(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 710 533 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.05.1996 Bulletin 1996/19

(51) Int. Cl.[6]: **B27N 7/00**

(21) Application number: **95202931.2**

(22) Date of filing: **31.10.1995**

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE

(30) Priority: **02.11.1994 NL 9401818**

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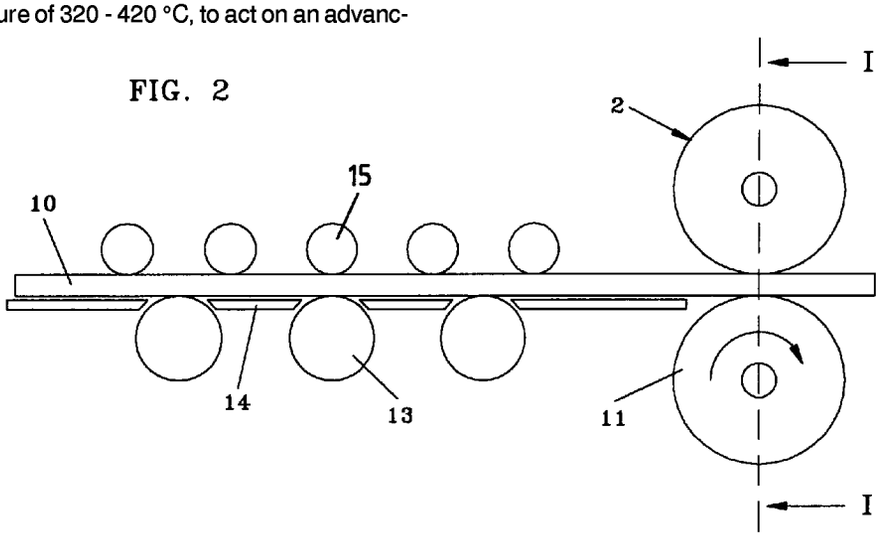
(54) Method, device and relief roller for applying a pattern to a surface of a fibreboard

(57) The invention relates to applying a relief to the main surface of a fibreboard (10), such as MDF or HDF boards, by causing a roller (2), provided with low, preferably narrow projections (7), which is heated at its surface up to a temperature of 320 - 420 °C, to act on an advancing fibreboard. The results are to a considerable degree aesthetically acceptable and do not cause in any way protruding fine hairs or roughnesses, so that any ensuing painting or colouring treatment can by easily carried out.

FIG. 2



EP 0 710 533 A1

Description

The invention relates to a method for applying a relief pattern to a fibreboard surface, in which a heated die element is brought into contact with the fibreboard surface by the application of pressure.

In the present patent application, by a fibreboard is first understood a wood fibreboard, being MDF (Medium Density Fibreboard) as well as HDF (High Density Fibreboard), but fibreboards containing other fibre material, such as hemp, flax and even synthetic fibres, are also suitable for being applied to the present invention.

The method and device, as outlined hereinabove, have been described in the American patent specification 4,197,078. In said publication a moulding plate is placed on a modelled edge of the board, which moulding plate is urged in a heated condition against the edge. The result is a smooth surface, suitable for further painting treatments. In addition, said publication states that in treating the fibreboard edges, the patterns or shapes of the moulding plate need not be patterns of the recurrent type but can have configurations such as wood grain and so on. It has, however, in no way been indicated how this is to be achieved.

A disadvantage of said known method is that a heated moulding plate must each time be pressed on an edge, held in the pressed state for some time and then must be withdrawn again, upon which a new fibreboard can replace the old one in order to undergo a similar treatment. This requires a relatively complicated and extensive equipment and leads to slow production rates.

Moreover, in this known process no pattern is applied to a main surface of a fibreboard. Such main surfaces tend to be relatively smooth and entirely uniform in colour. In practice, to such boards wood-grain alike patterns have indeed been applied, but this was effected either by gluing real wood veneer onto the board or by means of a layer of paper with a wood-grain pattern. Both solutions require labour and material, an additional disadvantage being that a fibreboard, to which at one side a layer has been applied, tends to warp, so that in practice a layer is likewise applied to the other side.

The invention aims at removing or reducing the above-mentioned disadvantages and in particular at providing a method and device that enable a quick and cheap application of a pattern to the main surface as well as to an edge surface of a fibreboard.

The aims mentioned hereinabove are attained in accordance with the invention by providing that the die element is of the co-moving type with the pattern to be applied on the co-moving surface, which co-moving surface moves along with the surface of the fibreboard.

In many cases the die element is a roller. As a result a high local pressure is obtained and also a simple device. However, it is also possible to use a conveyor belt for a die element, such as is known per se from the European patent application 0 187 665.

From the European patent application 0 187 665 a method is known for continuously refining the surface of a fibreboard, in which during the formation of the board an infinite band or a roller co-moves with the surface of the board. Said band or roller may have a relief. In this process the board has not been cured and the application of the relief is therefore relatively simple. In doing so the relief is applied to the particles of the cover layer, which particles were previously applied to a fibrous fleece. Here, the problem of how to apply a moulded pattern to a prepared fibreboard is neither brought up nor solved.

It is now preferably provided that the relief of the pattern is 0.2 - 0.6 mm high with respect to a, apart from that, smooth surface. This embodiment of the invention has been found to give a sufficiently distinct pattern, in which the local slits of the relief in the fibreboard do not lead to the formation of protruding fine hairs nor any other roughnesses.

Here, it is preferably provided that the relief pattern contains thin lines having halfway their height a width of at most 0.25 mm. When the elements of the relief pattern have a larger width it is desired that they protrude less from the smooth surface.

In general, good results can be obtained when the smooth surface is heated up to a temperature of 320 - 420 °C. The relief protruding from the surface and often consisting of thin lines will, due to the direct contact with the fibreboard, cool off relatively rapidly and will have a lower temperature. During tests, at which the temperature was increased, it was observed that the relief pattern initially did not penetrate into the fibreboard and did not remain visible, until the relief pattern penetrated into the fibreboard at a certain temperature and a distinctly visible pattern remained. This pattern is not rough to the touch and neither has it protruding particles nor hairs nor any other roughnesses.

In accordance with a further elaboration of the invention it can be provided that more than one die element of the co-moving type cooperate with the same surface or an other surface of the fibreboard. This gives the possibility of varying the relief pattern considerably, by using either the one, or the other or a combination of both patterns, in which moving in the axial direction of the rollers results in a possibility of rich variety. It is also possible to lift at least one of the rollers alternately and to press it against the fibreboard. Additionally, it is possible to couple the rollers in direction of rotation.

Should treatment be desired of not only the main surface but also of the edges, it can be provided that the co-moving surfaces of several die elements of the co-moving type are located in different planes and cooperate with different surfaces of the fibreboard. To these relatively narrow surfaces a pattern can be applied as well, but in most cases this is unnecessary, so that a smooth surface will suffice, wherefrom, also in case of painting treatment, no fine hairs will protrude.

According to a still further embodiment of the invention it can be provided, that the die element is of the co-moving type and that moving means are present in order to cause the die element and the fibreboard to carry out

a co-movement. This gives a very great possibility to vary the pattern and can be used especially to imitate the grain of specific kinds of wood.

The invention also comprises a device for applying the method. Departing from the device in accordance with the American patent specification US-A-4197078, which is provided with a die element and means of forcing together a fibreboard and the die element, and heating means for the die element, the device according to the invention is characterized in that the die element is of the co-moving type and that moving means are present in order to cause the die element and the fibreboard to carry out a co-movement.

In accordance with a prefered embodiment the support roller is here the driving means.

The die element preferably has a relief pattern containing relief parts that protrude from the superficies of the roller. These preferably have a height of 0.2 up to 0.6 mm above the surface.

When the relief parts have a minimum transverse dimension of less than 0.25 mm, forming, therefore, in fact relatively thin lines, a pattern is created of fine slits without any roughnesses nor protruding fine hairs. This way a very good imitation of a wood grain has been found possible, which is, moreover, considerably more wear and tear resistant than a layer of paper, and always remains sufficiently distinct. In principle, the relief roller can be of any hard material, but already in a trial set up satisfactory results have been achieved with a steel roller, onto which also a chromium containing surface-hardened layer can be applied.

Heating the relief roller preferably takes place by means of electric heating elements fixed at the crosscut sides of the roller. The electrical feeding of said elements can take place in the manner known per se through slip contacts.

When the surface temperature of the relief roller has to be controlled, the fact that this temperature is difficult to measure poses a problem. The relief roller has all sorts of projections and a contact temperature probe is therefore impossible. It has, however, been found that when an other temperature, namely the one located at a small distance of the surface, is established in radiation interchange with it by the temperature probe, it can be very well used as a control quantity. Once it has been established at which temperature indication of the probe the right operation point is reached, controlling can be done by virtue of this temperature measurement as well.

Finally, the invention also comprises a die element such as a relief roller, applicable in the method or capable of being included in the device according to the invention. Together with the protruding relief parts, the surface of the element can be provided with a chromium containing hardened layer. The other elements of the device consist to a considerable extent of equipment known per se, but the relief roller should be given independent protection, since the manufacture of said roller and its ensuing exportation can easily lead to applying the invention.

The invention will hereinafter be further explained, reference being made to the drawing, where:

fig. 1 is a vertical cross-section over the line I-I of fig. 2;
fig. 2 is a side elevation of the device represented in cross-section in fig. 1; and
fig. 3 schematically shows a wood-grain imitating pattern.

In fig. 1 by 1 the axis is indicated of the relief roller 2, which at its ends is mounted in bearings 3 and 4. The roller 2 is made of solid metal, preferably steel, and is at its crosscut surfaces in heat-interchange with electric elements 5 and 6. Said elements heat the intermediate section of the axis 1 in the same way as the roller 2, so that no excessive thermal stresses occur. The roller 2 has been provided with moulded patterns 7, which protrude for instance by 0.4 mm from the surface 8 of the roller 2. A complex of slip rings 9 ensures the connection to both heating elements 5 and 6. The supports 3 and 4 are preferably adjustable in vertical direction, in which a rigid resilient mounting, which means a great force variation at a slight displacement, is preferred.

The roller 2 is preferably idle. At the bottom side the fibreboard 10, which with its upper side touches the relief roller 2, is supported by a support roller 11, which is mounted on an axis 12 preferably driven in a manner not further indicated.

In fig. 2 a side elevation of the device is schematically represented. Here the conveyor rollers 13 with in between support elements 14 form a support for the fibreboard 10, which is preferably subjected from above to the action of pressing rollers 15, as a result of which it is achieved in a manner known per se that the board 10 slides over the support plates 14 with a slight friction and can be driven by one or more rollers 13. The board then advances between the relief roller 2 and the support roller 11, in which its upper surface is provided with the relief pattern, which is applied to the surface of the relief roller 2.

In practice, the operation can be carried out with a velocity of 40-60 m per minute and the width of the board is in principle not subject to any limitations. Tests with a roller 2 with an axial length of 20 cm and a girth of 72 cm have produced good results. It has been found that such a roller can be brought at the right temperature in about thirty minutes by means of two heating elements 5 and 6 of 2 kW each.

Fig. 3 shows an example of a relief pattern in imitation of a wood grain. The pattern is composed of relatively short pieces of line 16, each of them having an upward tapering shape with halfway their height a width of about 0.2 up to 0.1 mm. When the right temperature has been reached, such relief-pattern lines cut smoothly into the fibreboard without thin hairs disengaging themselves nor the occurrence of roughness in any other way.

It has been found that a fibreboard with such a pattern can easily be painted, whereupon it turns out a very feasible imitation of a chosen wood species.

When a fibreboard should obtain a certain shape at its edges, a cross-sectional shape by virtue of the removal of material, such as shaving and/or moulding, can be effected in a manner known per se. Subsequently, said edges can be smoothed by means of fixed ironing elements or heated rollers, in which said rollers usually are located approximately perpendicular to the bevelled moulded edge section of the fibreboard.

The relief roller has a cylindrical shape with pattern elements protruding from it. It is now possible that in the sections of the cylindrical wall parts have been removed, resulting in surface parts of the fibreboard not being touched by the roller. This may cause a (slight) colour shade.

The invention provides a great saving when applying patterns, in particular wood-grain patterns, to the fibreboard, the quality of the result being better than when using methods employed thus far.

Claims

1. Method for applying a relief pattern to a fibreboard surface, in which a heated die element is brought into contact with the fibreboard surface by the application of pressure, **characterized in that** the die element is of the co-moving type with the pattern to be applied on the co-moving surface, which co-moving surface moves along with the surface of the fibreboard.

2. Method as claimed in claim 1, **characterized in that** the relief has a height of 0.2 - 0.6 mm with respect to the co-moving surface, which apart from the relief pattern is even on the location of the pattern.

3. Method as claimed in claim 2, **characterized in that** the pattern contains thin lines, having halfway their height a width of at most 0.25 mm.

4. Method as claimed any of the claims 1 - 3, **characterized in that** the co-moving surface has a temperature of 320 - 420 °C.

5. Method as claimed in any of the claims 1 - 4, **characterized in that** more than one die element of the co-moving type cooperate with the same surface or an other surface of the fibreboard.

6. Method as claimed in claim 5, **characterized in that** the co-moving surfaces of several die elements of the co-moving type are located in different planes and cooperate with different surfaces of the fibreboard.

7. Method as claimed in claim 5, **characterized in that** at least two die elements if the co-moving type have the same co-moving surface and cooperate with the same surface of the fibreboard.

8. Method as claimed in any of the claims 1 - 7, **characterized in that** at least one die element of the co-moving type is moved to and fro transversely to its co-moving direction.

9. Device for applying the method as claimed in any of the claims 1 - 8, provided with a die element and means of forcing together a fibreboard and the die element and heating means for the die element, **characterized in that** the die element is of the co-moving type and that moving means are present in order to cause the die element and the fibreboard to carry out a co-movement.

10. Device as claimed in claim 9, **characterized in that** the moving means are devised for conveying to the fibreboard a translation movement and that at least one support roller is devised for supporting the fibreboard at te location of the die element.

11. Device as claimed in claim 10, **characterized in that** the support roller is part of the moving means and is provided with a driving means.

12. Device as claimed in claim 9 or 10, **characterized in that** at the location of the relief pattern the die element has a even surface with elevations of 0.2 - 0.6 mm.

13. Device as claimed in claim 12, **characterized in that** the elevations contain thin lines having halfway their height a width of at most 0.25 mm.

14. Device as claimed in any of the claims 9 - 13, **characterized in that** the die elements are rollers.

15. Device as claimed in claim 14, **characterized in that** the rollers have been provided with electric heating elements at each of their end surfaces.

16. Device as claimed in any of the claims 9 - 15, **characterized in that** a control circuit is present for the heating means of the die elements, which is monitored by a temperature probe located at a small distance of the surface of the die element.

17. Die element for application in the method as claimed in any of the claims 1 - 8 or in the device as claimed in any of the claims 9 - 16, **characterized in that** it has a smooth co-moving surface with a relief pattern protruding from said surface.

18. Die element as claimed in claim 17, **characterized in that** the relief pattern contains thin lines having a height of 0.2 - 0.6 mm and halfway their height a width of at most 0.25 mm.

19. Die element as claimed in claim 17 or 18, **characterized in that** the pattern is an imitation of a wood grain.

20. Method for applying a wood grain pattern to a MDF (medium density fibreboard) or HDF (high density fibreboard), **characterized in that** a co-moving die element having a relief pattern containing lines with a height of 0.2 - 0.6 mm and halfway their height a width of at most 0.25 mm is pressed against the surface of the fibreboard.

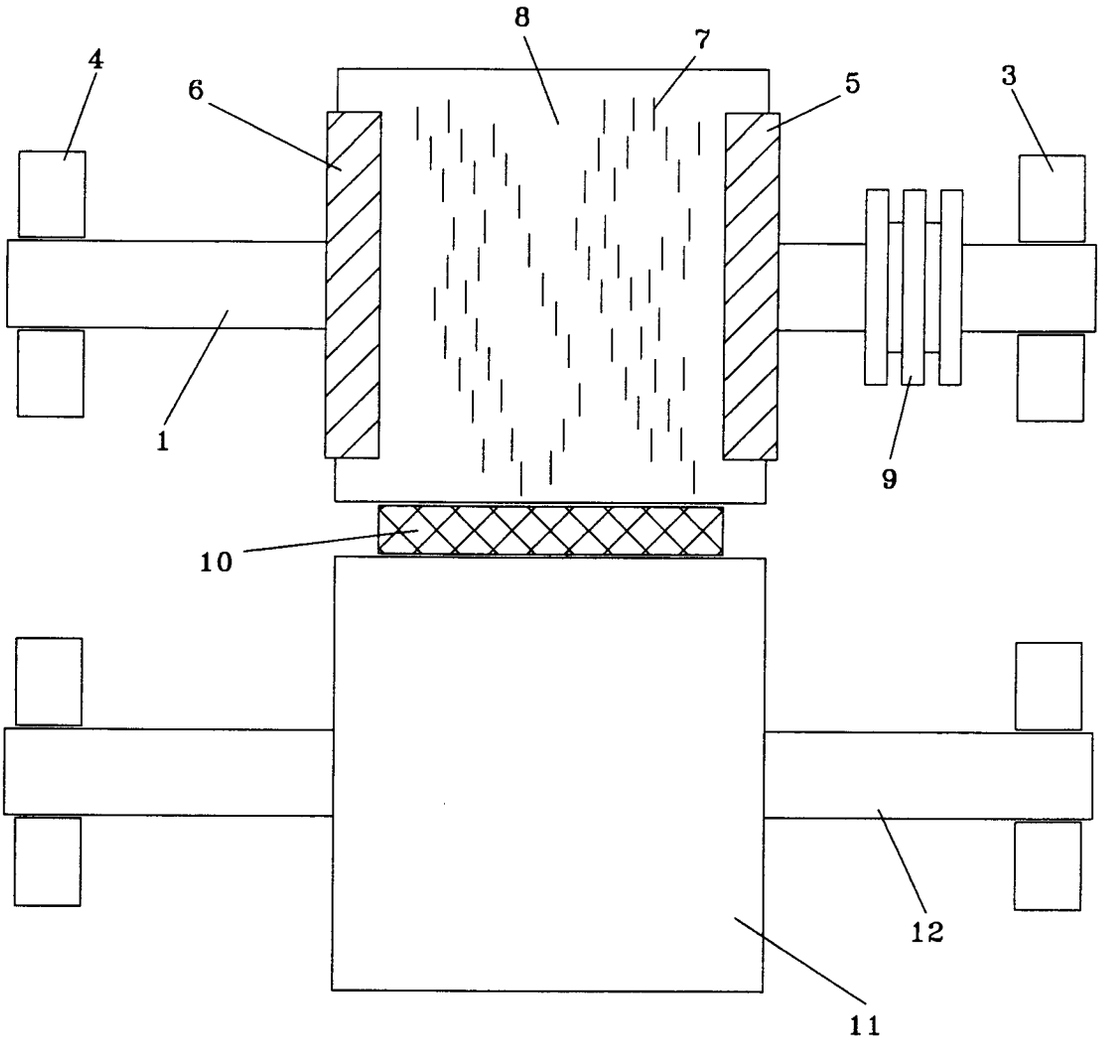
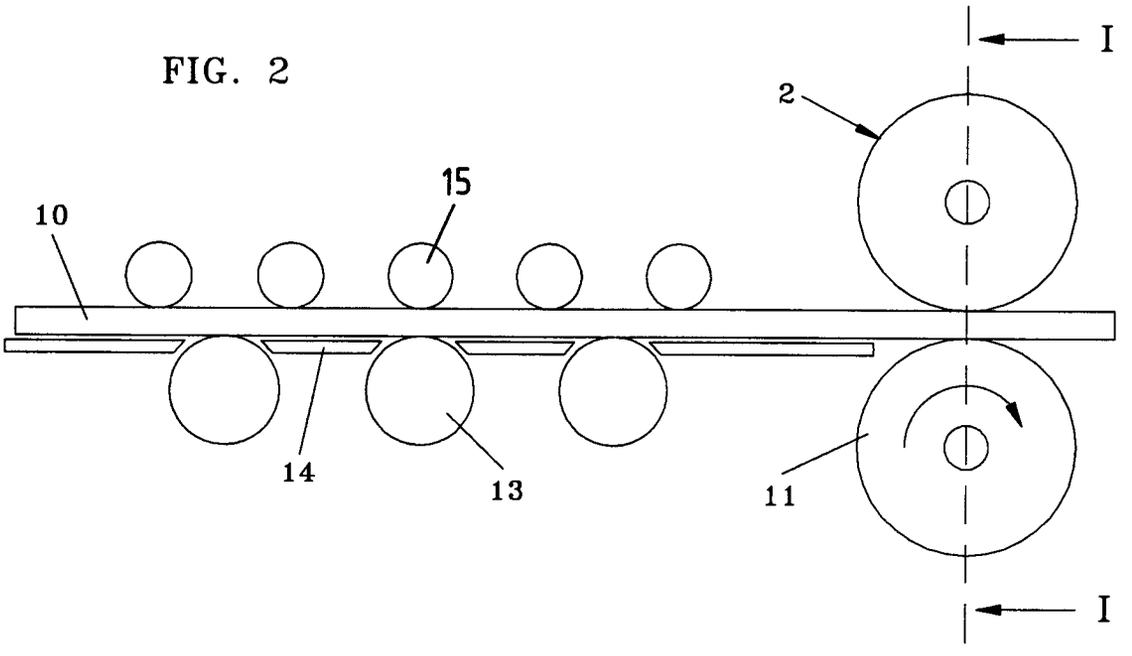


FIG. 1

FIG. 2



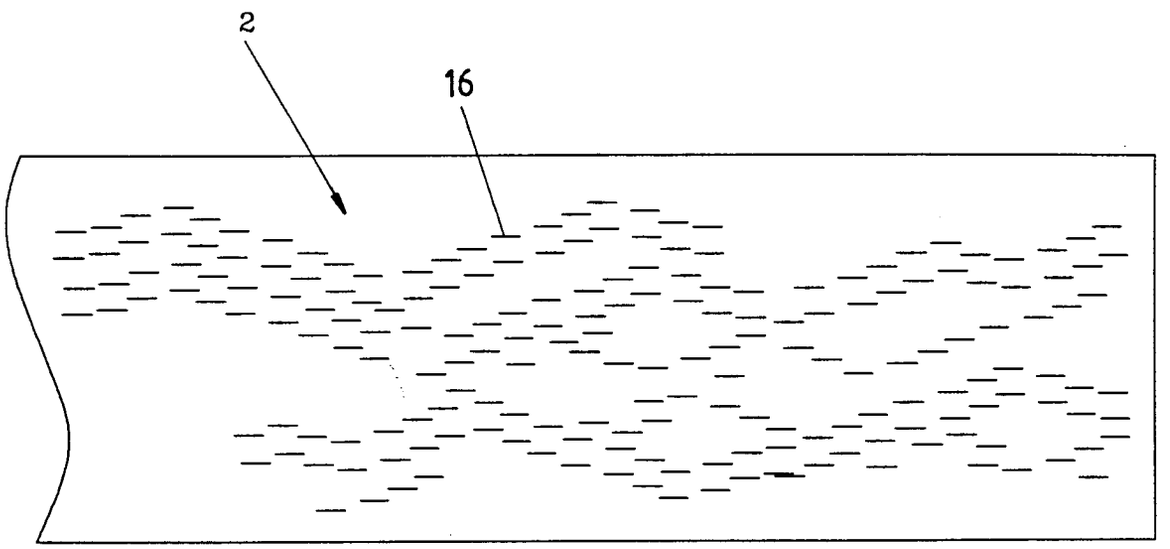


FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2931

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.6)
X	US-A-4 007 767 (COLLEDGE) 15 February 1977 * column 3, line 51 - column 4, line 2 * * column 4, line 16 - line 46; claims; figures *	1-4, 9-15,19	B27N7/00
A		5-8, 16-18,20	
X	US-A-4 104 429 (COLLEDGE) 1 August 1978 * the whole document *	1,4	
A	US-A-4 007 076 (CLARKE ET AL.) 8 February 1977		
A	DE-A-24 21 576 (AB STATENS SKOGSINDUSTRIER) 21 November 1974		
A	EP-A-0 371 371 (TOPAN GMBH) 6 June 1990		
A	US-A-4 221 758 (BURKEY ET AL.) 9 September 1980		TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US-A-3 483 057 (MITTMANN) 9 December 1969		B27N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 March 1996	Soederberg, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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