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54 Positive displacement pumps.

57 A pump has inner and outer lobed rotors (11,12) which define between them a series of pumping chambers. An inlet passage (18) to the pump has a restriction (19) which causes cavitation in the pump when the pump speed rises above a predetermined value. Two outlet passages (20,21) are also provided and interconnect via a non-return valve (24). The interconnection of the two outlet passages ensures that even when cavitation is caused in the pump there is no reverse flow in the outlet passages. In this way less noisy operation of the pump may be achieved.

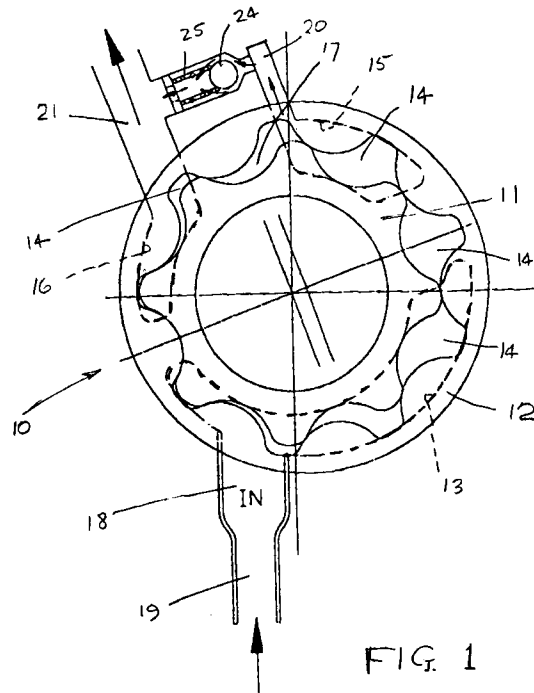


FIG. 1

This invention relates to positive displacement pumps and has a particularly useful but not exclusive application in pumps for supplying lubricant to internal combustion engines.

According to this invention in one aspect there is provided a gerotor or lobe-type pump comprising a housing in which inner and outer lobed rotors are mounted for rotation, said rotors defining between them a series of pumping chambers, said housing having an inlet passage leading to an inlet port for admitting a working fluid to the chambers, a restriction in said inlet passage, and two outlet ports through which the working fluid from said inlet port is discharged into respective discharge passages, said outlet ports being sealed from each other, the discharge passage leading from one of said outlet ports communicating through a spring-loaded non-return valve with the (main) discharge passage leading from the second of said outlet ports, said valve being opened by the pressure of the working fluid in said one discharge passage when said pressure rises to a value sufficient to overcome the loading on said valve.

The restriction may be fixed. Alternatively the restriction may be controlled by means responsive to the temperature of the working fluid so as to reduce the restriction when said temperature is low.

The invention will now be described in more detail with reference by way of example to the accompanying diagrammatic drawings in which:

Figures 1 and 2 respectively show a positive displacement pump according to the invention in operating in its low-speed and high speed conditions respectively.

Referring first to Figure 1 of the drawings, the system is intended to supply lubricating oil to the main oil gallery of an internal combustion engine. For this purpose a gerotor or $N(N+1)$ pump 10 is employed comprising in the known manner inner and outer lobed rotors 11, 12 the outer rotor 12 being rotatable in a recess in the pump housing (only part of which is shown), and the inner rotor 11 being mounted eccentrically with respect to the outer rotor on a drive shaft (not shown). The housing provides axial faces at opposite axial sides of the assembly of the two rotors 11, 12 and an inlet port 13 formed in one of the axial faces extends over the part of the cycle during which the pumping chambers 14 formed between the rotors are increasing in volume. Two outlet ports 15, 16 are also formed at circumferentially spaced locations in the housing and are sealed from each other by a sealing land 17 in the said one axial face of the housing. The two outlet ports jointly extend over the part of the cycle during which the pumping chambers 14 are decreasing in volume. The sealing land 17 has a circumferential extent such that as each pumping chamber becomes cut off from the first outlet port 15 it comes into communication with the second outlet port 16.

The working fluid, which is oil in this instance, is fed to the inlet port 13 through an inlet passage 18 and is discharged under pressure, partly through port 15 and partly through port 16. First and second discharge passages 20, 21, lead from the respective outlet ports. The second discharge passage constitutes the main discharge passage and leads to the main oil gallery (not shown) of the engine.

The first discharge passage 20 communicates with the main discharge passage 21 through a non-return valve 24 loaded by a light spring 25, so that when the pressure in the first discharge passage exceeds that in the second discharge passage the valve is opened and oil flows from the first into the main discharge passage.

A restriction 19, which may be fixed or adjustable, is provided in the inlet passage 18 to the pump and is designed to cause cavitation in the pump when the pump speed rises above a value at which the pump delivery pressure and volume reach values which are adequate for engine speeds up to the maximum. In consequence the pump chambers begin to be filled with oil vapour and liquid oil instead of just liquid oil, and since compression of the vapour requires the expenditure of less energy than for liquid oil, the power expended in compressing the contents of the pumping chambers is reduced and the load on the engine is reduced correspondingly. Also, since the discharge through the second outlet port determines the pressure in the outlet passage, no reverse flow of oil and vapour from the second discharge passage into the pumping chambers will occur, and since the valve is a non-return valve and will not permit flow from the first into the second discharge passage until the pressure in the first discharge passage equals that in second discharge passage, there is no reverse flow into the first discharge passage, and consequently the cavitation results in less noisy operation than would otherwise be the case.

It will be understood that the position of the sealing land between the first and second outlet ports can be selected to alter the proportion of the oil discharged through the two ports in relation to each other.

The cavitation effect may be achieved by using an inlet pipe to the pump of appropriately small diameter, instead of a restrictor, but it may be advantageous to employ a restrictor controlled by a thermostat responsive to the oil temperature to avoid cavitation at too low a pump speed when the ambient air temperature is low and the oil is more viscous, or under starting conditions of the engine.

55 Claims

1. A gerotor or lobe-type pump comprising a housing in which inner and outer lobed rotors are

mounted for rotation, said rotors defining between them a series of pumping chambers, said housing having an inlet passage leading to an inlet port for admitting a working fluid to the chambers, a restriction in said inlet passage, and two outlet ports through which the working fluid from said inlet port is discharged into respective discharge passages, said outlet ports being sealed from each other, the discharge passage leading from one of said outlet ports communicating through a spring-loaded non-return valve with the main discharge passage leading from the second of said outlet ports, said valve being opened by the pressure of the working fluid in said one discharge passage when said pressure rises to a value sufficient to overcome the loading on said valve.

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2. A pump as claimed in claim 1, wherein the restriction is a fixed restriction.

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3. A pump as claimed in claim 2, wherein the restriction is provided by a small diameter inlet pipe to the inlet port.

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4. A pump as claimed in claim 1, wherein the restriction is a variable restriction controlled by means responsive to the temperature of the working fluid so as to reduce the restriction when said temperature is low.

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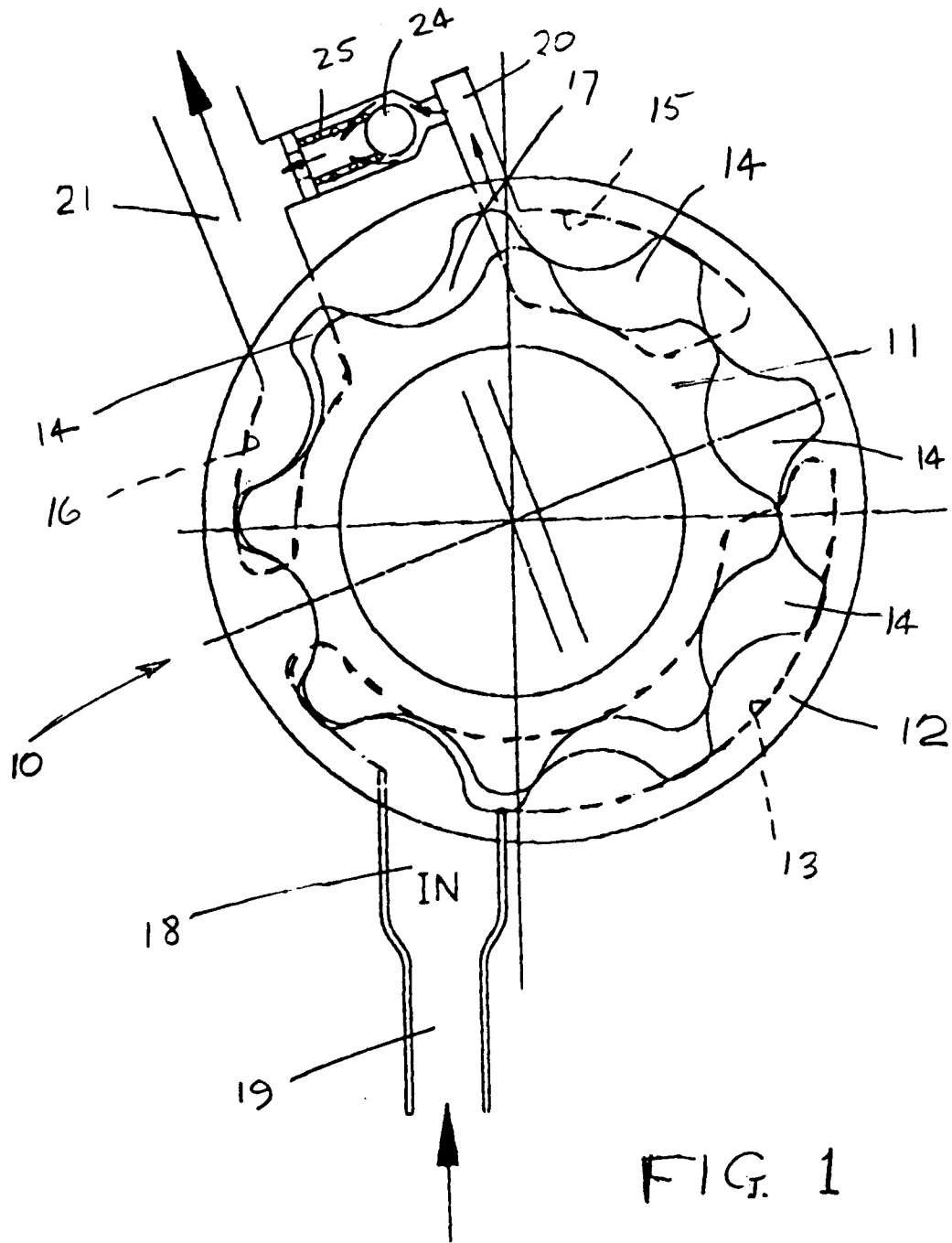
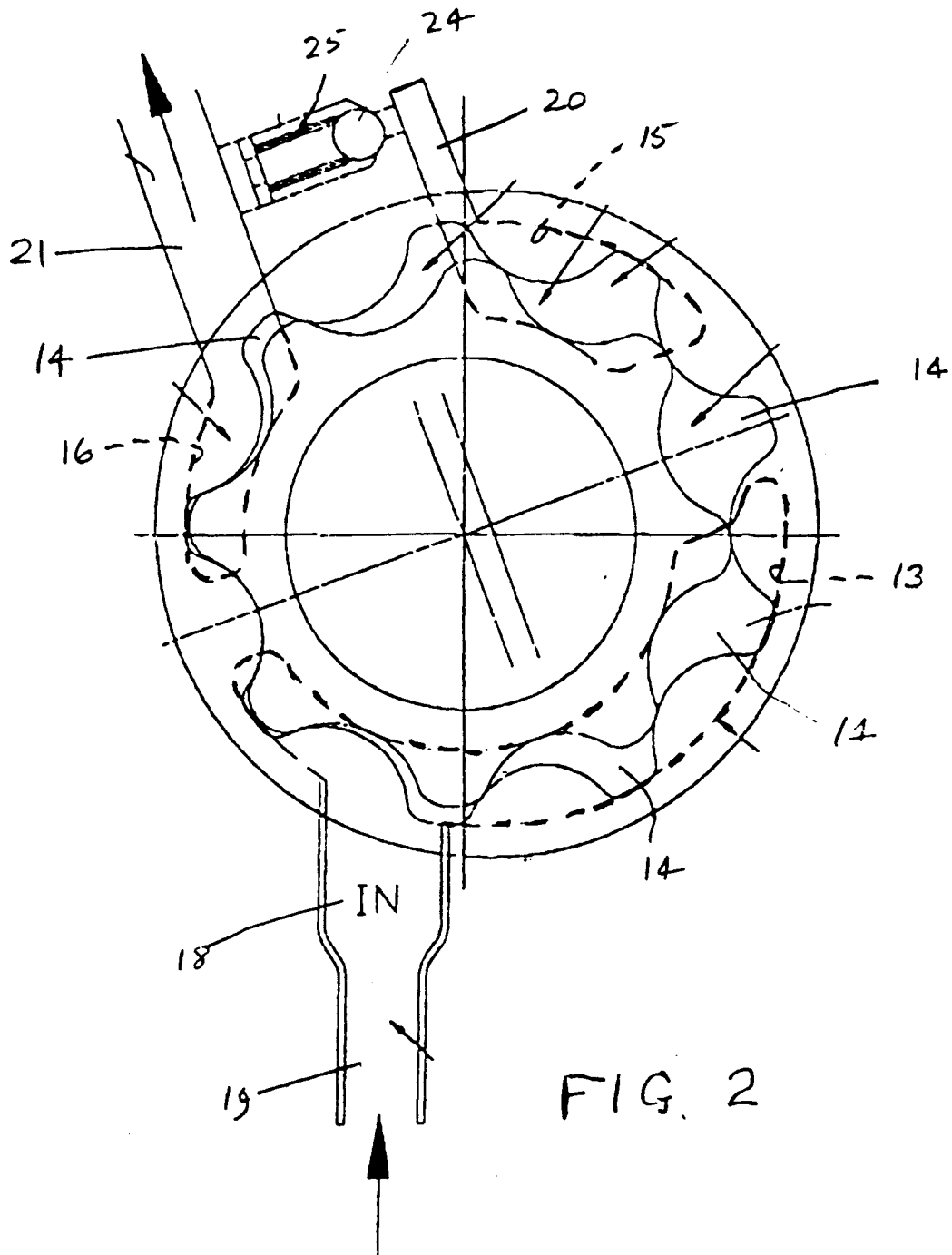


FIG. 1





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 8838

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.6)
X Y	GB-A-2 259 333 (ALFRED TEVES) * page 2, line 7 - page 3, line 4 * * page 3, line 28 - page 5, line 3 * * page 7, line 27 - page 8, line 7; figure 5 * * page 8, line 25 - page 9, line 19; figure 7 * * page 9, line 20 - line 37; figure 8 * ---	1-3 4	F04C15/04 F04C15/00
Y	GB-A-1 081 711 (ROBERT BOSCH) * page 2, line 57 - page 3, line 62; figures 1, 2 * * page 4, line 44 - line 112; figure 4 * * page 4, line 128 - page 5, line 26; figure 5 * ---	4	
A	EP-A-0 561 304 (EISENMANN) * column 1, line 1 - line 26 * * column 3, line 15 - column 4, line 49 * * column 5, last paragraph * * column 6 - column 9; figures * -----	1, 4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F04C F01C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 March 1995	Examiner Kapoulas, T
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			

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