(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 059 086**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **82300856.0**

(22) Date of filing: **19.02.82**

(51) Int. Cl.³: **F 02 B 67/06**, F 04 C 21/00

(30) Priority: **19.02.81 GB 8105211**

(43) Date of publication of application: **01.09.82 Bulletin 82/35**

(84) Designated Contracting States: **DE FR IT SE**

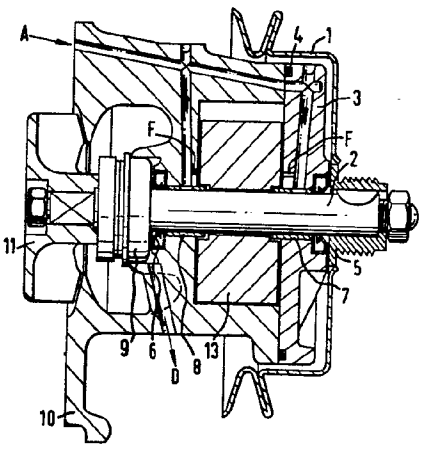
(71) Applicant: **CLAYTON DEWANDRE COMPANY LIMITED, P.O. Box 9 Titanic Works, Lincoln, LN5 7JL (GB)**

(72) Inventor: **Thistleton, John Stuart, Highthorpe, Southrey Nr. Lincoln (GB)**

(74) Representative: **Hartley, David et al, c/o Withers & Rogers 4 Dyer's Buildings Holborn, London, EC1N 2AJT (GB)**

(54) **Ancillary rotary equipment for engines.**

(57) A rotary exhauster, preferably a vane type vacuum pump and a water pump are arranged in a common housing and the rotary of the exhauster and the rotor of the water pump are mounted on and driven by a common shaft. The housing is adapted for flange mounting to an engine crankcase and this mounting includes drilling by means of which a supply of oil under pressure is led to the shaft bearings and to the vacuum pump chamber in order to provide a seal and lubricate the shaft and the vanes of the rotor. This invention has the advantage not only of a reduction in water and cost as compared with separate pumps, but also enables a much simplified belt drive associated with the engine, also plain bearings may be used instead of conventional ball bearings and leaked oil can be despatched to the engine pump by the vacuum pump exhaust.



EP 0 059 086 A1

ANCILLARY ROTARY EQUIPMENT FOR ENGINES

This invention relates to ancillary rotary equipment for engines and, more particularly to water pumps, rotary exhausters, compressors and blowers or the like.

A water pump is fitted to petrol and diesel engines to circulate the cooling water and is commonly fitted to the front face of the crankcase and driven by a vee-belt from the engine crankshaft.

Vacuum pumps or exhausters, which are used to give servo-boost to the vehicle braking system are becoming more important with the growing popularity of diesel engined vehicles which do not allow vacuum utilisation from the engine inlet manifold. Rotary vane type pumps driven by a vee-belt from the engine crankshaft are a simple and reliable means of vacuum production. It is known to mount a rotary vane vacuum pump on the engine crankcase whereby supply of oil under pressure normally available from the supply to the engine main bearings, can be led via drillings in the flange directly to lubricate plain bearings supporting the pump rotor, and by means of leakage from the bearings into the pump chamber to lubricate and seal to vaned rotor. The vacuum pump discharges together

with the leakage oil directly to the engine sump, again via drillings in the flange mounting. Plain bearings are preferred even for water pumps since they have a longer working life but because a separate oil supply, with its additional and vulnerable pipework cannot be justified particularly in compact engines, water pumps are generally fitted with twin ball-race bearings, which are more expensive than plain bearings and furthermore can be disadvantageous due to the finite life of the ball bearing units (to total failure) particularly if partial failure of the water seals allows water to wash away the lubricating grease.

A third item of ancillary equipment necessary for engines is an alternator, this also being driven by a V-belt pulley and mounted on the crankcase.

Space is at a premium in modern vehicles and with this in mind it has for some years been known to use what is often called a through-drive alternator - effectively an alternator and a vacuum pump the housings of which are bolted together and which are driven by common shaft. In addition to saving mounting space on the crankcase, this also reduces to two the number of belt drives needed but, requires accurate machining and assembly if problems due to accumulated tolerances in the combined unit are to be avoided. Also, external pipework is needed for the vacuum pump which cannot in this arrangement

be flange mounted on the engine crankcase.

According to the present invention we propose, the combination in a common housing of a rotary vacuum pump or exhauster and a water pump which are mounted on and driven by a common shaft.

By this invention the number of crankcase mountings are reduced to two and the number of vee-belt drives needed is also reduced to two. This is also true of the arrangement using a through drive alternator but only at the expense of complicated and vulnerable pipework.

Driving speeds for existing vacuum pumps and water pumps vary from engine speed to twice engine speed which means that there is no problem with regard to speed compatability in thecombination of the two pumps, and higher speeds can be used advantageously to increase the output of both pumps.

One important advantage of this combined unit, apart from the relative ease of manufacture and assembly (with particular reference to tolerance build-up) in a common housing, reduction in total weight and cost as against separate pumps for each function, is the simplification of the drive belt arrangements of the engine. As both units have low torque requirements, the belt tension, and therefore pump shaft bearing requirements, will normally be determined by any other units driven by the same vee-belt.

This invention also has the advantage, that both units which previously were preferably both flange mounted, (but separately) on the engine crankcase, are disposed in a common housing and the single flange mounting can be designed for communication with the crankcase to service both units. Again the oil and air from the exhaust of the vacuum pump can be returned to the engine sump via the mounting flange. By this means, all vulnerable external pipework to service the vacuum pump is eliminated.

Furthermore, the present invention proposes the combination of the two items of ancillary equipment which can benefit from plain bearings so that the need for expensive ball bearings in the water pump is avoided altogether, without the need for external pipework and the total number of plain bearings which in any event yield a longer working life, is reduced to two since the water pump and vacuum pump are mounted on a common shaft.

One embodiment of this invention will now be described by way of example with reference to accompanying drawings of which:-

Figure 1, is a cross-section of a rotary vacuum pump/ water pump,

Figure 2, is a cross-section of the same housing but taken on axis XX and,

Figure 3, is a cross-section taken on line AA in Figure 2.

As can be seen from Figure 1, both the water pump rotor (11) and the vacuum pump rotor (13) turn in the same housing (10), the shaft being supported on bearings (8) and (7), fitted in the housing (10) and in the end cover (3).

The water pump rotor (11) rotates in a housing (16) which is shaped to promote the pumping action.

The connection to the brake vacuum reservoir is through drilling (c), this passage alternatively including a non-return valve to prevent oil from the vacuum pump passing into the inlet line. Exhaust air and oil from the vacuum pump is returned to the engine sump through drilling (B). The inlet and outlet ports are displaced circumferentially as is normal rotary vane vacuum pump practise.

The unit is normally driven by a vee-belt, the pulley (1) being of top-hat section to place the belt loads as near as possible to being central between the two bearings (7) and (8). In order that the pulley may be detachable from the shaft (2) a form of torque transmission device is provided in the pulley hub, i.e. key to keyway, squared shaft or D-shaped shaft and held in place with a threaded nut or screw. As shown in the diagrams, the pulley hub may be used as the mounting for the engine cooling fan at (12).

The vacuum pump rotor (13) is rigidly fixed to the shaft (2) either by interference fit, by the use of adhesive, or by the use of drive pins. This method of fixing is sufficient to take the thrust loads developed as well as the drive torque. In Figure 3, the four sliding vanes are shown carried in grooves which are tangential to the centre of rotation, the number of vanes in the rotor may vary for different pump requirements and the vanes may alternatively be carried in radial slots. The axial clearance of the rotor (13) within the housing (10) is the minimum to ensure that, with tolerance variation, the rotor is always free to rotate.

The removable end cover (3) is restrained to be concentric with the main housing (10), in this case by the use of dowels at (15). In order to minimise the dimension 'X', and therefore the pulley diameter, the cover is held by bolts at positions (17), these being of adequate dimensions and the end cover being made of sufficient rigidity to allow this limited clamping. Other bolting and dowelling positions can be used where space permits. The end cover is preferably sealed to the main housing by the use of an 'O' ring (4).

In this case plain bearings (7) and (8) are used to support the rotor, these are supplied by oil through drillings at (A). The oil supply passes through the end cover/main housing interface, leakage into the main vacuum pump chamber is permissable. Spillage of oil from the bearings into the main vacuum pump chamber is used to seal and lubricate the vanes and rotor thrust faces. This may be augmented by oil flow through the additional drillings shown at (F).

Conventional oil seals (5) and (6) are fitted to the outer end of each bearing, any pressure on the oil side of these is

relieved by drillings (E) to the exhaust port of the unit.

The water pump seal (9) is of the spring loaded face seal type as conventionally used for engine water pumps, any leakage from this being drained to atmosphere through drilling at (D).

The water pump rotor (11) is mounted on shaft (2) which is shaped to ensure concentricity and provide transmission of the drive torque and allow for easy removal for servicing.

0059086

Claims:

1. The combination, in a common housing, of a rotary air pump such as an exhauster, compressor, blower or the like and a water pump, the air pump rotor and the water pump rotor being mounted on and driven by a common shaft.

2. The combination according to claim 1 wherein the air pump is a vacuum pump.

3. The combination according to claim 1 or claim 2, wherein the said shaft is mounted in bearings, at least a bearing between the air pump and the motor pump being a plain bearing supplied through drillings in the housing with oil under pressure.

4. The combination according to claim 3 wherein the air pump is a rotary vane type vacuum pump wherein oil leaking or diverted from the main shaft bearings is used to seal and lubricate the vanes and rotor thrust faces.

5. The combination according to claim 4 and comprising additional drillings communicating between the supply of oil under pressure and the vacuum pump chamber to seal and lubricate the pump vanes.

6. The combination according to any one of the preceding claims 3, 4 or 5, wherein the housing comprises a flange adapted for mounting to the crankcase of an engine, such that the said drillings in the housing communicate with appropriate drillings in the crankcase, and, when the air pump is a vacuum pump, such that oil and air exhausted from the vacuum pump is discharged into the sump of the engine.

7. The combination according to any one of claims 3 to 6, wherein the air pump is a vacuum pump and comprising on each side of the vacuum pump chamber a plain bearing supplied with oil under pressure and on the side of each of the said plain bearings remote from the vacuum pump chamber, a convention oil seal around the shaft.

8. The combination according to claim 7 wherein the pressure on the oil side of each plain bearing is relieved by drillings communicating with the vacuum pump exhaust port.

FIG. 1.

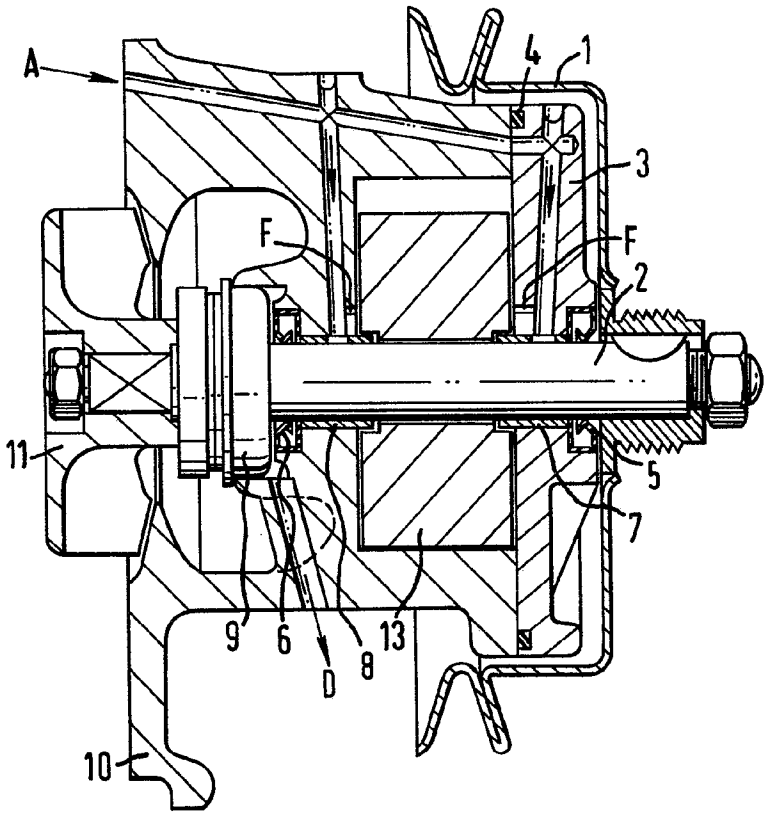
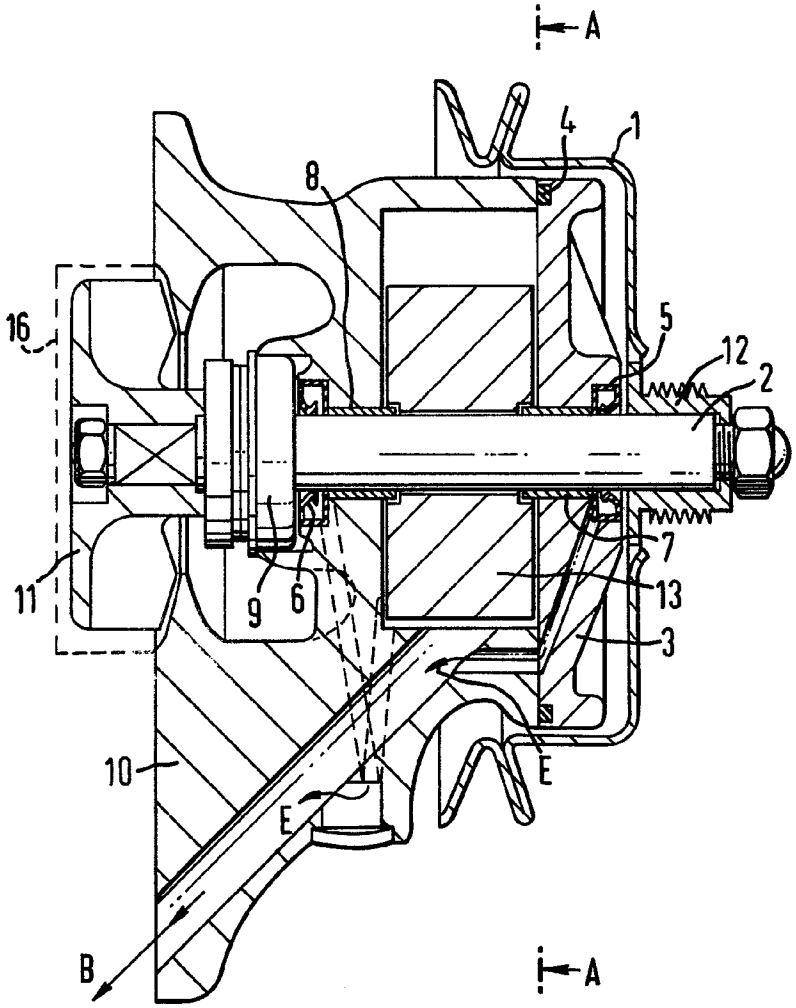


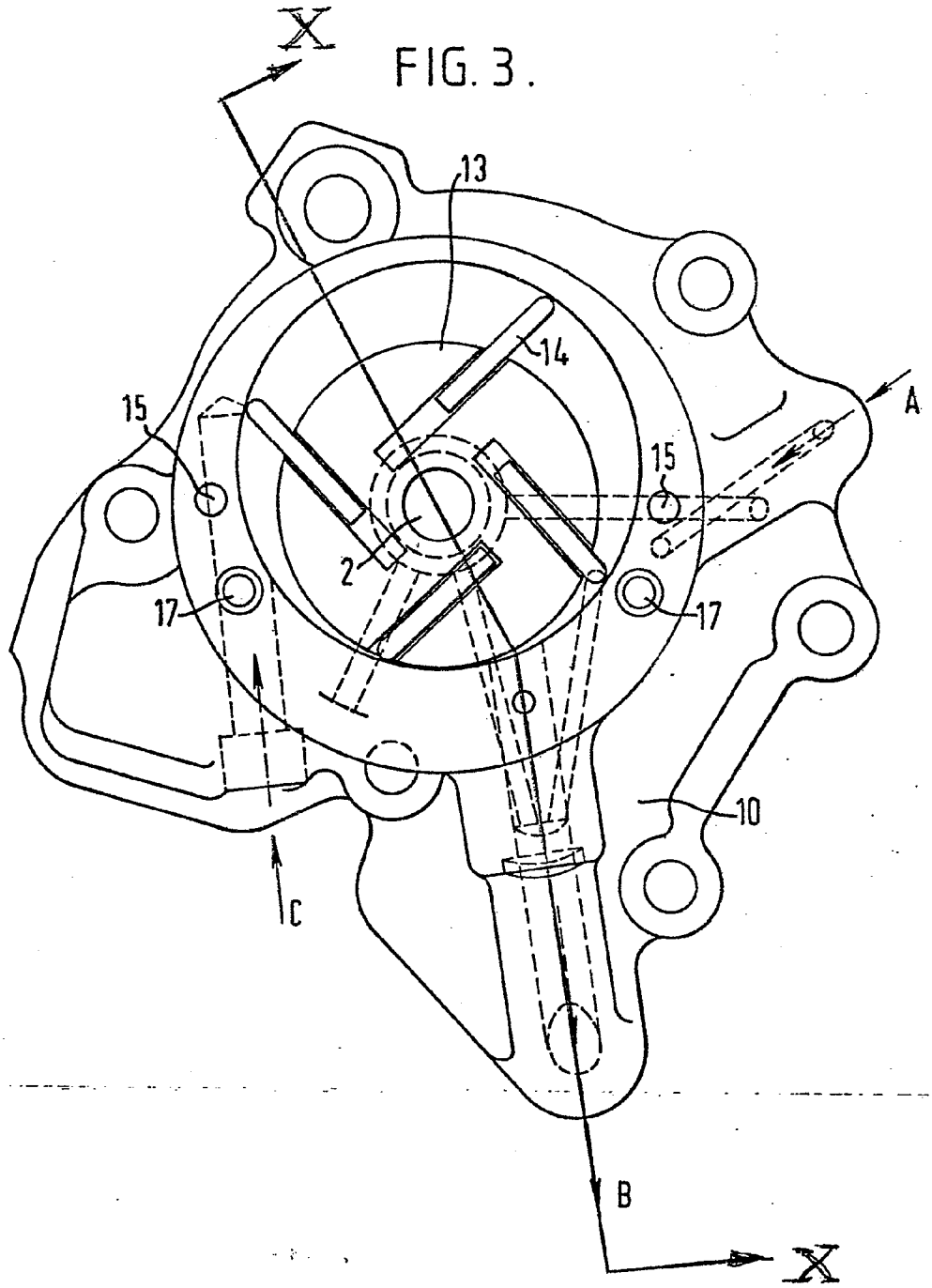
FIG. 1

FIG. 2.



0059086

FIG. 3.



European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 82 30 0856

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. ³)
X,Y	US-A-2 662 481 (GRISE) *Column 1, lines 3-11; column 2, line 2 to column 3, line 38; figures 1-2*	1-7	F 02 B 67/06 F 04 C 21/00
Y	GB-A-2 026 612 (BARMAG BARMER) *Page 1, lines 50-78; page 2, line 59 to page 3, line 45; figure 1*	3-7	
X	US-A-3 082 694 (BRKICH) *Column 1, lines 22-27; column 2, lines 7-61; column 3, lines 35-39; figure 1*	1,2,6	
A	FR-A-1 352 410 (AUTO UNION) *Page 1, paragraphs 1-4; page 2, left-hand column; paragraph 7 to right-hand column, paragraph 5; page 3, left-hand column paragraphs 2,3; figures 1,2*	3,6	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

F 02 B
F 01 P
F 04 C
F 04 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27-04-1982	KOOIJMAN F.G.M.

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

EPO Form 1503 03 82