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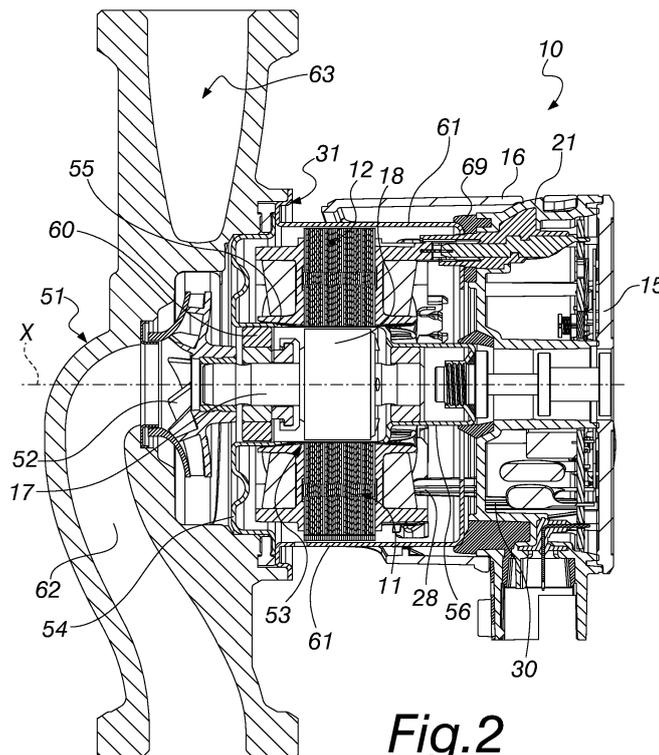
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(54) **CENTRIFUGAL PUMP ASSEMBLY WITH ELECTRIC MOTOR**

(57) A centrifugal pump assembly (10), with electric motor (11) arranged in a casing (61), the assembly (10) comprising, at one end, a wet section (51), formed by a volute (64) and containing an impeller (52), and, at the

other end, a box (13), which contains an electrical board (14), in contact with one end of the casing (61). The electric motor (11) is of the permanent-magnet brushless type and the casing (61) is made of stainless steel.



**Fig.2**

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## Description

**[0001]** The present invention relates to a centrifugal pump assembly with electric motor.

**[0002]** In water circulation pumps for systems for domestic use, the motor used is normally of the asynchronous type and the motor casing is made of aluminum.

**[0003]** An electrical board, contained in a box, supplies power and controls the operation of the motor.

**[0004]** The choice of aluminum for the provision of the casing is dictated by its adequate capacity to dissipate the heat produced by the asynchronous motor.

**[0005]** However, this background art has aspects that can be improved.

**[0006]** Aluminum in fact has a good heat dissipation capacity, but it has to be subjected to treatments in order to avoid oxidation, corrosion and wear, such as for example cathaphoresis processes.

**[0007]** The set of operations adapted to render the aluminum of the motor casing resistant to oxidation, corrosion and wear entails: long production cycles, logistical complexities, linked both to the organization of the spaces for the provision of the various steps and to the spaces for storage between the various steps of the cycle, and considerable costs.

**[0008]** The aim of the present invention is to provide a pump assembly that is capable of improving the background art in one or more of the aspects indicated above.

**[0009]** Within this aim, an object of the invention is to provide a pump assembly with a motor casing that does not require subsequent treatments to avoid oxidation, corrosion and wear.

**[0010]** Another object of the invention is to provide a pump assembly with a motor casing that is provided according to simpler production cycles and by reducing logistical complexities linked thereto, with respect to pump assemblies of the known type.

**[0011]** A further object of the invention is to provide a pump assembly with a motor that produces less heat than those of the known type.

**[0012]** Another object of the invention is to provide a pump assembly that allows an effective method of connection between the electronic box and the casing of the motor.

**[0013]** Furthermore, an object of the present invention is to overcome the drawbacks of the background art in a manner that is alternative to any existing solutions.

**[0014]** A further object of the invention is to provide a pump assembly that is highly reliable, relatively easy to provide and at competitive costs.

**[0015]** This aim, as well as these and other objects which will become better apparent hereinafter, are achieved by a centrifugal pump assembly, with electric motor arranged in a casing, the assembly comprising, at one end, a wet section, formed by a volute and containing an impeller, and, at the other end, a box, which contains an electrical board, in contact with one end of said casing, characterized in that said electric motor is of the perma-

nent-magnet brushless type and said casing is made of stainless steel.

**[0016]** Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the pump assembly according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is an overall exploded view of a pump assembly according to the invention;

Figure 2 is a sectional view of a pump assembly according to the invention;

Figure 3 is a sectional view of a detail of the pump assembly of Figure 2;

Figures 4a and 4b are detail views of two parts of the pump assembly of Figure 1;

Figure 5 is a sectional view of a detail of the pump assembly according to the invention.

**[0017]** With reference to the cited figures, the centrifugal pump assembly with electric motor according to the invention is designated generally by the reference numeral 10.

**[0018]** The centrifugal pump assembly 10 comprises at one end a wet section 51 which is provided with an intake duct 62 and a delivery duct 63 and a volute 64, and an impeller 52, of a known type, which is immersed in said wet section.

**[0019]** The impeller 52 is keyed on a shaft 17 of an electric motor 11 that is composed of a stator 12 and a rotor 18.

**[0020]** In particular, the electric motor 11 is of the brushless permanent-magnet type.

**[0021]** The pump assembly 10 comprises a gap sleeve 53.

**[0022]** The gap sleeve is constituted by a tubular body section 55, which has a flanged end 54 which is faced by the impeller 52, and a tubular end 56, in which the cross-section tapers with respect to the cross-section of the body 55 and the diameter is smaller than the diameter of the body 55.

**[0023]** The gap sleeve 53 has an axis of extension X, which coincides with the axis of extension of the pump body, which coincides with the axis of rotation of the rotor 18 and of the impeller 52.

**[0024]** In some cases, the axis of extension of the gap sleeve 53 might not coincide with the axis of extension of the pump body.

**[0025]** The centrifugal pump assembly 10 comprises, at the other end, an electrical box 13, which contains an electrical board 14 adapted to control and supply the electric motor.

**[0026]** The electric motor 11, and in particular its stator 12, is closed externally by a casing 61.

**[0027]** In particular, the casing 61 is cup-shaped, its base 67 being proximate to the free tip of the tubular end 56 of the gap sleeve 53.

**[0028]** The axis of extension of the casing coincides with the axis of extension X of the pump body.

**[0029]** The base 67 is provided with a hole 66 to allow access to the wet section and partially to the stator 12.

**[0030]** Furthermore, the base 67 has an opening 68 adapted for the insertion of terminals 25 of the electric motor 11 which are connected to the electric board 14.

**[0031]** The casing 61 has one end in contact with the electrical box 13.

**[0032]** The casing 61 has, at the end that is opposite to the one for contact with the electrical box 13, a perimetric annular tab 31 which has a plurality of through holes 32 adapted for the insertion of screws 34 for fixing the casing 61 to the body of the volute 64.

**[0033]** A particularity of the invention resides in that the casing 61 is made of stainless steel.

**[0034]** Stainless steel has a lower heat dissipation capacity than aluminum, but the use of a permanent-magnet brushless motor 11 causes a lower generation of heat than that generated by asynchronous motors and consequently a lower need for heat dissipation.

**[0035]** This lower need is met adequately by the stainless steel of the casing 61.

**[0036]** Furthermore, the use of stainless steel eliminates the need to perform additional treatments against corrosion, oxidation and wear.

**[0037]** This determines shorter production times with respect to a similar casing made of aluminum, and smaller logistical difficulties.

**[0038]** A sealing element 69 is present between the casing 61 and the electrical box 13, is made for example of rubber and is co-molded with the electrical box 13.

**[0039]** The particularity of the casing 61 of being made of stainless steel produces an adequate seal with the element 69.

**[0040]** It should be noted that if the casing 61 were made of aluminum, it would be necessary to machine the region for interfacing with the sealing element in order to remove locally the cathoporesis treatment and provide adequate roughness.

**[0041]** The casing 61 and the electrical box 13 are connected and rendered integral by the presence of an intermediate element 16.

**[0042]** The intermediate element 16 is a connecting and/or covering element and has a tubular shape.

**[0043]** The electrical box 13 and the casing 61 for accommodating the stator 12 have mutually complementary contact surfaces.

**[0044]** The intermediate element 16 is provided with components which are adapted to be complementary, on one side, with respect to components of the electrical box 13 and, on the other side, with respect to components of the casing 61 for accommodating the stator 12, generating couplings by interlocking with interference.

**[0045]** Advantageously, the intermediate element 16 can fix the box 13 to the stator accommodation casing 61 even in a different manner.

**[0046]** The intermediate element 16 is provided with

seats and/or holes 20 adapted for the insertion of protrusions 21, which are conveniently shaped on the surface that is lateral and parallel to the axis X of rotation of the impeller, of the electrical box 13, generating an interlocking coupling.

**[0047]** Likewise, with reference to Figure 3, elements such as for example teeth 22 are present on the intermediate element 16, on the internal tubular surface, and are adapted to generate an interference with elements such as for example projections 23 which are conveniently contoured on the surface of the casing 61 that is lateral, external and parallel to the axis X of rotation of the impeller.

**[0048]** With reference to Figures 4a, 4b and 5, on the base 67 there are furthermore elastically deformable elements 70, such as for example leaf springs or flexing springs, three in the illustrated example, which have a substantially rectangular shape.

**[0049]** The springs 70 are for example provided by through blanking from the base 67 and are adapted to generate thrust on corresponding pins 71 which are present on the surface 72 of the box 13, which faces the base 67, and are visible in Figures 4b and 5.

**[0050]** The thrust of the elements 70 on the respective pins 71 ensures perfect coupling between the casing 61 and the box 13 since it allows to maintain over time contact between the teeth 22 that are present on the internal tubular surface of the intermediate element 16 and the projections 23 of the casing 61.

**[0051]** The presence of the elastically deformable elements 70 integrates the thrust produced by the sealing element 69, which being made of plastic is subject to aging and therefore becomes stiffer.

**[0052]** One or more first axial pins 28 extend from the electrical box 13 and are adapted to be inserted in corresponding through holes 29 provided on the surface of the casing 61 of the stator 12 in contact with said electrical box 13.

**[0053]** The pins are adapted to connect the box 13 and the casing 61 of the stator 12 and to facilitate the assembly of the pump 10.

**[0054]** Likewise, the box 13 has one or more second pins 30, which extend inside the box 13 and in the direction of a lid 15 for the closure of said box 13.

**[0055]** The tips of the second pins 30 are adapted for insertion in corresponding holes provided on the surface of the lid 15 that is directed toward the inside of the box 13.

**[0056]** The pins are adapted to connect the box 13 and the lid 15 and to facilitate the assembly of the pump 10.

**[0057]** It should be noted that the stator accommodation casing made of stainless steel, which eliminates the need for treatments against corrosion, oxidation and wear, allows shorter production cycles and simpler logistical organizations.

**[0058]** It should also be noted that the stator accommodation casing made of stainless steel, by eliminating the need for treatments against corrosion, oxidation and wear, reduces production costs.

[0059] Moreover, it should be noted that the stator accommodation casing made of steel, in contact with the gap sleeve also made of steel, allows better grounding due to steel-on-steel contact, without the need to remove locally the cathoporesis treatment, in the region of interface with the gap sleeve, as instead occurs in the case of an aluminum casing.

[0060] In practice it has been found that the invention achieves the intended aim and objects, providing a centrifugal pump assembly with electric motor arranged in a casing, the assembly comprising, at one end, a wet section, formed by a volute and containing an impeller, and, at the other end, a box, which contains an electrical board, in contact with one end of said casing, characterized in that said electric motor is of the permanent-magnet brushless type and said casing is made of stainless steel.

[0061] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0062] In practice, the materials used, so long as they are compatible with the specific use, as well as the contingent shapes and dimensions, may be any according to the requirements and the state of the art.

[0063] The disclosures in Italian Patent Application No. 102018000000660 from which this application claims priority are incorporated herein by reference.

[0064] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A centrifugal pump assembly (10), with electric motor (11) arranged in a casing (61), the assembly (10) comprising, at one end, a wet section (51), formed by a volute (64) and containing an impeller (52), and, at the other end, a box (13), which contains an electrical board (14), in contact with one end of said casing (61), **characterized in that** said electric motor (11) is of the permanent-magnet brushless type and said casing (61) is made of stainless steel.
2. The centrifugal pump assembly (10) according to claim 1, **characterized in that** said casing (61) is cup-shaped with a base (67) which comprises one or more elastically deformable elements (70), which are adapted to generate a thrust on one or more corresponding pins (71) arranged on the surface (72) of said box (13) that faces said base (67).

3. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** said casing (61) is provided with a perimetric annular tab (31) provided with a plurality of through holes (32) adapted for the insertion of screws (34) for fixing said casing (61) to a body of said volute (64).
4. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** said base (67) is provided with an opening (68) adapted for the insertion of terminals (25) of said electric motor (11) connected to the electrical board (14).
5. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** said base (67) is provided with a hole (66) for access to said wet section (51) and partially to a stator (12) of said electric motor (11).
6. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** said base (67) of said casing (61) of said electric motor (11) is proximate to a free tip of a tubular end (56) of a gap sleeve (53).
7. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** said box (13) and said casing (61) have mutually complementary contact surfaces.
8. The centrifugal pump assembly (10) according to one or more of the preceding claims, **characterized in that** a sealing element (69), co-molded with said box (13), is present between said casing (61) and said box (13).

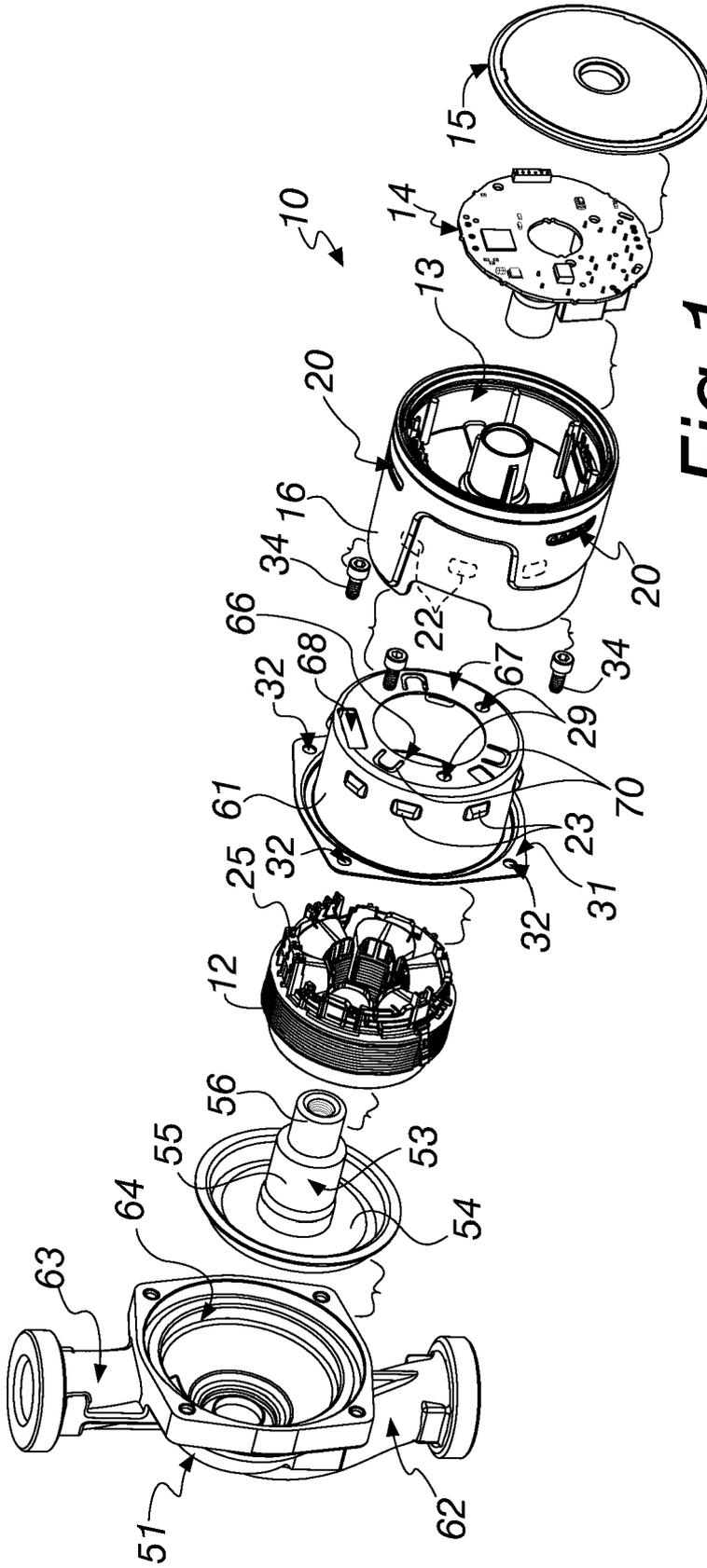


Fig. 1

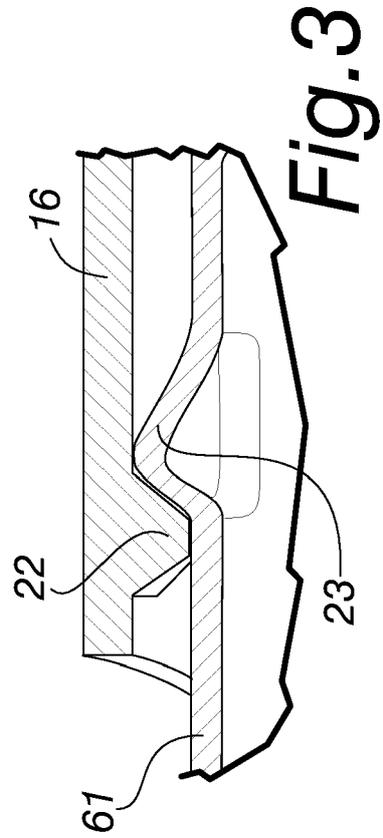
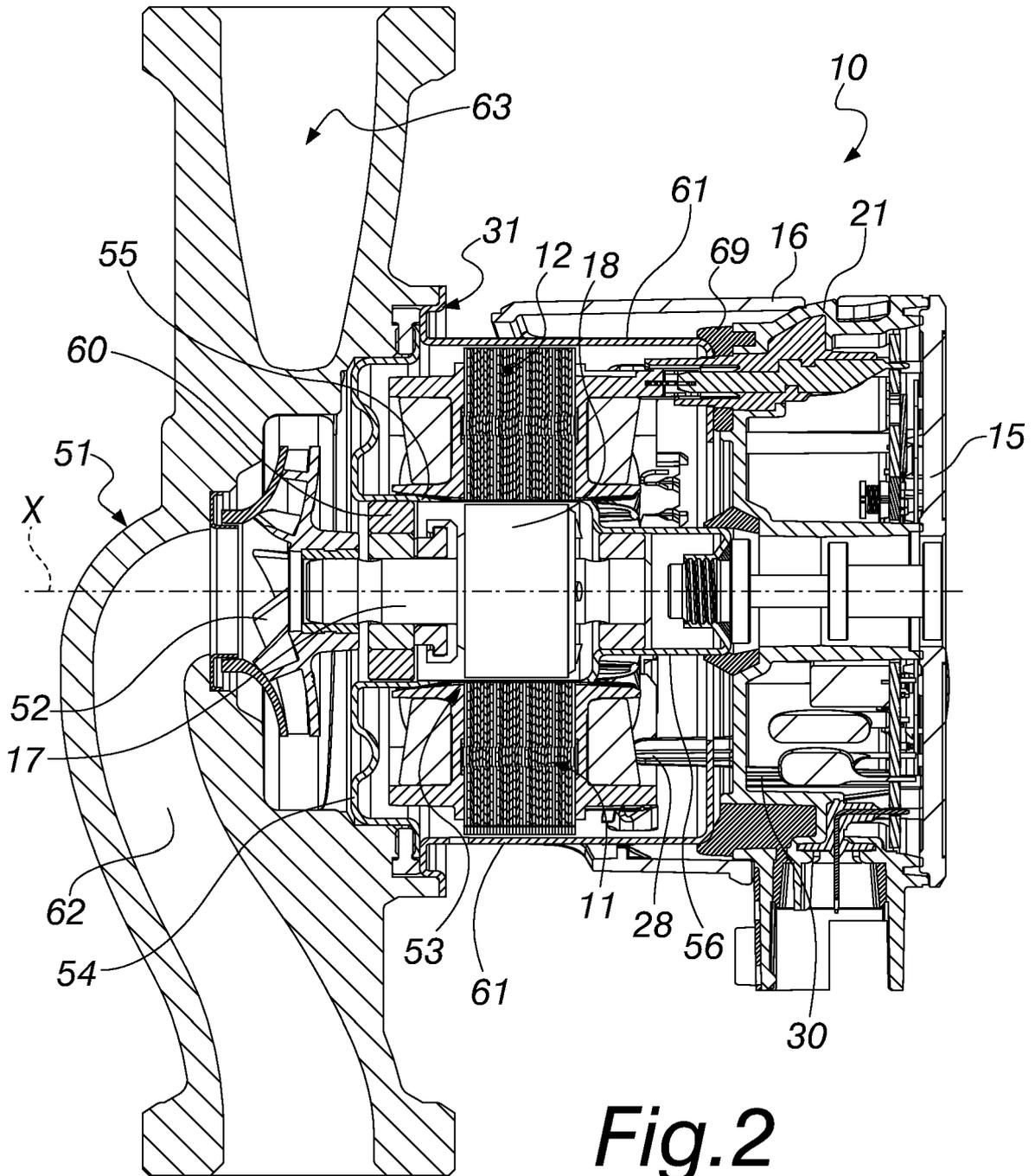


Fig. 3







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