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

(11) Publication number: **0 084 446**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83300200.9**

(22) Date of filing: **14.01.83**

(51) Int. Cl.³: **D 04 H 11/00**

(30) Priority: **18.01.82 GB 8201329**

(43) Date of publication of application:
27.07.83 Bulletin 83/30

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

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(54) **Carpeting and a method of making carpeting.**

(57) A method of manufacturing carpeting, said process comprising the steps of forming a body of material from a stack of sheets of non-woven material, said body having at least one end face, compressing the body in at least one direction which lies in the plane of said end face at least in the region of said end face, and bonding together the material of the body at said end face.

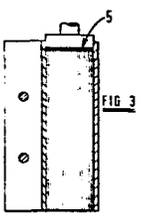

FIG 3

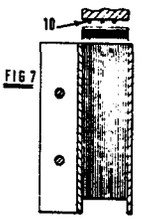

FIG 7

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Carpeting and a method of making carpeting.

THE PRESENT INVENTION relates to carpeting and to the manufacture of carpeting, and in particular relates to the manufacture of carpet tiles, although it must be appreciated that methods in accordance with the invention may be utilised for manufacturing articles other than carpet tiles.

At the present time carpet tiles are widely utilised, particularly in areas where carpeting is subject to heavy wear.

It has been proposed to make carpeting, especially in the form of carpet tiles, by forming a body of substantially parallel fibres or strands having a flat end face that is perpendicular to the axes of the fibres or strands, and bonding the fibres or strands exposed at that end face together or to a backing sheet, and subsequently cutting the fibres or strands to form a pile bearing element, with the fibres or strands protruding from the bonded region to a desired height. Two prior proposed methods of this type are disclosed in United Kingdom Patent Specification No. 1 118 031, and in U.S.A. Patent Specification No. 3 673 048.

In these prior proposed processes it is difficult to form the fibrous body with the fibres or strands in the desired parallel orientation, and it is also difficult to provide the resultant carpet element with an accurately registered pattern. If fibres or strands of different colours are used the relative positions of the fibres to each other may vary over the length of the body of fibrous material, thus leading to undesired pattern variations in the resultant carpet tiles.

The present invention seeks to provide a process for the manufacture of carpeting which will reduce or eliminate some or all of the above described disadvantages of the currently utilised production methods.

According to this invention there is provided a method of manufacturing carpeting, said process comprising the steps of forming a body of material from a stock of sheets of non-woven material, said body having at least one end face, compressing the body in at least one direction which lies in the plane of said end face at least in the region of said end face, and bonding together the material of the body at said end face.

Preferably the method also comprises the further step of separating the bonded end face and a portion of unbonded material secured to the bonded end face, from the remainder of the body of material.

Conveniently said material has thermoplastic properties, or incorporating a material having thermoplastics properties, said bonding step being effected by heating the said end face.

Alternatively said bonding may be effected by coating the exposed face with adhesive and permitting or causing the adhesive to cure.

Preferably the method comprises the step of applying a backing material to said bonded fibres. Said sheets may comprise polymeric film, which may be pre-treated to cause them to fibrilate when they are brushed or mechanically deformed.

Alternatively said sheets may comprise sheets formed by a paper-making technique.

Preferably said sheets are treated or printed or incorporate coloured fibres so that the resultant carpeting is patterned and/or textured.

The invention also relates to carpeting whenever manufactured by a method as described above.

In order that the invention may be more readily understood and so that further features thereof may be appreciated, the invention will now be described by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a stack of sheets of fibrous material to be utilised in the production of carpet tiles,

FIGURE 2 is a diagrammatic view showing the stack of sheets being compressed in a compressing apparatus,

FIGURE 3 is a diagrammatic cross-sectional view through the compressed stack of sheets showing a heated platen applied to one exposed side edge of the stack of sheets,

FIGURE 4 is a view corresponding to Figure 3 showing the side edges of the sheets welded or bonded together,

FIGURE 5 is a view corresponding to Figure 4 showing a backing material added to the bonded side edges of the sheets,

FIGURE 6 is a view corresponding to Figure 5 showing a backing scrim being applied to the backing material of Figure 5, and showing the stack of sheets being moved in the compressing apparatus,

FIGURE 7 is a view corresponding to Figure 6 showing identifying marks being printed on the backing scrim and also showing a carpet tile severed from the compressed stack of sheets,

FIGURE 8 shows the stack of sheets remaining in the compressing apparatus after the process step illustrated in Figure 7,

FIGURE 9 is a side elevational view of a carpet tile after it is cut from the sheets within the compressing apparatus, and

FIGURE 10 is a side elevational view of a finished carpet tile.

In manufacturing a carpet tile by a process in accordance with the invention, initially a body of fibrous material is assembled from a stack of separate sheets of non-woven fibrous material. The body is compressed in at least one direction. In the embodiment illustrated in Figure 1 the fibrous material is initially supplied in the form of sheets of rectangular shape, and

each sheet 1 has at least a substantial proportion of the fibres therein aligned with the longitudinal axis 2 of this sheet. The sheets may be of many possible forms, as will be described hereinafter in greater detail. However, in this embodiment of the invention the sheets are formed of a material that has some thermoplastic properties.

Illustrated in Figure 2 is a compressing apparatus comprising a substantially "U" shaped former 3 and a plunger 4 adapted to be received within the former 3. The plunger is provided with means (not shown) for driving the plunger downwardly in the direction illustrated by the arrow 5. It can be seen that the stack of sheets 1 is located in position within the hollow interior defined by the "U" shaped former 3 and then the plunger 4 is driven downwardly, thus providing a stack of sheets compressed in one direction, the stack of sheets having a substantially square exposed end face.

Referring now to Figure 3 a heated platen 5 is applied to the exposed end face of the stack of sheets. Since the sheets have, as described above, some thermoplastic properties, the sheets become fused together, and the fused portion of the material 6 forming the sheets is clearly visible in Figure 4, which shows the situation that exists when the heated platen has been removed. It can be seen that there is a slight recess defined between the fused material 6 and the ends of the former 3 and plunger 4.

Turning now to Figure 5 it can be seen that a molten backing material has been inserted into the depression and has been permitted to cool. The molten backing material may comprise limestone filled bitumen, although it is to be appreciated that a filled thermoplastic backing, such as a filled plastisol, or filled molten PVC could be utilised. The backing material 7 cools, within the recess, and partially solidifies. The stack, together with the cooled backing material is then pushed partially from the recess and plunger by a platen 8 which is illustrated as pushing upwardly in Figure 6. At this time a backing scrim 9 may be applied to the partly solid bitumen or thermoplastic backing 7.

During the next stage of operation, as illustrated in Figure 7 any required product identification is printed onto the backing, by printing members 10 although it is to be appreciated that a pre-printed backing sheet may be utilised if desired. The protruding part of the stack is then cut off either by utilising a mechanical cutter, such as, for example, a continuous abrasive belt cutter, or by utilising a high pressure fluid jet cutter or a laser cutter. The stack is cut flush with the end faces of the trough 3 and plunger 4. The part of the stack that is cut off is, of course, the part of the stack associated with the backing member, and this part of the stack then constitutes a square section of carpet, as shown in Figure 9. The cut surface is then brushed to produce a required pile surface, and it is to be appreciated that fibres and binder removed during the process may be stored for reuse in the manufacture of the sheets 1 utilised as the first step of the process. The finished carpet tile will be checked for quality control and will then be packed for delivery.

It is to be appreciated that the above described bitumen material will shrink on cooling, and also the compressed sheets will relax after being cut from the rest of the stack, since the stack is under considerable pressure. This will ensure that the carpet tile 11, as shown in Figure 10, will have at least two opposed outwardly inclined side edges in the region of the pile. Thus, when tiles of this type are laid the outwardly inclined edges of the pile will serve to disguised joins between adjacent tiles, and will tend to prevent the above described recesses or valleys forming between adjacent tiles when the tiles have been laid. It is to be appreciated that the above described process provides tiles that have primarily two opposed outwardly inclined edges. However, if two perpendicular compressional forces are applied to the stack, the tile may have four outwardly inclined side edges. This can be achieved by utilising sheets that are slightly wider than the distance between the side walls of the "U" shaped former 3, or can be achieved by utilising an "L" shaped former and two plungers.

While the invention has been described above with reference to the manufacture of square carpet tiles, tiles of any appropriate shape (e.g. rectangular or hexagonal) may be made by a method in accordance with the invention.

In a practical embodiment of the above described method, the stacks may be inserted in the former 3, and the former can then be located on a "carousel" type machine. The stack within the former will then be compressed by the plunger 4 and wil move through sequential work stations where the various process steps described above will be performed. At the end of the first circuit, the former, in the condition illustrated in Figure 8, will be returned to the first operational station where the platen 5 is introduced to the exposed ends of the sheets contained within the former. The process will be repeated until the supply of sheets within the former is totally exhausted. A fresh stack of sheets will then be inserted in position.

The sheets 1 may comprise a stack of sheets of polymeric film. Some, or all of the polymeric films could be pre-textured to increase the body of the carpet, or alternatively the films could have different degrees of cross linking of the polymer, so that the films would respond differently to a subsequent heat treatment. Hence texturing could be introduced into certain areas of the resultant carpet tiles. Alternatively the polymer films could have different degrees of cross linking that respond to radiation by a high energy electron beam. An electron beam could then be provided to generate patterns in the carpet tiles by "writing" with the beam in a predetermined configuration. The polymeric films could be coloured, and precoloured polymeric films could be stacked in a predetermined order to provide a desired design for each carpet tile. Of course, provided that the polymeric films are appropriately printed there will be no problems with registration.

Alternatively the sheets 1 can be prepared by the use of a technique closely relating to a paper-making technique. The fibres would, during the paper making process, be substantially aligned with the longitudinal axis of the sheets, and it will be appreciated that by following this route it would be possible to produce sheets including cellulose fibres, viscose fibres or thermoplastic fibres. It is envisaged that it may be possible to incorporate animal hairs in sheets formed by such a process. Self-coloured fibres could be utilised when forming the fibrous sheets or the fibrous sheets could, after being manufactured, be pattern-colour printed. Again, in this way, pattern variations can be introduced into tile surface by appropriate stacking of appropriately printed coloured sheets.

It is to be appreciated that sheets made by a paper-making-type process as described above and polymeric films may both be utilised in forming a stack of sheets to be utilised in a process in accordance with the invention.

It is to be appreciated that in the above described process the heated platen 5 was utilised to fuse the exposed ends of the sheets with the primary function of fusing or bonding the sheets together. Of course, it is possible to utilise other procedures to achieve the same end result. Thus, for example, the exposed ends of the sheets (or the exposed end of a compressed fibrous mass) may be fused by using a flame, or may be coated with an adhesive which may be a heat-curing or a radiation-curing adhesive. In such cases heat, or radiation, would be applied to the adhesive to cause the adhesive to cure. Of course, any other form of adhesive could be utilised, as may be appropriate.

It is envisaged that the above described embodiment, whilst being satisfactory for small runs of production, will have the disadvantage that a fresh stack of sheets has to be inserted between the "U" shaped member and the plunger 4 whenever the stack introduced initially has been exhausted. It is envisaged that a process in accordance with the invention may operate on a substantially continuous basis. It is envisaged that, in such a process, a plurality of reels of sheet will be provided, and the ends of the reels will be withdrawn and stacked to form a substantially continuous stack corresponding to the stack illustrated in Figure 1. The stack will then be introduced to a continuous processing machine, and as the processing machine draws the stack through the machine, so further portions of the respective sheets will unwind from the reels. The apparatus will include means capable of compressing the stack in at least one direction transverse to the direction of advance of the stack, the means being such that the stack can be advanced under pressure, and the exposed end of the stack can be treated to bond together the elements comprising the stack, to apply a backing material, if desired, and to cut the thus-formed carpet tile from the rest of the stack. In one embodiment a plurality of separate lockable frames may be utilised to engage and advance the stock, a frame advancing to the front face of the stack being removed and replaced at the rear of the stacks. Alternatively two or more compressing endless belts (similar to

conveyor belts, but pressed firmly into contact with the edges of the stack to compress and advance the stack) may be used.

CLAIMS:

1. A method of manufacturing carpeting, said process comprising the steps of forming a body of material from a stack of sheets of non-woven material, said body having at least one end face, compressing the body in at least one direction which lies in the plane of said end face at least in the region of said end face, and bonding together the material of the body at said end face.

2. A method according to claim 1 comprising a further step of separating the bonded end face and a portion of unbonded material secured to the bonded end face, from the remainder of the body of material.

3. A method according to claim 1 or claim 2 wherein said material has thermoplastic properties, or incorporating a material having thermoplastics properties, said bonding step being effected by heating the said end face.

4. A method according to any one of claims 1 or 2 wherein said bonding is effected by coating the exposed face with adhesive and permitting or causing the adhesive to cure.

5. A method according to any one of the preceding claims comprising the step of applying a backing material to said bonded fibres.

6. A method according to any one of the preceding claims said sheets comprise polymeric film.

7. A method according to claim 1 wherein the sheets are pre-treated to cause them to fibrilate when they are brushed or mechanically deformed, and including the step of brushing or deforming the sheets after the bonding step to form a piled carpet.

8. A method according to any one of claims 1 to 5 wherein said sheets comprise sheets formed by a paper-making technique.

9. A method according to any one of the preceding claims wherein said sheets are treated or printed or incorporate coloured fibres so that the resultant carpeting is patterned and/or textured.

10. Carpeting whenever formed by a method according to any one of claims 1 to 9.

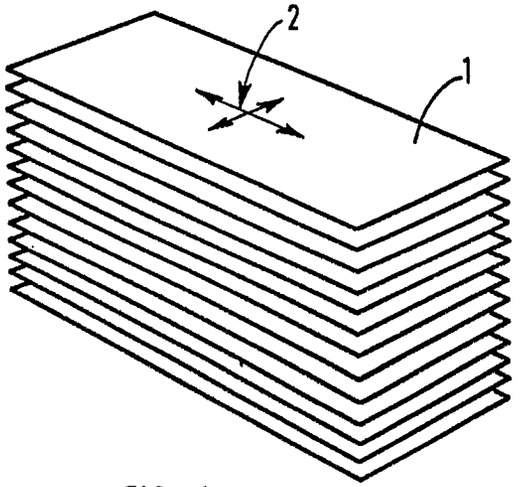

FIG 1

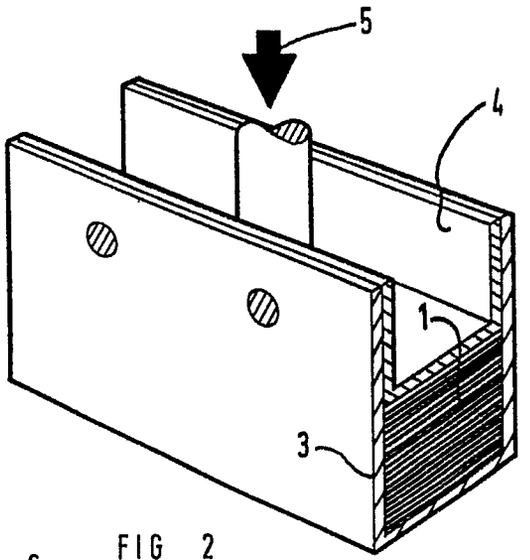

FIG 2

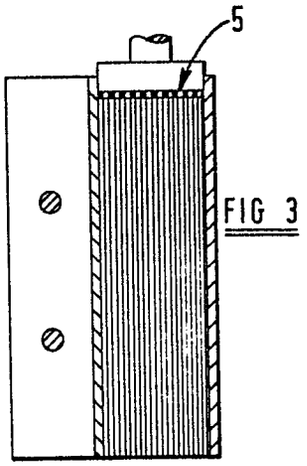

FIG 3

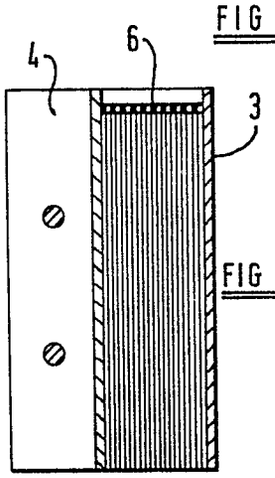

FIG 4

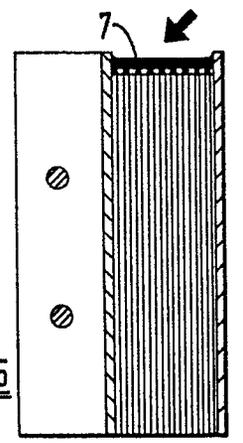

FIG 5

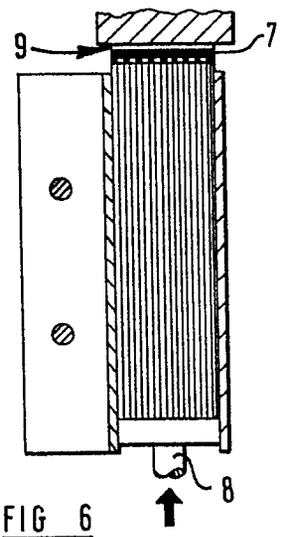

FIG 6

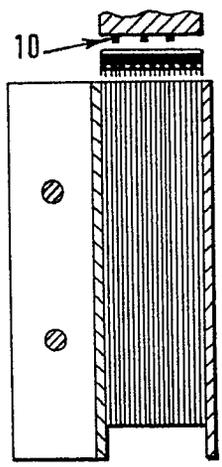

FIG 7

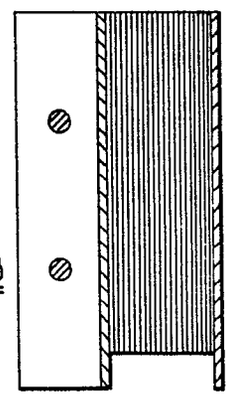

FIG 8

FIG 9

FIG 10