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(54) **System for supplying solid polymeric combustible for industrial and/or civil combustors**

(57) The present invention refers to a system and relative equipments for supplying polymeric solid fuel in combustors used for industrial and civil purposes.

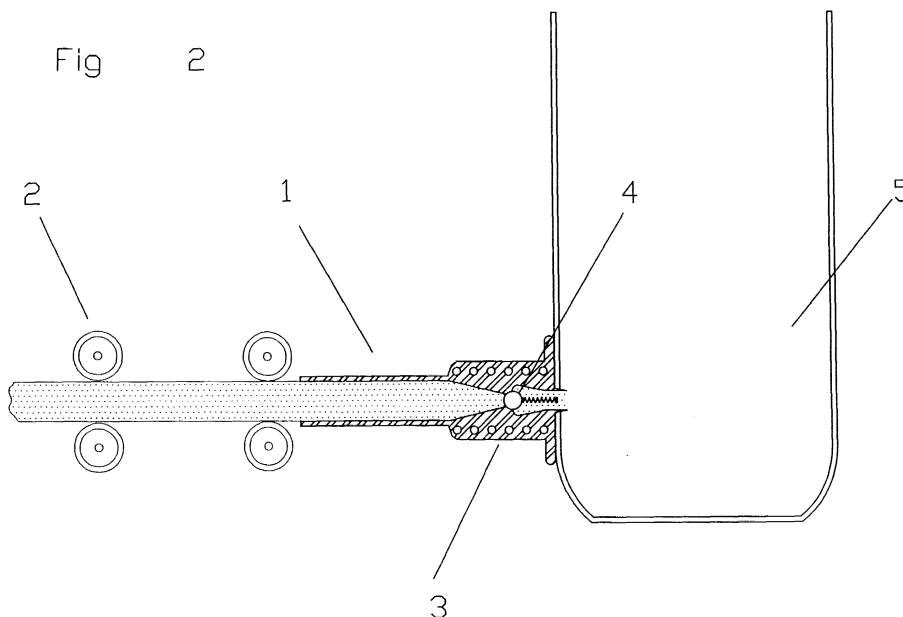
The apparatus can use thermoplastic or thermosetting polymer and specific injectors with materials that can be supplied as continuous elements with a suitable size and shape.

Homogeneous or charged polymeric materials can be used. The charged type materials are doped with specific additives in order to optimise the combustion process enhancing the efficiency and minimizing the emission of polluting elements during combustion.

The main features of the present invention are

- use of plastic materials from recycling and/or from industrial scraps as continuous bars, continuous wire or as discrete element suitably thermoformed immediately before the device with a dedicated apparatus;
- easy interfacing to most industrial and civil combustion systems;
- best feed control of solid fuel relating to actual systems;
- reduction of pollutants produced during combustion.

Fig 2



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**Description***STATE OF THE ART*

**[0001]** In the recent years, industrial countries devoted particular attention to problems concerning the handling of polymeric wastes.

**[0002]** The specific chemical-physical characteristics aimed all the efforts of industrial operators to the recycling of such materials that in some cases can be considered as economical resource. In fact, recycled polymer can be used in energy production in different industrial and/or civil sectors as: cement factories, lime factories, paper factories, power station, incinerators, foundry district heating etc. In all cases, relating to different specific application, it is important to optimise the air/fuel ratio to increase the combustion efficiency and minimize pollutants in flue gas.

**[0003]** The control of the fuel flow rate is particularly difficult in actual systems mainly due to granulometric and morphologic characteristics of polymeric materials.

*DESCRIPTION*

**[0004]** The present invention refers to the device and related equipments for supplying a solid polymeric material used as fuel in most systems for energy production and/or for thermodestruction.

The device is designed to operate using of polymeric combustible coming from a specific production or from industrial scrap, plastic recycling after suitable pre-treatments.

The combustible, thermoplastic or thermosetting polymeric material, can be used as a continuous element of a suitable size and shape (circular, square cross-section).

The continuous element, relating to operating regimes of the combustor and to chemico-physical characteristics of the material used, can be used or as discrete bars (of suitable length) or as continuous wire (in roll) or suitably thermoformed with a dedicated apparatus before the supply of the combustible to the device.

The feeding device of the polymeric combustible is made by specific injectors that are generally formed by two sections: the first one to feed the material, the second one to control the temperature and the physical state of the combustible.

The combustible flow rate to the combustion chamber, i.e. the feeding velocity is controlled by mechanical and/or pneumatic system.

The feeding device can utilise two type of combustible material:

1. Homogeneous (Fig. 1,a)
2. Charged (Fig. 1,b,c)

## Homogeneous

**[0005]** The homogeneous material (fig. 1, a) is made by polymers of the same type or by a blend of different type with a chemical and/or a mechanical cohesion of polymer particles. This kind of material can be divided in two categories: thermoplastic or thermosetting.

## Charged

**[0006]** The charged material can be produced by a homogeneous polymer adding a suitable amount of solid and/or liquid chemical compounds able to enhance the following combustion limiting the emission and the production of noxious compounds. The additives can be blended homogeneously in the polymer matrix (Fig. 1,b) or located in one or more cavities inside of the continuous element (Fig. 1 c).

**[0007]** The material, homogeneous or charged, of suitable size and shape is feed into combustion chamber by the devices illustrated in fig. 2 and fig. 3 referred as injector 1 (**I1**), and injector 2 (**I2**).

The injector **I1** can be used with thermoplastic polymers obtaining a supply of the polymeric material to the combustor in plastic, liquid or gaseous state.

As shown in figure 2 the injector **I1** is designed with a guide chamber (1) in order to obtain a suitable supply of the material to the nozzle; the feed of solid polymer is obtained by means the device (2). The injector **I1** is equipped with the section (3) to control polymer temperature and hence for supplying to combustors the material in solid, or liquid or gaseous state in relation to the relative temperature level and optimising the combustion process. At the end of the section (3) is located a converging zone in which a suitable amount of liquid polymer, due to a higher temperature level, control the pneumatic sealing between the material and the injector. The complete pneumatic sealing and the pneumatic uncoupling between the combustion chamber and the injector is obtained by a security valve. This valve preserves the feeding device by possible over-pressure phenomena that can be produced in the combustion chamber (5).

**[0008]** The injector **I2** can work with both solid or liquid polymer.

As shown in figure 3, the injector **I2** has a guide chamber (6) with, at the end, a heating/cooling device (7) to control the combustible temperature.

The sealing between the combustible bar and the injection device is obtained by a suitable sealing system (8). The injector type has to be optimised relating to specific combustor. In the following, explanatory examples are shown.

**Example N°1****Bubbling Fluidised Bed Combustor, Circulating Fluidised Bed Combustor**

[0009] Both injector types can be used with these combustors. Combustible temperature is controlled at a level in order to supply to the fluidised bed polymer drop-lets, by means the injector I1, or solid polymer, by means the injector 12. The material burns in contact with the powder at high temperature. In this case, in respect to actual feeding devices, a higher control of the polymer flow rates can be obtained, avoiding the undesired under/overfeeding of combustible to the combustor. This control can be obtained controlling the feeding velocity of solid polymer bar and optimising the nozzle size and shape in relation to process conditions.

**Example N°2****Boiler Combustor**

[0010] The injector I1 is used in this case. A gas of polymer is fed to the combustor. The nozzle temperature must be controlled at level so high to obtain the gasification of polymeric combustible. The mixing of this polymeric gas with the air allows to obtain a very controlled and efficient combustion with a very low production of combustion products. The polymeric flame can be activated for example by a driving-flame or by an electric igniter.

**Claims**

1. Device to supply polymeric material to combustor for energy production.
2. Device, claimed at n° 1, to supply plastic material to thermodestruction plants.
3. Supplying system, as described in previous claims, to supply thermoplastic polymer.
4. Supplying system, as described in previous claims, to supply thermosetting polymer.
5. Supplying system, as described in previous claims, to supply polymeric material as a continuous element of suitable size and shape.
6. Supplying system, as described in previous claims, to supply polymeric material as bars of suitable length, size and shape.
7. Supplying system, as described in previous claims, provided with a thermoforming device.
8. Supplying system, as described in previous claims, to supply polymeric material as continuous wire in roll.
9. Supplying system, as described in previous claims, using specific injectors to obtain a controlled supplying of polymeric combustible.
10. Injectors, as described in claims n° 9, with two different sections. First one to feed the continuous combustible elements and control the combustible flow rate; the second one to control the physic characteristics of polymeric combustible by means of the control of the operating temperature of the continuous elements.
11. Supplying system, as described in previous claims, to supply homogeneous and charged polymeric material.
12. Supplying system, as described in previous claims, to supply at combustion chambers homogeneous polymeric materials of similar chemical structure or blends of polymeric materials with a suitable chemical and/or a mechanical cohesion of polymer particles to form a continuous element.
13. Supplying system, as described in previous claims, to supply at combustion chambers charged polymeric material, i.e. homogeneous polymeric materials charged with solid or liquid compounds able to enhance the combustion and to limit the production of noxious compounds during combustion process.
14. Supplying system, as described in previous claims, to supply at combustion chambers charged polymeric material of thermoplastic type or thermosetting type.
15. Supplying system, as described in previous claims, that can be equipped by two different type of injectors: injector I1 and injector I2 respectively shown in figure 2 and figure 3.
16. Supplying system, as described in previous claim n° 15, that can use injector I1 with thermoplastic or thermosetting polymers.
17. Injector, as described in claims n° 15 and n° 16, that allows the supply of polymeric combustible in solid, liquid and gaseous phase.
18. Supplying system, as described in previous claim n° 15, that can use injector I2 with thermosetting polymers.
19. Injector, as described in claims n° 15 and n° 18, that allows the supply of polymeric combustible in liquid

and gaseous phase.

20. Supplying system, as described in previous claims, that can be used to supply polymeric material to different type of combustor, i.e.: Bubbling Fluidised Bed Combustors, Circulating Fluidised Bed, Heating Boiler Combustors, Boiler Combustor for energy production.

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Fig. 1

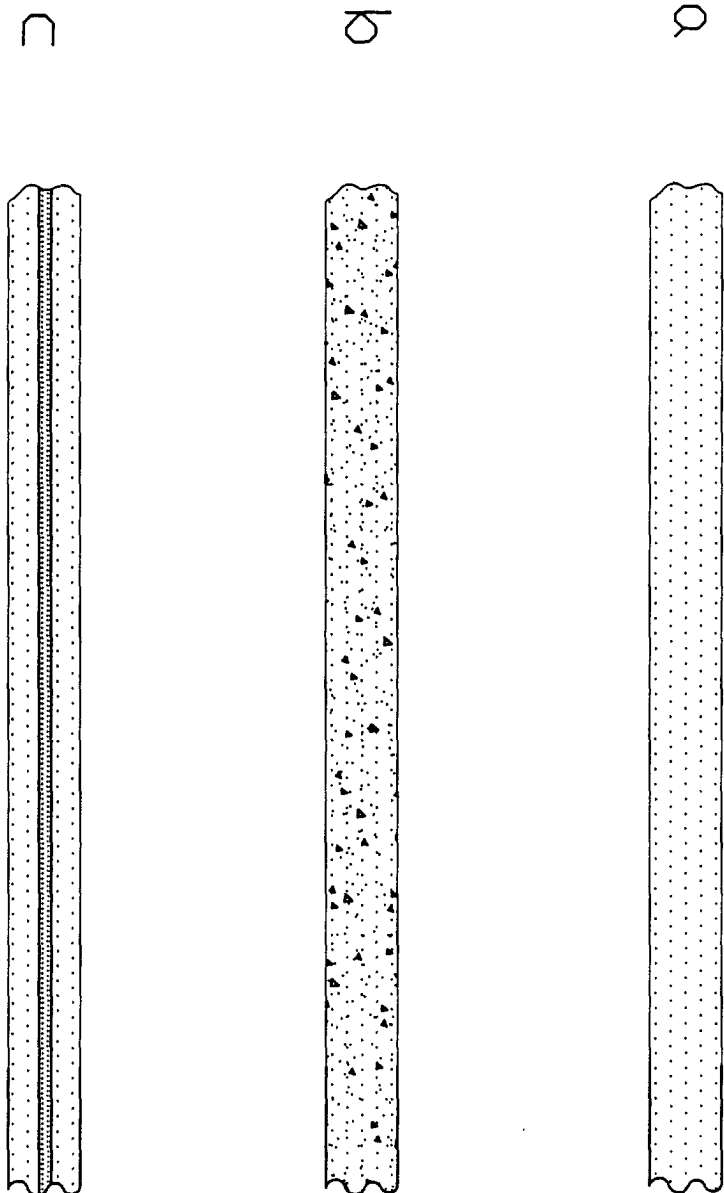


Fig 2

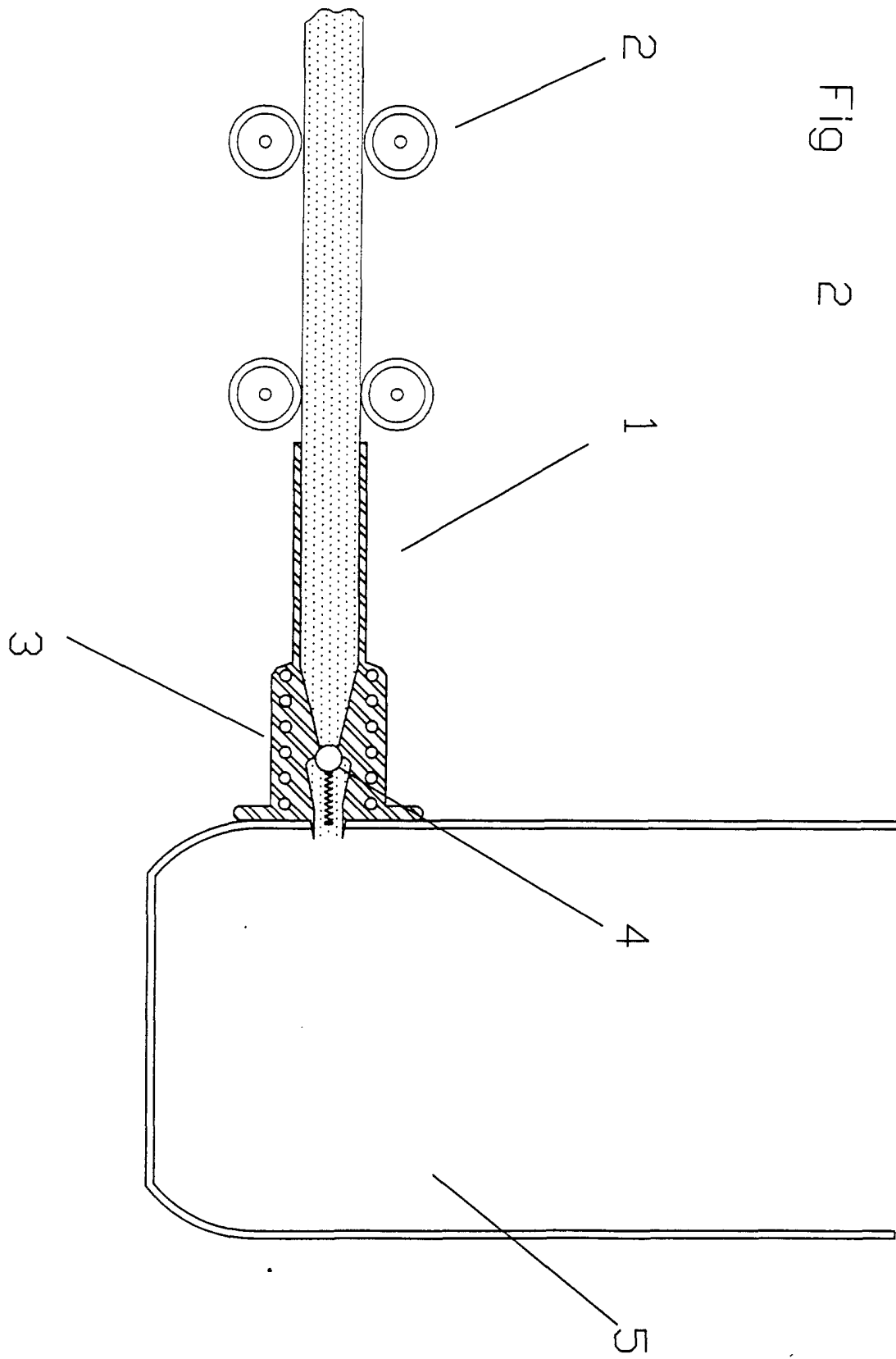
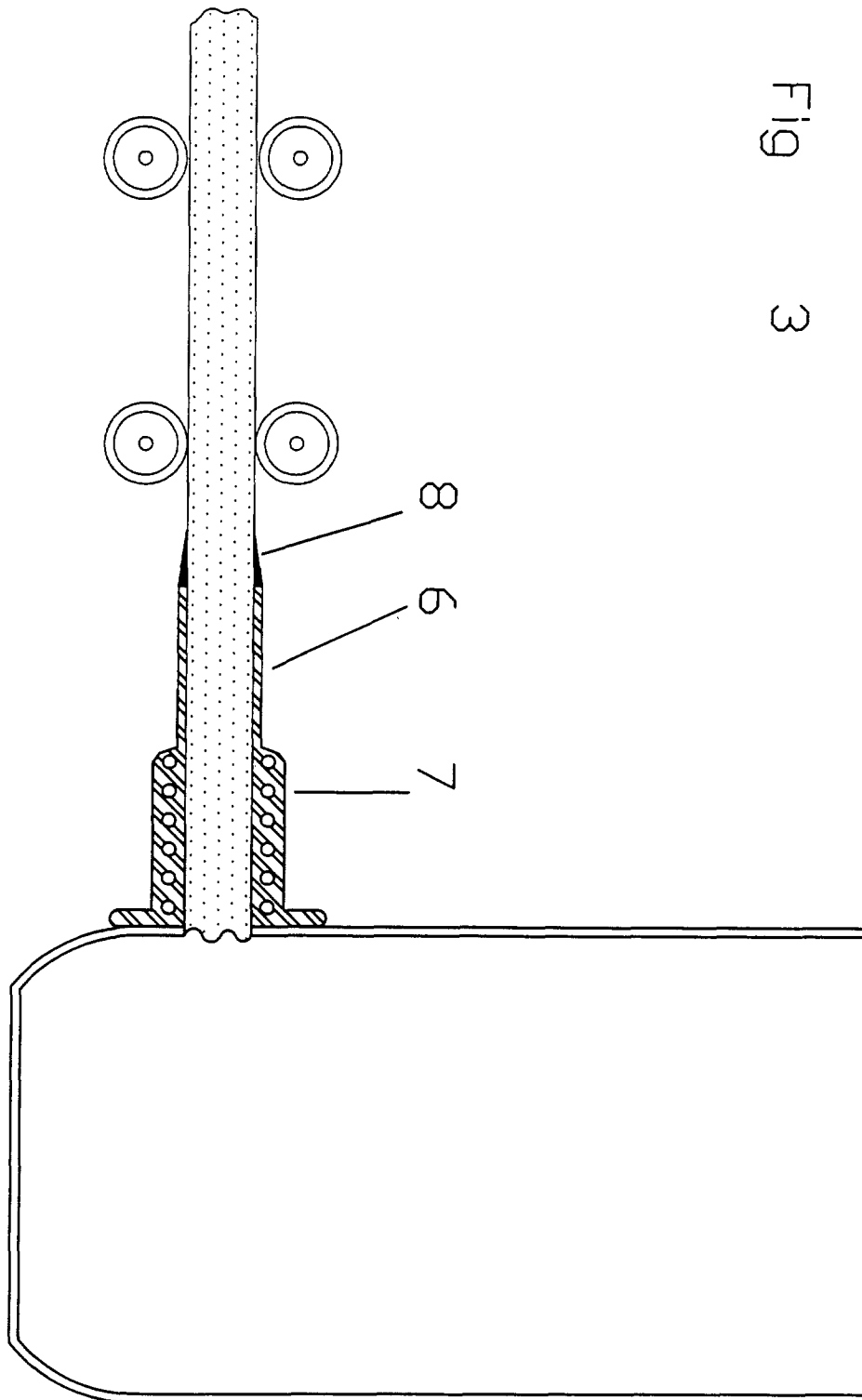


Fig 3





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# EUROPEAN SEARCH REPORT

Application Number  
EP 01 83 0111

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)
X	US 5 890 443 A (MAEDA MASAFUMI ET AL) 6 April 1999 (1999-04-06)	1-6,8-20	F23G7/12
Y	* the whole document *	7	F23G5/44
	---		F23G5/02
X	US 4 423 688 A (KUO HONG-HSIANG) 3 January 1984 (1984-01-03)	1-6,8-20	
	* the whole document *		
	---		
X	DE 196 43 328 A (MENGENS GEORG) 23 April 1998 (1998-04-23)	1-6,8-20	
	* the whole document *		
	---		
X	DE 24 00 778 A (ERNST ERICH) 17 July 1975 (1975-07-17)	1-6,8-20	
	* the whole document *		
	---		
Y	DE 44 02 575 A (WILLE ROLF DIPL ING ;PHILIPP CHRISTIAN DR ING (DE)) 3 August 1995 (1995-08-03)	7	
	* the whole document *		
	---		
A	GB 1 378 340 A (FLUMS AG MASCHF) 27 December 1974 (1974-12-27)	7	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
	* the whole document *		F23G
	---		
A	DE 298 22 639 U (SANFTENBERG PETER ;GEIER HELDRATH (DE); PIETSCH PETER (DE); SPIEGEL) 30 September 1999 (1999-09-30)		
	-----		
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		7 June 2001	Coli, 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  
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 83 0111

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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07-06-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5890443 A	06-04-1999	JP 8229533 A	10-09-1996
US 4423688 A	03-01-1984	NONE	
DE 19643328 A	23-04-1998	NONE	
DE 2400778 A	17-07-1975	NONE	
DE 4402575 A	03-08-1995	NONE	
GB 1378340 A	27-12-1974	CH 557763 A	15-01-1975
		DE 2261678 A	19-07-1973
		FR 2166003 A	10-08-1973
		CH 546174 A	28-02-1974
DE 29822639 U	30-09-1999	NONE	