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(54) Method for sealing and packing toxic wastes

(57) A method for the packing and sealing of radioactive or toxic waste materials 1 for the purpose of environmentally safe and long term storage or disposal. In the method the waste 1 is compressed, compacted or solidified and placed into a metal container 111 which is closed by lid 112 and sealed hermetically in a packing apparatus 21. The container 11 is transferred to an encasing apparatus 22 wherein the metal container 11 is enclosed in a container of plastics material 12. After removing the air from said plastic container by means of vacuum apparatus 222 the container 121 has applied thereto a lid 122 which is sealed by a welding or fusion process using an induction welding apparatus 221. In an alternative embodiment the metal container 11 is dipped into a liquid plastics material to produce a coating sealing the container.

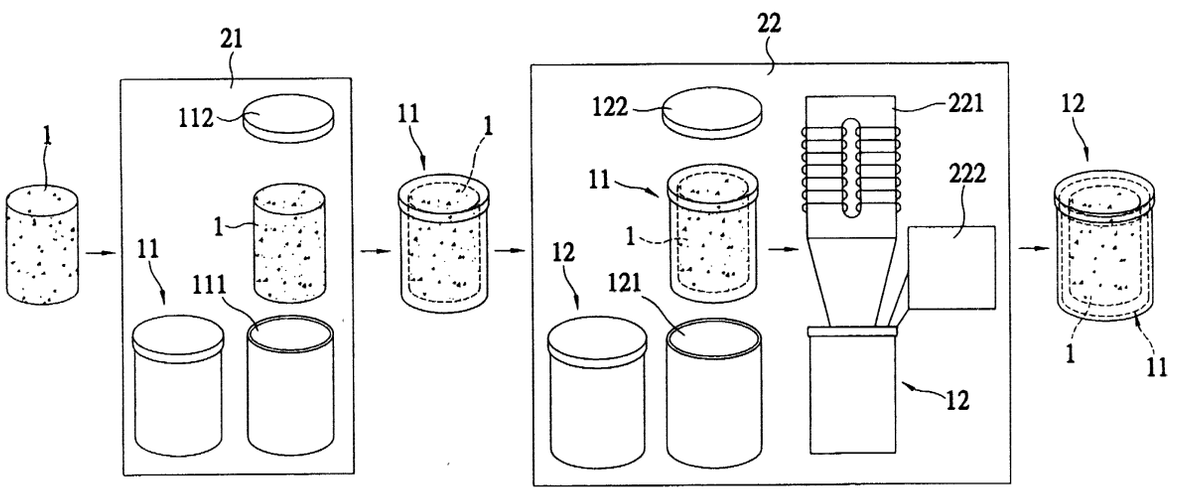

FIG.1

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Description

[0001] This invention relates to a method for sealing and packing radioactive or other toxic wastes. More particularly this invention provides a method for sealing and packing wastes using a vacuum package or insulating packing technique to seal and pack metal containers with radioactive or toxic wastes.

[0002] To prevent radioactive wastes, radioactive cores in radioactive wastes, or toxic wastes, for example mercury mud, produced by manufacturing industries from polluting the environment, it is necessary to treat radioactive or toxic wastes and change them to a relatively fixed solid form. The concentrated sodium sulphate fluid, resin powder, and filtered residuals produced by nuclear power plants may be treated by cement solidification. Toxic wastes, such as mercury mud, produced by factories are also treated by cement solidification; highly radioactive wastes, however, are treated by glass solidification. After being appropriately packed, the radioactive cores contained in radioactive wastes or the toxic substance contained in toxic wastes should not be released from the wastes. The packed and treated radioactive or toxic wastes are sent to an intermediate dump and stored there for 40 to 70 years. After the storage in the intermediate dump, a landfill deep under the ground where ground water will not be polluted is found for final disposal of the wastes. So far the treatment of radioactive wastes in most advanced countries progresses only to an intermediate stage and they are very careful in selecting final disposal landfill and preventing diffusion of pollution. The intermediate dump or final disposal landfill of radioactive or toxic wastes may comprise multi-barriers to prevent radioactive cores of radioactive wastes from being released to the outside or toxic wastes from polluting the environment, so as not to influence the environmental quality and living security of human life during the long-term storage or disposal.

[0003] The barriers may include a solidified body of radioactive wastes, steel container, concrete, buffer material, reinforced concrete, back fill material, filled soil, drainage facilities and plants, such as planting plants on back filled soil. The buffer material shall be one with low permeability and high absorption ability. The low permeability of the buffer material can prevent outside water from permeating the solidified body of radioactive wastes. Even if the outside water permeates the solidified body of radioactive wastes and extracts the radioactive cores released from the radioactive wastes, the buffer material will, by the use of high absorption, remove the water containing these radioactive cores to prevent the cores from flowing into the sources of ground water. Expanded clay, that is soapy clay as buffer material, is used to stop water.

[0004] Multi-barriers in intermediate dumps or final disposal landfills to prevent radioactive cores of radioactive wastes from being released to the outside or toxic wastes from polluting the environment are not used. At present, steel containers of radioactive wastes are stored in intermediate dumps or the steel containers of toxic wastes are put into final disposal landfills. In this case the permeating ground water and air continuously corrode the containers and further soak and dissolve the radioactive or toxic wastes inside. The ground water with dissolved radioactive or toxic wastes will then permeate the buffer material outside the steel containers and penetrate the intermediate dump or final disposal landfill when it reaches the saturation point. It will further pollute the sources of ground water and environment.

[0005] This invention seeks to provide a method for sealing and packing radioactive or toxic wastes by which the radioactive or toxic wastes will first be compressed or solidified or packed in vacuum plastic bags and put in metal containers covered with a layer or reinforced plastic coating for protecting the surface of the containers. Such radioactive or toxic wastes in the containers can be safely stored for a long time.

[0006] An object of this invention is to provide a method for sealing and packing radioactive or toxic wastes using vacuum or insulating packing technique that can prevent water and air from corroding metal containers of radioactive or toxic wastes so that the containers can be stored safely for a long time.

[0007] According to this invention there is provided a method for the packing and sealing of radioactive or toxic waste materials for the purpose of environmentally safe and long term storage or disposal, the method being characterised by the steps:

a) compressing, compacting or solidifying the waste materials,
b) placing said material into a metal container,
c) closing and sealing the metal container,
d) encasing the metal container in an enclosure of plastics material,
e) removing the air from said plastic enclosure, and
f) sealing the plastic enclosure by a welding or fusion process.

[0008] Preferably the metal container is a zinc plated corrosion proof steel barrel. The enclosure of plastics material may comprise a container of polyethylene with a lid, the lid being fusion welded to the container after removal of air therefrom. The metal container may be immersed in a liquid plastics material to provide a sufficiently thick plastics coating thereon and then dried under heat to form the plastics enclosure.

[0009] The waste material, in an alternative arrangement, can be packed into a plastic bag, the air is removed from said bag and the bag sealed, the bag then being inserted into the metal container followed by the steps of enclosing the said container in plastics material.

[0010] This invention thus provides a method for the packing and sealing of radioactive or toxic waste materials for the purpose of environmentally safe and long term storage or disposal. In the method the waste is

compressed, compacted or solidified and placed into a metal container which is closed by lid and sealed hermetically in a packing apparatus. The container is transferred to an encasing apparatus wherein the metal container is enclosed in a container of plastics material. After removing the air from said plastic container by means of vacuum apparatus the container has applied thereto a lid which is sealed by a welding or fusion process using an induction welding apparatus. In an alternative embodiment the metal container is dipped into a liquid plastics material to produce a coating sealing the container.

[0011] This invention is further described and illustrated with reference to Examples taken in conjunction with the drawings showing schematic embodiments.

[0012] In the drawings:

Figure 1 is a process flow diagram of the embodiment of Example 1, for solidified waste,

Figure 2 is a process flow diagram of the embodiment of Example 2 for solidified waste, and

Figure 3 is a process flow diagram of the embodiment of Example 3, for non-solidified waste.

[0013] Reference is now made to the following examples taken in conjunction with the relevant figure of the drawings.

Example 1

[0014] As shown in Figure 1, solidified radioactive or toxic waste 1 is transferred to a first packing machine 21 for first stage of package. Said first packing machine 21 includes standard sized zinc plated steel barrels 11. Each barrel 11 comprises a barrel body 111 and a barrel cover 112. The modified radioactive or toxic waste 1 in the first packing machine 21 is packed into a barrel body 111 inside the zinc plated steel barrel 11 and then sealed by a barrel cover 12. Said zinc plated steel barrel 11 containing the modified radioactive or toxic waste 1 is transferred to the second packing machine 22 for final packing. The second packing machine 22 includes standard sized polyethylene (PE) barrels 12. Said PE barrel comprises a PE barrel body 121 and a barrel cover 122. The modified radioactive or toxic wastes 1 packed inside the zinc plated steel barrel 11 is packed in the PE barrel body 121. An induction, ultrasonic or heat welding machine 221 and a vacuum machine 222 are used to weld the PE barrel body 121 and the PE barrel cover 122 in an airtight manner. The surface of the zinc plated steel barrel 11 inside the PE barrel 12 is waterproof and airtight and corrosion proof, so the solidified radioactive or toxic waste 1 inside the zinc plated steel barrel 11 can be stored safely for a long period.

Example 2.

[0015] As shown in Figure 2, the solidified radioactive or toxic waste 3 is transferred to first packing machine 41 for a first stage of packing. Said first packing machine contains standard sized zinc plated steel barrels 31. Each barrel 31 comprises a barrel body 311 and a barrel cover 312. The modified radioactive or toxic waste 3 is packed in the zinc plated steel barrel body 311 inside the zinc plated steel barrel 31 and sealed by the barrel cover 312. The zinc plated steel barrel 31 containing the radioactive or toxic waste 3 is transferred to second packing machine 42 for final packing. The second packing machine 42 contains a liquid plastic soaking tank 421 and a drying compartment 422. The zinc plated steel barrel 31 containing the modified radioactive or toxic waste 3 is processed using the plastic liquid in the second packing machine 42. The zinc plated steel barrel 31 containing the solidified radioactive or toxic waste 3 is soaked in the plastic liquid in the plastic liquid tank 421. A proper thickness of plastic is formed on the surface of zinc plated steel barrel 31 and warmed and dried to a solid form in the drying compartment 422. The plastic protecting film 32 formed on the zinc plated steel barrel 31 can insulate air and water preventing the surface of the zinc plated steel barrel 31 from the corrosion. By doing so, the solidified radioactive or toxic waste 3 inside the zinc plated steel barrel 31 can be stored safely for a long time.

Example 3

[0016] As shown in Figure 3, there are three packing machines 61, 62 and 63 in a process for packing the non-solidified radioactive or toxic wastes. The first packing machine 61 comprises an ultrasonic, induction or heating machine 611, vacuum machine 612 and standard sized plastic bags 51. The non-solidified radioactive or toxic waste 5 is packed in the plastic bag 51 in the first packing machine 61. The plastic bag 51 containing the non-solidified radioactive or toxic waste 5 is then packed with air removed and airtight using the high frequency wave machine 611 and vacuum machine 612. Then the plastic bag 51 is transferred to second packing machine 62 to be packed in a zinc plated barrel 52 which comprises a barrel body 521 and a barrel cover 522. The zinc plated barrel 52 is transferred to the plastic liquid soaking tank 631 and drying compartment 632 in the third packing machine 63 to follow the plastic liquid processing. In this process, a proper thickness of solidified plastic protecting film 53 is formed on the surface of the zinc plated steel barrel 52. Said protecting film 53 can insulate air and water protecting the surface of zinc plated steel barrel 52 from corrosion. Thus the non-solidified radioactive or toxic waste 5 inside the vacuum plastic bag 51 contained in the zinc plated steel barrel 52 can be stored safely for a long time.

Claims

1. A method for the packing and sealing of radioactive or toxic waste materials for the purpose of environmentally safe and long term storage or disposal, the method being characterised by the steps:

    a) compressing, compacting or solidifying the waste materials,
    b) placing said material into a metal container,
    c) closing and sealing the metal container,
    d) encasing the metal container in an enclosure of plastics material,
    e) removing the air from said plastic enclosure, and
    f) sealing the plastic enclosure by a welding or fusion process.

2. A method in accordance with Claim 1, characterised in that the metal container is a zinc plated corrosion proof steel barrel.

3. A method in accordance with Claim 1 or 2, characterised in that the enclosure of plastics material comprises a container of polyethylene with a lid, the lid being fusion welded to the container after removal of air therefrom.

4. A method in accordance with Claim 1, 2 or 3, characterised in that the metal container is immersed in a liquid plastics material to provide a sufficiently thick plastics coating thereon and then dried under heat to form the plastics enclosure.

5. A method in accordance with any preceding claim, characterised in that the waste material is packed into a plastic bag, the air is removed from said bag and the bag sealed, the bag then being inserted into the metal container followed by the steps of enclosing the said container in plastics material.

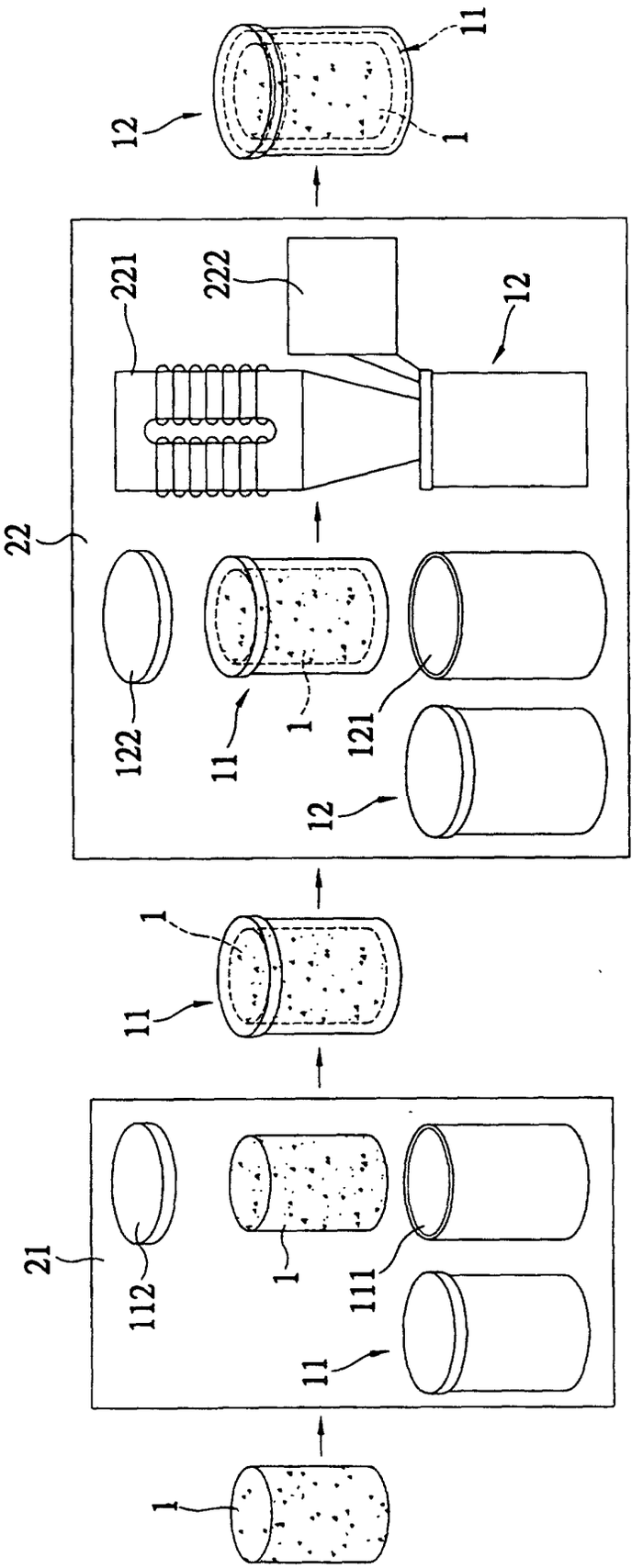

FIG. 1

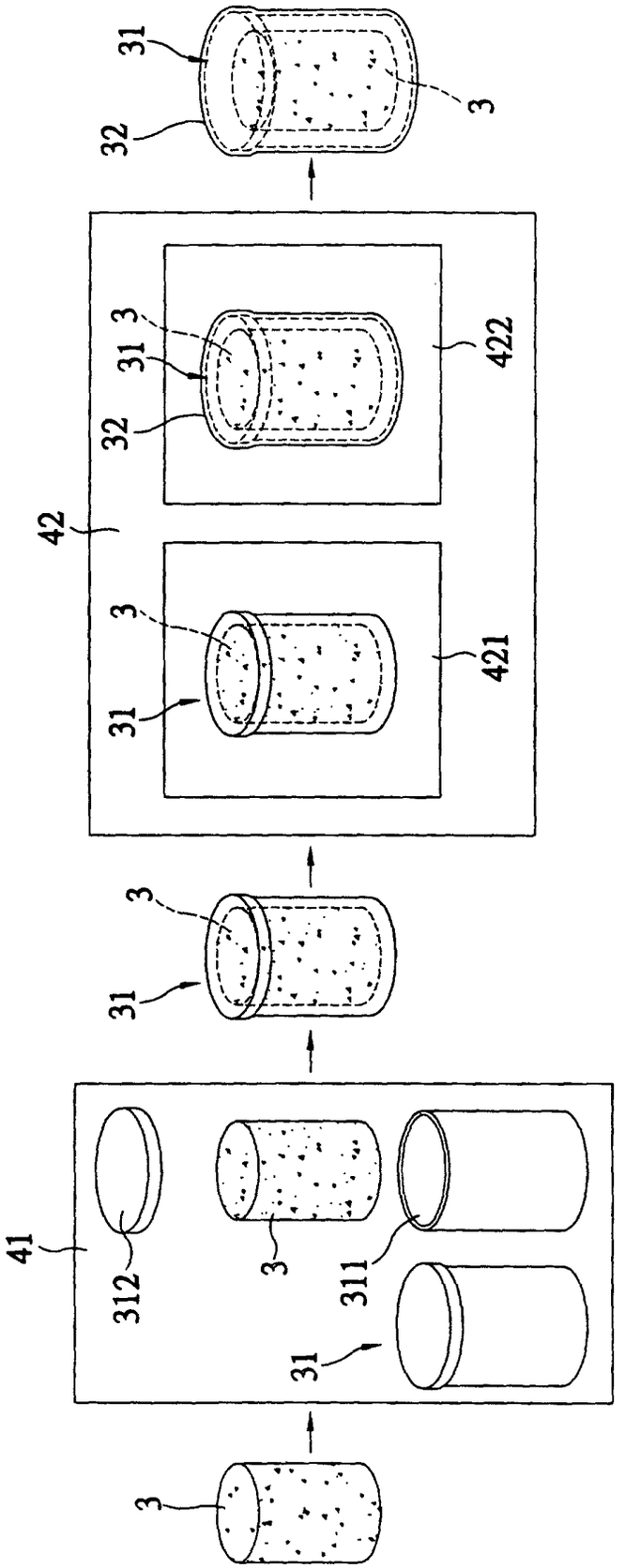

FIG. 2

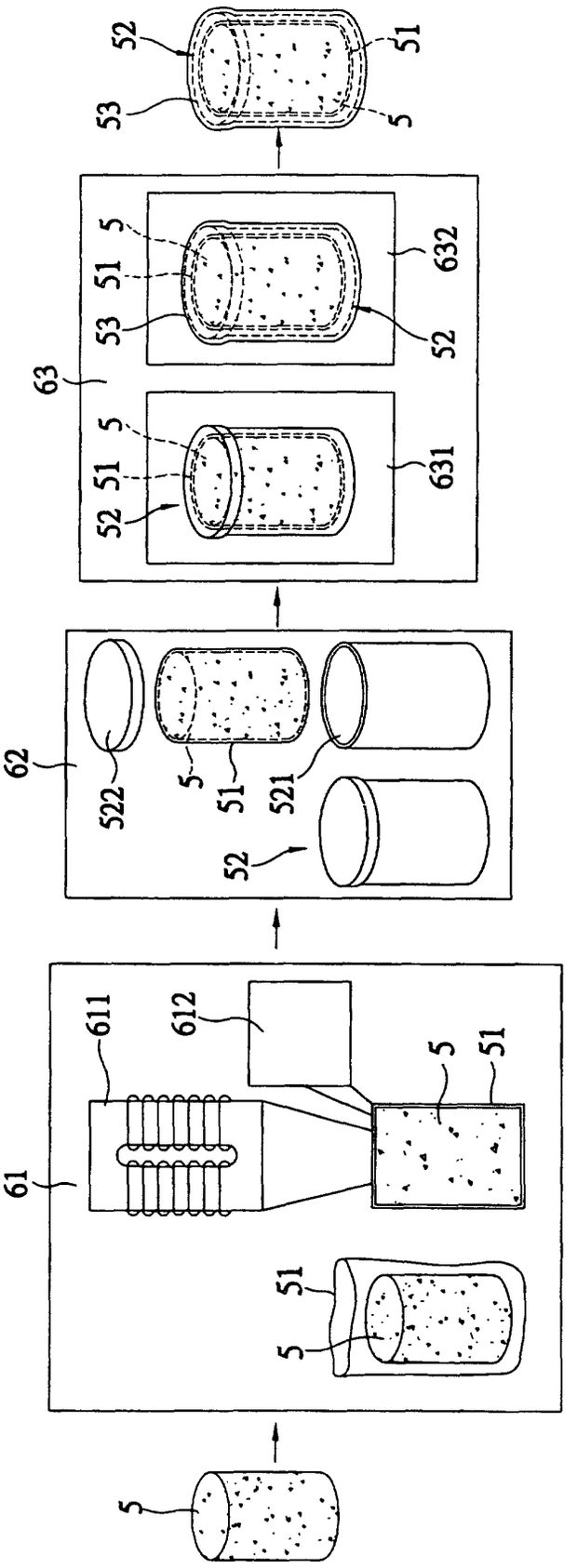

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 1070

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)
A	FR 2 584 854 A (COMMISSARIAT ENERGIE ATOMIQUE) 16 January 1987 (1987-01-16) * the whole document *	1	G21F9/36
A	EP 0 072 429 A (NUKEM GMBH ;WIEDERAUFARBEITUNG VON KERNBRE (DE)) 23 February 1983 (1983-02-23) * the whole document *	1	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			G21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 August 2000	Brothier, J-A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 1070

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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