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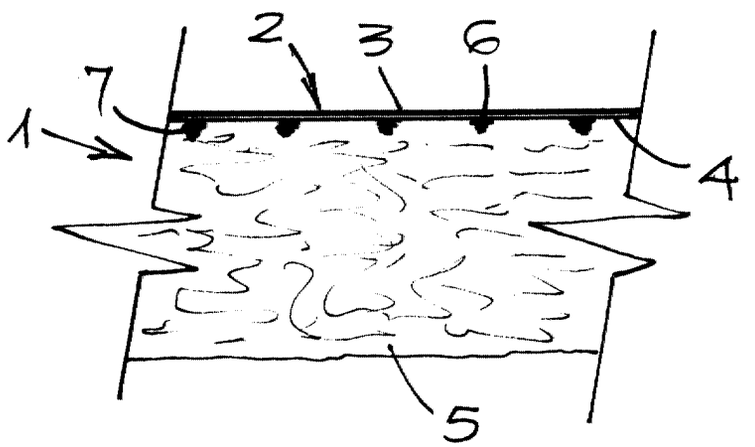
(54) Insulation product and method for making it

(57) The invention provides an insulation product (1) comprising a mineral wool blanket (5), a facing material (2) comprising a laminate of vapour-barrier polymer film (4) and a reinforcing layer (3) adhered to the mineral wool blanket, and an adhesive material (6) which fastens the vapour-barrier polymer film of the laminate to the surface of the mineral wool blanket and which penetrates (7) into the thickness of the blanket. The insulation product is formed by applying the adhesive, preferably as a foamed, water-based material to the polymer film of the facing, disposing the mineral wool blanket on the adhesive and compressing the assembly to cause the adhesive to penetrate into the thickness of the blanket.

FIG. 1



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Description

[0001] This invention relates to an insulation product and to a method for making it. More especially, the invention relates to insulation products of the type used to provide thermal and/or acoustic insulation in residential and commercial buildings.

[0002] Insulation products including mineral fiber blankets and, more particularly, fibrous glass blankets are well known in the art. Such prior art fibrous glass blanket insulation often includes a binder, such as a phenolic resin, applied to the fibrous glass subsequent to the fiberising process and cured in an oven while setting the thickness or "loft" of the blanket. The resulting insulating material has sufficient strength to ensure a degree of structural integrity for handling and to enable the insulation material to recover its thickness and insulating capability after being compressed for packaging and transportation purposes.

[0003] It is common practice to provide such insulation products, in the form of continuous lengths (packaged as rolls) or of individual panels, or batts, with facing materials on one or both major surfaces or with an encapsulating envelope to enable the insulation product to be handled more easily and to be fastened in position for insulating purposes, and to minimise dusting of the mineral fibers within the insulation product. The envelope is generally perforated or otherwise capable of permitting passage of air and water vapour both to facilitate compression and recovery and to avoid forming a vapour barrier. In most instances, however, the provision of a facing that forms a vapour barrier is desirable in order largely to prevent water vapour passing through the insulation product and condensing on a cold surface.

[0004] Facing materials may be adhered to the mineral fiber blanket in a number of ways. For example, solvent-based or water-based adhesives or hot-melt adhesives may be applied to the facing material or to the surface of the mineral wool blanket, and the mineral wool blanket and the facing material then brought together to surface bond the two materials. In this connection, hot-melt adhesives have a number of environmental advantages over solvent-based and water-based adhesives at the application stage but frequently suffer the disadvantage of having poor fire retardancy properties. Alternatively, the facing material itself may be rendered adhesive before application to the mineral wool blanket. For example, a thermoplastics material such as a synthetic polymer or a bituminous layer on one surface of the facing material may be heat softened for that purpose. However, these latter systems generally provide their own disadvantages, for example unreliable surface adhesion between the facing material and the mineral wool blanket and penetration of the mineral wool fibers through the facing material (which will, of course, destroy or at least seriously impair any vapour barrier function of the facing material). Additionally, the heat treatment of polyethylene (the most commonly used synthetic polymer in this context) may destroy its water vapour barrier properties. Still further, bituman presents its own environmental disadvantages.

[0005] A product which has met with some commercial success, manufactured by Owens Corning under the name Thermolan TI 212, consists of a kraft paper/polyethylene vapour barrier bonded via the polyethylene to a glass wool blanket. However, this product has been demonstrated to suffer from the disadvantage that the facing is not reliably bonded to the blanket. A more sophisticated product consists of an aluminium foil/kraft paper vapour barrier adhesively bonded on its kraft paper surface to a glass wool blanket. Although this product is somewhat more robust than the Thermolan TI 212 material described above, the aluminium foil incorporated as the vapour barrier renders it much more expensive.

[0006] There is therefore a need for a practical procedure for making vapour-barrier faced mineral wool blanket insulation products that offer reliable adhesion between the facing and the mineral wool, and satisfactory handling, safety and environmental characteristics and that are relatively inexpensive.

[0007] In accordance with the invention, there is now provided an insulation product comprising

a mineral wool blanket;
a facing material comprising a laminate of a vapour-barrier polymer film and a reinforcing layer adhered thereto; and
an adhesive material which fastens the vapour-barrier polymer film of the laminate to a surface of the mineral wool blanket and which penetrates into the thickness of the blanket.

[0008] According to the invention, there is provided also a method for making such an insulation product which comprises the steps of

applying an adhesive to the polymer film surface of the facing material;
disposing the mineral wool blanket on the adhesive;
compressing the mineral wool blanket against the facing material to cause the adhesive to penetrate into the thickness of the mineral wool blanket; and
allowing the adhesive to harden/dry/cure.

[0009] The insulation product of the invention has a robust structure by virtue of the penetration of the adhesive material into the thickness of the mineral wool blanket. The insulation product of the invention is therefore highly resistant to damage caused by repeated and/or rough handling, without the vapour barrier facing separating from the mineral wool blanket, and without adversely affecting the insulation properties of the mineral wool blanket.

[0010] The mineral wool blanket may comprise any one or more of the materials traditionally used for mak-

ing mineral wool insulation products, for example slag, basalt and various types of glass. In the context of the present invention, however, fibrous glass is preferred. When a fibrous glass blanket is used for forming the insulation products of the invention, it is preferred that the fibrous glass blanket contains a binder, for example a phenolic resin binder, suitably applied to the fibers immediately after fiberisation.

[0011] According to a preferred aspect of the invention, the facing material is a laminate of a thermoplastic polymer and a paper material. Such a facing material has the advantage that the thermoplastic polymer provides a reliable vapour-barrier membrane even as a very thin film and permits good bonding to the adhesive material, while the paper provides strength to the facing to assist in handling during installation of the insulation product and a more robust surface to avoid damage to the insulation product during manufacture, compression, storage and transportation. Alternatively, the facing material may be a laminate of different plastics materials with or without a paper layer. For example, the facing material may be a laminate of thermoplastic polymer vapour barrier film/paper/plastics film or a laminate of thermoplastic polymer vapour barrier film/paper/metal foil. In these instances, the plastics film or metal foil may be provided with a decorative or other surface finish.

[0012] In one embodiment of the invention, the facing material may be a laminate of recycled paper and polyethylene. However, recycled paper does not possess optimum mechanical properties. Accordingly, in a preferred embodiment of the invention, the facing material is a kraft paper/polyethylene laminate. Such laminates are readily available commercially, one example being UG KRAFT available from Walki Wisa GmbH.

[0013] The polyethylene film suitably has a thickness corresponding to a weight of 10 to 50 g/m^2, preferably 15 to 45 g/m^2 and more preferably 25 to 35 g/m^2, for example about 30 g/m^2. Such a thickness is generally sufficient to prevent penetration by individual fibers of the fibrous mineral wool blanket and thereby retain the vapour-barrier characteristics of the product, while avoiding contributing unnecessary weight to the insulation product.

[0014] Instead of polyethylene, other synthetic thermoplastic polymer materials may be used provided that they offer the required combination of properties for their intended purpose. For example, the polymer material must be a vapour-barrier at the required thickness, it must be of sufficient strength or puncture resistance to inhibit penetration by mineral wool fibers, it must be susceptible to being bonded to the paper backing and it must, of course, be compatible with the selected adhesive material by means of which it is bonded to the fibrous mineral wool blanket. Polyethylene, however, offers the optimum combination of properties to be the most preferred material and has the advantage of low cost and ready availability.

[0015] The paper is preferably kraft paper because of its ready availability and low cost, its inherent strength and durability and its ability to be readily laminated to the preferred polyethylene films. The kraft paper suitably has a thickness corresponding to a weight of 40 to 150 g/m^2, preferably 50 to 100 g/m^2 and more preferably 60 to 80 g/m^2, for example about 70 g/m^2. However, other types of paper such as recycled paper or callendered paper may be used especially where particular properties, such as visual appearance or susceptibility to the application of other products, such as printing, may be desired, although kraft paper is itself susceptible to printing, for example in order to carry product information.

[0016] The adhesive may be any known and/or traditional adhesive material that will provide a strong, reliable and permanent bond between the polymer film of the facing material and the mineral wool blanket and which will penetrate into the thickness of the blanket. Although hot-melt adhesives may be used for this purpose provided that they do not introduce a flammability problem into the insulation product, it is preferred that solvent-based or water-based adhesives are used. However, solvent-based adhesives tend to introduce fire risk problems during product manufacture and to increase the cost of manufacture by requiring the presence of solvent venting and recovery equipment. Consequently, the use of aqueous adhesive systems is especially advantageous.

[0017] In accordance with an especially preferred aspect of the invention, there is used an aqueous adhesive material which has been foamed before its application to the facing material. In this respect, the aqueous adhesive material may be foamed by the injection of air or other inert gas, for example nitrogen and carbon dioxide. Foaming of the adhesive material assists penetration of the adhesive material into the mineral wool blanket by increasing the volume of the adhesive composition so that less adhesive may be applied than would otherwise be necessary in order to obtain the same adhesive effect.

[0018] The adhesive material is preferably an adhesive with self-curing characteristics. A preferred adhesive material in this respect is a PVAC (polyvinylacetate/polyvinylalcohol) adhesive which is milky white in colour and which dries and cures to a generally white or colourless state, thereby avoiding unsightly colouration of the final insulation product. Such adhesives are readily available commercially, one example being Reverfix Rx 4028/1 available from Revertex Belgium S.A.

[0019] The adhesive material may be applied to the polymer surface of the facing material by spraying, roller-coating, brushing or doctoring or by any other method that is practical under the circumstances. Generally, roller-coating is preferred. Although the adhesive material may be applied over the whole of the surface of the polymer film of the facing material, it is preferred to apply it to only a part of the surface. In this respect, it may be

applied in a random fashion or as a number of discrete spots or stripes, or as a grid. Preferably, it is applied by roller-coating as a number of separate stripes. For example, where the adhesive is applied to a facing material having a width of, say, 1.2 metres, it may form stripes approximately 5 mm wide spaced by approximately 15 mm. The adhesive material is preferably applied at a rate of 5 to 50 g/m^2, more preferably 10 to 30 g/m^2, for example approximately 15 g/m^2.

[0020] In a preferred aspect of the invention, a white water-based PVAC adhesive is applied to the polyethylene face of a kraft paper/polyethylene laminate which is then heated to a temperature of 90 to 150°C, preferably to 100 to 130°C, for example approximately 110°C. This elevated temperature serves first to activate the polyethylene surface of the laminate and possibly thereby render it more receptive to the PVAC adhesive and second to initiate evaporation of water from the water-based adhesive and thereby accelerate its eventual drying and curing. The elevated temperature serves additionally to soften the polyethylene, thereby rendering the polyethylene more susceptible to direct bonding with the fibers of the mineral wool blanket. This heating step may be carried out by subjecting the adhesive-coated facing to radiant heat, for example by conveying it past an infrared heater, or by passing it over a heated roller, for example an oil filled roller.

[0021] Following application of the adhesive to the facing material and following any optional heating step, the facing material is applied to the mineral wool blanket. The assembled facing/mineral wool blanket is then compressed to ensure adhesion of the mineral wool blanket to the facing material and to force a portion of the adhesive into the thickness of the mineral wool blanket. In this manner, adhesion of the facing to the glass wool becomes more than just a surface contact phenomenon and a far stronger and more durable insulation product is formed. The foamed nature of the adhesive facilitates penetration of the adhesive into the mineral fiber wool but the limited quantity of adhesive and the preferred non-continuous coating of adhesive on the facing material assist in avoiding saturation of the mineral wool blanket with adhesive and penetration of the adhesive through the whole thickness of the mineral wool blanket, thereby preserving the resilient nature and insulating properties of the mineral wool blanket.

[0022] The degree of compression to which the assembly of mineral wool blanket and facing material is subjected for enhancing adhesion will depend upon the density and compressibility of the mineral wool blanket and the degree of adhesive penetration required relative to the amount of adhesive applied. In this respect, it should be borne in mind that a fibrous glass blanket containing binder will generally have a greater fiber density at its surface than in its interior as a result of its loft being set in the binder curing oven. Some compression of the blanket will therefore be necessary in most cases to force the adhesive through the more dense surface layer of fiber into the interior of the blanket. Generally, all that will be required to provide satisfactory enhancement of adhesion is to compress the assembly to approximately 50 to 95% of its uncompressed thickness, preferably 60 to 85%, for example about 75%. Such compression can be applied between an upper roller and a lower roller or conveyor surface. Alternatively, it can be provided by passing the assembly of mineral wool blanket and facing material under tension around a roller surface. Clearly, it is not required or desired to retain the mineral wool blanket in a compressed state for any significant period of time since it is undesirable for the adhesive to dry or cure while the blanket is in a compressed state. Indeed, all that is required is that the adhesive should be forced to penetrate into the thickness of the blanket and that the adhesive is then permitted to dry or cure with the blanket in its recovered state.

[0023] The mineral wool blanket preferably has a thickness of approximately 20 to 300 mm, especially 60 to 260 mm, and a bulk density of 8 to 40 kg/m^3 (0.5 to 2.5 pcf), for example approximately 12 kg/m^3 (0.75 pcf).

[0024] Following its release from compression, the blanket may be cut immediately into individual insulation batts. Preferably, however, the adhesive is first permitted to completely dry and/or cure (or at least to almost completely dry and/or cure so as to avoid slippage between the mineral wool blanket and the facing material) and the blanket can then be cut into individual batts which may then be folded and/or compressed and packaged for storage and transportation. Alternatively, the blanket may be rolled up under compression and packaged for storage and transportation. Generally, the adhesive will require only a very few minutes to dry and/or cure to the stage where it is no longer tacky, especially at the slightly elevated temperatures prevailing in the vicinity of the heating roller referred to above. The cured blanket or batt may be compressed to the usual degree, that is to say to about 50% or less, for example to 12 to 15% of its uncompressed thickness.

[0025] At the intended site of installation, the compressed and packaged insulation product may be unpacked and allowed to recover its original thickness and then utilised in any one of a number of insulating situations. Such water vapour-barrier faced insulation does, however, find particular utility for roof insulation. For example, the insulation may be laid, facing down, between the ceiling joists of an upper floor room or below or between the rafters in order to insulate an attic space.

[0026] The following Example illustrates the invention.

EXAMPLE

[0027] The invention is described below by way of example only with reference to the accompanying drawings, in which Fig. 1 is a part sectional end view of an insulation product according to the invention, and Fig. 2

is a schematic representation of the manufacture of such an insulation product in accordance with the method of the invention.

[0028] Referring first to Fig. 2 of the drawings, a kraft/polyethylene facing material 10, obtained from Walki Wisa GmbH under the name UG KRAFT, having a weight of 70/30 g/m^2, as a roll 11 having a width of 1.2 m, was passed at a linear speed of 19 m/min over a number of idler rolls to an application roll 12 where it was coated on its polyethylene surface with a plurality of parallel 5 mm wide 15 mm spaced machine direction stripes of foamed water-based PVAC adhesive. The foamed adhesive was transferred from a trough 13 via a pick-up roll 14. The application roll 12 was rubber faced with a grooved surface, and coated the adhesive on the facing material at a rate of approximately 15 g/m^2. The PVAC adhesive was obtained from Revertex Belgium S.A. under the name Reverfix Rx 4028/1 and had been passed through a commercial foaming device in which it was agitated with injected air to obtain a foam having a density of 0.6 g/ml, corresponding to an air content of approximately 50%.

[0029] The adhesive-bearing facing material was then passed over an oil-filled heating roll 16 and thereby brought to a temperature of approximately 100°C and immediately contacted with a fibrous glass blanket 17 having a width of 1.2 m, a thickness of 280 mm and a density of 10.5 to 11.0 kg/m^3. The resulting insulation assembly was immediately compressed against the heating roll 16 by a roller 18 to a thickness of 210 mm which served to force the adhesive applied to the facing material into the thickness of the fibrous glass blanket to an average depth of 3 mm from the facing.

[0030] 20 m downline of the roller 18, the resulting insulation assembly 19 was chopped in the transverse direction by blade 20 into lengths of insulation material having a size of 1.2 m by 5.5 m. The 5.5 m lengths of insulation product were immediately rolled and compressed to a thickness of 30 mm and packaged for storage and transportation.

[0031] Referring now to Fig. 1 of the drawings, there is shown a batt according to the invention. The product 1 consists of a fibrous glass blanket 5 having a facing material 2 on its upper surface. The facing material 2 is a laminate of kraft paper 3 and a polyethylene film 4, the latter being bonded to the fibrous glass blanket by a number of parallel stripes of adhesive 6. As shown in Fig. 1, the adhesive 6 has penetrated into the thickness of the fibrous glass blanket at 7 to more firmly bond the facing to the blanket.

[0032] The insulation material produced as described above had a robust structure which was resistant to repeated handling and the facing could not be separated from the fibrous glass blanket without destroying the whole structure of the material. The insulation was tested for its insulating value and were found to have an R value of 5 m^2/W°C.

Claims

1. An insulation product (1) comprising:

a mineral wool blanket (5);
a facing material (2) comprising a laminate of a vapour-barrier polymer film (4) and a reinforcing layer (3) adhered thereto; and
an adhesive material (6) which secures the vapour-barrier polymer film (4) of the laminate to a surface of the mineral wool blanket (5) and which penetrates (7) into the thickness of the blanket.

2. An insulation product according to claim 1, wherein the mineral wool is fibrous glass wool.

3. An insulation product according to claim 1 or claim 2, wherein the facing material is a laminate of a thermoplastic polymer and a paper material.

4. An insulation product according to claim 3, wherein the facing material is a laminate of polyethylene and kraft paper.

5. A method for making an insulation product (1) according to any one of claims 1 to 4, which comprises the steps of:

applying an adhesive to the polymer film surface of the facing material;
disposing the mineral wool blanket on the adhesive;
compressing the mineral wool blanket against the facing material to cause the adhesive to penetrate into the thickness of the mineral wool blanket; and
allowing the adhesive to harden/dry/cure.

6. A method according to claim 5, wherein the adhesive is an aqueous adhesive.

7. A method according to claim 6, wherein the adhesive is foamed before its application to the polymer film surface of the facing material.

8. A method according to claim 7, wherein the adhesive is a foamed PVAC adhesive.

9. A method according to any one of claims 5 to 8, wherein the adhesive is applied to the polymer film surface of the facing material as a plurality of parallel stripes.

10. A method according to any one of claims 5 to 9, wherein the facing material and the applied adhesive are heated to a temperature of 90 to 150°C immediately before the mineral fiber blanket is dis-

posed on the facing.

FIG. 1

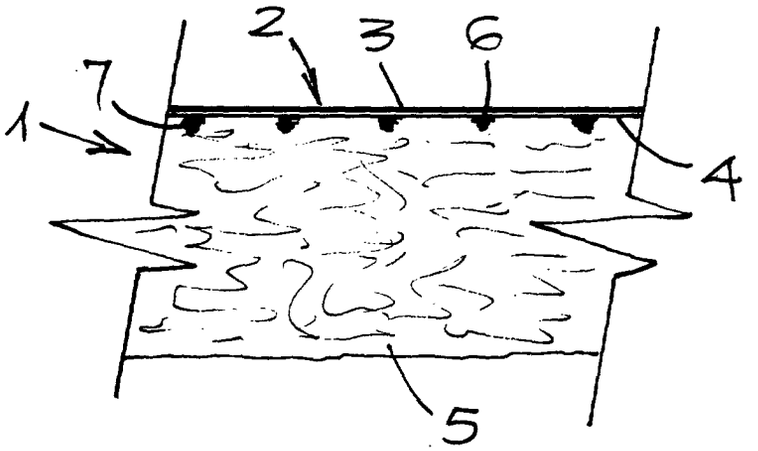
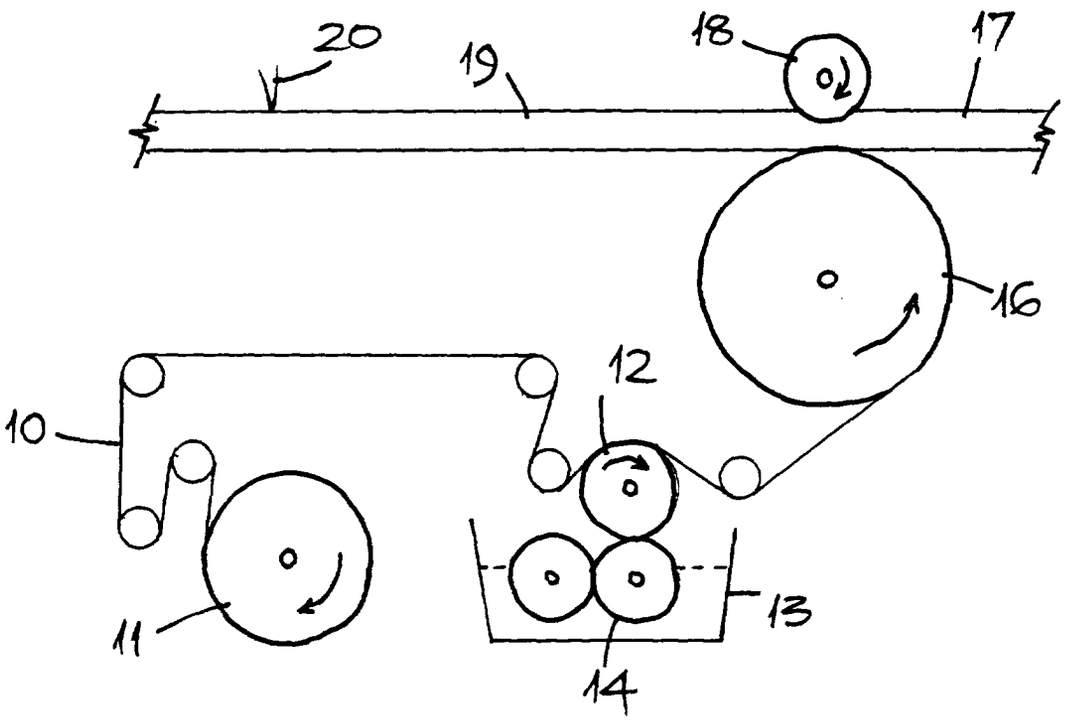


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 6576

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	WO 97 40237 A (ROCKWOOL LAPINUS) 30 October 1997 (1997-10-30) * page 2, line 37 - page 3, line 12; figure 1 *	1-4	E04B1/76
A	US 4 726 985 A (FAY ET AL.) 23 February 1988 (1988-02-23) * column 3, line 53 - column 4, line 7; figures 2,5 *	5,6,8	
A	WO 94 29540 A (OWENS-CORNING FIBERGLAS CORPORATION) 22 December 1994 (1994-12-22) * page 6, line 5 - line 33; figure 1 *	9	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E04D
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 December 2000	Mysliwetz, W

CATEGORY OF CITED DOCUMENTS

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05-12-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9740237 A	30-10-1997	NL 1002930 C	24-10-1997
		AU 2408797 A	12-11-1997
		EP 0895557 A	10-02-1999
US 4726985 A	23-02-1988	NONE	
WO 9429540 A	22-12-1994	AU 4406093 A	03-01-1995
		DE 69313306 D	25-09-1997
		DE 69313306 T	05-03-1998
		EP 0701645 A	20-03-1996
		JP 8511070 T	19-11-1996
		KR 189213 B	01-06-1999

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