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(54) METHOD OF AND APPARATUS FOR PRODUCING LOCALISED AREAS OF ADHESION ON WEBS OF MATERIAL

(71) We, DR. PLATE G.M.B.H., a German Body Corporate, of 53 Bonn, Dransdorfer Weg 21, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of and apparatus for producing discrete points of adhesion on webs of material.

In the manufacture of laminates, for example made of webs of textile material, paper or plastic sheeting, it is known firstly to apply a layer of thermoplastic adhesive to webs of material which are to be joined. Secondly, the webs are then compressed under heat and pressure, the thermoplastic adhesive thus becoming soft, so that after they have cooled the adhesive joins the webs of material securely together. Laminates can be produced very rapidly from prepared webs of material, since the principle time factor involved is dependent on the cooling time of the thermoplastic adhesive, which may be kept within very narrow limits by appropriate means, for example, a stream of cooling air or the use of cooling rollers.

In known methods, the thermoplastic adhesive is generally applied to the web of material as a continuous layer. As a result, a relatively large amount of adhesive is employed, so that laminates made of webs of textile material lose their permeability to air, apart from which a laminate of only limited flexibility can be obtained.

In contrast to the foregoing, an object of the present invention is to provide the webs of material with thermoplastic adhesive only at discrete points which are preferably uniformly distributed in an array, so that, as a result, less adhesive will be required, and as regards webs of material of the type under

discussion, the flexibility and the permeability to air of the laminate produced from said webs, will be affected as little as possible. In principle, this procedure of only joining the webs of material of a laminate at discrete points is already known, but known methods and apparatus are relatively uneconomical. The invention aims to provide a method and apparatus which will enable discrete points of adhesion to be produced extremely economically by distributing a thermoplastic adhesive as an array of blobs on moving webs of material.

According to one aspect of the invention a method of producing discrete points of adhesion distributed in an array on a moving web of material comprises spreading a layer of powdered thermoplastic material on a continuously moving surface, heating the moving surface at points corresponding to the said discrete points to produce molten blobs of thermoplastic material, bonding the blobs to the moving web such that they adhere at said discrete points, and removing the excess powdered adhesive from the moving surface.

If the areas of adhesion are to be located on the upper surface of the moving web of material, in conformity with the invention, provision may be made for spreading the layer of powder directly on to the web of material, heating and pressing the molten adhesive material on to said web at the discrete points and then removing the excess powdered adhesive from the web by suction.

However, if the areas of adhesion are to be located on the under surface of the moving web of material, the invention provides for said layer of adhesive powder to be formed on a continuously moving, non-adhesive auxiliary endless belt and for the molten or sintered adhesive produced at points in the layer of powder, to be continuously trans-

ferred to the under surface of the moving web of material.

In a further development of the method in accordance with the invention, the areas of adhesion may be produced on the upper surface and the under surface of the web of material in a single operation.

According to a further aspect of the invention apparatus for forming discrete points of adhesion on the upper surface of a moving web of material comprises means for spreading a layer of powdered thermoplastic adhesive evenly over the web of material, a heatable rotatably drivable studded roller which is located above the web, which is movable by driving means, so that as the roller rotates the studs make contact with the layer of powdered adhesive, thereby heating the powdered adhesive to form molten blobs and pressing the blobs onto the web of material at discrete points, and means for removing the excess powdered adhesive.

According to a yet further aspect of the invention apparatus for producing discrete points of adhesion on the under surface of a moving web of material comprises an endless drivable belt conveyor whose surface consists of polytetrafluoroethylene, means for spreading said layer of powdered thermoplastic adhesive evenly over the belt conveyor, and a heatable and continuously rotatable drivable studded roller disposed between the conveyor belt and the web of material, which is movable by driving means, so that as the roller rotates, the studs make contact with the layer of powder, thereby heating the powder to form molten blobs on the ends of the studs and so that on further rotation of the roller the studs engage the web of material so as to transfer the molten blobs to the web of material, and bond them to the web at the said discrete points. In this case, a collecting trough for excess powdered adhesive may be arranged at one end of the conveyor.

In accordance with certain additional optional features of the invention, where the studs of the studded roller act on powdered adhesive arranged on the surface of the web they may be coated with polytetrafluoroethylene, so that molten or sintered adhesive will not adhere to the spikes. Furthermore, the end faces of the studs may be cupped in a concave fashion, thus facilitating the formation, on the web of material, of the discrete areas of adhesion of a pre-determined size. Also, each spiked roller may cooperate with an auxiliary pressure roller.

As a result of the invention, webs of material for the production of laminates may be prepared extremely economically. By employing a thermoplastic of high bond strength, the areas of adhesion will ensure extremely firm interlaminar cohesion. The bonding of the webs of material at certain areas only, reduces the amount of plastic re-

quired and allows the manufacture of flexible and/or air-permeable laminates.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 shows, in somewhat diagrammatic form, apparatus in accordance with the invention and for forming areas of adhesion on the upper surface of a moving web of material, and

Fig. 2 is a view similar to Fig. 1 but showing apparatus for producing areas of adhesion on the underside of a moving web.

Referring to Fig. 1 thermoplastic adhesive powder falls from a supply bin 1 on to the web of material 2. Skimming means 3 distribute it uniformly over the web of material. The studs of a heated studded roller 4, whose ends are truncated or cupped in a concave fashion, press the powder which has been spread over the web of material 2 on to the web and melt it to produce molten areas of adhesion thereon. An auxiliary pressure roller 5 supports the web of material and cooperates with the studded roller 4, at the same time trimming the web of material 2. The excess powder remaining after the formation of the areas of adhesion is removed by a suction pipe 6, the process of removing the powder from the web of material being facilitated by a vibrator 7. Preferably the studs of the roller 4 are coated with polytetrafluoroethylene.

In the apparatus shown in Fig. 2, the adhesive powder passes from the supply bin 1 on to an endless revolving belt conveyor 8 and is distributed by skimming means 3, so that an evenly spread layer is formed. The conveyor 8, which is made of polytetrafluoroethylene, is mounted beneath the web of material 2 and between these latter lies a heated studded roller 4, the studs of which make contact with the layer of powder on conveyor 8, whilst simultaneously engaging with the web of material 2. In the layer which has been spread over the conveyor 8, the studs of the roller 4 form molten or sintered blobs of adhesive which are conveyed around with the roller as it rotates on the end of the studs, and which are transferred to the underside of the web of material 2. The auxiliary pressure roller 5 takes up the pressure exerted by the studded roller 4. The excess powder which has not been melted, falls into a collecting trough 9.

In the embodiment shown in Fig. 2, care must be taken to ensure that the studs of the roller 4, exert a force whose line of action extends between the conveyor 8 and the web of material 2.

By combining the devices illustrated in Figs. 1 and 2, the areas of adhesion can be arranged on both sides of a web of material in a single operation.

WHAT WE CLAIM IS:—

1. A method of producing discrete points of adhesion distributed in an array on a moving web of material, comprising spreading a layer of powdered thermoplastic material on a continuously moving surface, heating the moving surface at points corresponding to the said discrete points to produce molten blobs of thermoplastic material, bonding the blobs to the moving web such that they adhere at said discrete points, and removing the excess powdered adhesive from the moving surface.

2. A method as claimed in Claim 1, wherein the continuously moving surface is defined by the upper surface of the moving web on which the discrete points of adhesion are to be formed, the layer of powdered adhesive being spread directly on the upper surface of the web, and the powdered adhesive being melted at the said discrete points to produce the molten blobs which are pressed onto the web at these points, and wherein the excess powdered adhesive is removed from the upper surface of the web by suction.

3. A method as claimed in Claim 1, wherein the discrete points of adhesion are formed on the undersurface of the web of the material, and wherein the layer of powdered adhesive is spread on a continuously moving non-adhesive auxiliary endless belt, the molten blobs of thermoplastic adhesive being formed in the layer of powder at points corresponding to the said discrete points and being continuously transferred from the auxiliary belt to the undersurface of the moving web of material so that they are bonded to the said undersurface at the said discrete points.

4. A method as claimed in any one of claims 1 to 3, wherein the discrete points of adhesion are produced on the undersurface and upper surface of the web of material simultaneously.

5. Apparatus for carrying out a method as claimed in Claim 1 or 2, comprising means for spreading a layer of powdered thermoplastic adhesive evenly over the web of material, a heatable rotatably drivable studded roller which is located above the web, which is movable by driving means, so that as the roller rotates the studs make contact with the layer of powdered adhesive, thereby heating the powdered adhesive to form molten blobs and pressing the blobs onto the web of material at discrete points,

and means for removing the excess powdered adhesive.

6. A device as claimed in Claim 5, wherein the means for removing the excess adhesive is a suction device.

7. A device in accordance with Claim 5 or 6, wherein the studs of the studded roller are coated with polytetrafluoroethylene.

8. A device for carrying out the method as claimed in Claim 1 or 3 comprising an endless drivable belt conveyor whose surface consists of polytetrafluoroethylene, means for spreading said layer of powdered thermoplastic adhesive evenly over the belt conveyor, and a heatable and continuously rotatably drivable studded roller disposed between the conveyor belt and the web of material, which is movable by driving means, so that as the roller rotates, the studs make contact with the layer of powder, thereby heating the powder to form molten blobs on the ends of the studs and so that on further rotation of the roller the studs engage the web of material so as to transfer the molten blobs to the web of material, and bond them to the web at the said discrete points.

9. A device as claimed in Claim 8 wherein the excess powder is deposited into a collecting trough arranged at one end of the belt.

10. A device as claimed in any one of claims 5 to 8, wherein the ends of the studs are cupped in a concave fashion.

11. A device as claimed in any one of claims 5 to 8, characterised in that the studded roller co-operates with an auxiliary pressure roller.

12. A device as claimed in any preceding claim wherein the discrete points are uniformly arranged within the array.

13. A method of producing localised areas of adhesion on a web of material, the method being substantially as herein particularly described with reference to Figure 1 or Figure 2 of the accompanying drawings.

14. Apparatus for producing localised areas of adhesion on a web of material, the apparatus being constructed and arranged substantially as herein particularly described with reference to Figure 1 or Figure 2 of the accompanying drawings.

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