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(54) An electric pump for cooling circuits

(57) An electric pump (10) for cooling circuits of internal combustion engines comprising a rotor (12) with shaft (16), a stator (14), an impeller (18) connected to an end of said rotor and provided with two or more pass-through holes (46), a control and command electronic board (20) and a containment casing or shell (22) wherein said casing is made of thermo-setting resins or plastic material and it is co-moulded with at least said stator (14).

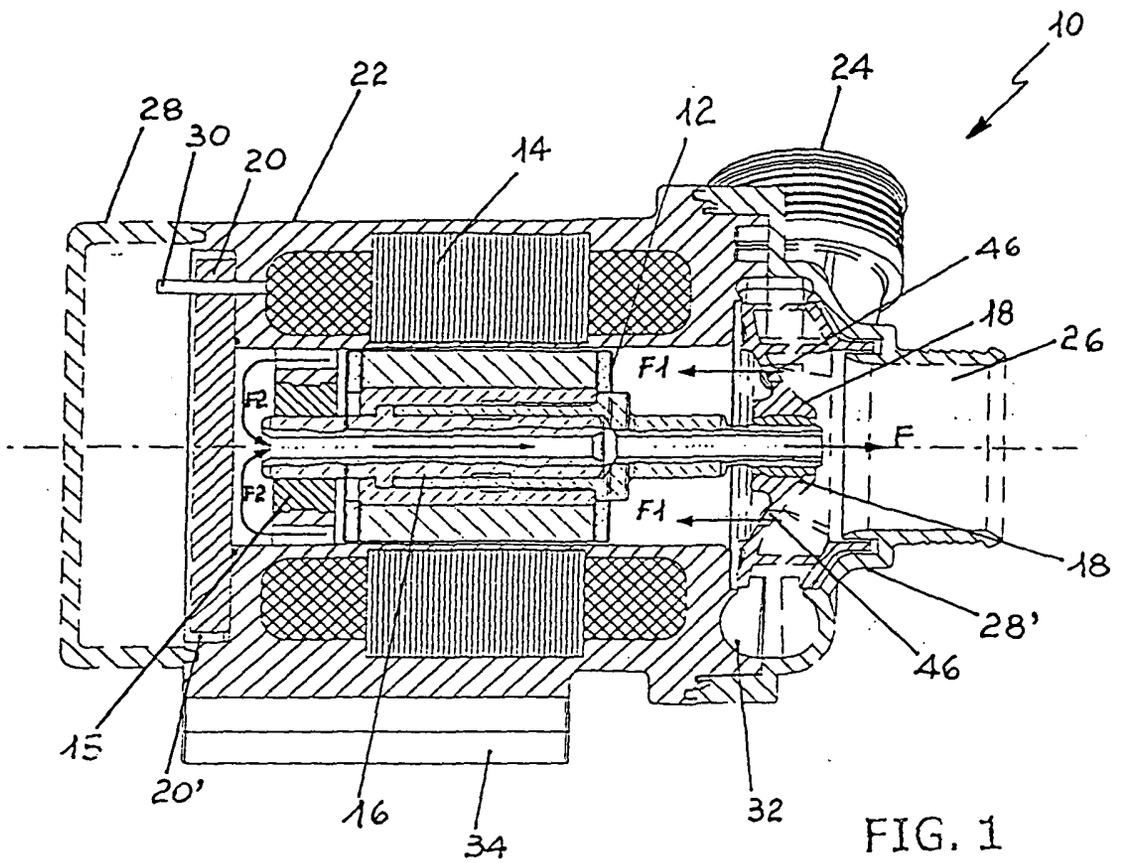

FIG. 1

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Description

[0001] The present invention refers to an electric pump for cooling circuits.

[0002] More particularly, the present invention refers to an electric pump for cooling circuits of internal combustion engines of motor vehicles and the like.

[0003] It is known that the internal combustion engines comprise cooling devices such as pumps, exchanger fans and radiators that dissipate the heat going out through a cooling liquid removing it from the engine passing through a given circuit.

[0004] The device setting out the fluid circulation comprises a pump, which is usually operated by the driving shaft.

[0005] Even though this known solution is appropriate from the functional point of view, it shows some relevant drawbacks concerning the complexity in manufacturing and the assembly of the various components of the pump.

[0006] The electric pumps which are presently known require the arrangement of various single components, such as the insulation capsule between the stator and the fluid, the half-volute, the above-mentioned flange for the mounting of the pump to the relevant base and the seat to house the control and command electronic board.

[0007] As can be seen, the equipping and the reciprocal assembly of these components imply important difficulties and subsequent costs affecting the finished product from the economical point of view.

[0008] It is also clear that the assembly of a plurality of components as regards this kind of product also requires many sealing points that are potential critical elements as for malfunctions and failures.

[0009] Moreover, the electric pumps that are presently known are usually provided with a thrust device of the rotor shaft and this implies further manufacturing and mounting difficulties.

[0010] Object of the present invention is to solve the above-mentioned drawbacks.

[0011] More particularly, object of the present invention is the provision of an electric pump especially for cooling circuits of internal combustion engines of motor vehicles and the like comprising a limited number of components to be easily assembled between them.

[0012] A further object of the present invention is the provision of an electric pump as defined above wherein, the critical sealing points that could cause failures are reduced.

[0013] Another object of the present invention is the provision of an electric pump suitable for carrying out the optimum thermal exchange between the fluid and the control and command electronic board.

[0014] A further object of the present invention is the provision of an electric pump which does not require an additional device making the thrust device of the rotor shaft.

[0015] A further object of the present invention is to provide the users with an electric pump, especially for cooling circuits of internal combustion engines assuring a high resistance and reliability level in time and is easily manufactured at low costs.

[0016] According to the present invention, these and other objects will be obtained by an electric pump which is especially suitable for cooling circuits of internal combustion engines comprising a rotor with shaft, a stator, an impeller connected to one end of said rotor or provided with two or more pass-through holes, a control and command electronic board and a containment casing or shell which is mainly characterized in that said casing is made of thermo-setting resins or plastic material wherein at least said stator is co-moulded.

[0017] The building and functional features of the electric pump for cooling circuits of the present invention will be better understood from the following description, wherein reference is made to the figures of the attached drawings representing a preferred and non-limitative embodiment wherein:

Figure 1 is a longitudinal section schematic view of the electric pump for cooling circuits of the present invention;
Figure 2 is a longitudinal section schematic view of the rotor of said electric pump and its shaft;
Figure 3 is a schematic view of an enlarged detail "A" of Figure 2.

[0018] With reference to Figure 1, the electric pump for cooling circuit of the present invention, marked in its whole with 10, essentially comprises a rotor 12 being axially developed into the pump-body and therein supported by known means, a complementary stator 14 and a shaft 16 of the rotor 12 one end of which is connected to an impeller 18. To the opposite end with respect to the impeller 18, the stator 14 is connected to a control and command electronic board 20.

[0019] The above-mentioned components are contained into a containment shell or casing 22 comprising a suction duct 26 and a delivery duct 24 of the fluid.

[0020] According to the present invention, said casing 22 is made of thermo-setting resins or plastic material and it is at least co-moulded with the stator 14. The casing 22 is preferably co-moulded both with said stator 14 and with a shaped insert 15, acting as a support seat for a fixed spindle 36 which will be described hereinafter. Said insert 15 is advantageously made of metal bush-shaped cylindrical body of or other suitable material.

[0021] In correspondence with the electronic board 20, the rear end of said casing or shell 22 is closed by a socket cover 28 fastened to the same casing by adhesives or equivalent means. Said cover 28 is preferably made of the same material as the casing 2 and it delimits and seals the components inside the body-pump and the electronic board 20 which is placed close to the same cover 28 and it is advantageously connect-

ed to the stator through a connection device 30 of the faston kind or the like.

[0022] In particular, said board is placed in a lowered seat 20' formed near the edge of the casing 22 matched with the cover 28.

[0023] In correspondence with the opposite side of the cover 28, the casing or shell 22 is provided with a half-volute 32 being integrally made with same casing during its moulding.

[0024] The moulding of the casing 22 is carried out by a moulding process with a steel mould wherein, before the plastic is injected, the stator 14 and the insert 15 are inserted. The mould is then closed and the moulding step begins; this step consists in pressing a pre-heated plastic pellet which due to the temperature and pressure liquefies filling in all the cavities and wrapping the stator 14 and the insert 15. After the plastic material has solidified the mould can be opened to extract the casing 22 integrating the stator 14 and the insert 15.

[0025] In the opposite position with respect to the cover 28, i.e. on the side of the half-volute 32, the casing 22 is provided with an opposite shaped cover, marked with 28', made of thermo-setting material.

[0026] Said opposite cover 28' usually comprises said suction (26) and delivery (24) ducts of the fluid and it is made integral with the casing 22 by adhesives assuring both the mechanical resistance and the sealing.

[0027] A mounting flange 34 of the pump to the relevant base (not shown) is advantageously obtained in one body together with the same casing during the co-moulding.

[0028] According to a further advantageous feature of the present invention, the shaft 16 of the rotor 12 represented in detail in Figure 2, axially integrates the above-mentioned support fixed spindle 36 acting as thrust device equipped with a pass-through hole 38 extending lengthwise.

[0029] At two third of its development, the support fixed spindle 36 is provided with a projection or annular collar 40 integrally obtained with said support fixed spindle 36. Said projection or annular collar 40 engages with a complementary miter 42 formed along a sleeve 44 near the rotor 12.

[0030] As shown by the arrows F, F1 and F2 in Figure 1, the fluid passes through the hole 38 of the spindle 36 and through two or more holes 46 obtained into the impeller thus generating a blow-by flow regularly attacking the electronic board 20; the latter is therefore flooded and properly cooled during the operation of the pump. The obtained thermal exchange keeps the temperature of said board to an optimum level which is lower to the limit allowed for its proper operation.

[0031] As can be seen from the previous description, the advantages obtained by the present invention are clear.

[0032] The electric pump of the present invention especially suitable for cooling circuits of internal combustion engines is made of a reduced number of components that can be easily assembled according to the presence of the casing 22 obtained by co-moulding and integrating the stator 14 and the shaped insert 15.

[0033] Therefore the critical sealing points are drastically reduced while the cooling of the command and control electronic board 20 is accurately assured by the passage of the fluid through the hole 38 of the spindle 36 and the holes 46 of the impeller.

[0034] The manufacturing of said spindle 36 acting as thrust device thanks to the collar 40 integrated into the rotor block 12 is also advantageous.

[0035] Even though the present invention has been described above with reference to one embodiment which is given only by way of non-limitative example, some changes and variants will be clear to a technician skilled in the art according to the above-mentioned description. It is therefore clear that the present invention is meant to include all changes and variants falling within the spirit and the protection field of the appended claims.

Claims

1. An electric pump (10) for cooling circuits of internal combustion engines comprising a rotor (12) with shaft (16), a stator (14), an impeller (18) connected to an end of said rotor and provided with two or more pass-through holes (46), a control and command electronic board (20) and a containment casing or shell (22), **characterized in that** said casing (22) is made of thermo-setting resins or plastic material and it is co-moulded with at least said stator (14).

2. The electric pump according to claim 1, **characterized in that** the casing (22) is co-moulded with the stator (14) and with a shaped insert (15) making the support for a fixed spindle (36) cooperating with the shaft (16).

3. The electric pump according to claim 1 or 2, **characterized in that** the rear end of the casing (22) in correspondence with the electronic board (20), is closed by a socket cover (28) made of thermo-setting resin or other suitable plastic material and is made integral with the same casing by adhesives or other equivalent means.

4. The electric pump according to any of the previous claims, **characterised in that** the electronic board (20) is placed in a lowered seat (20') formed near the edge of the casing (22) matched by the cover (28), said board (20) being connected to the stator (14) by a connection means of the faston type or the like.

5. The electric pump according to any of the previous claims, **characterized in that** the casing (22) is provided with a half-volute (32) along the side opposite

to said cover (28) which is obtained together with the same casing during the moulding.

6. The electric pump according to any of the previous claims, **characterized in that** it comprises a mounting flange (34) obtained in one body with the casing (22) during its co-moulding.

7. The electric pump according to any of the previous claims, **characterized in that** the shaft (16) of the rotor (12) axially integrates the support fixed spindle (36) provided with a pass-through hole (38) extending lengthwise.

8. The electric pump according to claim 7, **characterized in that** the support fixed spindle (36) is provided with an integral annular collar (40) and the pump comprises a sleeve (44) placed near the rotor (12), provided with a complementary miter (42); said annular collar (40) being engaged into said miter (42).

9. The electric pump according to any of the previous claims, **characterized in that** it comprises an opposite shaped cover (28') made of thermo-setting material and placed in the opposite position with respect to the cover (28) and being provided with a suction duct (26) and a delivery duct (28) of the fluid fastened to the casing (22) by adhesives or other equivalent means.

10. The electric pump according to claims 3 or 9, **characterized in that** the socket cover (28) and/or the opposite cover (28') are made of the same material as the casing (22).

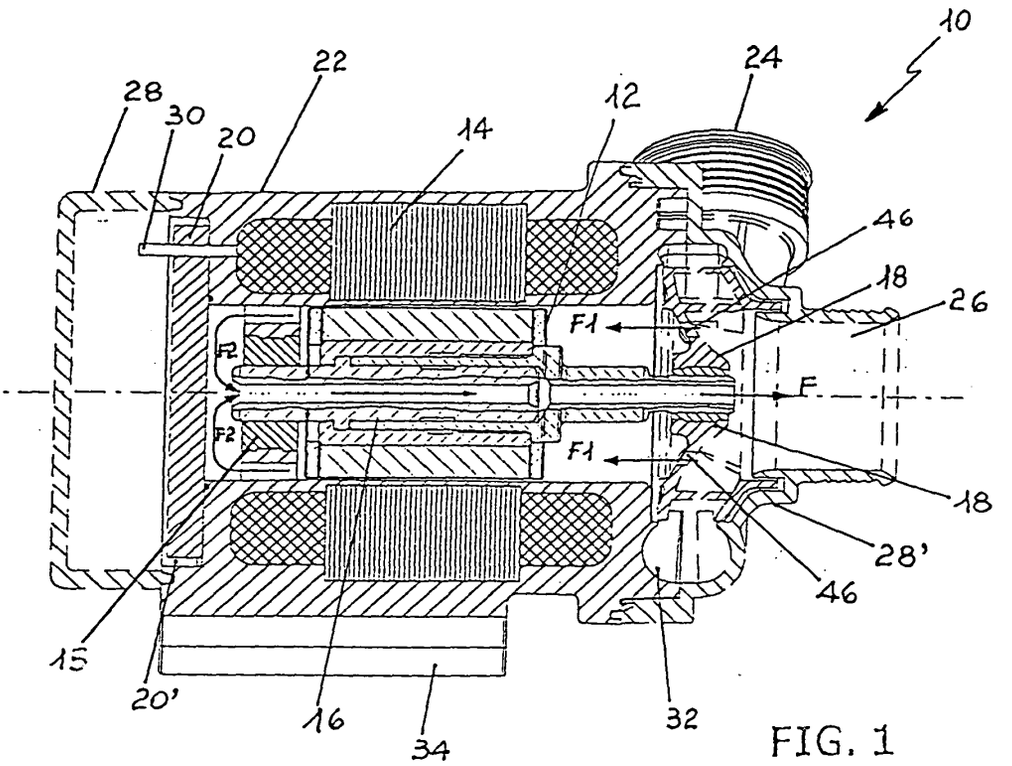

FIG. 1

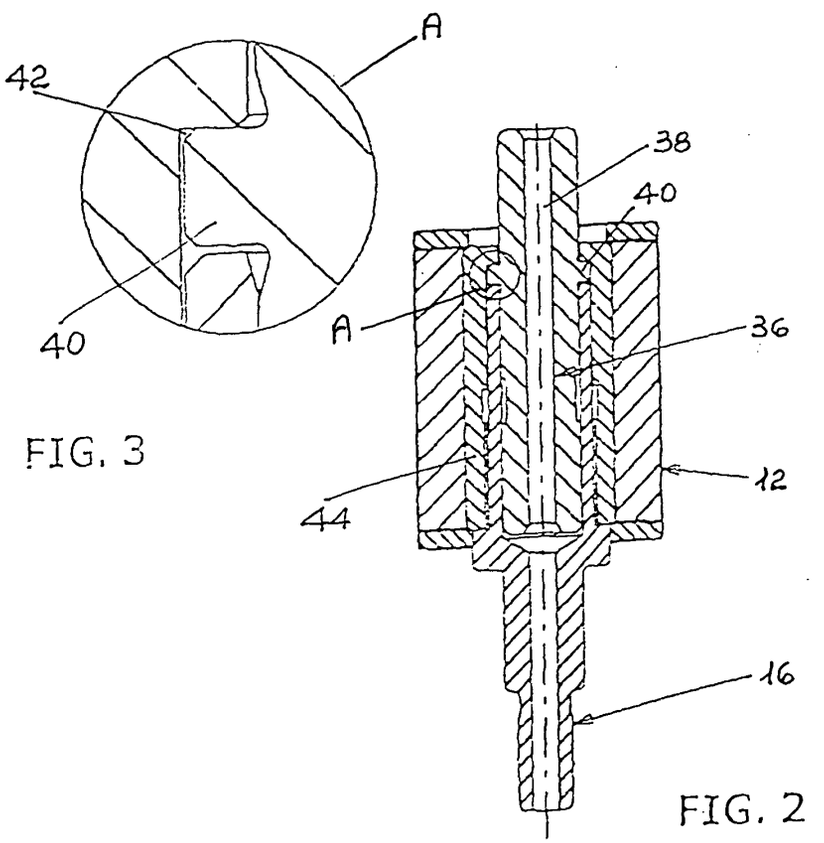

FIG. 3

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 00 5881

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y A	GB 790 333 A (GEN ELECTRIC) 5 February 1958 (1958-02-05) * page 1, line 79 - page 2, line 73 * * page 3, line 14 - page 3, line 28; figures 1,4 *	1,2,4,5,7 3,6,9	F04D13/06 F04D29/58 F04D29/04 F01P5/12
Y A	EP 1 124 302 A (SIEMENS CANADA LTD) 16 August 2001 (2001-08-16) * paragraph [0006] * * paragraphs [0023] - [0026]; figure 1 *	1,2,4,5,7 9	
A	DE 100 45 596 A (BUEHLER MOTOR GMBH) 4 April 2002 (2002-04-04) * column 1, line 1 - column 2, line 39; figures *	1,4,6	
A	GB 1 040 953 A (HANS MOSER) 1 September 1966 (1966-09-01) * page 1, lines 62-72 * * page 2, lines 41-46; figures 1,3 *	1,9	
A	WO 02/058213 A (MIYAZAKI YOSHIAKI ; KURITA KANAME (JP); MATAKE KOZO (JP); EBARA CORP () 25 July 2002 (2002-07-25) * page 8, lines 1-12; figure 1 *	1,9,10	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
F04D
F01P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 November 2004	Luta, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-11-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 790333 A	05-02-1958	NONE	
EP 1124302 A	16-08-2001	US 5949171 A	07-09-1999
		EP 1124302 A2	16-08-2001
		DE 69917138 D1	17-06-2004
		EP 0967707 A2	29-12-1999
		US 6111334 A	29-08-2000
DE 10045596 A	04-04-2002	DE 10045596 A1	04-04-2002
GB 1040953 A	01-09-1966	CH 410639 A	31-03-1966
WO 02058213 A	25-07-2002	JP 2002213385 A	31-07-2002
		CN 1488186 T	07-04-2004
		EP 1352461 A1	15-10-2003
		WO 02058213 A1	25-07-2002
		US 2004076532 A1	22-04-2004

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