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(54) COMPOSITE PACKING MATERIAL

(71) We, UCB, of 4 Chaussée de Charleroi, Saint-Gilles-lez-Bruxelles, Belgium, a Body Corporate organised under the laws of Belgium, 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:—

10 The present invention is concerned with the manufacture of a composite packing material by means of a solventless adhesive and, more particularly, is concerned with the manufacture of a material containing at least one film of plastics material.

15 In the present invention, by "composite", or more simply "laminated", packing material, is to be understood the material obtained by bonding together at least one film of plastics material, and at least one sheet of any other material, which may be, for example, a film of plastics material, a metallic foil, paper or fabric.

20 By "solventless adhesive", there is understood an adhesive the use of which for a bonding operation does not entail the evaporation of volatile materials. This excludes, in particular, water-based glues, glues in the form of a dispersion, solution or emulsion and also glues constituted by a natural or synthetic resin dissolved or emulsified in at least one volatile organic solvent. A typical representative of a solventless adhesive which is preferably used according to the present invention is that known as a two (or multi-) reactive component adhesive, the two (or more) components of which react together *in situ* to form a cross-linked adhesive polymer. Examples of this kind of adhesive include a hydroxylated polyester or polyether which is reacted with a di- or polyisocyanate and an epoxy resin which is reacted with compounds containing at least two active hydrogen atoms. It is to be understood that any solventless ad-

hesive as defined above may be used for carrying out the present invention and that the nature of this adhesive is not limited in any way to the examples given above solely by way of illustration.

At present, laminates of the kind defined above are usually manufactured with solvent type adhesives and, since these contain, as bonding agent, a high molecular weight polymer which has already been formed, the bond produced initially is sufficient to produce a firm joint between the films bonded together. Furthermore, the solvent makes it possible to adjust, as desired, the viscosity best suited to the application of the adhesive to the film and also to adjust the weight of adhesive applied per unit of area to values which are as low as desired. Nevertheless, this technique suffers from numerous disadvantages. First, for obvious reasons of hygiene, it is necessary to provide special, very expensive installations to prevent the poisoning of operators by the solvent vapours and to avoid all risk of fire. In addition, the use of a solvent for the preparation of the adhesive entails various stages of operation, such as dissolving the adhesive in the solvent, intimate mixing of the components and, finally, the elimination of the solvent, preferably in an oven, before bonding the laminate, which entails great expenditure of time and cost of equipment. In these operations, either the solvent is lost, which represents a loss of raw material, or else it is recovered as far as possible but this also requires expensive installations. Another disadvantage is that the active life of the adhesive in its ready-for-use form is limited, this life being inversely proportional to the reactivity of its components. If the machine manufacturing the laminates should stop, the adhesive still remaining in the coating vessels is lost, because its period of reactivity or "pan life" is too limited.

It would be much more advantageous to use solventless adhesives, because the disadvantages inherent in the use of solvents would be eliminated. Nevertheless, it has hitherto not been easy to use solventless adhesives in the manufacture of laminates for the following reasons: the initial adhesive power of a solventless adhesive is very low because the polymerisation (poly-addition) of its components does not start until the moment when the adhesive is applied to the sheet of the laminate to be manufactured and, consequently, adhesivity, which is a corollary of polymerisation (poly-addition), is acquired only after a certain time, which may vary from a few minutes to several hours. This low initial molecular weight of the solventless adhesive is, nevertheless, necessary in order to prevent the system from acquiring excessive viscosity which would prevent the application of the adhesive to the laminate sheet at ambient temperature or at higher temperature. This low viscosity is all the more necessary because, in the manufacture of laminates, an extremely thin layer of adhesive is applied, generally with a thickness of from 0.5—5 microns.

It will be readily appreciated that it is extremely difficult to spread a layer of adhesive at a rate of 0.5 to 5 grammes per square metre (a thickness of 0.5 to 5 microns) uniformly on a film of plastics material. It is a solution of this problem, which hitherto has constituted an obstacle to the use of a solventless adhesive in the manufacture of laminates, which constitutes the object of the present invention.

There is already an antecedent for the application of a solventless adhesive to a film of plastics material (see British Patent Specification No. 1,158,740) but the method and apparatus described in this Patent Specification do not permit the manufacture of laminates. This Patent Specification contemplates, in particular, the application of a strip of adhesive to the film of plastics material for the purpose of manufacturing bags. This is clear from the accompanying drawing, in which a stereotype cylinder (5) applying adhesive to a film of plastics material has the dimensions required for forming a narrow adhesive strip. It would obviously be possible to conceive this cylinder (5) as having a suitable width for applying the adhesive over the entire width of a film of plastics material, for example with a width of 1.20 metre but this would implicitly entail a corresponding increase of the dimensions of the two-cylinder system (counter cylinder (2) and applicator cylinder (1)) used for feeding the adhesive to the stereotype cylinder (5). Although this Patent Specification does not specify this, the counter-cylinder (2) and the applicator

cylinder (1) are necessarily of metal because each of them contains an internal heating system (14 and 15) and, consequently, they must be good conductors of heat. In order to be able to apply such small amounts of adhesive of 0.5—5 grammes per square metre, preferably 1 to 2.5 grammes per square metre, it would be necessary to bring the counter-cylinder (2) so close to the feeder cylinder (1) that seizing would become inevitable because of the large dimensions which they would need to have. This is all the more so because, according to this Patent Specification, all these cylinders have different circumferential speeds, the ratio of circumferential speeds between the applicator cylinder (1) and the counter-cylinder (2) being from 1.1 to 5, preferably from 1.5 to 1.7, and the ratio of the circumferential speeds between the stereotype cylinder and the applicator cylinder being from 1 to 3.5. These different circumferential speeds, which constitute an essential characteristic of this Patent Specification, have the object of producing shearing forces effecting intimate mixing of the old adhesive, which is still contained on each of the cylinders, with the fresh adhesive supplied, in order to avoid the formation of "cobwebs". For the purpose of lamination, it is necessary to prevent old adhesive, the degree of condensation of which has already reached too advanced a stage, from remaining on the rollers, as this would entail difficulties in the uniform transmission of the complete layer of adhesive to the film to be coated and would cause the film of plastics material to stick to the stereotype roller. Precisely because of the fact that the apparatus of this Patent Specification necessarily contains a stereotype cylinder has the consequence that there will always be a mixture of fresh adhesive and old adhesive, because the depressions in the stereotype roller become progressively filled with hardened adhesive, which, after a certain period of operation, causes a film of plastics material to stick to the stereotype cylinder.

Contrarily to the foregoing, according to the present invention, it is possible to remove substantially all the adhesive fed to the adhesive applicator system and to transfer it entirely to the film to be coated; in other words, the problem of the formation of "cobwebs" is eliminated because substantially no mixture of old adhesive with fresh adhesive is formed.

According to the present invention, there is provided a method of manufacturing a laminate having a width of at least 30 cm. by means of a solventless adhesive, wherein, in a first stage, a solventless adhesive is continuously supplied to a distributor means comprising a pre-dosing element (as hereinafter defined) and an elastic-surfaced

roating element, for example a metal cylinder provided with a covering of synthetic or natural rubber, in such a manner as to coat the surface of the elastic-surfaced rotating element with a layer of solventless adhesive having a thickness of from 5 to 50 microns, preferably of from 10 to 25 microns, the layer then being substantially transferred to a moving film of plastics material to be laminated, the circumferential speed of said elastic-surfaced rotating element and the speed of displacement of the film being in a ratio of from 1/10—1/50, preferably of 1/10—1/15, so that the film receives a layer of solventless adhesive with a thickness of from 0.5 to 5 microns, preferably of from 1 to 2.5 microns, and, in a second stage, the said film coated in this manner is bonded in known manner to a sheet of material to form a laminate.

The continuous intimate mixing of the components of the solventless adhesive is effected in a distribution head of known type, which does not form part of the present invention. The distribution head supplies the adhesive to the apparatus of the present invention between the pre-dosing element and the elastic-surfaced rotating element. Depending on the width of the film of plastics material to be coated, one or more distribution heads extending over the entire width of the pre-dosing element or else a single oscillating distribution head which periodically deposits adhesive over the entire width of the pre-dosing element, may be provided. In order to prevent the adhesive from overflowing laterally beyond the pre-dosing element and the elastic-surfaced rotating element, lateral baffles are provided, which are adjustable in the width direction depending upon the width of the layer of adhesive to be applied.

The pre-dosing element of the distributor means according to the present invention is to be understood to be a means made of a rigid material, preferably of metal, which may be fixed or rotatable, and which is used for controlling the amount of adhesive applied to the elastic-surfaced rotating element. When it is fixed, it may comprise a doctor bar and a fixed cylinder or similar device. When it is rotatable, it is provided with drive means and comprises a cylinder, the rotational speed of which is different from the rotational speed of the elastic-surfaced rotating element described hereinbelow. Whether it is fixed or rotatable, the pre-dosing element bears against the elastic-surfaced rotating element in such a manner as to form a layer of adhesive with a thickness of from 5 to 50 microns on the surface of the rotating element.

The elastic-surfaced rotating element comprises a metal cylinder, the surface of

which is provided with a covering of natural or synthetic rubber capable of withstanding the possibly corrosive action of the solventless adhesive used. The thickness of the elastic layer should be sufficient to ensure flexible contact with the pre-dosing element.

The layer of solventless adhesive present on the elastic-surfaced rotating element may be transferred indirectly or directly to the film of plastics material.

When the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred indirectly to the film of plastics material to be coated, it is transferred with the aid of an intermediate rotating cylinder made of a smooth-surfaced rigid material, for example metal, and provided with drive means, interposed between the elastic-surfaced rotating element and the film of plastics material to be coated, its circumferential speed being at least ten times greater than that of the elastic-surfaced rotating element. Preferably, the drive means of the elastic-surfaced rotating element and the drive means of the intermediate rotating cylinder are so adjustable that their circumferential speeds will be in a ratio of from 1/10 to 1/50. Because of this great difference in speed, the intermediate element completely removes the adhesive from the surface of the elastic-surfaced rotating element. Similarly, the means of controlling the displacement of the film to be coated can be so adjustable that the speed of displacement of the film will be equal to or higher than the circumferential speed of the intermediate rotating cylinder so as to remove all the adhesive disposed on the surface of the latter. A counter-cylinder, preferably having an elastic surface, may be provided in order to press the film of plastics material to be coated against the elastic-surfaced rotating element or against the intermediate rotating cylinder.

When the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred directly to the film of plastics material to be coated, the latter may simply be stretched over the rotating element in the manner of a belt or else it may be pressed against the rotating element by means of a counter-cylinder, preferably provided with an elastic surface, in the manner indicated in the preceding paragraph.

In the case of indirect transfer of the adhesive, the counter-cylinders will have a circumferential speed equal to or preferably slightly greater than that of the intermediate rotating cylinder.

On the other hand, in the case of direct adhesive transfer, the circumferential speed of the counter-cylinder and that of the elastic-surfaced rotating element will be in

a ratio of at least 10/1—50/1 and preferably of from 10/1 to 15/1.

The film of plastics material which has been coated with the solventless adhesive in the manner according to the present invention then passes into the second part of the apparatus, in which it is bonded in known manner to the second component of the laminate, i.e. to a sheet of material, for example by passing the sheet and the film between an elastic-surfaced cylinder and a rigid cylinder, for example of metal. This metal cylinder may optionally be provided with heating means.

If it is required to produce laminates composed of more than two laminae, this operation may be carried out either by a plurality of passes through the apparatus according to the present invention, adding one more lamina each time, or by providing a plurality of systems according to the present invention, disposed in series. Thus, the manufacture of laminates composed of more than two laminae may be carried out either by passing a laminate, instead of a film of plastics material, into the first part of the apparatus or by supplying a laminate, instead of a sheet, in the bonding part of the apparatus, or else by using these two methods simultaneously; of course, these laminates may or may not have been manufactured according to the present invention.

To summarise, whatever the embodiment of the present invention adopted, it is of prime importance, for good operation of the apparatus and for obtaining a laminate of good quality, that the adhesive should be removed substantially completely from each cylinder and be transferred completely to the film of plastics material so that it will not be able, in the course of time, to form a hardened coating on the surface of these cylinders. For this purpose, it is necessary that the ratio between the circumferential speed of the elastic-surfaced rotating element and the speed of linear displacement of the film of plastics material to be coated should be at least 1:10 (in the case of direct transfer) or that this same ratio of at least 1:10 should be maintained between the circumferential speed of the elastic-surfaced rotating element and the speed of the intermediate rotating cylinder which transfers the adhesive to the film to be coated, the latter having, in this case, a speed of displacement equal to or slightly greater than that of the intermediate rotating cylinder (in the case of indirect transfer).

The present invention is also concerned with the apparatus used for carrying out the process described above.

For a better understanding of the present invention, several embodiments thereof will now be described in more detail with refer-

ence to the accompanying drawings, in which:

Figure 1 illustrates diagrammatically an apparatus for carrying out the process of the present invention;

Figure 2 is an embodiment showing a fixed pre-dosing element;

Figure 3 is another form of construction in which the pre-dosing element is rotatable;

Figure 4 is a variant of Figure 2, in which a counter-cylinder is provided;

Figure 5 is another variant of Figure 2, in which a smooth-surfaced intermediate cylinder is disposed between the elastic-surfaced rotating element and the film of plastics material to be coated; and

Figure 6 shows, in perspective, a variant of the apparatus illustrated in Figure 5, containing a counter-cylinder and laterally adjustable lateral baffles.

Referring now to Figure 1, I designates the coating zone and II the bonding zone. In zone I, a film of plastics material 1 is guided by means of a cylinder 2 and a cylinder 3 in such a manner that it bears against an elastic-surfaced rotating element 4. A solventless adhesive is fed (arrow 10) through a duct 5 discharging over the entire width of a pre-dosing element 6, the spacing of which, in relation to the elastic-surfaced rotating element 4, is such that it deposits on the latter a layer of adhesive with a thickness of from 5 to 50 microns and preferably of from 10 to 25 microns. The speed of displacement of the film 1 and the circumferential speed of the elastic-surfaced rotating element 4 are in a ratio of at least 10:1. The film of plastics material coated in this manner with a coating of adhesive with a thickness of 0.5 to 5 microns and preferably of from 1 to 2.5 microns (about 0.5 to 5 grammes per square metre and preferably 1 to 2.5 grammes per square metre of solventless adhesive) passes beyond the guide cylinder 3 into the bonding zone II, in which the film 1 is bonded in known manner to a sheet 7 by passing between cylinders 8 and 9.

In Figure 2, the pre-dosing element comprises a fixed cylinder 6, which may be replaced by a fixed doctor blade. Adhesive is fed at the point marked by an arrow 10 symbolising the distribution head which distributes the adhesive over the entire width of the elastic-surfaced rotating element 4.

In Figure 3, the pre-dosing element 6 comprises a rotating cylinder having a preferably metallic smooth surface, the peripheral speed of which is different from that of the elastic-surfaced rotating element 4.

Figure 4 is similar to Figure 2, except that a counter-cylinder 11 is provided which presses the film of plastics material against

the elastic-surfaced rotating element 4. The arrows show that the film of plastics material can move in the same direction as or in the opposite direction to that of the elastic-surfaced rotating element 4, the ratio between the respective speeds of the film and of the elastic-surfaced rotating element being here equal to at least 10:1.

In Figure 5, there is illustrated an arrangement in which a rotating cylinder 12 is interposed between the elastic-surfaced rotating element 4 and the film of plastics material 1. The ratio between the peripheral speed of the element 4 and the peripheral speed of the element 12 is at least 1:10, while the speed of displacement of the film 1 in relation to the speed of the rotating cylinder 12 is equal or slightly higher.

Figure 6 shows lateral baffles 13 provided to prevent the adhesive from overflowing from the pre-dosing element 6 and from the elastic-surfaced rotating element 4. In addition, a counter-cylinder 11 is provided, as illustrated in Figure 4.

WHAT WE CLAIM IS:—

1. A method of manufacturing a laminate having a width of at least 30 cm. by means of a solventless adhesive, wherein, in a first stage, a solventless adhesive is continuously supplied to a distributor means comprising a pre-dosing element (as hereinbefore defined) and an elastic-surfaced rotating element in such a manner as to coat the surface of said elastic-surfaced rotating element with a layer of solventless adhesive having a thickness of from 5 to 30 microns, the layer then being substantially transferred to a moving film of plastics material to be laminated, the circumferential speed of said elastic-surfaced rotating element and the speed of displacement of the film being in a ratio of from 1/10 to 1/50, so that the film receives a layer of solventless adhesive with a thickness of from 0.5 to 5 microns, and, in a second stage, the said film coated in this manner is bonded in known manner to a sheet of material to form a laminate.

2. A method according to claim 1, wherein the surface of the elastic-surfaced rotating element is located with a layer of solventless adhesive having a thickness of from 10 to 25 microns.

3. A method according to claim 1, wherein the circumferential speed of the elastic-surfaced rotating element and the speed of displacement of the film is in a ratio of from 1/10 to 1/15.

4. A method according to any of the preceding claims, wherein the film receives a layer of solventless adhesive of a thickness of from 1 to 2.5 microns.

5. A process according to any of the

preceding claims, wherein the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred directly to the film to be coated.

6. A method according to any of claims 1 to 4, wherein the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred to the film to be coated by means of an intermediate rotating cylinder of smooth-surfaced rigid material, the circumferential speed of which is at least 10 times greater than that of the elastic-surfaced rotating element.

7. A method according to claim 6, wherein the speed of displacement of the film to be coated is equal to the circumferential speed of the intermediate rotating cylinder.

8. A method according to claim 6, wherein the speed of displacement of the film to be coated is greater than the circumferential speed of the intermediate rotating cylinder.

9. A method according to any of the preceding claims, wherein the film to be coated is a laminate.

10. A process according to claim 9, wherein the film to be coated is a laminate produced according to the process of any of claims 1 to 8.

11. A method according to any of the preceding claims, wherein the sheet bonded to the coated film is a laminate.

12. A method according to claim 11, wherein the sheet bonded to the coated film is a laminate produced according to the process of any of claims 1 to 10.

13. A method according to claim 1 of manufacturing a laminate, substantially as hereinbefore described and exemplified and with reference to any of the Figures of the accompanying drawings.

14. Apparatus for carrying out the process according to claim 1, said apparatus having a coating zone comprising a pre-dosing element (as hereinbefore defined) of rigid material co-operating with an elastic-surfaced rotating element, a solventless adhesive supply means adapted to feed adhesive between the pre-dosing element and the elastic-surfaced rotating element, means of guiding the film to be coated which either brings said film into contact with the surface of the elastic-surfaced rotating element, or brings said film into contact with the surface of an intermediate rotating cylinder of smooth-surfaced rigid material to which said adhesive has been applied from the elastic-surfaced rotating element, means for driving the elastic-surfaced rotating element and means for controlling the speed of the film, both said means being so adjustable that the circumferential speed of the elastic-surfaced rotating element and the speed of displacement

the elastic-surfaced rotating element 4. The arrows show that the film of plastics material can move in the same direction as or in the opposite direction to that of the elastic-surfaced rotating element 4, the ratio between the respective speeds of the film and of the elastic-surfaced rotating element being here equal to at least 10:1.

In Figure 5, there is illustrated an arrangement in which a rotating cylinder 12 is interposed between the elastic-surfaced rotating element 4 and the film of plastics material 1. The ratio between the peripheral speed of the element 4 and the peripheral speed of the element 12 is at least 1:10, while the speed of displacement of the film 1 in relation to the speed of the rotating cylinder 12 is equal or slightly higher.

Figure 6 shows lateral baffles 13 provided to prevent the adhesive from overflowing from the pre-dosing element 6 and from the elastic-surfaced rotating element 4. In addition, a counter-cylinder 11 is provided, as illustrated in Figure 4.

WHAT WE CLAIM IS:—

1. A method of manufacturing a laminate having a width of at least 30 cm. by means of a solventless adhesive, wherein, in a first stage, a solventless adhesive is continuously supplied to a distributor means comprising a pre-dosing element (as hereinbefore defined) and an elastic-surfaced rotating element in such a manner as to coat the surface of said elastic-surfaced rotating element with a layer of solventless adhesive having a thickness of from 5 to 30 microns, the layer then being substantially transferred to a moving film of plastics material to be laminated, the circumferential speed of said elastic-surfaced rotating element and the speed of displacement of the film being in a ratio of from 1/10 to 1/50, so that the film receives a layer of solventless adhesive with a thickness of from 0.5 to 5 microns, and, in a second stage, the said film coated in this manner is bonded in known manner to a sheet of material to form a laminate.

2. A method according to claim 1, wherein the surface of the elastic-surfaced rotating element is located with a layer of solventless adhesive having a thickness of from 10 to 25 microns.

3. A method according to claim 1, wherein the circumferential speed of the elastic-surfaced rotating element and the speed of displacement of the film is in a ratio of from 1/10 to 1/15.

4. A method according to any of the preceding claims, wherein the film receives a layer of solventless adhesive of a thickness of from 1 to 2.5 microns.

5. A process according to any of the

preceding claims, wherein the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred directly to the film to be coated.

6. A method according to any of claims 1 to 4, wherein the layer of solventless adhesive disposed on the elastic-surfaced rotating element is transferred to the film to be coated by means of an intermediate rotating cylinder of smooth-surfaced rigid material, the circumferential speed of which is at least 10 times greater than that of the elastic-surfaced rotating element.

7. A method according to claim 6, wherein the speed of displacement of the film to be coated is equal to the circumferential speed of the intermediate rotating cylinder.

8. A method according to claim 6, wherein the speed of displacement of the film to be coated is greater than the circumferential speed of the intermediate rotating cylinder.

9. A method according to any of the preceding claims, wherein the film to be coated is a laminate.

10. A process according to claim 9, wherein the film to be coated is a laminate produced according to the process of any of claims 1 to 8.

11. A method according to any of the preceding claims, wherein the sheet bonded to the coated film is a laminate.

12. A method according to claim 11, wherein the sheet bonded to the coated film is a laminate produced according to the process of any of claims 1 to 10.

13. A method according to claim 1 of manufacturing a laminate, substantially as hereinbefore described and exemplified and with reference to any of the Figures of the accompanying drawings.

14. Apparatus for carrying out the process according to claim 1, said apparatus having a coating zone comprising a pre-dosing element (as hereinbefore defined) of rigid material co-operating with an elastic-surfaced rotating element, a solventless adhesive supply means adapted to feed adhesive between the pre-dosing element and the elastic-surfaced rotating element, means of guiding the film to be coated which either brings said film into contact with the surface of the elastic-surfaced rotating element, or brings said film into contact with the surface of an intermediate rotating cylinder of smooth-surfaced rigid material to which said adhesive has been applied from the elastic-surfaced rotating element, means for driving the elastic-surfaced rotating element and means for controlling the speed of the film, both said means being so adjustable that the circumferential speed of the elastic-surfaced rotating element and the speed of displacement



of the film will be in a ratio of from 1/10 to 1/50, lateral baffles, which are adjustable in the width direction in dependence upon the width of the layer of adhesive to be applied and which bear against the pre-dosing element and the elastic-surfaced rotating element; and a laminating zone comprising a pair of cylinders between which the film coated with adhesive and a sheet of material are passed against one another in order to form a laminate.

15. Apparatus according to claim 14, wherein the pre-dosing element is fixed.

16. Apparatus according to claim 14, wherein the pre-dosing element is rotatable and is provided with drive means.

17. Apparatus according to any of claims 14 to 16, wherein the pre-dosing element is made of metal.

19. Apparatus according to any of claims 14 to 17, wherein an intermediate rotatable cylinder of smooth-surfaced rigid material is interposed between the elastic-surfaced rotating element and the path of the film to be coated, drive means being provided for said intermediate rotating cylinder, the drive means of the elastic-surfaced rotating element and the drive means of the intermediate rotating cylinder being so adjustable that their circumferential speeds will be in a ratio of from 1/10 to 1/50.

19. Apparatus according to claim 18, wherein the means of controlling the displacement of the film to be coated is so adjustable that the speed of displacement of the film will be equal to the circumferential speed of the intermediate rotating cylinder.

20. Apparatus according to claim 19, wherein the means of controlling the displacement of the film to be coated is so adjustable that the speed of displacement of the film will be higher than the circumferential speed of the intermediate rotating cylinder.

21. Apparatus according to any of claims 14 to 20, wherein the elastic-surfaced rotating element is a metal cylinder, the surface of which is provided with a covering of natural or synthetic rubber.

22. Apparatus according to any of claims 18 to 21, comprising a counter-cylinder adapted to press the film to be coated against the elastic-surfaced rotating element or against the intermediate rotating cylinder.

23. Apparatus according to claim 22, wherein the counter-cylinder is provided with an elastic surface.

24. Apparatus according to claim 14 for carrying out the process according to claim 1, substantially as hereinbefore described and exemplified and with reference to any of the Figures of the accompanying drawings.

25. A laminate, whenever produced by the use of one or more apparatus according to any of claims 14 to 24.

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