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(71) Applicant: **Dab Pumps S.p.A.**
**35035 Mestrino (Padova) (IT)**

(72) Inventors:
- **Tazioli, Stefano**
  **57016 ROSIGNANO MARITTIMO,**
  **Località Gabbro LI (IT)**
- **Sinico, Francesco**
  **36075 MONTECCHIO MAGGIORE VI (IT)**

(74) Representative: **Modiano, Micaela Nadia et al**
**Modiano & Partners (IT)**
**Via Meravigli, 16**
**20123 Milano (IT)**

(54) **Centrifugal electric pump**

(57) A centrifugal electric pump (10), of the type comprising a shell (11) for the containment of a set of impellers (12) interleaved with fixed diffusers (13), and of a motor (14) that drives the impellers (12) to rotate, since they are keyed on a same shaft (15) as the motor (14), a sealing chamber (16) is provided between the impellers (12) and the motor (14) and is extended around the shaft (15) to collect condensation water and water seepage originating from the set of impellers (12), the sealing chamber (16) is connected to the outside of the pump (10) by means of at least one water discharge duct (18).

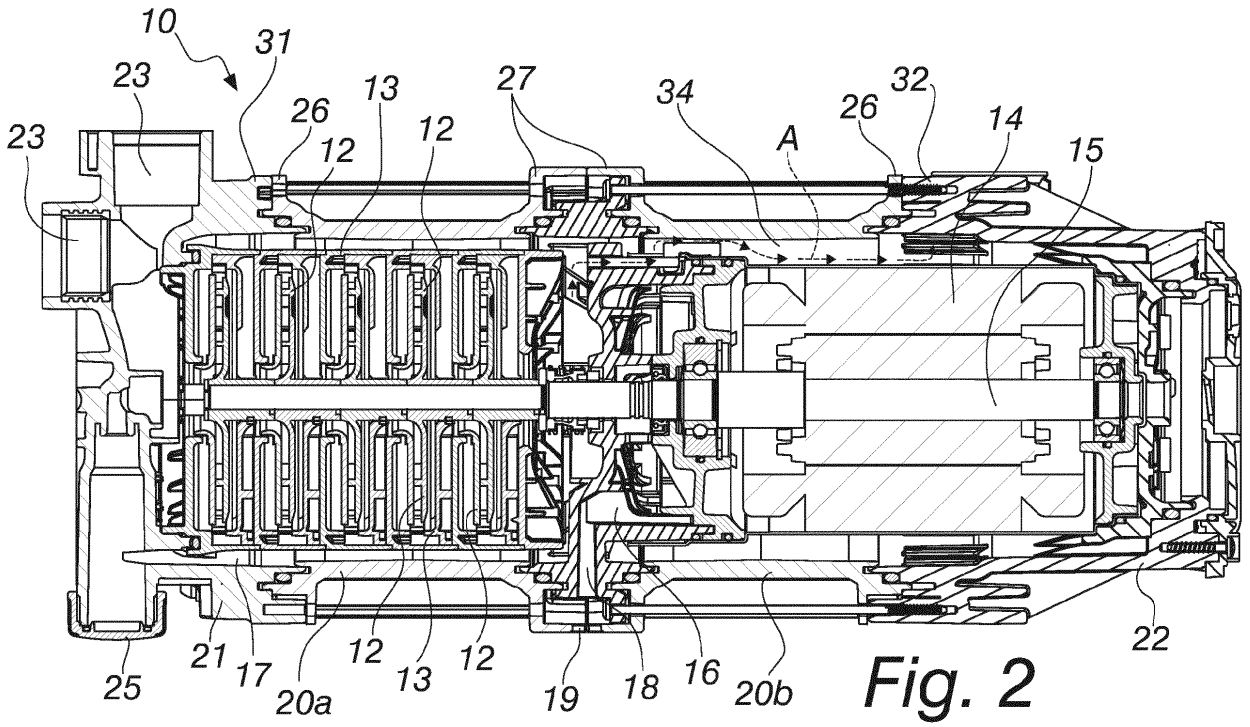


Fig. 2

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## Description

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

**[0002]** Centrifugal electric pumps are currently known which are composed substantially of a hollow body provided with intake and delivery ducts and containing a plurality of impellers interleaved by diffusers and keyed on the shaft of an electric motor.

**[0003]** The motor and the pump are typically separated hermetically in order to prevent the escape of any water seepage from the impellers or of condensation from reaching the inside of the motor.

**[0004]** When the motor is liquid-cooled, it is advantageously skimmed externally by at least a fraction of the liquid moved by the pump.

**[0005]** Although widespread, such electric pumps suffer a significant drawback, which resides in that the mechanical seal is subject to wear over time, allowing the passage of liquid infiltrations that compromise the operation of the motor and therefore of the electric pump itself.

**[0006]** The aim of the present invention is to improve a centrifugal electric pump, in order to preserve the operation of the motor and therefore of the entire device, preventing the passage of any water infiltrations into the motor.

**[0007]** Within this aim, an object of the invention is to provide an electric pump that is structurally simple and can be manufactured with low costs.

**[0008]** This aim, as well as these and other objects that will become better parent hereinafter, are achieved by a centrifugal electric pump, of the type comprising a shell for the containment of a set of impellers, interleaved with fixed diffusers, and of a motor that drives said impellers to rotate, since they are keyed on the same shaft as said motor, said pump being **characterized in that** a sealing chamber is provided between said impellers and said motor and is extended around said shaft to collect the condensation water and water seepage originating from the set of said impellers, said sealing chamber being connected to the outside of said pump by means of at least one water discharge duct.

**[0009]** Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the pump according to the invention, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the pump according to the invention in an assembled condition;

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

Figure 3 is a partially exploded perspective view of the pump according to the invention.

**[0010]** With reference to the figures, the pump according to the invention is generally designated by the reference numeral 10 and is of the type comprising a shell 11 for the containment of a set of impellers 12, interleaved (as indicated in the sectional view of Figure 2) with fixed diffusers 13 that are integral with the shell 11, and of a motor 14 that drives the impellers 12 to rotate, since they are keyed on the shaft 15 of said motor 14.

**[0011]** In the pump 10 described and illustrated herein, the centrifugal pump is of the multistage type with five impellers 12; however, the proposed solution can also be applied in the use of pumps with a different number of impellers 12.

**[0012]** The pump 10 is provided with a sealing chamber 16 to collect the condensation water and water seepage originating from the set of the impellers 12. Said chamber is extended around the shaft 15, conveniently interposed between the set of impellers 12 and the motor 14, and is advantageously connected to the outside of the pump 10 by means of a water discharge duct 18.

**[0013]** In Figure 2 the reference numeral 17 designates an interspace, that is comprised between the set of impellers 12 and the shell 11, for recirculation of pressurized water.

**[0014]** The duct 18, with respect to the drawing that illustrates it, is substantially vertical and the shell 11 has thereat a discharge hole 19 that is conveniently arranged in its lowest part.

**[0015]** The shell 11 is composed of multiple parts. In particular, it comprises a substantially cylindrical portion, which surrounds the impellers 12, the sealing chamber 16 and the motor 14; such portion is constituted by two jackets 20a, 20b which are mated on the transverse plane at the discharge hole 19. The shell 11 also comprises two opposite heads 21 and 22, respectively a first head 21 at the intake region of the pump and a second head 22 at the delivery region of the pump.

**[0016]** Conveniently, in fact, the first head 21 has at least one intake duct 23 for the flow that enters the impellers 12, two mutually perpendicular ones in the embodiment described here and shown in Figures 1 and 2, and the second head 22 has a flow delivery duct 24.

**[0017]** Both the intake ducts 23 and the delivery duct 24 are connected to the outside of the pump, since they are part of the shell 11; in particular, the intake ducts 23 merge into a single duct that conveys the flow to the first impeller of the set of impellers 12.

**[0018]** The first head 21 further has an outward opening which, as shown in Figure 1, can be closed by a plug 25.

**[0019]** As regards the two jackets 20a and 20b, they are substantially two cylindrical bodies which are hollow and open at their end faces, have the same shape and dimensions and are mated symmetrically on the transverse plane so as to constitute the substantially cylindrical portion of the shell 11.

**[0020]** In particular, each jacket has, at its two opposite end faces, respectively a first flange 26 and a second flange 27, the latter for mating with the other one of the two jackets 20a, 20b.

**[0021]** The second flange 27, as shown more clearly in Figure 1, is contoured on the edge so as to be provided laterally with one half of the discharge hole 19: in this manner, the two jackets 20a and 20b, by both mating symmetrically with the second flange 27, provide the discharge hole 19 by means of their two hole halves.

**[0022]** Moreover, again from Figure 1, it can be seen that the edge is contoured so as to define not only the hole half but also a protrusion 28 on one side with respect to it and a complementarily shaped recess 29 on the other side. In this manner, in the mating of the two jackets 20a and 20b, the protrusion 28 of each jacket 20a, 20b enters the respective recess 29 of the other jacket, preventing the relative rotation of the two jackets during assembly.

**[0023]** Again for assembly purposes, the four main components of the shell 11, i.e., the two jackets 20a, 20b and the first and second heads 21, 22, are joined by means of threaded tension members 30 that pass in succession through:

- a first annular element 31 of the first head 21 and the first flange 26 of the jacket 20a that surrounds the impellers 12, with which the first head 21 and the jacket 20a are associated,
- the two second flanges 27 of the two jackets 20a, 20b, at right angles to the transverse plane on which they mate symmetrically,
- the first flange 26 of the jacket 20b that surrounds mainly the motor 14, and a second annular element 32 of said second head 22, with which the jacket 20b and the second head 22 are associated.

**[0024]** Each one of the two jackets 20a and 20a is further provided externally with longitudinal and transverse stiffening ribs 33.

**[0025]** Moreover, as shown in Figure 2, between the jacket 20b and the motor 14 there is an interspace 34 through which the liquid propelled by the pump skims the motor 14, cooling it, and then rises toward the delivery duct 24, following the path designated by the reference letter A (which in the illustration is interrupted because the delivery duct 24 is covered by the section of the shell 11).

**[0026]** It should be noted that the sealing chamber 16 prevents the water that originates from seepage and condensation from reaching the inside of the motor of the pump, and since at least one discharge duct is also present, such water is conveniently discharged outside the shell 11.

**[0027]** Moreover, the pump can be used advantageously by utilizing this particularity both in a horizontal configuration and in a vertical configuration.

**[0028]** According to the first configuration, the duct 18 is in fact in a vertical position and the water collected from the sealing chamber 16 is easily discharged outside by gravity.

**[0029]** Equally easily, it is discharged outside in a vertical configuration, since the discharge hole 19 is in the lowest point of the sealing chamber 16.

**[0030]** It should also be noted that by using two jackets 20a and 20b it is easier to assemble the shell 11, locating the discharge hole 19 exactly at the discharge duct 18, with respect to what would occur with a monolithic jacket provided with a hole.

**[0031]** It should also be noted that the two jackets 20a and 20b, which are identical in dimensions and shape, can be manufactured by using a single mold, consequently containing the production costs of the pump. The shell 11 in fact can be made of plastic material, which can be replaced optionally with other material.

**[0032]** In practice it has been found that the invention achieves the intended aim and objects, by improving a centrifugal electric pump by way of which it is possible to prevent any infiltrations of water from reaching the inside of the motor, compromising the operation of the device.

**[0033]** Moreover, the proposed solution is structurally simple and can be provided with low production costs.

**[0034]** 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.

**[0035]** 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 requirements and to the state of the art.

**[0036]** The disclosures in Italian Patent Application No. PD2012A000284 from which this application claims priority are incorporated herein by reference.

**[0037]** 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 electric pump (10), of the type comprising a shell (11) for the containment of a set of impellers (12) interleaved with fixed diffusers (13), and of a motor (14) that drives said impellers (12) to rotate, since they are keyed on a same shaft (15) as said motor (14), said pump (10) being **characterized in that** a sealing chamber (16) is provided between said impellers (12) and said motor (14) and is extended around said shaft (15) to collect condensation water and water seepage originating from the set of said impellers (12), said sealing chamber (16) being connected to the outside of said pump (10) by means of at least one water discharge duct (18).

2. The pump according to claim 1, **characterized in**

**that** said shell (11) has at least one discharge hole (19) at said at least one discharge duct (18).

3. The pump according to claim 2, **characterized in that** said shell (11) comprises a substantially cylindrical portion, which surrounds said impellers (12), said sealing chamber (16) and said motor (14), and is constituted by two jackets (20a, 20b) which are mated on the transverse plane at said discharge hole (19) and two opposite heads (21, 22) for closing the end faces of said cylindrical portion, respectively a first head (21) at the intake and a second head (22) at the delivery of the pump.

4. The pump according to claim 3, **characterized in that** said two jackets (20a, 20b) are substantially two cylindrical bodies which are hollow and open at their end faces, have the same shape and dimensions and are coupled symmetrically on the transverse plane so as to constitute the substantially cylindrical portion of said shell (11).

5. The pump according to claim 4, **characterized in that** each one of said jackets (20a, 20b) has, at its two opposite end faces, respectively a first flange (26) and a second flange (27), the latter for mating with the other one of said jackets (20a, 20b).

6. The pump according to claim 5, **characterized in that** said second flange (27) is provided laterally with one half of said discharge hole (19), said jackets (20a, 20b), by mating symmetrically, providing said discharge hole (19).

7. The pump according to claim 5, **characterized in that** said two jackets (20a, 20b) and said first and second heads (21, 22) that compose said shell (11) are joined by means of threaded tension members (30) that pass in succession through:

   - a first annular element (31) of said first head (21) and said first flange (26) of the jacket (20a) that surrounds said impellers (12), with which said first head (21) and said jacket (20a) are associated,
   - said two second flanges (27) of said two jackets (20a, 20b), at right angles to the transverse plane on which they mate,
   - said first flange (26) of the jacket (20b) that surrounds said motor (14), and a second annular element (32) of said second head (22), with which said jacket (20b) and said second head (22) are associated.

8. The pump according to claim 3, **characterized in that** said first head (21) has at least one duct (23) for aspirating the flow that enters said impellers (12) and said second head (22) has at least one duct (24) for delivery of the flow.

9. The pump according to claim 3, **characterized in that** each one of said two jackets (20a, 20b) has stiffening ribs (33).

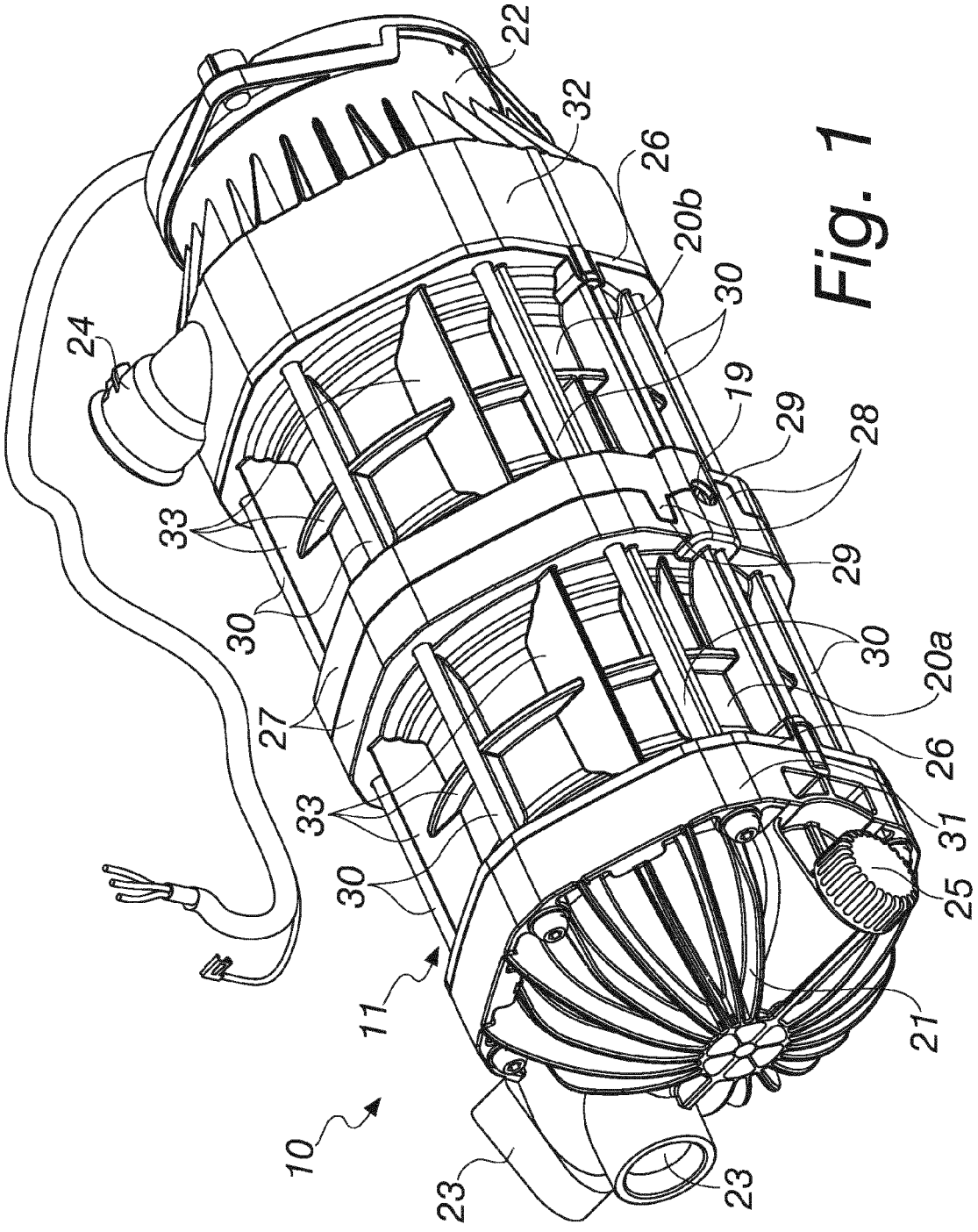
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Fig. 1

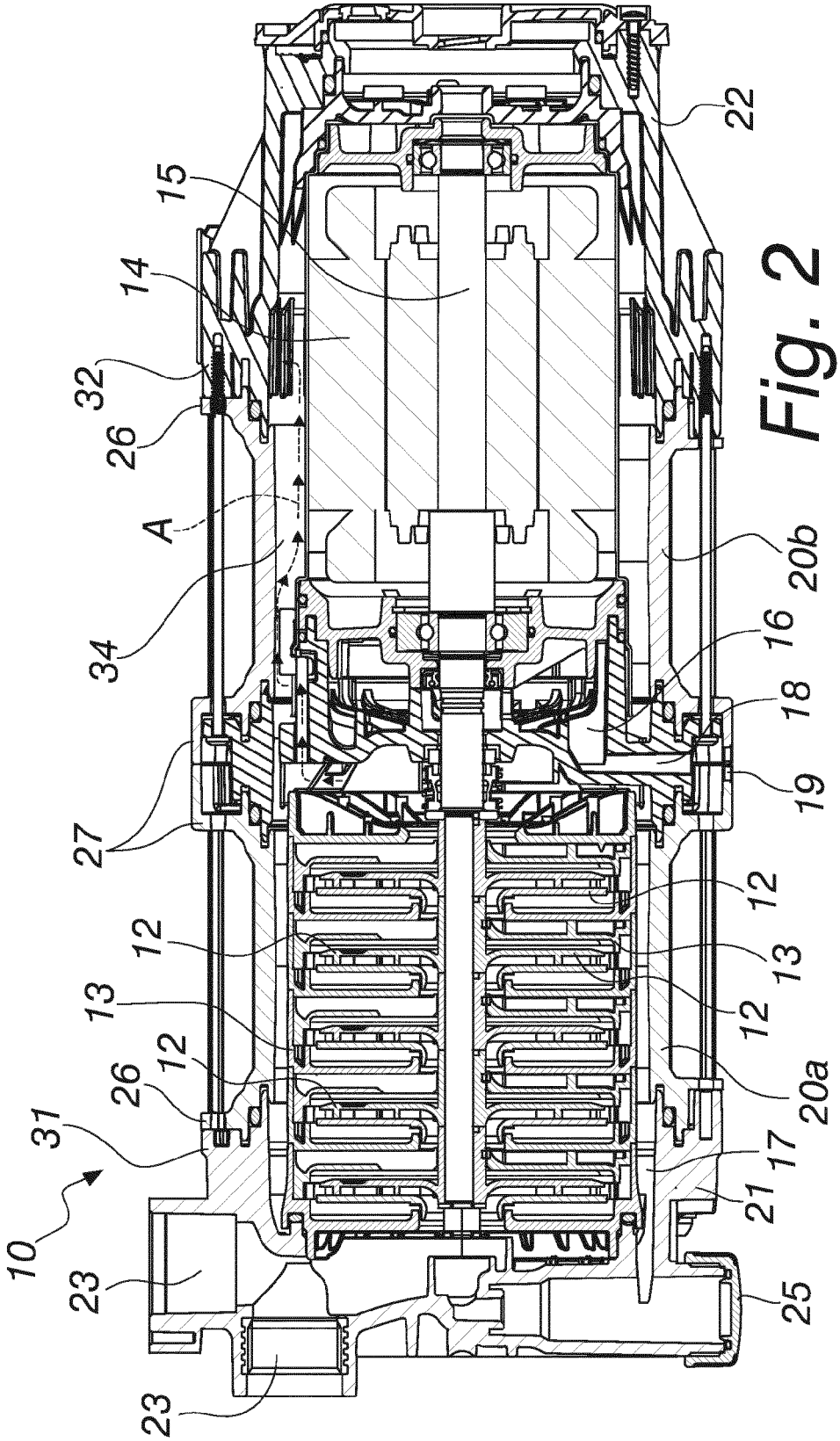
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Fig. 2

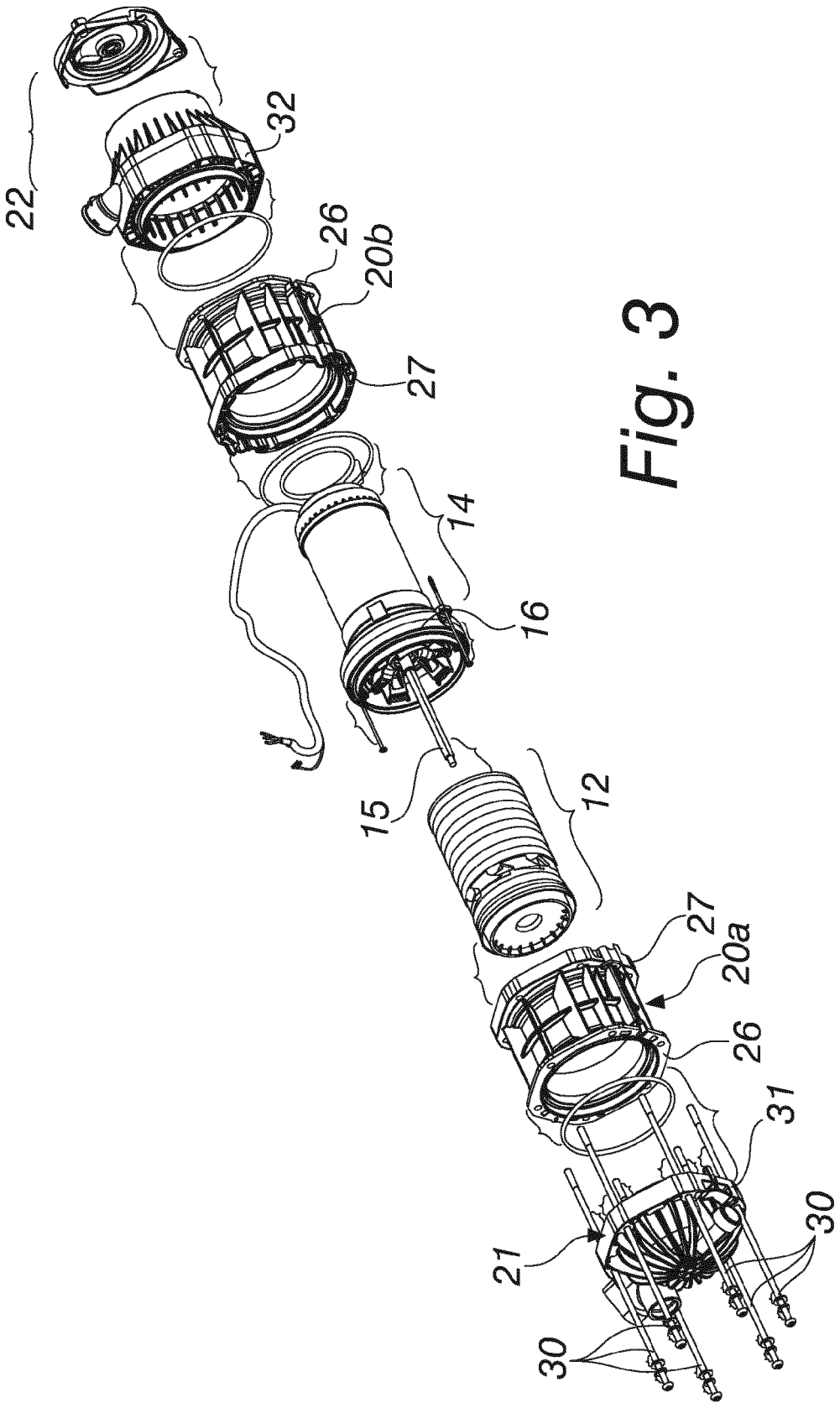


Fig. 3

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# EUROPEAN SEARCH REPORT

Application Number
EP 13 18 6586

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| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 October 2013 | de Martino, Marcello |

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 18 6586

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