(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 376 901 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89830554.5**

(51) Int. Cl.[5]: **F01M 1/02, F04C 11/00**

(22) Date of filing: **19.12.89**

(30) Priority: **30.12.88 IT 6817988**

(43) Date of publication of application:
04.07.90 Bulletin 90/27

(84) Designated Contracting States:
DE ES FR GB SE

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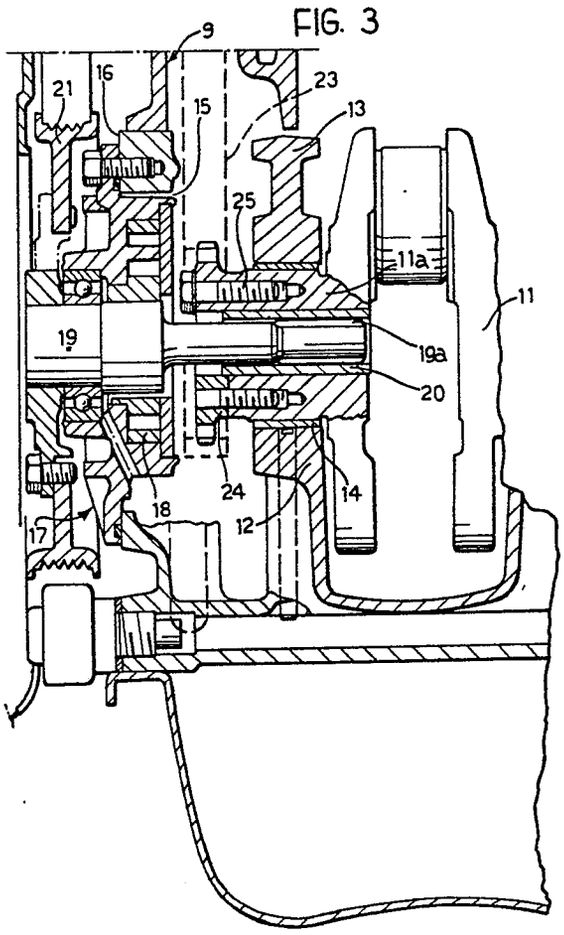
(54) An internal combustion engine, particularly for motor vehicles.

(57) An internal combustion engine for motor vehicles, in which the oil pump (17) and the pulley (21) for driving the auxiliary equipment are driven by the crankshaft (11) through an auxiliary shaft (19) which is coupled torsionally within a hollow end portion (11a) of the crankshaft, in axial correspondence with the respective main bearing (12).

FIG. 3



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An internal combustion engine, particularly for motor vehicles

The present invention relates to an internal combustion engine, particularly for motor vehicles, of the type comprising a driving shaft which is rotatable in main bearings, and an oil pump and a pulley for driving auxiliary equipment, which are rotated by one end of the driving shaft.

The object of the present invention is to produce an engine of the type defined above, in which the operation of the oil pump and the pulley for driving the auxiliary equipment by the driving shaft is free of orbital rotation.

According to the invention, this object is achieved by virtue of the fact that the end of the driving shaft is hollow, and that an auxiliary shaft coaxial with the driving shaft is coupled torsionally within the hollow end thereof, in axial correspondence with the respective main bearing, and rotates the pump and the pulley.

By virtue of this concept, and particularly the coupling of the auxiliary shaft to the end of the driving shaft in correspondence with its main bearing, it is ensured that the driving shaft, the oil pump and the auxiliary pulley are perfectly coaxial during rotation, avoiding malfunctions and premature wear which could result from their eccentric rotation.

The auxiliary shaft can be coupled directly within the hollow end of the driving shaft or, more conveniently, by means of an intermediate sleeve which is in turn fixed torsionally to the hollow end of the driving shaft.

The invention will now be described in detail with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a schematic cross-section of a mutli-cylinder internal combustion engine according to the invention,

Figure 2 is a schematic partial longitudinal section taken on the line II-II Figure 1, in which some parts have been omitted for simplicity of illustration, and

Figure 3 shows the detail indicated by the arrow III of Figure 2, on an enlarged scale, complete with the details omitted from Figure 2.

With reference initially to Figure 1, a four-cylinder internal combustion engine according to the invention, particularly for motor cars, is generally indicated 1.

The engine 1 is constituted essentially by a cylinder block 2 formed integrally with the cylinders 3, their combustion chambers 4, their intake ducts 5 and exhaust ducts 6, the seats 7 for the inlet and exhaust valves 8 and for any spark plugs, not illustrated, a sump structure 9 fitted beneath the cylinder block 2, and a timing control assembly 10 fitted on top of the cylinder block 2 and including a camshaft 22.

The connection of cylinder block 2 to the sump 9 on the one hand and to the timing control assembly 10 on the other is effected in correspondence with integral flanges 2a, 2b formed in single planes and in one piece with the cylinder block 2 and coupled to corresponding continuous integral flanges 9a, 10a formed in single planes on the sump 9 and the timing control assembly 10 respectively.

As shown in greater detail in Figure 2, the sump 9 is constituted by a structural body for supporting the crankshaft 11 of the engine. In effect, the sump 9 is formed with integral main bearings 12 for supporting the shaft 11 for rotation by means of main bearing caps 13 and bearings 14.

One of the end walls of the sump 2 has an aperture 15 which is coaxial with the crankshaft 11 and is defined by an annular flange 16 constituting an integral seat for an oil pump, generally indicated 17, whose impeller is indicated 18.

According to the invention, the end of the cranksahft 11, indicated 11a, that is, the end supported by the main bearing 12 which faces the aperture 15, is hollow and is coupled coaxially to an auxiliary shaft 19 to which the impeller 18 of the oil pump 17 is keyed. The torsional coupling between the auxiliary shaft 19 and the hollow end 11a of the crankshaft 11 may be direct or, as in the embodiment illustrated, may be achieved by means of an intermediate sleeve 20 whose outer surface is driven into the hollow end 11a and whose inner surface is splined for the engagement of a corresponding splined end portion 19a of the auxiliary shaft 19.

The shaft 19 extends out of the sump 9 through the aperture 15 and also drives a pulley 21 for rotating auxiliary equipment of the engine 1.

In any case, the auxiliary shaft 19 is coupled to the crankshaft 11 in axial correspondence with the end main bearing 12, which ensures that the alignment of the auxiliary shaft 19 with the crankshaft 11 is kept constant in use and avoids orbital rotation of the pump 17 and the pulley 21.

The camshaft 22 of the timing control assembly 10 is driven by means of a belt or chain 23 driven by a driving sprocket 24 fixed frontally and directly to the end 11a of the crankshaft 11 by means of screws 25 which are engaged in slots for enabling the angular adjustment of the timing of the engine.

Claims

1. An internal combustion engine having a driving shaft which is rotatable in main bearings, and an oil pump and a pulley for driving auxiliary equipment, which are rotated by one end of the driving shaft, characterised in that the said end (11a) of the driving shaft (11) is hollow and in that an auxiliary shaft (19) coaxial with the driving shaft (11) is coupled torsionally within the hollow end (11a) thereof, in axial correspondence with the respective main bearing (12), and rotates the pump (17) and the pulley (21).

2. An engine according to Claim 1, characterised in that an intermediate sleeve (20) is interposed between the hollow end (11a) of the driving shaft (11) and the auxiliary shaft (19) and is coupled for rotation with both.

FIG. 2

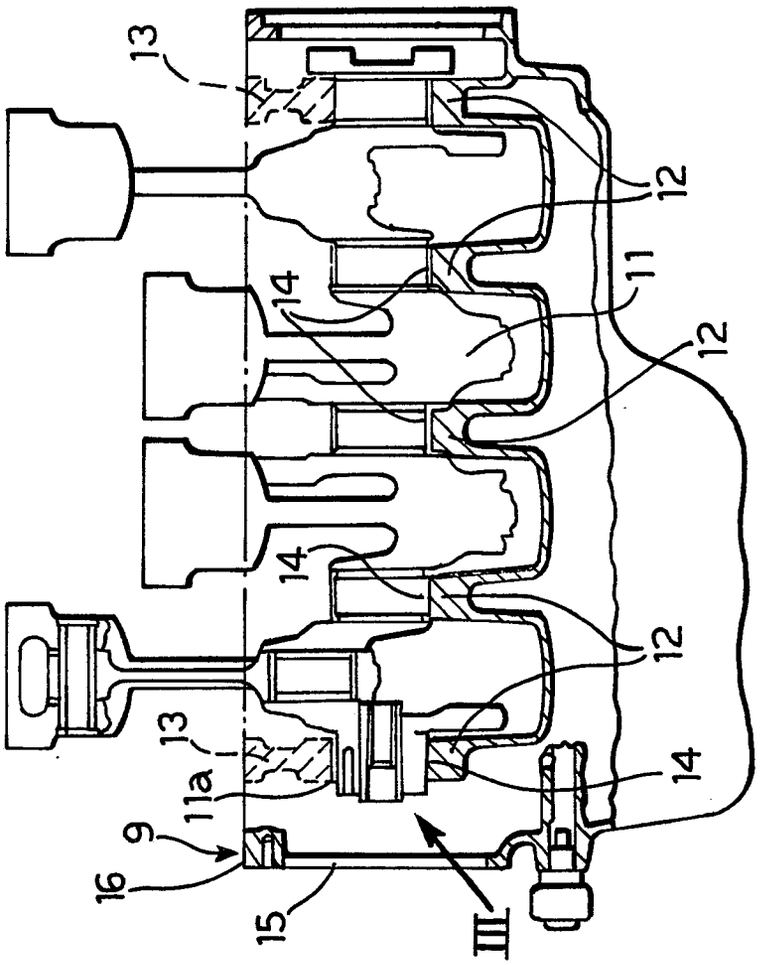

13
12
14
11
12
14
12
13
11a
14
9
16
15
III

FIG. 1

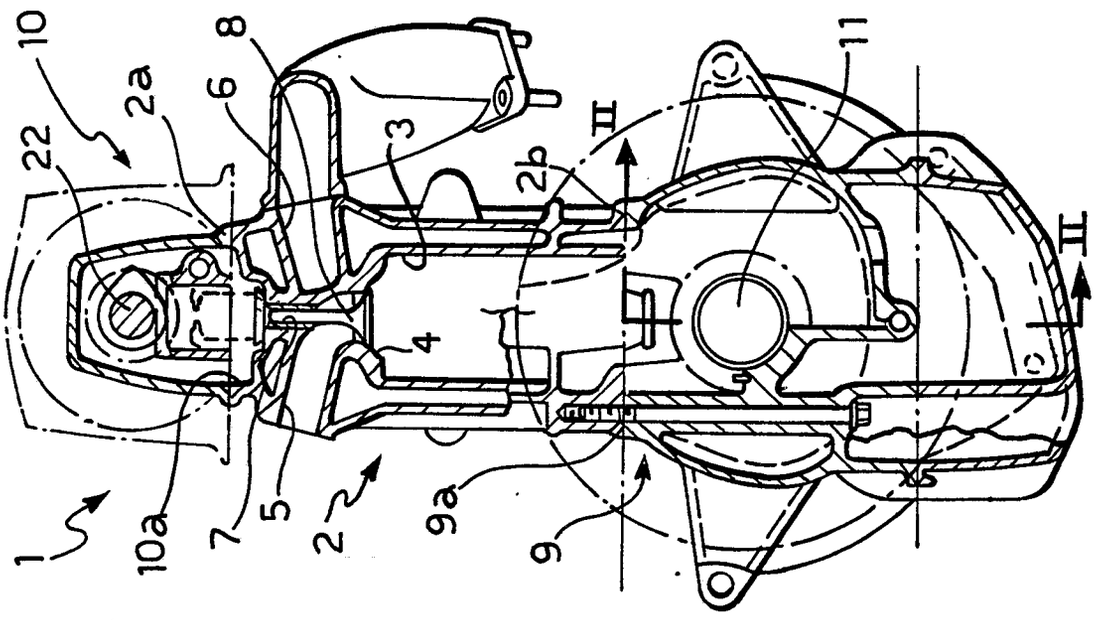
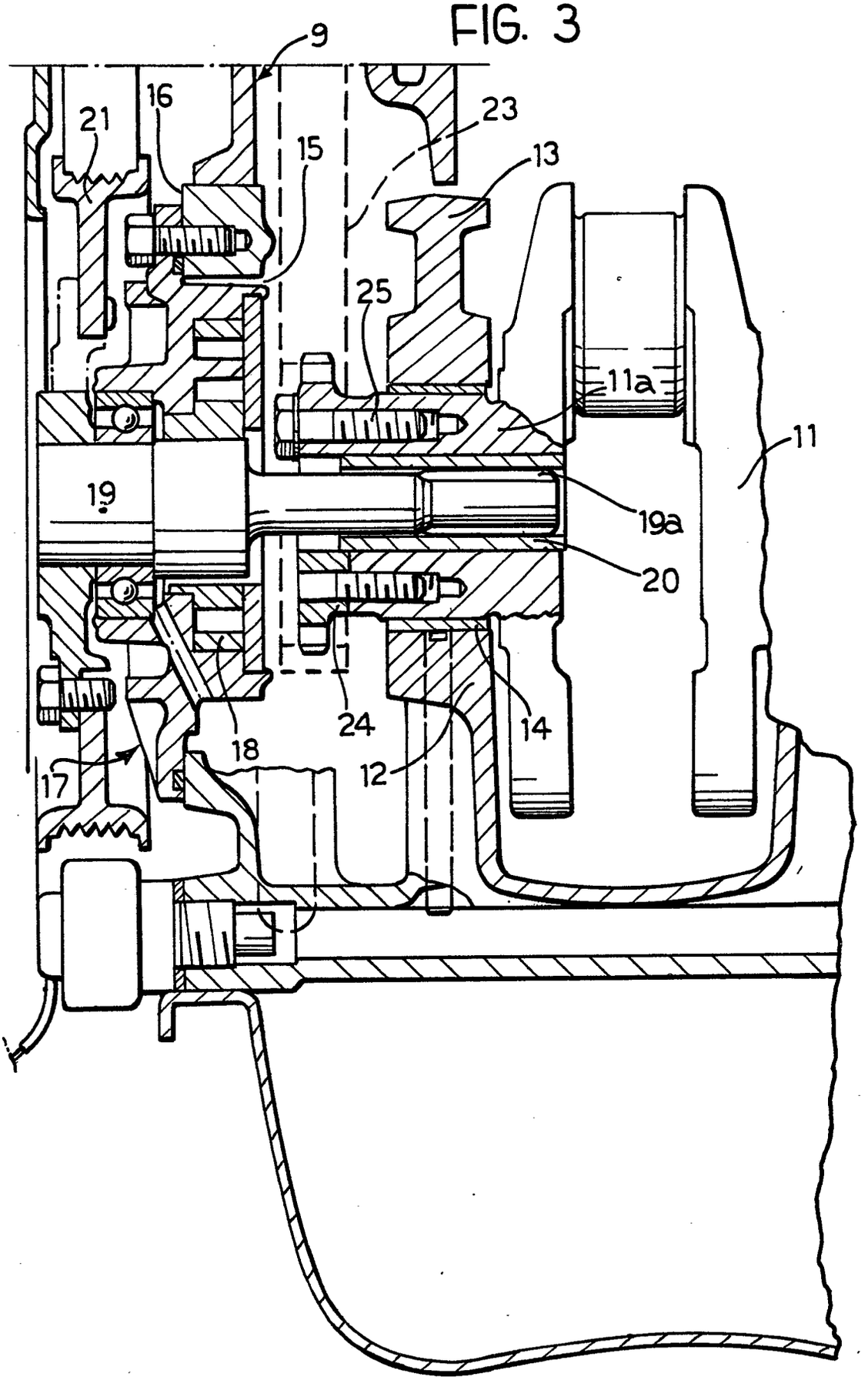

10
2a
6
8
22
3
2b
II
11
II
4
1
10a
7
5
2
9a
9

FIG. 3



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EUROPEAN SEARCH REPORT

Application Number

EP 89 83 0554

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-2 019 505 (BBC) * Page 1, line 90 - page 2, line 10; figures 1,2 *	1	F 01 M 1/02 F 04 C 11/00
A	FR-A-2 075 753 (MASERATI) * Page 3, line 18 - page 4, line 23; figures 1,2 *	1,2	
A	DE-A-3 142 458 (LIST)		
A	US-A-3 879 154 (DIXON)		
A	DE-A-3 506 928 (LORENZ)		
A	GB-A-2 047 349 (GIRLARDINI)		
A	FR-A-1 352 410 (AUTO UNION)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 01 M
F 16 N
F 04 C
F 02 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12-03-1990	KOOIJMAN F.G.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P0401)