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(54) **Device for conditioning of liquid fuel and liquid coolant.**

(57) The invention relates to a device for conditioning of liquid fuel and liquid coolant, and is applied especially to improve operation of internal-combustion engines, carburettor engines or compression-ignition engines, as well as gas and oil burners. The device comprises a body (1) in which a magnetic pile is situated incorporating permanent magnets (2) and pole shoes (3) or electromagnets. The body has two built-in independent flow circuits of conditioned agents. The liquid coolant circuit comprises a channel (5) between the wall of the body (1) and the magnetic pile (2), and a fuel conduit (8) in the form of a coil pipe with an odd number of coils, situated outside the magnetic pile (2) or inside the pile, incorporating a bed of ferromagnetic filings on which a magnetic field acts and through which fuel or gas being conditioned flows.

EP 0 465 705 A1

The subject of the present invention is a device for conditioning of liquid fuel and liquid coolant, applied especially to improve operation of internal combustion-, carburettor- or compression-ignition engines, as well as oil and gas burners.

Those skilled in the art know from the Polish patent specification no. 114283 a device for conditioning of liquids by means of magnetic field, consisting of a cylindrical housing, a ferromagnetic body in which a ferromagnetic roll is axially situated and surrounded by a set of annular magnets separated and bound into a whole by means of ferromagnetic internal and central pole shoes and external pole shoes situated in their planes and adhering to the internal surface of the cylindrical body. Sections of pole shoes are similar to the section of a rivet whose neck sets the distance between two neighbouring magnets.

The known devices designed for conditioning of liquids comprise sets of magnets, in most cases permanent ones arranged along the channel of the liquid flow, most often water, so that lines of forces of the magnetic field of particular magnetic circuits are perpendicular to its flow direction. From the specification of the Polish patent application no. P-264 entitled "Method and device for purification of liquids in magnetic field" a method of water treatment and conditioning is known. The said method consists in that the liquid is let pass through zones of different flow velocities, different velocity gradients, different internal pressure gradients and different gradients and intensities of the magnetic field. The device according to the said invention consists in that a filter bed consisting of packings having ferromagnetic properties is suspended in the magnetic field generated by a set of arc magnets situated circumferentially round a tank made of metal having dia- or paramagnetic properties, the said magnets having magnetic poles on the concave and convex side of the arc and two of them being situated side by side with their monomial poles, and pairs so formed - with their unlike poles.

Those skilled in the art know from the patent specification DE 3403797 a method of fuel combustion in an internal combustion engine and a device designed for that purpose, consisting in that fuel present in the fuel system of an internal combustion engine is subject to the effect of magnetic field, owing to what combustion can be improved and specific fuel consumption can be reduced. The said methods provides for that in the fuel system of an internal combustion engine, comprising fuel feed devices, a device for supplying fuel to at least one cylinder, and pipes connecting fuel paths, the fuel flowing from the feeding device to the device supplying fuel into the engine, is subject to the effect of magnetic field.

From the patent specification DE 2256379 a method of scattering of liquid fuels by means of flow magnetic field and interrupting action is known. Interaction of magnetic fields on fuel particles causes their charging and then their disintegration into microscopic, almost imperceptible petrol droplets. In the result thereof, combustion proceeds without any remainders, so, wihtout production of toxic substances. Owing to operation of the device according to the aforesaid patent, the finest particles should be transformed into complete gasification in the result of continuous influence of intermittent magnetic fields.

From the Polish patent application P-273505 there is known a method of improving the efficiency of an internal combustion engine and a device for conditioning of liquid coolant and fuel for an internal combustion engine. According to the said patent application the method of improving the efficiency of both a carburettor engine and a compression-ignition engine by conditioning of liquid coolant and fuel consists in that liquid coolant and fuel are subject to concurrent conditioning by means of a magnetohydrodynamic method by letting both these agents pass through a zone of the same magnetic field having the intensity of maximum about 2.8×10^5 A/m, with magnetic field gradient of about 10^7 A/m and velocity gradients in contractions, the magnetohydrodynamic treatment being connected with simultaneous heating of fuel by heat given up by liquid coolant. Besides, during magnetohydrodynamic treatment the flow direction of agents being treated changes in relation to the direction of lines of forces of magnetic field.

The object of the present invention is to improve operation of an internal combustion engine, to reduce fuel consumption and to protect the environment.

This object has been achieved by designing a device for conditioning of liquid fuel and liquid coolant, comprising a body incorporating a magnetic pile comprising permanent magnets, internal pole shoes and opposite external pole shoes, the said body being provided with a liquid fuel conditioning circuit and a liquid coolant conditioning circuit.

The said body incorporates also a liquid fuel feeding conduit formed by a closed bed of ferromagnetic filings, situated in magnetic field inside the magnetic pile.

An advantage of the invention consists in simultaneous combination of many conditioning processes of liquids by means of the magnetohydrodynamic method in a hybrid system and of secondary conditioning of liquid fuels at a changed flow velocity and with the use of heat given up by liquid coolant.

Owing to the invention, it is possible to con-

dition liquid coolant and liquid fuels at the same time, as well as to condition engine fuels with simultaneous reheating of fuel by heat given up in the process of engine cooling.

In the conditioning process of liquids and gases with the use of magnetic field having the intensity of minimum 2000 gausses and variable flow velocity permanent magnets and electromagnets can be used.

Moreover, in the course of the treatment liquid is swirled, what causes the flow direction of agents being conditioned in relation to the direction of lines of forces of magnetic field.

The subject of the invention is shown in examples of its embodiment in the drawing, in which fig.1 presents a longitudinal section of a device for conditioning of liquid fuel and liquid coolant, fig.2 - the device from fig.1 in the section along line A-A marked in fig.1, fig.3 - a second example of embodiment of the device from fig.1 with an additional conduit for conditioning lf liquid fuel, in longitudinal section, fig.4 - a device for combustion of fuel oil in burners for heating of flats, and for combustion of gas in gas furnaces and for simultaneous conditioning of hot water, with an additional conduit for secondary conditioning of liquid fuel and a second additional conduit for conditioning of liquid coolant, in longitudinal section.

The device /figs 1 and 2/ comprises a body 1 incorporating a magnetic pile comprising permanent magnets 2 and internal pole shoes 3 or electromagnets, and has a hybrid system of conditioning liquid coolant, liquid fuels or gases. The body has two built-in independent flow circuits for agents to be conditioned. The liquid coolant circuit is a channel 5 between the wall of the body 1 and the magnetic pile 2, connected by a liquid coolant feeding stub pipe 6 and a drain stub pipe 7 of said liquid coolant. The fuel or gas circuit is formed by a paramagnetic or diamagnetic conduit 8 shaped as a coil pipe with an odd number of coils situated outside the magnetic pile 2 and pole shoes 3. Ferromagnetic pole shoes 3 are in the form of disks provided with grooves forming a fuel or gas conduit 8 and have a rounded surface of a shape similar to the ellipse. The conduit /fig. 3/ feeding liquid fuel is formed by a bed of packings having ferromagnetic properties, preferably of steel filings 16 suspended in magnetic field generated by a set of annular magnets mounted on a tube made of metal having dia- or paramagnetic properties, separated by pole shoes and situated alternately with monomial polarity.

Fuel is let pass through zones of different flop velocities, different velocity gradients of internal pressures and different gradients and intensities of magnetic fields. The said different parameters are obtained owing to the influence of magnetic field on the zone incorporating packings of ferromagnetic properties and of different dimensions, and shapes stochastically arranged in relation to one another. In slots, depending on the shape and contact area of these packings, high intensity of magnetic field is obtained, reaching up to $10 \cdot 10^4$ A/m. In slots of high flow velocity and low internal pressure fuel degassing proceeds quicker, and in slots of low flow velocity and high intensity of magnetic field gas particles are stopped, accumulate into bubbles and are entrained by the fuel flux.

In the external zone of the cooling water flow there is also an influence of magnetic field with variable intensity and flow velocity gradients.

These two systems, being independent flows of fuel and water, gas and water, cooling air and fuel, cooling air and gas, form at the same time a common hybrid system for conditioning of liquid and gas by the magnetohydrodynamic method, additionally aided by secondary fuel conditioning by means of an additional conduit 14 or by secondary liquid conditioning by means of a conduit 15. The device does not require any additional filter on the liquid coolant circuit.

An advantage of the solution according to the invention is almost 100% efficiency of cleaning the cooling system from boiler scale with the application of water as a coolant and at least 5% fuel economy or gas saving, depending on the type of the engine, the burner and fuel.

The device may be included in the cooling system and the feeding system in internal combustion or gas engines. During their operation the flowing liquid coolant and fuel are subject to simultaneous magnetohydrodynamic influence. Since processes of conditioning the liquids by magnetic field proceed most effectively according to practical tests at the temperature of 70-90°, it should be recognized that in hybrid action the temperature of liquid coolant, fuel and gas is of essential importance. In the said process in liquid coolant polymers with surface activity are formed, which cause removal of impurities from the cooling system, especially boiler scale. Moreover, the whole cooling system improving the engine operation is made patent and, additionally, the said system is protected against corrosion.

In the result of the influence of magnetic field and heating, in fuel great amount of fine air bubbles with double layers are produced, on which fuel polymers get put in order. Intensification of this process will proceed by the flow in magnetic field velocity gradient. In the result of production of linear polymers drops will be broken up in the process of spraying of fuel in the carburettor. A change of the structure of hydrocarbon chains under the effect of applying the treatment with mag-

netic field will improve antiknock properties of fuel, i.e. will raise the octane number.

The application of the device according to the invention enables improving the efficiency of the cooling system in almost 100% and, additionally, protects the said system against corrosion, enables reducing fuel consumption by at least 5%, depending on the type of the carburettor engine or compression-ignition engines, reducing fuel combustion at idle running of the engine, increasing the engine idling speed at the same engine adjustment by about 10%, improving the acceleration and the maximum speed of the vehicle, steady running of the engine immediately after cold starting, considerably better starting at low temperature, considerably quicker and smooth reaching of high engine speed at low temperatures and under load, reducing the deposit on electrodes of spark plugs, reducing the emission of black and, thus, reduced smoking from the exhaust pipe, especially at a cold engine, considerable prolongation of the service life of the exhaust system, reduced emission of toxic substances such as CO, CO_2, nitric oxide and hydrocarbons in exhaust gases, improved combustion of carcinogenic benzene in lead-free petrol, considerable prolongation of the catalysts life owing to better combustion of fuel, complete elimination or considerable reduction of engine clashing in the result of increased octane number of fuel when low-octane or lead-free petrol is used, less intense heating-up of the turbo-charger and prolongation of its service life in turbo diesel engines after starting the angine, additional heating of fuel, delayed gelation of diesel oil and changing of gelation temperature from -14°C to about -18°C in the neares operation zone of the device at cold starting of the engine, improved operation of the fuel injection pump and the injection sprayers, as well as considerable prolongation of their service life, prolongation of failure-free operation of the carburettor engine and the compression-ignition engine, environment protection owing to lower fuel consumption and better combustion. Besides, the application of the device does not require any additional electric energy, except for devices designed with electromagnets.

Fig. 4 presents the device differing from the one presented in fig. 3 by that cooling water is subject to secondary conditioning by elongation of its flow path in magnetic field. This is of particular importance for conditioning of, for instance, warm water in gas furnaces in which water is used after treatment, i.e. it is not re-circulated. Owing to such a solution, the effectiveness of the treatment with magnetic field is increased.

The device according to the invention as presented in Figs 1 ÷ 4 is widely applicable in motorization and heating installations, in sea navigation, refrigerating engineering and in generating sets.

Reference signs in the claims are intended for better understanding and shall not limit the scope.

Claims

1. Device for conditioning of liquid fuel and liquid coolant, characterized in that it comprises a body /1/ in which a magnetic pile is situated incorporating permanent magnets /2/ and internal pole shoes /3/ and opposite external pole shoes /12/, and the said body is provided with a liquid fuel conditioning circuit and with a liquid coolant conditioning circuit.

2. Device according to claim 1, characterized in that the body /1/ incorporates a conduit for liquid fuel, formed by closed bed of ferromagnetic filings /16/ situated in magnetic field inside the magnetic pile.

3. Device according to claim 1, characterized in that the liquid fuel conditioning circuit has an additional conduit /14/ for secondary conditioning of liquid fuel and an additional conduit /15/ for secondary conditioning of liquid coolant.

4. Device according to claim 1, characterized in that pole shoes /3/ are in the form of disks provided with grooves forming a fuel conduit /8/ and have a rounded surface in the form similar to the ellipse.

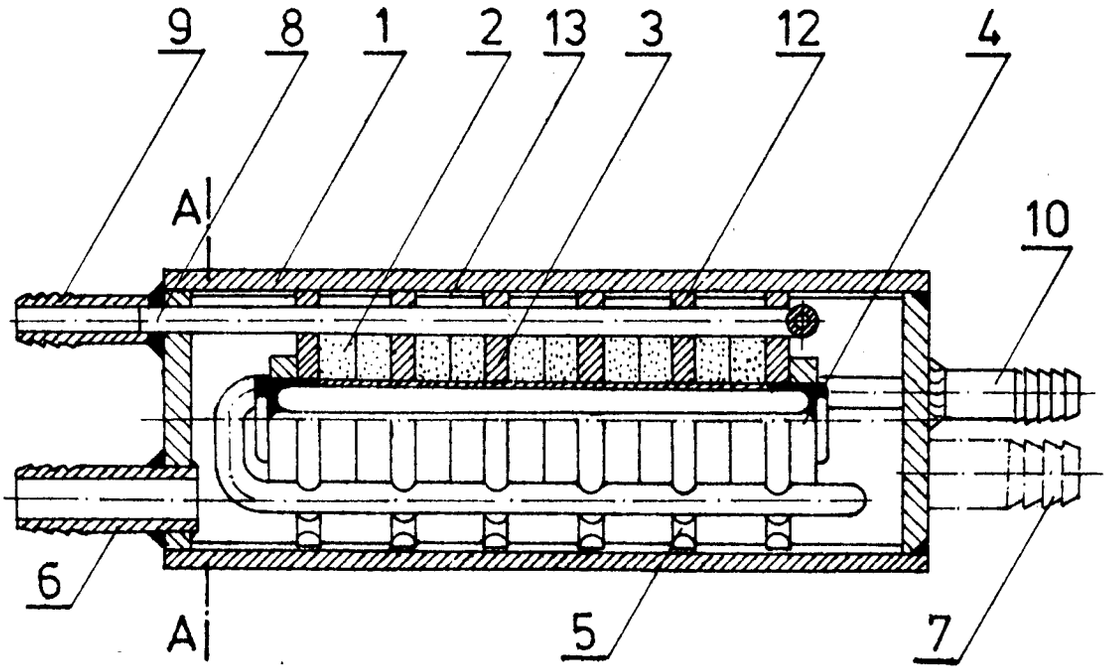

Fig. 1.

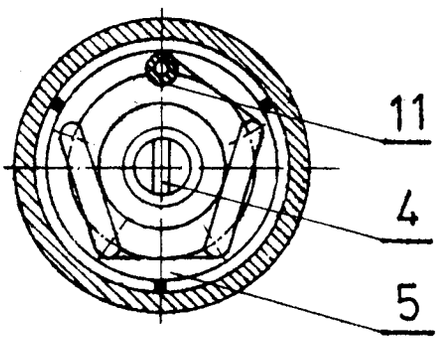

Fig. 2.

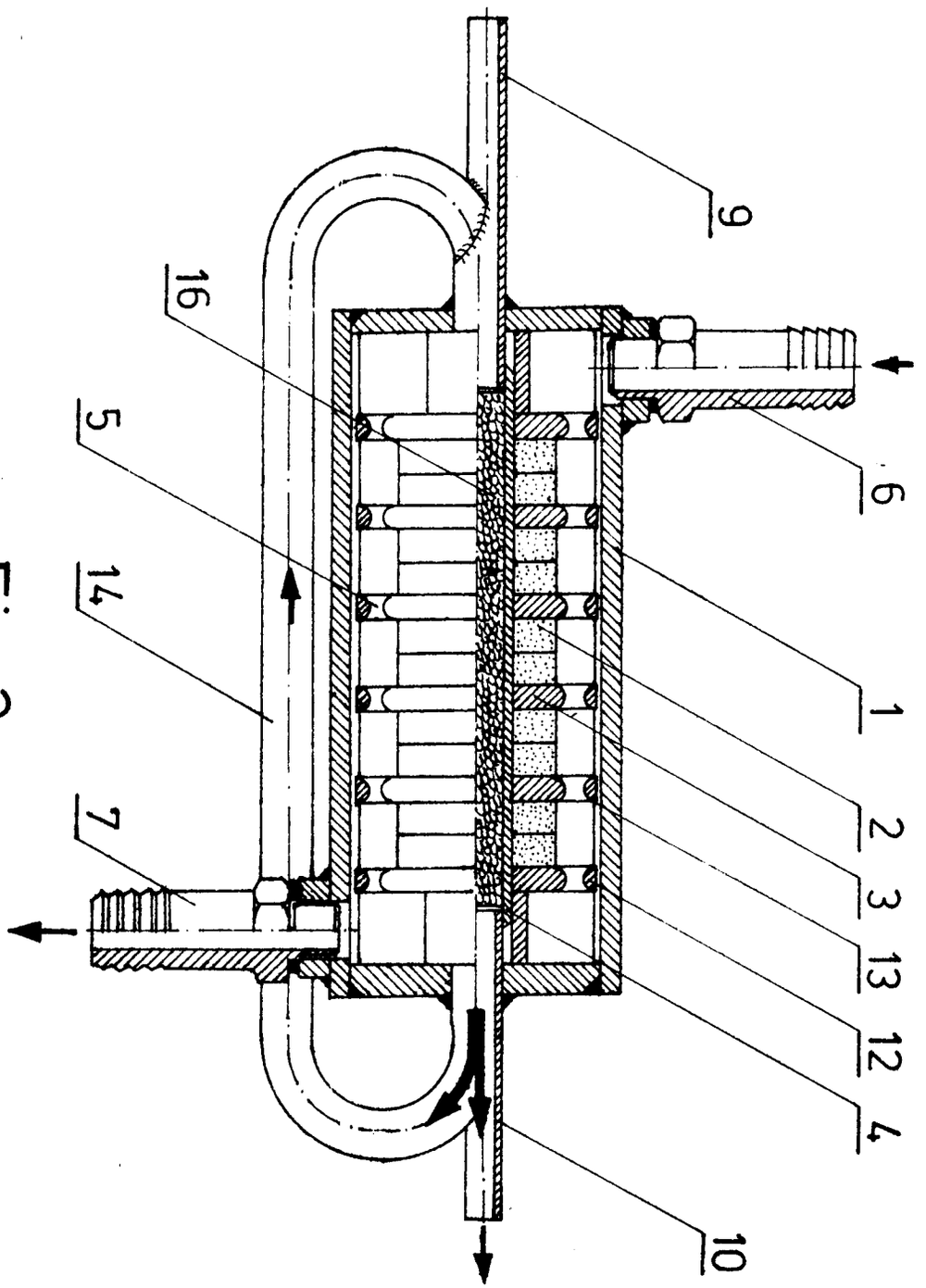

Fig.3.

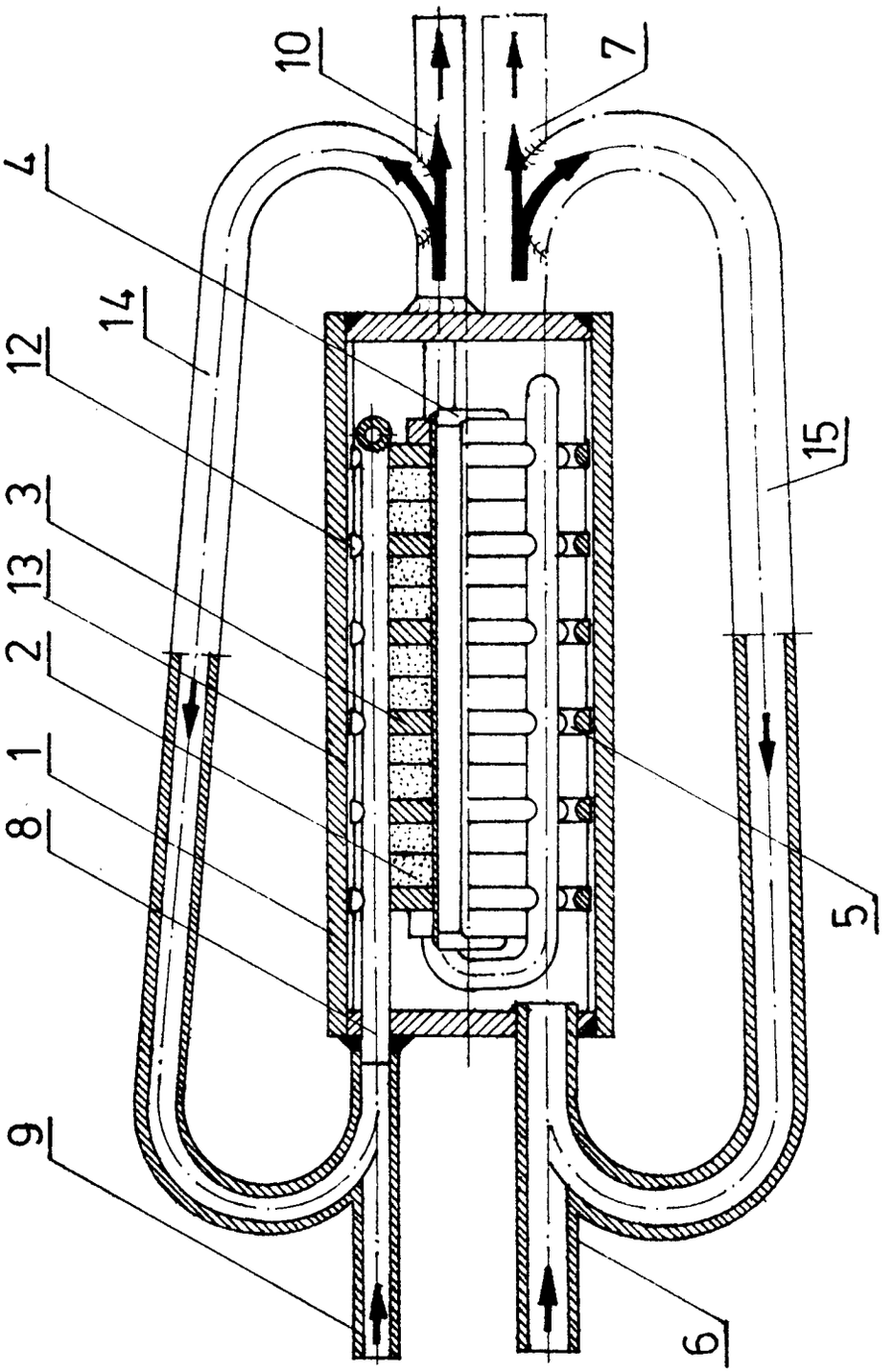

Fig.4.

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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 3261

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)
A	EP-A-0 073 077 (S.B.H. TRADING S.A.) * page 1; figures 1-4 *	1	F 02 M 27/04
A	US-A-3 951 807 (SANDERSON) * claim 1; figures 1-4 *	1	
A	FR-E-71 176 (M.R. MELI) * page 1, left-hand column, paragraphs 1 - 2 * * page 2, left-hand column, paragraph 2; figures 4, 5 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 02 M
F 23 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	21 February 91	ALCONCHEL Y UNGRIA J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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