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(71)(72) Applicant and Inventor: SUNDHOLM, Göran [FI/FI]; Ilmari Kiannon kuja 4, FIN-04310 Tuusula (FI).

(74) Agent: OY KOLSTER AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

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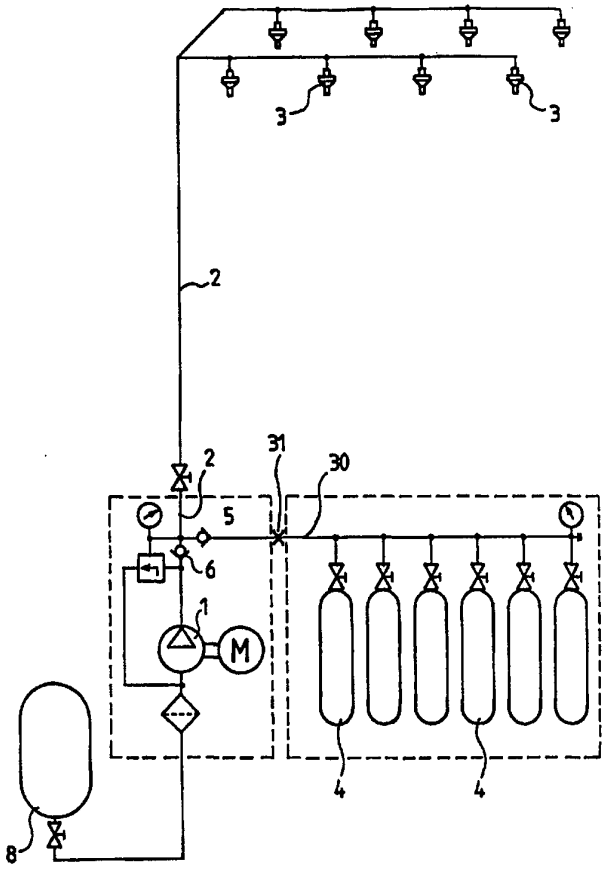
(54) Title: A FIRE FIGHTING INSTALLATION FOR DISCHARGING A LIQUID-GAS FOG

(57) Abstract

The object of the invention is to provide a novel fire extinguishing installation enabling effective delivery of liquid with immediate effective mixing of gas in the liquid right from the start. This is achieved by connecting to the outlet line (2) of a high-pressure pump (1) having a comparatively small flow a plurality of compressed-gas bottles (4) having the same pressure as the pump (1).



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A FIRE FIGHTING INSTALLATION FOR DISCHARGING A LIQUID-GAS FOG

The present invention relates to a fire fighting installation comprising a liquid source, a pump connected to said liquid source and preferably having a high liquid pressure and comparatively small flow, and a gas source connected by way of a line to an outlet line of the pump for mixing gas with outbound extinguishing liquid delivered to spray heads.

Certain kinds of gasoline fires, for example a kerosene fire in an aircraft jet engine undergoing an engine test in a hangar designed for that purpose, are nearly impossible to extinguish even by means of strong mist-like jets of liquid, as suggested for example in international patent application PCT/FI92/00155. Such a jet engine fire will only go out when the entire hangar, which may typically have a volume of about 3000 cm^3, has been subjected to "total flooding", i.e. is in practice entirely filled with liquid mist having very small particles.

The liquid mist can in principle be produced with apparatus as described in international patent application PCT/FI92/00317. In that application, an outgoing ascension tube of a hydraulic accumulator is provided with wall apertures, so that the propellent gas of the accumulator initially drives out liquid only, and after the liquid level has sunk to be even with the uppermost tube wall aperture, mixing of propellent gas into the outbound liquid is gradually started as the liquid level sinks and more tube wall apertures are exposed. In the final stage of emptying the accumulator, it is possible to obtain a liquid mist having sufficiently small droplets for the present purpose, but too large a portion of the liquid contained in the hydraulic accumulator will go waste.

It is an object of the present invention to provide a novel installation enabling effective delivery of liquid with immediate effective mixing of gas into the liquid right from the start. The installation of the invention is primarily characterized in that the gas source is connected to the outlet line of the pump for producing a finely divided liquid mist. The purpose of the gas is to enable fine division of the liquid droplets, which produces a finely divided liquid mist. When the pressure in the line leading to the nozzles is increased, the liquid mist becomes even more finely divided. Preferably, the gas source is arranged to mix gas in the outlet line of the pump with at least substantially the same high pressure as the pump.

The gas source can advantageously be constituted by a plurality of compressed-gas bottles coupled in parallel. The gas may be nitrogen, argon, air, etc. In principle, any suitable gas may be used. The contents of the compressed-gas bottles may be partially in liquid form, depending on the type of gas employed. The charge pressure of the gas bottles, like the operating pressure of the pump, may be approximately 50-200 bar, even though both lower and higher pressures are possible.

A comparatively small pump flow in this context means that the flow is smaller than the flow capacity of the relevant sprinklers or spray heads at maximum operating pressure. The pump flow may be 10-80%, preferably 20-50% of the total flow of extinguishing fluid at maximum operating pressure.

Thus, one can cope with a small pump that is inexpensive and requires little electric power.

In so-called pure oil fires, it is often expedient to mix a foam concentrate with the extinguishing liquid to produce a fire-smothering foam that

prevents re-ignition. The hitherto known installations for this purpose have usually been ineffective, as the fire smoke will spoil the foam, that is, prevent the foam concentrate from developing into a foam.

The installation in accordance with the present invention enables effective foam formation on account of the comparatively large amount of pure gas, e.g. nitrogen gas, injected concurrently, which will shield the fire smoke from direct contact with the injected foam concentrate.

In a fire for example on the car deck of a car ferry, also other material than oil, such as wood, cardboard, etc., will burn. To be able to overcome also such fires, in a preferred embodiment of the invention the gas source, preferably a plurality of gas bottles, is arranged at a first stage to empty one or more liquid tanks in order to at least suppress the fire, the gas pressure being so adapted that when the liquid tanks are empty, the gas pressure is at least substantially as high as the operating pressure of the pump.

In the following the invention will be described with reference to the accompanying drawing showing two preferred embodiments of the installation in accordance with the invention.

Figure 1 shows an embodiment for immediate production of finely divided liquid mist.

Figure 2 shows an embodiment for initial spraying of liquid and subsequent production of finely divided liquid mist and foam.

The embodiment shown in Figure 1 comprises a pump 1, having an outlet line 2 leading to a plurality of spray heads 3. The pump 1 may be a high-pressure pump with a typical operating pressure of 50-200 bar. A plurality of compressed-gas bottles 4 coupled in parallel are connected to the outlet line 2 of the pump

via a check valve 5 ensuring that no liquid will enter the compressed-gas bottles 4. A check valve 6 mounted in the outlet line 2 of the pump ensures likewise that the gas will be correctly routed. The compressed-air bottles 4 can be filled with nitrogen. The pressure of the gas in the compressed-gas bottles can suitably be 100-300 bar.

A throttle 31 has been coupled in the line 30 between the compressed-gas bottles and the outlet line 2 of the pump. The purpose of the throttle 31 is to enable adjustment of the mixing ratio of liquid and gas in the extinguishing fluid flowing in the outlet line 2. The throttle 31 is not indispensable. It could be contemplated that the mixing ratio could be adjusted by variously dimensioning the line 30.

In Figure 2, reference numeral 11 denotes a pump aggregate that can comprise for example two 11 kW pumps each having a flow of approximately 50 l/min. and a pressure of approximately 120 bar. An outlet line 12 leads to a plurality of fire zones A-E having respective spray heads or sprinklers 13A-13E. A plurality of compressed-gas bottles 14 and a plurality of liquid tanks 15, with a total of for example 400 litres, are provided for each pump. The compressed gas at an initial pressure of 200 bar, for instance, first forcibly drives out the liquid from the tanks 15 to the respective activated fire zone with a flow of for example 1000 l/min., whereafter the operation is in principle similar as in Figure 1. After the bottles have been emptied of liquid, the pressure in the compressed-gas bottles 14 has decreased to 120 bar, that is, to the pressure of the pump 11. Thereafter the pressure of the pump 11 adjusts itself in accordance with the pressure of the compressed-gas bottles 14, so that the pump flow is 20-100% of the declining total flow of extinguishing

fluid. When there is no gas in the compressed-gas bottles 14 and the gas pressure has decreased to zero, the pump flow is 100% of the total flow of extinguishing fluid.

A container for foam concentrate is denoted at 16 and a foam-mixing device at 17. A freshwater tank, for example 3000 litres, is denoted at 18 and a seawater or lake-water connection is denoted at 19.

In the first stage, when the tanks 15 are being emptied of liquid, the effect/action of the pump aggregate 11 is negligible. Valve 20 must be open during said first stage so that no water will enter the foam-mixing device 17 in order to keep said device out of operation, since mixing of foam into the extinguishing fluid must be avoided at the beginning of the extinguishing operation. This is because the foam has a negative effect of making the droplets issuing from the nozzles larger, which will prevent the development of finely divided liquid mist. At the beginning of the extinguishing operation, finely divided liquid mist is specifically wanted. Thus foam will not serve well at the beginning of the extinguishing operation.

After the tanks 15 are emptied, effective production of finely divided liquid mist can be upheld with the exemplary values given above for about half an hour by using the freshwater tank 18, whereafter seawater or lake-water can be used if necessary.

After the fire has been suppressed with water mist, valve 20 can advantageously be shut to supply foam into the extinguishing fluid to produce a thick "foam matting" that will prevent re-ignition. It is to be noted that the installation in accordance with Figure 2 need not comprise a foam-mixing device at all. In practice, valve 20 is shut in such a way that a pressure switch 140 coupled in line 130 is adapted to give

a pressure signal after the pressure has decreased under a predetermined level, for example 30 bar. This pressure signal thus controls valve 20.

The gas bottles 14 can naturally be alternatively connected to the outlet line 12 to by-pass the liquid tanks 15.

The invention has been described in the above by way of examples, and therefore it should be noted that the invention may vary in its details in many ways within the scope of the appended claims. Thus for example the execution of the compressed-gas source may vary. The gas source need not necessarily be constituted by compressed-gas bottles.

Claims:

1. A fire fighting installation comprising a liquid source (8, 18), a pump (1, 11) connected to said liquid source and preferably having a high liquid pressure and comparatively small flow, and a gas source (4, 14) connected by way of a line (30, 130) to an outlet line (2, 12) of the pump for mixing gas with outbound extinguishing liquid delivered to spray heads (3, 13A, 13E, 23), c h a r a c t e r i z e d in that the gas source (4, 14) is connected to the outlet line (2, 12) of the pump (1, 11) for producing a finely divided liquid mist.

2. An installation as claimed in claim 1, c h a r a c t e r i z e d in that the gas source (4, 14) is adapted to mix gas in the outlet line (2, 12) of the pump (1, 11) with at least substantially the same high pressure as the pump (1, 11).

3. An installation as claimed in claim 1, c h a r a c t e r i z e d in that the gas source is constituted by a plurality of compressed-gas bottles (4, 14) coupled in parallel.

4. An installation as claimed in claim 1, c h a r a c t e r i z e d in that a throttle (31) has been coupled in the line (30) between the compressed-gas bottles and the outlet line (2) of the pump (1).

5. An installation as claimed in claim 1 or claim 2, c h a r a c t e r i z e d in that the initial charge pressure of the gas source (14) is higher than the operating pressure of the pump (11), whereby at least one liquid tank (15) is incorporated between the gas source (14) and the outlet line (12) of the pump (11), the liquid from the tank being arranged to be driven out into the outlet line (12) by propellent gas from the gas source, and that the initial charge

pressure of the gas source and the volume of the liquid tank (15) are adapted to one another so that when the liquid tank (15) has been emptied the pressure of the gas source (14) is at least substantially the same as the operating pressure of the pump (11).

6. An installation as claimed in claim 1 or claim 2, c h a r a c t e r i z e d in that the initial charge pressure of the gas source (4, 14) is 100-300 bar and that the flow of the pump (1, 11) is approximately 10-80% of the total flow of extinguishing fluid at maximum operating pressure.

7. An installation as claimed in claim 1, comprising a foam-mixing unit having a foam-mixing source (16) and a foam-mixing apparatus/device (17), c h a r a c t e r i z e d in that a pressure switch (140) is coupled in the line (130) leading from the gas source (14) to the outlet line (12) of the pump (11), said pressure switch being adapted to give a pressure signal after the pressure has decreased under a predetermined level, for example 30 bar, and the pressure signal being adapted to control a valve (20) to effect mixing of foam into the extinguishing liquid.

8. An installation as claimed in claim 7, c h a r a c t e r i z e d in that the pressure switch (140) is adapted to shut the valve (20) at said pressure level for mixing foam concentrate into the extinguishing liquid, said valve being adapted to prevent foam concentrate from being mixed with the extinguishing liquid while being open.

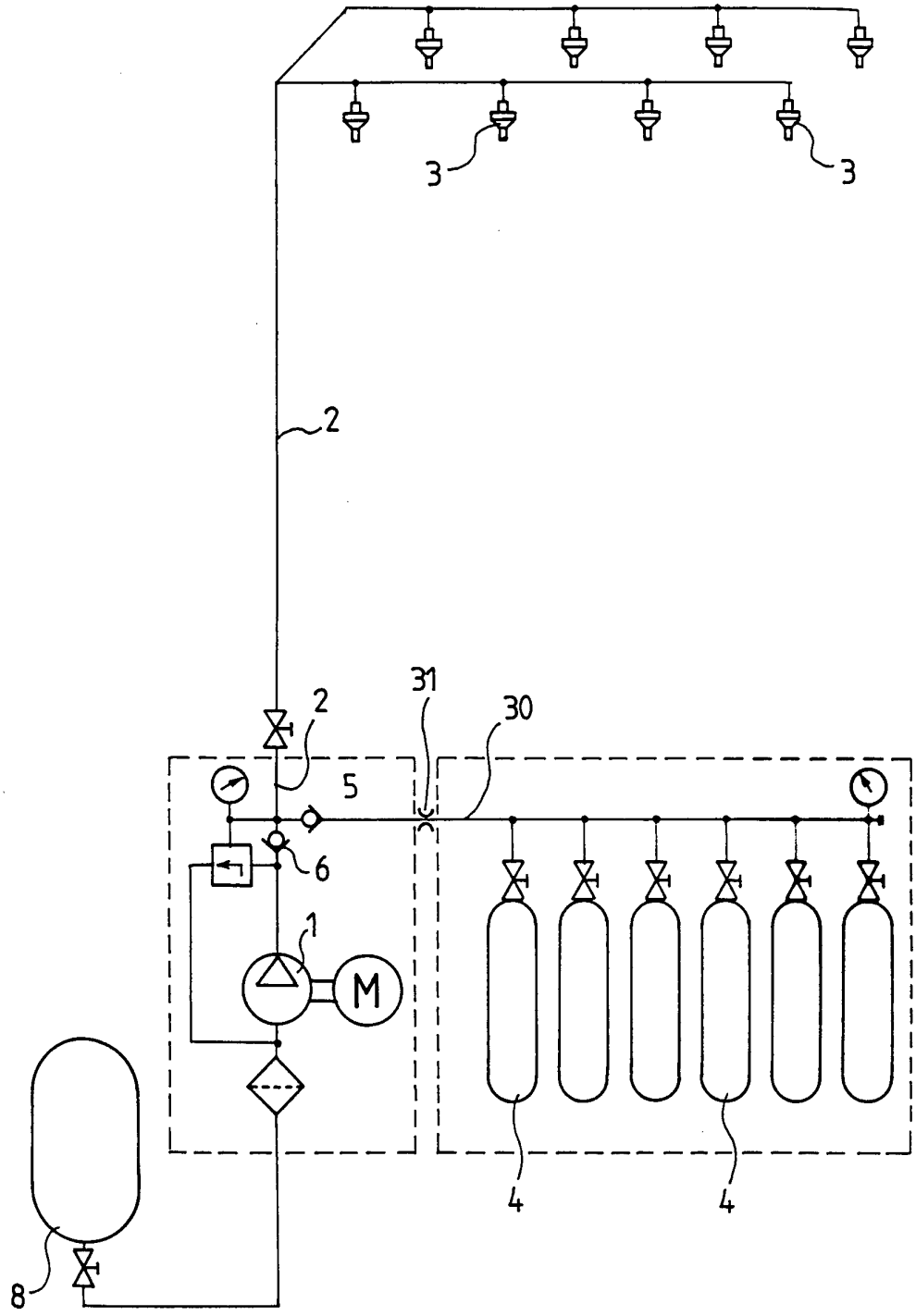

FIG. 1

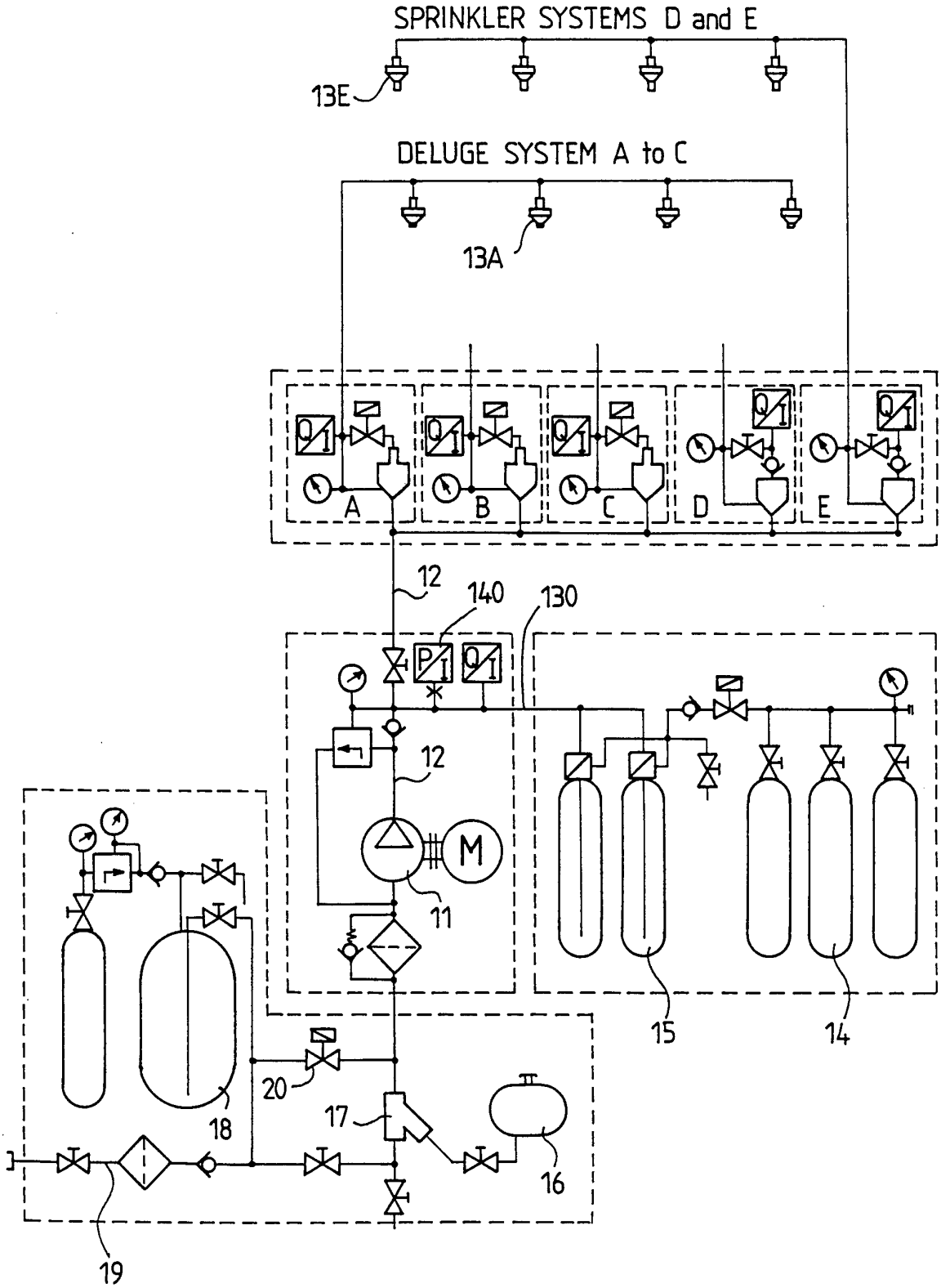
SPRINKLER SYSTEMS D and E
13E
DELUGE SYSTEM A to C
13A
A
B
C
D
E
12
140
130
P/I
Q/I
12
M
11
15
14
20
17
18
16
19

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 95/00216

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A62C 31/00, A62C 35/02, A62C 35/62, A62C 39/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 5113945 A (CABLE), 19 May 1992 (19.05.92) --	1,2,7
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A	Derwent's abstract, No 86-330389/50, week 8650, ABSTRACT OF SU, 787048 (FIRE-FIGHTING ENG C), 15 December 1980 (15.12.80) --	5

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Derwent's abstract, No 88-166804/24, week 8824, ABSTRACT OF SU, 1353444 (BOGOMOLOV A A), 23 November 1987 (23.11.87) --	5
A	US 4390069 A (ROSE, JR.), 28 June 1983 (28.06.83) --	1,7

INTERNATIONAL SEARCH REPORT

Information on patent family members

29/05/95

International application No.
PCT/FI 95/00216

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US-A- 5113945	19/05/92	NONE	
US-A- 4981178	01/01/91	NONE	
US-A- 4390069	28/06/83	NONE	