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(54) Endothermal injection engine

(57) An endothermal injection engine (1) comprising a head (2) and, for each cylinder, an injector (10) and at least one pair of valves (3) cooperating with a spring plate (8) secured to the head (2); the injector (10) is connected to a high pressure fuel supply tube (40) by an annular member (27) housed in the head (2) below the spring plate (8) and provided with a radial sleeve (32) through which the tube (40) itself is disposed, and a connector (42) screwed into the sleeve (32) in order to urge an end head (41) of the tube (40) against a supply opening (25) of the injector (10).

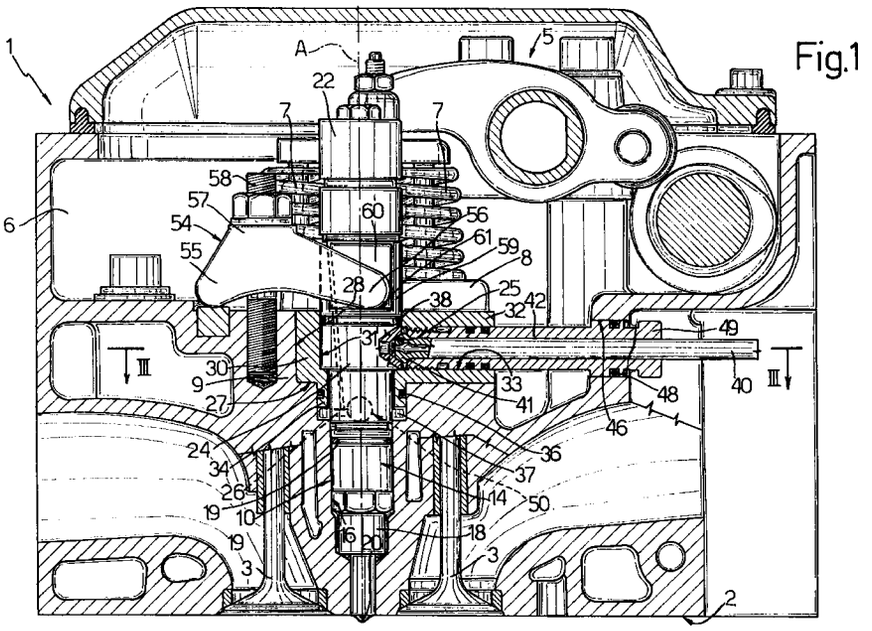


Fig.1

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Description

The present invention relates to an endothermal injection engine, particularly but not exclusively of the compression ignition (Diesel) type used in industrial vehicles.

As is known, the injectors are mounted in the engine head, preferably in a position coaxial to the relative cylinder, with the atomiser unit disposed to pass through a wall of the head bounding the top of the combustion chamber; the injector extends axially into the tappet space between the springs of the valves which bear at the bottom on an abutment plate, or spring plate, secured to the head or forming an integral part of this head.

The injector is generally provided with a coupling for a connection member of a high pressure fuel supply tube and a collection tube for fuel flowing back from the injector to the tank.

The coupling extends integrally in a snap-locking manner from the body of the injector and is provided in the upper portion thereof, i.e. above the spring plate.

Engines of the type described briefly above have certain drawbacks.

The coupling and the relative supply connector in particular occupy additional space in an area, such as the tappet space, in which the space available is already very small because of the bulk of the valve springs, the injector body and the relative fastening bracket. This obviously creates very restrictive design constraints.

The high and low pressure tubes have to project, moreover, from the tappet space thereby making it necessary to use external oil seals and creating problems as regards the assembly and dismantling of the cover.

It cannot, moreover, be envisaged to provide a coupling for the supply connector of a conventional type in the area of the head below the spring plate; this would make it necessary to dismantle the valve control unit whenever it was necessary to remove the injector, since the coupling would not allow for the axial removal of the injector.

Solutions are also known in which the fuel supply tube is accessed below the spring plate; in this case, in order to enable the injector to be dismantled, the coupling for the connection of the supply tube cannot be provided on the injector itself, but has to be provided on the head with a tubular spacer interposed in a leak-tight manner between the supply tube connector and the inlet opening of the injector. This solution cannot be used, however, in cases in which the head is made from light alloy, since repeated assembly and dismantling of the connector would damage the coupling.

The object of the present invention is to provide an endothermal injection engine which makes it possible to remedy the drawbacks and limitations connected with the known engines described above.

This object is achieved by the present invention which relates to an endothermal injection engine of the type comprising at least one cylinder, a head, at least one injector associated with the cylinder and housed in the head, means for connecting the injector to a high pressure supply tube and to a recycling duct, at least one valve associated with the cylinder and provided with at least one spring housed in a tappet space of the head bounded at the bottom by a wall of this head, and means for controlling the valve housed in the tappet space, characterised in that the connection means comprise an annular member housed at least partially in the wall of the head bounding the tappet space and provided with a through cavity through which the injector is mounted, this annular member being provided with a radial sleeve facing a supply opening of the injector, and a tubular connector screwed into the radial sleeve of the annular member in order to grip one end of the tube disposed within the sleeve against the supply opening of the injector.

For a better understanding of the present invention, a preferred embodiment is described below by way of non-limiting example with reference to the accompanying drawings, in which:

Fig. 1 is a cross-section through a head of an endothermal engine embodied in accordance with the present invention;

Fig. 2 shows a detail of Fig. 1, on an enlarged scale and with some parts removed for clarity;

Fig. 3 is a cross-section along the line III-III of Fig. 1.

In Fig. 1, an endothermal engine (shown in part) is shown overall by 1.

The engine 1 comprises a block (not shown) defining a plurality of cylinders (not shown) and a head 2 advantageously made by fusion from aluminium alloy.

The engine 1 comprises four valves 3 per cylinder, which are housed and guided in a known manner in the head 2. The valves are controlled by a valve control unit 5 of known type, with cams and rocker arms, housed in a tappet space 6 provided in the head 2. The valves 3 are normally kept closed by respective springs 7 which bear on a plate 8, or spring plate, secured to a wall 9 of the head 2 bounding the bottom of the tappet space 6.

The engine 1 further comprises an injector 10 for each cylinder; the following description refers, for the sake of brevity, solely to the injector 10 shown in the drawings, as it is evident that similar considerations apply to the other injectors.

The injector 10 has a substantially tubular, elongate body 14 of axis A, comprising a lower portion 18 which houses an atomiser unit of known type (not shown) and an upper portion 22 which houses an electro-hydraulic control unit (not shown).

The lower portion 18 of the body 14 is housed in a housing 16 of the head 2 coaxial to the relative cylinder

with the possible interposition of a sealing ring 19, and has an end nozzle 20 facing this cylinder; the upper portion 22 extends into the tappet space 6 between the springs 7 of the valves 3.

The injector 10 has, at the location of an intermediate zone 24 of the body 14, a conical opening 25 for the intake of high pressure fuel and an outlet opening 26 for the recycling of the fuel at low pressure. The latter receives the flow of fuel recycled at low pressure formed both by the seepage along the atomiser unit and by the exhaust flow from the control unit via an inner longitudinal channel 17 of the injector 10 (Figs. 2 and 3).

The above-mentioned intermediate zone 24 is disposed to pass through an annular clamping member 27 housed with play in a housing 28 provided in the wall of the head 2 below the spring plate 8 and communicating with the housing 16.

The member 27 integrally comprises a bushing 30 of axis A, provided with an axial through cavity 31 housing the intermediate zone 24 of the injector 10, and a tubular sleeve 32, extending radially in a snap-locking manner from the bushing 30 and provided with a longitudinal through hole 33 which communicates with the cavity 31 at the location of the supply opening 25 of the injector 10. A sealing ring 38 is interposed between the bushing 30 and the injector 10, above the supply opening 25.

The bushing 30 has a lower portion 34 of reduced diameter, which extends into a lower section 35 of correspondingly reduced diameter of the housing 28, with the interposition of a sealing ring 36; the axial length of the portion 34 is smaller than that of the section 35, so as to leave a lower portion of the latter free, defining an annular chamber 37 with which the outlet opening 26 of the injector 10 communicates.

The injector 10 is associated with a high pressure fuel supply tube 40.

The tube 40 has an enlarged head 41 with a nose-shaped endpiece which is urged, in a substantially leak-tight manner, against the conical opening 25 of the injector 10. This thrust action is produced by a tubular connector 42, externally coaxial with the tube 40, which has a threaded end 43 screwed into a threaded section of the hole 33 and cooperating axially against the head 41. A pair of sealing rings 45 (Fig. 2) is interposed between an intermediate portion 44 of the connector 42 and an end of the sleeve 32. The connector 42 is mounted to pass through a lateral hole 46 of the head 2, through which the tube 40 projects laterally from the engine 1, with the interposition of a sealing ring 48. Outside the wall 47, the connector 42 is terminated by a hexagonal manipulation head 49 that allows it to be screwed and unscrewed by an appropriate spanner.

The annular chamber 37 communicates with a fuel recycling channel 50 provided in the head 2.

The injector 10 is locked axially in the housing 16 by a bracket 54 of known type, which has one end 55 bearing on the head 2, an opposite forked end 56 cooperating with the injector 10 and a central portion 57 secured to this head by a bolt means 58.

More precisely, the end 56 cooperates prismatically with a portion 59 of the body 14 of the injector 10 provided with lateral facets 60 and exerts an axial downward thrust on respective lateral shoulders 61 of this body.

In operation, the high pressure fuel is supplied to the injector 10 via the relative tube 40. Any seepage of fuel through the contact area between the head 41 of the tube and the opening 25 flows, between the body of the injector 10 and the opening 30, into the chamber 37. The low pressure fuel discharged from the outlet opening 26 of the injector 10 also flows into this chamber 37.

The low pressure fuel therefore flows from the chamber 37 into the recycling duct 50 since it cannot flow in any other direction as a result of the sealing rings 19 and 36 disposed in the vicinity and on opposite sides of the chamber 37 and the sealing rings 38 and 45. This prevents any contamination of the fuel and the lubricating oil in the tappet space 6.

The advantages that can be obtained from the present invention are evident from an examination of the characteristic features of the engine 1 embodied in accordance with the present invention.

In particular, as a result of the use of the annular member 27 and the connector 42, it is possible to obtain the lateral connection of the tube 40 to the injector 10 at the location of the wall 9 without having to use connections threaded into the head and without compromising the ease of assembly and dismantling of the injectors.

Moreover, the clamping force of the connector 42 is exerted solely on the member 27 and not on the head 2.

It is evident from the above that the invention is particularly advantageously (although not exclusively) applied to engines with a head 2 of light alloy.

Since the injector receives a radial load from the tube 40 at the location of the opening 25 and an equivalent and opposite load from the bushing 30 at the location of an opposite generatrix of the portion 24, it is not subject to torsional deformation which could compromise its operating accuracy.

Lastly, the recycled fuel and any seepages are collected in a single chamber, enabling a simplification of the recycling circuit.

It is evident that modifications and variants may be made to the engine 1 described above, provided that they do not depart from the scope of protection of the present invention.

For instance, the injector 10 nay be of any type, in particular an electro-injector adapted to a "common rail" system, or of the conventional type in which the injection is controlled exclusively by the supply pressure.

The recycled fuel may be collected in a series of ducts provided in the cylinder head that is more complex than that illustrated, depending on particular application requirements.

Claims

1. An endothermal injection engine (1) of the type comprising at least one cylinder, a head (2), at least one injector (10) associated with the cylinder and housed in the head (2), means (27, 42) for connecting the injector (10) to a high pressure supply tube (40) and to a recycling duct (50), at least one valve (3) associated with the cylinder and provided with at least one spring (7) housed in a tappet space (6) of the head (2) bounded at the bottom by a wall (9) of this head, and means (5) for controlling the valve (3) housed in this tappet space (6), characterised in that the connection means (27, 42) comprise an annular member (27) housed at least partially in the wall (9) of the head (2) bounding the tappet space (6) and provided with a through cavity (31) through which the injector (10) is mounted, this annular member (27) being provided with a radial sleeve (32) facing a supply opening (25) of the injector (10), and a tubular connector (42) screwed into the radial sleeve (32) of the annular member (27) in order to grip one end (41) of the tube (40) disposed within the sleeve (32) against the supply opening (25) of the injector (10).

2. An engine as claimed in claim 1, characterised in that the supply opening (25) of the injector (10) has a conical shape, and in that the end of the tube (40) comprises an enlarged head (41) with a nose-shaped front profile adapted to cooperate, in a substantially leak-tight manner, with the supply opening (25) of the injector (10).

3. An engine as claimed in claim 1 or 2, characterised in that the head (2) of the engine (1) is made from a light alloy.

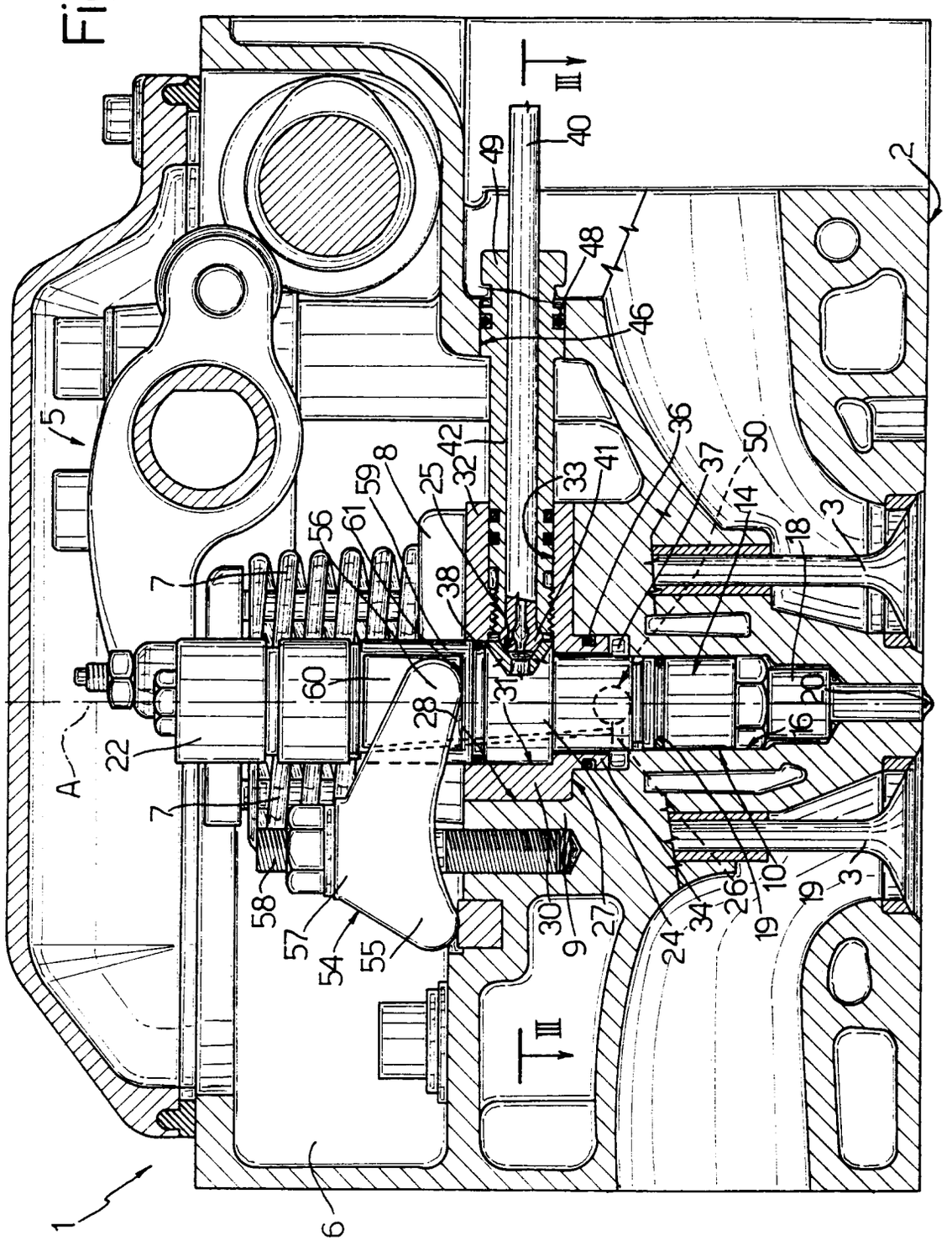
4. An engine as claimed in one of the preceding claims, characterised in that the annular member (27) bounds, with the head (2), an annular chamber (37) surrounding the injector (10), the recycling duct (50) being provided in this head (2) and communicating with this annular chamber (37) and the injector (10) having a single outlet opening (26) communicating with the annular chamber (37).

5. An engine as claimed in claim 4, characterised in that the injector (10) comprises an inner longitudinal duct (17) for the supply of the fuel from an electro-hydraulic control unit of the injector (10) to the outlet opening (26).

6. An engine as claimed in claim 4 or 5; characterised in that it comprises first sealing means (36) interposed between the annular member (27) and the bead (2) in the vicinity of the annular chamber (37).

7. An engine as claimed in one of claims 4 to 6, characterised in that it comprises second sealing means (38) interposed between the injector (10) and the annular member (27), the supply opening (25) of the injector (10) being disposed between these third sealing means (38) and the annular chamber (37).

Fig.1


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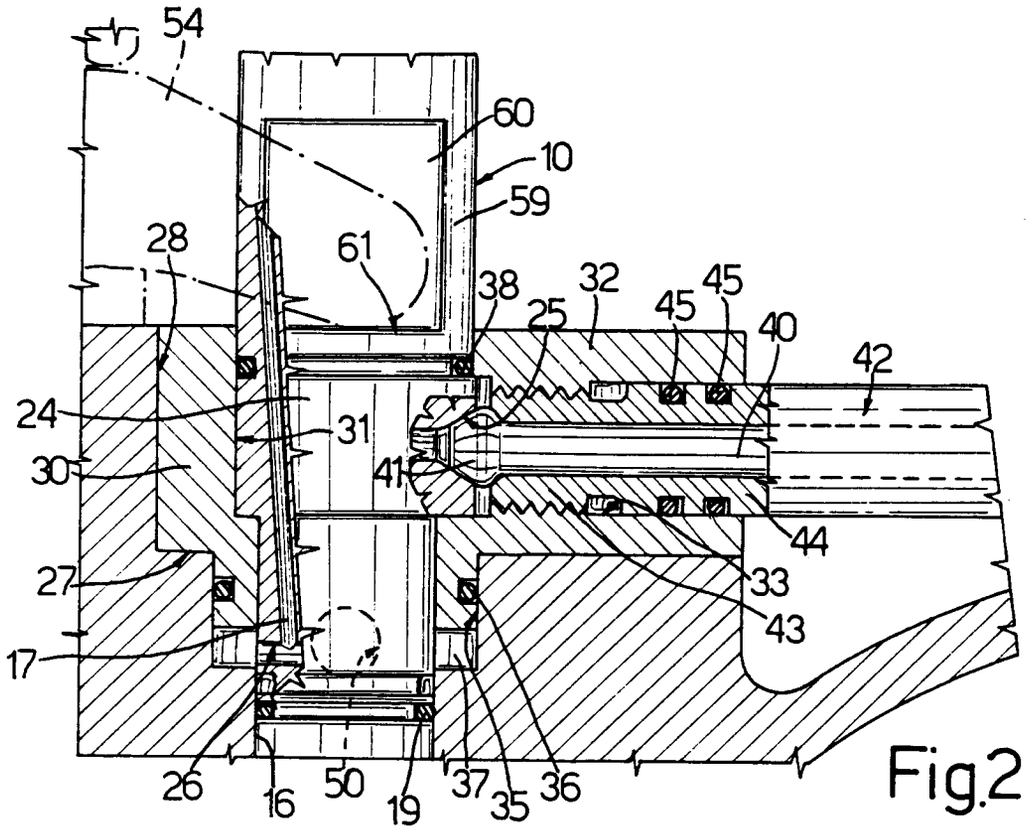

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Fig.2

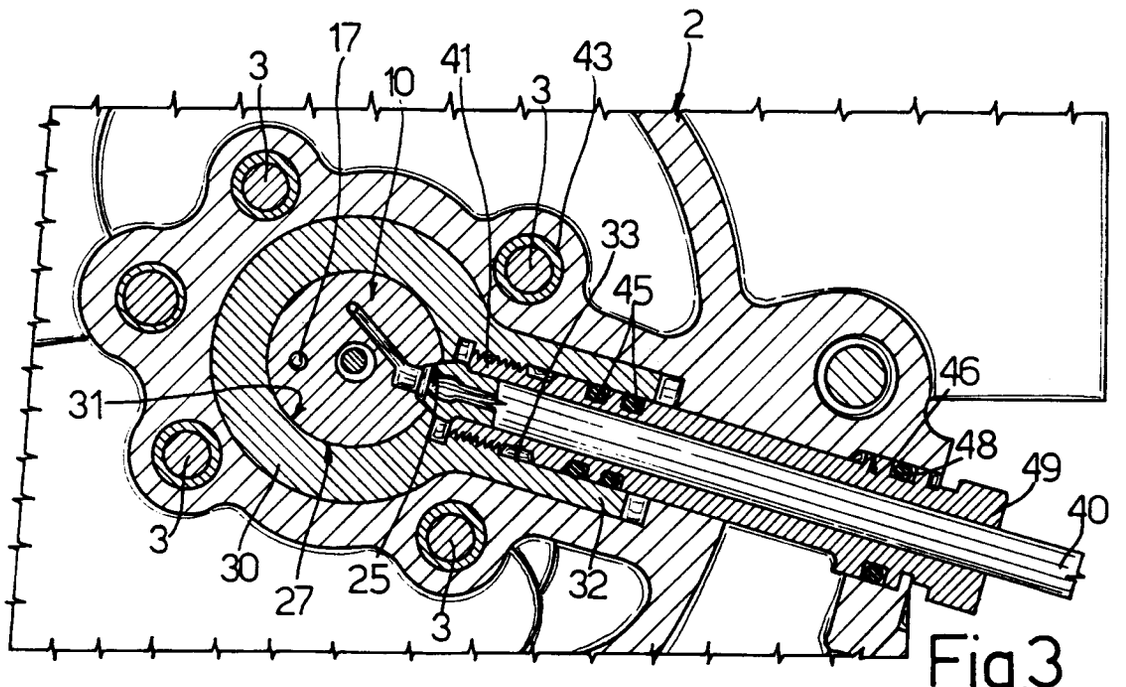

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Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 2561

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 A	FR 1 318 701 A (SOCIÉTÉ ALSACIENNE DE CONSTRUCTIONS MÉCANIQUES) 22 February 1963 * page 2, paragraph 5 - paragraph 16; figures 1-4 *	1,2 5	F02M55/02 F02M61/14
A	DE 44 27 717 C (DAIMLER BENZ AG) 31 August 1995 * column 1, line 43 - column 2, line 12; figures 1,2 *	1,2,7	
A	US 3 845 748 A (EISENBERG E) 5 November 1974 * column 2, line 61 - column 4, line 25; figures 1,2 *	1,2,4	
A	US 2 533 195 A (METZGER L.W.) 5 December 1950 * column 2, line 17 - column 4, line 56; figure *	1	
A	GB 2 049 806 A (FIAT VEICOLI IND) 31 December 1980 * page 1, line 110 - page 2, line 19; figures 1-4 *	3	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F02M F02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 September 1997	Hakhverdi, M

CATEGORY OF CITED DOCUMENTS

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