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(71) Applicant: **Muller, Jan**
Harm Nijholtstraat 20
NL-8375 BV Oldemarkt(NL)

(72) Inventor: **Muller, Jan**
Harm Nijholtstraat 20
NL-8375 BV Oldemarkt(NL)

(54) Valve gear for an internal-combustion engine.

(57) A valve arrangement for all kinds of four stroke combustion engines with the possibility to open the inlet and outlet valve without, or with less valve spring tension. This occurs by means of two auxiliary camshafts (3 and 5) which are commanding two camfollowers (3 and 5). By this system the valve spring (4) has been commanded from the up- and down side. That is giving a possibility to have no spring tension at opening the valves and the normal tension of closing the valves. The result of this system will be the possibility to open the in- and outlet of the valves quicklier to get a much better fillingsdegree ofthe cilinders and a better exhaust. The result of this invention will be improvement of the efficiency of four stroke combustion engines.

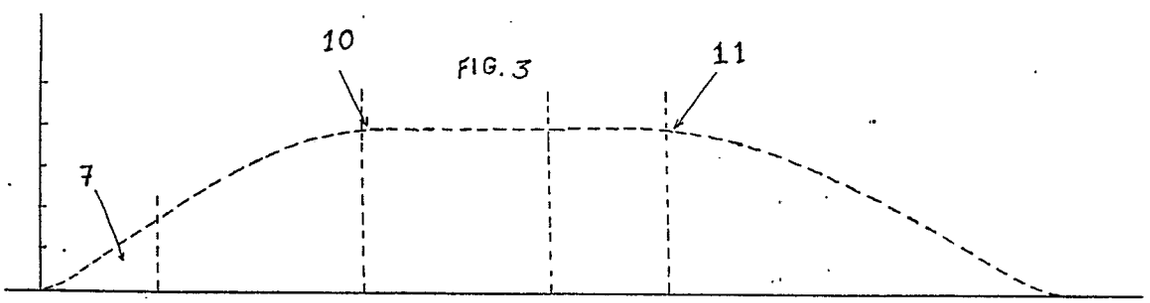

FIG. 3

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INTERNAL COMBUSTION ENGINE

The invention is related to one or more cylinder four stroke internal combustion engines and especial to the improvement of the degree of admission of the cylinders of those engines.

Since the beginning of the development of four stroke engines, the admission- and exhaust gear were controlled by valves. Unless some attempts to control the admission- and exhaust gear with sliding valves, a on top of the piston constructed conical rotating cylinder with a system of in- and outlet openings, known under the name of 'Aspin engine', a same system with a at right angels to the top of the piston constructed cylindrical box with in- and outlet openings, known as 'Cross sliding valve', and further a, dating from a 1928 French patent nr. 638.771, system in which the spring tension is produced by a plate spring packet, untill now the everywhere used piston engine with valve-controlled in- and outlet systems has maintained.

One exception is the 'Wankel motor', the so called rotating piston engine, still being in use and under construction. This engine is being produced for different purposes, however not in competition with the piston engine.

In the field of valve control, the so called desmodromic valve control system was applied during the 1950-ies, which suited very well for high revolving engines meant for racing purposes, but not very well satisfying for normal use.

The main feature of this invention is to improve considerable the already mentioned degree of admission, which is relatively very low with the systems of valve control which are customary at present.

In the following paragraph, the invention will be outlined with reference to the enclosed drawings.

Fig. 1 shows a cross section of a cylinder head with two over head cam shafts and two auxiliary cam shafts, according to the invention.

Fig. 2 shows a valve lift diagram of an average of combustion engines, presently in use.

Fig. 3 shows a valve lift diagram of a, according to the invention, feasible possibility with equal load on material.

Fig. 4 shows a valve spring tension diagram for the main cam shaft in relation with the valve lift diagram.

Fig. 5 shows a variation of fig. 1 where valve control is accomplished by means of one cam shaft with two rockers.

Fig. 6 shows a variation of fig. 1 where one central cam shaft controls all valves by means of rockers.

The construction drawing in fig. 1 shows a over head cam shaft (1) system, general customary in present engine constructions and supposed to be well known. New in this construction are two lower lying auxiliary cam shafts (2) which control the valve springs 4) from the bottom by means of cam followers (3).

The feature of these double-sided controlled valve springs (4) is, in combination with correctly profiled cams (1 and 2) and cam followers (3 and 5), by better controlled valve spring tensions and occurend mass forces, to reach a more favourable opening- and closing time of the valves and with that a higher degree of admission of the cylinders.

This system of valve control can be applied on big and small, one or more cylinder fore stroke petrol- or diesel engines.

It is suitable for engines with one in- and outlet valve per cylinder as well as for engines with more in- and outlet valves per cylinder, on condition that the valves are working parallel. The system can not be applied on engines with radial valve control.

With a better possibility of adjusting the occurend valve tensions and mass forces, a longer life and more silent operation of the valve mechanism will be possible. It will also be possible to increase significantly the motor output of a particular engine, consequently very important for engines meant for racing- and sporting purposes.

With the accomplished better cylinder admission in this system, the need for pressure admission by means of a turbo or compressor will decrease considerably.

In fig. 2 a valve lift diagram is shown assuming an average of the valve control systems concerning present engines.

The diagram in fig. 3 shows the feasibility with more or less the same load on material. In elucidating this, fig. 2 (6) and fig. 3 (7) demonstrate the important difference in gas passing at the beginning of the lift on the in- and outlet valve. This is the result of the important decrease of the initial tension of the valve spring during the opening of the valve, made possible by this system. Also improvements are feasible during the closing of a valve, as the valve spring tension can be adjusted by means of the auxiliary cam to the cam profile to be followed. This of course is subject to the demands to be put to the particular engine.

With better possibilities for opening and closing of the valves, the advanced opening, the overlap and the reclosing of the valves at equal motor output will get significant lower values, by which in particular the thermal load of the outlet valve will be more favourable by longer contact with the valve seat.

Also the closing of the valves will improve because of the possibility to decrease the valve spring tension at the end of the valve movement, so consequently the driving in of the valve seat will decrease considerable.

Fig. 4 shows two diagrams (8 and 9) in which 8 demonstrates the valve spring tension of the main cam (1 fig. 1) and 9 the valve spring tension of the auxiliary cam (2 fig. 1).

In fig. 3, 10 and 11 indicate the critical points in the valve movement, namely the termination of the lift elevation in connection with the mass forces (10) and the needed valve spring tension in connection with the cam profile to be followed.

According to diagrams 8 and 9 (fig. 4) it is possible to get an optimal value spring tension by means of the cam - and cam follower profiles of the main cam 1 (fig. 1) and of the auxiliary cam 2 (fig. 1), in connection with the maximum number of revolutions.

The driving of the complete system can be done by means of toothed wheels and a toothed belt. With this, less knocking loadings will occur by a better regulation of the valve spring tension so consequently, life duration will increase.

Fig. 5 shows a construction with one cam shaft where valve 13 is controlled by main cam 14 and rocker 15 and where the bottom of valve spring 16 is controlled by the auxiliary cam 17 and rocker 18. This is a simplyfied construction of fig. 1.

Fig. 6 shows a construction with one cam shaft (19) which per cylinder contains all the needed main- (20) and auxiliary cams (21) and which controls all in- (22) and outlet valves (23) by means of main- (24) and auxiliary rockers (25). This constuction is very simplyfied because only one cam shaft is needed whereas still the advantages of the construction shown in fig. 1 remain, except for some possible limitation in the maximum number of revolutions.

Claims

1. Valve driving for one- and more cylinder diesel- or petrol combustion engines with two or more valves per cylinder, with the feature that a movable valve spring support, by means of a second cam, controls the valve spring tension in such a way that during the opening of the in- or outlet valve the spring tension can be kept low and during the closing of the valve(s) the spring tension can be increased according to the needs.

2. A combustion engine according to conclusion 1 with the feature that the valve driving occurs by means of one cam shaft, provided with main- and auxiliary cams which control the valve stem and the seats of the valve springs with one set of rockers.

3. A combustion engine according to conclusions 1 and 2 with the feature that the valve driving occurs by means of one centrally placed cam shaft, which controls all present in-and outlet valves by means of main- and auxiliary cams.

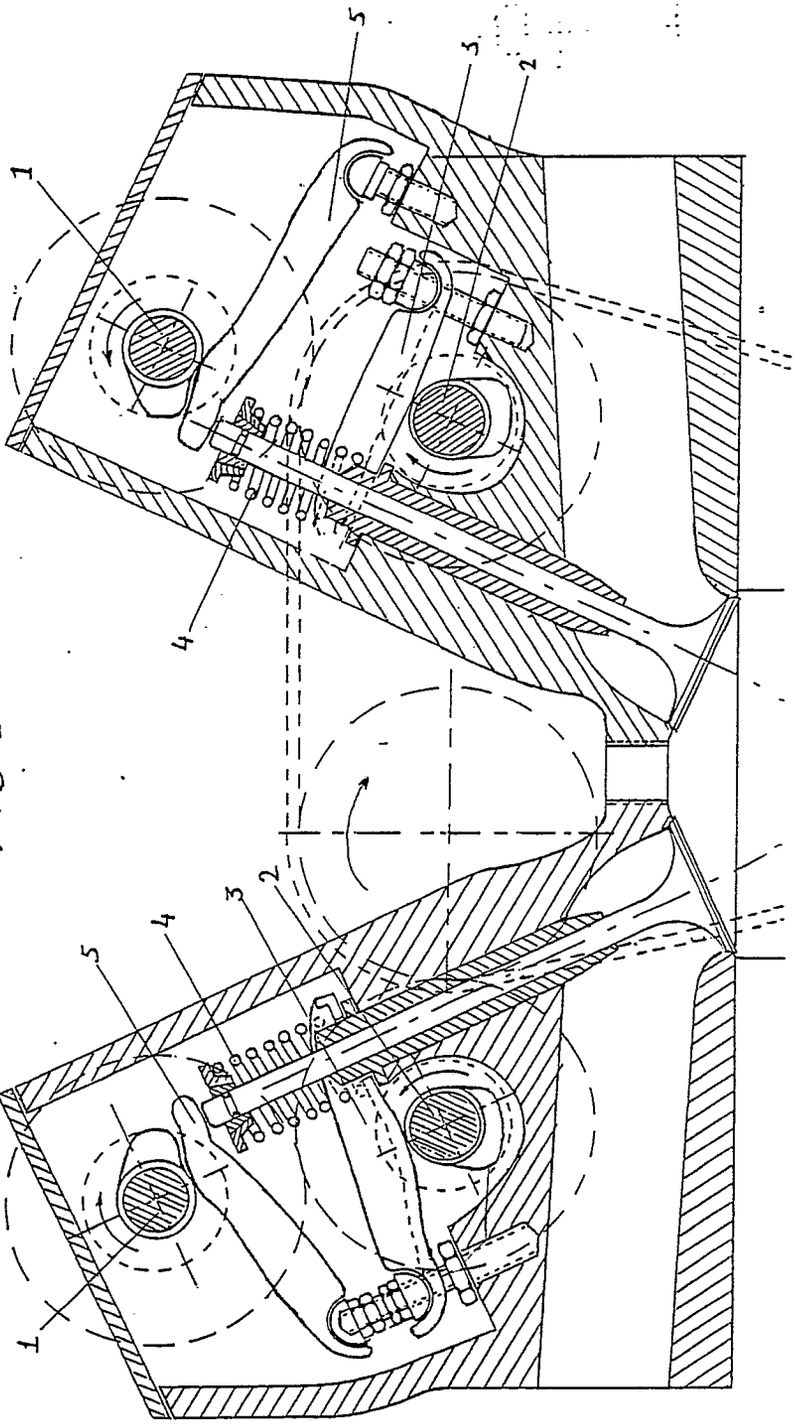


FIG 1

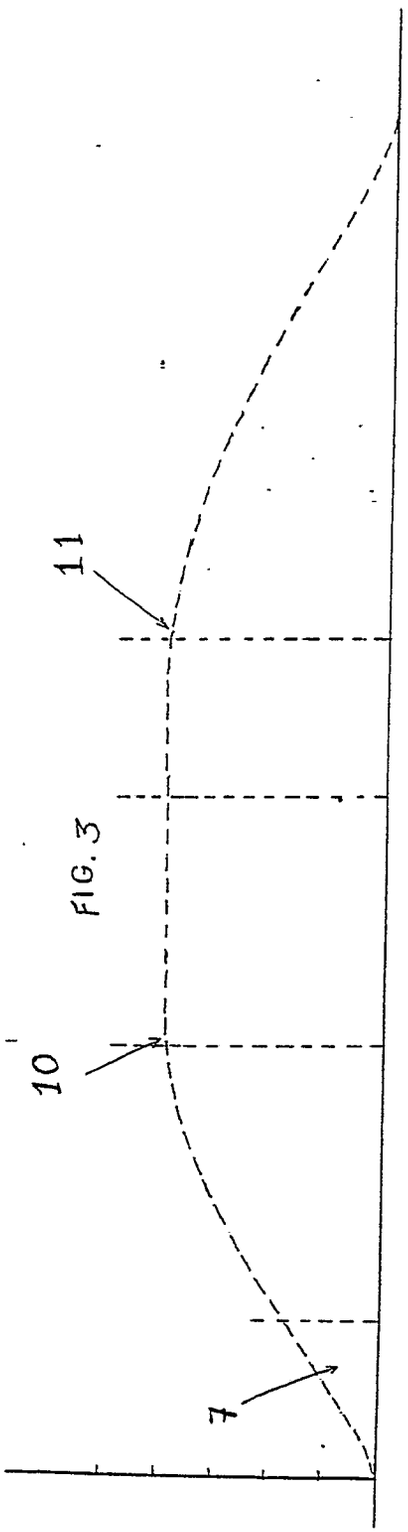


FIG. 3

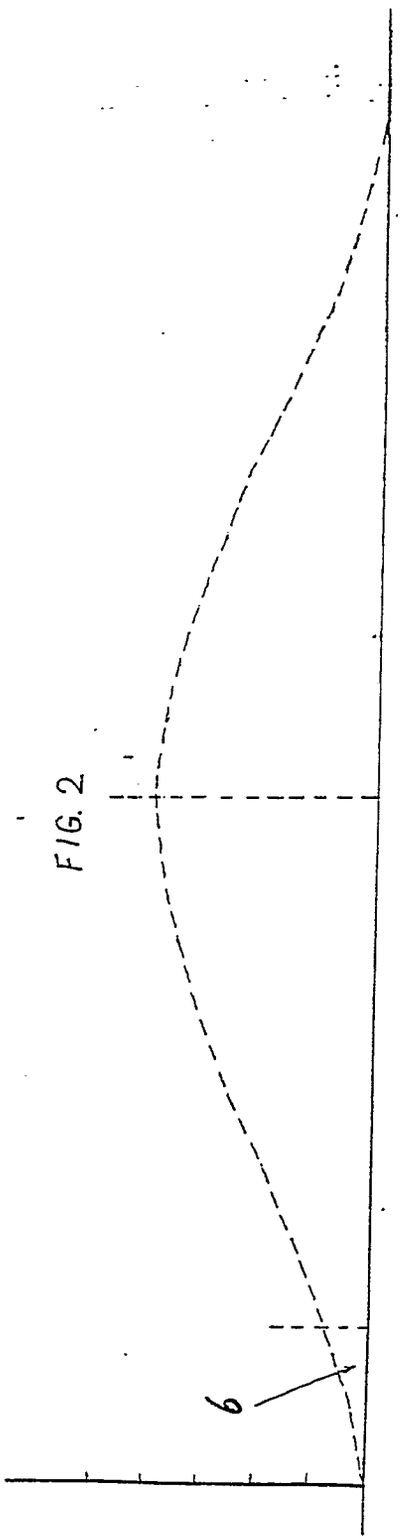


FIG. 2

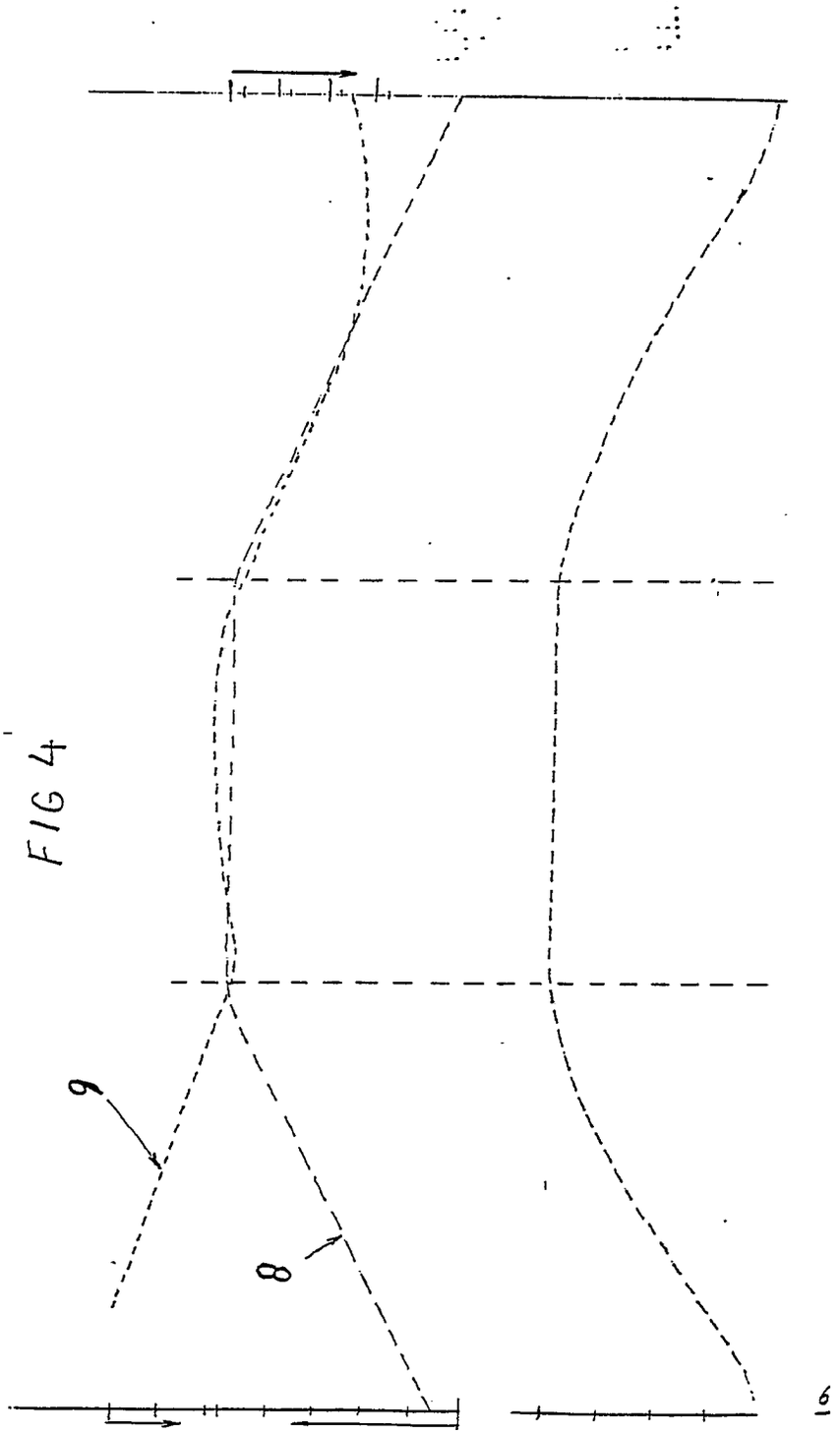
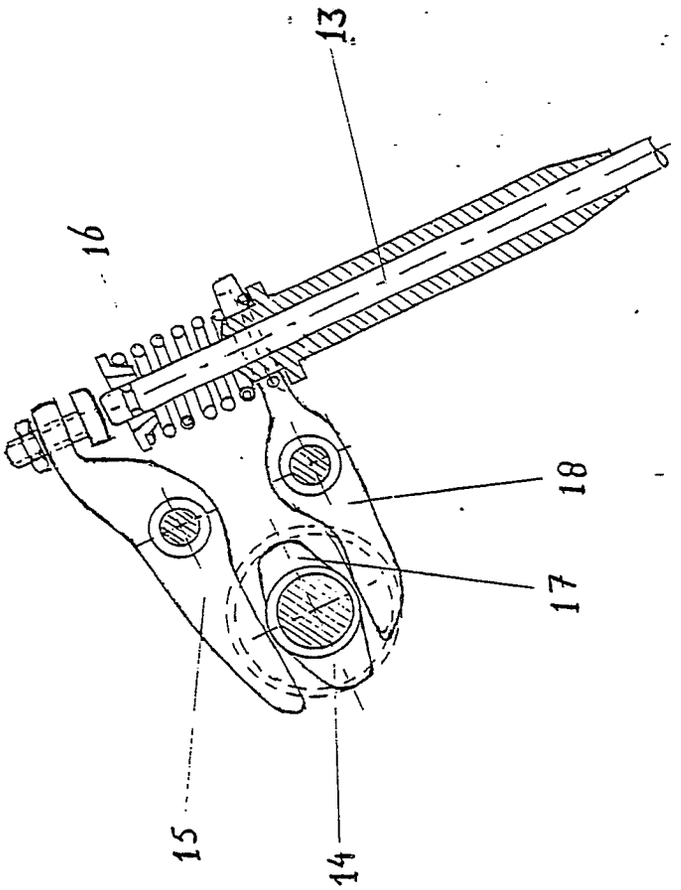


FIG 4

FIG 5



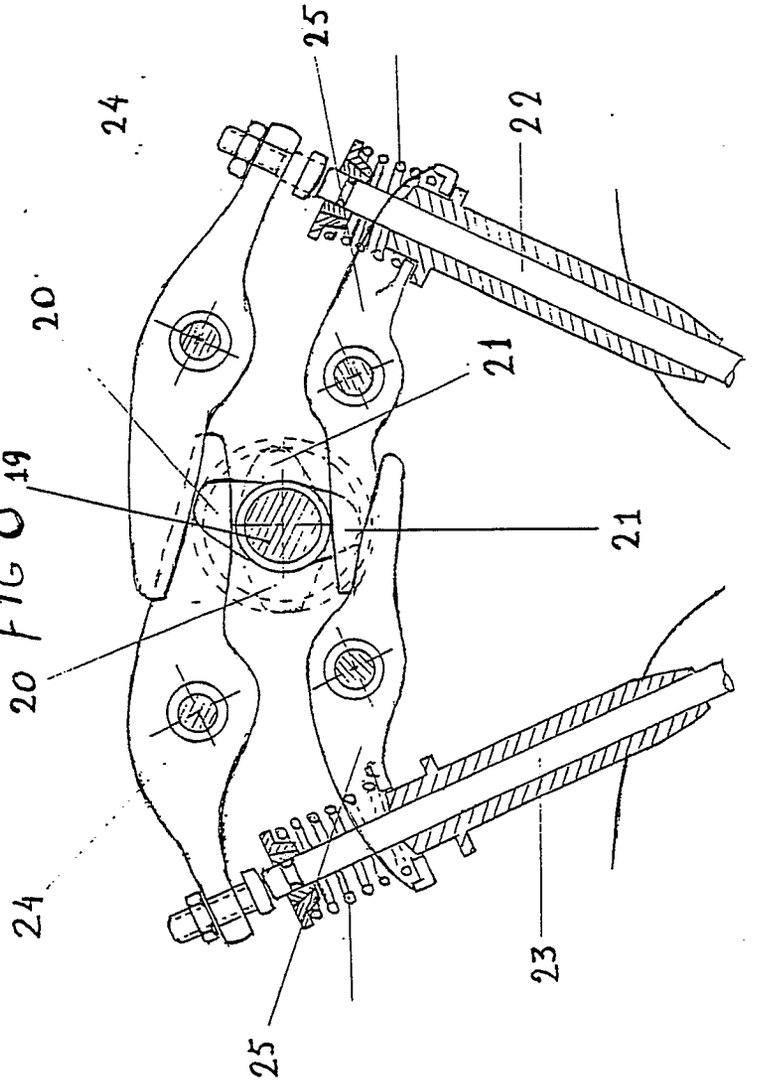


FIG 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 20 0322

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.4)
X	DE-A-3 604 412 (AUDI) * Column 11, lines 6-43; column 11, line 53 - column 12, line 12; figures 1,2 *	1-3	F 01 L 1/30
X	FR-A- 701 697 (HAAS) * Page 2, lines 7-29; figures 1,2 *	1-3	
X	FR-A- 815 195 (WOERTHER) * Page 1, line 36 - page 2, line 4; figure 1 *	1,2	
X	WO-A-8 703 645 (STIDWORTHY) * Page 4, line 24 - page 5, line 30; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 01 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25-07-1989	LEFEBVRE L.J.F.

CATEGORY OF CITED DOCUMENTS

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