



(12) **EUROPEAN PATENT APPLICATION**

(21) Application number : **94300461.4**

(51) Int. Cl.⁵ : **F04B 1/20**

(22) Date of filing : **21.01.94**

(30) Priority : **21.01.93 GB 9301163**

(43) Date of publication of application :
27.07.94 Bulletin 94/30

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

(88) Date of deferred publication of search report :
21.12.94 Bulletin 94/51

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(54) **Axial piston pump.**

(57) An axial piston pump comprises a drive shaft (2), a cylinder block (4) rotatable with the drive shaft (2), a plurality of pistons (6a-6i) provided within the cylinder block (4), a swashplate (12) situated at one axial end of the cylinder block (4) for causing reciprocation of the pistons (6a-6i) when the said cylinder block (4) is rotated, and a valve plate (26) situated at a second axial end of the cylinder block (4); wherein either one of the cylinder block (4) or valve plate (26) is urged against the other to form a hydrostatic seal between the cylinder block (4) and a face (52) of the said valve plate (26). The pump may be characterised by one or both of the following features :-

A spiral groove bearing (50) is provided between the valve plate (26) and the cylinder block (4).

The valve plate (26) is urged against the cylinder block (4) by means of a second piston (60) which has an arcuate load face.

Additionally, an axial piston pump comprises a drive shaft (2), a cylinder block (4) rotatable with the drive shaft (2), a plurality of pistons (6a-6i) provided within the cylinder block (4), a swashplate (12) situated at one axial end of the cylinder block (4) for causing reciprocation of the pistons (6a-6i) when the cylinder block (4) is rotated; the said swashplate (12) being provided with a curved back, the curved back being seated within a curved recess in a swashplate cradle (14), a hydrostatic bearing (70, 72) being formed between the said curved back of the swashplate (12) and the curved recess of the swashplate cradle (14), and the said swashplate (12) being capable of swivelling within the said recess; wherein high pressure oil is supplied to

the said hydrostatic bearing (70,72) via a passage provided in at least one of the said pistons and via a hole (80) provided in the body of the said swashplate (12).

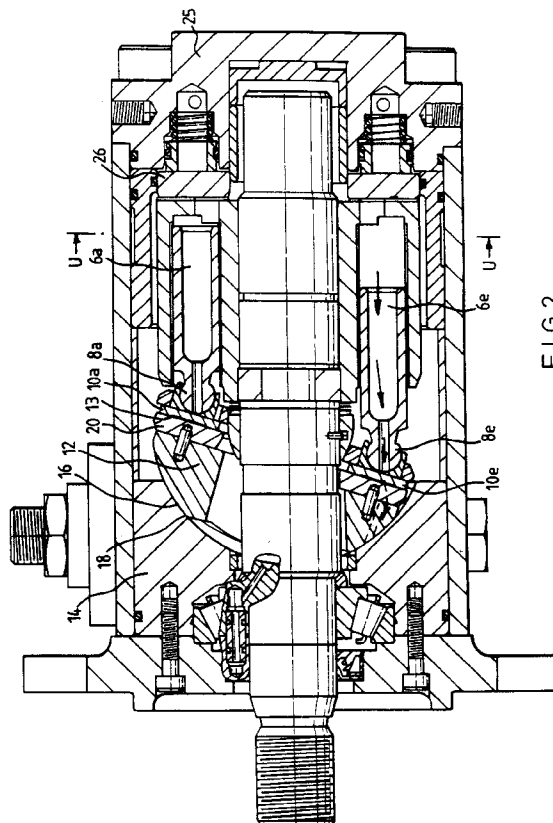
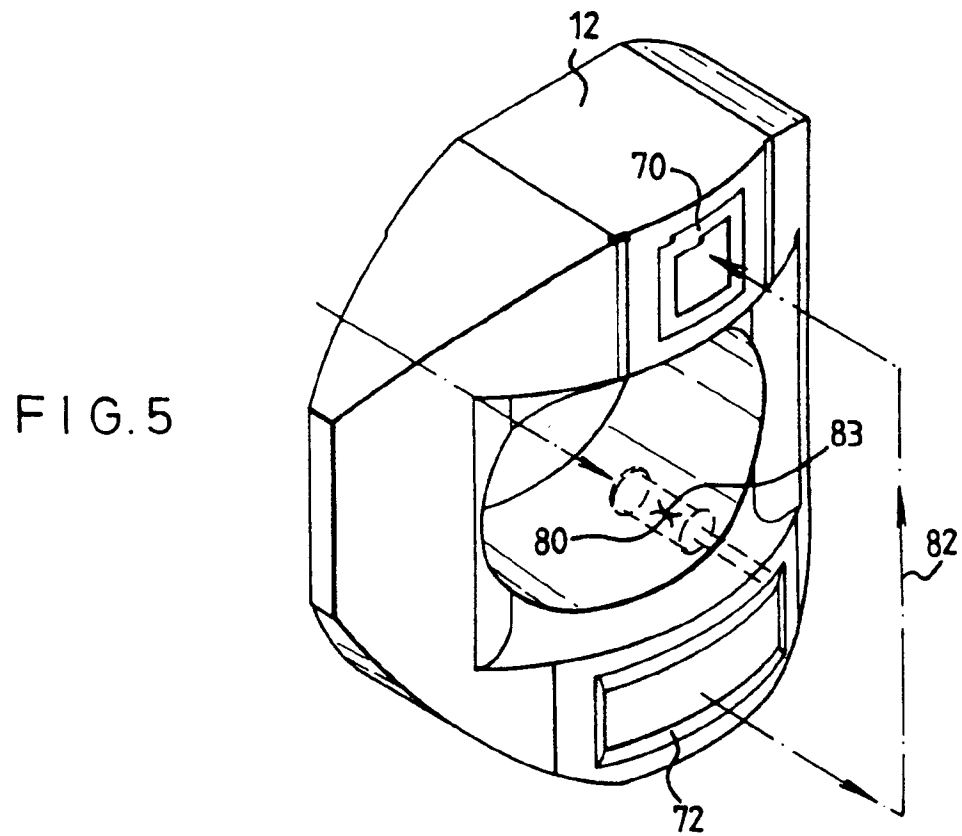
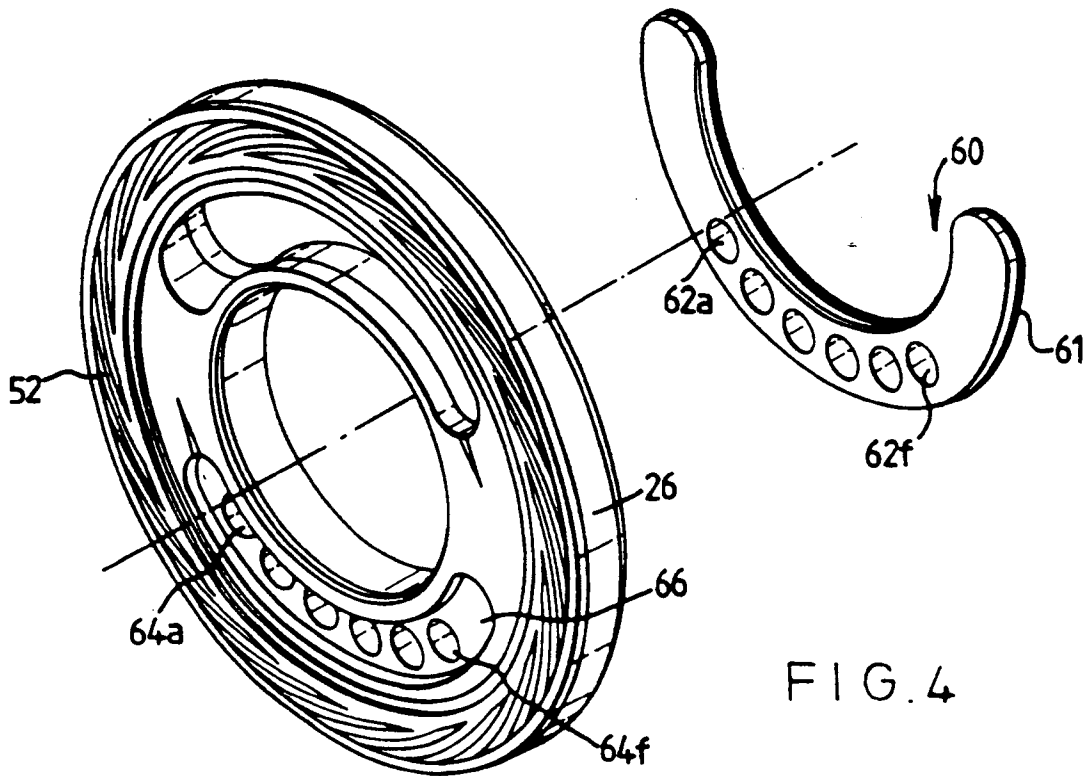


FIG. 2





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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 0461

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.5)
Y	DE-A-41 25 391 (TOYODA) * column 6, line 7 - column 7, line 20; figures 1-3 *	1,3-8	F04B1/20
Y A	DE-A-16 53 565 (BEIEN) * column 5, line 7 - column 7, line 10; figures 1-3 *	1,2,4-8	
Y	PATENT ABSTRACTS OF JAPAN vol. 10, no. 342 (M-536) (2398) 19 November 1986 & JP-A-61 144 423 (MITSUBISHI) 2 July 1986 * abstract *	1-8	
A	DE-A-15 28 471 (VAN DER LELY) * page 18, paragraph 1; figures 10,13 *	1,2,5,6	
A	US-A-3 487 788 (THOMA) * column 2, line 70 - column 3, line 19; figures 1,3 *	1,4,6	
A	US-A-4 624 175 (WAHLMARK) * column 5, line 15 - line 21; figures 1,2 *	1,3,5,7	TECHNICAL FIELDS SEARCHED (Int.Cl.5) F04B F01B F16C F03C
X	US-A-2 241 701 (DOE) * page 1, right column, line 45 - page 2, left column, line 29; figures 1,2,4 *	9,10,12	
X	EP-A-0 175 206 (HITACHI) * page 12, line 21 - page 13, line 28; figures 5,6 *	9,10,12	
X	US-A-3 495 542 (KRAZENBERG) * column 5, line 34 - line 66; figure 2 *	9	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 September 1994	Examiner Bertrand, G
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 03.92 (P04C01)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

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- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 0461

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.5)
A	GB-A-1 026 343 (LUCAS) * page 2, line 21 - line 59; figures 1,2 *	9,11	
X	FR-A-2 124 739 (ROBERT BOSCH) ---	13,14, 16-18	
Y	* page 2, line 18 - page 8, line 21; figures 1-7A *	15	
X	EP-A-0 241 898 (THE OILGEAR COMPANY) * page 4, line 21 - page 8, line 33; figures 1-5 *	13,14, 16-18	
X	US-A-4 903 577 (LOFFLER) * column 3, line 4 - line 63; figures 1-4 *	13,14, 17,18	
Y	GB-A-2 134 188 (LINDE) * page 3, line 97 - line 106; figures 5,6 *	15 13,14	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
The present search report has been drawn up for all claims			
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EP 94 30 0461 -B-

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-8,19: Axial piston pump having a spiral groove bearing between the valve plate and the cylinder block
2. Claims 9-12: Axial piston pump wherein the valve plate is urged against the cylinder block by a piston
3. Claims 13-18: Axial piston pump having a hydrostatic bearing between the swashplate and the swashplate cradle