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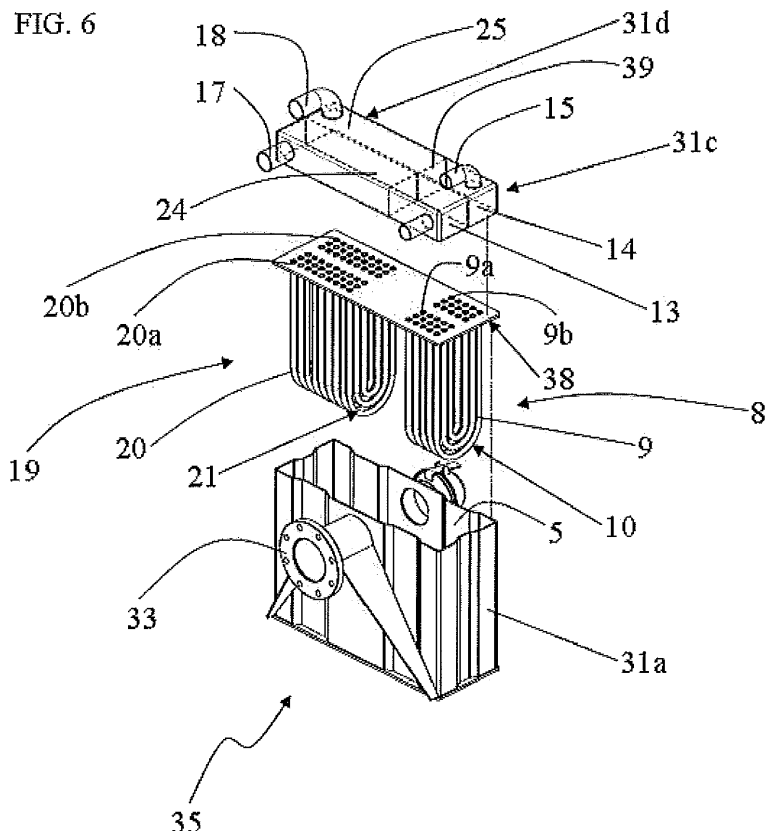
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(54) **Energy-saving motor pump**

(57) Motor pump (1) comprising a motor (2), an irrigation pump (3) and a heat exchanger (35) for cooling the refrigerant fluid coming from the motor (2) and air coming from a turbo compressor of the motor (2), said heat exchanger (35) being provided with a first circuit (8) for the passage of the fluid, a second circuit (19) for the

passage of the air and a collection chamber (5) for water drawn by the irrigation pump (3), said first passage circuit (8) and said second passage circuit (19) being disposed in the collection chamber (5) in such a way as to be immersed in the water drawn in, thereby cooling the fluid and the air.



Description

[0001] The present invention relates to an energy-saving motor pump, in particular used in the agricultural sector for the irrigation of soils.

[0002] As is generally known, the motor pumps currently on the market comprise a motor, an irrigation pump and a device for cooling the refrigerant fluid coming from the motor.

[0003] Traditionally, the device for cooling the refrigerant fluid uses a first radiator and a blowing fan.

[0004] The main disadvantage of this solution is tied to the high consumption of energy. In fact, the device for cooling the fluid consumes a percentage of the motor power ranging between 8% and 10%.

[0005] Moreover, motors of the modern generation (e.g. aspirator motors or turbo motors) need radiators and fans capable of rapidly dissipating larger and larger amounts of heat. This implies an increase in the size of both the radiators and the fans, with evident problems in terms of bulk and costs.

[0006] A second solution, applied to motor pumps with turbo or aspirated motors, envisages the use of a heat exchanger to cool the refrigerant fluid. The heat exchanger consists of a tank in which the water drawn by the irrigation pump is collected. In the tank there is a coil having an inlet for the refrigerant fluid coming from the motor and an outlet for the cooled fluid. As is generally known, in supercharged motors it is possible to further increase the power by cooling the compressed air coming from the turbo compressor, which is very hot and lacking in oxygen. In this manner, reliability being equal, the consumption of the motor can be reduced and its efficiency increased. Following the traditional approach, there are solutions using a second radiator for the air, commonly known as an "intercooler". The intercooler is positioned in proximity to the radiator for the refrigerant fluid in such a way as to exploit the same fan.

[0007] However, the power drawn by the fan inevitably leads to higher fuel consumption. Moreover, the presence of two radiators results in a considerable increase in the overall dimensions. Furthermore, in order to increase the efficiency of the motors, the supercharging pressures will be increased (at present, for applications in motor pumps there are pressures of around 1.8 bar at 180°C) and, consequently, the temperatures will rise as well. For this reason, the size and costs of radiators will have to increase in turn.

[0008] There likewise exist solutions employing systems for cooling the air coming from the turbo compressor which are based on a heat exchanger and use the refrigerant fluid coming from the motor. However, these are scarcely effective solutions because the fluid coming from the motor can reach temperatures of up to around 70°C.

[0009] In a sector totally different from the one concerned, there is known a motor pump for watercraft having a first section for cooling a fluid coming from the motor

and a second section for cooling air coming from a turbo compressor (US 2003/0013361 A1).

[0010] In this context, the technical task at the basis of the present invention is to propose an energy-saving motor pump which overcomes the above-mentioned drawbacks of the known art.

[0011] In particular, it is an object of the present invention to make available an energy-saving motor pump provided with a system for cooling the hot air coming from the turbo compressor of the motor which is simple, economical, efficient and compact.

[0012] A further object of the present invention is to propose an energy-saving motor pump in which consumption and the emission of exhaust gas are reduced compared to known solutions.

[0013] A further object of the present invention is to make available an energy-saving motor pump in which the noise emissions are reduced compared to known solutions.

[0014] A further object of the present invention is to present an energy-saving motor pump that can shut itself down in the event of a failure in the cooling system.

[0015] The defined technical task and the specified objects hereof are substantially achieved by an energy-saving motor pump comprising the technical characteristics described in one or more of the appended claims. Further characteristics and advantages of the present invention will become more apparent from the approximate, and hence non-restrictive, description of a preferred, but not exclusive, embodiment of an energy-saving motor pump as illustrated in the appended drawings, in which:

- figure 1 illustrates an energy-saving motor pump, according to the present invention, viewed from above;
- figures 2 and 3 illustrate two different side views of the motor pump of figure 1;
- figures 4, 5 and 6 respectively illustrate a front perspective view, rear perspective view and exploded view of a detail of the device of figure 1;
- figures 7, 8 and 9 respectively illustrate a rear elevation view, side view and view from above of the same detail as in figure 4;
- figures 10 and 11 respectively illustrate a perspective view and a side view of another detail of the device of figure 1.

[0016] With reference to the figures, 1 indicates a motor pump, in particular used in the agricultural sector for the irrigation of soils.

The motor pump 1 comprises a motor 2, in particular a thermal motor. This motor 2 is provided with a turbo compressor. The motor pump 1 is also provided with an irrigation pump 3 having an intake conduit 4. Preferably, the intake conduit 4 is made of rubber so as to dampen the vibrations originating from the irrigation pump 3 and the motor 2.

The motor pump 1 comprises a collection chamber 5 for the water drawn by the irrigation pump 3. Innovatively,

the collection chamber 5 is defined within an initial length 4a of the intake conduit 4. In particular, the collection chamber 5 is disposed upstream from the irrigation pump 3 and motor 2.

The motor pump 1 includes a first section 6 for cooling a refrigerant fluid coming from the motor 2. Preferably, the motor pump 1 comprises an outward conduit 7 for conveying the refrigerant fluid from the motor 2 to the first cooling section 6. In particular, the outward conduit 7 for the refrigerant fluid receives the fluid from a thermostatic valve of the motor 2 and conveys it to the cooling section 6. In addition, the motor pump 1 comprises a return conduit 15 for conveying the cooled fluid from the first cooling section 6 to the motor 2. In particular, the return conduit 15 for the cooled fluid receives the fluid from the cooling section 6 and conveys it to an expansion tank 37 of the motor 2.

The first cooling section 6 comprises a first circuit 8 for the passage of the refrigerant fluid. Advantageously, this first circuit 8 is disposed in the collection chamber 5 in such a way as to be immersed in the water drawn in, thereby cooling the refrigerant fluid.

Innovatively, in the embodiment described and illustrated herein, the first passage circuit 8 comprises a first plurality of conduits 9 bent into a U shape. In particular, each of these conduits 9 has an inlet 9a for the refrigerant fluid coming from the motor 2 and an outlet 9b for the cooled refrigerant fluid. Preferably, the conduits 9 of the first passage circuit 8 are formed from cylindrical tubes bent into a U shape having the same cross-section. In particular, the inlets 9a and the outlets 9b of the conduits 9 have a circular cross-section. More preferably, the conduits 9 are organised into groups 10 of three. In particular, the conduits 9 of each group 10 have different lengths and are disposed within the collection chamber 5 in such a way that the centres of the inlets 9a and of the outlets 9b of the conduits 9 are situated substantially along a same straight line. The groups 10 are organised in such a way that the conduits 9 of each group 10 are substantially parallel to those of the other groups 10. For example, the cylindrical tubes have a diameter of 15 mm and a thickness of 2 mm. Each group 10 has a first cylindrical tube having a length of 800 mm, a second cylindrical tube having a length of 900 mm and a third cylindrical tube having a length of 1000 mm.

In a second unillustrated embodiment, the first passage circuit 8 comprises a first coil having an inlet for the refrigerant fluid coming from the motor 2 and an outlet for the cooled refrigerant fluid.

Advantageously, the first cooling section 6 comprises an intake compartment 13 for the fluid to be cooled and an outlet compartment 14 for the cooled fluid, said compartments communicating with each other by means of the first passage circuit 8.

[0017] In the embodiment described and illustrated herein, the inlets 9a of the conduits 9 of the first cooling circuit 8 are connected to the intake compartment 13 of the first cooling section 6, to which is connected, in turn,

the fluid outward conduit 7. The outlets 9b of the conduits 9 of the cooling circuit 8 are connected instead to the outlet compartment 14 of the first cooling section 6, to which is connected, in turn, the return conduit 15 for the cooled fluid.

[0018] In the second embodiment, the inlet of the first coil is connected to the intake compartment 13 of the first cooling section 6, to which is connected, in turn, the fluid outward conduit 7. The outlet of the first coil is connected instead to the outlet compartment 14 of the first cooling section 16, to which is connected, in turn, the return conduit 15 for the cooled fluid. Advantageously, the motor pump 1 is provided with a second section 16 for cooling the air coming from the motor 2. Preferably, the motor pump 1 comprises an outward conduit 17 for conveying the air from the turbo-compressor to the second cooling section 16. Moreover, the motor pump 1 comprises a return conduit 18 for conveying the cooled air from the second cooling section 16 to the motor 2. In particular, the return conduit 18 conveys the air toward an intake manifold of the motor 2.

[0019] Innovatively, the second cooling section 16 comprises a second circuit 19 for the passage of air. Advantageously, this second circuit 19 is disposed in the collection chamber 5 in such a way as to be immersed in the water drawn in, thereby cooling the air.

[0020] Innovatively, in the embodiment described and illustrated herein, the second passage circuit 19 comprises a second plurality of conduits 20 bent into a U shape. In particular, each of said conduits 20 has an inlet 20a for the air coming from the turbo-compressor and an outlet 20b for the cooled air. Preferably, the conduits 20 of the second passage circuit 19 are formed from cylindrical tubes bent into a U shape having the same cross-section. In particular, the inlets 20a and the outlets 20b of the conduits 20 have a circular cross-section. More preferably, the conduits 20 are organised into groups 21 of three. In particular, the conduits 20 of each group 21 have different lengths and are disposed within the collection chamber 5 in such a way that the centres of the inlets 20a and of the outlets 20b of the conduits 20 are situated substantially along a same straight line. The groups 21 are organised in such a way that the conduits 20 of each group 21 are substantially parallel to those of the other groups 21. For example, the cylindrical tubes have a diameter of 15 mm and a thickness of 2 mm. Each group 21 has a first cylindrical tube having a length of 800 mm, a second cylindrical tube having a length of 900 mm and a third cylindrical tube having a length of 1000 mm.

[0021] In the second, unillustrated embodiment, the second passage circuit 19 comprises a second coil having an inlet for the air coming from the motor 2 and an outlet for the cooled air.

[0022] Advantageously, the second cooling section 16 comprises an intake compartment 24 for the air to be cooled and an outlet compartment 25 for the cooled air, said compartments communicating with each other by means of the second passage circuit 19.

[0023] In the embodiment described and illustrated herein, the inlets 20a of the conduits 20 of the second cooling circuit 19 are connected to the intake compartment 24 of the second cooling section 16, to which is connected, in turn, the air outward conduit 17. The outlets 20b of the conduits 20 of the second cooling circuit 19 are connected instead to the outlet compartment 25 of the second cooling section 16, to which is connected, in turn, the return conduit 18 for the cooled air.

[0024] In the second embodiment, the inlet of the second coil is connected to the intake compartment 24 of the second cooling section 16, to which is connected, in turn, the air outward conduit 17. The outlet of the second coil is connected instead to the outlet compartment 25 of the second cooling section 16, to which is connected, in turn, the return conduit 18 for the cooled air.

[0025] Advantageously, the first cooling section 6, the second cooling section 16 and the collection chamber 5 are housed within a single container 31. Preferably, the container 31 has a height of 600 mm, a width of 710 mm and a depth of 260 mm. The container 31 constitutes a heat exchanger 35 both for the refrigerant fluid and for the air. Preferably, the container 31 is made of stainless steel. Preferably, the container 31 has the shape of a parallelepiped having at least a first wall 38 inside it which serves to divide it into a first portion 31a and a second portion 31b. In particular, this first portion 31a also has the shape of a parallelepiped and defines the collection chamber 5. The second portion 31b, which likewise has the shape of a parallelepiped, has a second wall 39 inside it which serves to divide the second portion 31b into a third portion 31c and a fourth portion 31d. In the third portion 31c there are situated the intake compartment 13 and the outlet compartment 14 of the first cooling section 6. In the fourth portion 31d there are situated the intake compartment 24 and the outlet compartment 25 of the second cooling section 16. Preferably, the fourth portion 31d has a larger volume than the third portion 31c. Preferably, the number of conduits 20 of the second passage circuit 19 is greater than the number of conduits 9 of the first passage circuit 8. Accordingly, the second cooling section 16 will have greater overall dimensions than the first cooling section 6.

[0026] Preferably, the container 31 has at least a first water inlet 32 and an outlet 33 connected to the initial length 4a of the intake conduit 4. In particular, the first inlet 32 and the outlet 33 of the container 31 are formed on opposite faces of the first portion 31a. Preferably, the container 31 has a second water inlet 34 formed in the first portion 31a, on the same face as the first inlet 32. Advantageously, the second inlet 34 enables easy access to the collection chamber 5 and, through the latter, to the outlet 33, for maintenance and cleaning purposes. In fact, while water is being drawn in, undesired elements (e.g. shrubs, blades of grass or leaves) may accumulate inside the collection chamber 5 or in proximity to the outlet 33.

[0027] Advantageously, along the return conduit 18 for

the cooled air there is present a condensate drainage device 26. Preferably, the drainage device 26 comprises a collection tank 27 for the residues of condensation of the cooled air, said tank communicating with the return conduit 18 for the cooled air. Preferably, the drainage device 26 further comprises a cock operatively active on the tank 27. More preferably, the cock is associated with a lower drain of the tank 27 which discharges to the outside. In particular, the cock is movable from a first configuration in which the lower drain of the tank 27 is closed so that the residues of condensation accumulate inside the tank 27 to a second configuration in which the lower drain of the tank 27 is opened and the residues of condensation are discharged to the outside.

[0028] Advantageously, a safety device 29 is present along the return conduit 18 for the cooled air. Preferably, the safety device 29 is integrated into the condensate drainage device 26. Preferably, the safety device 29 comprises a float element 30 inserted in the tank 27. In particular, the float element 30 consists of a float ball having larger dimensions than an upper drain of the tank 27 so that it will always remain inside the tank 27 itself. In the event of a failure, for example of the heat exchanger 35, the water drawn in may invade the return conduit 18 for the cooled air and thus enter the tank 27. The float ball, immersed in the water, will rise and proceed to obstruct the upper drain, that is, the flow of water toward the motor 2.

[0029] Preferably, the motor pump has a frame 42 on which the motor 2 and the irrigation pump 3 are housed. In particular, the frame 42 has a cantilevered portion 42a positioned at a lower end of the frame 42. The cantilevered portion 42a accommodates a vibration-damping element 43 upon which a support 44 for the container 31 is disposed. For example, the support 44 is formed from a bent metal plate with its concavity facing upward.

[0030] The functioning of the energy-saving motor pump according to the present invention is described below.

[0031] During normal operation of the motor 2, the irrigation pump 3 draws water into the collection chamber 5, for example through the first inlet 32 of the container 31. In particular, the second inlet 34 of the container 31 remains closed so as to prevent water from coming out of the collection chamber 5. Preferably, the temperature of the water drawn in is lower than 18°C. In particular, the irrigation pump 3 is capable of drawing a quantity of water ranging between 500 and 30000 litres per minute. For example, the irrigation pump 3 draws water from canals or wells.

[0032] Under predefined temperature conditions, the thermostatic valve activates the cooling of the refrigerant fluid. In particular, the refrigerant fluid passes from the motor 2 to the first cooling section 6 through the fluid outward conduit 7. Said fluid enters the intake compartment 13 of the first cooling section 6 and then flows into the first plurality of conduits 9 bent into a U shape, where it is cooled. In particular, the refrigerant fluid goes from

an initial temperature ranging between 90°C and 100°C to a final temperature ranging between 50°C and 80°C. Through the outlets 9b of said conduits 9, the refrigerant fluid thus cooled arrives in the outlet compartment 14 of the first cooling section 6. Through the return conduit 15 for the cooled fluid, said fluid is conveyed to the expansion tank 37 of the motor 2 and then to the motor 2 itself.

[0033] The air passes from the turbo compressor to the second cooling section 16 through the air outward conduit 17. The air enters the intake compartment 24 of the second cooling section 16 and then flows into the second plurality of conduits 20 bent into a U shape, where it is cooled. In particular, the air goes from an initial maximum temperature ranging between 200°C and 300°C to a final temperature ranging between 30°C and 80°C. Through the outlets 20b of said conduits 20, the air thus cooled arrives in the outlet compartment 25 of the second cooling section 16. Through the return conduit 18 for the cooled air, the air is then conveyed back to the motor 2.

[0034] In order to drain the residues of condensation accumulated in the tank 27 to the outside, the cock 28 is moved from the first to the second configuration. Preferably, the cock 27 is manually actuated to pass from the first to the second configuration.

[0035] In the event of a failure, for example of the heat exchanger 35, the water drawn in may invade the return conduit 18 for the cooled air and thus enter the tank 27. The float ball, immersed in the water, will rise and proceed to obstruct the upper drain, i.e. the flow of water toward the motor 2. In this manner, the motor 2 will shut down and be protected from serious damage due to the intake of water.

[0036] During maintenance and cleaning operations, i.e. while the motor 2 is off, the second inlet 34 is opened to enable access to the collection chamber 5 and, via the latter, to the outlet 33 of the container 31. In this manner it is possible to recover any undesired elements that have remained trapped in the container 31.

[0037] The characteristics of the energy-saving motor pump, according to the present invention emerge clearly from the description provided, as do the advantages thereof. In particular, the motor pump described has a compact, constructively simple cooling section. In fact, the hot air coming from the turbo-compressor and the refrigerant fluid coming from the motor are cooled within the single container forming the heat exchanger. This heat exchanger is less bulky than the two radiators and fan of traditional solutions.

[0038] Moreover, cooling takes place in an efficient and economical manner thanks to the exploitation of large quantities of water (natural or artificial basins) to cool both the air and the fluid. In fact, the water coming from canals or wells has a constant temperature that is considerably lower than the temperature of the air used in traditional cooling with radiators and a fan.

[0039] Furthermore, the cooling takes place in an efficient and rapid manner thanks to the use of conduits bent into a U shape, which serve to increase the surface ex-

posed to water and thereby speed up the heat exchange. The use of conduits bent into a U shape also contributes to the realisation of a compact heat exchanger.

[0040] Moreover, as the second cooling section (for the air) has greater overall dimensions than the first cooling section (for the fluid), the air too is effectively cooled despite the fact that the initial temperatures and pressures in play are higher than those of the refrigerant fluid.

[0041] Furthermore, the simplicity of the motor pump is mainly tied to the use of the water drawn in to cool both the hot air and the refrigerant fluid coming from the motor.

[0042] Moreover, as the outward and return conduits used (both for the air and the fluid) are cylindrical, there are no head losses due to changes in cross-section.

[0043] Furthermore, the collection chamber is connected to the inlet of the intake conduit and, in general, the collection chamber is disposed upstream of the irrigation pump and motor, making it possible to avoid consuming further power of the motor.

[0044] The motor pump proposed makes it possible to reduce energy consumption by a percentage of between 8% and 10% compared to systems using fans and radiators.

[0045] Moreover, the energy savings also influence the savings in terms of fuel for the motor, with a consequent reduction in the heat released into the atmosphere and a reduction in the emissions of exhaust gases.

[0046] Furthermore, the absence of a blowing fan favours a reduction in the noise levels of the motor pump, contributes to reducing consumption and avoids the emission of hot air into the atmosphere.

[0047] Moreover, the condensation drainage device allows the condensation residues of the cooled air to be easily eliminated.

[0048] Finally, the presence of the safety device causes a motor shutdown in the event of a failure in the cooling system.

Claims

1. Motor pump (1) comprising:

a motor (2);
an irrigation pump (3);
a collection chamber (5) for water drawn by the irrigation pump (3);
a first section (6) for cooling a refrigerant fluid coming from the motor (2),
characterised in that it comprises a second section (16) for cooling air coming from a turbo compressor of the motor (2) having a second circuit (19) for the passage of said air disposed in said collection chamber (5) in such a way as to be immersed in the water drawn in, thereby cooling the air.

2. Motor pump (1) according to claim 1, wherein said

second passage circuit (19) comprises a second plurality of conduits (20) bent into a U shape, each of said conduits (20) having an inlet (20a) for the air coming from the turbo compressor and an outlet (20b) for the cooled air.

3. Motor pump (1) according to claim 1, wherein said second passage circuit (19) comprises a second coil having an inlet for the air coming from the turbo compressor and an outlet for the cooled air. 5
4. Motor pump (1) according to any of the preceding claims, wherein the first cooling section (6) comprises a first circuit (8) for the passage of the refrigerant fluid, disposed in said collection chamber (5) in such a way as to be immersed in the water drawn in, thereby cooling the refrigerant fluid. 10
5. Motor pump (1) according to claim 4, wherein said first passage circuit (8) comprises a first plurality of conduits (9) bent into a U shape, each of said conduits (9) having an inlet (9a) for the refrigerant fluid coming from the motor (2) and an outlet (9b) for the cooled refrigerant fluid. 15
6. Motor pump (1) according to claim 4, wherein said first passage circuit (8) comprises a first coil having an inlet for the refrigerant fluid coming from the motor (2) and an outlet for the cooled refrigerant fluid. 20
7. Motor pump (1) according to any of the preceding claims, wherein the first cooling section (6), the second cooling section (16) and the collection chamber (5) are housed within a single container (31). 25
8. Motor pump (1) according to any of the preceding claims, wherein the second cooling section (16) comprises an intake compartment (24) for the air to be cooled and an outlet compartment (25) for the cooled air, said compartments communicating with each other by means of said second passage circuit (19). 30
9. Motor pump (1) according to claims 4 to 8, wherein the first cooling section (6) comprises an intake compartment (13) for the fluid to be cooled and an outlet compartment (14) for the cooled fluid, said compartments communicating with each other by means of said first passage circuit (8). 35
10. Motor pump (1) according to any of the preceding claims, **characterised in that** it comprises a condensate drainage device (26) for eliminating residues of condensation of the cooled air, said drainage device (26) being situated along a conduit (18) through which the air cooled by the second cooling section (16) returns to the motor (2). 40
11. Motor pump (1) according to any of the preceding 45

claims, **characterised in that** it comprises a safety device (29) for obstructing the flow of the cooled air toward the motor (2) in the event of a failure, said safety device (29) being situated along a conduit (18) through which the air cooled by the second cooling section (16) returns to the motor (2).

12. Motor pump (1) according to any of the preceding claims, wherein said collection chamber (5) is defined within an initial length (4a) of an intake conduit (4) of the irrigation pump (3). 50

FIG. 1

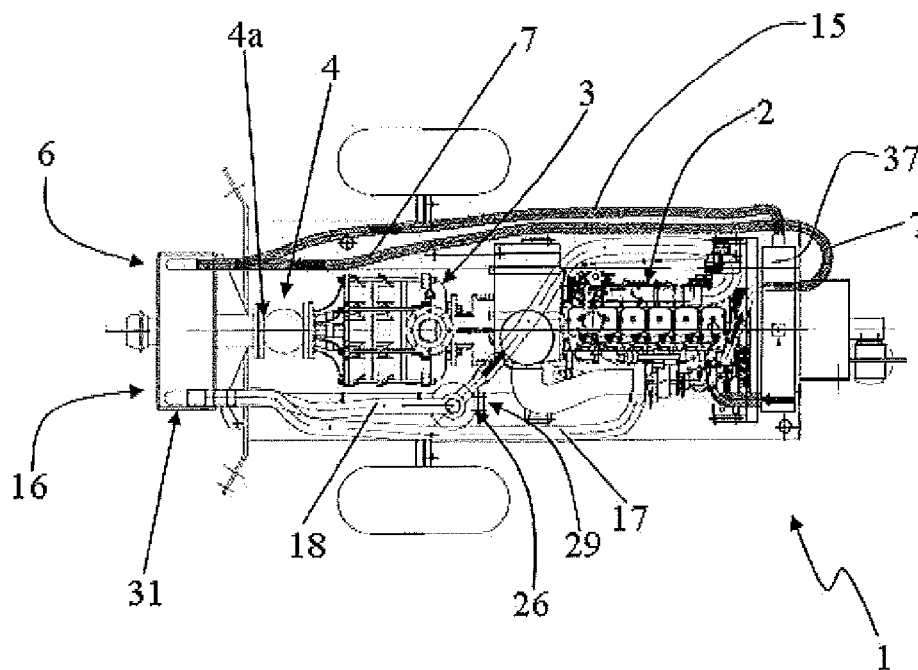


FIG. 2

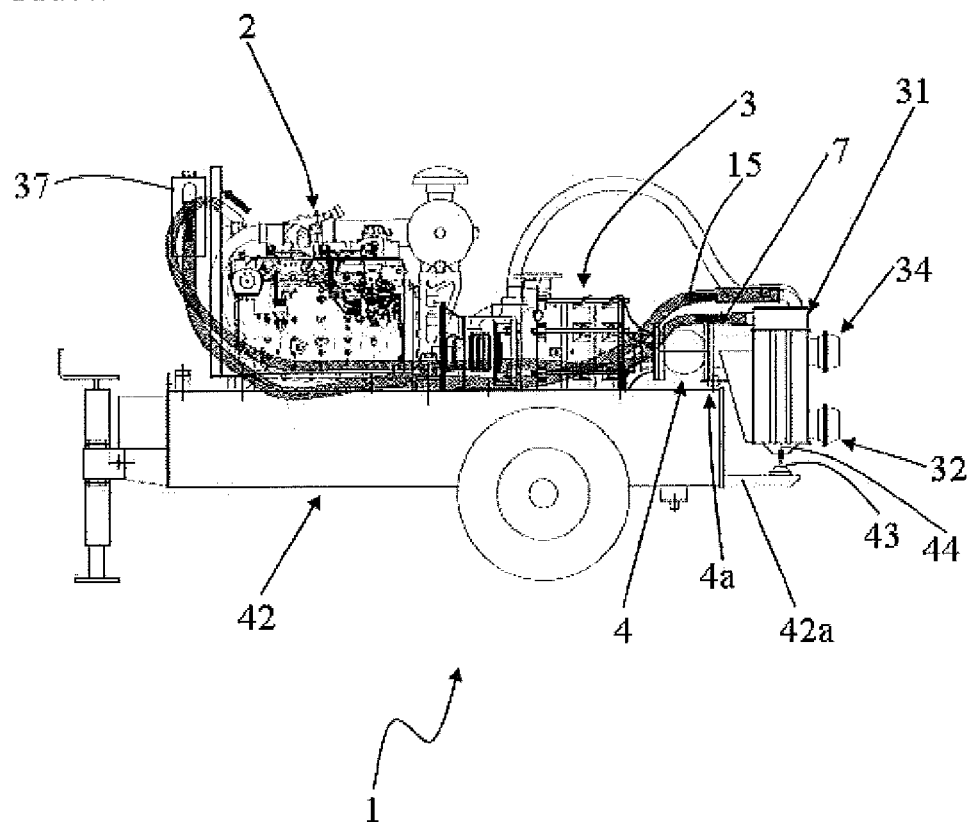


FIG. 3

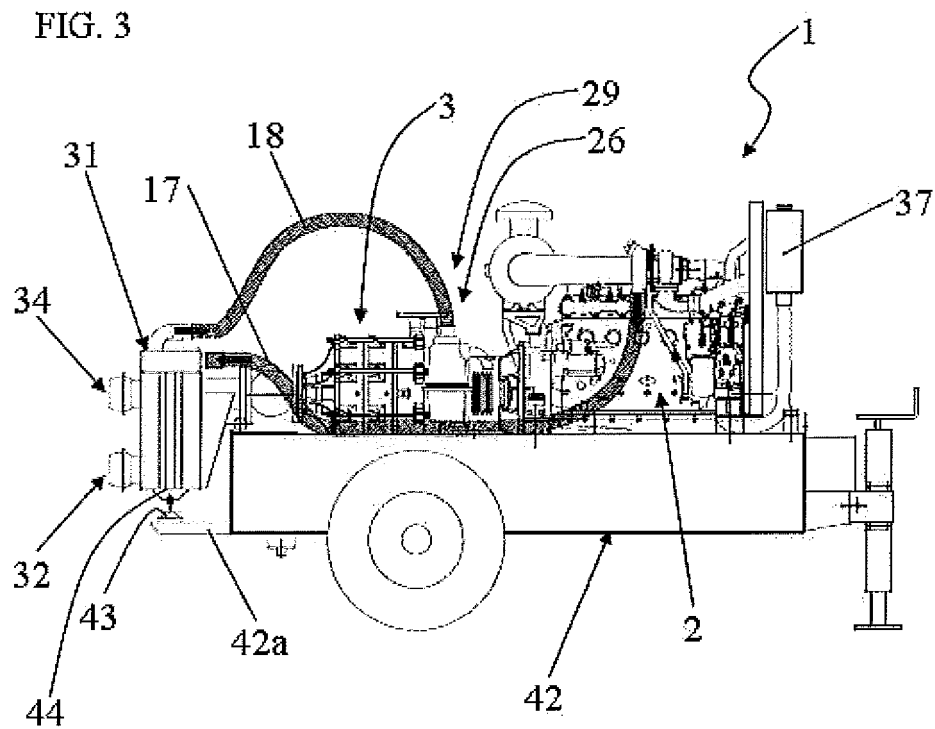


FIG. 4

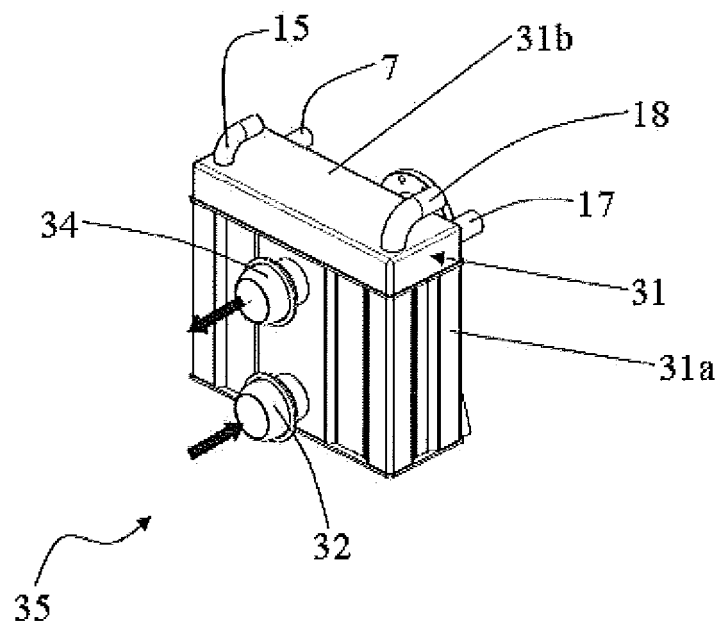


FIG. 5

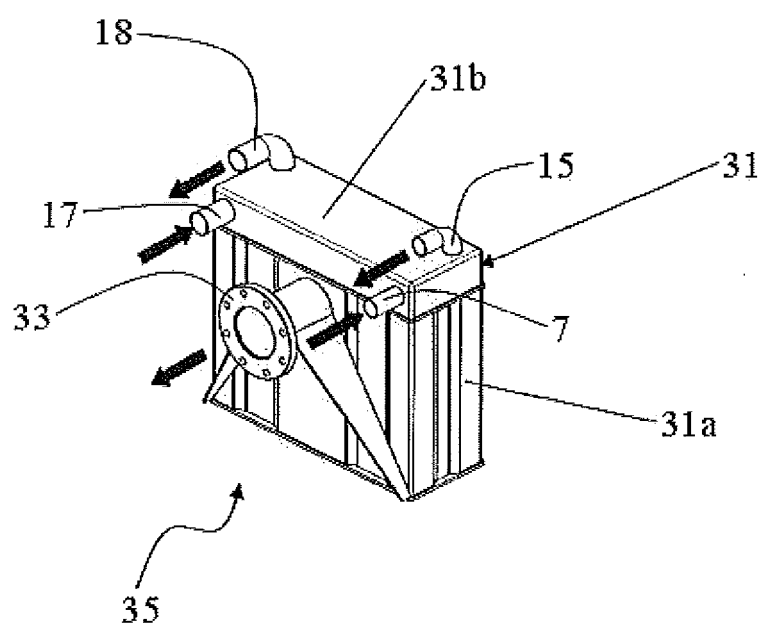


FIG. 7

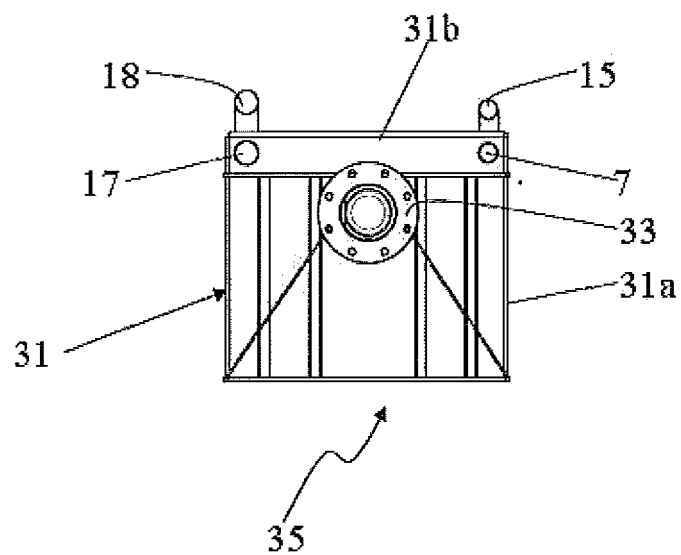


FIG. 6

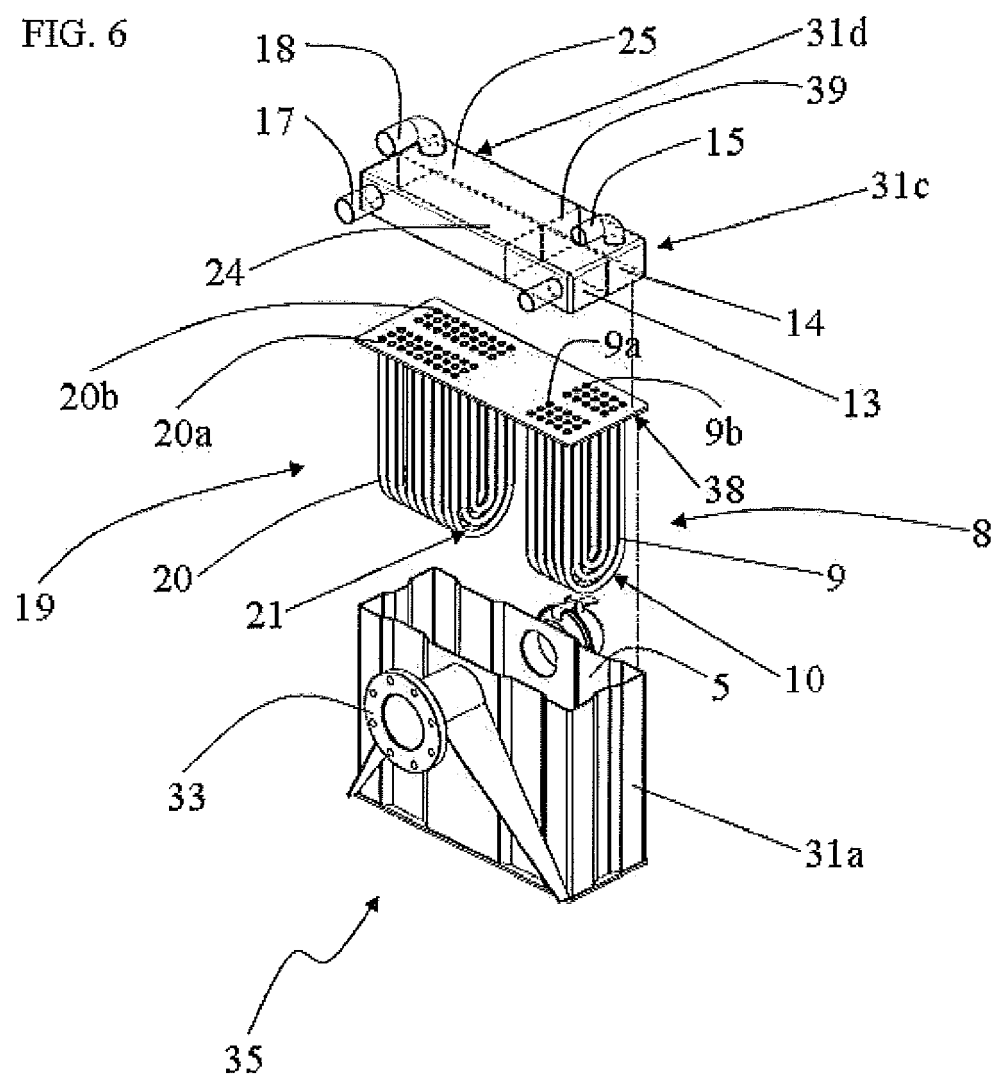


FIG. 8

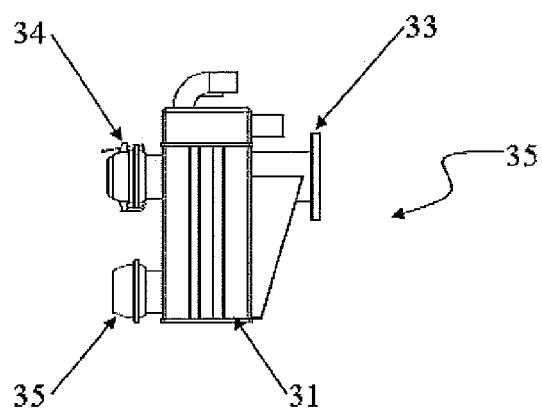


FIG. 9

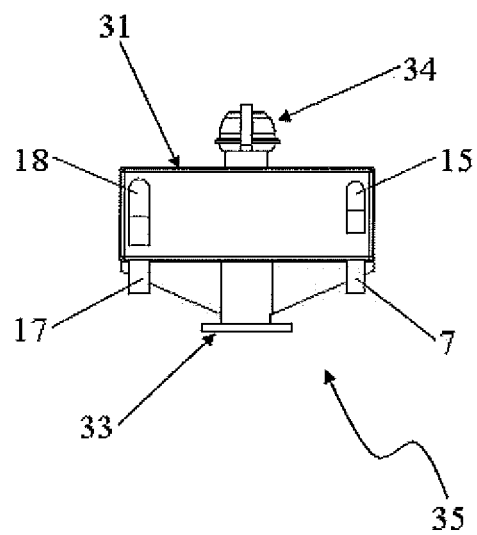


FIG: 10

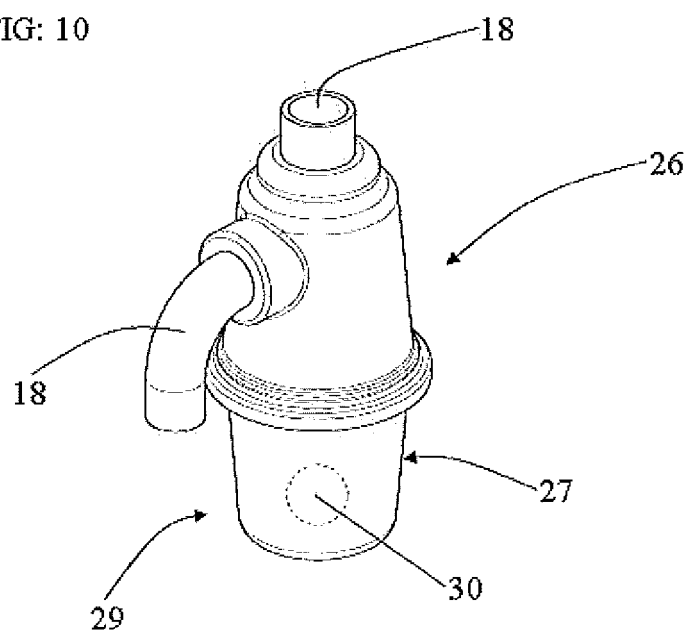
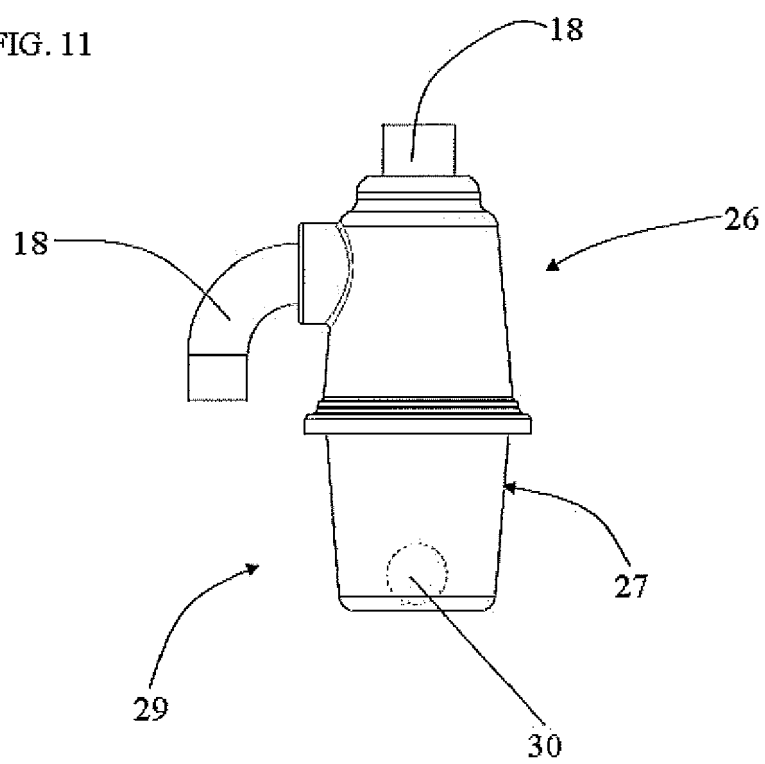


FIG. 11





EUROPEAN SEARCH REPORT

Application Number
EP 09 17 3501

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2008/021251 A (EXNER MARK [US]; EXNER BILL [US]; BINGLE AARON SCOTT [US]; BINGLE ERIC) 21 February 2008 (2008-02-21) * paragraph [0055] - paragraph [0068] * * figures 1-4 *	1-12	INV. F04D13/02 F04D29/58
A	US 2003/013361 A1 (GOKAN YOSHITSUGU [JP]) 16 January 2003 (2003-01-16) * paragraph [0023] * * paragraph [0047] * * paragraph [0052] - paragraph [0060] * * paragraph [0064] * * paragraph [0094] - paragraph [0095] * * figures 1,4-6(b) *	1-12	
A	US 2003/032345 A1 (GOKAN YOSHITSUGU [JP] ET AL) 13 February 2003 (2003-02-13) * paragraph [0010] - paragraph [0034] * * figures 1,4,5 *	1-12	
A	US 5 921 829 A (IWATA YOSHIBUMI [JP]) 13 July 1999 (1999-07-13) * column 2, line 34 - column 4, line 63 * * figures 1,2 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) F04D
A	"MTU'S SPLIT-CIRCUIT COOLING GIVES BETTER LOW LOAD PERFORMANCE" MARINE ENGINEERS REVIEW, INSTITUTE OF MARINE ENGINEERS. LONDON, GB, 1 January 1990 (1990-01-01), page 18/19, XP000101759 ISSN: 0047-5955 * the whole document *	1-12	
A	EP 1 233 159 A (BLOKSMA B V [NL]) 21 August 2002 (2002-08-21) * paragraph [0015] - paragraph [0019] * * figures 1,2 *	1-12	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 January 2010	Examiner Homan, Peter
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

2
EPO FORM 1503 03/02 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
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