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(54) **Perforated, foamed olefine polymer films**

(57) A wallcovering or ceiling covering comprising a foamed thermoplastic olefin polymer film with substantially all its cells being of the closed type and having a density of 0.05 - 0.5 g/cc, which has, on average, between 1 and 30 perforations extending through the full thickness of the film in every square centimetre of surface.

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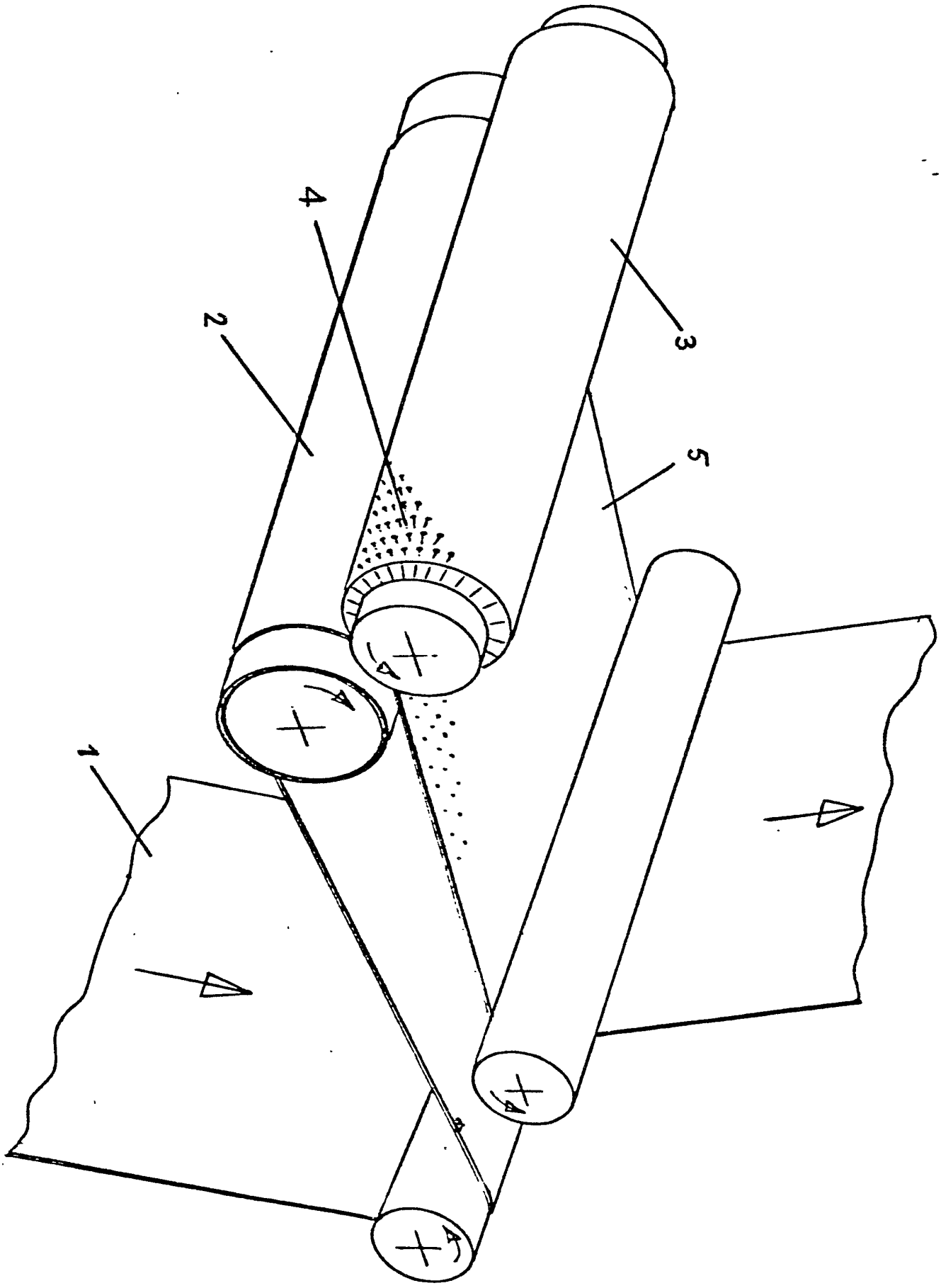

SPECIFICATION

Wallcovering or ceiling covering

This invention relates to wallcoverings of the type which are composed essentially of foamed films of a polyolefin.

It has already been proposed, for example in British Specifications Nos. 1,220,053 and 1,306,373 and in European Patent Publication No. 0.001,807, to employ foamed films of a polyolefin, in particular of polyethylene, as the basis for wallcoverings or ceiling coverings (hereinafter referred to simply as "wallcoverings"). More specifically, European Patent Publication No. 0,001,807 describes wallcoverings derived from foamed films of low-density polyethylene blended with a minor proportion of an ethylene copolymer containing polar groups, in which the cells of which the foam is composed are substantially all closed in character. It is stated that such wallcoverings possess advantages in respect of, *inter alia*, abrasion resistance and printability. Practical experience has, however, shown that closed-cell polyethylene foam wallcoverings are liable to develop blistering shortly after they have been applied to a wal surface with the aid of a water-based adhesive of the kind conventionally used for paper hanging purposes, due to subsequent localised loss of adhesion between the wallcovering and the wall surface.

We have now found that this disadvantage may be overcome by the provision of perforations extending through the thickness of the foamed film and distributed over its entire surface.

According to the present invention there is provided a wallcovering comprising a foamed film formed from a thermoplastic polyolefin in which substantially all the cells of the foam are of the closed type and the density of which is in the range 0.05-0.5 g./cc., characterised in that the film is furnished with a plurality of perforations each of which extends through the full thickness of the film and which are distributed over the surface of the film so as to provide, on average, between 1 and 30 such perforations in every square centimetre of surface.

The foamed film may be formed from any thermoplastic polyolefin, including polymers and copolymers of ethylene (either high or low density), propylene, butene-1 and 4-methyl-pentene-1. Particularly suitable foamed films are those derived wholly from ethylene homopolymer or from copolymers derived from ethylene in admixture with a proportion, e.g. from 10% to 70% of the total weight of the copolymer, of one or more of the other olefins mentioned above. Also included are foamed films formed from a blend of such a polymer or copolymer of ethylene with a minor proportion, e.g. from 4% to 20% of the total weight of the film, of a different polymer or copolymer, for example a copolymer of ethylene with vinyl acetate.

The foamed film may be produced by any of the procedures known in the art. These in general involve the extrusion of the polymer of polymer blend in the molten conditions from a zone of high pressure to a zone of lower pressure, a suitable blowing agent having been uniformly introduced into the material prior to extrusion. The blowing agent may be a substance which generates gas as the result of chemical decomposition occurring at the temperature of extrusion, for example azodicarbonamide of a mixture of citric acid and sodium bicarbonate, or it may be a chemically inert liquid which is miscible with the polymer under the conditions of extrusion and which boils, under the said lower pressure, at a temperature at least 10°C below the extrusion temperature; suitable liquids include pentane, hexane and other petroleum fractions, methylene dichloride and 1,1,2-trichloro-1,2,2-trifluoroethane. The proportion of blowing agent will normally lie in the range 5% to 15% of the weight of the polymer or polymer blend, the particular proportion used depending on the density which it is desired the foam should have. Where an inert liquid blowing agent is used, there may with advantage also be introduced into the material to be extruded a minor proportion of a nucleation agent whereby the uniformity of the cell structure of the resulting foam may be enhanced; such a nucleating agent may be a thermally decomposable substance of the kind already mentioned or it may be a chemically inert compound which has a critical temperature lower than the temperature of extrusion, for example nitrogen gas. Advantageously the extrusion may be effected through an annular die in order to produce a tube-shaped extrudate which is then inflated, flattened and slit to form flat film.

Preferably the material which is extruded also incorporates from 5% to 20% of its weight of an opacifying agent, more particularly a pigment of high covering power such as titanium dioxide, calcium carbonate or barium sulphate.

The closed cells of the foamed film are preferably of an average diameter in the range 0.01 - 1mm.

The foamed film, after extrusion, may if desired be subjected to a known surface treatment; in particular it may be subjected to corona discharge treatment, whereby its printability may be improved. Such treatment may be limited to the surface of the film which is to form the outer, or decorative, surface of the wallcovering, but it may alternatively include also the other surface, which becomes attached to the wall, in order to improve its adhesion characteristics.

The decorative surface of the wallcovering may be printed with a suitable pattern by any of the conventional techniques such as flexographic, gravure, screen or lithographic printing methods.

Instead of, or in addition to, its being printed, the foamed film may be embossed by passage in known manner through the nip between a rigid embossing roller carrying a suitable raised pattern and a backing roller which is either of a resilient nature and in which a corresponding recessed embossing pattern is impressed by rolling contact with the embossing roller, or which is also rigid and in which a corresponding recessed pattern is engraved.

The foam film preferably has a thickness immediately following extrusion, in the range 0.2 to 1mm, more preferably 0.3 to 0.6mm. Where the film is subsequently embossed, the thickness may be re-

duced, in those areas which are compressed by the embossing process, to a value of 50% to 75% of the original unembossed thickness.

The perforations with which the foamed film is furnished have a diameter preferably in the range of 0.05mm to 0.5mm. The perforations may if desired be arranged in a regular geometrical array with respect to the surface of the film, e.g. in a square grid pattern, but it is preferred, in order not to detract from the final appearance of the wallcovering, that they should be randomly distributed over the surface. Preferably there are on average between 1 and 25 perforations for every square centimetre of film surface.

The perforations may readily be formed in the foamed film by passing the latter through the nip between a rigid roller, the surface of which carries a plurality of projecting points or needles of appropriate diameter and spacing, and a resilient backing roller, e.g. one composed of or covered with felt, whereby the needles are caused to press completely through the film. Preferably the needles are radially disposed with respect to the roller surface so that any tendency for tearing, rather than clean perforation, of the film is minimised. The perforation operation may, according to convenience, be performed prior to, substantially simultaneously with, or following printing of the foamed film. However, where the film is also to be embossed it is preferred that this operation is carried out after perforation since the deformation of the film caused by embossing can usefully mask any apparent regularity in the perforation pattern. Perforation can normally be effected satisfactorily on film moving continuously at the speeds which are conventional in the printing and embossing of wallcoverings, viz. speeds in the range 20 to 200 m/min, so that all these operations can conveniently be performed in a single pass of the material.

Perforated closed-cell wallcoverings according to the invention overcome or minimise the above-mentioned disadvantage of unmodified closed-cell wallcoverings of the formation of blisters shortly after their application to a wall with the aid of a water-based adhesive. They also have a longer-term advantage in comparison with the unmodified wallcoverings in permitting any moisture which may subsequently find its way into the wall to escape to the atmosphere through the wallcovering.

Wallcoverings according to the invention show in general a water vapour transmission rate in the range 1050 - 1890 g/m^2/24 hr, as compared with a rate of 15 - 21 g/m^2/24 hr for the same material before perforation. The air porosity of the perforated material is usually in the range 0.3 - 3.5 litres/min/100 cm^2/cm head of water.

The invention is illustrated, but not limited by the following Example.

Example

Closed cell foam film (1 : see accompanying drawing) composed of a blend of 96-97% polyethylene and 4-3% of ethylene/vinyl acetate copolymer, having a thickness of 0.38 mm, a density of 0.26 g/cc and a cell size in the range 0.03 - 0.3 mm, was passed through a nip comprising a steel backing roller (2) covered with felt and a rigid roller (3) which carried on its surface a plurality of radially disposed needles (4). Each of the needles was 6 mm in length and they were arranged symmetrically around and along the roller surface at a density of 25 per sq.cm. The film was passed through the nip at a speed of 20 m/min. The perforations thus created in the film were clearly visible; their size was measured and found to be in the range 0.3 - 0.4 mm at their widest point, near to the faces of the film, and in the range 0.16 - 0.19 mm at the narrowest point, towards the centre of the film thickness.

The perforated material (5) was subsequently embossed, resulting in a compression of the thickness of the film by about 20% in the embossed areas. The size of the perforations was again measured and found to be now in the range 0.05 - 0.1 mm at the narrowest point.

Measurements of water vapour transmission rate carried out on the film before and after perforation gave the following results:-

Unperforated film	:	18 g/m^2/24 hr.
Perforated film	:	1470 g/m^2/24 hr.

CLAIMS

1. A wallcovering or ceiling covering comprising a foamed film formed from a thermoplastic polyolefin in which substantially all the cells of the foam are of the closed type and the density of which is in the range 0.05 - 0.5 g./cc., characterised in that the film is furnished with a plurality of perforations each of which extends through the full thickness of the film and which are distributed over the surface of the film so as to provide, on average, between 1 and 30 such perforations in every square centimetre of surface.

2. A wallcovering or ceiling covering as claimed in claim 1, wherein the foamed film is formed from ethylene homopolymer.

3. A wallcovering or ceiling covering as claimed in claim 1, wherein the foamed film is formed from a copolymer of ethylene in admixture with from 10% to 70% of the total weight of the copolymer of one or more comonomers selected from propylene, butene-1 and 4-methylpentene-1.

4. A wallcovering or ceiling covering as claimed in claim 2 or claim 3, wherein the foamed film is formed from a blend of a homopolymer or copolymer of ethylene as defined with from 4% to 20% of the total weight of the film of a copolymer of ethylene and vinyl acetate.

5. A wallcovering or ceiling covering as claimed in any one of claims 1 to 4, which incorporates from 5% to 20% of its weight of an opacifying agent.

6. A walcovering or ceiling covering as claimed in any one of claims 1 to 5, wherein the closed cells are of an average diameter in the range 0.01 - 1.0 mm.

7. A wallcovering or ceiling covering as claimed in any one of claims 1 to 6, wherein the perforations have a diameter in the range 0.05 to 0.5 mm.

8. A wallcovering or ceiling covering as claimed in any one of claims 1 to 7, wherein the perforations

are randomly distributed over the surface of the film.

9. A walcovering or ceiling covering as claimed in any one of claims 1 to 8, wherein there are on average between 1 and 25 perforationss for every square centimetre of film surface.

10. A wallcovering or ceiling covering according to claim 1 substantially as hereinbefore described, with reference to the foregoing Example.

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