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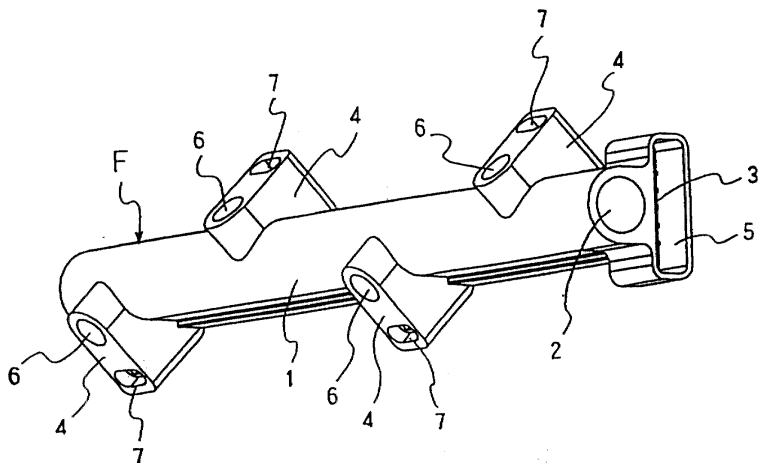
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Engine fuel rail and method of fabricating same

(57) The invention provides an engine fuel rail (F) compact and having highly reliable functions because it is an insert-molded product integral with an electrical wiring (3), contributing to reduction in the number of fabrication steps and cost of fabrication, and a method of fabricating the same. An oil delivery path (2) and the electrical wiring (3) in parallel therewith are embedded in a base member (1) molded from a synthetic resin, as a main body, so as to be integral with each other, and a plurality of branching blocks (4) for respective cylinders of an engine are provided protuberantly on the right side and the left side of the base member (1), alternately, the base member (1) having an opening at one end thereof to serve as a socket (5) on an input side for the electrical

wiring (3), while the end face of respective branching blocks (4) has an opening to serve as a fixture mount (6) for respective injectors and an opening to serve as a socket (7) on an output side for connection of the respective injectors with the electrical wiring (3). Thus, the engine fuel rail (F) of the invention can be fabricated as a component at a low cost because it is an insert-molded product integral with the electrical wiring (3) and the cord can be omitted. Further, it can be provided as a highly reliable product capable of withstanding severe ambient conditions existing inside an engine room in addition to having suitability for saving of labor in application due to reduction in the number of fabrication steps, and capability of rendering the product lighter in weight and compact.

FIG. 4



Description

[0001] The present invention relates to a fuel rail (also called a fuel gallery or fuel distributor) fitted to an engine of an automobile and the like for delivering gasoline or the like to the engine through distribution among respective cylinders thereof, and a method of fabricating same.

[0002] The fuel rail is one of primary components among products for a fuel injection system for use in the middle between a fuel tank and the engine, and as such, pressure tightness, airtightness (leak-proof), and oil tightness are strictly required of it owing to needs of ensuring that it has a function of stably delivering a combustible such as gasoline or the like.

[0003] A conventional fuel rail has a construction, wherein a fuel pipe is provided with a plurality of openings to serve as a fixture mount for respective injectors in dedicated use for respective cylinders of an engine and integrally formed mainly of aluminum by die casting, and an electrical wiring insert-molded in a covering made of synthetic resin which is used for activating respective injectors is attached to a side of the fuel pipe separately for connection therewith. The electrical wiring insert-molded in the covering made of synthetic resin is used for driving a solenoid valve of the respective injectors, and a cord fitted with a female connector is drawn out up to the tip thereof while a male connector is fitted to the respective injectors protuberantly.

[0004] With the conventional fuel rail described above, the electrical wiring insert-molded in the covering made of synthetic resin is disposed so as to be used in parallel therewith, and this configuration not only has taken much space of an engine room but also has required additional steps in an assembling process, resulting in a higher cost of fabrication.

[0005] The electrical wiring insert-molded in the covering made of synthetic resin is formed by embedding an electrical wiring into the covering made of synthetic resin by means of insert-molding, but it is susceptible to the effect of severe ambient conditions existing inside an engine room due to the fact that the covering can not be expected to have a sufficient thickness in view of economics and needs for weight reduction, and a cord is used for connection thereof with the respective injectors, thus posing uncertain factors for occurrence of troubles such as a faulty motion caused to occur in activation of the injectors.

[0006] Similarly, the thickness of the fuel rail itself is under constraints, and this also has posed a problem with reliability thereof in respect of pressure tightness, airtightness (leak-proof), and oil tightness as described in the foregoing.

[0007] In light of the circumstances described above, the present invention has been developed, and an object of the invention is to provide an engine fuel rail, compact and having highly reliable functions, wherein the number of fabrication steps as well as a cost of fabrication can be reduced because it is a component molded

integrally with electrical wiring by means of the insert molding, and a method of fabricating the same.

[0008] To achieve the above object, the engine fuel rail according to a first aspect of the invention comprises a base member molded from a synthetic resin, as a main body, wherein an electrical wiring is embedded in the base member so as to be in parallel and integral with an oil delivery path, and a plurality of branching blocks are provided protuberantly on the right side and the left side of the base member, alternately, so as to be put to dedicated use by respective cylinders of an engine, and wherein the base member has an opening at one end thereof to serve as a socket on an input side for the electrical wiring, while the end face of respective branching blocks has an opening to serve as a fixture mount for respective injectors and an opening to serve as a socket on an output side for connection of the respective injectors with the electrical wiring.

[0009] With the configuration described above, the engine fuel rail can be rendered compact even if a sufficient thickness is provided in the insert molding whereby an oil delivery path is molded integrally with the electrical wiring. Furthermore, since the end face of the respective branching blocks has an opening to serve as a fixture mount for respective injectors and the other opening to serve as a socket on the output side for the electrical wiring, a cord interconnecting the both openings is no longer required if a two-pronged injector that can be inserted into the both openings is used.

[0010] A method of fabricating an engine fuel rail according to the invention has advantages in that since the electrical wiring is securely held by reinforcement blocks, and the electrical wiring and an oil delivery pipe that are positioned stably are subjected to the insert molding, molding can be executed in a rationally manner, and in addition, a stable structure in terms of strength is attained as a result of primary molding and secondary molding that are executed.

[0011] In accordance with a first aspect of the invention, there is included a case of molding the oil delivery path without executing the primary molding described above, that is, a case of molding the oil delivery path in the secondary molding. However, in the case where the oil delivery pipe is fabricated in the primary molding as with the case of the method of fabricating the engine fuel rail in accordance with a second aspect of the invention, the invention will have the advantages as described in the foregoing.

[0012] Thus, the engine fuel rail of the invention can be provided as a component fabricated at a low cost because it is an insert-molded product integral with the electrical wiring and the cord can be omitted. Further, it has advantageous effects such as suitability for saving of labor in application due to reduction in the number of fabrication steps, and capability of not only rendering the product lighter in weight and compact, but also providing the engine fuel rail as a product highly reliable that can withstand severe ambient conditions existing

inside an engine room.

[0013] In particular, the method of fabricating the engine fuel rail according to the invention can demonstrate further conspicuous effects in enhancement of reliability.

Fig. 1 is a perspective view of an electrical wiring of an engine fuel rail according to the invention;

Fig. 2 is a perspective view showing a state wherein the electrical wiring is securely held by reinforcement blocks;

Fig. 3 is a perspective view of an oil delivery pipe of the engine fuel rail according to the invention;

Fig. 4 is a perspective view of the engine fuel rail according to the invention as a finished product; and

Fig. 5 is a partly cutaway perspective view of the engine fuel rail according to the invention described above.

[0014] Now, embodiments of the invention are described hereinafter with reference to the accompanying drawings.

[0015] These drawings show an embodiment of the invention, and as shown in Figs. 4 and 5, a fuel rail according to the embodiment comprises a base member 1 made of a synthetic resin, molded in the form of a rod long from side to side, as a main body, wherein an oil delivery path 2 is formed between opposite ends thereof, and an electrical wiring 3 is embedded therein, and four branching blocks 4 dedicated for four cylinders are provided protuberantly on the right side and the left side thereof, alternately, in a staggered arrangement in the case of a 4-cylindere engine. Further, the base member 1 has an opening at one end thereof to serve as a socket 5 on an input side for the electrical wiring 3, and the end face of respective branching blocks 4 has both an opening to serve as a fixture mount 6 for respective injectors (not shown) and an opening to serve as a socket 7 on an output side for the electrical wiring 3.

[0016] The construction of the fuel rail is described in more detail hereinafter in the order of steps of fabricating the same, and a similar construction will be applicable to the case of a 6-cylindere engine.

[0017] The electrical wiring 3 is formed by pressing a copper sheet into a wiring configuration so as to regularly activate a solenoid valve of four injectors, respectively, and the wiring is arranged such that a length of electrical wire 11 among five lengths of electrical wires, parallel with each other, has positive polarity while the other four lengths of electrical wires 12 have negative polarity. Further, one end of any of the lengths of electrical wires 11, 12 is projected inside the socket 5 on the input side as an input terminal, and output terminals 11a and 12a of the lengths of electrical wires 11, 12, respectively, with positive polarity and negative polarity, respectively, are projected inside the respective sockets 7 on the output side.

[0018] In forming the electrical wiring 3, connection

ribs 15 for reinforcement are formed (refer to Fig. 1) in preparation for a succeeding step, and removed by press cutting upon completion of the succeeding step (refer to Fig. 2). As shown in Fig. 2, in the succeeding step, reinforcement blocks 17 for holding the lengths of electrical wires 11, 12 running in parallel with each other at given spacings are formed. The reinforcement blocks 17 in the aggregate may be molded in a block out of necessity for positioning to prevent deformation occurring at the time of a secondary molding (refer to Figs. 4 and 5) as the final molding, however, a minimum amount of the synthetic resin is used by providing voids between the respective reinforcement blocks 17 so that any excess in thickness of a final product can be eliminated. For the synthetic resin used in the molding, a thermoplastic resin (for example, PPS) is used.

[0019] In molding of the oil delivery path 2 alongside the electrical wiring 3, an oil delivery pipe 19 is molded of the synthetic resin and the fixture mounts 6 for the injectors are integrally molded therewith so as to be protruded therefrom in a step of a primary molding as shown in Fig. 3.

[0020] In molding of the final product (refer to Figs. 4 and 5), the oil delivery pipe 19 fitted with the sockets 7 on the output side, fabricated in the step of the primary molding as described above, and the electrical wiring 3 fitted with the reinforcement blocks 17 are assembled into a mold, thereby executing insert molding with the synthetic resin.

[0021] As shown in the figures, the fuel rail F fabricated by molding as described in the foregoing is a component small in size and compact, thereby attaining significant reduction in fabrication cost. Further, a thickness 20 of the fuel rail, provided to a sufficient degree, together with embedding of the oil delivery pipe 19 therein, has enabled the fuel rail to have a stable shape in terms of strength. In addition, use of two-pronged injectors and omission of the cord have contributed to a safe connection condition without a risk of occurrence of electrical leakage.

[0022] The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. An engine fuel rail (F) comprising a base member (1) molded from a synthetic resin, as a main body, wherein an electrical wiring (3) is embedded in the base member (1) so as to be in parallel and integral with an oil delivery path (2), and a plurality of branching blocks (4) are provided protuberantly on the right side and the left side of the base member (1), alternately, so as to be put to dedicated use by respective cylinders of an engine; said base mem-

ber (1) having an opening at one end thereof to serve as a socket (5) on an input side for the electrical wiring (3), while the end face of respective branching blocks (4) has an opening to serve as a fixture mount (6) for respective injectors and an opening to serve as a socket (7) on an output side for connection of the respective injectors with the electrical wiring (3). 5

2. A method of fabricating an engine fuel rail (F) comprising the steps of: 10

integrally molding an oil delivery pipe (19) from a synthetic resin, provided with a plurality of openings to serve as a fixture mount (6) for respective injectors, disposed on the right side and the left side of an oil delivery path (2), alternately; 15
forming an electrical wiring (3) by applying press working to a metal sheet; 20
securely holding the electrical wiring (3) with a plurality of reinforcement blocks (17) by insert molding of the synthetic resin; and
molding the oil delivery pipe (19) integrally with the electrical wiring (3) in a base member (1) of the engine fuel rail (F), molded from the synthetic resin, by means of insert molding, whereby the base member (1) is provided with an opening at one end thereof to serve as a socket (5) on an input side for the electrical wiring (3), and also provided with a plurality of branching blocks (4) formed integrally therewith at the side thereof, each having both an opening to serve as the fixture mount (6) for the respective injectors and an opening to serve as a socket (7) on an output side for the electrical wiring (3). 25 30 35

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FIG. 1

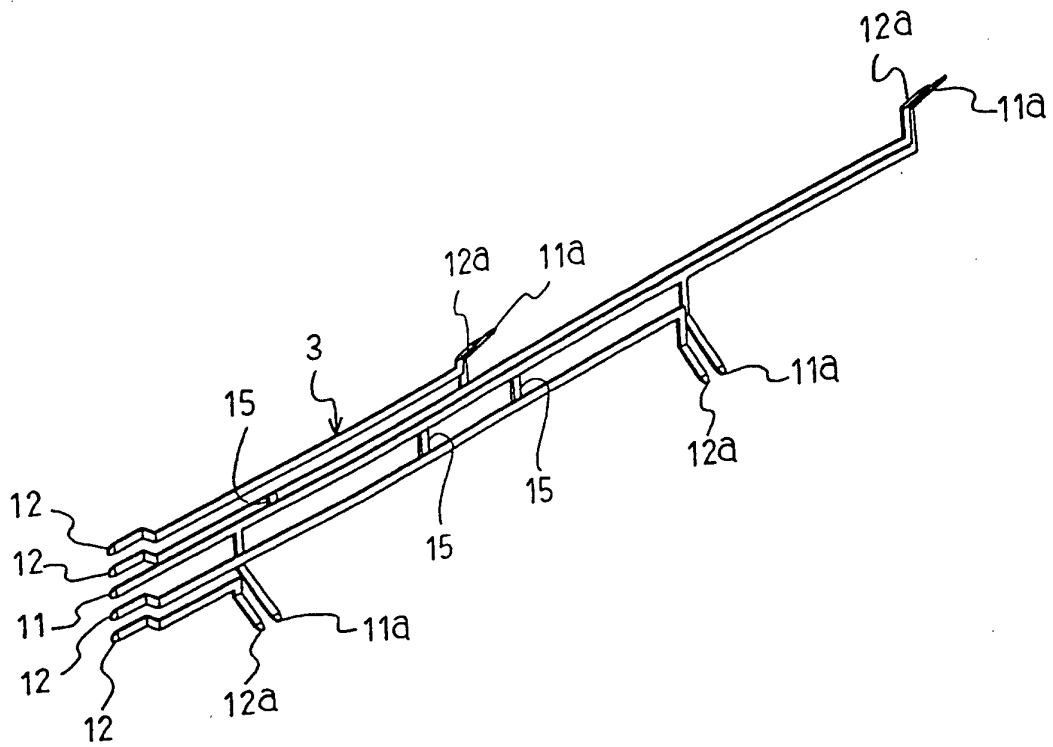


FIG. 2

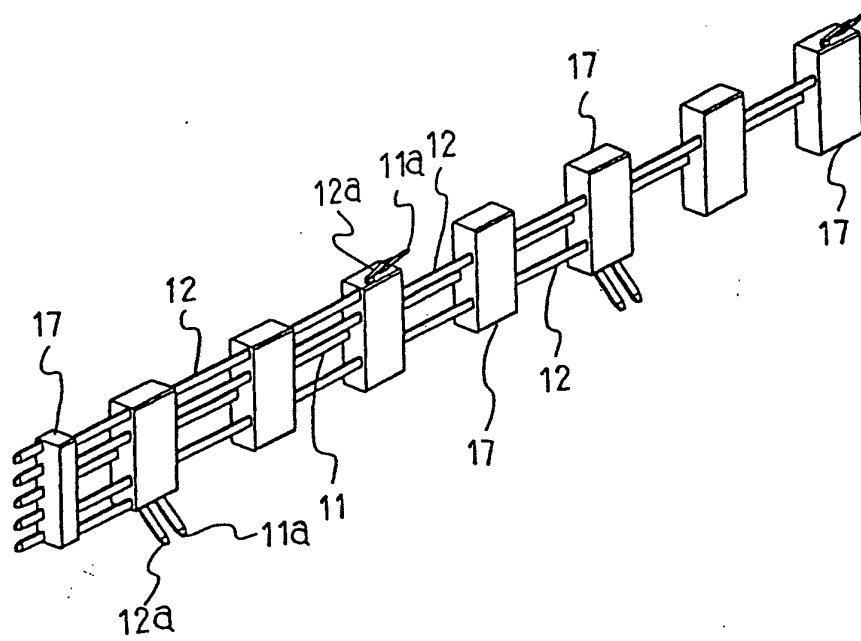


FIG. 3

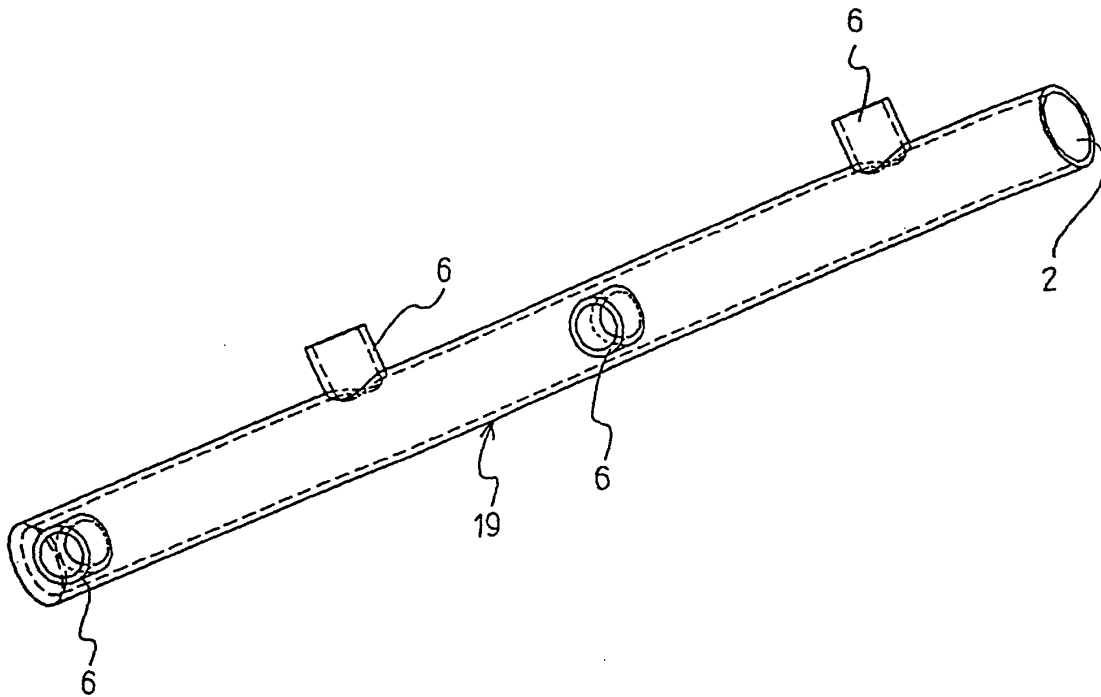


FIG. 4

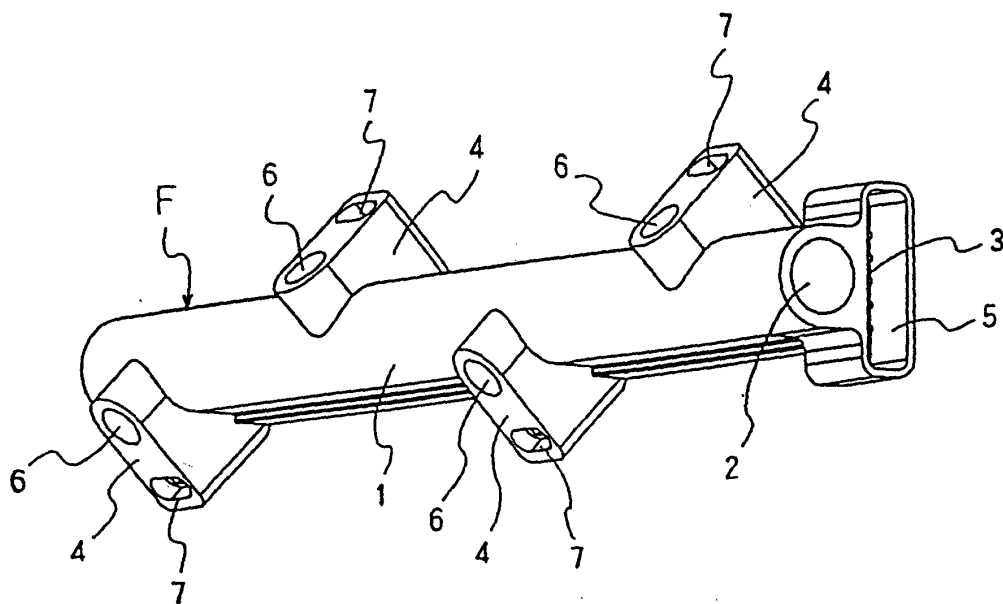
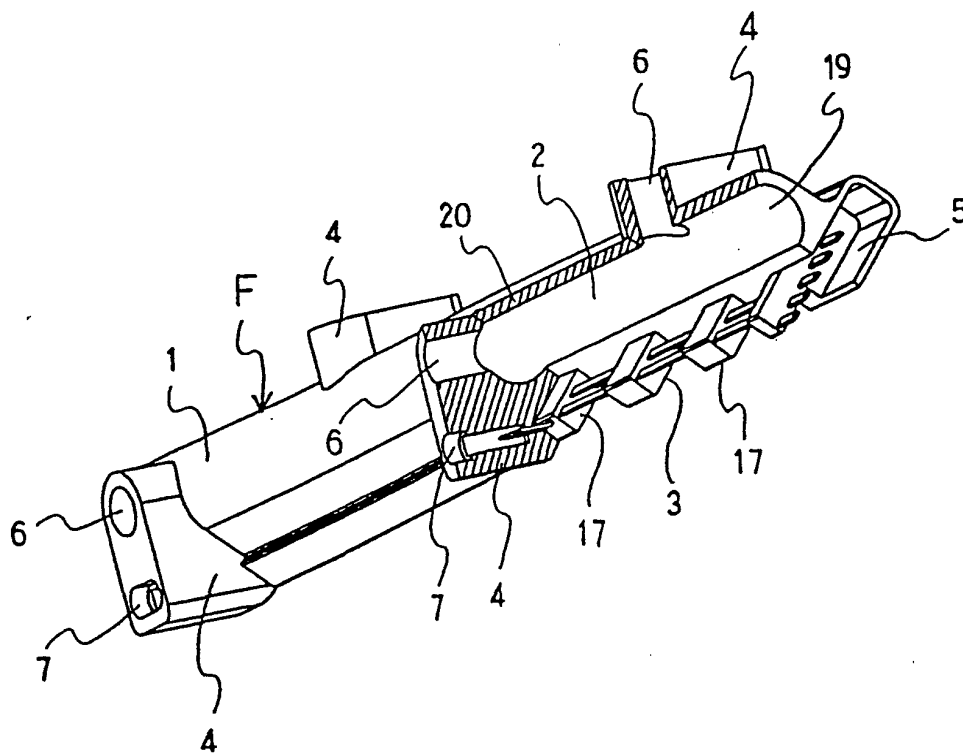


FIG. 5





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 3960

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.7)
Y	US 4 570 601 A (ITO MASAKI ET AL) 18 February 1986 (1986-02-18) * column 2, line 29 - column 3, line 40; figures *	1	F02M55/02
Y	ABTHOFF J: "DER NEUE ZWOELFZYLINDER-MOTOR FUER DIE NEUE MERCEDES-BENZ S-KLASSE" MTZ MOTORTECHNISCHE ZEITSCHRIFT, DE, FRANCKH'SCHE VERLAGSHANDLUNG, ABTEILUNG TECHNIK. STUTTGART, vol. 52, no. 5, 1 May 1991 (1991-05-01), pages 220-232, XP000207872 ISSN: 0024-8525 * figure 24 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F02M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 August 2000	Examiner Torle, E
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 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 10 3960

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on

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07-08-2000

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i For more details about this annex : see Official Journal of the European Patent Office, No. 12/82