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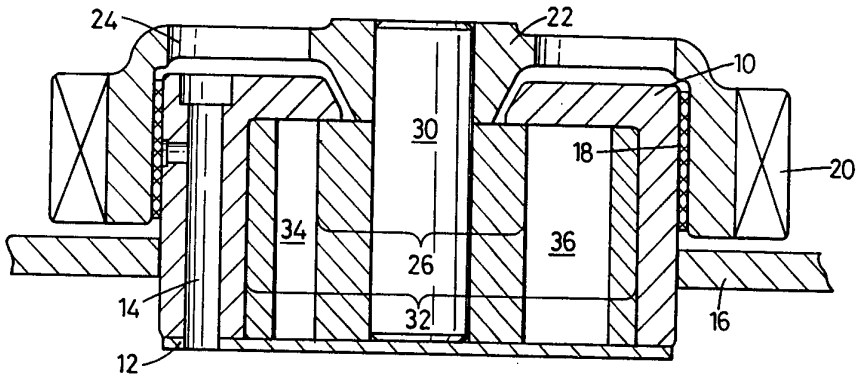
(54) Title: COMPACT GEROTOR PUMP



(57) Abstract

A gerotor pump is made of extremely compact axial dimensions by using a shaft (30), which is neither fast with the pump body (10) nor journalled in the pump body (10). This is achieved by making the shaft fast with either or both of the rotor (26) or the hub (22) of the drive gear (20) and journalling the drive gear on the body by a bush (18). The bearing length which carries the cantilever load is thus co-extant or substantially so with the gerotor set.

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Compact gerotor pump.

This invention relates to gerotor pumps which, as well known, comprise a male lobed rotor with n lobes, located in and meshed with a female lobed annulus having n+1 lobes. This rotor and annulus, called the gerotor set, rotate relative to one another about parallel axes so that a series of chambers each defined between a pair of parallel lines of contact between the two parts rotate about said axes, increase in size as they pass over an inlet port in a first half revolution, and decrease in size as they pass over an outlet port in the following half revolution. The ports are formed in a body having a cylindrical cavity for the gerotor set.

Many different designs of gerotor pump are known: the objects of the present invention are to simplify manufacture and particularly to provide for axial compactness, without sacrificing efficiency or durability.

According to the invention, a gerotor pump is characterised by an externally at least part-cylindrical body, a drive gear journalled on said body part and angularly fast with a drive shaft concentric of the body, said shaft also being angularly fast with the rotor of the gerotor set.

Preferably the shaft is a clearance fit in the body of the pump, that is, it does not make contact with the body at any point. Hence the pump of the invention is distinguished from the prior art in that the shaft is neither fast with the body (as has previously been suggested in certain prior art patents) nor is it journalled in the body, which has been the norm in pumps of this kind. When the shaft is fast with the body, it is necessary to provide a certain body length which can support the shaft in cantilever fashion, and when the shaft is journalled in the body an even greater axial length has to be provided to support the shaft. By

supporting the shaft from the drive gear, with which it is fast and journalling the gear, reduced axial dimensions are possible without any sacrifice of pump performance.

The axial length of the shaft is equal to the sum of the axial length of the rotor, the axial thickness of the drive gear and its hub, i.e. in the region of the shaft, and the dimension between the two parts, if any.

The pump body may be cup-shaped with the base of the cup apertured for the shaft to extend through, and the rim of the cup may sit on an associated part such as the face of an engine block or sump. Or the rim of the cup may be associated with a closure plate. The shaft may extend up to that block, sump or plate with a slight end clearance for the shaft.

The shaft may be an interference fit in both rotor and drive gear, or alternatively it may be splined to one or the other to allow for removal for maintenance purposes.

The engineer to whom this specification is addressed will understand that the shaft requires to run true, and its cantilever stiffness is dictated by the journalling of the gear together with the connection between the shaft and the gear.

In the accompanying drawings, two pumps are illustrated which are generally similar, both being shown in sectional elevation.

Turning first to Figure 1, the body 10 is generally cup-shaped and secured to a closure plate 12 by means of cap screws located in spaced apertures 14. In this instance the pump is accommodated in an aperture in an engine component 16.

A bearing bush 18 is supported on the cylindrical exposed portion of the body wall and this journals drive gear 20. The gear is unitary with the hub 22 and there

are apertures 24 in the gear to reduce weight and provide access to the cap screws.

It will be noted that the body 10 has an enlarged central opening and the hub 22 extends into that opening with a clearance between it and the body.

The rotor 26 is located in the body and has the same axial length as the cylindrical cavity therein. The rotor is fast with shaft 30 for example as an interference fit thereon. In this pump of Figure 1, the drive gear is also fast with the shaft as an interference fit thereon. The rotor and hub abut one another. It will be appreciated that assembly is achieved by fitting the shaft one or other of gear and rotor, passing the remaining shaft portion through the body central opening and then pressing the shaft and other of the rotor and gear into interference fit assembly.

The gerotor set also comprises the annulus 32 which is of the same axial length as the rotor and is journalled in the body 10. Two of the chambers formed between the gerotor parts are indicated by the reference numerals 34 and 36, and these chambers open axially through the plate 12 to the inlet and outlet ports, not shown. It will be appreciated that this provides an extremely axially compact pump.

In the arrangement shown in Figure 2 all of the parts are the same except that here the shaft has a splined portion 38 engaging in the hub 40 and the hub and shaft are held together against axial displacement on these splines by a circlip (RTM) 42. This enables the drive gear to be removed without dismantling the pump.

It will be seen that the cantilever loads, that is to say the maintenance of co-axiality and concentricity without tilt, are carried by the journal bearing length on the bush 18. Hitherto in the prior art, the equivalent length for carrying the cantilever load was that of the journal portion of the shaft which was essentially additional to the rotor length: here it is

co-extant, thus substantially shortening the pump.

CLAIMS

1. A gerotor pump having an externally at least part-cylindrical body, a drive gear journalled on said body part and angularly fast with a drive shaft concentric of the body, said shaft also being angularly fast with the rotor of the gerotor set.

2. A pump as claimed in Claim 1 wherein the shaft is a clearance fit in the body part.

3. A pump as claimed in Claim 1 wherein the body part is cup-shaped and the shaft extends through the base of the cup.

4. A pump as claimed in Claim 3 wherein the cup rim is arranged to sit on an associated part which is provided with ports.

5. A pump as claimed in any preceding claim wherein the shaft is an interference fit in the rotor.

6. A pump as claimed in any preceding claim wherein the shaft is an interference fit in the drive gear.

7. A pump as claimed in any of Claims 1 to 4 wherein the shaft is splined to the rotor or drive gear.

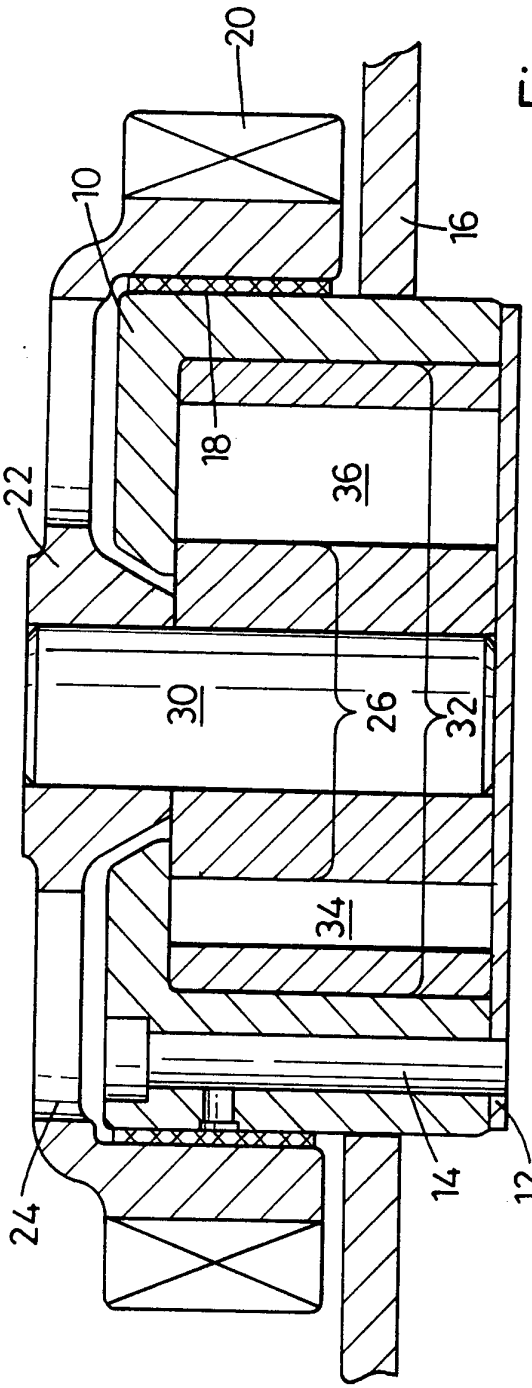

Fig. 1

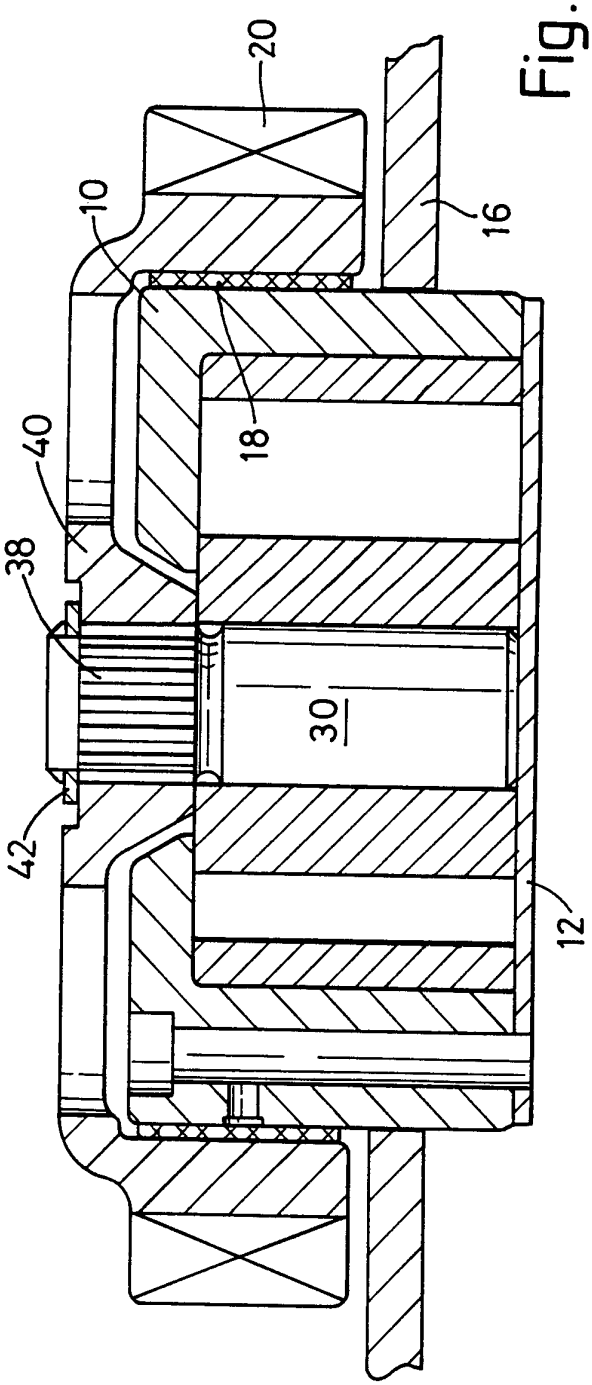

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 93/01680

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 F04C2/10; F04C11/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	F04C ; F01C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
P,A	EP,A,0 517 014 (SCHWÄBISCHE HÜTTENWERKE GESELLSCHAFT) 9 December 1992 see the whole document	1
A	EP,A,0 361 716 (CONCENTRIC PUMPS LTD.) 4 April 1990 see the whole document	1

° Special categories of cited documents :[10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
26 OCTOBER 1993	03. 11. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	DIMITROULAS P.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9301680
SA 77854

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0517014	09-12-92	DE-A- 4123190	10-12-92
EP-A-0361716	04-04-90	AU-B- 617002	14-11-91
		AU-A- 4128789	05-04-90
		GB-A,B 2223275	04-04-90
		JP-A- 2185682	20-07-90