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(54) **LAUNDRY WASHING MACHINE EQUIPPED WITH A BEARING ASSEMBLY FOR THE WASHING DRUM**

(57) The invention relates to a laundry washing machine (1) comprising a tub (3) and a drum (4) rotatable inside the tub (3) by means of a shaft (50) which is supported by said tub (3) at a wall (36) thereof by means of a bearing assembly (100). The bearing assembly (100) comprises a first element (102) fixedly provided to the wall (36) and a second element (104) removably connected to the first element (102).

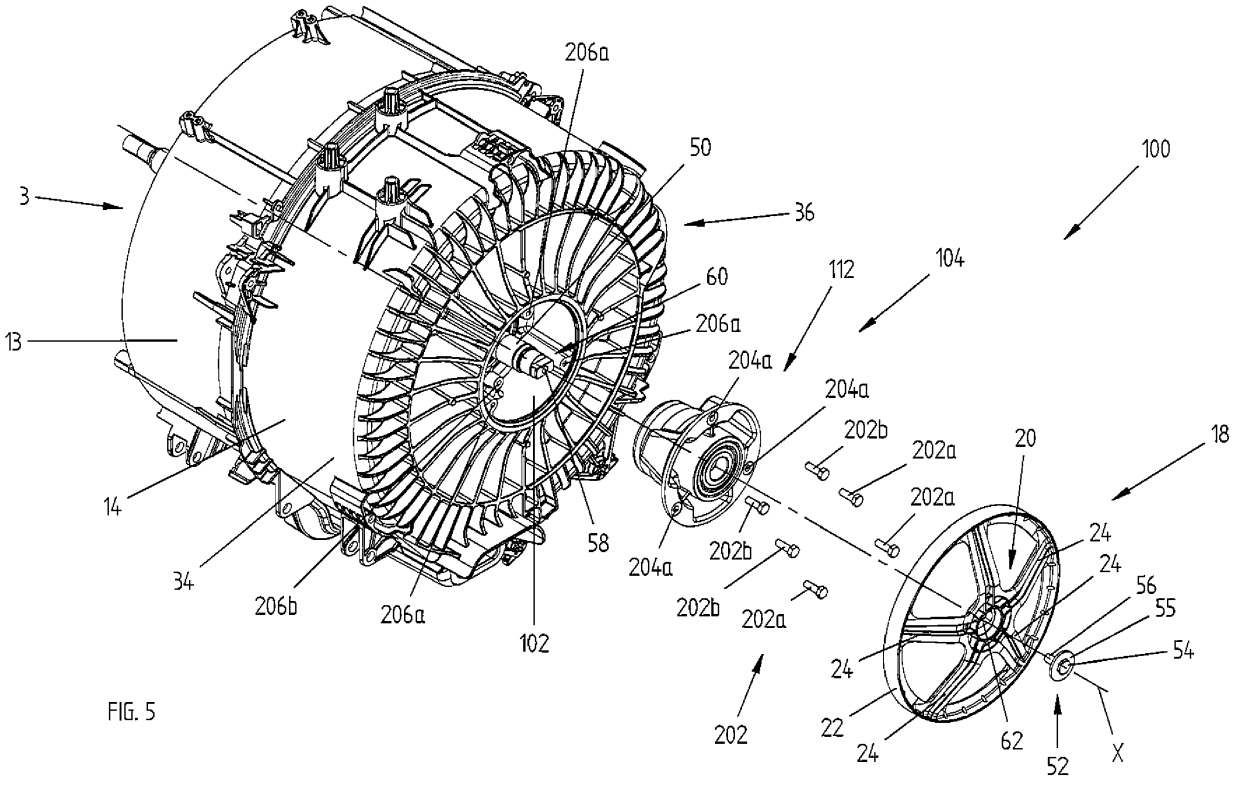

FIG. 5

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Description

[0001] The present invention concerns the field of laundry washing machines.

[0002] In particular, the present invention refers to bearing assemblies for washing drums in laundry washing machines.

BACKGROUND ART

[0003] Nowadays the use of laundry washing machines, both "simple" laundry washing machines (i.e. laundry washing machines which can only wash and rinse laundry) and laundry washing-drying machines (i. e. laundry washing machines which can also dry laundry), is widespread.

[0004] In the present description, the term "laundry washing machine" will refer to both a simple laundry washing machine and a laundry washing-drying machine. Laundry washing machines generally comprise an external casing, or cabinet, provided with a washing tub rotatably supporting a rotatable perforated drum where the laundry is placed.

[0005] The drum is preferably rotated by means of a shaft and a motor unit coupled thereto.

[0006] A motor unit of known type comprises an electric motor usually arranged close to the tub and connected to the shaft by means of a mechanical transmission device, preferably by means of a belt that drives a pulley coupled to the shaft. Another motor unit of known type comprises a so called "direct drive motor". The motor unit preferably comprises a stator which is preferably fixed to the rear wall of the tub and a rotor which is directly connected to the shaft so that the drum can be rotated without using further mechanical transmission devices. According to the known technique, the shaft is preferably rotatably supported by the tub through a bearing assembly.

[0007] US7,862,871B2 discloses a bearing assembly of known type. The document discloses a laundry washing machine including a washing tub having a plastic injection-molded wall wherein the bearing assembly is provided for supporting the shaft thereto.

[0008] The bearing assembly comprises a plastic member, moulded with said wall, which is, in turn, injection-moulded onto a bearing shell apt to rotatably receive the shaft.

[0009] Analogously, US8,590,347B2 discloses a bearing assembly of known type. The document also discloses a laundry washing machine including a washing tub having a plastic injection-molded wall wherein the bearing assembly is provided for supporting the shaft thereto.

[0010] The bearing assembly comprises a housing sleeve, moulded with said wall, which is, in turn, moulded onto two rolling bearings apt to rotatably receive a support shaft of the drum.

[0011] The bearing assembly represents a critical part of a laundry washing machine since it must withstand high mechanical stresses, for example vibrations, in particular during the centrifugal step of a laundry washing cycle. Mechanical stresses are mainly due to rotation of the soaked laundry inside the drum and therefore strongly depends on the drum rotation speed and/or on the amount of load which is inserted into the drum and/or the imbalance state of the load inside the drum.

[0012] At this purpose, designing and realization of bearing assemblies is strictly linked to the type of laundry washing machine, in particular to the maximum laundry load amount which can be loaded, known as capacity, and/or to its maximum rotation speed.

[0013] In fact, a bearing assembly for a laundry washing machine of higher capacity (for example a 9kg large load capacity laundry machine) requires bulky and/or stronger components than a laundry washing machine with lower capacity (for example a 6kg medium load capacity laundry machine). Analogously, a bearing assembly for a laundry washing machine with high maximum rotation speed (for example 1500 rpm) requires bulky and/or stronger components than a laundry washing machine with lower maximum rotation speed (for example 1000 rpm). The bearing assemblies according to the known technique, nevertheless, revealed some drawbacks.

[0014] A drawback posed by the bearing assemblies of the known art and/or the laundry washing machines having such bearing assemblies lies in that they require high manufacturing costs.

[0015] Another drawback posed by the bearing assemblies of the known art lies in that mechanical stresses negatively affect the strength and stiffness of the assembly and therefore reliability of the laundry washing machine.

[0016] This may negatively affect maintenance costs, in particular if replacement of the bearing assembly or parts thereof is required.

[0017] The object of the present invention is therefore to overcome the drawbacks posed by the known technique.

[0018] It is an object of the invention to provide a bearing assembly having reduced designing and/or manufacturing costs compared to laundry washing machines of known type.

[0019] It is another object of the invention to provide a laundry washing machine equipped with a bearing assembly having higher reliability compared to laundry washing machines of known type.

DISCLOSURE OF INVENTION

[0020] The applicant has found that by providing a laundry washing machine comprising a tub and a drum rotatable inside the tub by means of a shaft which is supported by said tub at a wall thereof by means of a bearing assembly, wherein the bearing assembly comprises a first element fixedly provided to the wall and a second element removably connected to the first element, it is possible to overcome drawbacks of known techniques.

[0021] The present invention relates, therefore, to a laundry washing machine comprising:

a casing supporting a tub and a drum adapted to receive laundry to be treated,
said drum being housed in a rotatable manner inside said tub;
a shaft coupled to said drum and aligned along a reference rotation axis for rotating said drum;
a bearing assembly supporting said shaft at a wall of said tub, wherein said bearing assembly comprises a first element fixedly provided to said wall of said tub and wherein said bearing assembly comprises a second element apt to support said shaft with respect to said tub and to allow rotation of said shaft, wherein said second element is adapted to be removably connected to said first element.

[0022] In a preferred embodiment of the invention, the tub is made of a polymeric material.

[0023] Preferably, the first element is injection-moulded to said wall of the tub.

[0024] In a preferred embodiment of the invention, the first element comprises a tubular insert.

[0025] According to a preferred embodiment of the invention, the first element is made of a metallic material and the second element is made of a metallic material or a polymeric material.

[0026] Preferably, the first element is made of steel material or cast iron or aluminium. Preferably, the second element is made of steel material or cast iron or aluminium or a reinforced plastic material.

[0027] According to a preferred embodiment of the invention, the second element is removably connected to the first element by means of one or more fastening devices.

[0028] Preferably, said one or more fastening devices comprise one or more fastening devices selected from the group comprising: screws, rivets, snap connections, bayonet connections.

[0029] Preferably, the fastening devices comprise screws engaging the first element and the second element, more preferably engaging holes or threaded holes of the second element and threaded holes of the first element.

[0030] In a preferred embodiment of the invention, the fastening devices comprise a first set of fastening devices and a second set of fastening devices.

[0031] Preferably, the first set of fastening devices are spaced apart from the second set of fastening devices along the reference rotation axis.

[0032] In a preferred embodiment of the invention, the laundry washing machine further comprises one or more rolling devices interposed between the second element and the shaft.

[0033] Preferably, said one or more rolling devices comprise one or more rolling devices selected from the group comprising bearings or bushings.

[0034] Preferably, said one or more rolling devices comprise a first rolling device and a second rolling device spaced apart one to the other along the reference rotation axis.

[0035] According to a preferred embodiment of the invention, the first set of fastening devices is at least partially aligned along the reference rotation axis to the first rolling device and/or the second set of fastening devices is at least partially aligned along the second reference rotation axis to the second rolling device.

[0036] In a preferred embodiment of the invention, the second element extends along the reference rotation axis between a first end side and a second end side.

[0037] Preferably, the first set of fastening devices is located closer to the first end side of the second element along the reference rotation axis than the second set of fastening devices and the second set of fastening devices is located closer to the second end side of the second element along the reference rotation axis than the first set of fastening devices.

[0038] In other words, the distance of the first set of fastening devices from the first end side of the second element along the reference rotation axis is lower than the distance of the second set of fastening devices from said first end side along the reference rotation axis and the distance of the second set of fastening devices from the second end side of the second element along the reference rotation axis is lower than the distance of first set of fastening devices from said second end side along the reference rotation axis.

[0039] Preferably, the first rolling device is located closer to the first end side of the second element along the reference rotation axis than the second rolling device and the second rolling device is located closer to the second end side of the second element along the reference rotation axis than the first rolling device.

[0040] In other words, the distance of the first rolling device from the first end side of the second element along the reference rotation axis is lower than the distance of the second rolling device from said first end side along the reference rotation axis and the distance of second rolling device from the second end side of the second element along the reference rotation axis is lower than the distance of first rolling device from said second end side along the reference rotation axis.

[0041] In a preferred embodiment of the invention, the laundry washing machine comprises a motor unit for driving in rotation the shaft.

[0042] According to a preferred embodiment of the invention, the motor unit comprises a pulley fixedly coupled to the shaft, an electric motor and a belt connecting the electric motor to the pulley.

[0043] According to a further preferred embodiment of the invention, the motor unit comprises a stator which is fixed to the wall of the tub and a rotor connected to the shaft.

[0044] In a further preferred embodiment of the invention, the laundry washing machine comprise two shafts

coupled to respective opposite walls of the drum and aligned along a reference rotation axis for rotating the drum and two bearing assemblies supporting a respective one of said two shafts.

[0045] Preferably, one of the two shafts which is connected to a motor unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description of a preferred embodiment of the invention, provided with reference to the enclosed drawings. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In such drawings:

- Figure 1 shows a front perspective view of a laundry washing machine according to a preferred embodiment of the invention;
- Figure 2 shows the front perspective view of the laundry washing machine of Figure 1 in which the casing has been depicted in transparency in order to show internal components of the laundry washing machine;
- Figure 3 shows a rear view of the laundry washing machine of Figure 2;
- Figure 4 shows some components of Figure 3 isolated from the rest;
- Figure 5 shows components of Figure 4 in a disassembled configuration;
- Figure 6 shows components of Figure 4 in a further disassembled configuration;
- Figure 7 shows some components of Figure 6 isolated from the rest;
- Figure 8 shows a side plan view of Figure 4;
- Figure 9 shows components of Figure 8 with an element removed therefrom;
- Figure 10 shows a plan view of Figure 8 sectioned along line X°-X°;
- Figure 11 shows an enlarged view of a detail of Figure 10;
- Figure 12 shows an enlarged view of a detail of Figure 11.

DETAILED DESCRIPTION OF THE INVENTION

[0047] The present invention has proved to be particularly advantageous when applied to laundry washing machines, as described below. It should in any case be underlined that the present invention is not limited to laundry washing machines. On the contrary, the present invention can be conveniently applied to laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry).

[0048] The laundry washing machine 1 illustrated in Figure 1 is a laundry washing machine of the front loading type; it is however clear that the invention can be applied as well to a top-loading laundry washing machine.

[0049] The laundry washing machine 1 comprises an external casing or cabinet 2 in which a washing tub 3 (or simply tub), preferably supported by coil springs and shock-absorbers 19, is fixed to the casing 2 (indicated in Figure 2). The external casing 2 preferably comprises vertical side walls 2a-2d and an upper side wall 2e. Tub 3 encloses a rotatable washing drum 4 (or simply drum), wherein laundry can be loaded to be submitted to a washing process (or also to a drying process in the case of a washing-drying machine). The drum 4 is located in axially rotating manner inside the tub 3 along a reference rotation axis X.

[0050] The tub 3 and the drum 4 both preferably have a substantially cylindrical-shaped, tubular body.

[0051] The tub 3 preferably comprises a front hemi-shell 13 and a rear hemi-shell 14 structured for being reciprocally coupled to form the tub 3.

[0052] The tub 3 preferably comprises a front wall 30 provided with a front mouth 32, a lateral substantially cylindrical wall 34 and a rear wall 36. The rear wall 36 is preferably provided with enforcement ribs 36a. The ribs 36a are advantageously arranged concentrically to provide structural rigidity to the tub 3 which is necessary due to vibrations generated by the rotating drum 4.

[0053] Preferably, the tub 3 is made of a polymeric material, more preferably of plastic material in an injection moulding process.

[0054] In particular, preferably, rear wall 36 is defined in the rear hemi-shell 14 of the tub 3.

[0055] Analogously, the drum 4 preferably comprises a front wall 40 provided with a front mouth 42, a lateral substantially cylindrical perforated wall 44 and a rear wall 46.

[0056] A shaft 50 is coupled to the drum 4, preferably protruding from its rear wall 46, through which the drum 4 is made rotated during the washing (or drying) cycle(s).

[0057] The shaft 50 extends along an axis which coincides with the reference rotation axis X of the drum 4.

[0058] The shaft 50 is advantageously fixedly connected to the rear wall 46 of the drum 4 so that the drum 4 may rotate when the shaft 50 is made rotated by a motor unit 10.

[0059] Preferably, the drum 4 is made of a metallic material, more preferably of stainless steel.

[0060] According to an aspect of the invention, the shaft 50 is preferably rotatably supported at the rear wall 36 of the tub 3 by a bearing assembly 100.

[0061] The bearing assembly 100 is preferably arranged centrally at the rear wall 36 of the tub 3.

[0062] In the preferred embodiment described and illustrated herein, the motor unit 10 preferably comprises a pulley 18 fixedly coupled to the shaft 50, an electric motor 12 arranged close to the tub 3, preferably below the tub 3, and a belt 16 connecting the electric motor 12 to the pulley 18 for driving the pulley 18 and the shaft 50 in rotation.

[0063] The pulley 18 preferably comprises a central

body 20 and a circular rail 22 for the belt 16, the central body 20 and the circular rail 22 being preferably interconnected through radial arms 24, more preferably five arms 24.

[0064] The pulley 18 is preferably coupled to the shaft 50 by means of a bolt 52 having an enlarged head 54 abutting the central body 20 of the pulley 18 and a threaded shank 56 which engages with a threaded hole 58 provided at the end 60 of the shaft 50.

[0065] A washer 55 is preferably interposed between the enlarged head 54 of the bolt 52 and the central body 20 of the pulley 18.

[0066] Preferably, a squared hole 62 of the central body 20 is fitted to the respective squared end 60 of the shaft 50 to allow a firm connection of the pulley 18 to the shaft 50.

[0067] In further preferred embodiments, the motor unit may be of the type called "direct drive motor". In this case, the motor unit preferably comprises a stator which is preferably fixed to the rear wall of the tub and a rotor which is directly connected to the shaft so that the drum can be rotated without using further mechanical transmission devices.

[0068] According to the invention, the bearing assembly 100 preferably comprises a first element 102 fixedly provided to the rear wall 36 of the tub 3 and a second element 104.

[0069] In particular, preferably, the first element 102 is fixedly provided to the rear wall 36 of the rear hemi-shell 14 of the tub 3.

[0070] The second element 104 is preferably apt to support the shaft 50 with respect to the tub 3 and allows the rotation of the shaft 50.

[0071] The first and second elements 102 preferably extends along the reference rotation axis X.

[0072] The second element 104 preferably extends along the reference rotation axis X between a first end side 124 and a second end side 126.

[0073] The first element 102 preferably comprises an insert 106 which is fixedly provided to the rear wall 36 of the tub 3.

[0074] The first element 102 is preferably made of a rigid and stable material such as a metallic material, for example a steel material or cast iron or aluminium. Preferably the insert 106 is injection-moulded to the rear wall 36 of the tub 3. The insert 106 is preferably tubular shaped and extends substantially perpendicular to the rear wall 36 of the tub 3. The insert 106 is coaxial, in the assembled condition, to the shaft 50.

[0075] The insert 106 preferably extends from an inner side surface 108 to a front side surface 110 thereof (as shown in Figure 11). Width of the insert 106, which is substantially defined by the distance between the inner side surface 108 and the front side surface 110, preferably substantially corresponds to, or is slightly smaller than, the width of the central area of the rear wall 36 of the tub 3.

[0076] A covering portion 203 of the tub 3 preferably covers the inner side surface 108 of the insert 106. More preferably, material which constitutes the covering portion 203 is embedded in a circumferential recess 205 realized in the inner side surface 108 of the insert 106. The tub 3 advantageously acquires a good cohesion or adhesion with the insert 106.

[0077] According to a preferred aspect of the invention, the second element 104 of the bearing assembly 100 is removably connected to the first element 102.

[0078] The second element 104 is preferably removably connected to the first element 102 by means of fastening devices 200.

[0079] In the preferred embodiment described and illustrated herein, the fastening devices 200 preferably comprise screws 202a, 202b, as described in detail later. In further preferred embodiments, the fastening devices may comprise different and/or further devices, for example rivets and/or snap connections and/or bayonet connections.

[0080] The second element 104 is preferably made of a metallic material or a polymeric material, for example steel material or cast iron or aluminium or a reinforced plastic material.

[0081] The bearing assembly 100 further preferably comprises one or more rolling devices 300 interposed between the second element 104 and the shaft 50 to allow rotation of the latest.

[0082] In the preferred embodiment described and illustrated herein, the rolling devices 300 preferably comprise first and second bearings 302, 304 with respective outer rings 302a, 304a contacting the second element 104 and respective inner rings 302b, 304b contacting the shaft 50.

[0083] Preferably, first and second bearings 302, 304 are spaced apart along the reference rotation axis X.

[0084] More preferably, the first bearing 302 is located closer to the first end side 124 of the second element 104 along the reference rotation axis X than the second bearing 304 and the second bearing 304 is preferably located closer to the second end side 126 of the second element 104 along the reference rotation axis X than the first bearing 302. In other words, the distance of the first bearing 302 from the first end side 124 of the second element 104 along the reference rotation axis X is lower than the distance of the second bearing 304 from said first end side 124 along the reference rotation axis X and the distance of second bearing 304 from the second end side 126 of the second element 104 along the reference rotation axis X is lower than the distance of first bearing 302 from said second end side 126 along the reference rotation axis X.

[0085] Advantageously, mechanical stresses which affect the bearing assembly 100, in particular the mechanical stresses which affect the second element 104 supporting the shaft 50 through the bearings 302, 304 during rotation of the drum 4, are well distributed over the bearings 302, 304 and the shaft 50.

[0086] In a preferred embodiment, the second element

104 is injection-moulded (or over-moulded) onto the outer rings 302a, 304a of said bearings 302, 304.

[0087] In further preferred embodiments, the rolling devices may comprise different elements, for example bushing elements.

[0088] The second element 104 preferably comprises a hub 112, preferably tubular shaped, surrounding the shaft 50 and that houses said bearings 302, 304.

[0089] The hub 112 is preferably formed by injection moulding of a polymeric material. The hub 112 preferably comprises spaced apart seats 116, 118 which receive respective outer rings 302a, 304a of said bearings 302, 304 (as illustrated in Figure 12).

[0090] The second seat 118 preferably comprises a shoulder 118a which axially abuts the outer ring 304a of the second bearing 304.

[0091] Inner ring 304b of the second bearing 304 axially abuts against a spacer element 66 mounted on the shaft 50 that rests on the rear wall 46 of the drum 4.

[0092] The second bearing 304 is therefore axially maintained in position by said shoulder 118a and spacer 66.

[0093] A shield assembly 68 is preferably provided for the second bearing 304 to help retain bearing lubrication and prevent contamination from the environment.

[0094] The first seat 116 preferably comprises a shoulder 116a which axially abuts the outer ring 302a of the first bearing 302.

[0095] Inner ring 302b of the first bearing 302 axially abuts a shoulder 53 of the shaft 50, at one side, and the central body 20 of the pulley 18, at the opposite side. Preferably, a washer 155 is also interposed between the central body 20 of the pulley 18 and the inner ring 302b of the first bearing 302.

[0096] The first bearing 302 is therefore axially maintained in position by said shoulders 116a, 53 and said pulley 18.

[0097] The hub 112 preferably ends at an annular rim 121 which abuts the front side surface 110 of the insert 106.

[0098] The annular rim 121 preferably lies in a plane perpendicular to the reference rotation axis X.

[0099] Between the hub 112, the tub 3 and the shield assembly 68, more preferably between the hub 112, the covering portion 203 of the tub 3 and the shield assembly 68, a sealing element 180 (O-ring) is preferably arranged to ensure the watertight integrity of the tub 3. The hub 112 preferably comprises an annular recess 182 to receive the sealing element 180.

[0100] As said above, the second element 104 is removably connected to the first element 102 by fastening devices 200 comprising screws 202a, 202b.

[0101] Said screws 202a, 202b are preferably inserted through holes 204a, 204b of the second element 104 and engage threaded holes 206a, 206b of the first element 102.

[0102] In the preferred embodiment described and illustrated herein, the fastening devices 200 preferably comprise a set of six screws 202a, 202b.

[0103] Preferably, the set of screws 202a, 202b is formed by a first set of screws 202a, for example three screws 202a, and a second set of screws 202b, for example three screws 202b, which are spaced apart along the reference rotation axis X. The first set of screws 202a is preferably located closer to the first end side 124 of the second element 104 along the reference rotation axis X than the second set of screws 202b and the second set of screws 202b is preferably located closer to the second end side 126 of the second element 104 along the reference rotation axis X than the first set of screws 202a. In other words, the distance of the first set of screws 202a from the first end side 124 of the second element 104 along the reference rotation axis X is lower than the distance of the second set of screws 202b from said first end side 124 along the reference rotation axis X and the distance of the second set of screws 202b from the second end side 126 of the second element 104 along the reference rotation axis X is lower than the distance of first set of screws 202a from said second end side 126 along the reference rotation axis X.

[0104] More preferably, the first set of three screws 202a are inserted through three holes 204a realized in the annular rim 121 of the hub 112 and engage three threaded holes 206a realized in the front side surface 110 of the insert 106. The second set of three screws 202b are inserted through three holes 204b realized in respective seats 122 of the hub 112 of the second element 104 and engage three threaded holes 206b realized in protruding element 140 extending from the inner side surface 108 of the insert 106.

[0105] Advantageously, by providing a first set of screws 202a and a second set of screws 202b which are spaced apart along the reference rotation axis X the robustness of the coupling between the first and second elements 102, 104 is increased.

[0106] More preferably, as shown in Figure 11, the first set of screws 202a are substantially axially aligned along the reference rotation axis X to the first bearing 302 and the second set of screws 202b are substantially axially aligned along the reference rotation axis X to the second bearing 304.

[0107] The first set of screws 202a substantially belongs to a plane perpendicular to the reference rotation axis X and passing through the to the first bearing 302 and the second set of screws 202b substantially belongs to a plane perpendicular to the reference rotation axis X and passing through the to the second bearing 304. Advantageously, said sets of screws 202a, 202b are arranged to withstand mechanical stresses, in particular to withstand vibrations, acting on the bearings 302, 304 when the drum 4 is made rotated through the shaft 50.

[0108] According to an advantageous aspect of the invention, removability of the second element 104 with respect to the first element 102 facilitates replacements of the bearing assembly components. For example, replacement of the hub 112 and/or of the bearings 302,

304 may be easily achieved by acting on the fastening devices 200 (unscrewing/screwing screws 202).

[0109] Replacement of the hub 112 and/or of bearings 302, 304 may be necessary in case of failures and/or wear-out failures during the useful lifetime of the bearing assembly 100.

[0110] According to another advantageous aspect of the invention, removability of the second element with respect to the first element allows to reduce designing and/or manufacturing costs of the bearing assembly and/or of the laundry washing machine.

[0111] From the above description, it can be appreciated that different embodiments/models of the bearing assembly and hence of the laundry washing machine may be easily obtained by substituting the hub and/or the bearings while maintaining other components of the laundry washing machine. In other words, the different embodiments/models of the bearing assembly and of the laundry washing machine may be manufactured utilizing the same, or almost the same, components, except from the hub and/or the bearings which can be adequately chosen. Manufacturing costs are therefore reduced.

[0112] For example, a laundry washing machine of higher capacity (for example a 9kg large load capacity laundry machine) and a laundry washing machine with lower capacity (for example a 6kg medium load capacity laundry machine) may be manufactured by utilizing the same rear hemi-shell and the same first element (insert) of the bearing assembly while the other components are chosen according to the design and construction requirements.

[0113] Thus, the manufacturing process of the laundry washing machines is simplified, in particular in large-scale manufacturing.

[0114] It has thus been shown that the present invention allows all the set objects to be achieved. In particular, it makes it possible to realize a bearing assembly having reduced designing and/or manufacturing costs compared to laundry washing machines of known type.

[0115] It is underlined that the bearing assembly and components thereof are preferably substantially cylindrically shaped; however it is clear that in different embodiments such components may be differently shaped.

[0116] While the present invention has been described with reference to a laundry washing machine of the front loading type, it should be noted that the present invention is can be applied as well to a top-loading laundry washing machine.

[0117] In laundry washing machines of the front loading type, i.e. of the type above described, the drum is substantially cantilevered supported by the bearing assembly at one side of the tub. The drum is therefore rotated by only one shaft rotatably supported by the bearing assembly.

[0118] In a laundry washing machines of the top-loading type, the drum is preferably supported by bearing assemblies at two opposite sides of the tub. Preferably, two opposite shafts are coupled to respective opposite walls of the drum and supported by the opposite bearing assemblies. The drum is therefore preferably rotated by means of one of the two shafts which is opportunely connected to a motor unit.

[0119] While the present invention has been described with reference to the particular embodiment shown in the figures, it should be noted that the present invention is not limited to the specific embodiment illustrated and described herein; on the contrary, further variants of the embodiment described herein fall within the scope of the present invention, which is defined in the claims.

Claims

1. A laundry washing machine (1) comprising:

   a casing (2) supporting a tub (3) and a drum (4) adapted to receive laundry to be treated, said drum (4) being housed in a rotatable manner inside said tub (3);
   a shaft (50) coupled to said drum (4) and aligned along a reference rotation axis (X) for rotating said drum (4);
   a bearing assembly (100) supporting said shaft (50) at a wall (36) of said tub (3), wherein said bearing assembly (100) comprises a first element (102) fixedly provided to said wall (36) of said tub (3) and wherein said bearing assembly (100) comprises a second element (104) apt to support said shaft (50) with respect to said tub (3) and to allow rotation of said shaft (50), wherein said second element (104) is adapted to be removably connected to said first element (102).

2. The laundry washing machine (1) according to claim 1, wherein said tub (3) is made of a polymeric material.

3. The laundry washing machine (1) according to any of the preceding claims, wherein said first element (102) is injection-moulded to said wall (36) of said tub (3).

4. The laundry washing machine (1) according to any of the preceding claims, wherein said first element (102) comprises a tubular insert (106).

5. The laundry washing machine (1) according to any of the preceding claims, wherein said first element (102) is made of a metallic material and said second element (104) is made of a metallic material or a polymeric material.

6. The laundry washing machine (1) according to any of the preceding claims, wherein said second element (104) is removably connected to said first element (102) by means of one or more fastening de-

vices (203a, 203b).

7. The laundry washing machine (1) according to claim 6, wherein said fastening devices (203a, 203b) comprise screws engaging said first element (102) and said second element (104), preferably engaging holes or threaded holes (204a, 204b) of said second element (104) and threaded holes (206a, 206b) of said first element (102).

8. The laundry washing machine (1) according to claim 6 or 7, wherein said fastening devices (203a, 203b) comprise a first set of fastening devices (203a) and a second set of fastening devices (203b).

9. The laundry washing machine (1) according to claim 8, wherein said first set of fastening devices (203a) are spaced apart from said second set of fastening devices (203b) along said reference rotation axis (X).

10. The laundry washing machine (1) according to any of the preceding claims, wherein it further comprises one or more rolling devices (302, 304) interposed between said second element (104) and said shaft (50).

11. The laundry washing machine (1) according to claim 10, wherein said one or more rolling devices (302, 304) comprise a first rolling device (302) and a second rolling device (304) spaced apart one to the other along said reference rotation axis (X).

12. The laundry washing machine (1) according to claim 8 and 11, wherein said first set of fastening devices (203a) is at least partially aligned along said reference rotation axis (X) to said first rolling device (302) and/or said second set of fastening devices (203b) is at least partially aligned along said second reference rotation axis (X) to said second rolling device (304).

13. The laundry washing machine (1) according to any of the preceding claims, wherein said second element (104) extends along said reference rotation axis (X) between a first end side (124) and a second end side (126).

14. The laundry washing machine (1) according to claim 13 when depending to any of the claims 8 to 12, wherein said first set of fastening devices (203a) is located closer to said first end side (124) of said second element (104) along said reference rotation axis (X) than said second set of fastening devices (203b) and said second set of fastening devices (203b) is located closer to said second end side (126) of said second element (104) along said reference rotation axis (X) than said first set of fastening devices (203a).

15. The laundry washing machine (1) according to claim 14 when depending to any of the claims 11 to 13, wherein said first rolling device (302) is located closer to said first end side (124) of said second element (104) along said reference rotation axis (X) than said second rolling device (304) and said second rolling device (304) is located closer to said second end side (126) of said second element (104) along said reference rotation axis (X) than said first rolling device (302).

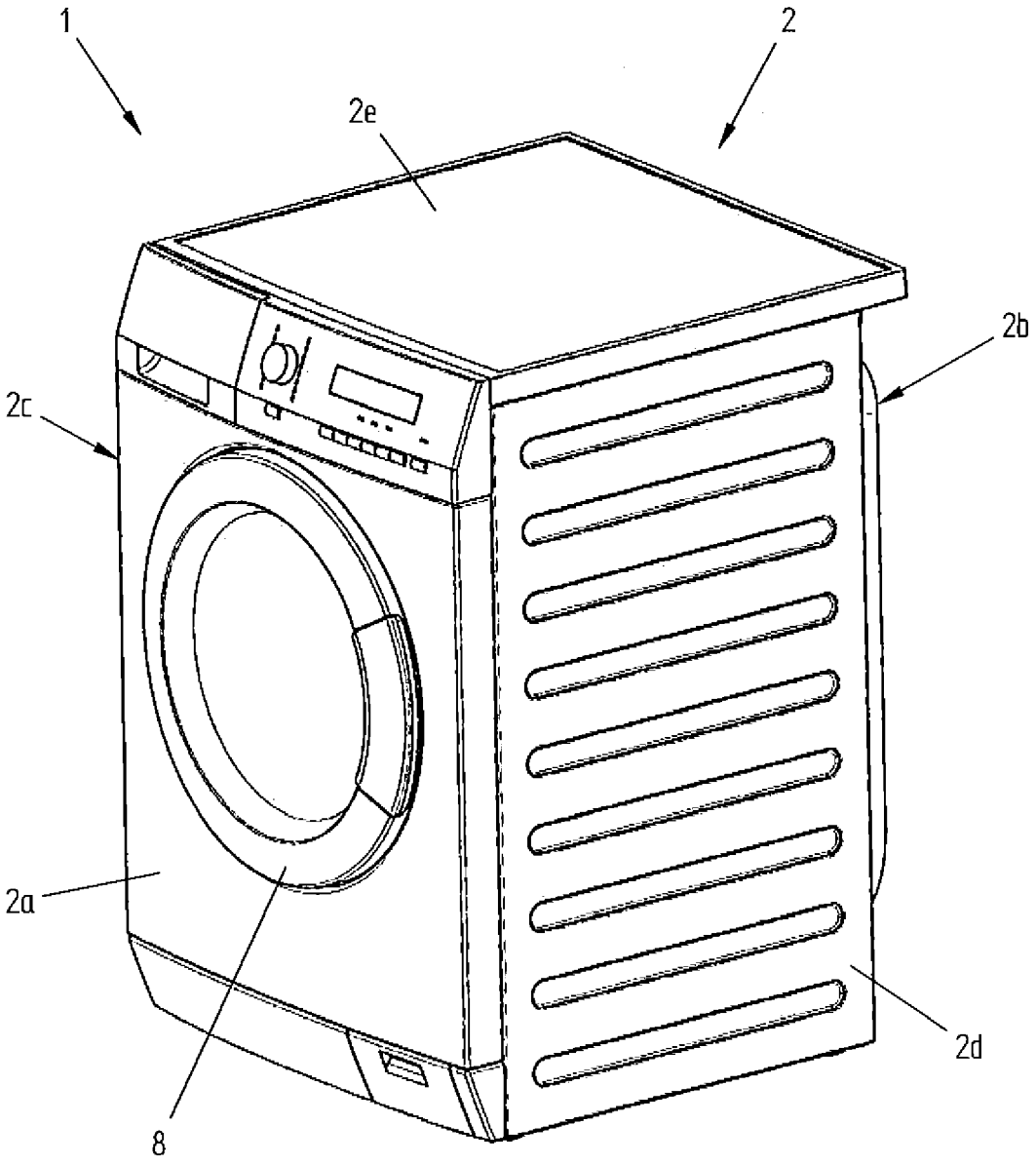


FIG. 1

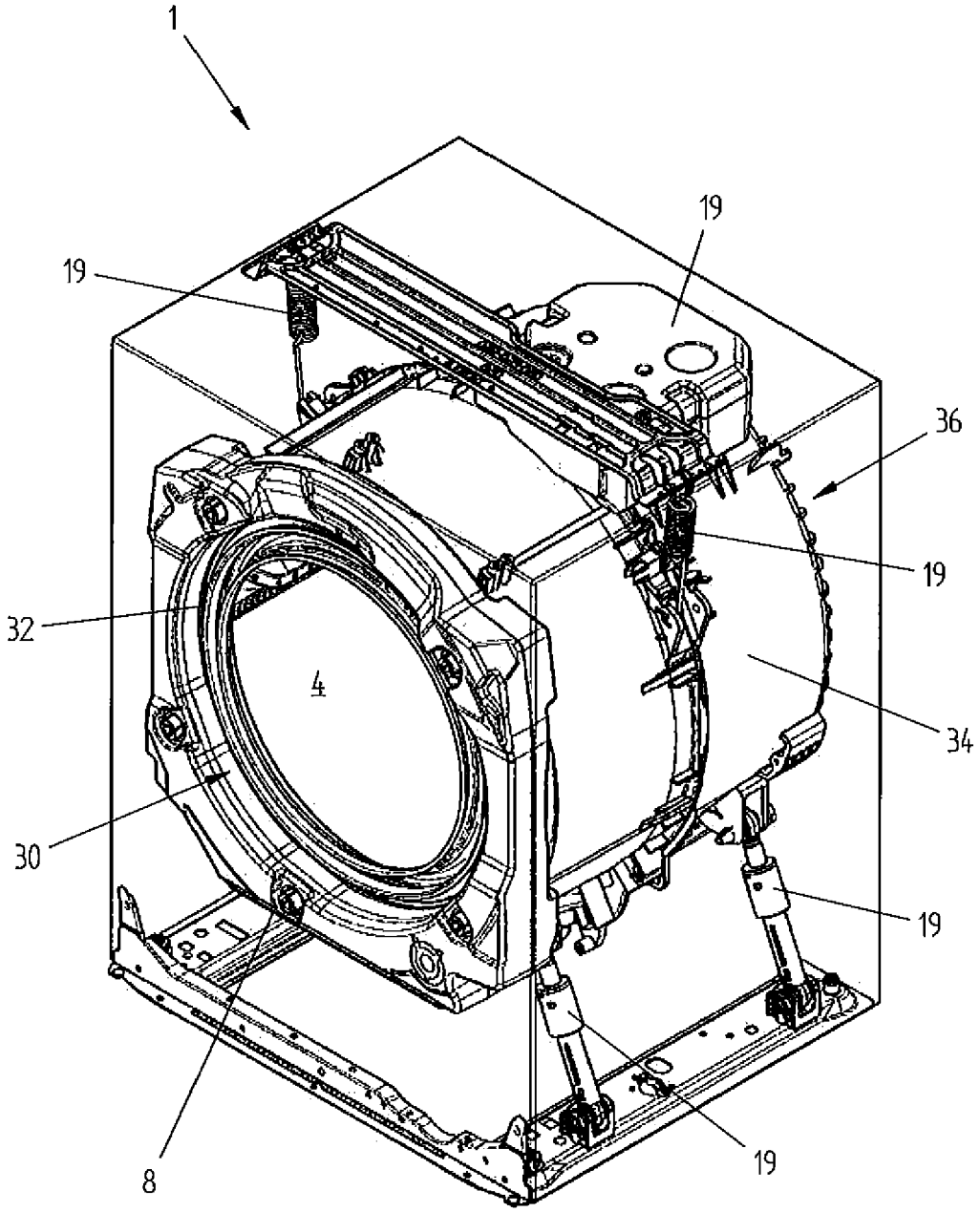


FIG. 2

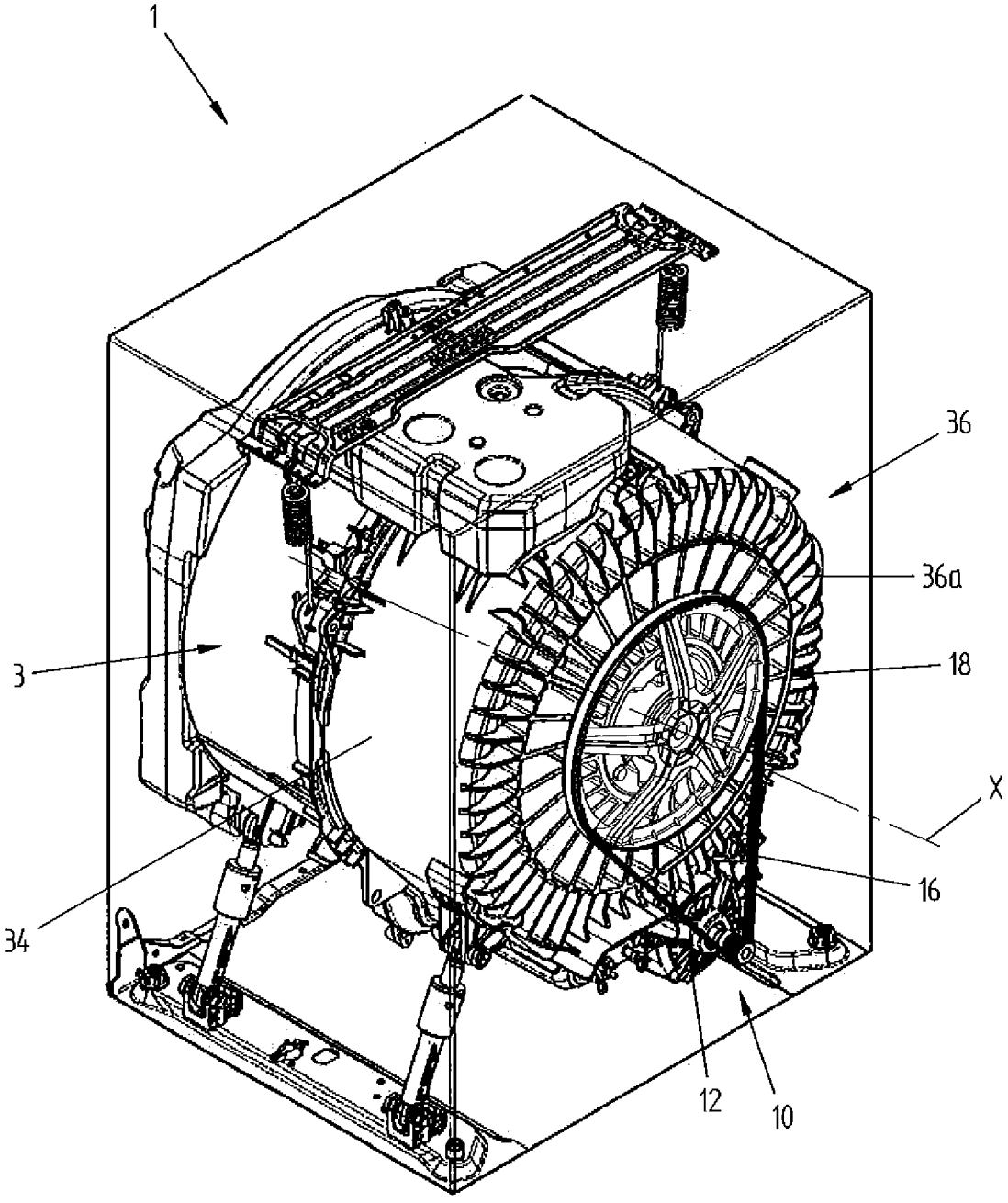


FIG. 3

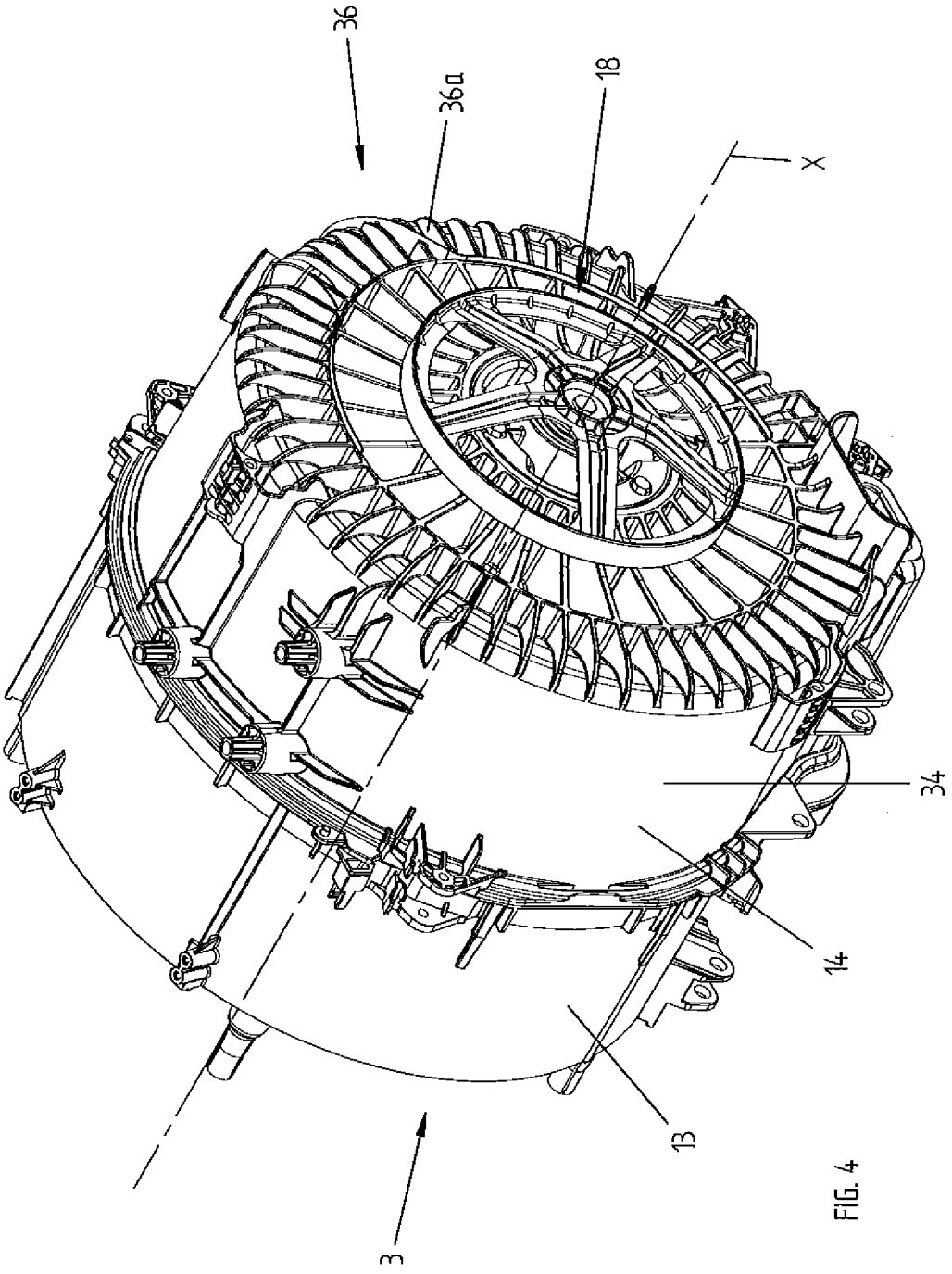


FIG. 4

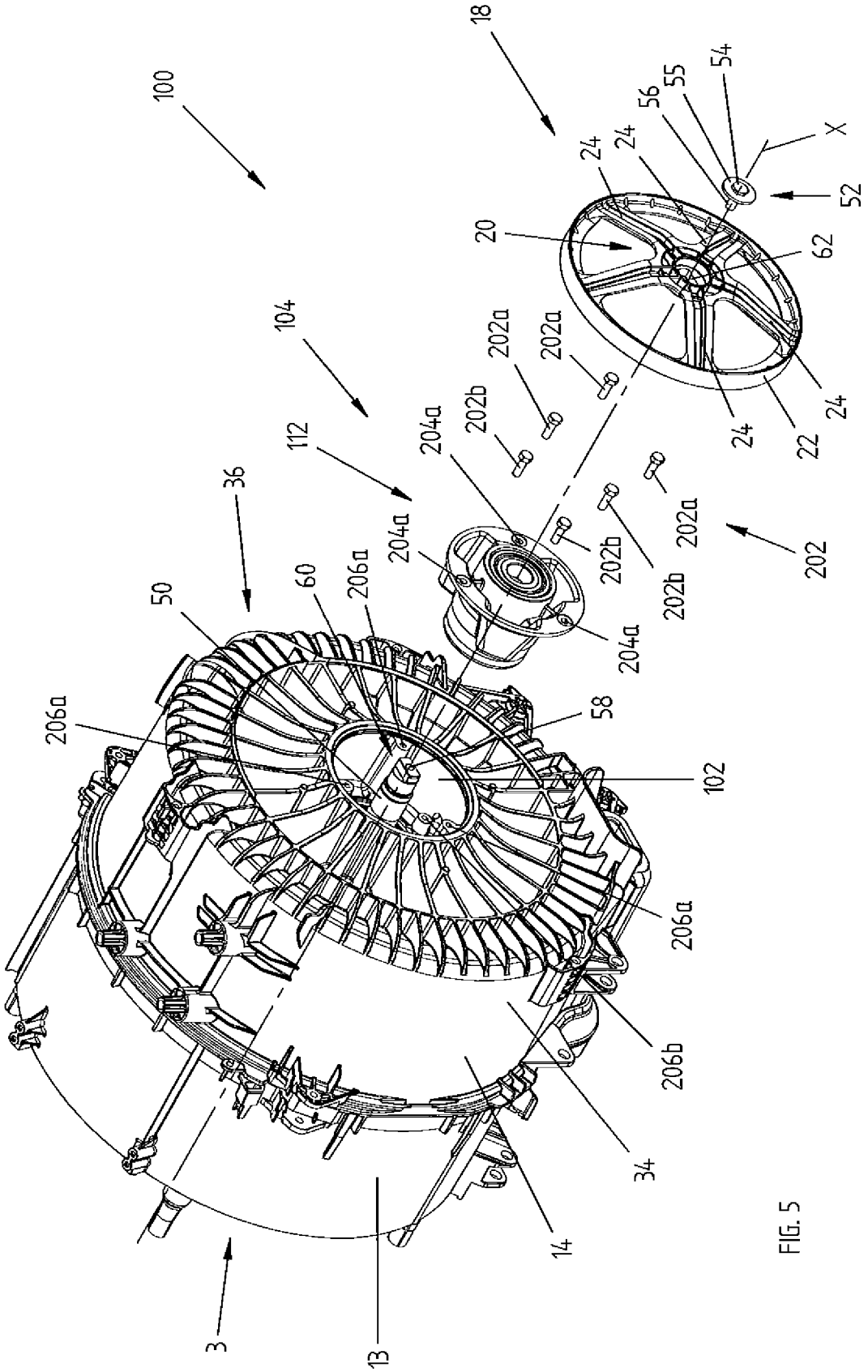

100
18
54
55
56
24
24
X
52
20
62
104
202a
202a
202b
204a
112
24
22
24
36
204a
202b
202a
202
60
206a
50
204a
202b
206a
58
102
206a
206b
34
14
3
13

FIG. 5

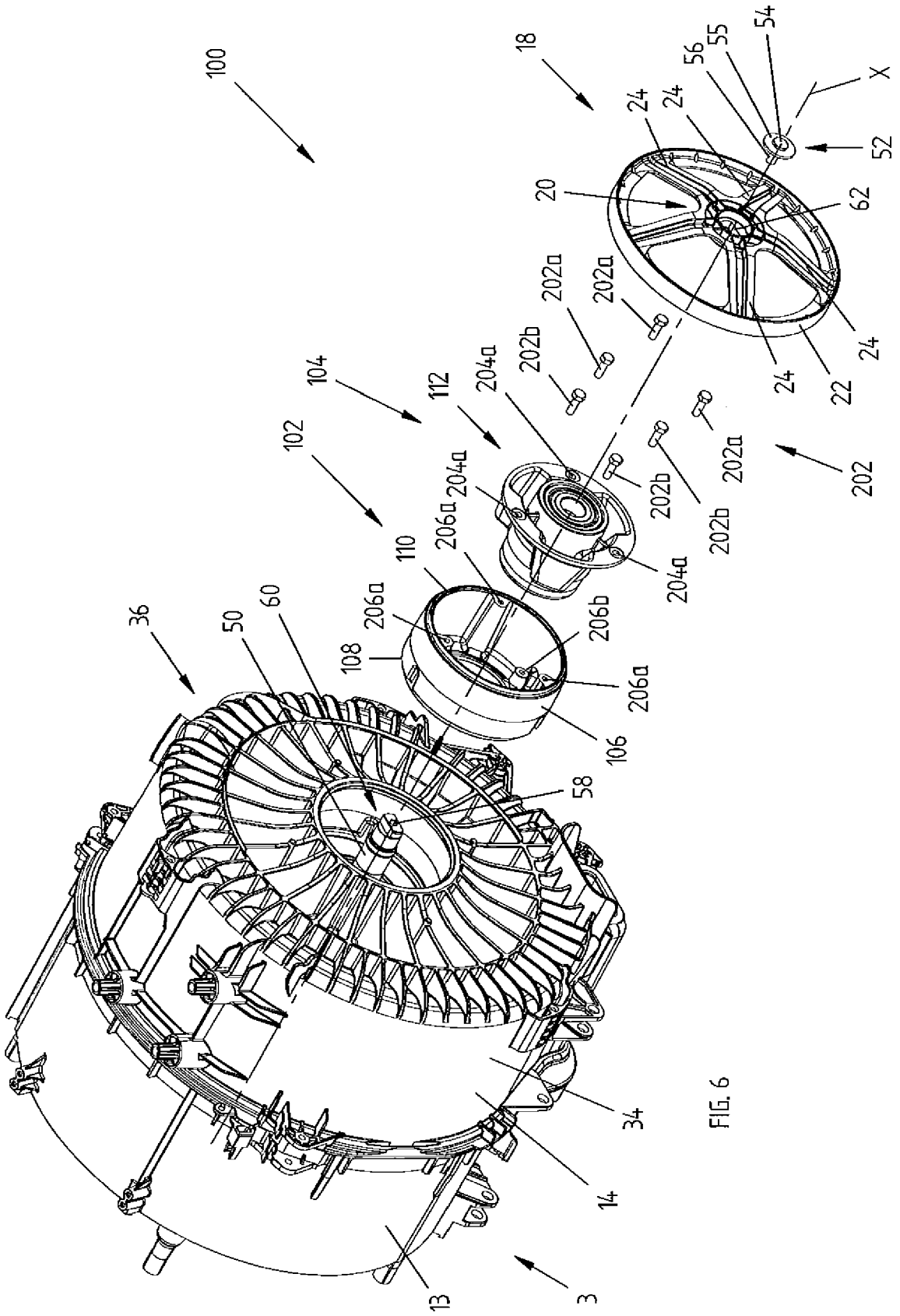
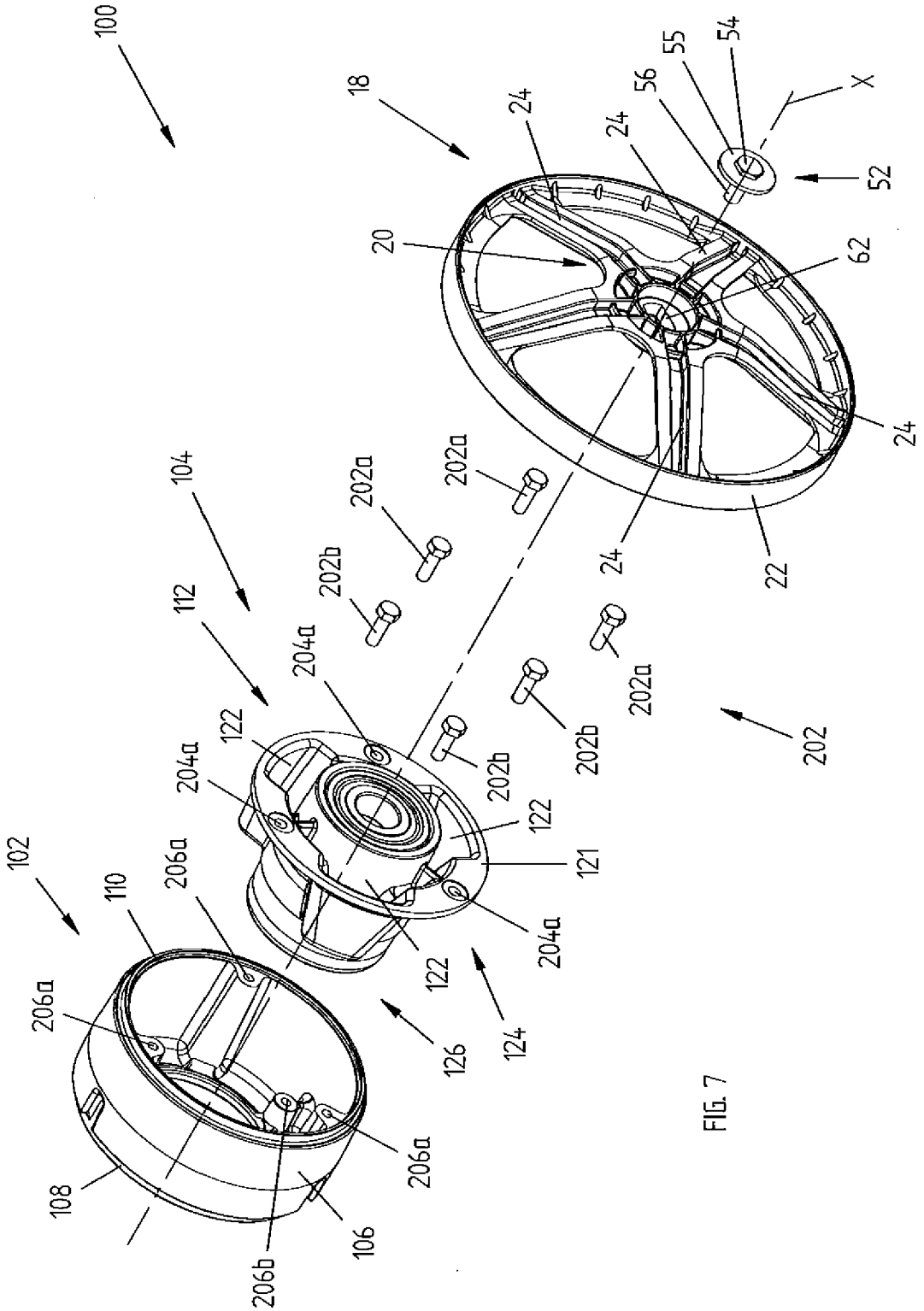

100
18
24
24
56
55
54
X
52
20
62
202a
202a
202b
24
24
22
24
104
112
204a
202b
102
204a
206a
110
202a
202
202b
204a
206a
206b
108
206a
36
50
60
106
58
34
14
13
3

FIG. 6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18
24
56
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54
X
52
20
62
24
104
202a
202a
202b
112
204a
122
204a
202b
122
121
102
110
206a
204a
206a
108
106
206b
126
124
24
22
202b
202a
202

FIG. 7

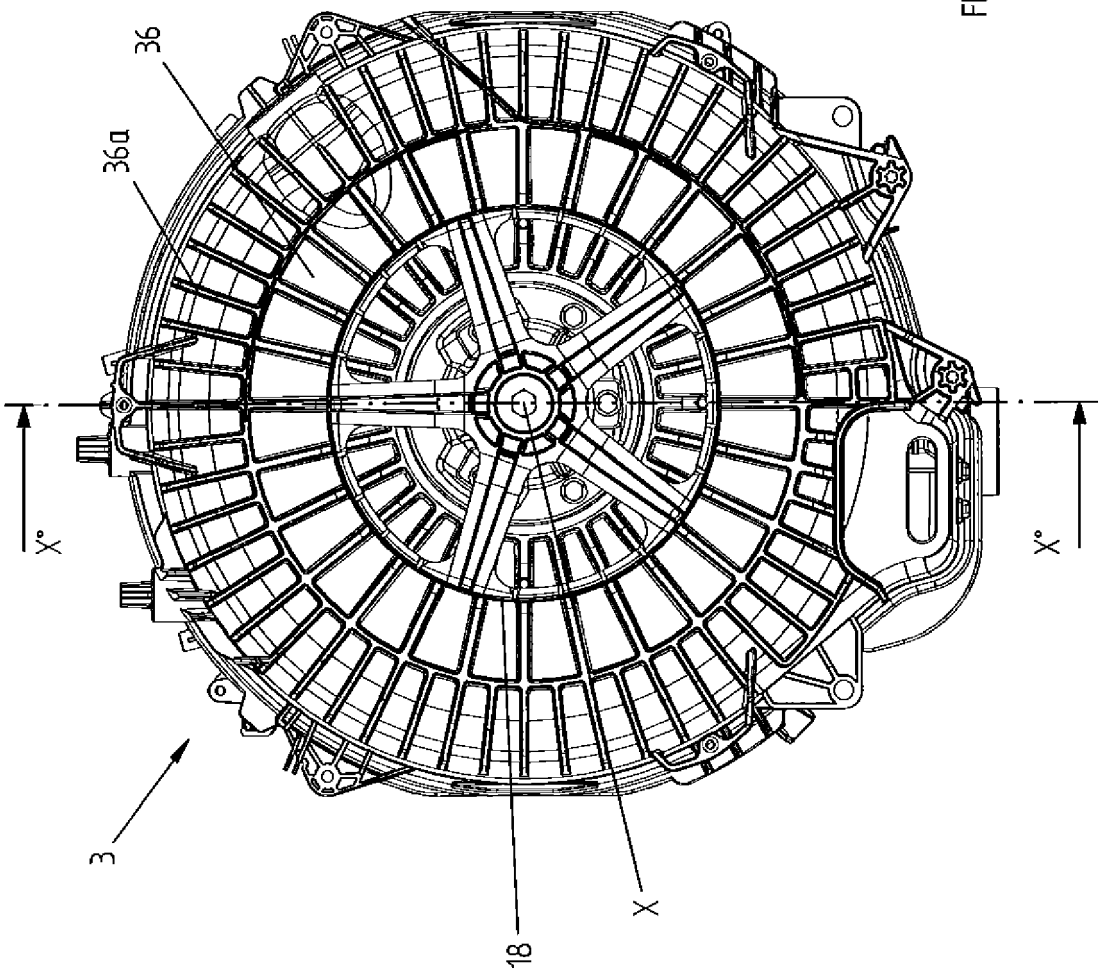

FIG. 8

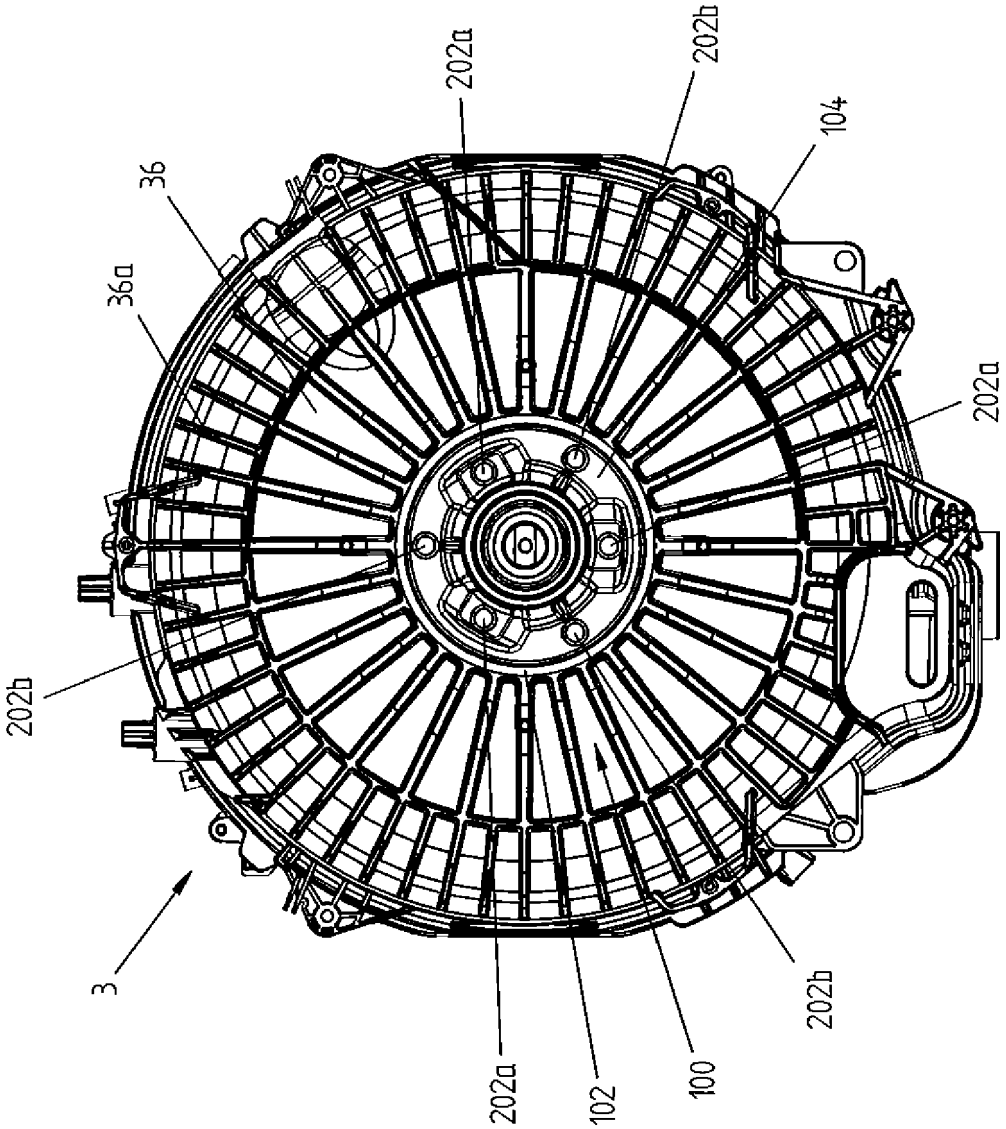

FIG. 9

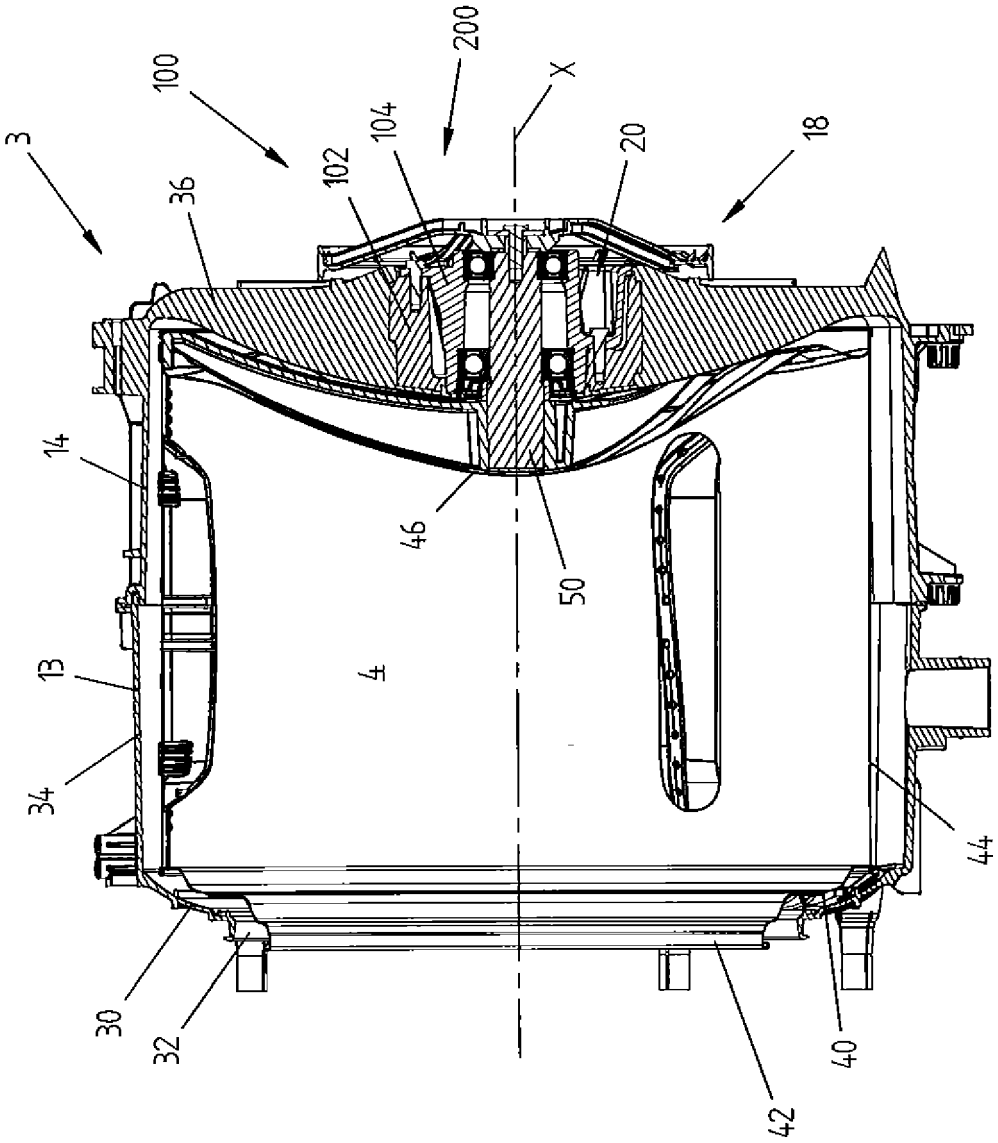

FIG. 10

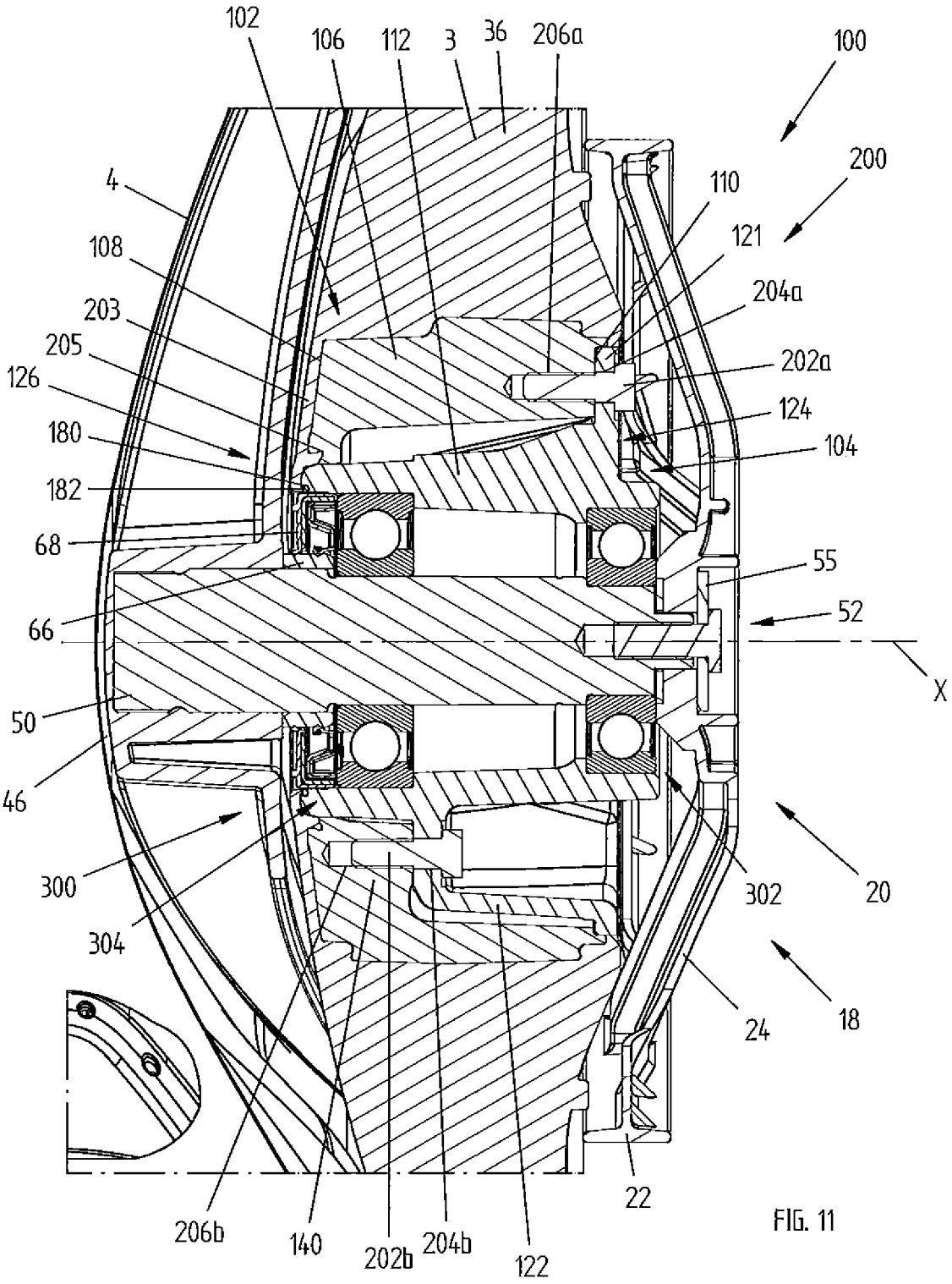
102
106
112
3
36
206a
100
200
4
110
121
108
204a
203
205
202a
126
124
180
104
182
68
55
66
52
X
50
46
300
302
20
304
24
18
22
206b
140
202b
204b
122

FIG. 11

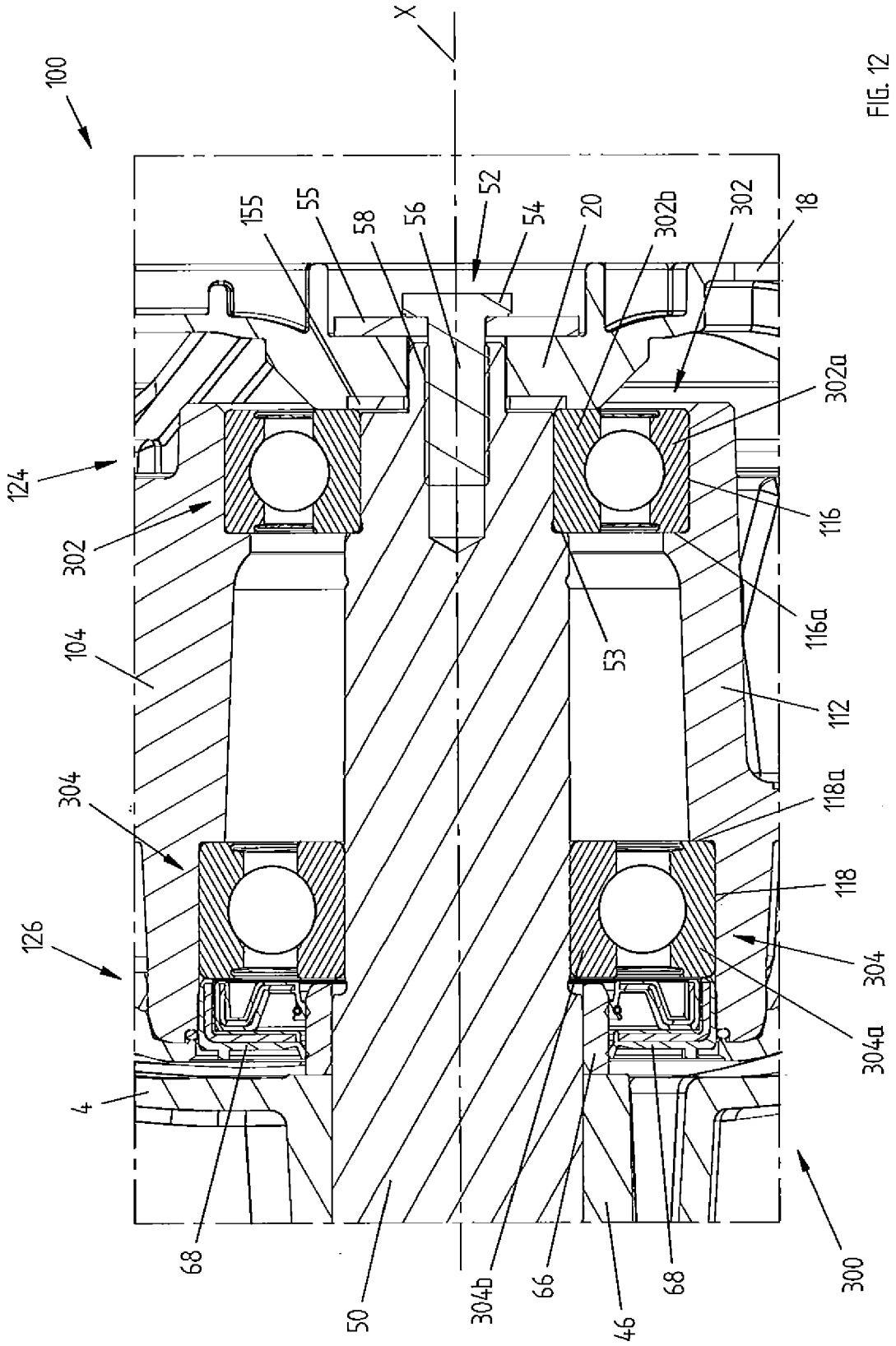
100
X
155
55
58
56
52
54
20
302b
302
18
302a
124
302
116
116a
104
53
112
304
118a
118
126
304
304a
4
68
50
304b
66
46
68
300

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 1831

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	EP 1 688 525 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 9 August 2006 (2006-08-09) * paragraph [0021] - paragraph [0036]; figures 1, 2 * * paragraph [0048]; figure 4 * -----	1,6-8, 10,11,13 2-4 5,9,12, 14,15	INV. D06F37/26 ADD. D06F37/00
Y	EP 2 671 998 A1 (ELECTROLUX HOME PROD CORP [BE]) 11 December 2013 (2013-12-11) * paragraph [0007] - paragraph [0008] * * paragraph [0040] - paragraph [0047]; figures 1B, 2, 3 * -----	2-4	
X A	GB 1 010 961 A (HOOVER LTD) 24 November 1965 (1965-11-24) * page 1, line 84 - page 2, line 6; figure 1 * -----	1,4,6,7, 10,11,13 2,3,5,8, 9,12,14, 15	
X A	US 5 105 636 A (ANASTASE CONSTANTIN [US] ET AL) 21 April 1992 (1992-04-21) * column 2, line 59 - column 3, line 22; figures 1-3 * * column 4, line 34 - line 42; figure 4 * -----	1,5-7, 10,13 2-4,8,9, 11,12, 14,15	TECHNICAL FIELDS SEARCHED (IPC) D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 May 2017	Sabatucci, Arianna

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1688525 A1	09-08-2006	CN 1814894 A	09-08-2006
		EP 1688525 A1	09-08-2006
		JP 2006212416 A	17-08-2006
		KR 20060089559 A	09-08-2006
		US 2006174665 A1	10-08-2006
EP 2671998 A1	11-12-2013	EP 2671998 A1	11-12-2013
		WO 2013182530 A1	12-12-2013
GB 1010961 A	24-11-1965	NONE	
US 5105636 A	21-04-1992	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- US 7862871 B2 **[0007]**
- US 8590347 B2 **[0009]**