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NOTICE OF ENTITLEMENT

We, JOSEF LICHTBLAU and HEINRICH WALLNER being the applicants in respect of Application No. 30,831/92 state the following:

The persons nominated for the grant of the patent (JOSEF LICHTBLAU and HEINRICH WALLNER) are the actual inventors.

The persons nominated for the grant of the patent (JOSEF LICHTBLAU and HEINRICH WALLNER) are the applicants of the application listed in the declaration under Article 8 of the PCT.

The basic application listed in the declaration under Article 8 of the PCT is the first application made in a Convention country in respect of the invention.

J. Lichtblau — 9.5.94

JOSEF LICHTBLAU — Date

G. Wallner — 9.05.94

HEINRICH WALLNER — Date

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(54) Title
PROCESS AND DEVICE FOR DISPOSING OF FOAMED MATERIAL INCLUDING BLOWING AGENT, ESPECIALLY FOAMS LIKE POLYURETHANE USED AS INSULATORS IN REFRIGERATORS

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(56) Prior Art Documents
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WO 91/2638

(57) Claim

1. A method for the disposal of foam materials containing propellants and more particularly of foam materials such as polyurethane (PUR) employed as an insulation material in refrigeration appliances, comprising the following steps:

- the introduction of the appliance into a chamber (1),
- using a fluid flow for blasting away or blasting in order to detach the synthetic resin foam and to destroy the cells walls of the synthetic resin foam to give foam material flocks and/or flour,
- separation of the foam material flocks for the propellant and fluid medium flow,

characterized in that

detachment by blasting is performed using a cooled fluid flow, whose temperature is below the boiling point of the propellant so that the released propellant becomes or remains liquid.

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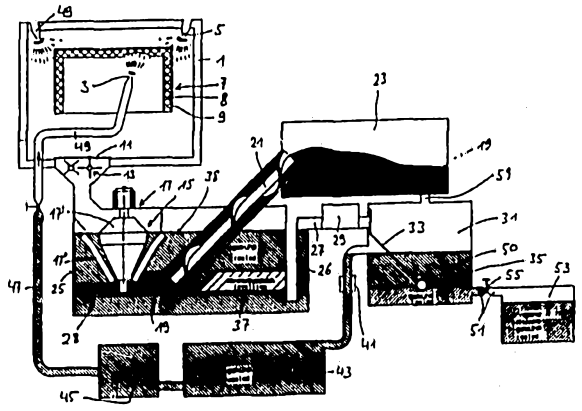
651513

(54) Title: PROCESS AND DEVICE FOR DISPOSING OF FOAMED MATERIAL INCLUDING BLOWING AGENT, ESPECIALLY FOAMS LIKE POLYURETHANE USED AS INSULATORS IN REFRIGERATORS

(54) Bezeichnung: VERFAHREN UND VORRICHTUNG ZUR ENTSORGUNG VON TREIBMITTEL ENTHALTENDEN SCHAUMSTOFFEN, INSBESONDERE VON ALS ISOLIERMATERIAL BEI KÜHLGERÄTEN VERWENDETEN SCHAUMSTOFFEN WIE POLYURETHAN

(57) Abstract

In order to be able to dispose of devices containing foamed materials in an environmentally friendly manner, such devices are put into a chamber (1) and the foamed material is there shot-blasted so that the plastic foam can be detached under this stream of fluid and the cell structure can be maintained while the blowing agent contained therein can be released. To improved this method of disposal and especially to use less power therein, the shot-blasting process takes place using a cooled stream of fluid, preferably water, the temperature of which is below the boiling point of the blowing agent. The blowing agents thus immediately become or remain liquid.



(57) Zusammenfassung

Um insbesondere mit Treibmittel enthaltenden Schaumstoffen ausgestattete Geräte umweltfreundlich entsorgen zu können, werden diese in eine Kammer (1) eingebracht und dort die Schaumstoffmaterialien ab- und/oder bestrahlt, um unter diesem Fluidstrom die Ablösung des Kunststoffschaumes zu ermöglichen und die Zellstruktur unter Freisetzung des darin enthaltenen Treibmittels zu gewährleisten. Um diese Entsorgung zu verbessern und vor allem dabei weniger Energie zu benötigen, ist vorgesehen, daß das Ab- und/oder Bestrahlen mittels eines gekühlten Fluidstromes, vorzugsweise Wasser erfolgt, dessen Temperatur unterhalb des Siedepunktes des Treibmittels liegt. Dadurch werden die freiwerdenden Treibmittel sofort flüssig oder bleiben flüssig.

618 P 1 PCT

A Method and an Apparatus for the Disposal of Foam Materials containing Propellants and more particularly of Foam Materials such as Polyurethane employed as insulating Material for Refrigeration Devices.

The invention relates to a method and an apparatus for the disposal of foam material containing propellants and more particularly of foam materials such as polyurethane employed as an insulating material for refrigeration appliances in accordance with the preamble of claim 1 and, respectively, claim 14.

In the Federal Republic of Germany as many as 2 million refrigeration appliances are taken out of service annually. As is known such refrigeration appliances contain fluorinated hydrocarbons as a liquid circulating refrigerant, that is to say FHC, such propellant, more especially the FHC Frigen R11 also being employed as a foaming agent for forming the cells of polyurethane foam material (or PUR foam) and consequently being contained in the foam materials utilized for insulation.

Moreover there are many other types of appliances and apparatus which comprise propellant likely to damage and attack the ozone layer.

This is the reason that the disposal of such appliances constitutes a problem which is attracting more and more attention.

The refrigerant used in the refrigeration circuit may in such cases be directly discharged from the refrigerant circuit. The problem then remaining is the propellant still comprised in the synthetic resin foam.

In accordance with the German patent publication 4,004,336 C1 there has therefore been a proposal to break down such refrigeration appliances in a sealed chamber mechanically and then to abrasively blast out the fragments produced with the aid of granular abrasive blasting materials. In this case the intention is to cut up the sealed cells of the polyurethane foam material and destroy the cells walls. The abrasively blasted fragments are freed of polyurethane foam flocks or, respectively, flour and for recycled for abrasive blasting. The polyurethane flocks and the respective polyurethane flour are collected and disposed of as compacted briquettes. The entire contaminated air in the chamber is drawn off at a number of

points are absorbed by activated carbon filters.

In accordance with a method described in German patent publication 3,929,666 Ai the foam materials containing fluorinated hydrocarbons are charged into a sealed chamber. The chamber is then pumped free of air and a pressing ram is driven into the chamber to compress the polyurethane foam with the result that the foam cells break down. The emerging propellants drawn off and collected.

In the case of the known method described in German patent publication 3,811,486 A1 there is a provision for placing foam material particles containing propellant and/or refrigerant more particularly in the form of FHC in a comminuting chamber, through which a fluid in the form of air passes. The emerging gaseous propellant is entrained in this fluid current. The fluid current is, after emerging from the comminuting chamber, fed to at least one cooling stage in order to condense out the propellant and/or refrigerant in such cooling stage.

In the case of the method previously described in the German patent publication 8,914,957 U1 there is also the feature that after the performance of a conventional shredding operation, as in the prior art method already described, the mixture of air, dust and fluorinated hydrocarbon is pumped off in order after cleaning to liquefy the propellant in a condensate collector.

Shredding as such possesses a number of disadvantages. In the shredded mixture there is, after degassing, as a rule still a substantial quantity of PUR foam and consequently of the fluorinated hydrocarbon Frigen R11. It is still possible for this propellant bound in the remaining foam to escape into the surroundings after removal of the foam material from the treatment chamber. In fact shredding is only able to be employed for recovering raw materials subject to certain conditions, from the mixture of materials coming from the shredder plant can only broken down into the individual components at great expense. In the case of synthetic resins this is frequently even impossible in some cases. Furthermore, shredding often requires an extremely great quantity of energy.

Finally it would also be possible to conceive of degassing PUR foam, recovered in a pure form, in suitable plant. However it is only extremely infrequently that pure polyurethane foam is to be found in the large number of appliances to be disposed of, more especially electrical household equipment such as refrigeration appliances. It is practically exclusively a question of composite materials. This method is consequently unsuitable for the disposal of household electrical equipment. On cutting up such composite materials a part of the propellant would be liberated. Such

cutting must naturally also be performed in a sealed plant.

A further disadvantage of the method described so far is substantial quantity of energy required.

One object of the present invention is, starting from the prior art mentioned initially, to provide a method and an apparatus for the disposal of foam materials containing propellant and more especially foam materials employed as insulation material in refrigeration appliances, such as polyurethane, in order to provide for the disposal of propellants or, respectively, synthetic resin foam containing propellants, which is more efficient than the prior art and requires less energy.

This object is to be attained by the process as claimed in claim 1 and, respectively, by the apparatus as claimed in claim 14. Advantageous further developments of the invention are recited in the dependent claims.

The present invention is based on a notion quite different to that of the prior art. In the case of the method in accordance with the invention or, respectively, in the case of apparatus in accordance with the invention the abrasive blasting of the foam material is performed using a cooled abrasive blasting material. In a case in which the cooled abrasive blasting agent has a temperature below the boiling point of the propellant, the use of a cooled abrasive blasting material opens up the possibility of immediately liquefying the propellant and of keeping it in liquid state. Liquefying the gaseous propellant as described in the prior art involving the use of large quantities of energy using condensing devices is no longer necessary.

Furthermore, it is possible for the liquid propellant to be readily separated from the fluid flow employed for other purposes.

It is preferred to utilize cooled water as the fluid flow for abrasive blasting, the water being abrasive blasted onto the foam material to be broken down using a high pressure abrasive blasting device. Since for the disposal the only thing produced, owing to method of proceeding is, in addition to the propellants, water which leaves the apparatus, there are in this instance no additional processing problems

Since more especially the specific gravity of the propellant is different to that of water, it is possible, in a following stage, to readily perform separation of the water and the propellant, for the lighter medium will float on the other one.

Since moreover the polyurethane freed of propellant has a greater density than water, it is possible for the same to sink to the bottom of a tank, whence it may also be drawn off without any problems either.

In accordance with the invention it is therefore preferred to employ

a cooled liquid abrasive blasting fluid, more particularly water, which may contain solid particles. However in accordance with the invention it is just as possible to perform the abrasive blasting method not only with a liquid fluid flow but also using a gaseous fluid flow, that is to say using compressed air and/or steam and the like, it being possible in this case as well to use, like the case of liquids as abrasive blasting fluid, added small abrasive particles of metal, synthetic resin or stone. The most familiar known method is in this case sand blasting.

In order to as far as possible to release all propellant contained in the foam material a high pressure abrasive blasting method performed in one processing chamber may, as matter of principle, be followed by a compressing stage in order to cause the release of any further residual propellants by an additional compression of the foam material particles still present.

In accordance with the invention there is the further provision that in the processing chamber there is no shredding of the appliances to be disposed of and instead of shredding, in accordance with the invention, for instance in the case of the disposal of refrigeration appliances prior to introduction into the chamber the synthetic resin lining of the refrigeration appliances is removed, something which is possible without any problems, in order to subject the appliances with exposed, open foam material insulation to high pressure abrasive blasting. The lining is basically not strongly secured to the foam material insulation so that the lining can be removed without any problems. The foam insulating material is only adhesively joined to the metallic outer wall of the refrigeration appliance.

This way of preparing the appliance furthermore offers the advantage that any other individual component, such as electronic ones and the like, can be previously removed and disposed over in a manner dependent on the material thereof.

In the case of older models it has turned out to be an advantage if for example, after the removal of heat exchanger coils to strip off any rear wall covering, this being a simple operation. From this position it is possible to abrasively blast and blast away the internally arranged foam material.

Further advantageous developments and convenient forms of the invention will be understood from the following detailed descriptive disclosure of embodiments thereof in conjunction with the accompanying drawings.

Figure 1 diagrammatically shows the functional structure of a plant for the disposal of propellant containing synthetic resin foam component, more particular-

ly polyurethane, in the case of which an aqueous fluid is employed having a specific gravity lower than that of the propellant.

Figure 2 shows a modification of the plant in accordance with figure 1, in the case of which a fluid is utilized which has a specific gravity higher than that of the propellant.

The plant depicted in figure 1 comprises a chamber 1, which is provided with a suitable inlet and outlet transfer channel or door.

At least one high pressure nozzle 3 leads into the chamber 1. In the illustrated working embodiment there are also further fine jet nozzles 5, which run through the chamber walls into the interior of the chamber 1.

In practice a suitable appliance to be disposed of is preferably freed of its lining, then introduced into the chamber 1 which is sealed. For instance at a pressure of above 120 bar and preferably even 150, 160, 170 160 or even 190 bar the exposed foam material is abrasively blasted using a cooled liquid. The one or more high pressure nozzles 3 may for example have different alignments, be arranged to rotate or be directed and operated from the outside using manipulators or sealing rubber gloves arranged in the chamber wall. However instead of this in the case of some old types of appliance it is also expedient for example to remove the rear wall of the appliance and from the rear to abrasively blast and remove the exposed foam material. Furthermore injection nozzle lances may be suitable for the present purpose.

As a fluid it is possible to employ a gaseous or a vapor media with or without the addition of solid components such as metals, synthetic resins or stone (sand).

However the fluid flow is cooled, that is to say it will have a temperature not higher than the boiling temperature of the propellant, as a rule the fluorinated hydrocarbon Frigen R11 of approximately 28.3° C.

A substantial part of the propellant is liberated in this method stage from the synthetic resin foam 8, as a rule polyurethane or PUR foam. The rest of the PUR foam still clinging to the housing wall 9 of the appliance has its foam structure destroyed by the high impact pressure of the abrasive blasting agent and the cell walls are broken down. The propellant fluorinated hydrocarbon Frigen R11 bound to the housing 9 is also liberated.

The propellant released immediately has energy remove from it by the

cooled abrasive blasting material so that the propellant becomes or remains liquid.

The fine jet nozzles produce a fine fluid mist in the abrasive blasting space, by which traces of fluorinated hydrocarbon are washed out of the abrasive blasting space if all the fluorinated hydrocarbons or the like related propellants are not reached and cooled by the abrasive blasting agent.

The water bound in the synthetic resin foam material, the PUR foam flocks and the PUR flour itself and the propellant then pass via an outlet 11 with the aid of a meshing wheel-like conveying rolls 13 into a compressing space 15.

The compressor 17 consists in the working embodiment of a crushing mill, which is tapered conically in the direction of flow through the device, the rotary crushing mill or compressor body 17' so cooperating with a mill wall 17'' surrounding it with the formation of a through gap, which tapers continuously downwards, that the PUR foam flocks or particles still present and which have not been completely disintegrated, are completely crushed in order to finally completely destroy any porous cell structure which is still present. In the illustrated working embodiment the compressor 17 is arranged so as to dip into the abrasive blasting agent, that is to say the fluid, so that in this treatment stage as well propellant still being released will be immediately cooled and will be present in a liquid form.

Since the liquid propellant will as a rule have a specific gravity of 1/0.68 and is hence substantially heavier than water, the propellant, which as a rule consists of liquid Frigen, will sink to the bottom; the abrasive blasting agent will float on the propellant, that is to say in the illustrated working embodiment the aqueous fluid. Since the polyurethane freed of the propellant 19 has a specific gravity greater than unity, it will sink in the aqueous liquid to the bottom.

Since in the present working embodiment the PUR foam freed of propellant has a specific gravity of approximately 1.2 and is consequently heavier than the aqueous fluid, but is lighter than the propellant 19, there would, if there is an at least partial separation of fluid and propellant and settlement thereof, be an supernatant intermediate layer with the polyurethane foam. In the present case illustrated in figure 1 however there is furthermore a filter 28 extending approximately horizontally a certain distance above the bottom of the tank 25, which for example may consist of a grating allowing the passage therethrough of the liquids, but on which the polyurethane foam with the particles therein would settle.

Via a worm conveyor 21 the polyurethane is cleared from the filter 28 on which it lies, and compressed in the worm 21 with the addition of water and so conveyed into an upper container 23 to receive it.

The tank 25 accommodating the compressor 17 is joined by way of a overflow 27 (via a filter 29) with a settling container 31. In the illustrated working embodiment in this case the connection between the tank 25 and the overflow 27 is via a sort of communicating vessel. The connection of the riser pipe 26 with the tank 25 is at the bottom of the tank, that is to say in the illustrated working embodiment by way of a cross section of the drain extending for some of the height. The inlet of the settling container is shut off by the regulating means preferably in the form of a float valve. Because of this the maximum level of the liquid in the separating zone, that is to say the maximum level 35 in the settling tank 31 which may not be exceeded, is fixed. Because the outlet 40 in the settling container 31 is not above the level height or separating zone 35, it is possible to ensure that medium, that is to say propellant, settling at the bottom of the settling container 31, can not rise as far as the outlet 4. The maximum level of filling in the settling tank 31 is set by the height of the outlet 40, the outlet 40 being lower down than the overflow 27 constituting the connection with the tank 25.

In order to provide a possibility of buffering in the process, the tank 25 is provided with a level compensating means 37 so that an increase or decrease in the volume thereof means that the respective level 38 may be so set that on the one hand the compressor 17 is always in the water while on the other hand the outlet to the settling container 31 may be controlled and acted upon.

The outlet 40 placed at a higher level than the bottom of the settling tank is for example joined, possibly via a fine filter 41, with an intermediate or compensating tank 43, which for its part is connected with a high pressure pump 45, whose output port 47 is joined via a pipe system 49 with the above mentioned high pressure nozzles 3 or, respectively, the fine jet nozzles 5. The above mentioned tank 25, the settlement container 31 and furthermore at least one intermediate or compensating container 43 are each cooled to a temperature below the boiling temperature of the propellant so that the fluid 50 is as well kept cooled to this temperature.

As shown in figures, the settling out of the propellant increasingly takes place at the bottom of the settlement container 31, which propellant is supplied via a separate riser pipe 51, which preferably extends from the settlement tank 31 adjacent to the bottom thereof, to a propellant collecting container 53 possibly via a check valve or shut off valve 55. This

propellant collecting container 53 is naturally also cooled, preferably by water, that is to say down to a temperature below the boiling point of the propellant.

Lastly there is furthermore a drain off or drain 59 connection 59 between the receiving container for the polyurethane 19 freed of propellant and the settlement container 31 arranged underneath it. Any aqueous fluid still adhering to the polyurethane may drip off downwards through a sieve, which retains the polyurethane material.

The present method is conceived for cases in which the appliance to be disposed of, without previous shredding, but after at least the removal of one covering wall is processed in the degree noted and then disposed off. Naturally the method as above mentioned is basically also applicable, if firstly in the chamber 1 an appliance is shredded t and the shreds so produced are then subjected to a suitable abrasive blasting with fluid.

Owing to the use of the cooled high pressure fluid flow the overall conduct of the method is extremely economic in the use of energy, since it is unnecessary to provide for condensation and reduction in temperature of the fluid medium, initially at a raised fluid pressure to a temperature below the boiling point of the propellant.

In what follows reference will be had to the working embodiment in accordance with figure 2, which is practically the same as the working embodiment according to figure 1. It is only the connection of the outlet 51 with the propellant collecting container 53 or, respectively, the outlet via the return pipe system for return of the fluid into the chamber 1, which is different.

For in the working embodiment in accordance with figure 2 it is assumed that the fluid employed has a higher specific gravity than the propellant. For this reason fluid, which is then heavier, settles to the bottom in the settlement chamber or, respectively, in the settlement container 31, the propellant which is then lighter, floating to the top. Because of the float of the valve 33 the inlet is shut off, when the maximum desired quantity of liquid is in the settlement container 31. The upper liquid level is dependent on the height of the connection of the outlet 51, via which the lighter propellant, which then floats on top, is able to flow adjacent to the water cooled propellant collecting container 53.

The valve 33 and the float associated with the same are so arranged that the separation level, that is to say the separation height 35 is between the lighter propellant and the heavier fluid, which is settling, is always at a sufficient distance above the outlet 40 and underneath the

other outlet. In the highest position of the float the valve 33 is then shut. This means that it is always the propellant settling at the top which is able to flow into the propellant collecting container 53. It is then preferred for the outlet 40 for the return system for recycling the fluid to be arranged adjacent to bottom of the settlement container 31.

618 P 1 PCT

A Method and an Apparatus for the Disposal of Foam Materials containing Propellants and more particularly of Foam Materials such as Polyurethane employed as an insulating Material for Refrigeration Devices.

Claims

1. A method for the disposal of foam materials containing propellants and more particularly of foam materials such as polyurethane (PUR) employed as an insulation material in refrigeration appliances, comprising the following steps:

- the introduction of the appliance into a chamber (1),
- using a fluid flow for blasting away or blasting in order to detach the synthetic resin foam and to destroy the cells walls of the synthetic resin foam to give foam material flocks and/or flour,
- separation of the foam material flocks for the propellant and fluid medium flow,

characterized in that
detachment by blasting is performed using a cooled fluid flow, whose temperature is below the boiling point of the propellant so that the released propellant becomes or remains liquid.

2. The method as claimed in claim 1, in the case of which the blasting or blasting away of the synthetic resin foam is performed with or without the use of small particles, more particularly of metal, synthetic resin or stone (sand), characterized in that such blasting or blasting away takes place additionally with the use of a liquid or a vapor or, respectively, a gas, more especially compressed air.

3. The method as claimed in claim 1 or in claim 2, characterized in

that as fluid flow cooled water is utilized.

4. The method, more particularly as claimed in any one of the claims 1 through 3 comprising a compression stage following the blasting or blasting away step, characterized in that the further subsequent compression of the synthetic resin flocks, which have not yet been destroyed, is performed with the aid of a crushing mill (17).

5. The method, more particularly as claimed in claim 4, characterized in that the compression is performed within the cooled fluid medium.

6. The method as claimed in any one of the claims 1 through 5, characterized in that the fluid, the propellant and the foam synthetic resin foam material freed of propellant is supplied to at least one settlement chamber (25 and 31), in which the fluid, the propellant and the foam material are caused to settle out in accordance with the size of the specific gravity thereof.

7. The method as claimed in any one of the claims 1 through 6, characterized in that the downardly settling synthetic resin foam material freed of propellant is conveyed away with the performance of further compression with the aid of a conveying screw from the settlement container.

8. The method as claimed in any one of the claims 1 through 7, characterized in that the fluid medium is conveyed into a following settlement tank (31) for the separation of the fluid medium from the propellant.

9. The method as claimed in claim 7 or in claim 8, characterized in that during the overflow from the first settlement container to the following settlement tank (25 and 31) the overflowing fluid medium and the propellant are filtered.

10. The method as claimed in any one of the claims 1 through 9, characterized in that the propellant settling downwards in the settlement tank (31) is supplied via a separate outlet (51) to a propellant collecting container (53).

11. The method as claimed in any one of the claims 1 through 10, characterized in that the overall circuit of the fluid flow from the chamber (1) via the following tanks and intermediate chambers and furthermore

pipe is cooled down to a temperature below the boiling point of the propellant.

12. The method as claimed in any one of the claims 1 through 11, characterized in that at least all tanks (25 and 31) and the intermediate or compensating containers (43), through which the fluid medium flows, are cooled to a temperature below the boiling point of the propellant.

13. The method as claimed in any one of the claims 1 through 12, characterized in that in the case of the appliances to be disposed of only at least one outer or inner wall or parts thereof are removed in order to expose the synthetic resin foam material thereunder to be removed and in that the appliances so got ready are blasted in the unshredded state.

14. An apparatus for the disposal of foam material containing propellants and more particularly of foam materials such as polyurethane (PUR) employed as an insulation material in refrigeration appliances, comprising a chamber (1) for the blasting or blasting away of synthetic resin foam material containing propellant, and a blasting device (3), characterized in that furthermore a cooling device is provided, by which the fluid flow supplied to the blasting device (3 and 5) is cooled to a temperature below the boiling point of the propellant.

15. The apparatus as claimed in claim 14, characterized in that the blasting device is if desired able to be supplied with small particles of metal, synthetic resin or stone (sand), characterized in that the blasting device is a high pressure jetting device for liquids or vapor or, respectively, additionally gas, more especially compressed gas.

16. The apparatus as claimed in claim 14 or claim 15, characterized in that the blasting device is a high pressure jetting device for cooled water.

17. The apparatus as claimed in any one of the claims 14 through 16, characterized in that furthermore a compressor (17) arranged downstream from the blasting device is provided, said compressor being of the crushing mill type.

18. The apparatus more particularly as claimed in claim 17, characterized in that the compressor (17) is arranged in a tank (25) which is

flooded with the cooled fluid medium.

19. The apparatus as claimed in any one of the claims 14 through 18, characterized in that at least one settlement chamber (25 and 31) is provided from the fluid and the propellant, for weight-specific and therefore stratum-dependent settlement and separation of the propellant.

20. The apparatus as claimed in at least one of the claims 14 through 19, characterized in that a conveying screw (21) is provided by means of which the propellant-free synthetic resin material settled in at least one settlement tank (25) is able to be conveyed away while performing a further compression.

21. The apparatus as claimed in at least one of the claims 14 through 20, characterized in that at least one further settlement tank (31) is provided for the separation of the fluid medium from propellant.

22. The apparatus as claimed in claim 20 or claim 21, characterized in that between the settlement tank and the following settlement tanks (25 and 31) a filter arrangement is provided.

23. The apparatus as claimed in at least one of the claims 14 through 22, characterized in that the settlement tank (31) is joined via a separate outlet (51), which is arranged at a higher level than the separate outlet (51), with a propellant collecting container (53).

24. The apparatus as claimed in at least one of the claims 14 through 23, characterized in that the overall circuit of the apparatus and more especially the fluid flow from the chamber (1) via the following containers (25 and 31) and intermediate chambers (43) and furthermore pipes (47 and 49) is cooled down to a temperature below the boiling point of the propellant.

25. The apparatus as claimed in at least one of the claims 14 through 24, characterized in that at least all tanks (25 and 31) and the intermediate or compensation containers (43), through which the fluid medium flows, are cooled by means of a cooling device to a temperature below the boiling point of the propellant.

26. The apparatus as claimed in at least one of the claims 14 through

25, characterized in that furthermore fine jet nozzles (5) are provided, via which in the chamber (1) a fluid mist is able to be produced for engaging, cooling and therefore washing out any propellant particles and/or propellant gas in suspension.

27. The apparatus as claimed in at least one of the claims 14 through 26, characterized in that a return pipe system (41, 43, 45, 47 and 49) is provided starting at the settlement tank (31) in order to supply fluid, which is separated from the propellant, to the blasting device (3).

Abstract of the Disclosure

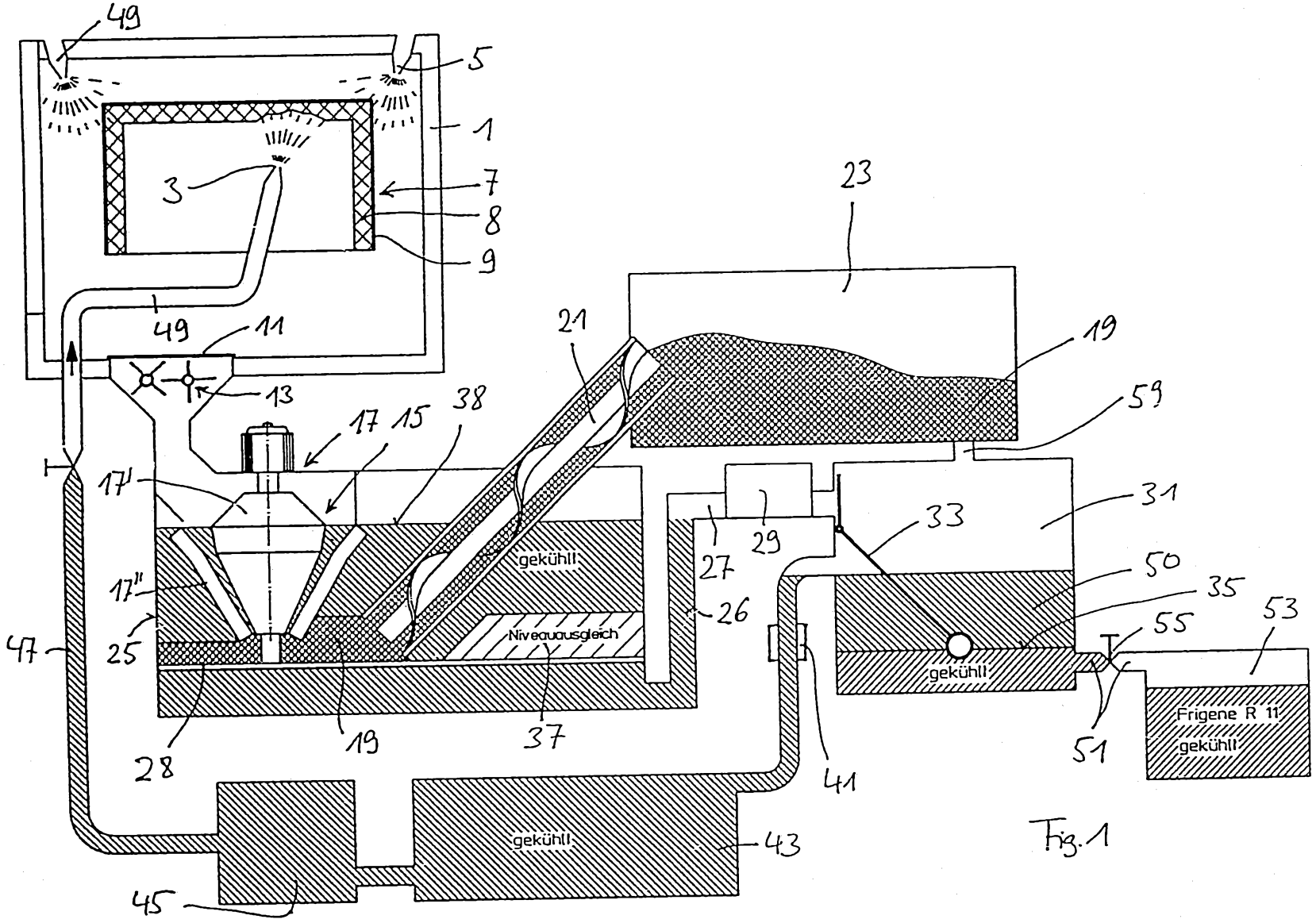
618 P 1 PCT

A Method and an Apparatus for the Disposal of Foam Materials containing Propellants and more particularly of Foam Materials such as Polyurethane employed as an insulating Material for Refrigeration Devices.

In order to more especially to be able to dispose of appliance having foam materials containing propellant in a manner compatible with the environment such the same are introduced into a chamber (1) where foam materials are blasted or blasted off in order to render possible the detachment of the synthetic resin foam and to destroy the cell structure while releasing the propellant contained therein. In order to improve upon such disposal and more particularly to decrease the energy requirement there is the provision in accordance that the blasting or blasting away is performed by means of a cooled fluid flow, preferably, water whose temperature is below that of the boiling point of the propellant. As a result the propellants released are immediately liquified or remain liquid.

(Figure 1)
Translation of wording employed in the drawing.

gekühlt = cooled
Niveauausgleich = level compensation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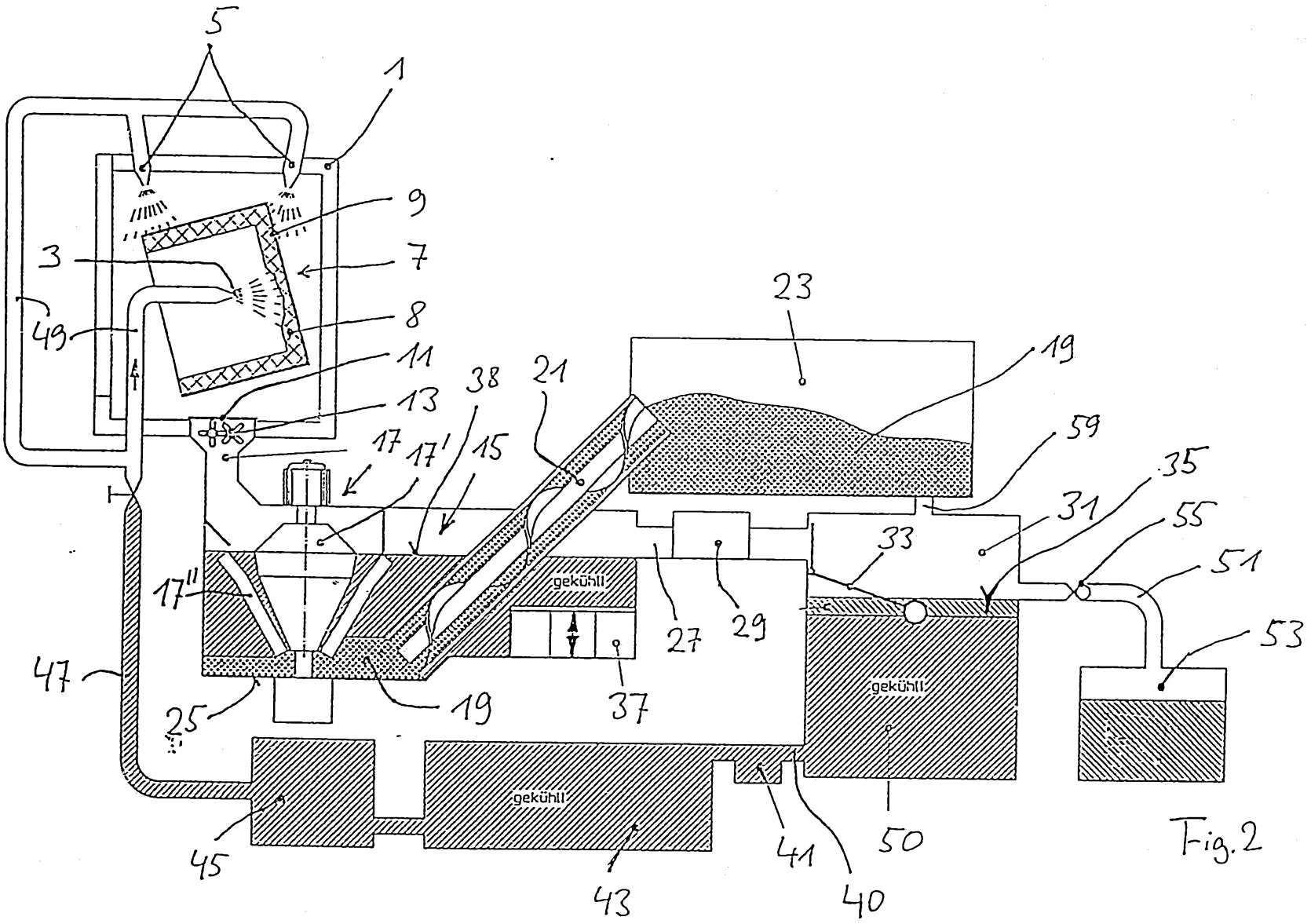
9
49
11
13
23
21
19
59
17
15
38
17'
31
33
29
27
50
35
17''
26
25
55
53
47
Niveauausgleich
gekühlt
gekühlt
Frigene R 11
gekühlt
28
19
37
41
51
gekühlt
43
45

Fig. 1

112


5
1
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gekühlt
gekühlt
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Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 92/02752

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.^{5} B09B 3/00

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)

Int. Cl.^{5} B09B; C08J

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A, 0 442 113 (APU GMBH, GES. FÜR ANALYTIK UND PLANUNG VON UMWELTTECHNOLOGIE) 21 August 1991 see column 1, line 29 - column 2, line 14 see column 5, line 19 - column 8, line 13; figure & DE, A, 4 004 336, cited in the application	1,2,4, 14,15,17
A	DE, A, 3 911 420 (TRÄBING) 11 October 1990 see column 4, line 55 - column 5, line 36; figures 3-5	1,2, 13-15
A	DE, U, 8 914 957 (SEG SONDER- ENTSORGUNGS- GMBH) 1 February 1990, cited in the application see page 1, line 1 - line 4, see page 6, line 9 - line 16, see page 9, line 11 - page 13, line 20, see page 14, line 12 - page 15, line 4; figures	1,14

./.

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 February 1993 (05.02.93)	17 February 1993 (17.02.93)
Name and mailing address of the ISA/ European Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 92/02752

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO, A, 9 102 638 (VORS) 7 March 1991 see abstract, see page 3, line 36 - page 5, line 26	1,6,8,12,14, 19,21,25
A	DE, A, 4 022 401 (MITSUBISHI DENKI K.K.) 31 January 1991	
A	DE, A, 3 929 666 (KIELMANN), 14 March 1991 cited in the application	
A	EP, A, 0 336 254 (ALFRED TEVES GMBH) 11 October 1989 & DE, A, 3 811 486 cited in the application	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9202752
SA 67166

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 05/02/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0442113	21-08-91	DE-C- 4004336	12-09-91
DE-A-3911420	11-10-90	DE-A- 3828912	08-03-90
DE-U-8914957	01-02-90	None	
WO-A-9102638	07-03-91	AU-A- 6351890	03-04-91
		CA-A- 2064909	22-02-91
		EP-A- 0489103	10-06-92
DE-A-4022401	31-01-91	JP-A- 3049224	04-03-91
		US-A- 5081068	14-01-92
DE-A-3929666	14-03-91	None	
EP-A-0336254	11-10-89	DE-A- 3811486	19-10-89
		WO-A- 8909663	19-10-89
		JP-T- 3500857	28-02-91

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/EP 92/02752

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int.Kl. 5 B09B3/00

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff [7]

Klassifikationssytem	Klassifikationssymbole
Int.Kl. 5	B09B ; C08J

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen [8]

III. EINSCHLAGIGE VEROFFENTLICHUNGEN [9]

Art.°	Kennzeichnung der Veröffentlichung [11], soweit erforderlich unter Angabe der maßgeblichen Teile [12]	Betr. Anspruch Nr.[13]
A	EP,A,0 442 113 (APU GMBH, GES. FÜR ANALYTIK UND PLANUNG VON UMWELTTECHNOLOGIE) 21. August 1991 siehe Spalte 1, Zeile 29 - Spalte 2, Zeile 14 siehe Spalte 5, Zeile 19 - Spalte 8, Zeile 13; Abbildung & DE,A,4 004 336 in der Anmeldung erwähnt ---	1,2,4, 14,15,17
A	DE,A,3 911 420 (TRÄBING) 11. Oktober 1990 siehe Spalte 4, Zeile 55 - Spalte 5, Zeile 36; Abbildungen 3-5 --- -/--	1,2, 13-15

° Besondere Kategorien von angegebenen Veröffentlichungen [10] :

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

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"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

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"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
05.FEBRUAR 1993	17 -02- 1993
Internationale Recherchenbehörde	**Unterschrift des bevollmächtigten Bediensteten**
EUROPAISCHES PATENTAMT	VAN DER ZEE W.T.

III. EINSCHLAGIGE VEROFFENTLICHUNGEN (Fortsetzung von Blatt 2)

Art °	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	DE,U,8 914 957 (SEG SONDER- ENTSORGUNGS-GMBH) 1. Februar 1990 in der Anmeldung erwähnt siehe Seite 1, Zeile 1 - Zeile 4 siehe Seite 6, Zeile 9 - Zeile 16 siehe Seite 9, Zeile 11 - Seite 13, Zeile 20 siehe Seite 14, Zeile 12 - Seite 15, Zeile 4; Abbildungen ---	1,14
A	WO,A,9 102 638 (VORS) 7. März 1991 siehe Zusammenfassung siehe Seite 3, Zeile 36 - Seite 5, Zeile 26 ---	1,6,8, 12,14, 19,21,25
A	DE,A,4 022 401 (MITSUBISHI DENKI K.K.) 31. Januar 1991 ---	
A	DE,A,3 929 666 (KIELMANN) 14. März 1991 in der Anmeldung erwähnt ---	
A	EP,A,0 336 254 (ALFRED TEVES GMBH) 11. Oktober 1989 & DE,A,3 811 486 in der Anmeldung erwähnt -----	

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

EP 9202752
SA 67166

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 05/02/93
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
EP-A-0442113	21-08-91	DE-C-	4004336	12-09-91
DE-A-3911420	11-10-90	DE-A-	3828912	08-03-90
DE-U-8914957	01-02-90	Keine		
WO-A-9102638	07-03-91	AU-A-	6351890	03-04-91
		CA-A-	2064909	22-02-91
		EP-A-	0489103	10-06-92
DE-A-4022401	31-01-91	JP-A-	3049224	04-03-91
		US-A-	5081068	14-01-92
DE-A-3929666	14-03-91	Keine		
EP-A-0336254	11-10-89	DE-A-	3811486	19-10-89
		WO-A-	8909663	19-10-89
		JP-T-	3500857	28-02-91

EPO FORM P0473

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82