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(71) Applicant: **Baruffaldi S.p.A.**
20067 Tribiano (MI) (IT)

(72) Inventors:
- **Boffelli, Piercarlo**
20067 Tribiano (IT)
- **Depoli, Erminio**
20067 Tribiano (IT)
- **Natale, Fabio**
20067 Tribiano (IT)

(74) Representative: **Raimondi, Margherita**
Dott. Ing. Prof. Alfredo Raimondi S.r.l.,
Piazzale Cadorna, 15
20123 Milano (IT)

(54) Fluid recirculating pump with device for transmission of the rotational movement to the associated driven shaft

(57) Cooling fluid recirculating pump, comprising a fixed pump body (11) carrying a driven shaft (2) for actuating the impeller (1) of the pump and at least one friction coupling (30;130) arranged between the movement generating means (21) and the driven shaft (2) and comprising at least on fixed electromagnet (32) and at least one armature (33;133) which is mounted axially movable on a sleeve (35) integral with the shaft (2), axially thrusting resilient means (34;134) acting on the armature (33), said electromagnet (32) being axially arranged on the opposite side to the armature (33;133) in an axially outer position with respect to the movement generating means (21,21a).

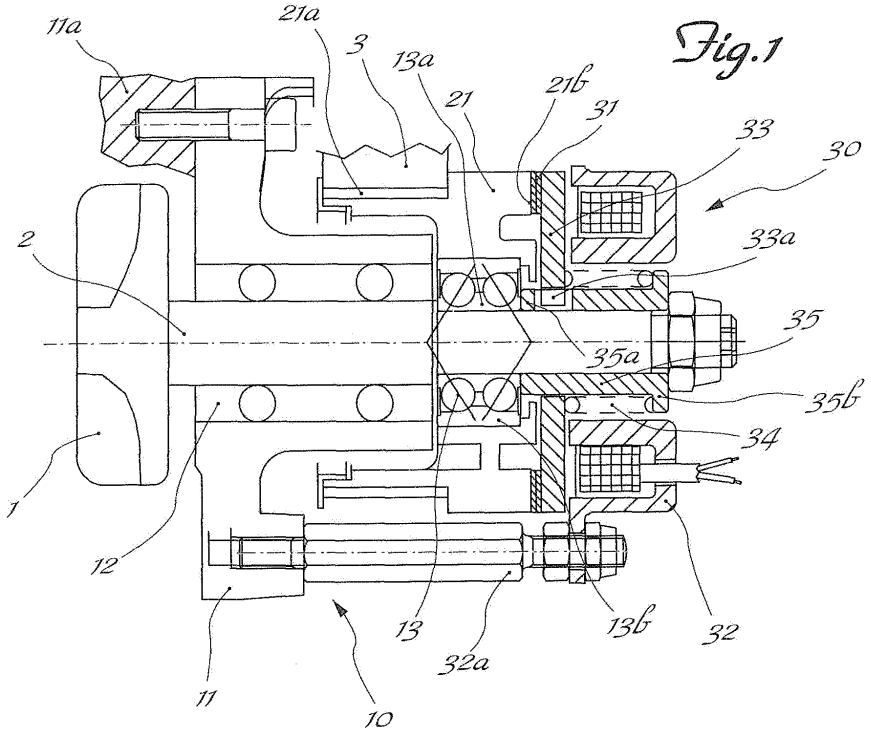


Fig.1

EP 2 110 530 A1

Description

[0001] The present invention relates to a pump for recirculating a fluid for cooling vehicle engines, equipped with a device for actuating the associated driven shaft.

[0002] It is known, for example in the sector relating to the production of engines, in particular internal-combustion engines, that there exists the need to cool said engines by means of recirculation of a cooling fluid which is moved by means of a corresponding recirculating pump, the impeller of which is rotated by a shaft actuated by a pulley and a belt connected to the driving shaft.

[0003] It is also known that recirculation of the cooling fluid must be performed with a flow rate corresponding to the actual cooling requirement determined by the real operating conditions and the external temperature, in order to avoid the constant and unnecessary operation, at full speed, of devices which consume useful power, increasing the wear of the various component parts and the consumption of the vehicle.

[0004] The technical problem which is posed, therefore, is to provide pumps for recirculating fluids, such as fluids for cooling vehicle engines, equipped with a device for operation of the associated driven shaft, able to cause rotation thereof when operated.

[0005] In addition, it must be possible to ensure rotation of the driven shaft also in the event of a fault in the electric power supply system (fail safe mode), this being a particularly important requirement in the case of recirculation of the engine cooling fluid.

[0006] In connection with this problem it is also required that this device should have small dimensions, in particular in the radial direction, but at the same time should be able to provide high torques and/or a high number of revolutions also at a slow running speed of the engine, so as to be applicable also to high-capacity pumps of heavy vehicles which have an engine with a low rpm.

[0007] It is also required that the device should be easy and inexpensive to produce and assemble and be able to be installed easily on the pump body without the need for special adaptation.

[0008] These results are achieved according to the present invention by a device for transmission of a rotational movement from movement generating means to a driven shaft, according to the characteristic features of Claim 1, and by a fluid recirculating pump according to the characteristic features of Claim 9.

[0009] Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention provided with reference to the accompanying drawings in which:

Figure 1 shows a cross-section along an axial vertical plane of a first embodiment of the recirculating pump according to the present invention under normal working conditions;

Figure 2 shows a cross-section similar to that of Fig. 1 with the device activated;

Figure 3 shows a cross-section along an axial vertical plane of a second embodiment of the recirculating pump according to the present invention under normal working conditions;

Figure 4 shows a cross-section similar to that of Fig. 3 with the pump in the idle condition;

As shown in Fig. 1, the impeller 1 of a pump for recirculating the cooling fluid in vehicles and the like is mounted on a first end of a driven shaft 2 supported by a fixed unit 10 comprising the body 11 of the pump fixed to the base 11a of the vehicle engine.

[0010] The pump body 11 has, arranged internally, a first bearing 12 which supports the shaft 2 of the impeller 1. The pump body 11 is provided externally with a second bearing 13 which is keyed onto the shaft 2 by means of the associated inner ring 13a and an outer ring 13b carrying a flange 21 which has a radial pulley 21a suitable for engagement with a movement transmission belt 3 and a front surface 21b for contact with a friction part 31 integral with the armature 33 of an electromagnet coupling 30 which is situated axially on the outside of the pulley 21a and which comprises a fixed electromagnet 32 coaxially mounted on a support 32a fastened to the pump body 11, being arranged on the opposite side to the armature with respect to the flange 21.

[0011] Said armature 33 has eyelets 33a which are arranged along a suitable diameter of the armature itself and which receive, engaged inside them, axial end teeth 35a of a sleeve 35 keyed onto the driven shaft 2 on the opposite side to the pump body relative to the bearing 13; at the end opposite to that of the teeth 35a the sleeve 35 has an annular edge 35b able to form the reaction surface for springs 34 which are axially arranged between the annular edge 35b itself and the armature 33 which is thus pushed axially against the flange 21.

[0012] With this coupling arrangement the armature 33 is able to perform movements in an axial direction towards/away from the flange 21, but is locked as regards relative rotation with respect to the sleeve 35.

[0013] With this configuration the operating principle of the pump actuating device is as follows:

- when the electromagnet 32 is de-energized, the armature 33 is pushed by the spring 34 towards the flange 21 with which it engages via the friction disk 31 which presses axially against the front surface 21b, transmitting the rotational movement of the pulley 21a to the driven shaft 2 which therefore rotates together with the impeller 1 at the same speed as the pulley 21a;
- when the electromagnet 22 is energized, a magnetic field is generated and, overcoming the thrusting force of the spring 34, recalls the armature 33, separating the friction disk 31 from the flange 21, thus causing stoppage of the impeller 1.

[0014] In this condition the electromagnetic coupling 30 acts as a brake for the driven shaft 2 which is kept in the stable stopped condition.

[0015] As shown in Figs. 3 and 4, where the numbering of the parts already described is maintained, a second embodiment of the pump according to the invention is envisaged, wherein the coupling 130 arranged between the electromagnet 32 and the armature 33 has a rotor 136 which is axially fixed and rotationally locked with the driven shaft 2.

[0016] Said armature 33 has seats 133 on its surface situated frontally opposite the rotor 136 and able to receive one end of respective compression springs 134 which are axially arranged between the said armature 33 and the rotor 136 and designed to exert an axial thrust on the armature 33, reacting against the axially fixed rotor 136.

[0017] With this configuration the operating principle of the pump actuating device is as follows:

- when the electromagnet 32 is de-energized, the armature 33 is pushed by the springs 134 towards the flange 21 with which it engages via the friction disk 31 which presses axially against the front surface 21b, transmitting the rotational movement of the pulley 21a to the driven shaft 2 which therefore rotates together with the impeller 1 at the same speed as the pulley 21a;
- when the electromagnet 32 is energized, a magnetic field is generated and, overcoming the thrusting force of the spring 134, recalls the armature 33 towards the rotor 136, separating the friction disk 31 from the flange 31.

[0018] In this condition the driven shaft 2 is free in the idle condition with respect to the pulley 21a.

[0019] It can therefore be seen how, with the device according to the present invention, it is possible to maintain large dimensions for the magnet 32, in particular with an outer diameter of the electromagnet 32 not less than the outer diameter of the pulley 21a, therefore being able to overcome high thrusting forces of the springs 34 which may, in turn, be designed with dimensions such as to obtain high pulley/armature transmission torques, also in the case of diameters of the pulley which are necessarily small owing to the need to limit the overall dimensions in the radial direction of the pump unit and coupling.

[0020] In addition, the device allows operation in failsafe mode, keeping the driven shaft rotating by means of the thrust of the springs also in the event of a fault in the electrical system, while being composed of a minimum number of components, thereby ensuring easy assembly and a low cost of the device as a whole.

Claims

1. Cooling fluid recirculating pump, comprising a fixed pump body (11) carrying a driven shaft (2) for actuating the impeller (1) of the pump and at least one friction coupling (30;130) arranged between the movement generating means (21) and the driven shaft (2) and comprising at least on fixed electromagnet (32) and at least one armature (33;133) which is mounted axially movable on a sleeve (35) integral with the shaft (2), axially thrusting resilient means (34;134) acting on the armature (33), **characterized in that** said electromagnet (32) is axially arranged on the opposite side to the armature (33; 133) in an axial outer position with respect to the movement generating means (21,21a).

2. Pump according to Claim 1, **characterized in that** said movement generating means consist of a circular flange (21) which has, formed on its outer circumferential edge, a pulley (21a) suitable for engagement with a corresponding drive belt (3).

3. Pump according to Claim 1, **characterized in that** said pulley (21a) is concentric with the pump body (11).

4. Pump according to Claim 1, **characterized in that** the outer diameter of the electromagnet (32) is not less than the outer diameter of the pulley (21a).

5. Pump according to Claim 1, **characterized in that** said movement generating means have a front surface (21b) suitable for engagement with friction means (31) integral with the armature (33).

6. Device according to Claim 1, **characterized in that** said movement generating means are mounted on a bearing (13) keyed onto the driven shaft (2).

7. Device according to Claim 1, **characterized in that** the means for engagement of said armature (33) with the sleeve (35) comprise at least one annular seat (33a) arranged along a suitable diameter of the armature itself.

8. Device according to Claim 7, **characterized in that** said parts of the sleeve (35) able to engage with the armature (33) consist of at least one tooth (35a) extending in the axial direction.

9. Device according to Claim 1, **characterized in that** said sleeve (35) has as many axial teeth (35a) as there are annular seats (33a) in the armature (33).

10. Pump according to Claim 1, **characterized in that** said axially thrusting resilient means (34) are arranged between the armature (33) and said sleeve (35).

11. Pump according to Claim 10, **characterized in that**

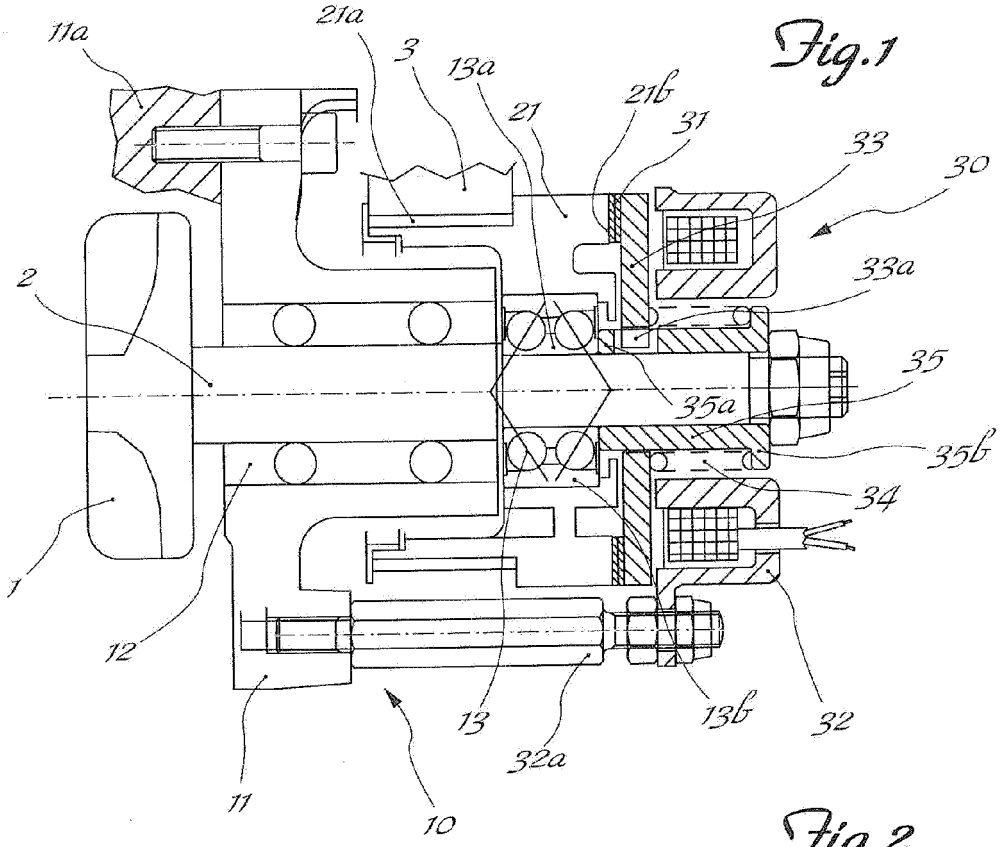
the armature (33) is rotationally locked when the electromagnet (32) is energized.

12. Pump according to Claim 1, **characterized in that** a rotor (136) axially fixed and rotationally locked with the driven shaft (2) is arranged between the electromagnet (32) and the armature (133).

13. Pump according to Claim 12, **characterized in that** said resilient means (134) are axially arranged between the armature (133) itself and the axially fixed rotor (136) against which they react.

14. Pump according to Claim 12, **characterized in that** said resilient means are compression springs (134) able to exert an axial thrust on the armature (133), reacting against the rotor (136).

Fig.1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32a
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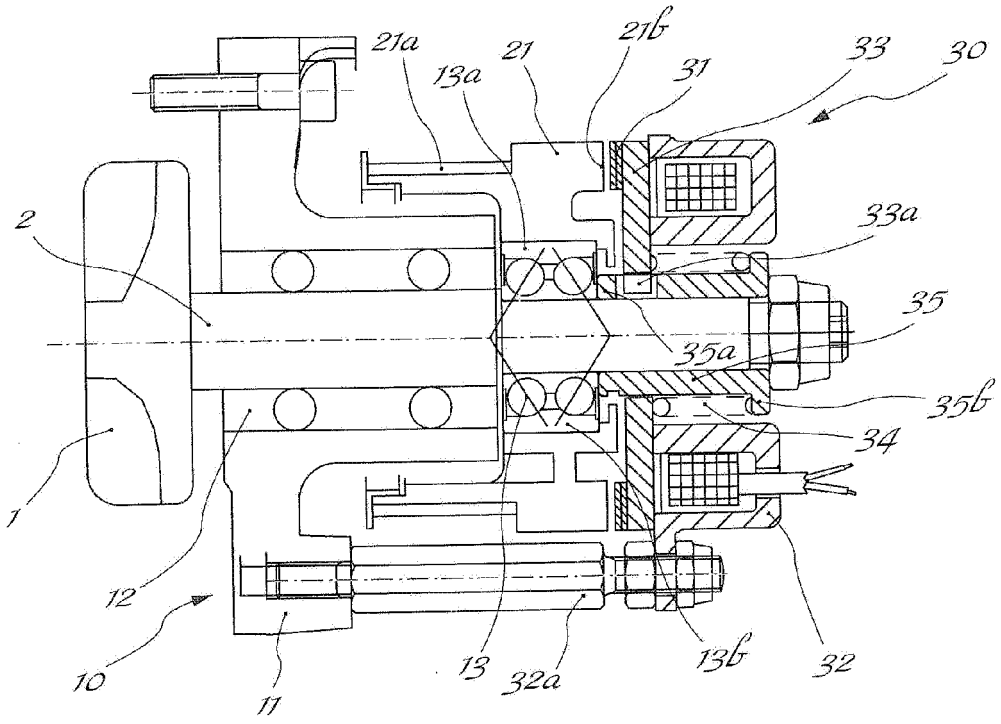
Fig.2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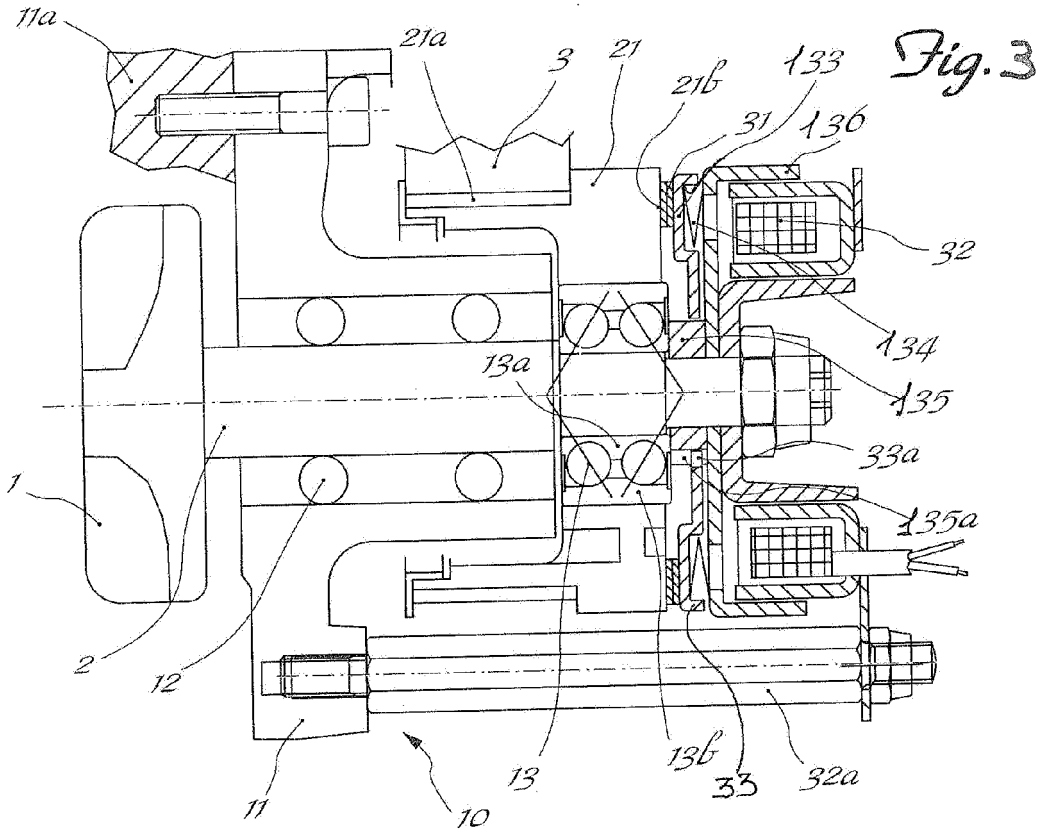
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32a
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Fig. 3

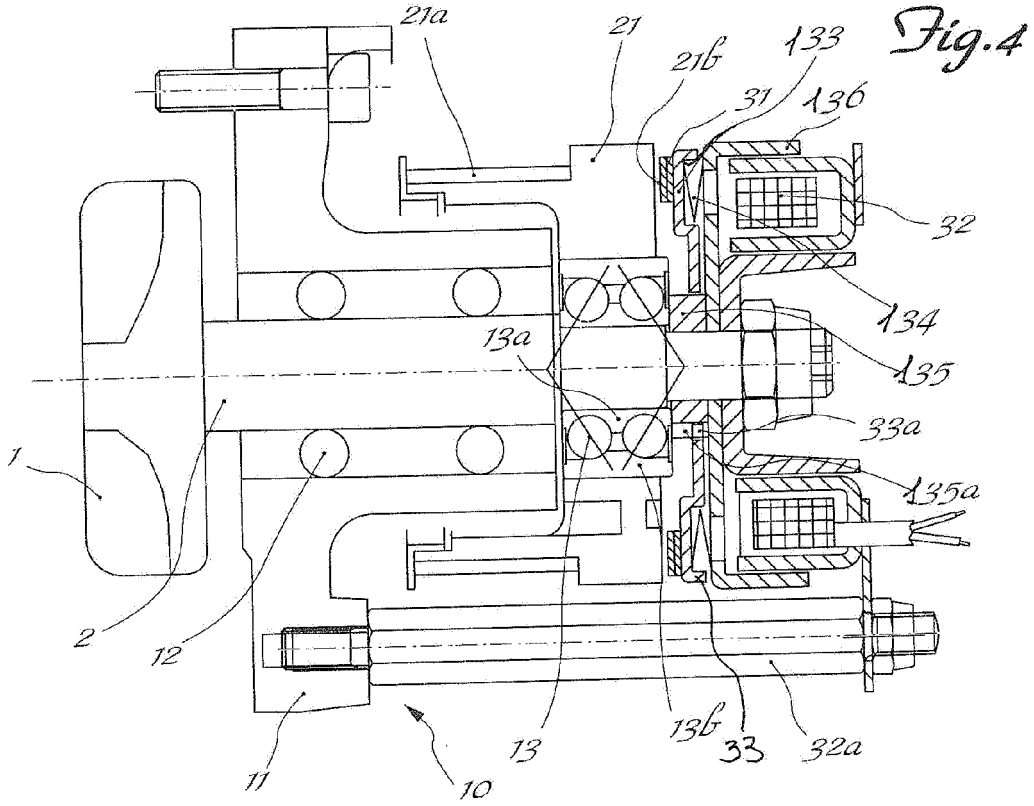
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Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 7580

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Y	* paragraphs [0010] - [0017], [0020] * * claims 1,2,4-6 * * figure 1 *	4,8,9	
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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	16 July 2009	Mallo López, Manuel

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 7580

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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	16 July 2009	Mallo López, Manuel

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