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(54) **WASHING GROUP FOR LAUNDRY WASHING MACHINES**

(57) Washing group (1) for laundry washing machines comprising a hollow washing tub (2), a revolving drum (3) fitted in axially rotatable manner inside the washing tub (2), and a motor assembly (4) which is rigidly attached outside the washing tub (2) and is capable of driving into rotation the revolving drum (3) inside the washing tub (2); the motor assembly (4) comprising a drive motor (8) and a supporting structure (10) provided with a number of connecting arms (15) each of which juts out from the drive motor (8) towards the peripheral wall (9) of washing tub (2), and has the distal end fitted onto a corresponding coupling pin (14) which cantilevered extends from the washing tub (2); each coupling pin (14) being substantially ogival-shaped and the distal end of each connecting arm (15) having a substantially ogival-shaped, hollow seat (16) which is substantially complementary in shape to that of the corresponding coupling pin (14) so as to be axially engaged by said coupling pin (14).

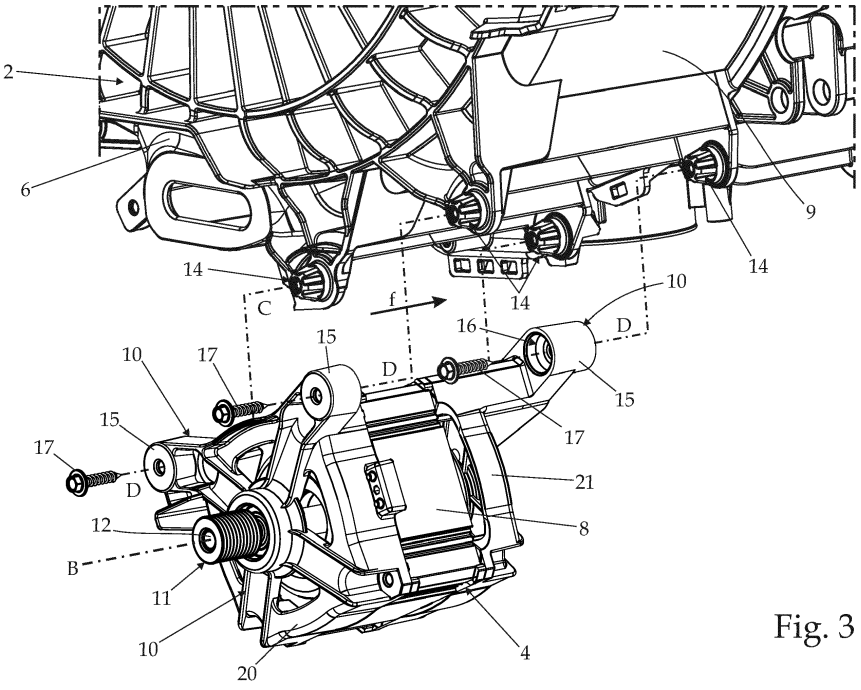

Fig. 3

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Description

[0001] The present invention relates to a washing group for laundry washing machines.

[0002] In particular, the present invention relates to a washing group for home laundry washing machines, to which the following description refers purely by way of example without this implying any loss of generality.

[0003] As is known, currently marketed home laundry washing machines generally comprise: a substantially parallelepiped-shaped, outer boxlike casing structured for resting on the floor; an approximately cylindrical, hollow washing tub which is usually arranged substantially horizontally inside the casing and is provided with a laundry loading and unloading mouth that directly faces a large pass-through opening which is formed either in the top or in the front wall of the casing and is dimensioned for allowing an easy manual loading and unloading of the laundry inside the washing tub; a substantially cylindrical, hollow drum which is fitted in axially rotatable manner inside the washing tub and is structured for accommodating the laundry to be washed; an elastically-deformable bellows which watertight connects the mouth of the washing tub to the pass-through opening formed in the top or front wall of the casing; and a manually-operated door which is hinged to the top or front wall of the casing so as to be able to rotate to and from a closing position in which the door closes the pass-through opening for watertight sealing the washing tub.

[0004] In addition to the above, currently marketed home laundry washing machines comprise: an electric motor which is rigidly attached outside and underneath the washing tub, and is mechanically connected to the rotatable drum thus to be able to drive into rotation the drum inside the washing tub; an electrically-operated, water and detergent supply assembly which is structured for selectively feeding into the washing tub, according to the selected washing cycle, a given amount of detergent, softener and/or other washing agent suitably mixed with the fresh water arriving from the water mains, or simply a given amount of fresh water arriving from the water mains; an electric heating device located inside the washing tub and capable of selectively heating up the water contained into the washing tub; and finally an electronic central control unit which controls the electric motor, the heating device and the water and detergent supply assembly to selectively perform one of the user-selectable washing cycles stored in the same central control unit.

[0005] To speed up the assembly of the household appliance, in today's home laundry washing machines the washing tub, the rotatable drum, the heating device and the electric motor are generally assembled to one another on a separate assembly line so as to form a so-called washing group which is subsequently inserted into the outer casing of the laundry washing machine.

[0006] EP2775024A1 discloses a washing group wherein the electric motor is firmly enclosed between a pair of reciprocally-faced, cup-shaped end-shields which are arranged coaxial to the longitudinal axis of the motor, and each of which is provided with a pair of outwards-projecting connecting arms structured for being rigidly fastened to the bottom of the washing tub.

[0007] More specifically, the distal end of each connecting arm protruding from the front end-shield, i.e. from the end-shield engaged in pass-through and axially rotatable manner by the driving shaft of the electric motor, is provided with a transversal hollow seat which is frustoconical in shape and is dimensioned to be axially fitted onto a corresponding, complementary-shaped, frustoconical coupling pin which is integrally formed on the bottom portion of the washing tub and extends outside of the washing tub coaxial to a reference axis parallel to the longitudinal axis of the motor. An axial screw moreover fastens the distal end of each connecting arm to the corresponding frustoconical-shaped coupling pin.

[0008] The distal end of each connecting arm protruding from the rear end-shield, in turn, is provided with a transversal, pass-through hole which is cylindrical in shape and is dimensioned to be axially fitted onto a corresponding, complementary-shaped cylindrical coupling pin which is integrally formed on the bottom portion of the washing tub and extends outside of the washing tub coaxial to a reference axis parallel to the longitudinal axis of the motor.

[0009] The two frustoconical-shaped coupling pins are used for centring the motor assembly on the fixing portion of the washing tub, whereas the two cylindrical-shaped coupling pins bears almost the whole weight of the motor assembly and support the mechanical stresses during operation of the electric motor.

[0010] Unfortunately, due to the considerable increase in rotation speed and torque value produced by today's electric motors, the referred-above fastening system is no more able to provided a sufficiently rigid coupling between electric motor and washing tub, with al problems that this entails.

[0011] Aim of the present invention is therefore to realize a much more rigid mechanical coupling between electric motor and washing tub, which is moreover capable of speeding up the assembly of the electric motor onto the bottom portion of washing tub.

[0012] In compliance with the above aims, according to the present invention there is provided a washing group for laundry washing machines comprising a hollow washing tub, a revolving drum fitted in axially rotatable manner inside the washing tub, and a motor assembly including a drive motor which is rigidly attached outside the washing tub and is capable of driving into rotation the revolving drum inside the washing tub;

the motor assembly also including at least one connecting part having an end portion fitted onto a corresponding coupling pin extending from the washing tub or vice versa;

the washing group **being characterized in that** each coupling pin has a frustoconical-shaped distal portion and an adjacent, cylindrical-shaped mid portion adjoining

said frustoconical-shaped distal portion; **and in that** the end portion of the connecting part has a hollow seat which is substantially complementary in shape to that of the corresponding coupling pin so as to be axially engaged by said coupling pin.

[0013] Preferably, though not necessarily, the washing group is furthermore characterized in that said cylindrical-shaped mid portion adjoins the frustoconical-shaped distal portion to a proximal end of the coupling pin which is rigidly connected to the washing tub or to the drive motor; the proximal end of said coupling pin having, adjacent to said cylindrical-shaped mid portion and opposite to the frustoconical-shaped distal portion, a stop surface wherein the distal end of the connecting part stably abuts.

[0014] Preferably, though not necessarily, the washing group is furthermore characterized in that the proximal end of said coupling pin is provided with a substantially annular-shaped, stop shoulder which adjoins the cylindrical portion, and wherein the distal end of connecting part stably abuts.

[0015] Preferably, though not necessarily, the washing group is furthermore characterized in that the axial length of said frustoconical-shaped distal portion is greater than the axial length of said cylindrical-shaped mid portion.

[0016] Preferably, though not necessarily, the washing group is furthermore characterized in that the axial length of said cylindrical-shaped mid portion is moreover approximately equal to half the axial length of said frustoconical-shaped distal portion.

[0017] Preferably, though not necessarily, the washing group is furthermore characterized in that the axial length of said frustoconical-shaped distal portion ranges between 5 mm and 25 millimeters.

[0018] Preferably, though not necessarily, the washing group is furthermore characterized in that the axial length of said cylindrical-shaped mid portion ranges between 5 mm and 15 millimeters.

[0019] Preferably, though not necessarily, the washing group is furthermore characterized in that the opening angle of said frustoconical-shaped distal portion ranges between 20° and 60°.

[0020] Preferably, though not necessarily, the washing group is furthermore characterized in that the outer diameter of said cylindrical-shaped mid portion ranges between 8 and 40 millimeters.

[0021] Preferably, though not necessarily, the washing group is furthermore characterized in that the motor assembly includes a number of connecting parts each having an end portion fitted onto a corresponding coupling pin extending from the washing tub or vice versa, and in that said coupling pins are substantially parallel to a common fitting direction.

[0022] Preferably, though not necessarily, the washing group is furthermore characterized in that the motor assembly includes a number of connecting parts each having an end portion fitted onto a corresponding coupling pin extending from the washing tub or vice versa, and in that all coupling pins are identical in shape to one another and are preferably four in number.

[0023] Preferably, though not necessarily, the washing group is furthermore characterized in that said revolving drum extends coaxial to a longitudinal axis of the washing tub, and in that said fitting direction is substantially parallel the longitudinal axis of said washing tub.

[0024] Preferably, though not necessarily, the washing group is furthermore characterized in that said motor assembly moreover comprises at least one fixing screw engaging in sequence the end portion of the connecting part and the corresponding coupling pin.

[0025] Preferably, though not necessarily, the washing group is furthermore characterized in that said fixing screw extends coaxial to said coupling pin.

[0026] Preferably, though not necessarily, the washing group is furthermore characterized in that the motor assembly includes a number of connecting parts each having an end portion fitted onto a corresponding coupling pin extending from the washing tub or vice versa, and in that said motor assembly comprises a fixing screw for each coupling pin.

[0027] Preferably, though not necessarily, the washing group is furthermore characterized in that the motor assembly additionally comprises a supporting structure which is provided with a number of connecting arms each of which juts out from the drive motor towards the peripheral wall of washing tub; the distal end of each connecting arm forming a respective end portion of the connecting part.

[0028] Preferably, though not necessarily, the washing group is furthermore characterized in that said revolving drum extends coaxial to a longitudinal axis of the washing tub, and in that supporting structure is designed to arrange said drive motor with the longitudinal axis of the motor substantially parallel to the longitudinal axis of said washing tub.

[0029] Preferably, though not necessarily, the washing group is furthermore characterized in that the drive motor is an electric motor, and in that said supporting structure comprises at least one substantially cup-shaped, end-shield which is rigidly secured to an end-portion of said electric motor, and is provided with a number of outwards-protruding, connecting arms which extend toward the coupling pins on the washing tub.

[0030] According to the present invention there is also provided a washing group for laundry washing machines comprising a hollow washing tub, a revolving drum fitted in axially rotatable manner inside the washing tub, and a motor assembly which is rigidly attached outside the washing tub and is capable of driving into rotation the revolving drum inside the washing tub;

the motor assembly in turn comprising a drive motor and a supporting structure provided with a number of connecting arms each of which juts out from the drive motor towards the peripheral wall of washing tub, and has the distal end fitted onto a corresponding coupling pin which cantilevered extends from the washing tub;

the washing group **being characterized in that** each

coupling pin has a frustoconical-shaped distal portion and an adjacent, cylindrical-shaped mid portion adjoining said frustoconical-shaped distal portion; **and in that** the distal end of each connecting arm has a substantially ogival-shaped, hollow seat which is substantially complementary in shape to that of the corresponding coupling pin so as to be axially engaged by said coupling pin.

[0031] Preferably, though not necessarily, the washing group is furthermore characterized in said cylindrical-shaped mid portion adjoins the frustoconical-shaped distal portion to a proximal end of the coupling pin which is rigidly connected to the washing tub; the proximal end of said coupling pin having, adjacent to said cylindrical-shaped mid portion and opposite to the frustoconical-shaped distal portion, a stop surface wherein the distal end of the connecting arm stably abuts.

[0032] Preferably, though not necessarily, the washing group is furthermore characterized in the proximal end of said coupling pin is provided with a substantially annular-shaped, stop shoulder which adjoins the cylindrical portion, and wherein the distal end of connecting arm stably abuts.

[0033] According to the present invention there is also provided a laundry washing machine having an outer casing structured for resting on the floor, and a washing group which is arranged inside the casing and comprises a hollow washing tub, a revolving drum fitted in axially rotatable manner inside the washing tub, and a motor assembly which is rigidly attached outside the washing tub and is capable of driving into rotation the revolving drum inside the washing tub;

the laundry washing machine being characterized in that said motor assembly includes a drive motor which is rigidly attached outside the washing tub and is capable of driving into rotation the revolving drum inside the washing tub, and also at least one connecting part having an end portion fitted onto a corresponding coupling pin extending from the washing tub or vice versa; in that each coupling pin has a frustoconical-shaped distal portion and an adjacent, cylindrical-shaped mid portion adjoining said frustoconical-shaped distal portion; and in that the end portion of the connecting part has a hollow seat which is substantially complementary in shape to that of the corresponding coupling pin so as to be axially engaged by said coupling pin.

[0034] According to the present invention there is also provided a laundry washing machine having an outer casing structured for resting on the floor, and a washing group which is arranged inside the casing and comprises a hollow washing tub, a revolving drum fitted in axially rotatable manner inside the washing tub, and a motor assembly which is rigidly attached outside the washing tub and is capable of driving into rotation the revolving drum inside the washing tub;

the laundry washing machine being characterized in that said motor assembly comprises a drive motor and a supporting structure provided with a number of connecting arms each of which juts out from the drive motor towards the peripheral wall of washing tub, and has the distal end fitted onto a corresponding coupling pin which cantilevered extends from the washing tub; in that each coupling pin has a frustoconical-shaped distal portion and an adjacent, cylindrical-shaped mid portion adjoining said frustoconical-shaped distal portion; and in that the distal end of each connecting arm has a substantially ogival-shaped, hollow seat which is substantially complementary in shape to that of the corresponding coupling pin so as to be axially engaged by said coupling pin.

[0035] A non-limiting embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view, with parts in section and parts removed for clarity, of a front-loading laundry washing machine provided with a washing group realized in accordance with the teachings of the present invention;
- Figure 2 is an enlarged perspective view of the washing group shown in Figure 1 with parts in section and parts removed for clarity;
- Figure 3 is an exploded perspective view of the bottom portion of the Figure 2 washing group, with parts removed for clarity;
- Figure 4 is an enlarged side view of the bottom portion of the Figure 2 washing group, with parts in section and parts removed for clarity; whereas
- Figure 5 is an exploded side view of the coupling between the washing tub and the motor assembly of the Figure 2 washing group, with parts in section and parts removed for clarity.

[0036] With reference to Figures 1 and 2, reference number 1 indicates as a whole a washing group suitably structured/designed for being incorporated into a laundry washing machine.

[0037] More in detail, a home laundry washing machine 100 basically comprises: a preferably, though not necessarily, substantially parallelepiped-shaped, outer boxlike casing 101 structured for resting on the floor; and a washing group 1 which is accommodated, preferably substantially horizontally, inside the casing 101.

[0038] In the example shown, in particular, the washing group 1 is preferably suspended in floating manner inside the casing 101 via a suspension system which preferably, though not necessarily, comprises at least one and preferably a couple of upper coil springs 102 connecting the upper portion of washing group 1 to the top portion of boxlike casing 101, and preferably at least one, and preferably a couple of vibration dampers 103 connecting the bottom portion of washing group 1 to the bottom portion of boxlike casing 101.

[0039] The washing group 1 in turn comprises: a preferably substantially cylindrical, hollow washing tub 2 which is structured for being arranged, preferably substantially horizontally, inside the casing 101, and is provided with a laundry loading and unloading mouth (not

visible in the figures) which is dimensioned for allowing an easy loading and unloading of the laundry inside the washing tub 2; a substantially cylindrical, hollow revolving drum 3 which is fitted in axially rotatable manner inside the washing tub 2 and is structured for accommodating the laundry to be washed; and a motor assembly 4 which is rigidly attached outside and preferably underneath the washing tub 2, and is mechanically connected to the revolving drum 3 thus to be able to drive into rotation the same revolving drum 3 inside the washing tub 2.

[0040] More in detail, the revolving drum 3 extends inside the washing tub 2 coaxial to a reference axis A preferably locally substantially coinciding with the preferably horizontally-oriented, longitudinal reference axis of washing tub 2, and is rigidly fixed to the inner axial end of a central supporting shaft 5 which extends coaxial to axis A and is fitted in pass-through and axially rotatable manner into the rear wall 6 of washing tub 2 so as to stick out from the back of washing tub 2.

[0041] The washing group 1 preferably furthermore comprises a first pulley 7 which is arranged outside of washing tub 2 coaxial to the longitudinal axis A of revolving drum 3 and supporting shaft 5, and is rigidly fitted to the outer axial end of supporting shaft 5, so as to be able to rotate about axis A together with revolving drum 3 and supporting shaft 5.

[0042] In the example shown, in particular, the washing group 1 is preferably structured for being incorporated into a front-loading laundry washing machine 100, therefore the preferably circular-shaped, laundry loading and unloading mouth (not visible in the figures) of washing tub 2 is preferably located roughly at centre of the front wall of washing tub 2, i.e. the wall opposite to rear wall 6, so as to directly face a large pass-through opening which is formed in the front wall of boxlike casing 101 and is dimensioned for allowing an easy manual loading and unloading of the laundry inside the washing tub 2.

[0043] The revolving drum 3, in turn, is preferably substantially cup-shaped and is fitted in axially rotatable manner inside the washing tub 2 with the concavity facing the laundry loading and unloading mouth of washing tub 2, so as to receive the laundry to be washed.

[0044] With reference to Figures 2, 3, 4 and 5, the motor assembly 4 in turn comprises: a drive motor 8 which is capable of driving into rotation the supporting shaft 5 of revolving drum 3 about longitudinal axis A, and is arranged beneath the washing tub 2, adjacent to a fixing arrangement formed on the substantially cylindrical-shaped, peripheral wall 9 of washing tub 2, with the motor longitudinal axis B locally substantially parallel to the longitudinal axis A of supporting shaft 5 and revolving drum 3; and preferably an intermediate supporting structure 10 which rigidly connects the drive motor 8 to the peripheral wall 9 of washing tub 2.

[0045] More in detail, the supporting structure 10 is firmly secured to the drive motor 8 and is structured/designed to be rigidly fitted and fastened to the fixing arrangement on peripheral wall 9, preferably in easy detachable manner, so as to arrange, when firmly secured to washing tub 2, the longitudinal axis B of drive motor 8 substantially parallel to the longitudinal axis A of supporting shaft 5 and revolving drum 3.

[0046] In the example shown, in particular, the motor assembly 4 preferably comprises a second pulley 11 which is arranged coaxial to longitudinal axis B, and is rigidly fitted to the distal end of the driving shaft 12 of drive motor 8; and the supporting structure 10 is preferably designed for arranging, when firmly secured to the washing tub 2, the pulley 11 substantially coplanar to pulley 7.

[0047] Preferably the washing group 1 furthermore comprises a driving belt 13 which is looped over pulleys 7 and 11 thus to allow the drive motor 8 to selectively drive into rotation both supporting shaft 5 and revolving drum 3 about longitudinal axis A.

[0048] With reference to Figures 3, 4 and 5, the fixing arrangement of washing tub 2 basically comprises a number of locally reciprocally-parallel and substantially ogival-shaped, coupling pins 14 which are rigidly fixed to the peripheral wall 9 of washing tub 2, and extend cantilevered outside of washing tub 2 while remaining locally parallel to a same fitting direction f which is preferably locally substantially parallel to the longitudinal axis A of supporting shaft 5 and of revolving drum 3, i.e. to the longitudinal axis of washing tub 2.

[0049] In other words, each coupling pin 14 is located outside of washing tub 2, has the proximal end stably connected to the peripheral wall 9 of washing tub 2, and finally extend cantilevered from washing tub 2 coaxial to a longitudinal reference axis C which is locally parallel to the fitting direction f and preferably also to the longitudinal axis A of supporting shaft 5 and revolving drum 3.

[0050] Preferably the coupling pins 14 are moreover identical in shape to one another.

[0051] In the example shown, in particular, each coupling pin 14 of washing tub 2 preferably cantilevered sticks out from a supporting appendage which protrudes from peripheral wall 9 and is preferably realized in one piece with peripheral wall 9 of washing tub 2.

[0052] With reference to Figures 4 and 5, each coupling pin 14 of washing tub 2 furthermore has a frustoconical-shaped distal portion 14a extending coaxial to longitudinal axis C, and an adjacent cylindrical-shaped mid portion 14b extending coaxial to longitudinal axis C. Said cylindrical-shaped mid portion 14b adjoins the frustoconical-shaped distal portion 14a to the proximal end of coupling pin 14.

[0053] The proximal end of coupling pin 14 moreover has, immediately adjacent to the cylindrical-shaped mid portion 14b and opposite to distal portion 14a, a stop surface 14c wherein the distal end of connecting arm 15 stably abuts.

[0054] More in detail, the proximal end of coupling pin 14 is preferably provided with a substantially annular-shaped, stop shoulder 14c which adjoins the cylindrical-shaped mid portion 14b, and wherein the distal end of

connecting arm 15 stably abuts.

[0055] In the example shown, furthermore, the axial length ℓ_a of frustoconical-shaped portion 14a is preferably greater than the axial length ℓ_b of cylindrical-shaped portion 14b.

[0056] Preferably the axial length ℓ_b of cylindrical-shaped portion 14b is moreover approximately equal to, or even greater than, half the axial length ℓ_a of the frustoconical-shaped portion 14a.

[0057] More in detail, the axial length ℓ_a of frustoconical-shaped portion 14a preferably ranges between 5 mm and 25 mm (millimeters), whereas the axial length ℓ_b of cylindrical-shaped portion 14b preferably ranges between 5 mm and 15 mm (millimeters).

[0058] Preferably the opening angle α of the frustoconical-shaped portion 14a furthermore ranges between 20° and 60°.

[0059] Preferably the outer diameter of cylindrical-shaped portion 14b furthermore ranges between 8 mm and 40 mm (millimeters).

[0060] With reference to Figures 2, 3, 4 and 5, the supporting structure 10 in turn comprises a number of connecting arms 15 each of which juts out from drive motor 8 and extends towards the fixing arrangement on peripheral wall 9, so as to reach and rigidly couple to a corresponding coupling pin 14 of washing tub 2.

[0061] More in detail, the distal end of each connecting arm 15 is provided with a substantially ogival-shaped, hollow seat 16 which is substantially complementary in shape to that of the coupling pins 14 so as to accommodate a coupling pin 14, and extends coaxial to a longitudinal reference axis D which is locally substantially parallel to the fitting direction f and preferably also to the longitudinal axis B of drive motor 8, so as to be axially engaged by said coupling pin 14.

[0062] In other words, the hollow seat 16 on the distal end of each connecting arm 15 is designed to have a frustoconical-shaped bottom portion 16a which extends coaxial to longitudinal axis D and is substantially complementary-shaped to the distal portion 14a of coupling pin 14; and an adjacent cylindrical portion 16b which extends coaxial to axis D for adjoining the frustoconical-shaped bottom portion 16a to the mouth of hollow seat 16, and is substantially complementary-shaped to the mid portion 14b of coupling pin 14, so that the distal end of connecting arm 15 can stably abut onto the stop shoulder 14c of coupling pin 14 when the coupling pin 14 is completely fitted into the ogival-shaped hollow seat 16.

[0063] Obviously when fitted into the hollow seat 16, the coupling pin 14 is coaxial to the longitudinal axis D of same hollow seat 16.

[0064] In the example shown, in particular, the connecting arms 15 are preferably located at both axial ends of drive motor 8, and furthermore extend towards the fixing arrangement on peripheral wall 9 preferably while remaining locally substantially perpendicular to the peripheral wall 9 and/or to the fitting direction f, and preferably also while remaining substantially perpendicular to longitudinal axis B of drive motor 8.

[0065] With reference to Figures 2, 3, 4 and 5, in more general terms the motor assembly 4 includes at least one connecting part 15 which has an end portion 16 fitted onto a corresponding substantially ogival-shaped, coupling pin 14 extending from the washing tub 2.

[0066] Preferably, with reference to Figures 3, 4 and 5, the motor assembly 4 additionally comprises, preferably for each coupling pin 14 of washing tub 2, a fixing screw 17 which engages in sequence the distal end of connecting arm 15 and the corresponding coupling pin 14, thus to firmly hold the distal end of connecting arm 15 in stable abutment against the stop shoulder 14c at the proximal end of coupling pin 14.

[0067] More in detail, fixing screw 17 preferably extends coaxial to the longitudinal axis C of coupling pin 14 so as to place the head 17a of fixing screw 17 in abutment on the distal end of connecting arm 15, opposite to the ogival-shaped hollow seat 16. The threaded shank 17b of fixing screw 17, in turn, firstly engages the distal end of connecting arm 15 thus to protrude into the ogival-shaped hollow seat 16 formed on said distal end, and then engages the coupling pin 14 preferably in pass-through manner, so as to firmly secure the two components in abutment to one another.

[0068] With reference to Figures 4 and 5, in particular, each coupling pin 14 is preferably provided with a through hole 18 extending coaxial to longitudinal axis C, and the tip portion of threaded shank 17b is screwed into said through hole 18. The distal end of connecting arm 15, in turn, is preferably provided, opposite to the mouth of hollow seat 16, with a through hole 19 that adjoins to the bottom of hollow seat 16, and the neck of fixing screw 17 engages said through hole 19.

[0069] As an alternative the coupling pin 14 could centrally incorporate a stiffening insert and the threaded shank 17b of fixing screw 17 screws into said stiffening insert, or the threaded shank 17b of fixing screw 17 could extend along the through hole 18 for the whole length of coupling pin 14 and screw into a lock nut arranged beyond the proximal end of the coupling pin 14.

[0070] With reference to Figure 3, in the example shown, in particular, the fixing arrangement on the peripheral wall 9 of washing tub 2 preferably comprises four reciprocally-parallel coupling pins 14, and preferably a fixing screw 17 for each coupling pin 14.

[0071] Preferably sais coupling pins 14 are furthermore arranged in pairs parallel and spaced beside to one another. Preferably the pairs of coupling pins 14 are moreover aligned to one another parallel to fitting direction f, so to form two adjacent and reciprocally-parallel rows of coupling pins 14 on peripheral wall 9 of washing tub 2.

[0072] With reference to Figures 2, 3 and 4, in the example shown, furthermore, the drive motor 8 is preferably an electric motor, such as for example a asynchronous motor or a commutator electric motor.

[0073] The supporting structure 10, in turn, preferably

comprises a pair of preferably substantially cup-shaped, end-shields 20 and 21 which are arranged on opposite sides of drive motor 8, roughly coaxial to the longitudinal axis B, and are rigidly secured respectively to the front and rear portions of electric motor 8 preferably via a number of fixing bolts or other fastening members.

[0074] The front end-shield 20, i.e. the end-shield engaged in pass-through and axially rotatable manner by the driving shaft 12 of drive motor 8, is preferably provided with two substantially coplanar and outwards-protruding, connecting arms 15 which extend toward a first pair of coupling pins 14 of washing tub 2. Each connecting arm 15 of end-shield 20 furthermore has a substantially cup-shaped, distal end which is designed to fit onto a respective coupling pin 14 of said first pair of coupling pins 14.

[0075] In other words, the central cavity of the cup-shaped, distal end of connecting arm 15 forms the substantially ogival-shaped, hollow seat 16 which is axially engaged by the coupling pin 14.

[0076] Similarly to front end-shield 20, the rear end-shield 21 is provided with two substantially coplanar outwards-protruding, connecting arms 15 which extend toward a second pair of coupling pins 14 of washing tub 2. Each connecting arm 15 of end-shield 21 furthermore has a substantially cup-shaped, distal end which is designed to fit onto a respective coupling pin 14 of said second pair of coupling pins 14.

[0077] With reference to Figures 1 and 2, preferably the washing group 1 finally comprises also an electric heating device 22, for example a resistor, which is fixed to washing tub 2 so as to at least partially protrude inside washing tub 2, and is capable of selectively heating up the water contained into the washing tub 2.

[0078] Preferably the laundry washing machine 100 moreover comprises: an electrically-operated, water and detergent supply assembly 104 which is preferably located immediately above the washing group 1, and is structured for selectively feeding into the washing tub 2 a given amount of detergent, softener and/or other washing agent suitably mixed with the fresh water arriving from the water mains, or simply a given amount of fresh water arriving from the water mains; and an electronic central control unit (not shown) which controls the electric motor 8, the heating device 22 and the water and detergent supply assembly 104 to selectively perform one of the user-selectable washing cycles stored in the same central control unit.

[0079] General operation of washing group 1 is clearly inferable from the above description, with no further explanation required.

[0080] The advantages deriving from the particular structure of coupling pins 14 and of the distal ends of connecting arms 15 are large in number.

[0081] Having both a frustoconical-shaped distal portion 14a and an adjacent cylindrical-shaped mid portion 14b, each coupling pin 14 can operate as a centring member during assembly of supporting structure 10 on washing tub 2, and at same time can directly bear the weight of motor assembly 4 even when fixing screws 17 are missing. Therefore the assembly of supporting structure 10 to washing tub 2 is significantly quicker.

[0082] Moreover, the presence of the stop shoulder 14c adjacent to the cylindrical-shaped portion 14b, improves stiffness of the mechanical coupling between the coupling pin 14 and the distal end of the connecting arm 15. The distal end of connecting arm 15, in fact, is now tighten between the stop shoulder 14c and the head 17a of fixing screw 17.

[0083] Furthermore being now arranged at vertex of a quadrilateral, the cylindrical-shaped mid portions 14b offers a much more stable support for motor assembly 4 during working of drive motor 8.

[0084] Last but not least, since each coupling pins 14 has a cylindrical-shaped mid portion 14b, the overall contact surface capable of bearing the mechanical stresses during working of drive motor 8 is significantly increased with respect to the fixing system disclosed in EP2775024A1, with all advantages that this entails.

[0085] Clearly, changes may be made to both washing group 1 and laundry washing machine 100 described above without, however, departing from the scope of the present invention.

[0086] For example, the coupling pins 14 may be located on the distal end of the connecting arms 15 whereas the hollow seats 16 may be integrally formed on the peripheral wall 9 of washing tub 2.

[0087] In other words, the motor assembly 4 may include one or more ogival-shaped, coupling pin 14 extending from the drive motor 8 and fitted into corresponding connecting part/s 15 formed on washing tub 2.

[0088] Furthermore the supporting structure 10 may solely comprise the front end-shield 20 with the corresponding connecting arms 15.

[0089] In other words, the supporting structure 10 may comprise a number of connecting arms 15 which juts out solely from the front portion of electric motor 8 towards a number of corresponding coupling pins 14 located on the peripheral wall 9 of washing tub 2.

Claims

1. Washing group (1) for laundry washing machines comprising a hollow washing tub (2), a revolving drum (3) fitted in axially rotatable manner inside the washing tub (2), and a motor assembly (4) including a drive motor (8) which is rigidly attached outside the washing tub (2) and is capable of driving into rotation the revolving drum (3) inside the washing tub (2);
the motor assembly (4) also including at least one connecting part (15) having an end portion (16) fitted onto a corresponding coupling pin (14) extending from the washing tub (2) or vice versa;
the washing group (1) **being characterized in that** each coupling pin (14) has a frustoconical-shaped distal portion (14a) and an adjacent, cylindrical-

shaped mid portion (14b) adjoining said frustoconical-shaped distal portion (14a); **and in that** the end portion (16) of the connecting part (15) has a hollow seat (16) which is substantially complementary in shape to that of the corresponding coupling pin (14) so as to be axially engaged by said coupling pin (14).

2. Washing group according to Claim 1, **characterized in that** said cylindrical-shaped mid portion (14b) adjoins the frustoconical-shaped distal portion (14a) to a proximal end of the coupling pin (14) which is rigidly connected to the washing tub (2) or to the drive motor (8); the proximal end of said coupling pin (14) having, adjacent to said cylindrical-shaped mid portion (14b) and opposite to the frustoconical-shaped distal portion (14a), a stop surface (14c) wherein the distal end of the connecting part (15) stably abuts.

3. Washing group according to Claim 2, **characterized in that** the proximal end of said coupling pin (14) is provided with a substantially annular-shaped, stop shoulder (14c) which adjoins the cylindrical portion (14b), and wherein the distal end of connecting part (15) stably abuts.

4. Washing group according to any one of the preceding claims, **characterized in that** the axial length (ℓ_a) of said frustoconical-shaped distal portion (14a) is greater than the axial length (ℓ_b) of said cylindrical-shaped mid portion (14b).

5. Washing group according to Claim 4, **characterized in that** the axial length (ℓ_b) of said cylindrical-shaped mid portion (14b) is moreover approximately equal to half the axial length (ℓ_a) of said frustoconical-shaped distal portion (14a).

6. Washing group according to any one of the preceding claims, **characterized in that** the opening angle (α) of said frustoconical-shaped distal portion (14a) ranges between 20° and 60°.

7. Washing group according to any one of the preceding claims, **characterized in that** the outer diameter of said cylindrical-shaped mid portion (14b) ranges between 8 and 40 millimeters.

8. Washing group according to any one of the preceding claims, **characterized in that** the motor assembly (4) includes a number of connecting parts (15) each having an end portion (16) fitted onto a corresponding coupling pin (14) extending from the washing tub (2) or vice versa, and **in that** said coupling pins (14) are substantially parallel to a common fitting direction (f).

9. Washing group according to any one of the preceding claims, **characterized in that** the motor assembly (4) includes a number of connecting parts (15) each having an end portion (16) fitted onto a corresponding coupling pin (14) extending from the washing tub (2) or vice versa, and **in that** all coupling pins (14) are identical in shape to one another and are preferably four in number.

10. Washing group according to Claim 8 or 9, **characterized in that** said revolving drum (3) extends coaxial to a longitudinal axis (A) of the washing tub (2), and **in that** said fitting direction (f) is substantially parallel the longitudinal axis (A) of said washing tub (2).

11. Washing group according to any one of the preceding claims, **characterized in that** said motor assembly (4) moreover comprises at least one fixing screw (17) engaging in sequence the end portion (16) of the connecting part (15) and the corresponding coupling pin (14).

12. Washing group according to Claim 11, **characterized in that** said fixing screw (17) extends coaxial to said coupling pin (14).

13. Washing group according to Claim 11 or 12, **characterized in that** the motor assembly (4) includes a number of connecting parts (15) each having an end portion (16) fitted onto a corresponding coupling pin (14) extending from the washing tub (2) or vice versa, and **in that** said motor assembly (4) comprises a fixing screw (17) for each coupling pin (14).

14. Washing group according to any one of the preceding claims, **characterized in that** the motor assembly (4) additionally comprises a supporting structure (10) which is provided with a number of connecting arms (15) each of which juts out from the drive motor (8) towards the peripheral wall (9) of washing tub (2); the distal end of each connecting arm (15) forming a respective end portion (16) of the connecting part (15).

15. Laundry washing machine (100) having an outer casing (101) structured for resting on the floor, and a washing group (1) which is arranged inside the casing (101) and comprises a hollow washing tub (2), a revolving drum (3) fitted in axially rotatable manner inside the washing tub (2), and a motor assembly (4) which is rigidly attached outside the washing tub (2) and is capable of driving into rotation the revolving drum (3) inside the washing tub (2);
the laundry washing machine (100) being **characterized in that** said washing group (1) is a washing group (1) according to any one of Claims from 1 to 14.

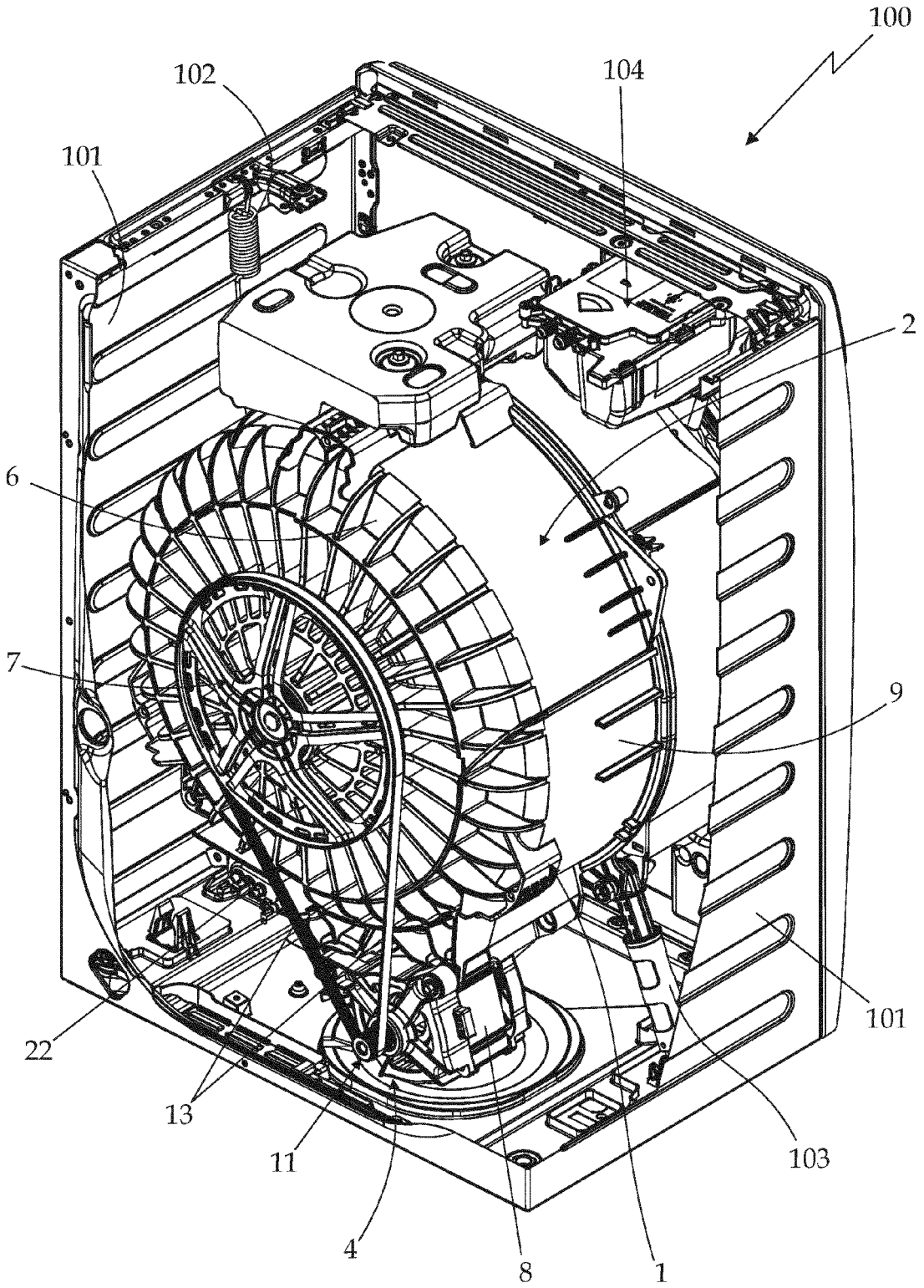


Fig. 1

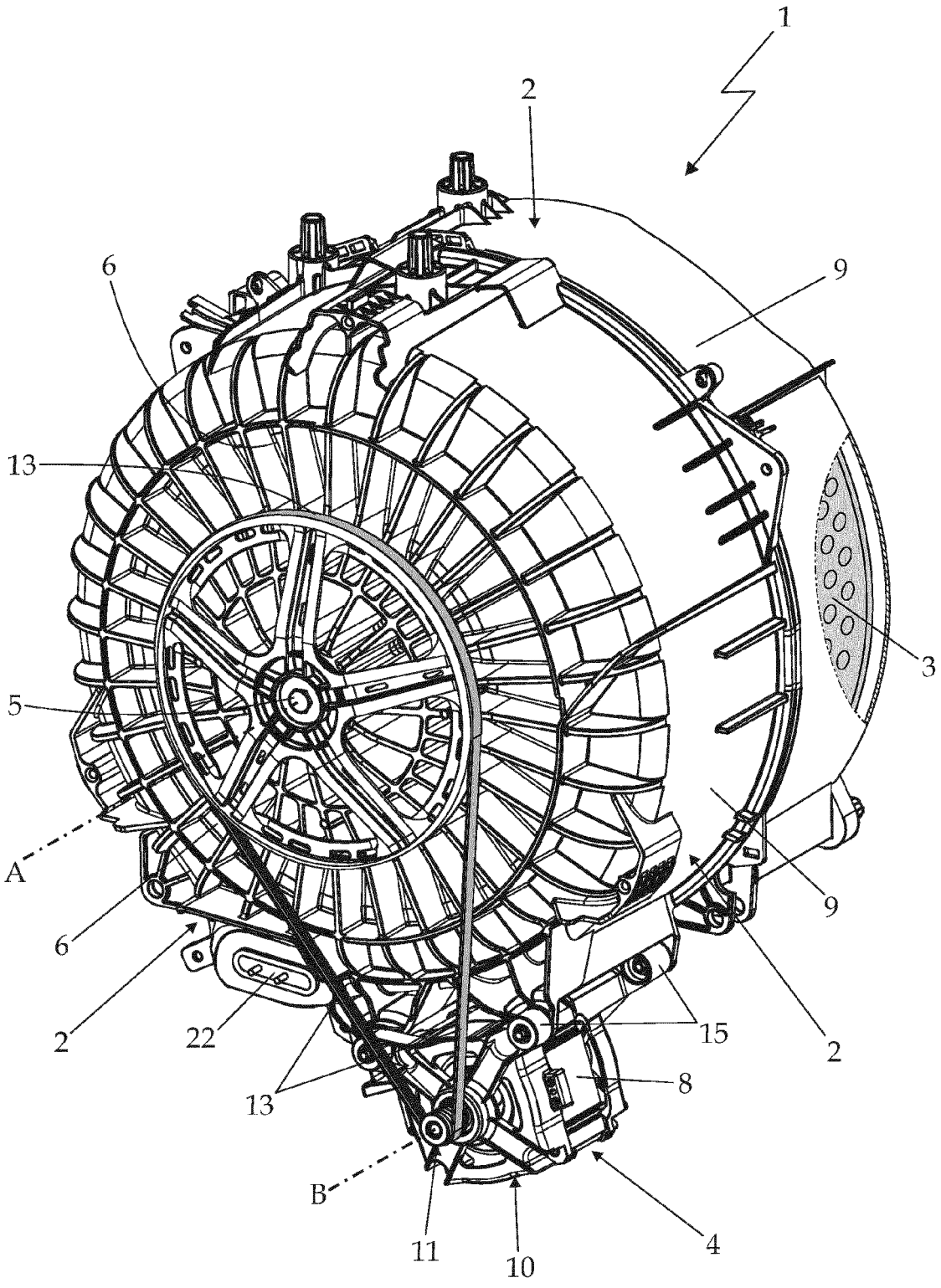


Fig. 2

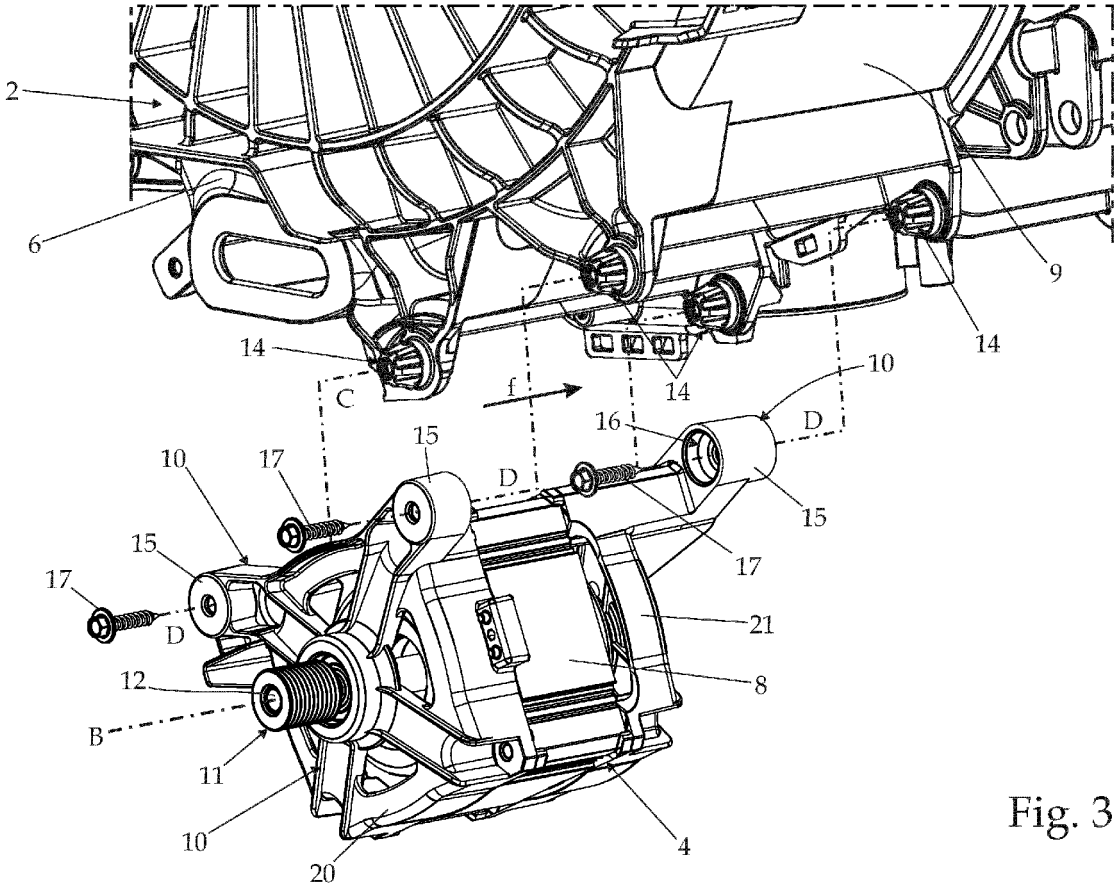


Fig. 3

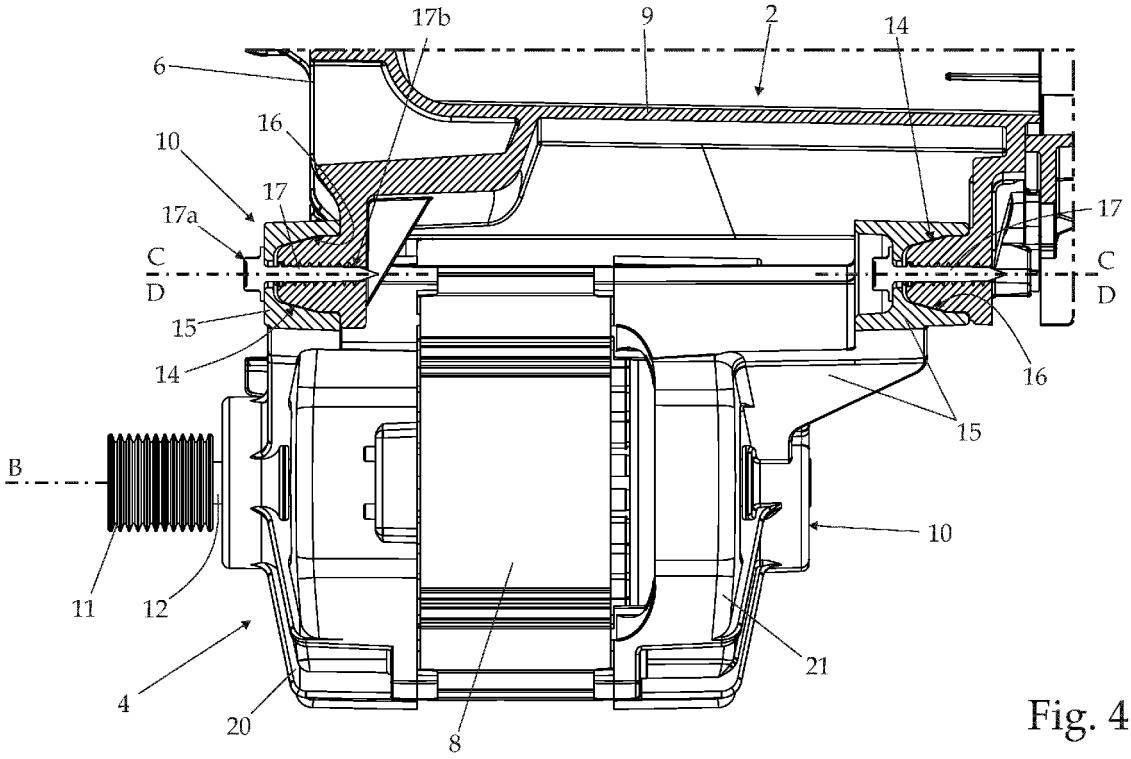
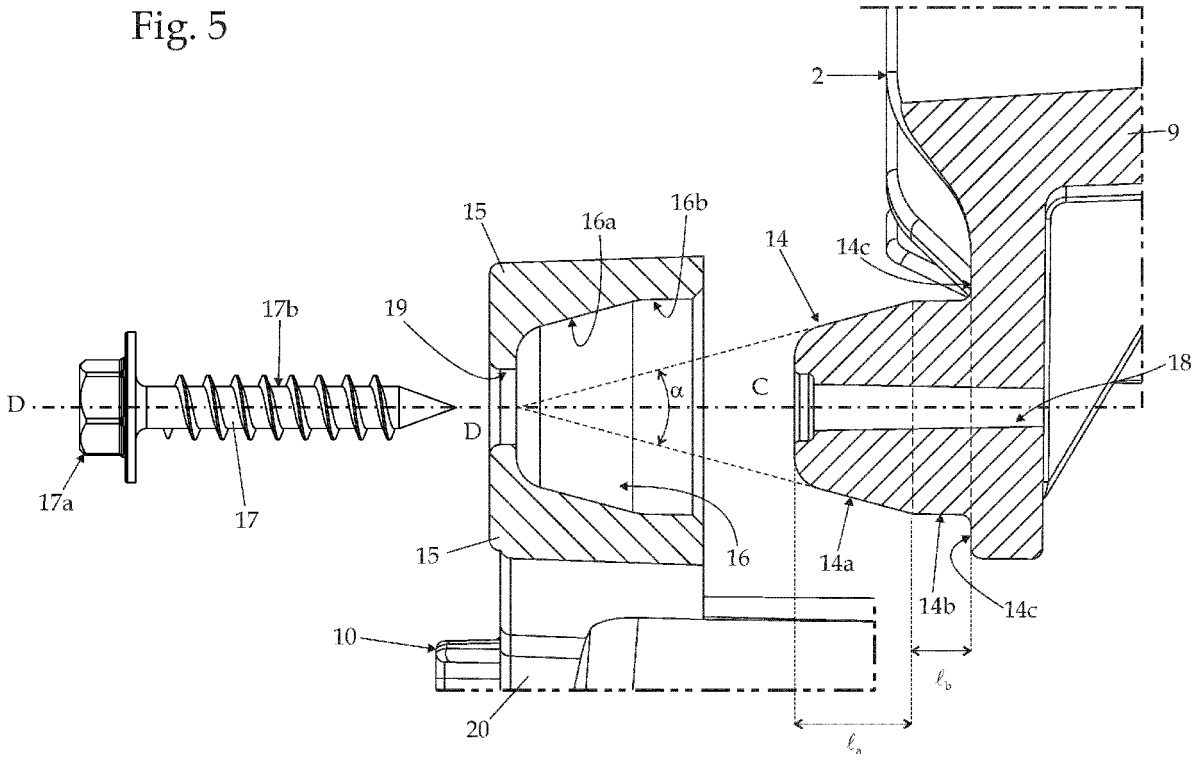


Fig. 4

Fig. 5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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 February 2016	Weidner, Maximilian

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EUROPEAN SEARCH REPORT

Application Number
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