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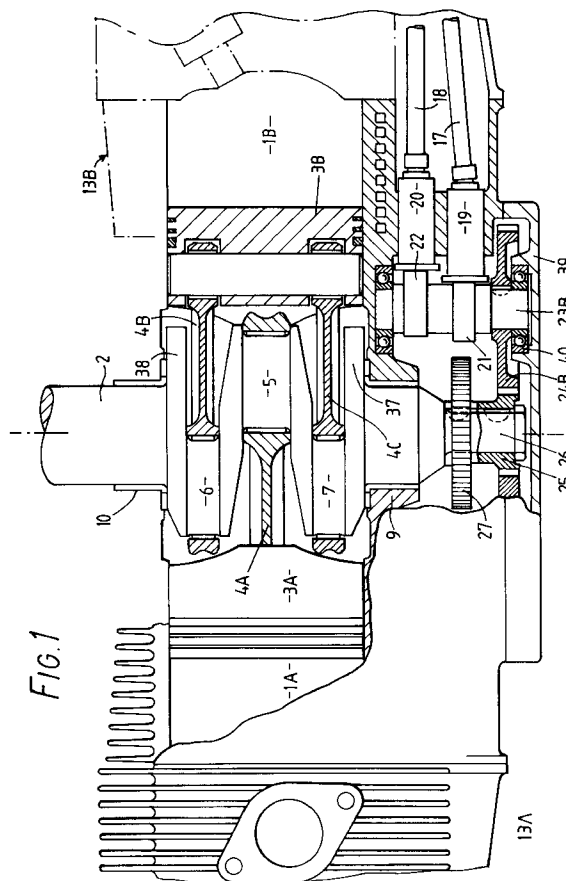
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(54) **Internal combustion engines.**

(57) A piston and cylinder machine, such as an internal combustion engine, has a pair of fixed coaxial cylinders (1A,1B) mounted on a crankcase which rotatably supports a rotary crankshaft (2) with the cylinders on opposite sides of the crankshaft. Each cylinder (1A,1B) has a respective piston (3A,3B) slidable in it. One piston (3A) is connected to a first crankpin (5) of the crankshaft by a single connecting rod (4A). The other piston (3B) is connected by second and third connecting rods (4B,4C) to second and third crankpins which are separated by the first crankpin and spaced from it by 180°.



The present invention relates to piston-and-cylinder machines having at least one pair of co-axial cylinders on opposite sides of a crankshaft, a piston in each cylinder, and connecting rods connecting the pistons to eccentric portions of the crankshaft.

An engine according to the present invention is characterised in that one piston of the pair is connected to a first eccentric portion of the crankshaft by a first connecting rod and the other piston is connected by second and third connecting rods to second and third eccentric portions of the crankshaft which are located on opposite sides, axially, of the first eccentric portion and are both spaced 180° from the first eccentric portion.

With such an arrangement, the pistons are reciprocated in their respective cylinders in phase with each other. Thus, in the case of a four-stroke internal combustion engine, the working chambers can fire alternately, with firing intervals of one revolution of the crankshaft.

By making the weight of each second and third connecting rod to be half of that of the first connecting rod and with corresponding weight distributions, complete balancing of the engine can be obtained by the use of simple counter weights on the crankshaft.

Advantageously, a crankcase enclosing the connecting rods crankshaft and rotatably supporting the crankshaft is divided at a plane through the crankshaft axis perpendicular to the common axis of the two cylinders. With this arrangement, the pistons connecting rods and crankshaft can be assembled together, the pistons inserted into their respective cylinders in the two crankcase halves and the latter then brought together to support the crankshaft.

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

Figure 1 is a horizontal section through a four-stroke internal combustion engine in accordance with the invention with portions removed for clarity;

Figure 2 is an elevational view from the rear of the engine with the timing cover removed; and

Figure 3 is a view of a crankcase half in the direction of the arrows III in figure 2, with the crankshaft and pistons removed.

The engine shown in the drawings has a pair of coaxial opposed cylinders 1A and 1B on opposite sides of the crankshaft 2. The pistons 3A and 3B are slidable in the cylinders 1A and 1B. The piston 3A has a connecting rod 4A articulated to it, the big end of the connecting rod 4A having a bearing running on a crankpin 5 of the crankshaft 2. The piston 3B is similarly connected by a pair of connecting rods 4B and 4C to two further crankpins 6 and 7 which are each disposed at 180° to the first crankpin 5. As can be seen in figure 1, the small ends of the connecting rods 4B and 4C are articulated to the piston 3B by means

of a gudgeon pin 8B.

The crankshaft 2 is rotatably mounted in bearings 9 and 10 in a crankcase which is divided at a vertical plane 11 into two crankcase halves 12A and 12B. The plane 11 passes through the axis of the crankshaft 2 at right angles to the common axis of the two cylinders 1A and 1B.

Each cylinder is closed by a cylinder head 13A, 13B having twin inlet valves 14 and a single exhaust valve 15. The valves 14 and 15 are operated in the normal manner by rockers such as 16, push rods 17, 18 and hydraulic self-adjusting tappets 19 and 20 engaging respective cam tracks 21 and 22 on cam shafts 23A and 23B, one for each cylinder. Each cam shaft 23 carries a timing gear 24 meshing with a timing gear wheel 25 of half the diameter of that the gear wheel 24, mounted on an extension 26 of the crankshaft 2, this extension also carrying a further gear wheel 27, the driving an input gear 28 of an alternator. An oil pump 29 has its jut shaft driven by a gear wheel 30 meshing with the camshaft wheel 23A and delivers pressurised oil in the normal manner to the crankshaft bearings through an oil filter 31.

Inlet air for the two cylinders is delivered from an intake duct 32 including a throttle 33 to ducts 34A and 34B supplying the respective inlet valves 14A and 14B.

The mass of the single connecting rod 4A is twice that of either of the connecting rods 4B or 4C. The combined weight distribution of the two rods 4B and 4C along their lengths is the same as that of the single rod 4A. The motion of the two pistons is equal and opposite at all positions of the crankshaft. Accordingly, complete mechanical balance is obtained by appropriate construction of counter weights 37 and 38 on the crankshaft 2. The rear end of the crankcase is closed by a timing cover 39 housing bearings 40 for the cam shafts 23.

Claims

1. A piston and cylinder machine having at least one pair of fixed coaxial cylinders (1A, 1B) on opposite sides of a rotatably mounted crankshaft (2), a piston (3A, 3B) in each cylinder, and connecting rods connecting the pistons to eccentric portions of the crankshaft, wherein one piston (3A) is connected to a first eccentric portion (5) of the crankshaft (2) by a first connecting rod (4A) and the other piston (3B) is connected by second and third connecting rods (4B, 4C) to second and third eccentric portions (6, 7) of the crankshaft which are located on opposite sides, axially of the first eccentric portion (5) and are both spaced 180° from the first eccentric portion (5).
2. A machine according to claim 1, wherein the

weight of each second and third connecting rod is half that of the first connecting rod.

3. A machine according to claim 1 or 2, wherein a crankcase enclosing the connecting rods and crankshaft and rotatably supporting the crankshaft is divided at a plane through the crankshaft axis perpendicular to the common axis of the two cylinders.

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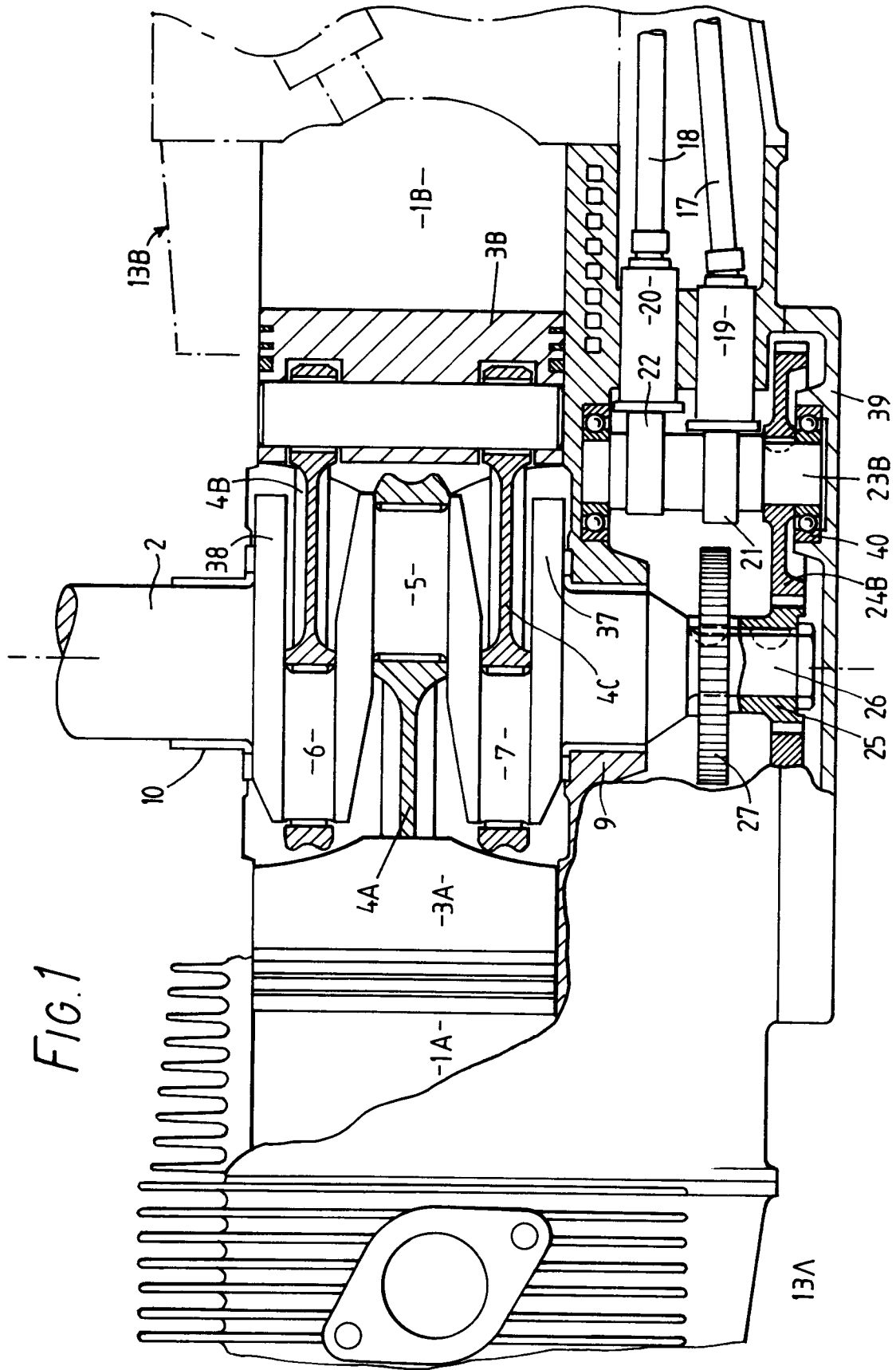
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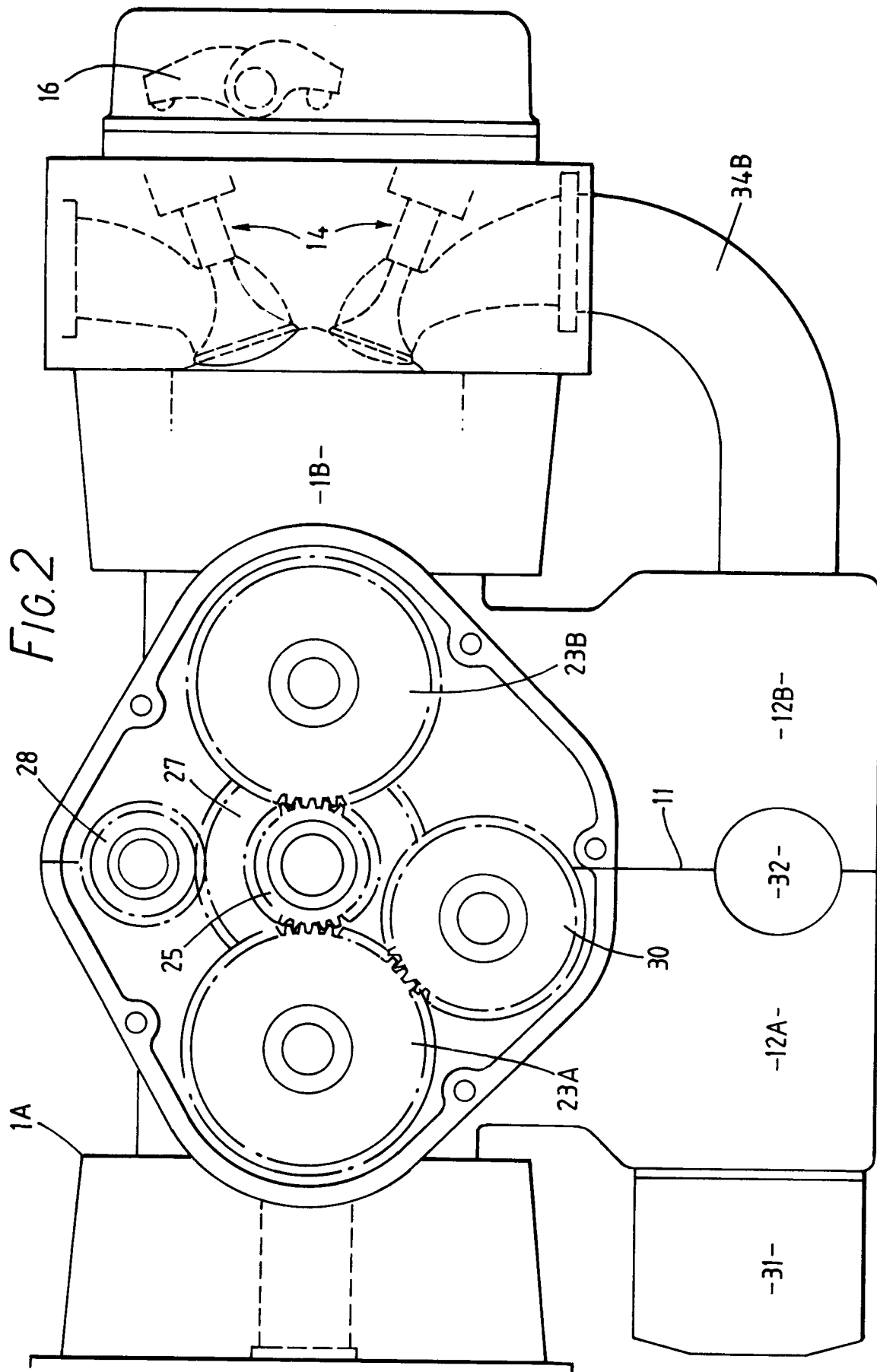
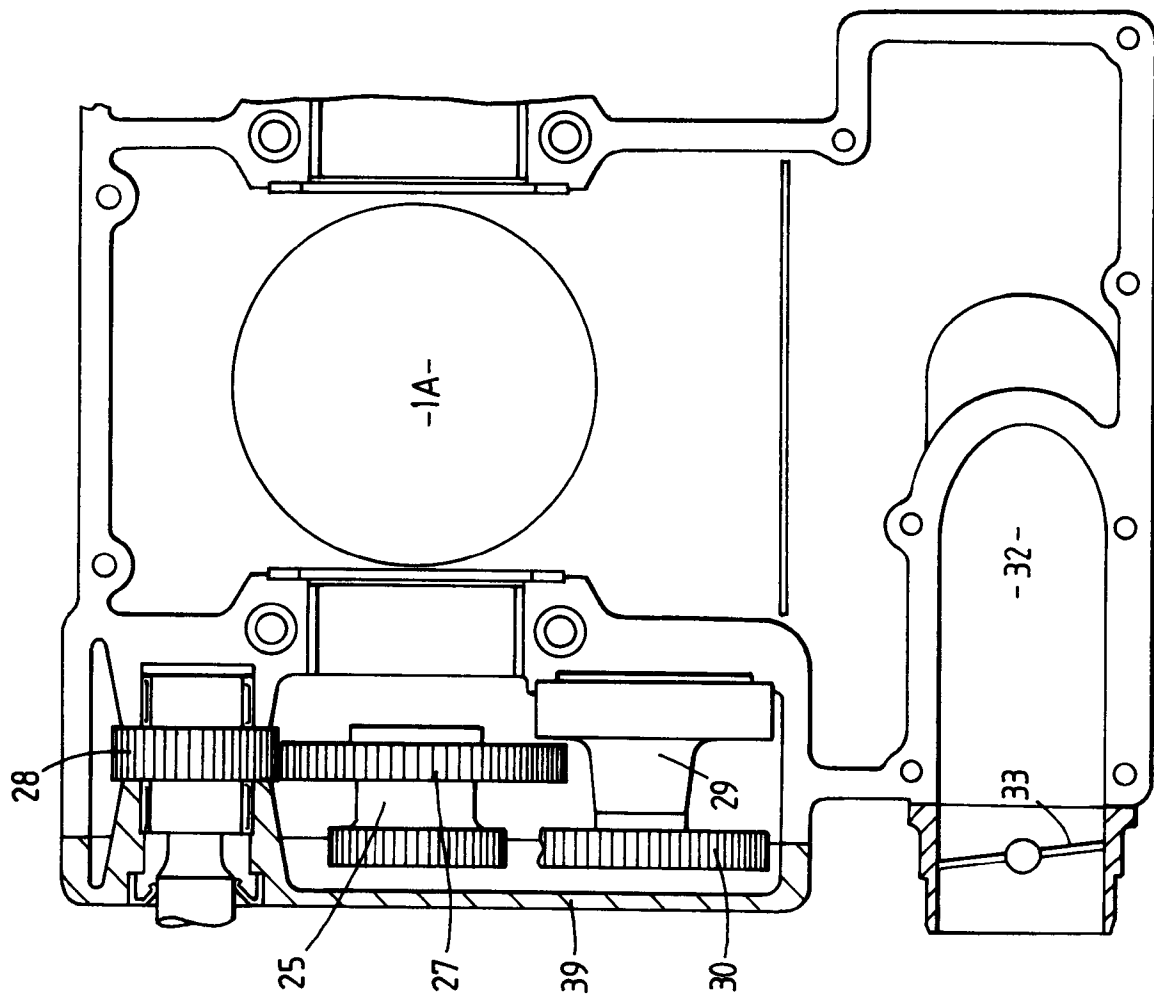


FIG.3





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 92 30 1896

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)
X	GB-A-3 349 A,D. 1913 (SENEAUD) * page 1, line 24 - page 1, line 41 * ---	1,2	F02B75/24 F01B7/06 F02F7/00
X	FR-A-428 845 (SENEAUD) * page 1, line 29 - page 1, line 58; figure 1 * ---	1,2	
X	DE-A-3 424 192 (PULCH) * page 2, paragraph 7 - page 3, paragraph 1; figure 1A * ---	1,2	
A	US-A-2 011 804 (DU BOIS) * figure 2 * -----	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F02B F01B F02F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 07 MAY 1992	Examiner WASSENAAR G, C, C.
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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