

(12) UK Patent Application (19) GB (11) 2 386 171 (13) A

(43) Date of A Publication 10.09.2003

(21) Application No 0205214.0

(22) Date of Filing 06.03.2002

(71) Applicant(s)
Concentric Pumps Limited
(Incorporated in the United Kingdom)
Unit 10, Gravelly Industrial Park,
Erdington, Birmingham B24 8HW,
United Kingdom

(72) Inventor(s)
Stephen Mark Hodge

(74) Agent and/or Address for Service
Withers & Rogers
Goldings House, 2 Hays Lane, LONDON,
SE1 2HW, United Kingdom

(51) INT CL⁷
F16H 41/30

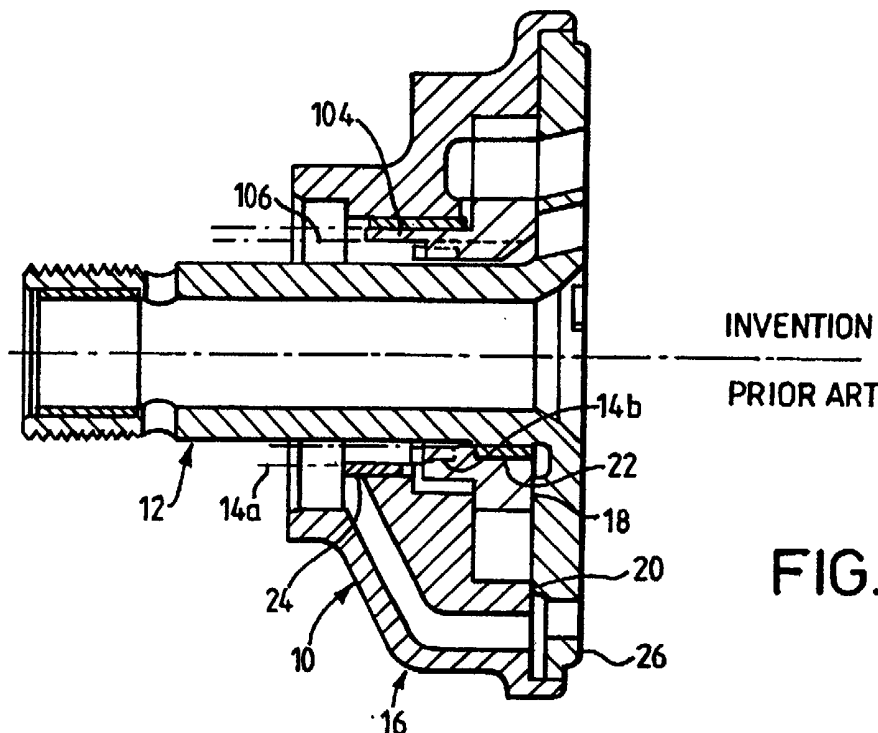
(52) UK CL (Edition V)
F2W W10B2
F1F FAX F1B5C

(56) Documents Cited
EP 0997666 A DE 004312053 A
DE 004301493 A JP 050044814 A
US 3252352 A US 2950630 A
US 2861480 A

(58) Field of Search
UK CL (Edition V) F1F, F2W
INT CL⁷ F04C, F16H
Other: Online: WPI, EPODOC, PAJ , TXTUS0, TXTUS1,
TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1

(54) Abstract Title
Transmission pump

(57) A transmission pump for a vehicle transmission comprises a static central shaft 12 for supporting a torque converter stator coupled to a housing 16 through a flange 26, and defining a cavity containing an inner pumping member, e.g. a drive gear 18, and an outer pumping member or driven gear 20. The drive gear is coupleable to a torque converter element sleeve 14a through tangs 106 to pump fluid through inlet and outlet ports in the flange. A single bush (long bushing, 60, Fig. 2) is arranged to take the load of both the rotating drive gear and a rotating part of the torque converter rather than separate inner gear and sleeve bushes 22, 24.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

GB 2 386 171 A

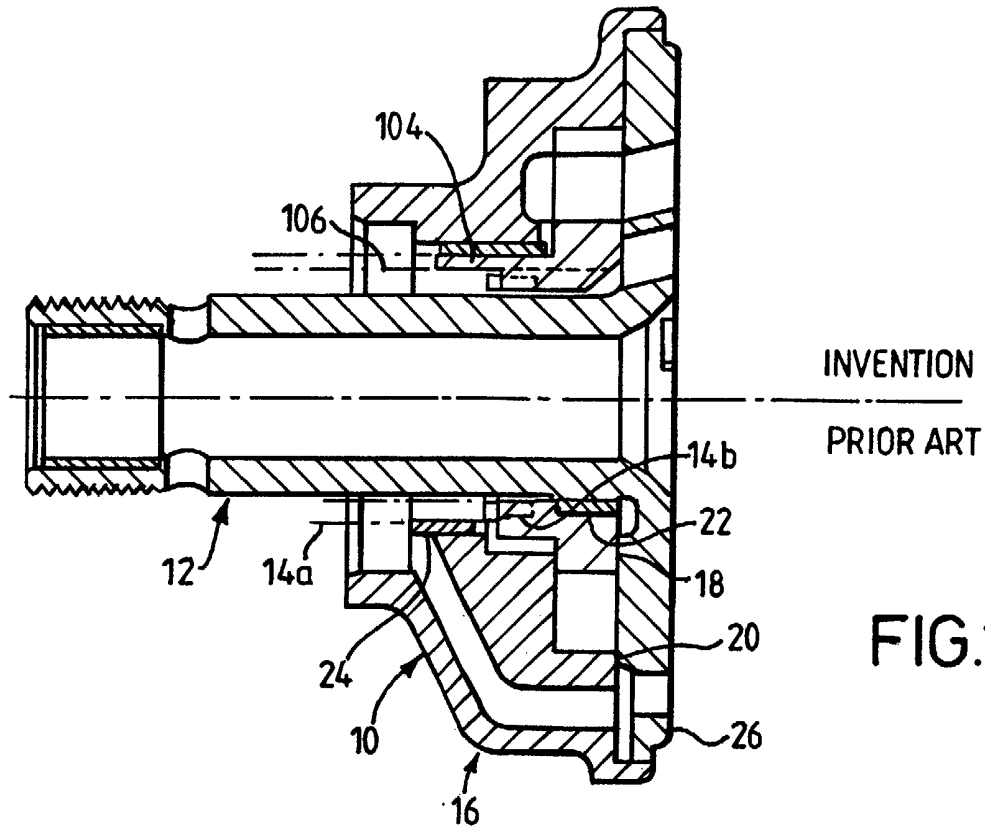


FIG.1.

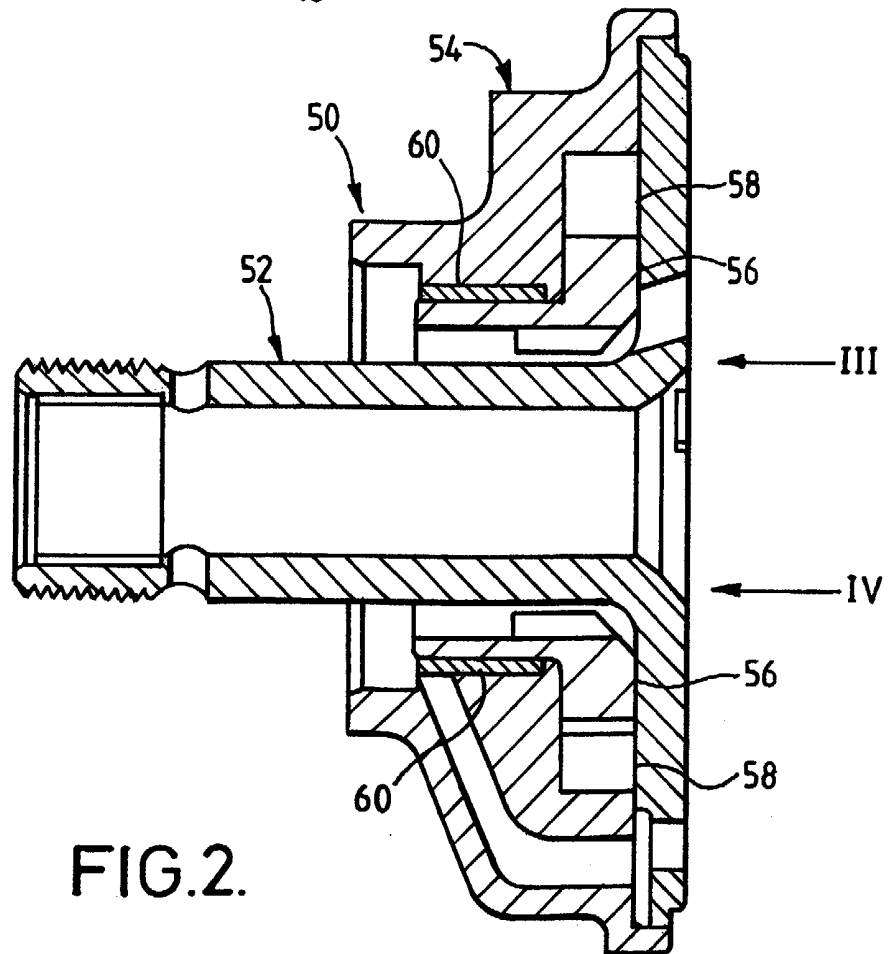


FIG.2.

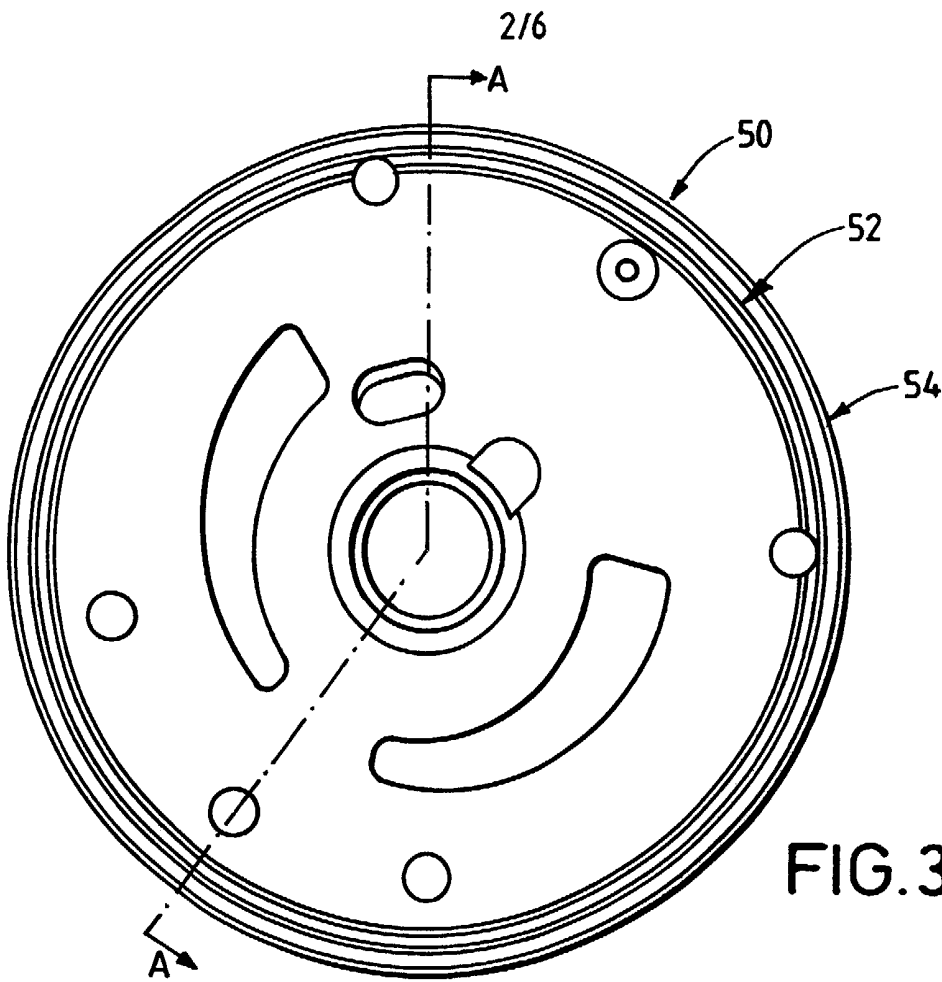


FIG. 3.

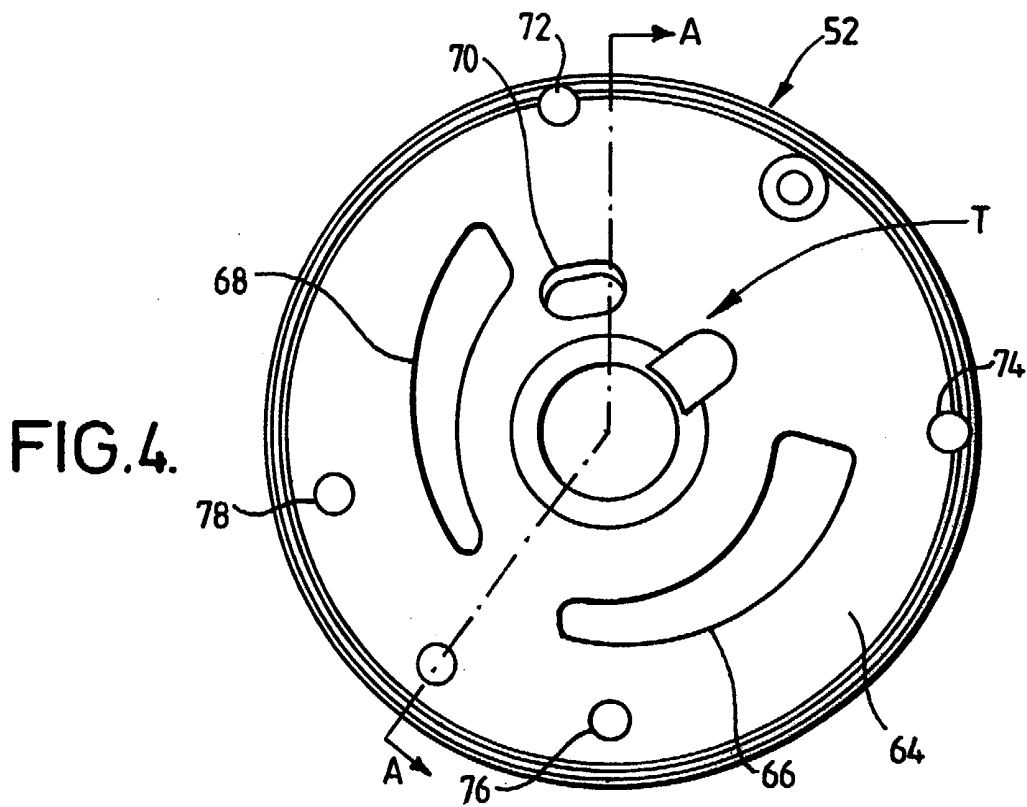


FIG. 4.

3/6

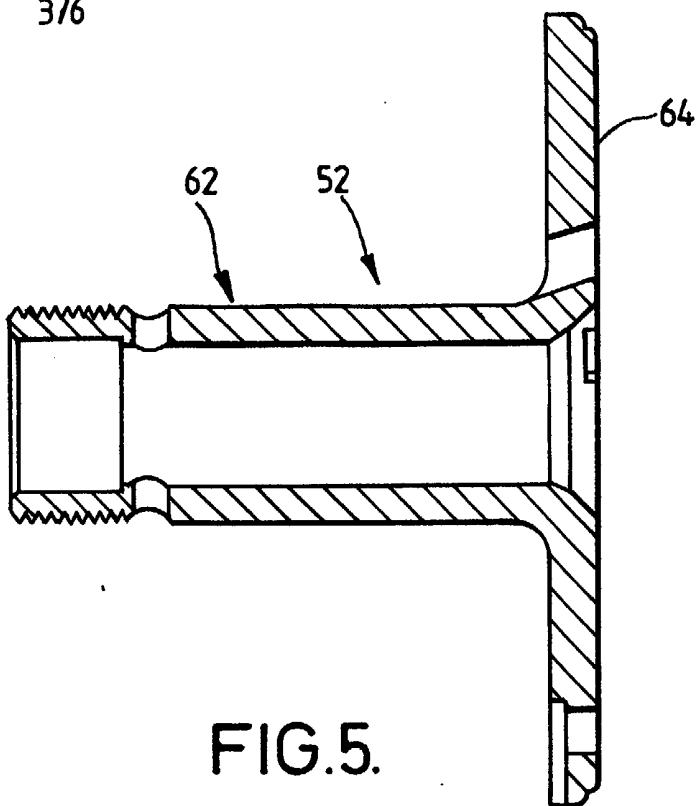


FIG. 5.

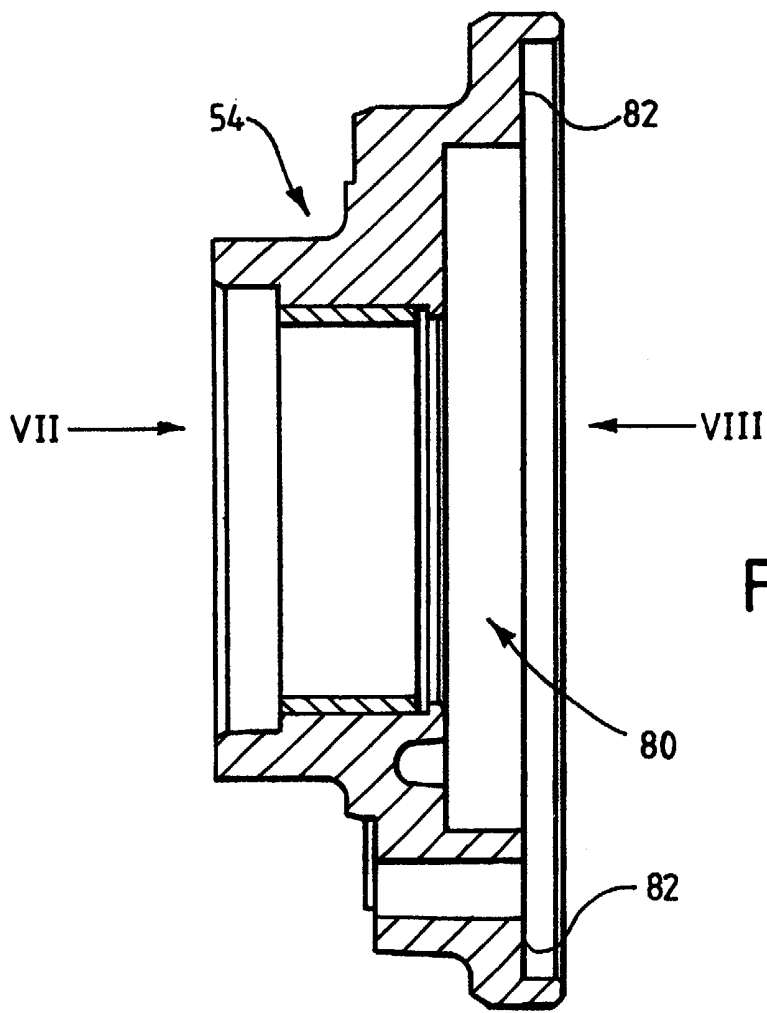


FIG. 6.

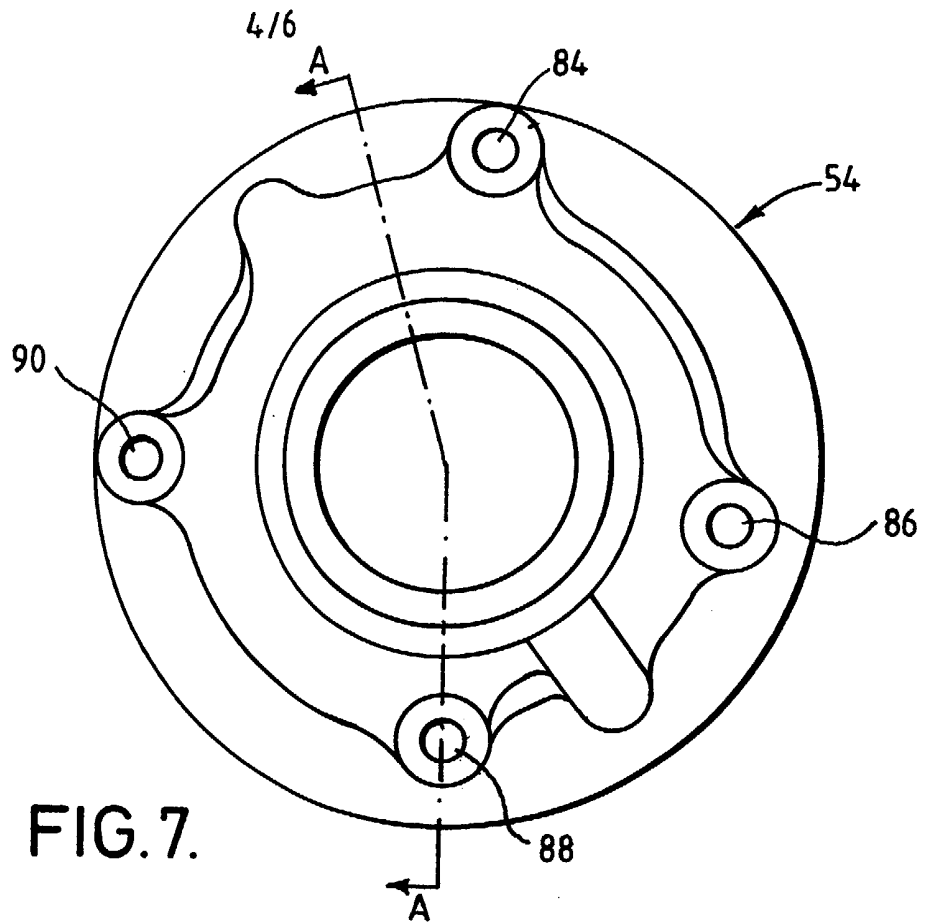


FIG. 7.

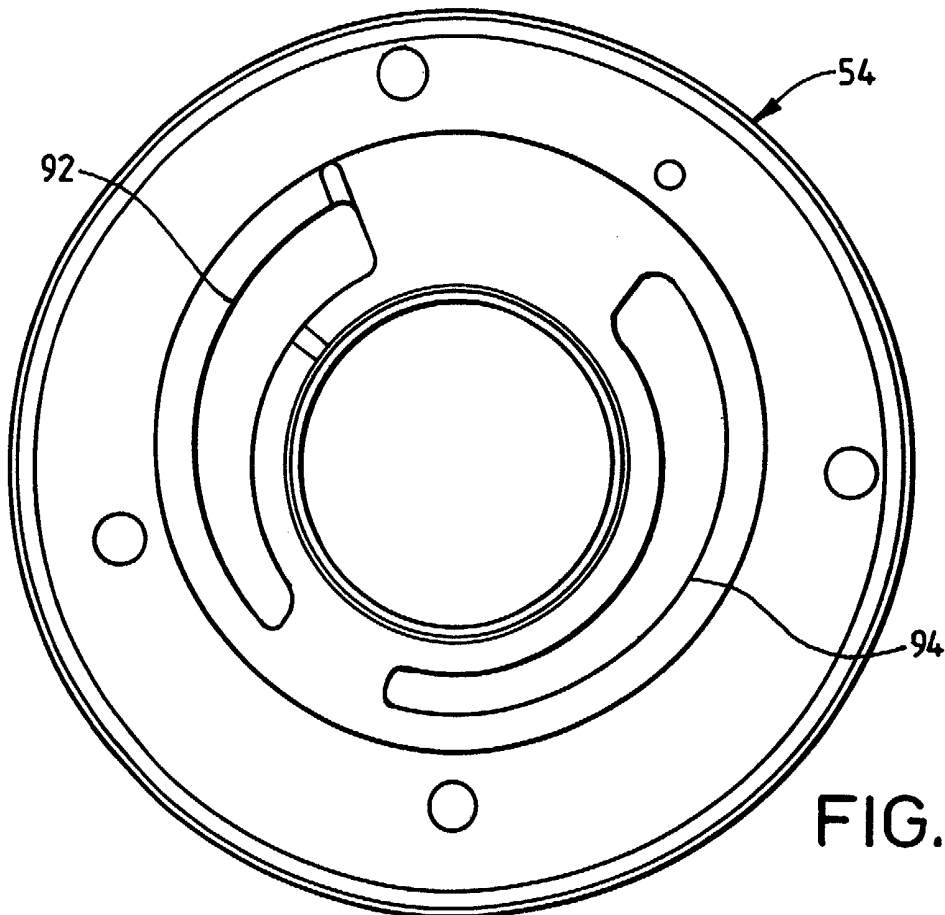


FIG. 8.

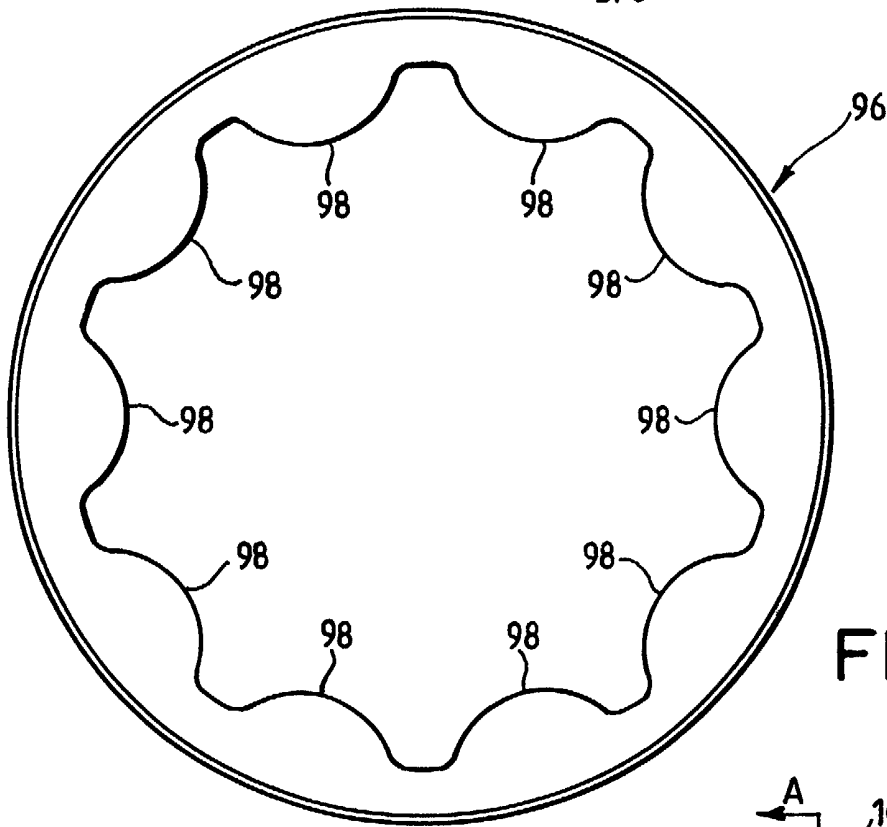


FIG. 9.

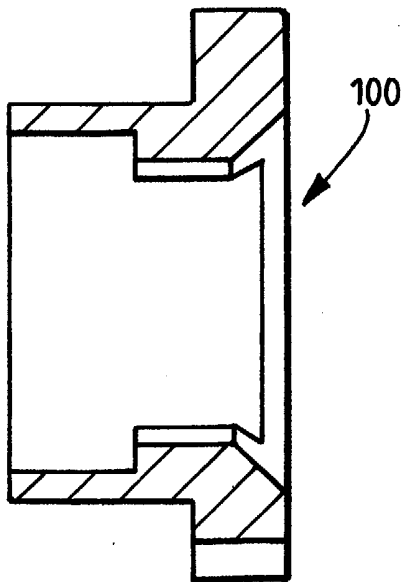


FIG. 11.

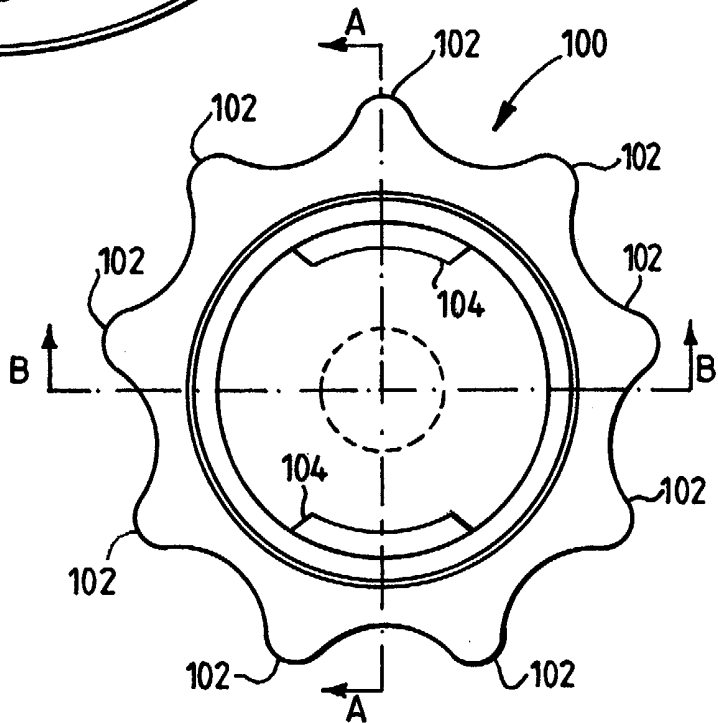


FIG. 10.

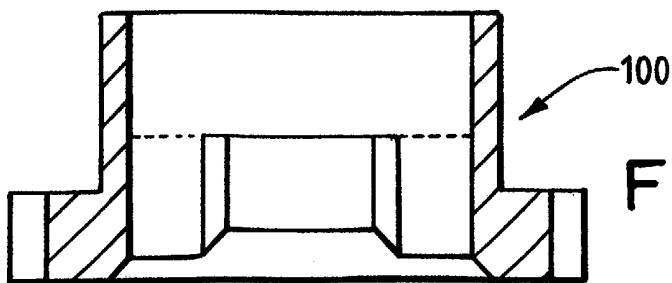


FIG. 12.

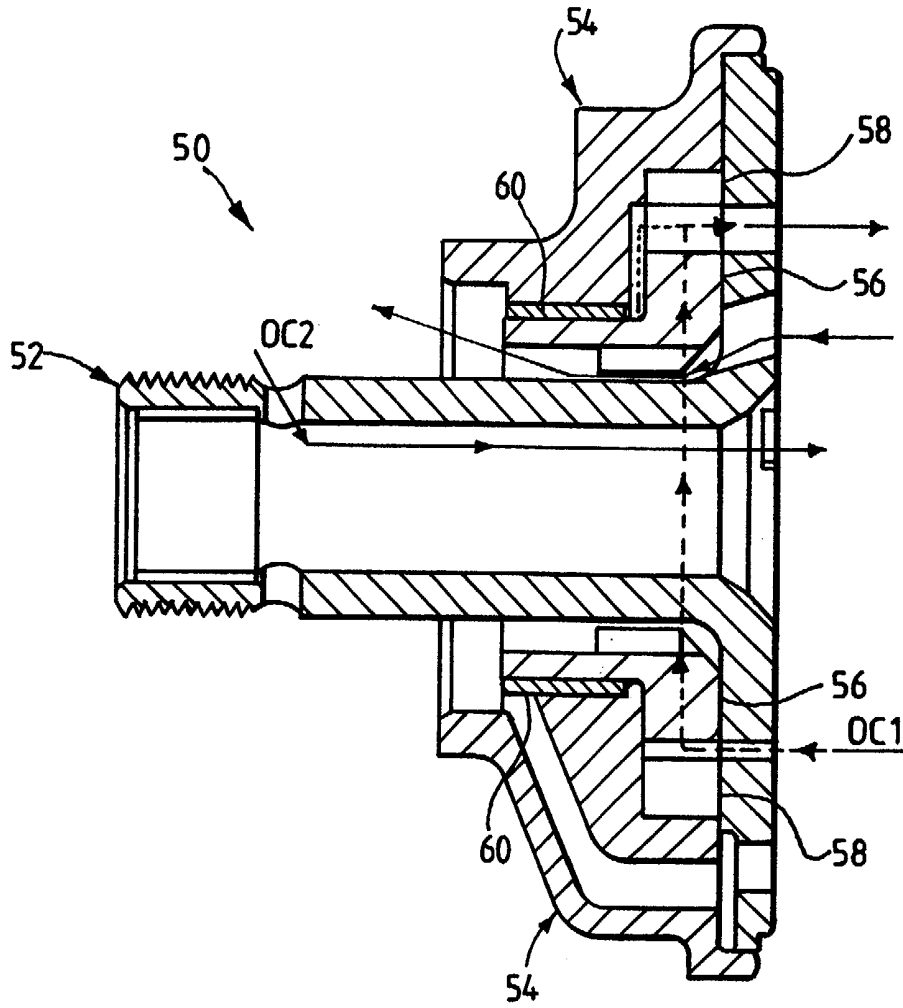


FIG.13.

Transmission Pump

The present invention relates to a transmission pump.

- 5 There exists a generic transmission pump design which is well known for use in vehicle transmissions.

Figure 1 is a cross section showing, below the longitudinal axis a transmission pump of known kind, and above the longitudinal axis, a transmission pump in accordance with
10 the invention

Referring to the lower half of Figure 1 of the drawings, a transmission pump 10 (for a vehicle transmission) comprises a static central shaft 12 for supporting a torque converter (TC) stator (of which only the sleeve 14a and pump drive tangs 14b are
15 shown), and a housing 16 fixable to the shaft. Pump mounting screws fix both shaft and pump housing firmly to the transmission housing in known manner (not shown). The shaft 12 comprises a flange part and a sleeve part the two parts being co-axial. The flange part has a larger external radius than the sleeve part and takes the form of a plate. An inner pumping member, in the form of a drive gear 18, and an outer pumping
20 member, in the form of a driven gear 20, are arranged in a space defined by the housing 16 and static central shaft 12.

The drive gear 18 is coupled to the TC via the tangs 14b on the end of the sleeve part 14a of the TC. In this way, whether the transmission is in gear or not the inner pumping
25 member (drive gear 18) rotates.

A first bush 22 is arranged in a bore of the inner pumping member (drive gear 18). The bush 22 is designed to bear the load of the rotating drive gear 18 outside it.

30 A second bush 24 is arranged on the housing 16 and is arranged to bear the load of the sleeve part 14a of the TC.

As briefly mentioned above, the shaft 12 comprises a plate 26. The plate 26 has an inlet and an outlet in the plate. The inlet and outlet (not shown) are rotationally spaced by a part of the plate (known as a "transfer area"). First and second recesses (not shown) in the housing correspond to the inlet and outlet in the plate in known manner.

5

In use, rotation of the drive gear 18 within the driven gear 20 causes a low pressure region adjacent the inlet of the plate 26. Oil flows from a transmission oil slump through the inlet into this low pressure region between the drive gear 18 and the driven gear 20. After the transfer area of the plate 26, the drive gear 18 and the driven gear 20 co-operate to define a reducing volume ie. a high pressure region. Oil is pumped around the drive gears through this high pressure region and exits the pump 10 via the outlet in the plate 20 transmission (to lubricate bearings, clutches, etc).

An aim of the invention is to provide an improved transmission pump.

15

According to the invention there is provided a transmission pump for a vehicle transmission, the pump comprising a static central shaft for supporting part of a torque convertor (TC), a housing fixable to the shaft, an inner pumping member and an outer pumping member arranged in a space defined by the housing and the shaft, the inner pumping member being coupleable to the TC to pump fluid through a flange of the shaft and wherein a bush is arranged to take the load of both the rotating inner pumping member and a rotating part of the torque convertor.

The invention has the advantage that one bush can be removed from the transmission pump of the known pump (see lower half of Figure 1).

The inner pumping member may comprise a drive gear or driven gear. The outer pumping member may comprise a driven gear or drive gear.

30 Although there are design restraints on the pump axial length, the bush may be longer due to the arrangement of the invention. The increase in length of the bush reduces the loading on any part of the bush bearing surface.

Preferably the bush is arranged on the housing.

5 Preferably, the shaft has no rotor journal machining. Therefore, the outside profile of the shaft may be more continuous than the above known shaft. Also, the shoulder between a plate of the shaft and a sleeve part of the shaft may be of the same diameter or more than the diameter of the sleeve part in the critical area for carrying load from the torque convertor. This is useful. This increase in diameter is allowable due to the removal of the cavity adjacent the drive gear in the prior art. The enlarged thickness of
10 the shaft in the critical area may have favourable repercussions in the choice of grade of material.

Preferably, the bush is arranged to receive high pressure oil lubrication adjacent the pump outlet, most preferably via a connecting groove or aperture from outlet towards
15 bush. This contrasts with the known design of housing bush which receives lubrication from the oil only after it has circulated round the transmission and is therefore at lower pressure. Also, on traditional designs there is a time delay in the oil reaching the bush bearing which can have a detrimental effect on bush wear during start up. Preferably the time it takes for oil to move from outlet to bush in the present invention is significantly
20 less the time it takes for lubricating oil to reach the bush in the prior art.

Preferably there is substantially zero relative movement between the torque convertor drive sleeve and the inner pumping member in which it locates.

25 A transmission pump will now be described by example only, and with reference to the remaining accompanying drawings, in which;

Figure 2 is a cross-section of a transmission pump in accordance with the invention, taken along the line A-A in Figure III,

30

Figure 3 is an end view of the transmission pump taken in the direction of arrow III in Figure 2,

Figure 4 is an end view of a centre shaft of the transmission pump of Figure 2, taken along arrow IV in Figure 2,

5 Figure 5 is a cross section of the shaft of Figure 4, taken along line A-A,

Figure 6 is a cross section of a housing of the transmission pump, taken in Figure 2,

Figure 7 is an external view of the housing of Figure 6, taken along the arrow VII in
10 Figure 6,

Figure 8 is a view into the housing of Figure 6, taken along arrow VIII in Figure 6,

Figure 9 is a view of an annulus of the transmission pump,
15

Figures 10, 11 and 12 are various views, of a drive gear of the transmission pump.
Figure 10 is an end view of the drive gear, a cross section of the drive gear, taken along
line A-A in Figure 10, and

20 Figure 12 is a section of the drive gear along line B-B in Figure 10,

Figure 13 is a schematic view of the transmission pump in accordance with the
invention in use.

25 Referring to Figures 2 and 3, a transmission pump assembly 50 comprises a shaft 52
and a housing 54. The shaft 52 and housing 54 define a recess and generally speaking,
an inner pumping member (in this embodiment a drive gear 56) and an outer pumping
member (in this embodiment a driven gear 58) are arranged inside the recess.

30 A bush 60 is arranged on the housing 54 adjacent an outer surface of the drive gear 56.

Further features of the transmission pump are as follows:

Referring to Figures 4 and 5, the shaft 52 comprises a cylindrical part 62 and an end plate 64. The end plate 64 has an inlet 66 and an outlet 68 rotationally spaced by a “transfer area” T (between the larger area ends of the inlet and outlet). The plate 64
5 comprises an aperture 70 for lubricating oil to pass via the inside surface of the drive gear 56 to a TC (see upper half of Figure 1). The plate 64 also comprises apertures 72, 74, 76 and 78 spaced about its periphery. The apertures 72, 74, 76 and 78 are designed to co-operate with corresponding apertures in the housing.

10 Referring to Figure 6, the housing 54 comprises a recess 80 through which the cylindrical part 62 of the shaft 52 is fed. The plate 64 of the shaft 52 abuts against a shoulder 82 of the housing 54.

The housing 54 comprises apertures 84, 86, 88 and 90 which correspond with,
15 respectively, apertures 72, 74, 76 and 78 on the plate 64. The apertures 72, 74, 76 and 78 on the plate 64 and apertures 84, 86, 88 and 90 of the housing 54 are arranged to allow clearance of bolt fasteners. Tapped holes (not shown) corresponding to above apertures 72, 74, 76, 78, 84, 86, 88 and 90 are provided in the transmission in known manner. Bolt fasteners (not shown) are passed through apertures 72, 74, 76, 78, 84, 86,
20 88 and 90 and screw into the tapped holes. The housing and shaft are therefore clamped to transmission housing by bolt fasteners.

Referring to Figure 8, the housing 54 comprises a first recess 92 and a second recess 94. The recesses 92, 94 correspond to the inlet and outlet 66, 68 of the plate 64 of the shaft
25 52.

Referring to Figure 9, the pump 50 comprises a driven gear in the form of an annulus 96, which has a circular periphery and inner teeth 98.

30 Referring to Figures 10 to 12, the pump 50 comprises an inner pumping member (in this embodiment a drive gear in the form of a rotor 100), which comprises teeth 102 spaced about its periphery intended to co-operate with recesses between teeth 98 on the

annulus 96. The drive gear 100 comprises two abutments 104. The abutments 104 are intended to co-operate with drive tangs 106 of a torque convertor (TC), see upper half of Figure 1.

5 Referring to Figure 13, in use, the transmission pump 50 works in a somewhat similar way to the prior art transmission pump. However, it will be noted that a single bush located on the housing 54 outside the tangs 100 of TC and the coupled rotor 100 replace the two separate bushes 22, 24 located inside the rotor 18 and outside the tangs, 14 of the TC in the prior art.

10

OC1 is the main oil pump circuit. Oil enters pump 50 via inlet port in centre rotor shaft, is pumped around the rotor set and exits pump via outlet port in centre shaft.

15 OC2 is the secondary oil circuit. Some oil at a lower pressure is returned to the pump 50. This oil travels under the rotor 100 and is fed to the TC. Oil returns to the sump via hollow centre of shaft part 52. Note, lower pressure oil is what was used in the prior art to lubricate the inner bush 22.

20 Although, there are restraints on the actual length of the transmission pump, due to the arrangement of the invention, the single bush can be increased in length. In the embodiment shown, the bush is 20mm long.

25 Due to the arrangement, there is direct high pressure oil feed to the bush 60. This means that the pressure of the oil to the bush is higher than in the prior art.

30

Also, due to the change in the rotor 60, no rotor journal machining is required. This allows the shaft 52 in the region where the cylindrical part 62 meets the plate 64 to be thicker and therefore stronger.

30

Claims

1. A transmission pump for a vehicle transmission, the pump comprising a static central shaft for supporting part of a torque convertor (TC), a housing fixable to the shaft, an inner pumping member and an outer pumping member arranged in a space defined by the housing and the shaft, the inner pumping member being coupleable to the TC to pump fluid through a flange of the shaft, wherein a bush is arranged to take the load of both the rotating inner pumping member and a rotating part of the TC.
2. A transmission pump according to Claim 1, wherein the inner pumping member comprises a drive gear.
3. A transmission pump according to Claim 1, wherein the inner pumping member comprises a driven gear.
4. A transmission pump according to Claim 1 or 2, wherein the outer pumping member comprises a driven gear.
5. A transmission pump according to Claim 1 or 3, wherein the outer pumping member comprises a drive gear.
6. A transmission pump according to any preceding claim, wherein the bush is arranged on the housing.
7. A transmission pump according to any preceding claim, wherein the shaft has no rotor journal machining.
8. A transmission pump according to any preceding claim, wherein a shoulder between a plate of the shaft and a sleeve part of the shaft is of the same diameter or more than the diameter of the sleeve part in the critical area for carrying load from the torque convertor.

9. A transmission pump according to any preceding claim, wherein the bush is arranged to receive high pressure oil lubrication adjacent the pump outlet.

10. A transmission pump according to Claim 9, wherein the bush is arranged to receive high pressure oil lubrication via a connecting groove or aperture from outlet towards bush.

11. A transmission pump according to any preceding claim, wherein there is substantially zero relative movement between the torque convertor drive sleeve and the inner pumping member in which it locates.

12. A transmission pump substantially as described herein with reference to any one or more of Figures 1 to 13 (in Figure 1 only the upper half of the drawing applies) and of the drawings.



INVESTOR IN PEOPLE

Application No: GB 0205214.0
Claims searched: 1-12

9

Examiner: J. C. Barnes-Paddock
Date of search: 22 January 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,2,4,6,7 9,10,11	DE4301493 A (FORD WERKE) See Figure 2 and WPI abstract accession No: 1994- 235815 [41]. Unitary flanged shaft and single bush supporting pump inner rotor and drive.
X	1,2,4,6,7 9-11	EP0997666 A (FUJI) See Figure 1 and para 0025 Bush 22 bears converter and pump components.
X	1,2,4,7,11	DE4312053 A (ZAHNRADFABRIK) See Figures 1 and 2 and WPI abstract accession No: 1994-325262 [41]. Inner radial and gear pump members and pump drive supported on same bush about flanged shaft. .
X	1,2,4,6,7	JP050044814 A (NISSAN) See Figure 4 and PAJ abstract. Single bush supports pump shaft and axially extended inner gear rotor.
X	1,2,3,6,7 11	US3252352 (FORD) See Figures 1. Single drive and gear rotor bush.
X	1,2,4 6-8,11	US2950630 (BORG WARNER) See Figure 1. Integral flanged shaft with single bush supporting pump inner rotor and drive
X	1,2,3,6-8 11	US2861480 (TOWMOTOR) See Figures 1 and 8 and col 6, lines 16-30. . Housing bush supports pump inner rotor and drive, note integral shaft/flange

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.



INVESTOR IN PEOPLE

Application No: GB 0205214.0
Claims searched: 1-12

10

Examiner: J. C. Barnes-Paddock
Date of search: 22 January 2003

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKCV:

F1F; F2W

Worldwide search of patent documents classified in the following areas of the IPC⁷:

F16H

The following online and other databases have been used in the preparation of this search report:

Online: WPI, EPODOC, PAJ , TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1