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(54) Integrated regenerative motor pump

Integrierte Motorpumpe mit Seitenkanallaufgrad

Pompe latérale intégrée

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Description

[0001] The present invention refers to a motor-pump of the regenerative type, comprising a chamber in which there is provided a concentric impeller rotating about an axis and provided with substantially radial vanes that are adapted to impart a kinetic impulse to the working fluid of the pump, which translates into delivery head at the outlet of the pump.

[0002] Particularly in the field of dishwashing machines, but also in various other fields of application, one of the most important aspects to be duly considered and taken into account since the early development and design stages is the reduction in the size and the overall space requirements of mechanical parts. In fact, any such reduction in the size and space requirements of the component parts used in a machine practically translates, for a same outer size, into a greater inner volume available to useful purposes.

[0003] Equally well-known in the art is the fact that, again in the field of dishwashing machines, the kind of pump that is most frequently used for circulating the washing liquor is the centrifugal one, in which the inlet is axial and the outlet is radial. Such a mutually perpendicular arrangement of the inlet and the outlet of the pump does not however allow for any reduction down to a certain limit in the overall axial size of a centrifugal pump.

[0004] From the US patent publication no. 3,847,666 the teaching can be derived of the use, as a water circulation pump in a dishwashing machine, of a regenerative-type of pump having an inlet and an outlet that are substantially coplanar.

[0005] Even in this case, however, the driving motor is mounted outside the pump itself, so that the overall axial size of the whole pump and motor assembly turns out to be undesirably large.

[0006] WO 99/28631 discloses a feed pump with a pump chamber formed in a housing a rotor arranged inside said chamber and an electric motor driving said rotor. The electric rotor and the hydraulic impeller are the same piece, and this piece is arranged inside the electric stator. This solution presents the drawback that the electric motor generates a reduced output power on the same axial height, because the magnetic gap between rotor and stator is reduced.

[0007] It therefore is a purpose of the present invention to provide a motor-pump that has a high level of hydraulic, i.e. water-handling performance capabilities and, at the same time, an advantageously reduced overall size, i.e. a low space requirement, in particular in the axial direction thereof.

[0008] A further purpose of the present invention is to provide a motor-pump of the above cited kind, which has a high delivery head and, as a result, is particularly suitable for use to water circulation purposes in a dishwashing machine or the like.

[0009] According to the present invention, these aims are reached through the use of a pump of a regenerative

type driven by an electric motor that is substantially housed coaxially within the casing of the same pump, thereby achieving a significant reduction in the overall axial size of the whole motor-pump assembly.

[0010] Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is an exploded axonometric view of a preferred embodiment of the present invention;
- Figure 2 is an exploded longitudinal-section view of the motor-pump according to the present invention;
- Figure 3 is an enlarged cross-sectional view of the motor-pump illustrated in Figures 1 and 2, with its component parts in the assembled state thereof.

[0011] With reference to the Figures, the motor-pump can be noticed to mainly comprise an electric motor adapted to drive the coaxial impeller 5 of a water circulation pump 28 of the regenerative type, ie. a pump that is largely known to feature a quite high head-to-flow rate ratio and is particularly suitable for use in such applications as the ones involving the delivery of washing liquor to the rotating spray arms in a dishwashing machine.

[0012] The water circulation pump 28 comprises a substantially cylindrical casing 2 that is coupled to a properly shaped shroud 13 with which it defines an annular chamber 30 of the pump 28.

[0013] Provided tangentially on said casing 2 there are an inlet 3 and an outlet 4, which, in this preferred embodiment, are coplanar. The inlet 3 and the outlet 4 are preferably separated from each other by appropriately shaped partitions 25 and 26. In the example described herein, the partition piece 25 is provided integrally inside the casing 2, while the partition piece 26 is provided integrally, ie. in a single-piece construction, with the shroud 13.

[0014] The impeller 5 is of a substantially cylindrical shape, hollow inside, and sealed on top by a coaxial, disc-shaped wall 31, in the middle of which there is provided, in correspondence of a bush 9, a coaxial bore 8.

[0015] Such a construction defines a niche 10 of a substantially cylindrical shape within the axial thickness of the impeller 5.

In correspondence of the outer circumference of the impeller 5, on a least a side thereof, there are arranged an array of substantially radial and preferably tapered vanes 6.

[0016] In the impeller 5 there is formed a peripheral niche in which a rotor 7 of the electric driving motor is housed. The rotor 7 is properly sealed, for instance with a coating of epoxy resin. In the particular case of application in a dishwashing machine, the latter is known to make use of aggressive washing media, since formed

generally by a mixture of water and detergents.

[0017] The properly shaped shroud 13 is arranged inside said niche 10. In particular, the shroud 13 has a shape that is defined by an outer circular crown 1, the outer perimeter of which is circumscribed by a peripheral profile 36, while the inner perimeter thereof joins up with a substantially cylindrical central portion 32 that is closed on a side thereof by a disc 33, which in turn comprises a substantially cylindrical, axial recess 14 closed on the opposite side with respect to the disc 33. As a result, said properly shaped sealing shroud 13 features a toroidal niche 38 and is attached to the casing 2 by the coupling of the peripheral profile 36 thereof to the grooved mouth 35 of the casing 2 by means of appropriate joining means (not shown, for reasons of greater simplicity) that are capable of ensuring an appropriate water-tightness, ie. an appropriate water sealing action, as well as an appropriate extent of resistance to a chemically aggressive environment. By way of example, such joining means can include ultrasound welding, bonding, interposition of O-rings, and the like.

[0018] The recess 14 accommodates internally a bush 15, preferably made of self-lubricating material and is adapted to rotate freely about a journal 17 extending through the bore 8 of the bush 9. A ring 16, preferably made of a self-lubricating material, is arranged between the bush 15 and the bush 9 in view of minimizing friction between the bush 15 and the impeller 5. On the outside of the disc-shaped wall 31, a ring 18, which is preferably made of a self-lubricating material, is passed through by the journal 17, whose head end portion 37 abuts against a properly shaped cap 19 that is housed inside a cylindrical cavity 20 provided coaxially in the inner surface of the casing 2.

[0019] The toroidal niche 38 of the sealing shroud 13 accommodates in its interior a stator 11 of the electric driving motor, in which said internally accommodated stator 11 is provided with a central bore 12, which the axial recess 14 extends into. In a preferred manner, the internal stator 11 is aligned axially with the external rotor 7, in such a manner as to effectively close the magnetic circuit of the electric motor.

[0020] The properly shaped shroud 13 creates a partition that separates the impeller 5 and the rotor 7 from the internal stator 11 of the electric driving motor, thereby preventing liquor from seeping or flowing into contact with the electric circuit of the stator 11. Furthermore, in order to ensure continuity of the magnetic circuit of the electric motor, the shroud 13 is preferably formed by deep drawing starting from a thin sheet-metal blank of austenitic stainless steel capable of ensuring both a good nonmagnetic behaviour and a high corrosion strength.

[0021] The mouth, or opening, of the casing 2 is preferably closed by a cover 21, in which there is provided an appropriate sunken or receding profile 22 with a preferably rectangular cross-section, associated to an aperture 23 through which the wire leads (not shown) of the power-supply circuit of the electric driving motor are

caused to pass.

[0022] The actual mode of operation of the motor-pump is at this point fully obvious to all those skilled in the art, so that it shall not be described here any further for reasons of greater simplicity.

[0023] On the other hand, it can be fully appreciated that the above described motor-pump has a structure featuring a particularly reduced overall axial size, since the electric motor 7, 11 is arranged, ie. contained within the axial thickness of the pump 28, in particular of the casing 2 thereof. Such an arrangement of the electric motor 7, 11 is allowed for by the particular construction of the entire impeller 5. Furthermore, the overall axial size of the motor-pump is minimized by the substantially coplanar, or at least non-orthogonal, arrangement of the inlet 3 and the outlet 4 of the pump 28, which is in turn made possible by the fact that the pump itself is of a regenerative type. With this arrangement of the inlet 3 and the outlet 4 thereof, the motor-pump according to the present invention can be operated in a selectively bi-directional manner, for instance to circulate and discharge the washing liquor, respectively.

[0024] It should also be noticed that the pump of the regenerative type has advantageously an elevated head-to-flow rate ratio and, as a result, is particularly suitable for applications involving water re-circulation in dish-washing or similar machines, in which it is particularly important for the overall size of the operational parts to be kept as small as possible. Furthermore, in such an application the motor-pump will be capable of advantageously rotate at a relatively low revolution speed and, as a result, with a far lower extent of vibrations.

[0025] It will be of course appreciated that the above described motor-pump may be subject to a number of modifications without departing from the scope of the present invention, as defined in the claims.

[0026] For instance, in the case that the stator 11 turns out to have an axial size that is larger than the one of the casing 2, the stator itself will be accommodated inside the casing 2 in such a manner as to partially protrude outwards. The cover 21 may be omitted. In any case, an advantageous reduction in the overall axial size of the motor-pump will be the ultimate result.

Claims

1. Motor-pump comprising a hydraulic pump (28) provided with a casing (2) in a substantially cylindrical shape, inside which there is arranged a coaxial impeller (5) adapted to be driven by an electric motor having a stator (11) and a rotor (7), wherein said hydraulic pump (28) is of the regenerative type **characterized in that** said impeller (5) is provided with a peripheral recess in which the rotor (7) of said electric motor (7, 11) is accommodated, and said impeller (5) is so shaped as to form a substantially cylindrical coaxial niche (10) that is closed on a side

thereof by a disc-shaped wall (31), in correspondence of which there is arranged the stator (11) of said electric motor.

2. Motor-pump according to claim 1, **characterized in that** said stator (11) is housed in a toroidal niche (38) of a shaped shroud (13) that seals off in a water-tight manner said impeller (5) with said rotor (7) inside said casing (2) of the pump (28).
3. Motor-pump according to claim 1, **characterized in that** the stator (11) and the rotor (7) of said electric motor are substantially aligned with each other in the axial direction.
4. Motor-pump according to claim 1, **characterized in that** the impeller (5) of the pump (28) is freely hinged in a cantilever manner, in correspondence of said disc-shaped wall (31), on a journal extending coaxially inside said casing (2).
5. Motor-pump according to claim 1, **characterized in that** the pump (28) of the regenerative type comprises an inlet (3) and an outlet (4) that are substantially tangential with respect to said casing (2), as well as coplanar with respect to each other.

Patentansprüche

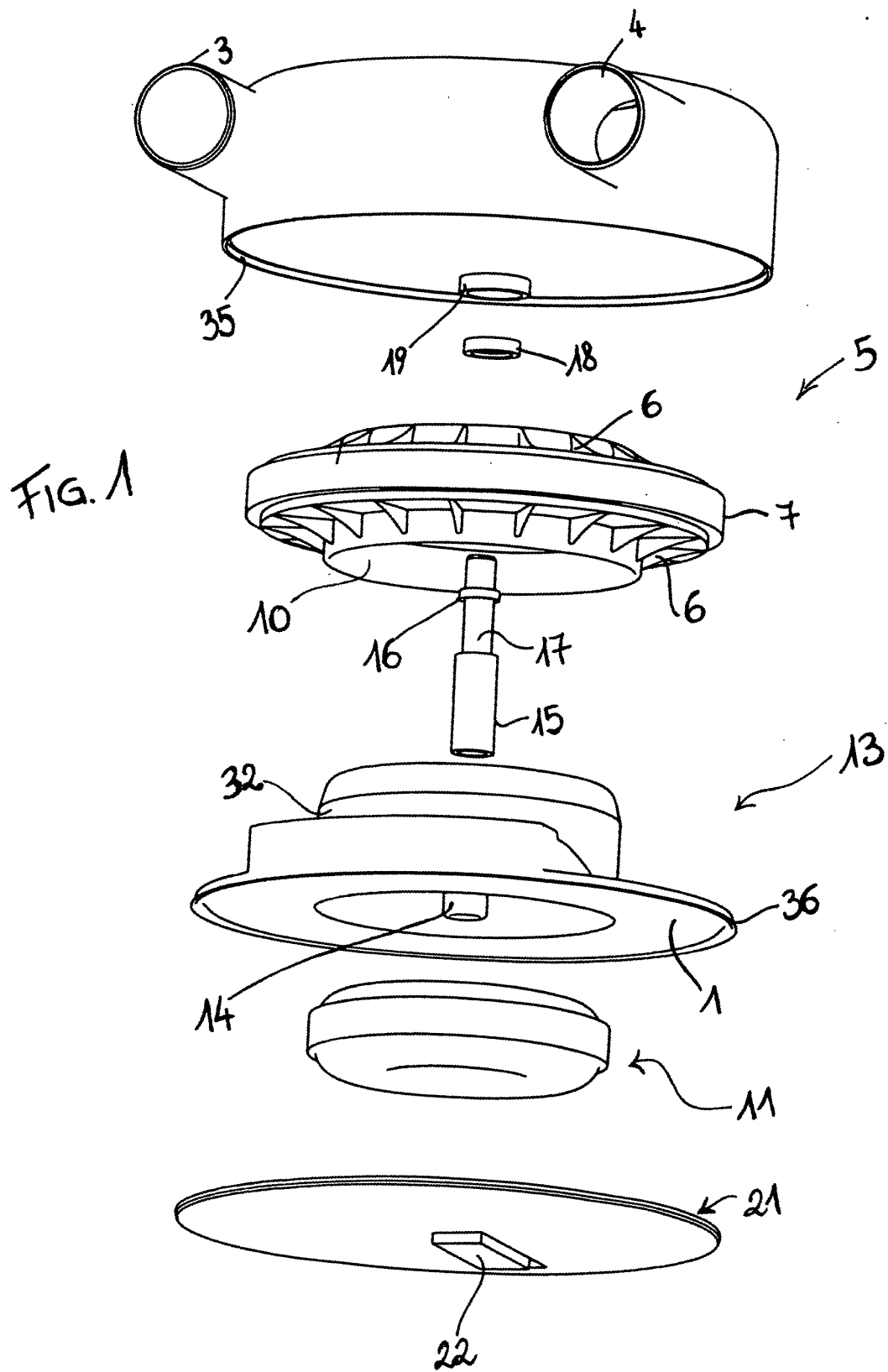
1. Motorpumpe, die eine Hydraulikpumpe (28) umfasst, die mit einem Gehäuse (2) in einer im Wesentlichen zylindrischen Form versehen ist, in dessen Inneren ein koaxiales Pumpenrad (5) angeordnet ist, das so engerichtet ist, dass es von einem Elektromotor mit einem Stator (11) und einem Rotor (7) angetrieben wird, wobei die Hydraulikpumpe (28) vom regenerativen Typ ist, **dadurch gekennzeichnet, dass** das Pumpenrad (5) mit einer Umfangsvertiefung versehen ist, in der der Rotor (7) des Elektromotors (7.11) aufgenommen ist, und das Pumpenrad (5) so geformt ist, das es eine im Wesentlichen zylindrische koaxiale Nische (10) aufweist, die an einer Seite durch eine scheibenförmige Wand (31) verschlossen ist, an der der Stator (11) des Elektromotors angeordnet ist.
2. Motorpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** der Stator (11) in einer Ringnische (38) einer geformten Abdeckscheibe (13) aufgenommen ist, die das Pumpenrad (5) wasserundurchlässig abdichtet, wobei sich der Rotor (7) im Inneren des Gehäuses (2) der Pumpe (28) befindet.
3. Motorpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** der Stator (11) und der Rotor (7) des Elektromotors im Wesentlichen in der axialen Richtung miteinander fluchtend sind.

4. Motorpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** das Pumpenrad (5) der Pumpe (28) an der scheibenförmigen Wand (31) auslegerartig an einem Lager frei angelenkt ist, das sich koaxial im Inneren des Gehäuses (2) erstreckt.

5. Motorpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** die Pumpe (28) des regenerativen Typs einen Einlass (3) und einen Auslass (4) umfasst, die im Wesentlichen tangential in Bezug auf das Gehäuse (2) und coplanar zueinander sind.

Revendications

1. Motopompe comprenant une pompe hydraulique (28) équipée d'un boîtier (2) d'une forme substantiellement cylindrique, a l'intérieur duquel est disposée une roue à aubes (5) coaxiale adaptée pour être entraînée par un moteur électrique ayant un stator (11) et un rotor (7), dans lequel ladite pompe hydraulique (28) est du type pompe régénératrice **caractérisée en ce que** ladite roue à aubes (5) est équipée d'un renforcement périphérique dans lequel est logé le rotor (7) dudit moteur électrique (7.11), et ladite roue à aubes (5) est façonnée de telle sorte à former une niche (10) coaxiale substantiellement cylindrique qui est fermée sur un côté de celle-ci par une paroi en forme de disque (31), en correspondance avec laquelle est disposé le stator (11) dudit moteur électrique.
2. Motopompe selon la revendication 1, **caractérisée en ce que** ledit stator (11) est logé dans une niche toroïdale (38) d'une enveloppe formée (13) qui scelle d'une manière étanche à l'eau ladite roue à aubes (5) avec ledit rotor (7) à l'intérieur dudit boîtier (2) de la pompe (28).
3. Motopompe selon la revendication 1, **caractérisée en ce que** le stator (11) et le rotor (7) dudit moteur électrique sont substantiellement alignés l'un avec l'autre selon la direction axiale.
4. Motopompe selon la revendication 1, **caractérisée en ce que** la roue à aubes (5) de la pompe (28) est librement articulée d'une manière suspendue, en correspondance avec ladite paroi en forme de disque (31), sur un tourillon s'étendant de manière coaxiale à l'intérieur dudit boîtier (2).
5. Motopompe selon la revendication 1, **caractérisée en ce que** la pompe (28) de type pompe régénératrice comprend une entrée (3) et une sortie (4) qui sont substantiellement tangentielles par rapport audit boîtier (2), ainsi que coplanaire l'une avec l'autre.



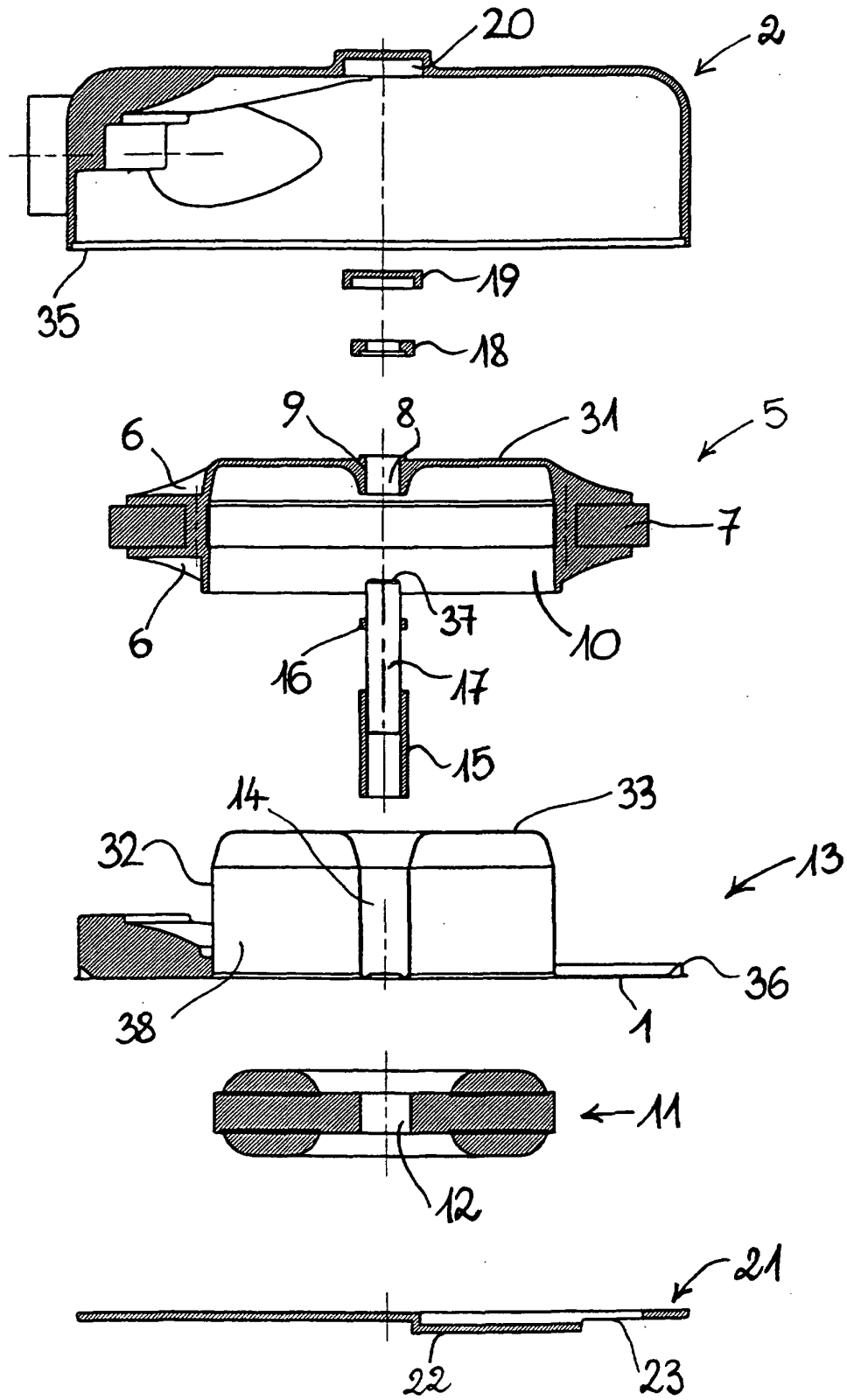


FIG. 2

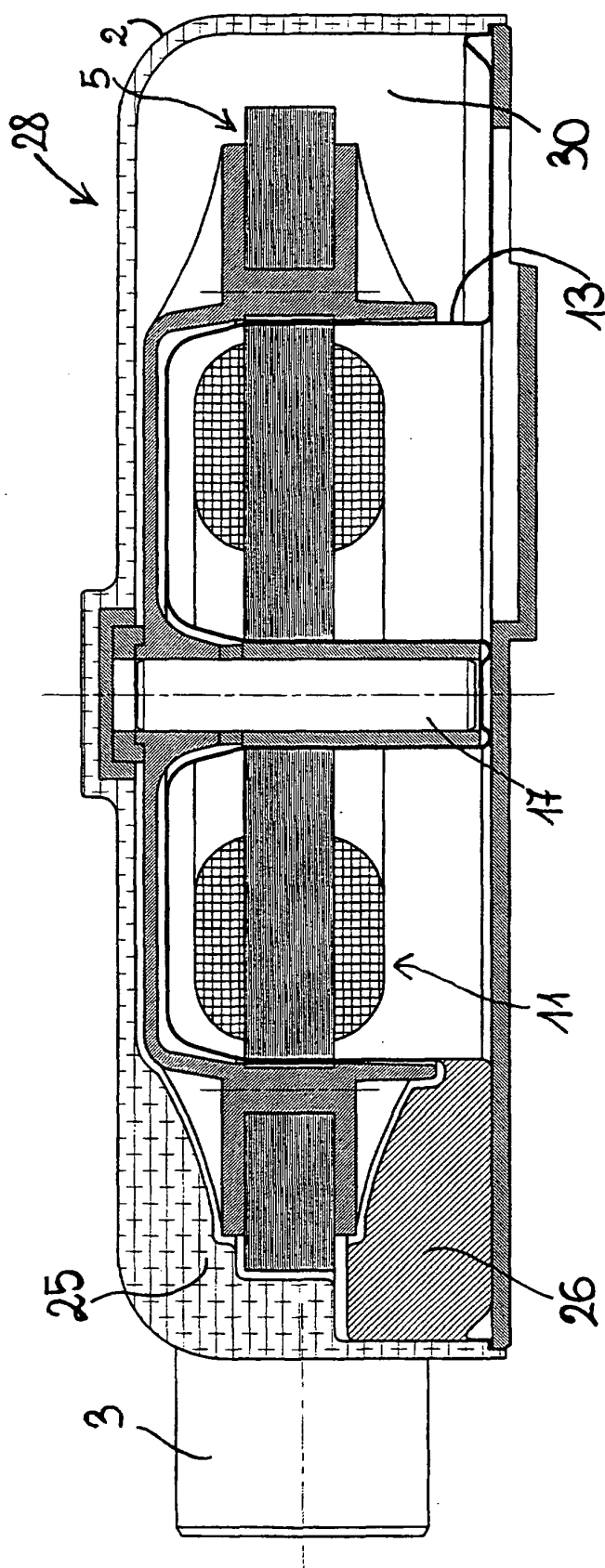


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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