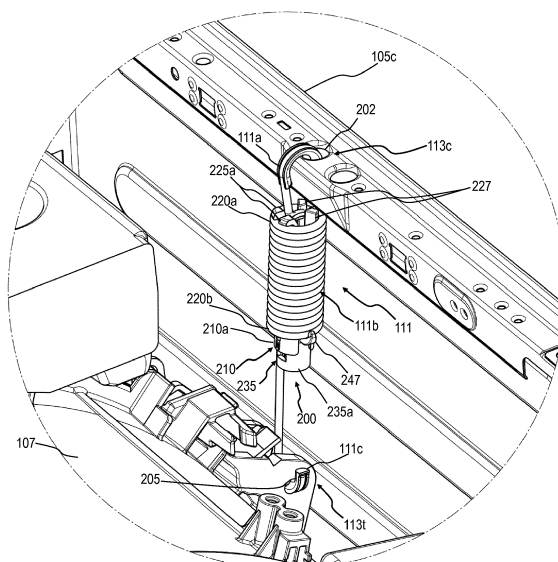


FIG.2F

Description

Field of the invention

[0001] The present invention relates to laundry treatment appliances or machines. In more detail, the present invention refers to appliances for washing laundry and/or washing and drying laundry comprising a rotating drum, both for domestic and professional use. Particularly, the present invention relates to a laundry machine comprising a load sensing device for evaluating a weight of laundry introduced into the laundry machine and a method to assembly said laundry machine.

Background of the invention

[0002] Washing and washing/drying laundry machines - which will be referred to simply as laundry machine in the following - typically comprise a casing substantially parallepiped-shaped.

[0003] The casing accommodates a laundry-treating chamber, comprising a drum, generally rotatable, apt to contain the laundry to be washed (and dried in the case of washing/drying laundry machines).

[0004] The laundry-treating chamber further comprises a tub in which the drum is rotatably contained.

[0005] The tub is suspended inside the casing by means of suspension elements (such as extension springs) and damping elements. Typically, suspension elements connect the tub to a top portion of the casing, while damping elements connect the tub to a lower portion of the casing.

[0006] A front panel of the casing may be provided with a loading opening to access the treating chamber for loading/unloading the laundry, and a door is provided for closing the loading opening, particularly during the laundry machine operation; in such case the laundry machine is defined as front-loading laundry machine. Alternatively, a top panel of the casing may be provided with a loading opening to access the treating chamber for loading/unloading the laundry, and a door is provided for closing the loading opening, particularly during the laundry machine operation; in such case the laundry machine is defined as top-loading laundry machine.

[0007] The casing also accommodates the electrical, electronic, mechanical (e.g., a motor for rotating the drum and an electronic control system for managing the laundry machine operation etc.), and hydraulic components necessary for the operation of the laundry machine (e.g., inlet and outlet hydraulic systems, treating agent dispenser etc.).

[0008] Generally, the laundry machine further comprises a control interface, e.g. comprising one or more among buttons, pushbuttons, knobs and displays for allowing a user set/select or to be informed about operating parameters and laundry-treating processes.

[0009] Finally, the laundry machine may comprise a treating agent drawer adapted to accommodate treating

agents, e.g. powdered/liquid detergent and/or softener, to be inputted in the hydraulic system of the laundry machine for treating laundry.

[0010] In order to achieve laundry treating processes having an improved efficiency it is known to adjust a duration, a spinning angular velocity and/or drying temperatures of the laundry treating processes based on a weight of the laundry to be treated and/or being treated.

[0011] Therefore, in the art many expedients have been proposed in order to automatically evaluate a weight of the laundry to be treated.

[0012] For example, GB2225030 discloses a load indicator for a domestic washing machine having a switch panel and a tub for detergent solution, which tub is suspended resiliently relatively to a mounting frame, comprising means responsive to vertical movement of said tub relatively to the mounting frame for providing a corresponding indication of the loaded state of the tub in an indicator window of the switch panel. Particularly, an electric coil connected to the frame of the domestic washing machine surrounds a spring and a magnetic core that are attached to the tub of the domestic washing machine. A movement of the tub and of the magnetic core is detected as a change in a magnetic flux by the electric coil and is connected to a weight increase that is electronically displayed.

Summary of invention

[0013] The Applicant has realized that the art do not provide a satisfactory load sensing device allowing for an accurate evaluation of a weight of laundry provided in the laundry machine and, at the same time, an easy and cost-effective implementation within the laundry machine.

[0014] For example, the Applicant has found that the known solutions couple load sensing devices, or portions thereof, with moving parts such as the tub and with fixed parts such as the machine cabinet; such a coupling may require connecting elements requiring a quite complex mounting means because a portion on the load sensing device has to be connected to fixed part, whereas a further portion has to be connected to moving parts; moreover, the displacement of the moving parts is sometime unpredictable (due for example to the drum speed as well as the unbalance state of the laundry contained therein), different from the theoretical linear movement between said parts, resulting in a unprecise acquisition of the displacement values, with a consequent mistake of weight estimation.

[0015] The Applicant has tackled the problem of devising an improved solution able to overcome, at least partly, the drawbacks of the prior art.

[0016] In particular, the Applicant has found that coupling the load sensing device, having a first device section and a second device section, with the suspension element so that the first device section is associated of a first portion of the suspension element and with the sec-

ond device section associated to a second portion of the suspension element or *vice versa*, so that the change in length of the suspension element causes the change of distance between the first and the second sensor elements, allow a reliable connection of all load sensing device components, being the latter connected to the same part (suspension element), and at the same time it improves the reliability of the signal acquired, because the load sensing device follows the movement / misalignments of the suspension element.

[0017] One or more aspects of the solution according to embodiments of the invention are set out in the independent claims, with advantageous features of the same solution that are indicated in the dependent claims.

[0018] An aspect of the solution according to one or more embodiments of the present invention relates to a laundry machine for treating laundry items. The laundry machine comprises a cabinet for accommodating components necessary for the operation of the laundry machine, a washing tub comprising a rotatable drum for containing laundry items, the washing tub being enclosed by the cabinet such that it can be moved in a floating manner inside said cabinet, at least one suspension element comprising a first portion associated to the cabinet and a second portion associated to the washing tub for movably coupling the tub with the cabinet of the laundry machine, and a load sensing device for measuring a physical value related to the weight of laundry items provided in the washing tub, wherein the load sensing device comprises a device first member comprising a first sensor element and a device second member comprising a second sensor element. The load sensing device is coupled with the at least one suspension element with the device first member associated to the first portion of said suspension element and with the device second member associated to the second portion of the suspension element or *vice-versa*. Thereby, the change of length of the suspension element causes the change of distance between said first and the second sensor elements.

[0019] In an advantageous embodiment of the invention, the first sensor element comprises at least one permanent magnet.

[0020] In an advantageous embodiment of the invention, the second sensor element comprises at least one magnetic field sensor.

[0021] In an advantageous embodiment of the invention, the at least one magnetic field sensor comprises a Hall effect sensor.

[0022] In an advantageous embodiment of the invention, the second sensor element comprises a sensor arrangement provided with an electronic board.

[0023] In an advantageous embodiment of the invention, the laundry machine further comprises a control system configured for controlling the operation of the laundry machine. Preferably, the electronic board further mounts electronic components for exchanging signals with the control system of the laundry machine.

[0024] In an advantageous embodiment of the inven-

tion, the device first member and the device second member are slidably coupled one another.

[0025] In an advantageous embodiment of the invention, the device first member comprises a tubular body which delimits a cavity. Preferably, the cavity is adapted to receive at least a portion of the second device section.

[0026] In an advantageous embodiment of the invention, the device second member further comprises a sliding portion. Preferably, the sliding portion is shaped to slidably fit the cavity delimited by the tubular body of the device first member.

[0027] In an advantageous embodiment of the invention, the first sensor element is provided in the tubular body of the device first member and, preferably, the second sensor element is provided in the sliding portion of the device second member. Alternatively, the first sensor element is provided in the sliding portion of the device second member and, preferably, the second sensor element is provided in the tubular body of the device first member.

[0028] In an advantageous embodiment of the invention, the suspension element comprises an upper coupling end for coupling with the cabinet of the laundry machine, a sequence of stacked spring coils, and a lower coupling end for coupling with the washing tub. Preferably, the device first member comprises at least one coupling protrusion protruding from the device first member, the at least one coupling protrusion is adapted to engage with the suspension element.

[0029] In an advantageous embodiment of the invention, the at least one coupling protrusion comprises a hooked free end adapted to engage with an upper spring coil of the sequence of stacked spring coils of the suspension element.

[0030] In an advantageous embodiment of the invention, the device first member is adapted to fit a space defined by the sequence of stacked spring coils of the spring element.

[0031] In an advantageous embodiment of the invention, the suspension element comprises an upper coupling end for coupling with the cabinet of the laundry machine, a sequence of stacked spring coils, and a lower coupling end for coupling with the washing tub. Preferably, the second member comprises at least one coupling protrusion protruding from the device second member, the at least one coupling protrusion is adapted to engage with the suspension element.

[0032] In an advantageous embodiment of the invention, the at least one coupling protrusion comprises a hooked free end adapted to engage with a bottom spring coil of the sequence of stacked spring coils of the suspension element.

[0033] In an advantageous embodiment of the invention, the washing tub comprises at least one retaining element. Preferably, the device second member comprises a clamping portion arranged for connecting to the at least one retaining element of the washing tub.

[0034] In an advantageous embodiment of the inven-

tion, the at least one retaining element of the washing tub comprises an eyelet and the at least one suspension element comprises a lower coupling end having a hook arranged for fitting the eyelet of the at least one retaining element. Preferably, the clamping portion of the device second member is adapted to be fitted into the same eyelet of the at least one retaining element in which the hook of the lower coupling end of the at least one suspension element is fitted into. Alternatively, the washing tub comprises two retaining elements, one associated to the lower coupling end of the suspension element and one associated to the device second member; preferably, one retaining element comprises an eyelet and the at least one suspension element comprises a lower coupling end having a hook arranged for fitting the eyelet of the at least one retaining element; moreover, the other retaining element preferably comprises an eyelet and the clamping portion of the device second member is adapted to be fitted into said eyelet.

[0035] In an advantageous embodiment of the invention, the clamping portion of the device second member is adapted to be coupled with the lower coupling end of the at least one suspension element.

[0036] In an advantageous embodiment of the invention, the clamping portion of the device second member is provided astride the lower coupling end of the at least one suspension element.

[0037] In an advantageous embodiment of the invention, the device first member is associated to the first portion or to the second portion of the suspension element through connection means allowing the rotation of said first portion around the fulcrum defined by the connection point between said connection means and said suspension element

[0038] Another aspect of the present invention proposes a method of assembly a laundry machine. The method comprises providing a cabinet for accommodating components necessary for the operation of the laundry machine, providing a washing tub comprising a rotatable drum for containing laundry items, providing at least one suspension element comprising a first portion and a second portion, associating the first portion of said suspension element to the cabinet, associating the second portion of said suspension element to the washing tub, thereby movably coupling the tub with the cabinet of the laundry machine such that it can be moved in a floating manner inside said cabinet, and providing a load sensing device for measuring a physical value related to the weight of laundry items provided in the washing tub, wherein the load sensing device comprises a device first member comprising a first sensor element and a device second member comprising a second sensor element. Providing a load sensing device comprises coupling the device first member with the first portion of said suspension element, and coupling the device second member with the second portion of said suspension element. Alternatively, providing a load sensing device comprises coupling the device second member with the first portion of said suspension

element, and coupling the device first member with the second portion of said suspension element.

[0039] In an advantageous embodiment of the invention, the at least one suspension element further comprises a sequence of stacked spring coils interposed between said first portion and second portion of said suspension element, the sequence of stacked spring coils delimiting an inner space, and the device first member of the load sensing device further comprises at least one coupling protrusions. Preferably, coupling the device first member with the first portion of said suspension element comprises inserting the device first member into the inner space defined by the sequence of stacked spring coils until said coupling protrusion engages an upper spring coil of the sequence of stacked spring coils.

[0040] In an advantageous embodiment of the invention, the device second member further comprises a respective coupling protrusion, and the device first member of the load sensing device further comprises a cavity. Preferably, coupling the device second member with the second portion of said suspension element comprises inserting the device second member into the cavity of the device first member until the respective coupling protrusions engages a lower spring coil of the sequence of stacked spring coils.

[0041] In an advantageous embodiment of the invention, the device second member further comprises a respective clamping portion, and the device first member of the load sensing device further comprises a cavity. Preferably, coupling the device second member with to the second portion of said suspension element comprises inserting the device second member into the cavity of the device first member, and coupling the respective coupling protrusions with the second portion of said suspension element.

Brief description of the annexed drawings

[0042] These and other features and advantages of the present invention will be made apparent by the following description of some exemplary and non limitative embodiments thereof. For its better intelligibility, the following description should be read making reference to the attached drawings, wherein:

Figure 1A is a schematic perspective view of a laundry machine in which a load sensor according to an embodiment of the invention may be implemented;

Figure 1B is a schematic perspective front view of the laundry machine of **Figure 1A** with removed parts;

Figure 1C is a schematic perspective rear view of the laundry machine of **Figure 1A** with removed parts;

Figure 2A is a schematic exploded view of a load sensor according to a first embodiment of the invention coupleable with a suspension element of the laundry machine,

Figures 2B to 2E are side views and cross-sectional side views of the load sensor according to the first embodiment of the invention coupled with the suspension element of the laundry machine,

Figure 2F is a schematic close up of the suspension element coupled with the load sensor according to the first embodiment of the present invention in its working position inside the laundry machine,

Figure 3A is a schematic exploded view of a load sensor according to a second embodiment of the invention coupleable with a suspension element of the laundry machine,

Figures 3B to 3E are side views and cross-sectional side views of the load sensor according to the second embodiment of the invention coupled with the suspension element of the laundry machine, and

Figure 3F is a schematic close up of the suspension element coupled with the load sensor according to the second embodiment of the present invention in its working position inside the laundry machine.

Detailed description of preferred embodiments of the invention

[0043] Referring now to the drawings, Figures 1A to 1C are schematic perspective views of a laundry machine 100 in which a load sensor (not detailed in Figures 1A to 1C) according to an embodiment of the invention may be implemented.

[0044] The laundry machine 100 is a machine for treating laundry, such as for example a laundry washing machine or a laundry washing/drying machine, of the front-loading type. Anyway, it should be apparent from the following description that laundry machines of the top-loading type may also benefit from the solution according to the present invention.

[0045] In the example at issue, the laundry machine 100 comprises a casing or cabinet 105 preferably substantially parallelepiped-shaped, which encloses a washing tub, or simply tub 107 (as shown in the perspective views with removed parts of Figures 1B and 1C), preferably substantially cylindrically-shaped, wherein the laundry is treated, along with any other component of the laundry machine 100 necessary for its operation (e.g., hydraulic, electronic and electromechanical apparatuses as described in the following).

[0046] The tub 107 houses a rotatable drum 110 preferably substantially cylindrically shaped, which, in operation, rotates about an axis A in order to tumble the laundry to be washed.

[0047] Typically, the tub 107 is suspended in the casing 105 in such a way to be substantially free to oscillate/float during its operation. For example, the tub 107 is connected to the casing 105 in movable manner by means of suspension elements 111 (e.g., spring elements, for example extension springs) and damping elements 112 (e.g., shock absorbers).

[0048] Preferably, each suspension element is cou-

pled with the casing 105 and with the tub 107 by means of respective casing retaining element 113c and tub retaining element 113t.

[0049] In an embodiment of the present invention, as shown in the example of Figures 1B and 1C, the casing retaining element 113c for the suspension element 111 is formed at least partly on a bracket element 105b of the casing 105. The bracket element 105b being arranged in order to mechanically couple two opposite side element 105c of the casing 105 (omitted in the Figures 1B and 1C, but a portion of such side element 105c is visible in the following Figures 2F and 3F).

[0050] In addition, the tub 107 comprises, in a backside or backwall 107a thereof, a shaft opening (not visible in the figures), in which a drum rotor shaft 110a is inserted. The rotor shaft 110a is attached to the drum 110 and rotatably connected by means of a transmission apparatus 115 to a, preferably electric, drum motor 120 comprised in the laundry machine 100 in order to rotate the drum 110 during operation. The drum motor 120 is preferably, although not limitatively, positioned in a bottom position with respect to the casing 105. The transmission apparatus 115 may comprise a transmission belt or chain 115a coupled with a pair of pulleys 115b and 115c, of which a first pulley 115b is mounted to the drum rotor shaft 110a while a second pulley 115c is mounted to a motor shaft 120a.

[0051] Alternatively, in other embodiments according to the present invention (not shown in the Figures), the rotating movement may be transferred to the drum in any other known manner; for example, a motor may be directly connected to the drum (so called "direct drive"), with the motor shaft coinciding to the drum shaft.

[0052] In order to allow a user to access the tub 107 and the inside of the drum 110 (for loading/unloading the laundry), a loading/unloading opening is advantageously provided on a front side of the laundry machine 100. The loading/unloading opening is closable by a door 125 (shown in closed configuration in Figure 1A), which is hinged, preferably, to the casing 105 by means of a hinge (not shown in the figures).

[0053] The tub 107 is provided with a tub opening 107c, and the drum 110 is provided with a drum opening having substantially the same size and alignment of the tub opening 107c. The tub opening 107c is adapted to be aligned with the loading/unloading opening provided in the casing 105, and with the drum opening of the drum 110.

[0054] Preferably, in order to achieve a watertight connection between the loading/unloading opening and the tub opening 107c (in order to avoid leakages of washing liquid into the casing 105), a bellows 130, preferably made of an elastomeric and waterproof material, is mounted in a watertight manner (such as by gluing, by welding, by interference fitting, etc.) to a border of the loading/unloading opening and is coupled with a border of the tub opening 107c.

[0055] The tub 107 is fluidly connected to a hydraulic

apparatus (not shown in the drawings) adapted to provide washing liquids (e.g., water mixed with detergents) in the washing tub **107** for treating the laundry therein, and to exhaust such liquids once used.

[0056] The laundry machine **100** may possibly comprise also a drying air apparatus (not shown) fluidly connected with the tub **107** adapted to heat up and blow drying air into the tub and draw therefrom moisturized cool air.

[0057] In addition, a user interface **140** is advantageously provided, preferably, although not limitatively, on a top portion **105t** of the casing **105**. Preferably, the user interface **140** may comprise a control panel **140a** for selecting laundry treatment cycles (e.g., a set of operations and parameters designed for treating peculiar fabrics, such as wool items) and / or parameters (e.g. water/washing liquid temperature) to be carried out by the laundry machine **100**, or to display information, and a drawer **140b** for loading laundry-treating products (e.g., detergents, softeners, bleachers, etc.).

[0058] The laundry machine **100** is advantageously provided with a control system **150** (e.g., schematically indicated by a dashed rectangle in **Figure 1A**, and comprising one or more microprocessors/microcontrollers and/or other electronic devices) adapted to control the laundry machine **100** operation, which is preferably, although not necessarily, placed in a top position inside the casing in order to be less prone to contacts with liquids or humidity possibly leaking from the tub **107**.

[0059] According to an embodiment of the present invention, the laundry machine **100** further comprises one or more load sensing devices arranged for providing a (electric) signal indicative of a weight of items (i.e., laundry items) provided in the drum **110** enclosed by the tub **107**.

[0060] Preferably, the load sensing device may be arranged for assessing a portion of a total weight due to water/washing liquid introduced in the tub **107** in order to perform a laundry-treating procedure and estimating a net weight of the laundry loaded in the rotating drum.

[0061] Preferably, the load sensing device is based on measurements of a relative displacement between two members of the load sensing device.

[0062] Indeed, the load sensing device is designed in such a way that the relative displacement mentioned above is associated with a corresponding displacement between the tub **107**, which as mentioned above may freely oscillate/float, and the casing **105**, which substantially stand statically during the laundry machine **100** operation.

[0063] In its turn, the extent of displacement between the tub **107** and the casing **105** is indicative of the weight of the laundry loaded in the rotating drum **110** of the laundry machine **100**.

[0064] Particularly, the displacement between the tub **107** and the casing **105** comprises two main components: a time-varying component generated by oscillations induced, e.g. by the rotation of the rotating drum **110** during

operation or by the action of loading laundry in the rotating drum **110**, and a substantial time-continuous component generated by the weight of the laundry (and possibly water/washing liquid) loaded in the rotating drum **107**.

[0065] In one embodiment of the invention, the measurement of the displacement between the two members of the load sensing device is based on variations in a magnetic field (as described in the following).

[0066] In an alternative embodiment of the invention, the measurement of the displacement between two members of the load sensing device is based on different physical expedients, such as for example optical measurements.

[0067] As shown **Figures 2A to 2F**, the load sensing device **200** according to a first embodiment of the invention is preferably adapted to be installed at a suspension element **111** of the laundry machine **100**.

[0068] Starting from top and then proceeding downward with respect to the **Figures 2A to 2F**, the generic suspension element **111** is preferably formed by an upper coupling end **111a**, a sequence of stacked spring coils **111b**, and a lower coupling end **111c**.

[0069] The upper coupling end **111a** has a shape adapted to be connected to a casing retaining element **113c** provided in the (upper side of) the casing **105**.

[0070] For example, the upper coupling end **111a** is shaped in the form of a hook adapted to engage a corresponding hole **202** (best view in **Figure 2F**) comprised in the casing retaining element **113c** provided on a side element **105c** of the casing **105** (with which the bracket element **105b** mentioned above couples).

[0071] Similarly, the lower coupling end **111c** has a shape adapted to connect to a tub retaining element **113t** provided the tub **107**.

[0072] For example, the lower coupling end **111c** is shaped in the form of a beam ending with a hook adapted to engage an eyelet **205** of the tub retaining element **113t** protruding from the washing tub **107** of the laundry machine **100**.

[0073] The suspension element **111** is preferably made of an elastic and resistant material such as steel.

[0074] According to an embodiment of the invention, the load sensing device **200** comprises two main members designed to slide one inside the other.

[0075] A device first (upper) member **210** is fixed to an upper spring coil **220a** of the sequence of stacked spring coils **111b** of the spring element **111**. The upper spring coil **220a** joins the upper coupling end **111a** to the sequence of stacked spring coils **111b**.

[0076] For example, the device first member **210** comprises a, preferably cylindrical, tubular body **210a** adapted to fit a (cylindrical) inner space defined by the sequence of stacked spring coils **111b** of the spring element **111**.

[0077] In order to be fixed to the upper spring coil **220a**, the device first member **210** comprises one or more, two in the example of **Figures 2A to 2F**, coupling protrusions **225**. Preferably, each coupling protrusion **225** protrudes

from a top end **210b** of the device first member **210** and comprises a hooked free end **225a** adapted to engage with upper spring coil **220a** (e.g., the hooked free end **225a** snap-fits the upper spring coil **220a**).

[0078] Preferably, the device first member **210** further comprises one or more, two in the example of **Figures 2A to 2F**, guiding protrusions **227**. The guiding protrusions **227** protrude from the top end **210a** of the device first member **210** and have a rod-like shape. The guiding protrusion **227** are arranged for guiding the movement of the device first member **210** in the space defined by the sequence of stacked spring coils **111b** of the spring element **111** and to maintain a correct positioning of the device first member **210** while the sequence of stacked spring coils **111b** is deformed by forces acting on the suspension element **111** (i.e., associated with displacements of the tub **107**).

[0079] The tubular body **210a** of the device first member **210** preferably delimits a cavity **230**.

[0080] The cavity **230** is preferably adapted to receive, at least partly, a second (lower) device member **235** of the load sensing device **200** (described in the following). In other words, at least a portion of the device second member **235** is preferably adapted to fit the cavity **230** of the device first member **210** and to slide inside it.

[0081] To this purpose, the cavity **230** is accessible through a hole **237** provided in a bottom end **210c** of the tubular body **210a** of the device first member **210** (i.e., the bottom end **210c** is opposite to the top end **210b**).

[0082] In one embodiment of the invention, the device first member **210** preferably comprises at least one first sensor element. For example the device first member **210** comprises two, preferably permanent, magnets **215**.

[0083] For example, each permanent magnet **215** is provided in a respective housing or niche **240** provided in the tubular body **210a** of the device first member **210**.

[0084] Preferably, the niche **240** is provided in such a way that the permanent magnet **215**, once inserted in the niche **240**, faces the cavity **230** of the device first member **210**. Even more preferably, the permanent magnet **215** has an elongated shape with the longest size aligned with a sliding direction of the device second member **235** within the cavity **237** of the device first member **210**. This configuration ensure that the device second member **235** results immersed in a magnetic field for a prevalent extent of its sliding inside the device first member **210**.

[0085] Furthermore, in case of a device first member **210** comprising two permanent magnets **215** (such as in the exemplary embodiment depicted in **Figures 2A to 2F**), preferably, the two permanent magnets **215** are arranged axially aligned (i.e., on in front of the other, as best visible in **Figures 2A and 2E**). Even more preferably, the permanent magnets **215** are provided in the respective niches **240** in such a way to have facing opposite magnetic north/south poles, thus generating a substantially uniform magnetic field within the cavity **237** through which the device second member **235** slides.

[0086] The second (lower) device member **235** preferably comprises a sliding portion **235a** and a second sensor element, such as a sensor arrangement **235b**.

[0087] The sliding portion **235a** is shaped in such a way to fit the cavity **230** of the tubular body **210a** of the device first member **210**.

[0088] Particularly, the sliding portion **235a** is shaped in such a way to slidably couple with the tubular body **210a** of the device first member **210**.

[0089] Advantageously, the sliding portion **235a** and the tubular body **210a** are designed in such a way that the sliding portion **235a** is not able to leave the cavity **230** of the tubular body **210a** even at a maximum elongation of the sequence of stacked spring coils **111b** of the suspension element **111**. For example, the sliding portion **235a** is formed with a cylindrical shape and size substantially corresponding to the cylindrical shape and size of the cavity **230** and of the hole **237** of the tubular body of the device first member **210**.

[0090] In a non-limiting embodiment of the invention, the sliding portion **235a** may be shaped in such a way to maintain a predetermined orientation while sliding in the cavity **237** of the tubular body **210a** of the device first member **210**.

[0091] For example, the sliding portion comprise a slot **245** suited for receiving a sliding guide. In an embodiment of the invention each one of the niches **240** provided in the tubular body **210a** for housing respective magnets **215** is advantageously used as sliding guide.

[0092] Preferably, each niche **240** may be formed in such a way to protrude inwards in the cavity **237** of the tubular body **210a** of the device first member **210** in order to act also as a sliding guide for a respective slot **245** of the sliding portion **235a**. Thus, during the sliding of the sliding portion **235a** in the cavity **237**, the niches **240** received in the slots **245** guide the sliding of the sliding portion **235a** along the cavity **237**, and advantageously prevent any rolling of the sliding portion **235a**.

[0093] It should be noted that in alternative embodiments (not shown), dedicated sliding guides may be provided instead and the niches for the permanent magnets may be made flush with an inner wall of the tubular body **210a** which delimits the cavity **237**.

[0094] Further alternative embodiments of the present invention may comprise a load sensing device without slots and sliding guides.

[0095] The device second member **235** is preferably fixed to a lower spring coil **220b** of the sequence of stacked spring coils **111b** of the spring element **111**. The lower spring coil **220b** joins the lower coupling end **111c** to the sequence of stacked spring coils **111b**.

[0096] In order to be fixed to the lower spring coil **220a**, the device second member **235** preferably comprises one or more coupling protrusions, such as a hooked protrusion **247**, shown in the example of **Figures 2A to 2F**.

[0097] Preferably, a hooked protrusion **247** protrudes from a lower portion of the sliding portion **235a** of the device second member **235** and comprises a hooked

shape adapted to engage with the lower spring coil **220b** (e.g., the hooked protrusion **247** snap-fits the lower spring coil **220b**). The sliding portion **235a** of the device second member **235** preferably houses the sensor arrangement **235b**.

[0098] In one embodiment of the invention, the sliding portion **235a** comprises a housing cavity **246** in which the sensor arrangement **235b** may be fitted.

[0099] Preferably, the sensor arrangement **235b** comprises an electronic board **250** mounting at least a sensor component designed to measure a relative displacement between the two members **210** and **235** of the load sensing device **200** by interacting with the first sensor element, i.e. the permanent magnets **215**, of the device first member **210**. In one embodiment of the invention, the sensor arrangement **235b** comprises at least one magnetic field sensor **255**. For example, the magnetic field sensor **255** comprises a Hall effect sensor.

[0100] Preferably, the electronic board **250** further mounts electronic components (e.g., resistors, capacitances, transducer elements and wirings) for exchanging signals (preferably electric, even though electromagnetic and/or optical signals are not excluded) with the control system **150** of the laundry machine **100**.

[0101] For example, the sensor arrangement **235b** comprises a connector terminal **256** (as best view in **Figure 2E**) which is accessible through a lower aperture **246a** of the housing cavity **246** in order to be connectable to the control system **150** of the laundry machine **150**.

[0102] Even more preferably, the sensor arrangement **235b** further comprises an electronic managing element **257**, such as for example a microprocessor, a microcontroller or a similar electronic component.

[0103] Advantageously, the electronic managing element **257** is configured for pre-processing electric signals provided by the magnetic field sensor **255** before forwarding them to the control system **150**. For example, the electronic managing element **257** is configured for filtering, amplifying and digitalizing the electric signals provided by the magnetic field sensor **255**.

[0104] Furthermore, the electronic managing element **257** may be configured for attenuating portions of the electric signal provided by the magnetic field sensor **255** due to time-varying components of the displacement between the tub **107** and the casing **105** and/or removing offsets of the electric signal provided by the magnetic field sensor **255** due to the weight of any water/washing liquid in the tub **107**.

[0105] It should be noted that the device first member **210** is fixed to the upper spring coil **220a** of the sequence of stacked spring coils **111b** - which is substantially integral with the upper coupling end **111a** of the spring element **111** and thus with the casing **105** of the laundry machine **100** to which the upper coupling end **111a** is coupled.

[0106] Therefore position of the device first member **210**, and particularly of the first magnetic sensor element (i.e., the permanent magnets **215**), is substantially inte-

gral with the casing **105** of the laundry machine **100**.

[0107] Similarly, the device second member **210** is fixed to the lower spring coil **220b** of the sequence of stacked spring coils **111b** - which is substantially integral with lower coupling end **111c** of the spring element **111** and thus with the tub **107** of the laundry machine **100** to which the lower coupling end **111c** is coupled of the spring element **111**.

[0108] Therefore position of the device second member **235**, and particularly of the second magnetic sensor element (i.e., the sensor arrangement **235b**), is substantially integral with the tub **107** of the laundry machine **100**.

[0109] In other words, the load sensing device **200** according to an embodiment of the present invention is arranged to be coupled with a suspension element **111** with the device first member **210** associated to a first portion of said suspension element (i.e., the upper coupling end **111a**) and with the device second member **235** associated to a second portion of the suspension element **111** (i.e., the lower coupling end **111c**) - even though the *vice versa* is not excluded.

[0110] It should be noted that such arrangement allows a reliable connection of all load sensing device components, particularly of the of the device first member **210** and the device second member **235**, being the latter connected to the same suspension element **111**. Thus, any change of length (i.e., any extension/compression) of the suspension element **111** causes a change of distance (i.e., a displacement) between the first and second member of the load sensing device **200** and thereby between said first and the second sensor elements **215** and **255**.

[0111] Thanks to such arrangement an improved reliability of the signal acquired is achieved since the load sensing device **200** is able to follow the movement/misalignments of the suspension element

[0112] It should be noted that, in further embodiments of the present invention (not shown), nothing prevents to invert the position of the first and the second sensor elements, e.g. a magnetic field sensor could be provided in the device first member while one or more permanent magnets could be provided in the device second member.

[0113] In a preferred embodiment of the invention, a diameter of the tubular body **210a** of the device first member **210** is smaller than a diameter of the (cylindrical) space defined by the sequence of stacked spring coils **111 b** of the spring element **111**.

[0114] Moreover, the coupling protrusions **225** are designed to engage the upper spring coil **220a** in such a way to allow the device first member **210** to rotate about the two contact points between the protrusions **225** and the upper spring coil **220a**. Thanks to the arrangement of the load sensing device **200** just described, the axis of the load sensing device **200** may rotate with respect to the axis of the suspension element **111**, particularly during extension and compression thereof, while the device first member **210** and the device second member **235** remain axially aligned (due to the precision between

the cavity **237** and the sliding portion **235a**).

[0115] In other words, the device first member **210** is free of rotating around a fulcrum defined by a connection point between said the coupling protrusions **225** and said suspension element **111**.

[0116] It should be noted, that in case two or more coupling protrusions **225** are provided, the disposition of the coupling protrusions **225** on the top end **210b** of the tubular body **210a** of the device first member **210** is designed in order to ensure that the load sensing device **200** is able to rotate with respect to the axis of the suspension element **111**, particularly during extension and compression thereof.

[0117] For example, in the load sensing device **200** the two the protrusions **225** are arranged on a same half of the top end **210b** of the tubular body **210a**, thus allowing at least the device first member **210** (and, generally, the whole load-sensing device **200**) to rotate with respect to the suspension element **111**, particularly in case of non-linear deformations (i.e., along directions different than the axis of the suspension element **111**).

[0118] Furthermore, a precision of the coupling between the device first member **210** and the device second member **235** is greater than a precision between the device first member **210** and the diameter of the (cylindrical) space defined by the sequence of stacked spring coils **111 b** of the spring element **111**.

[0119] In other words, a difference between a diameter of the cavity **237** and a diameter of the sliding portion **235a** (which is inserted in the former) is substantially smaller than a difference between the diameter of the space defined by the sequence of stacked spring coils **111 b** of the spring element **111** and a (external) diameter of the tubular body **210a**.

[0120] For example, the difference between a diameter of the cavity **237** and a diameter of the sliding portion **235a** is smaller than the difference between the diameter of the space defined by the sequence of stacked spring coils **111b** of the spring element **111** and the diameter of the tubular body **210a** of a factor comprised between 5 and 30, such as for example 20 - e.g., the difference between a diameter of the cavity **237** and a diameter of the sliding portion **235a** is 0.05mm (or less) while the difference between the diameter of the space defined by the sequence of stacked spring coils **111 b** of the spring element **111** and the diameter of the tubular body **210a** is 1mm (or more).

[0121] Thus, the play between the load sensing element **200** and the sequence of stacked spring coils **111b** of the spring element **111** is substantially greater than a play between the tubular body **210a** and the sliding portion **235a** of the load sensing device **200**.

[0122] Advantageously, capability of the load sensing element **200** or rotating with respect to the sequence of stacked spring coils **111 b** (thanks to the coupling protrusions **225**) together with the play between the load sensing device **200** and the sequence of stacked spring coils **111b** greater than the play between the tubular body

210a and the sliding portion **235a** of the load sensing device **200**, allows the load sensing device to substantially compensate the components of deformation of the spring element **111** occurring along axes different than the axis of the load sensing element **200** (e.g., transversal to the direction of the movement of the sliding portion **235a** within the tubular body **210a**).

[0123] In this way, it is possible to obtain a highly accurately measuring of displacements (e.g., in the order of the tenth to hundredth of millimeters) between magnets **215** and the sensing arrangement **235b** that is substantially unaffected by the components of deformations of the spring element **111** occurring along axes different than the axis of the load sensing element **200**.

[0124] During operation the load sensing device **200** may be used to evaluating a weight of laundry items comprised in the drum **110** of the laundry machine **100**.

[0125] As laundry items are loaded into the drum **110** contained inside the tub **107** of the laundry machine **100**, the weight of the laundry items causes the tub **107** to move downward.

[0126] As known, a length of the downward movement of the tub **107** is proportional to the weight of the laundry items provided in the drum **110** of the laundry machine **100**.

[0127] Such displacement of the tub **107** due to the weight of the laundry items causes a corresponding elongation in the suspension element **111** and a corresponding compression in the dampening elements **112**.

[0128] Moreover, the downward movement of the tub **107** causes the device second member **235** to rigidly move downward according to the extension of the sequence of stacked spring coils **111b** of the spring element **111**. In other words, a length of the displacement from a rest position - i.e., corresponding to a unloaded condition of the drum **110** and to a rest position of the suspension element **111** - of the device second member **235** substantially corresponds to the length of the downward movement of the tub **107** due to the weight of the laundry items loaded into the drum **110** of the laundry machine **100**.

[0129] The relative movement between the permanent magnets **215** and the sensor arrangement **235b** affects an operating electric parameter, e.g. an electric current value, of the magnetic field sensor **250** to an extent related to the length of the displacement.

[0130] The control system **150** of the laundry machine **100** is arranged to evaluate a weight of the laundry items provided in the drum **110** of the laundry machine by analyzing a corresponding signal provided by the sensor arrangement **235b** based on the electromagnetic interaction between the first and second sensor elements (i.e., the permanent magnets **215** and the magnetic field sensor **250**) advantageously processed by the electronic managing element **257**.

[0131] The components of the load sensing device **200** according to the present invention has a structure that may be simply and cheaply manufactured (e.g., in mould-

ed plastic material) and assembled.

[0132] Moreover, the load sensing device **200** may be simply provided in a laundry machine **100** without the need of specific tools or particular training for technicians. Indeed, the load sensing device **200** may be simply coupled with a suspension element **111** of the laundry machine **100** by firstly inserting the device first member **210** into the (cylindrical) space defined by the sequence of stacked spring coils **111b** until the coupling protrusions **225** engage the upper spring coil **220** of the sequence of stacked spring coils **111b**.

[0133] Afterwards, the device second member **235** is inserted into the cavity **237** of the tubular body **210a** of the device first member **210** until the hooked protrusion **247** engages the lower spring coil **220b** of the sequence of stacked spring coils **111b**.

[0134] Finally, the suspension element **111** with the load sensing device **200** is mounted in its operating position in the laundry machine **100**. Particularly, the suspension element **111** (carrying the load sensing device **200**) is coupled with the casing retaining element **113c** of the casing **105** and with the tub retaining element **113t** of the tub **107** by means of the upper coupling end **111a** and lower coupling end **111c**, respectively.

[0135] It should be noted that the load sensing device **200** may be provided to a laundry machine **100** without requiring the latter to comprise dedicated housing or receptacles. In other words, the load sensing device **200** is suited to be added to different laundry machines typologies without any (or minimum) changes to the design thereof and/or the load sensing device **200** is suited for easy retrofitting/substitution in deployed laundry machines **100**.

[0136] Turning now to **Figures 3A to 3F**, a different load sensing device **300** according to a second embodiment of the invention is shown. The load sensing device **300** is also adapted to be installed at a suspension element **111** of the laundry machine **100**.

[0137] The load sensing device **300** differs from the load sensing device **200** described above in what follows, where similar parts are denoted by similar reference and their description is not repeated for the sake of brevity.

[0138] The device second member **335**, according to the second embodiment of the invention, comprises a sliding portion **335a** and a clamping portion **360**.

[0139] The sliding portion **335a** is shaped in such a way to fit the cavity **330** of the tubular body **310a** of the first device member **310**. Particularly, the sliding portion **335a** is shaped in such a way to slidably couple with the tubular body **310a** of the device first member **310**, substantially as described above with respect to the sliding portion **335a** and the tubular body **310a**.

[0140] The clamping portion **360** is arranged for connecting with the tub **107** of the laundry machine **100**. Preferably, the clamping portion **360** is a coupling protrusion of the device second member **335** that protrudes from the bottom of the sliding portion **335a** and extends downwards.

[0141] For example, the clamping portion **360** is provided coupled with lower coupling end **111c** of the suspension element **111**, e.g. the clamping portion **360** is provided astride the lower coupling end **111c**. The clamping portion **360** is preferably adapted to be fitted into the same eyelet **305** of the tub retaining element **113t** wherein the hook of the lower coupling end **111c** of the suspension element **111** is fitted into. Alternatively, the clamping portion **360** is adapted to be fitted into an eyelet (not shown in the drawings) of an additional dedicated tub retaining element.

[0142] As in the load sensing device **200**, in the load sensing device **300**, the device first member **310** is fixed to the upper spring coil **320a** of the sequence of stacked spring coils **111b** - which is substantially integral with the upper coupling end **111a** of the spring element **111** and thus with the casing **105** of the laundry machine **100** to which the upper coupling end **111a** is coupled.

[0143] Therefore, the position of the device first member **310**, and particularly of the first sensor element (i.e., the permanent magnets **315**), is substantially integral with the casing **105** of the laundry machine **100**.

[0144] Conversely, the device second member **335** is fixed to the tub **107** (i.e., the second device member **335** is substantially integral with the tub **107**) as the lower coupling end **111c** of the suspension element **111** (to which the clamping portion **360** is coupled), the position of the second sensor, i.e. the magnetic field sensor **350**, varies according the oscillations of the tub **107**, as the suspension element **111** elongates and compresses according to the oscillations of the tub **107**.

[0145] In other words, the load sensing device **300** according to an embodiment of the present invention is arranged to be coupled with a suspension element **111** with the device first member **310** associated to a first portion of said suspension element (i.e., the upper coupling end **111a**) and with the device second member **335** associated to a second portion of the suspension element (i.e., the lower coupling end **111c**) - even though the *vice versa* is not excluded.

[0146] Thanks to such arrangement, any change of length (i.e., any extension/compression) of the suspension element **111** causes a change of distance (i.e., a displacement) between the first and second members **310** and **335** of the load sensing device **300** and thereby between said first and the second sensor elements **315** and **350**.

[0147] Thanks to such arrangement an improved reliability of the signal acquired is achieved since the load sensing device **200** is able to follow the movement/misalignments of the suspension element

[0148] It should be noted that, in further embodiments of the present invention (not shown), nothing prevents to invert the position of the first and the second sensor elements, e.g. a magnetic field sensor could be provided in the device first member while one or more permanent magnets could be provided in the device second member.

[0149] During operation the load sensing device **300** may be used to evaluating a weight of laundry items comprised in the drum **110** of the laundry machine **100** substantially as described above with respect to load sensing device **200** and with the same advantages.

[0150] In a preferred embodiment of the load sensing device **300** according to the invention, a diameter of the tubular body **310a** of the device first member **310** is smaller than a diameter of the (cylindrical) space defined by the sequence of stacked spring coils **111b** of the spring element **111**.

[0151] Moreover, the coupling protrusions **325** are designed to engage the upper spring coil **320a** in such a way to allow the device first member **310** to rotate about the two contact points between the protrusions **325** and the upper coil spring **320a**.

[0152] Thanks to the arrangement of the load sensing device **300** just described, the load sensing device **300** may rotate with respect to the axis of the suspension element **111**, particularly during extension and compression thereof, while the device first member **310** and the device second member **335** remain axially aligned (due to the precision between the cavity **337** and the sliding portion **335a**).

[0153] In other words, the device first member **310** is free of rotating around a fulcrum defined by a connection point between said the coupling protrusions **325** and said suspension element **111**.

[0154] Moreover, the load sensing device **300** may be simply provided in a laundry machine **100** without the need of specific tools or training for technicians. Indeed, the load sensing device **300** may be simply coupled with a suspension element **111** of the laundry machine **100** by simply inserting the device first member **310** into the sequence of stacked spring coils **111b** until the coupling protrusions **325** engage the upper spring coil **320** of the sequence of stacked spring coils **111b**.

[0155] Afterwards, the device second member **335** is inserted into the cavity **337** of the tubular body **310a** of the device first member **310**, at the same time the clamping portion **360** is coupled with the lower coupling end **111c** of the suspension element **111**.

[0156] It should be noted that also the load sensing device **300** may be provided to a laundry machine **100** without requiring the latter to comprise dedicated housing or receptacles. In other words, the load sensing device **300** is suited to be added to different laundry machines typologies without any (or minimum) changes to the design thereof and/or the load sensing device **300** is suited for easy retrofitting/substitution in deployed laundry machines **100**.

[0157] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations.

[0158] For example, in a further embodiment of the present invention (not shown) a device second member may be provided with both a hooked protrusion, for cou-

pling with a lower spring coil of the sequence of stacked spring coils, and a clamping portion, for coupling with the lower coupling end of the suspension element.

[0159] Furthermore, in alternative embodiments (not shown) a stand-alone load sensing device may be provided. The stand-alone load sensing device differs from the load sensing device **300** in what follows.

[0160] The stand-alone load sensing device may be directly connected to both the casing and to the tub of a laundry machine independently from any suspension elements.

[0161] For example a device first member of the stand-alone load sensing device may be provided with one or more modified clamping protrusions adapted to engage a respective retaining element provided in a top portion of the casing of the laundry machine, while the device second member of the stand-alone load sensing device may be connected to a respective retaining element provided in the tub of the laundry machine by means of the clamping portion.

Claims

1. A laundry machine (**100**) for treating laundry items, the laundry machine (**100**) comprising:

a cabinet (**105**) for accommodating components necessary for the operation of the laundry machine (**100**);

a washing tub (**107**) comprising a rotatable drum for containing laundry items, the washing tub (**107**) being enclosed by the cabinet (**105**) such that it can be moved in a floating manner inside said cabinet;

at least one suspension element (**111**) comprising a first portion (**220a, 111a; 320a, 111a**) associated to the cabinet (**105**) and a second portion (**220b, 111c; 111c**) associated to the washing tub (**107**) for movably coupling the tub (**107**) with the cabinet (**105**) of the laundry machine (**100**), and

a load sensing device (**200; 300**) for measuring a physical value related to the weight of laundry items provided in the washing tub (**107**), wherein the load sensing device (**200; 300**) comprises a device first member (**210; 310**) comprising a first sensor element (**215; 315**) and a device second member (**235; 335**) comprising a second sensor element (**235b; 335b**)

characterized in that

the load sensing device (**200; 300**) is coupled with the at least one suspension element (**111**) with the device first member (**210; 310**) associated to the first portion (**220a, 111a; 320a, 111a**) of said suspension element (**111**) and with the device second member (**235; 335**) associated to the second portion (**220b,**

- 111c; 111c)** of the suspension element **(111)** or *vice-versa*, thereby the change of length of the suspension element **(111)** causes the change of distance between said first and the second sensor elements.
2. The laundry machine **(100)** according to claim 1, wherein the first sensor element **(215; 315)** comprises at least one permanent magnet **(215; 325)**.
 3. The laundry machine **(100)** according to claim 2, wherein the second sensor element **(235b; 335b)** comprises at least one magnetic field sensor **(255; 355)**.
 4. The laundry machine **(100)** according to any one of the preceding claims, wherein the second sensor element **(235b; 335b)** comprises a sensor arrangement **(235b)** provided with an electronic board **(250; 350)**.
 5. The laundry machine **(100)** according to claim 4, further comprising a control system **(150)** configured for controlling the operation of the laundry machine **(100)**, and wherein the electronic board **(250; 350)** further mounts electronic components for exchanging signals with the control system **(150)** of the laundry machine **(100)**.
 6. The laundry machine **(100)** according to any one of the preceding claims, wherein the device first member **(210; 310)** and the device second member **(235; 335)** are slidably coupled one another.
 7. The laundry machine **(100)** according to claim 6, wherein the device first member **(210; 310)** comprises a tubular body **(210a; 310a)** which delimits a cavity **(230; 330)**, the cavity **(230; 330)** being adapted to receive at least a portion of the second device section **(235)**.
 8. The laundry machine **(100)** according to claim 7, wherein the device second member **(235; 335)** further comprises a sliding portion **(235a; 335a)** shaped to slidably fit the cavity **(230; 330)** delimited by the tubular body **(210a; 310a)** of the device first member **(210; 310)**.
 9. The laundry machine **(100)** according to claim 8, wherein the first sensor element **(215; 315)** is provided in the tubular body **(210a; 310a)** of the device first member **(210; 310)** and wherein the second sensor element **(235b; 335b)** is provided in the sliding portion **(235a; 335a)** of the device second member **(235; 335)**, or *vice-versa* the second sensor element **(235b; 335b)** is provided in the tubular body **(210a; 310a)** of the device first member **(210; 310)** and wherein the first sensor element **(215; 315)** is provided in the sliding portion **(235a; 335a)** of the device second member **(235; 335)**.
 10. The laundry machine **(100)** according to any one of the preceding claims, wherein the suspension element **(111)** comprises a upper coupling end **(111a)** for coupling with the cabinet **(105)** of the laundry machine **(100)**, a sequence of stacked spring coils **(111b)**, and a lower coupling end **(111c)** for coupling with the washing tub **(107)**, wherein the device first member **(210; 310)** comprises at least one coupling protrusion **(225; 325)** protruding from the device first member **(210; 310)**, the at least one coupling protrusion **(225; 325)** being adapted to engage with the suspension element **(111)**.
 11. The laundry machine **(100)** to any one of the preceding claims, wherein the suspension element **(111)** comprises a upper coupling end **(111a)** for coupling with the cabinet **(105)** of the laundry machine **(100)**, a sequence of stacked spring coils **(111b)**, and a lower coupling end **(111c)** for coupling with the washing tub **(107)**, and wherein the device second member **(235; 335)** comprises at least one coupling protrusion **(247)** protruding from the device second member **(235; 335)**, the at least one coupling protrusion **(247)** being adapted to engage with the suspension element **(111)**.
 12. The laundry machine **(100)** according to any one of the preceding claims, wherein the device first member **(210; 310)** is associated to the first portion **(220a, 111a; 320a, 111a)** or to the second portion **(220b, 111c; 320b, 111c)** of the suspension element **(111)** or *vice-versa* through connection means **(225; 325)** allowing the rotation of said first portion **(220a, 111a; 320a, 111a)** around the fulcrum defined by the connection point between said connection means **(225; 325)** and said suspension element **(111)**.
 13. Method of assembly a laundry machine **(100)** comprising:
 - providing a cabinet **(105)** for accommodating components necessary for the operation of the laundry machine **(100)**;
 - providing a washing tub **(107)** comprising a rotatable drum for containing laundry items,
 - providing at least one suspension element **(111)** comprising a first portion and a second portion;
 - associating the first portion of said suspension element **(111)** to the cabinet **(105)**;
 - associating the second portion of said suspension element **(111)** to the washing tub **(107)**, thereby movably coupling the tub **(107)** with the

cabinet (105) of the laundry machine (100) such that it can be moved in a floating manner inside said cabinet, and
 providing a load sensing device (200; 300) for measuring a physical value related to the weight of laundry items provided in the washing tub (107), wherein the load sensing device (200; 300) comprises a device first member (210; 310) comprising a first sensor element (215; 315) and a device second member (235; 335) comprising a second sensor element (235b; 335b)

inserting the device second member (235) into the cavity (230) of the device first member (210) until the respective coupling protrusions (247) engages a lower spring coil (220b) of the sequence of stacked spring coils (111b).

characterized in that

providing a load sensing device (200; 300) comprises:

coupling the device first member (210; 310) with the first portion of said suspension element (111), and
 coupling the device second member (235; 335) with the second portion of said suspension element (111), or
vice-versa coupling the device second member (235; 335) with the first portion of said suspension element (111), and
 coupling the device first member (210; 310) with the second portion of said suspension element (111).

14. The method according to claim 13, wherein the at least one suspension element (111) further comprises a sequence of stacked spring coils (111b) interposed between said first portion and second portion of said suspension element (111), the sequence of stacked spring coils (111b) delimiting an inner space, and
 the device first member (210; 310) of the load sensing device (200; 300) further comprises at least one coupling protrusions (225; 325), and
 wherein the coupling the device first member (210; 310) with the first portion of said suspension element (111) comprises:

inserting the device first member (210; 310) into the inner space defined by the sequence of stacked spring coils (111b) until said coupling protrusion (225; 325) engage an upper spring coil (220a; 320a) of the sequence of stacked spring coils (111b).

15. The method according to claim 14, wherein the device second member (235) further comprises a respective coupling protrusion (247), and
 the device first member (210) of the load sensing device (200) further comprises a cavity (230), and
 wherein coupling the device second member (235) with the second portion of said suspension element (111) comprises

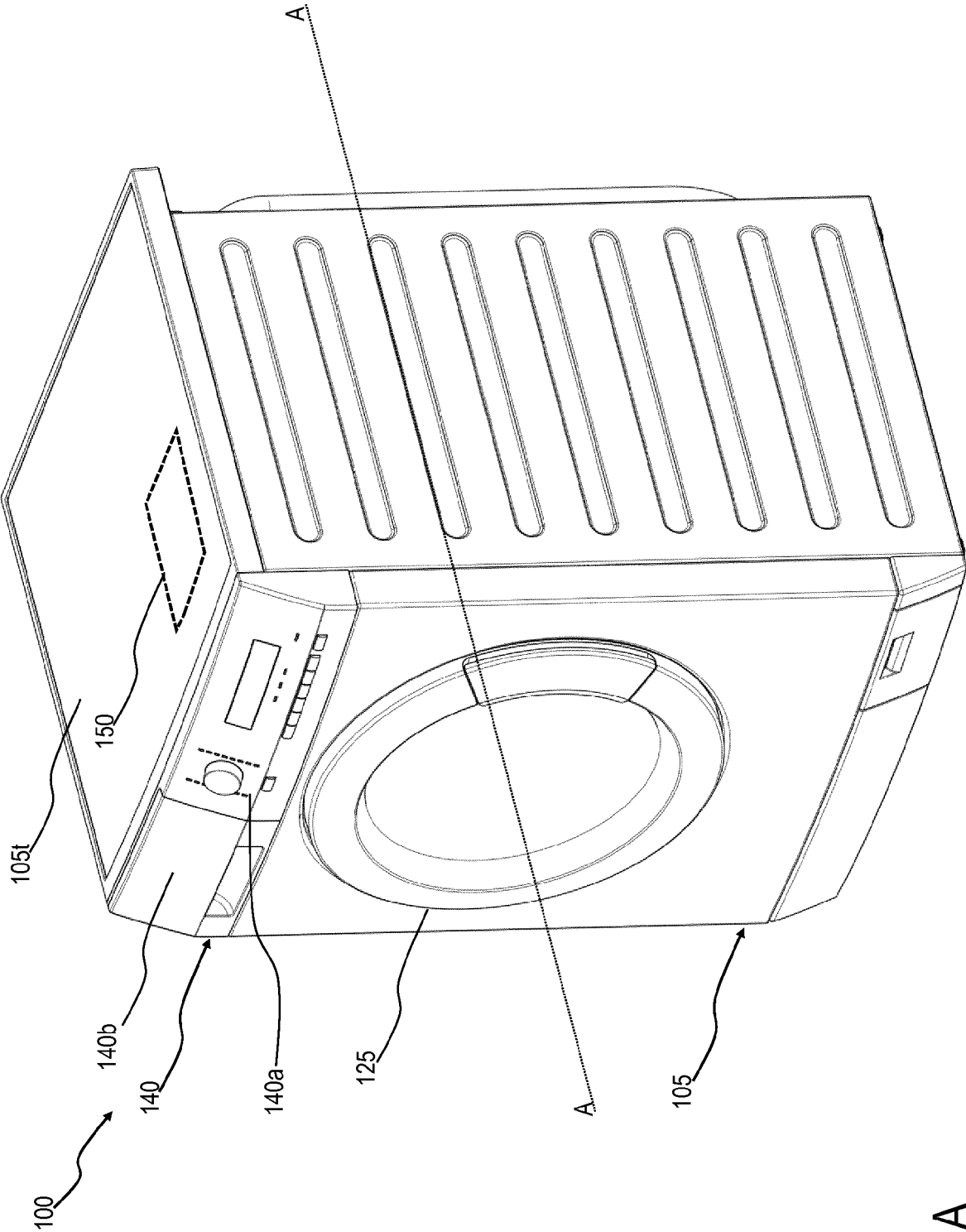


FIG. 1A

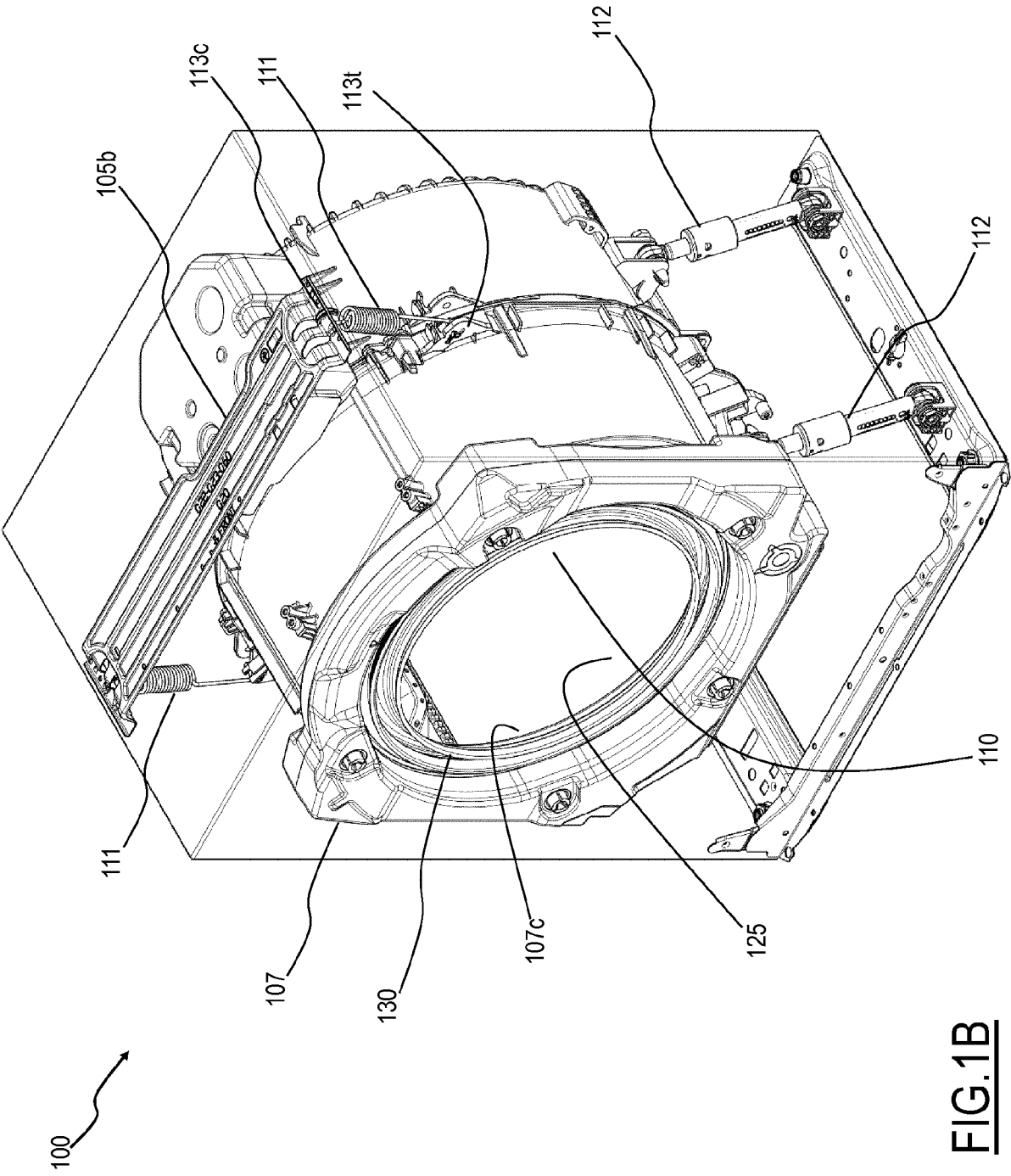


FIG.1B

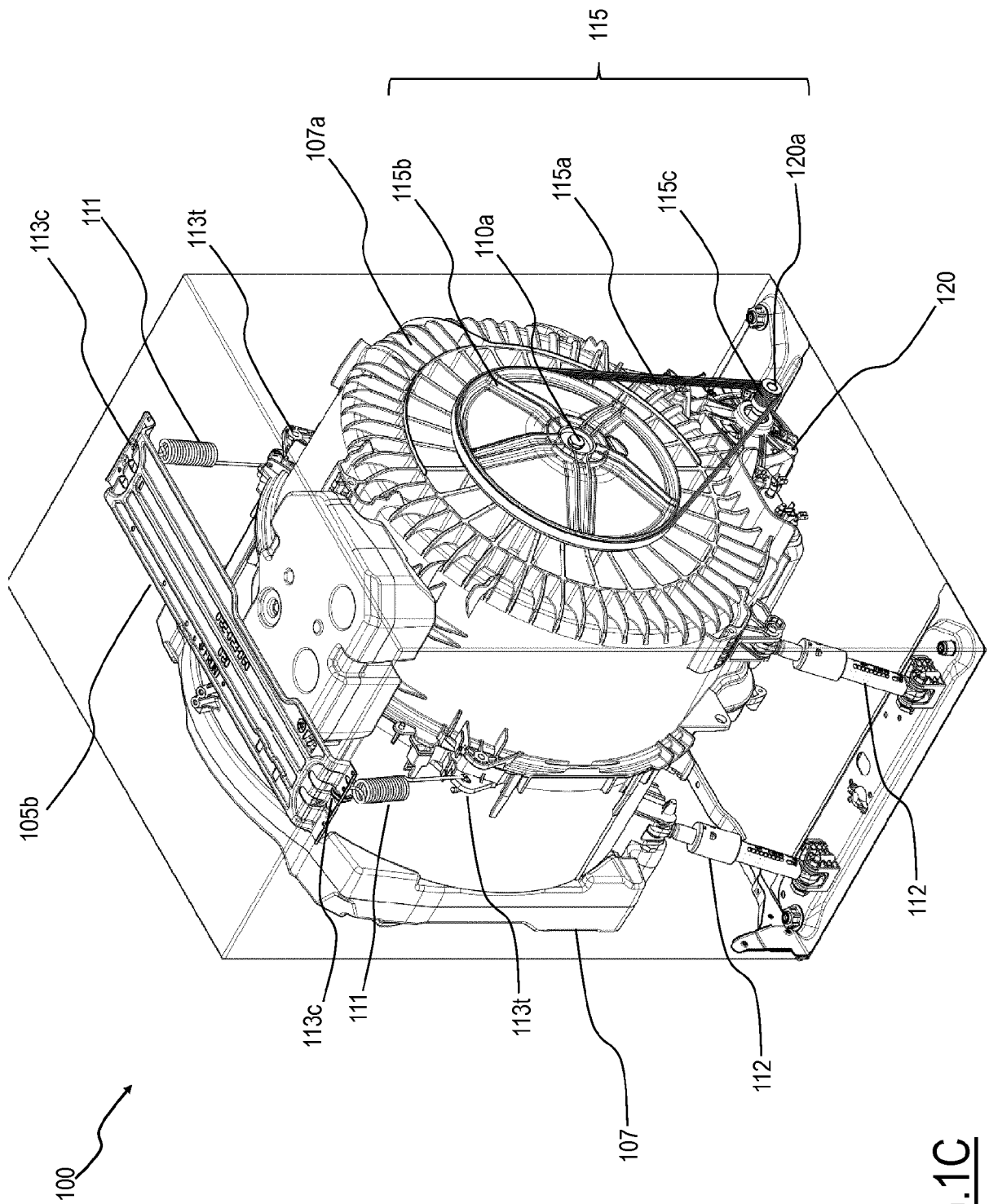


FIG.1C

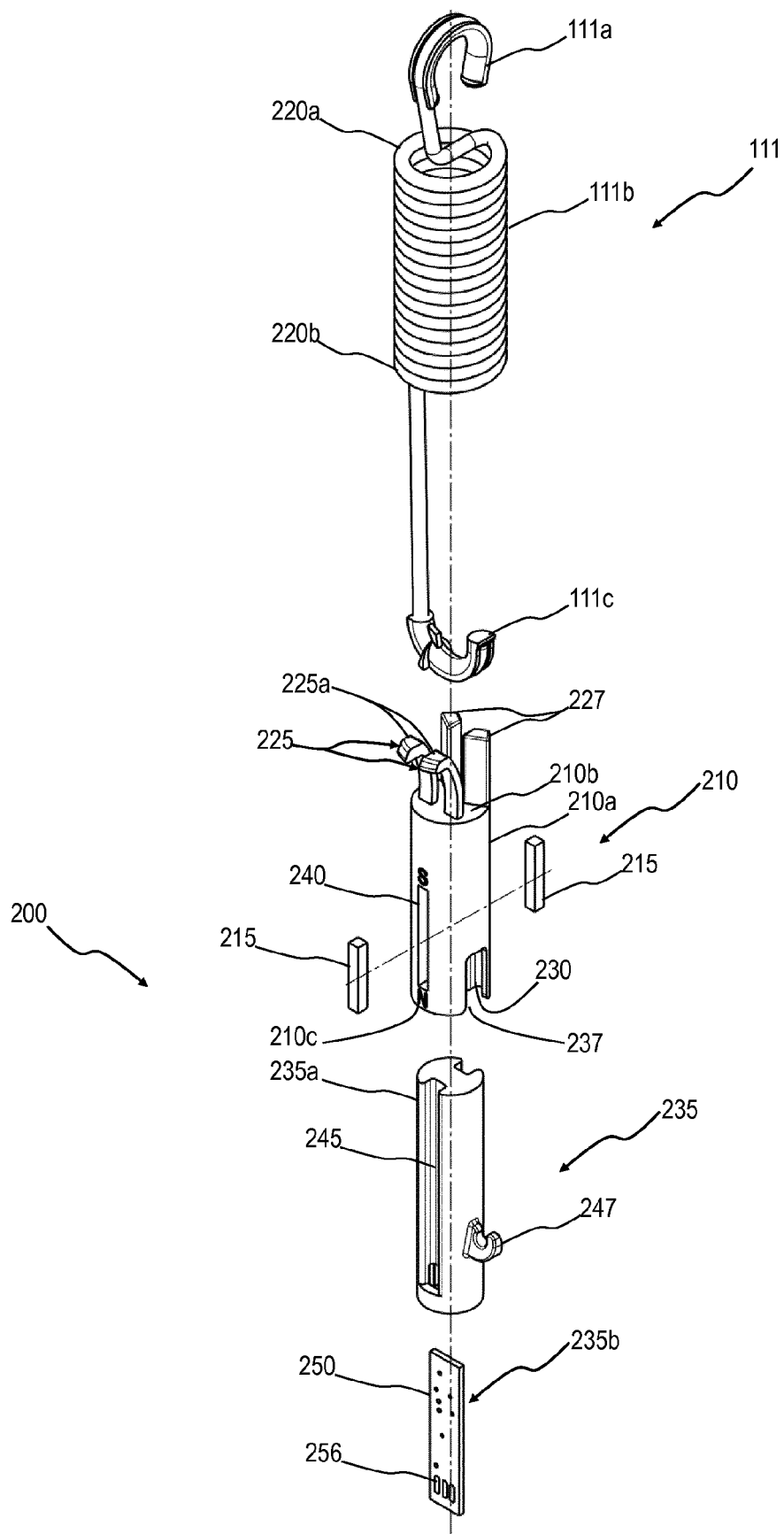
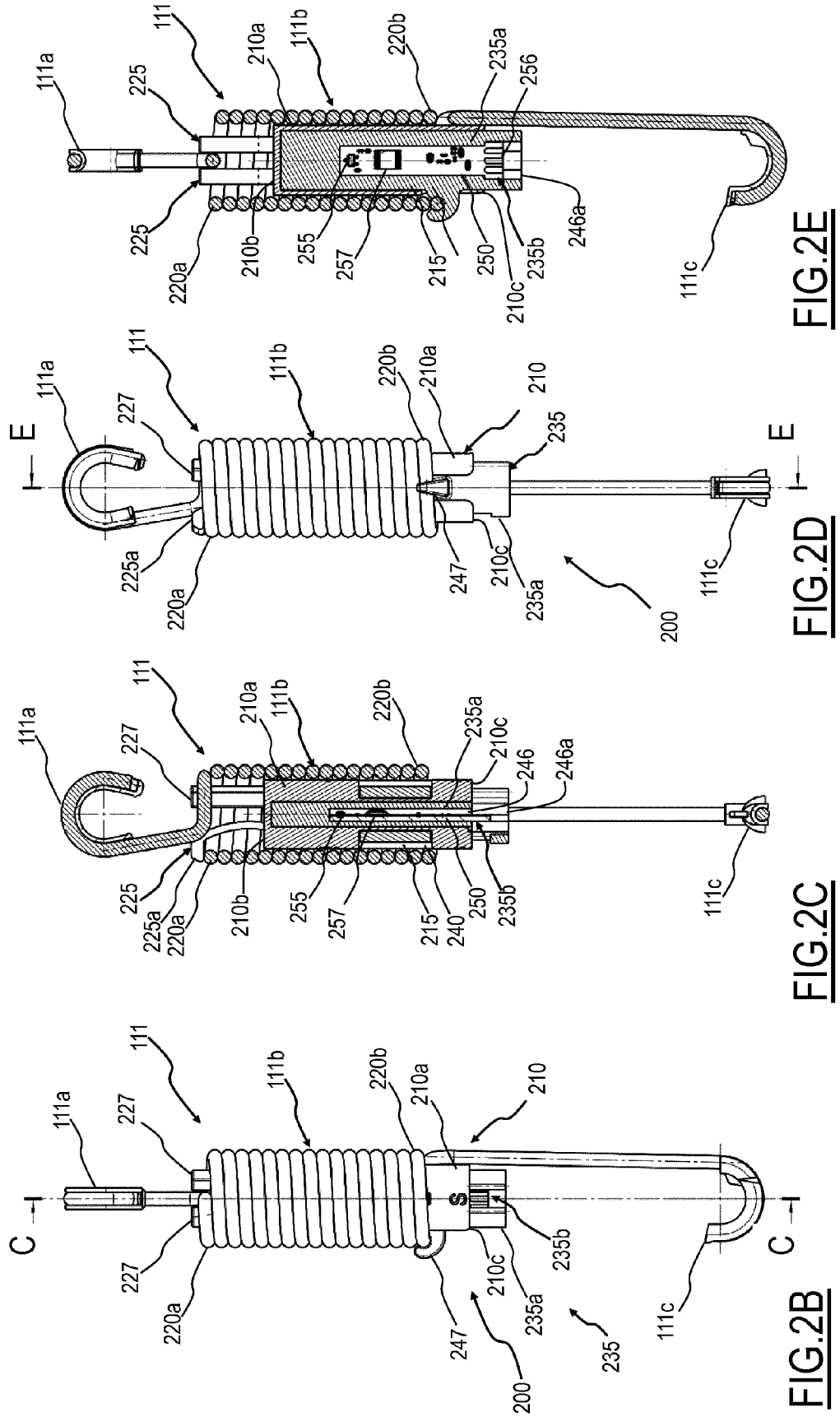


FIG. 2A



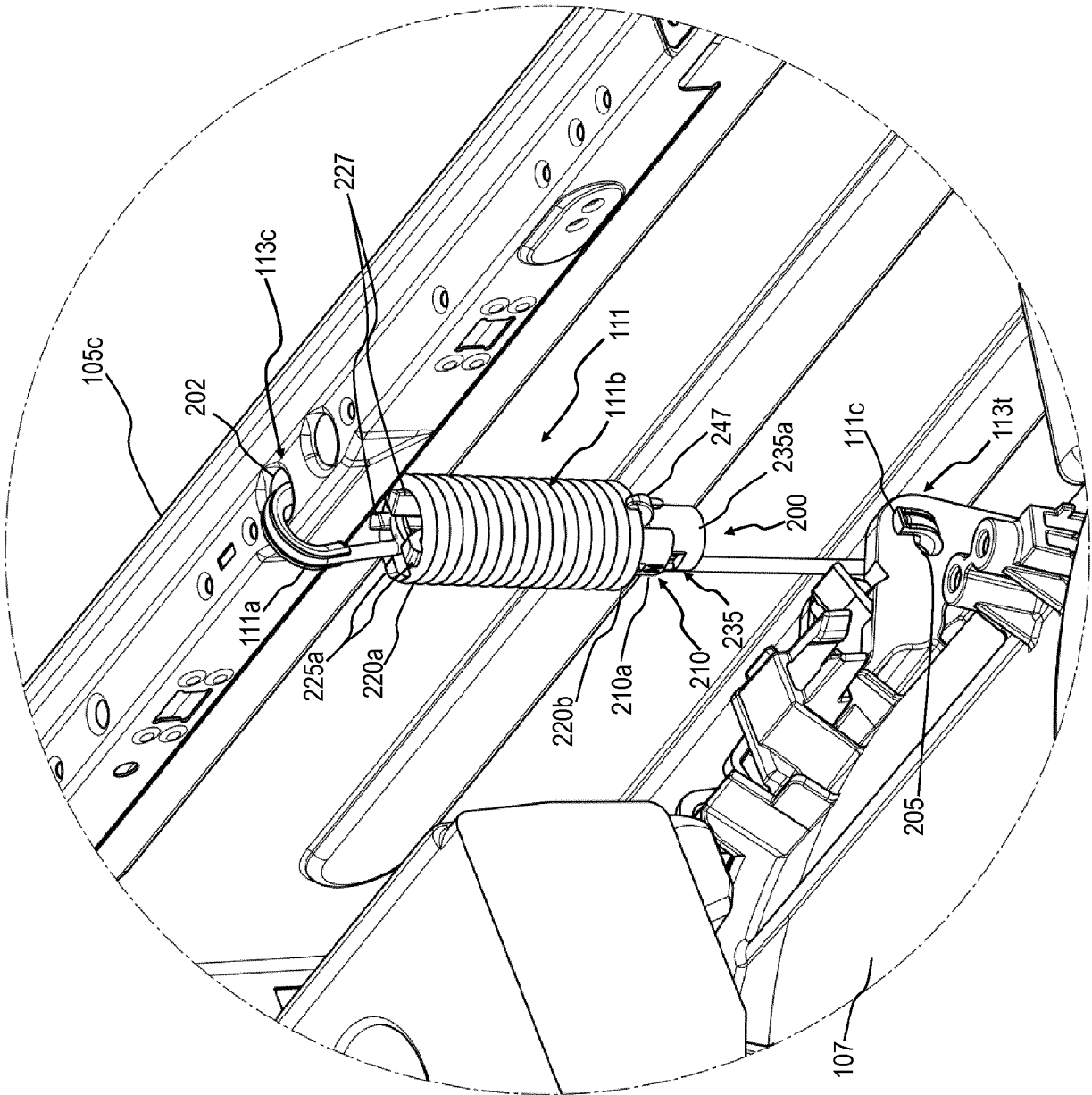


FIG. 2F

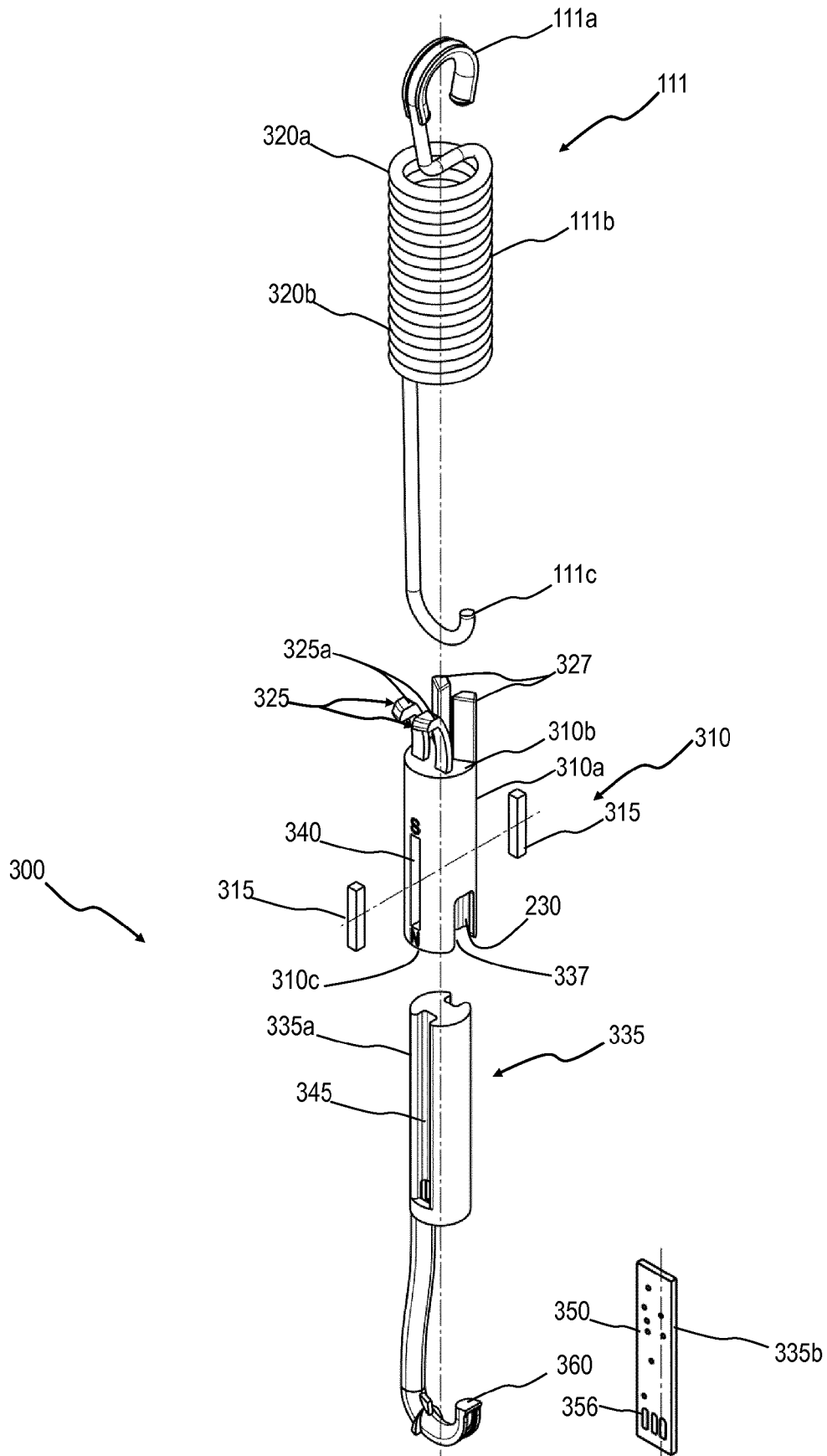
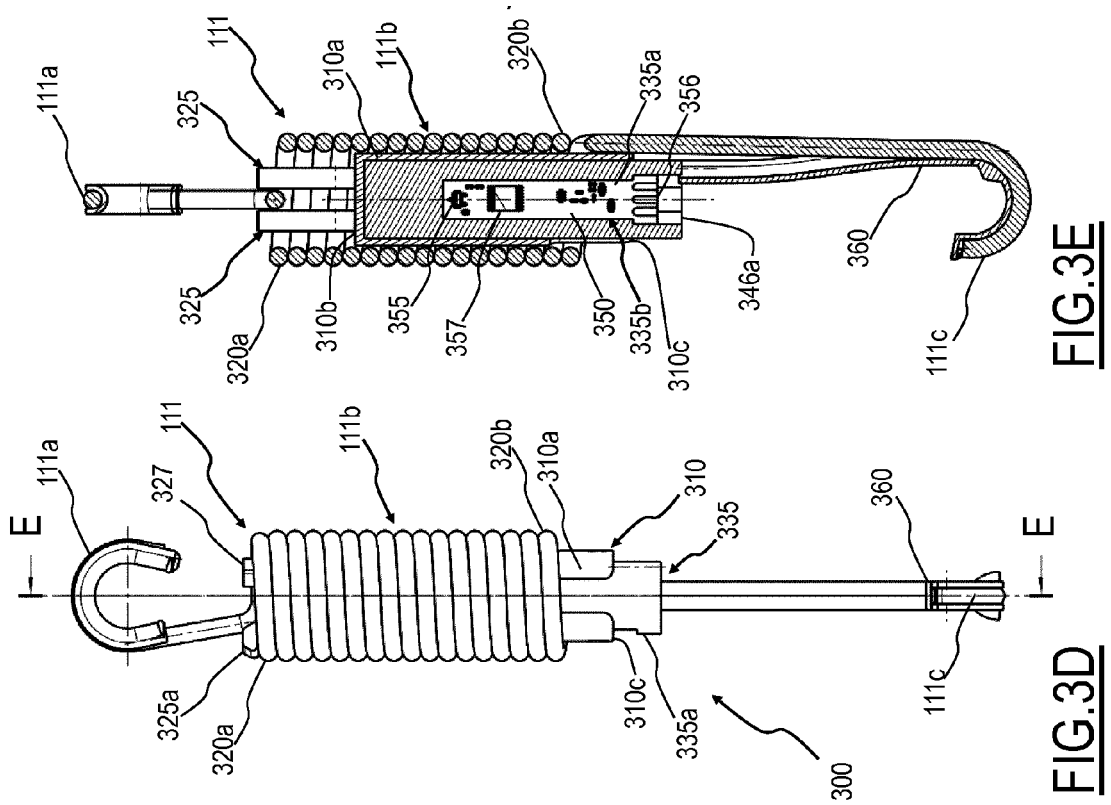
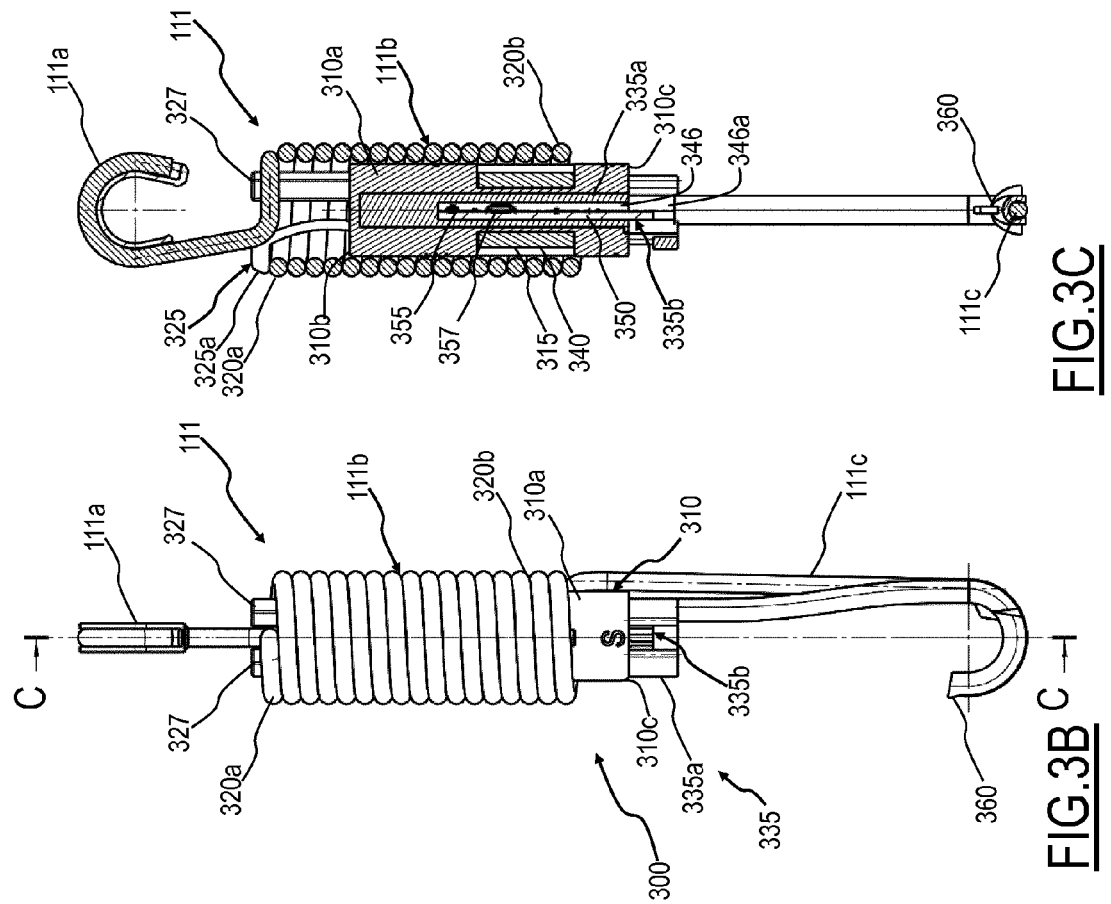
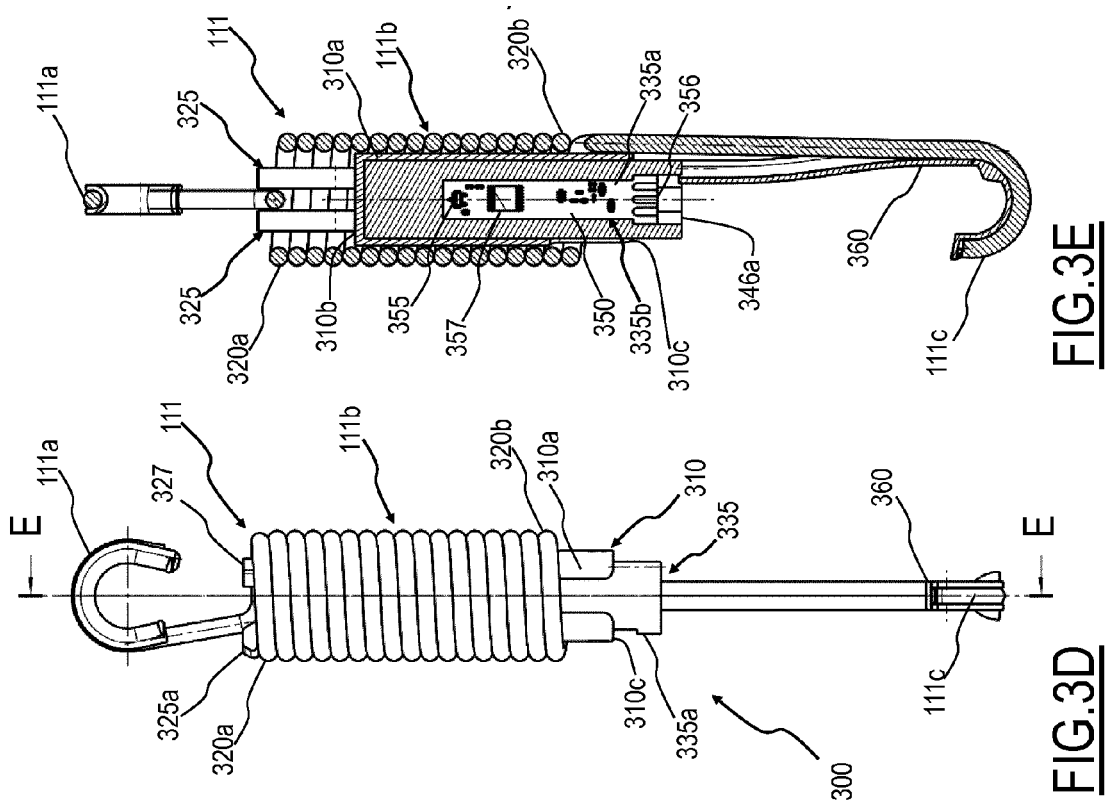


FIG. 3A



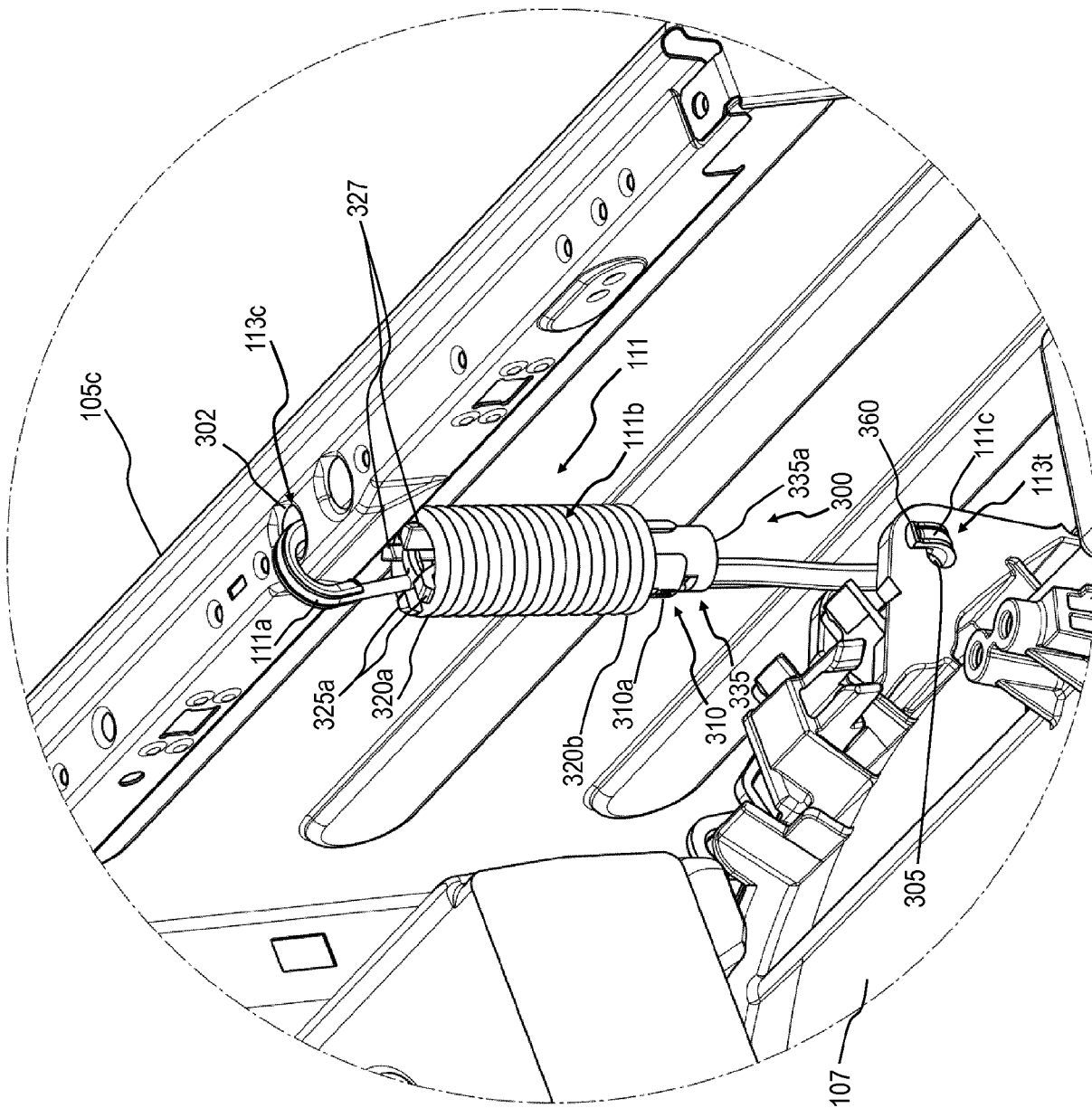


FIG. 3F



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