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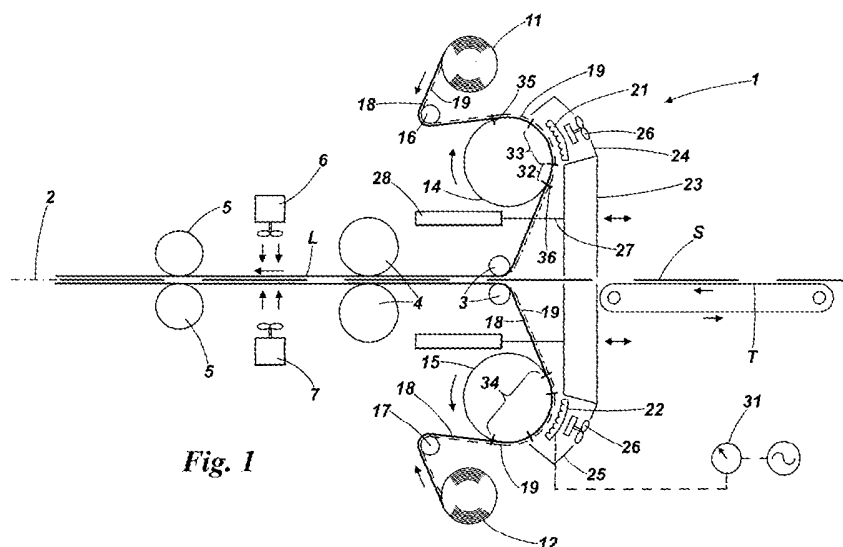
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(54) Title of the Invention: Lamination machine
Abstract Title: Lamination machine

(57) A lamination machine 1 for laminating lower melting point biodegradable polyester material 18 to a substrate, using a hot melt adhesive. The machine includes a radiant heater 21 for heating the hot melt adhesive applied to the biodegradable polyester material and a conduction roller 14 for heating the biodegradable polyester film to a lower temperature. The machine also comprises a nip roller 3 for applying the film including the hot melt adhesive to the substrate, and coolers 6, 7 for cooling the laminated material. This allows sufficient heating of the hot melt adhesive to for it to be adequately molten or at least tacky to adhere to the substrate, and yet keeps the biodegradable file below its shrink temperature.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 22(1) of the Patents Rules 2007.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 2007.

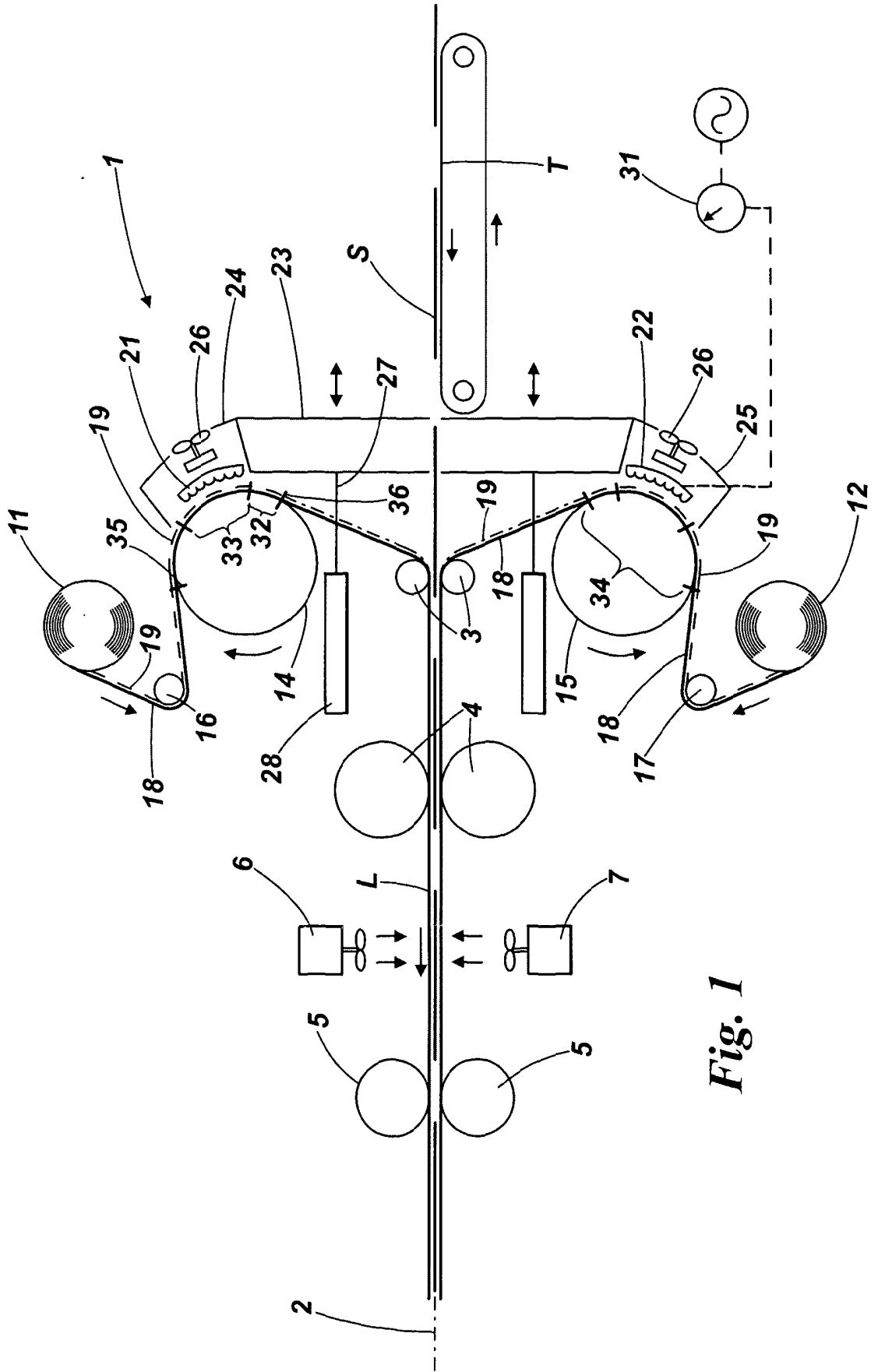


Fig. 1

LAMINATION MACHINE

The present invention relates to a lamination machine.

5 Conventional lamination film is bi-directionally oriented polyester material. It has a shrink temperature, that is a temperature at which it tends to revert to its state before bi-directional stretching, which exceeds the melt temperature of hot melt adhesive which is applied to it and with which it can be adhered to substrate material to be laminated. Thus it can be heated to hot melt temperature for lamination by
10 conduction of heat to it via a heated drum. The film is kept tensioned as it passes around the drum and can readily withstand this tension.

 However, the polyester of such film is long-lasting whereby waste does not deteriorate when disposed of in land fill as it must be. Further it is difficult to recycle
15 being of base polyester and a second polymer – hot melt adhesive.

 Biodegradable polyester is now available. However, in sheet form it is not bi-directionally oriented and has a lower shrink temperature. This makes it awkward for lamination film use.

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 The object of the present invention is to provide an improved lamination machine capable of laminating biodegradable polyester material.

 According to the invention there is provided a lamination machine for
25 lamination of film onto a substrate, the lamination film comprising a laminating sheet with hot melt adhesive applied to one side, the machine comprising:

- means for feeding a substrate along a substrate path;
- means for supplying lamination film towards the substrate path along a film path;
- 30 • radiant means to one side of the film path for heating the hot melt adhesive of the lamination film by radiation onto the adhesive at a heating extent of the film path;

- conduction means on the other side of the film path for heating the laminating sheet of the lamination film by conduction to the film at the heating extent of the film path;
- a support member movable with the film on the conduction side thereof at the heating extent of the film path;
- a nip roller for applying the film to the substrate.

Whilst it is conceivable that the machine will be supplied with single ones of the supplying means, the two heating means, the support member and the nip roller, for lamination onto a single side of the substrate, in the preferred embodiment, these items will be duplicated for laminating onto both sides of the substrate.

Normally, the support member will form part of the means for conduction of heat to the film. However, it can be envisaged that the conduction means could be arranged in an up-stream portion of the heating extent of the film path, with the radiant heating means being arranged down-stream towards the nip rollers. It is not expected that the radiant heating means could be arranged upstream, since the hot melt temperature is expected to be higher than the softening temperature of the film for which this machine is intended and heating such film to the hot melt temperature is expected to cause the film to lose stability and shrink.

In the preferred embodiment, the support member is an internally heated roller, acting to conduct heat to the film. Where the radiant means is arranged down-stream of such a roller, the support member can be a further roller between the first, heated roller and the nip roller.

Alternatively, the support member can be a web loop, possibly metallic or possibly of elastomeric material extending behind the film at least opposite the radiant means.

It is preferred that the heated roller, the further roller and/or the web loop, whichever is arranged opposite the radiant means should be reflective, to reflect

radiant heat back to the hot melt adhesive as opposed to being a black body absorbing radiant heat and thus tending to heat the film as opposed to the adhesive.

In accordance with an important feature of the invention, the radiant means is provided with actuation means for moving it away from the film when the machine is stopped. Further, it is preferably provided with a power control for adjusting its output.

To help understanding of the invention, a specific embodiment thereof will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic cross-sectional view of a laminating machine according to the invention.

Referring to the drawings, a laminating machine 1 has a horizontal plane 2 through it defining a path on which substrate material S, typically paper or light card, passes through the machine. Typically, a feed table T is provided upstream of the machine for feeding the material to it. Since it is conventional it will not be described further.

The plane 2 includes the nips of a pair of nip rollers 3, an upstream and a downstream pair of cooling station transport rollers 4,5, between which is an upper and a lower fan 6,7 for cooling the laminated material L passing out of the machine.

Upper and lower rolls of lamination film 11,12 are provided above and below the nip rollers. Between the respective rolls and nip rollers heating drums 14,15 are provided, together with guide rollers 16,17 for directing the film from the rolls to the respective heated drums. The film is wound with its lamination sheet 18 outermost and its hot melt adhesive coating 19 innermost, so that the adhesive is outermost as the film passes over the heating drums 14,15.

The rolls have brakes and the drums nip rollers and transport rollers all have drives from a machine drive motor (not shown). These are conventional and will not



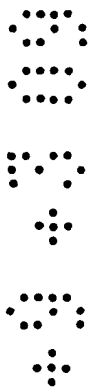
be described; indeed all of the features so far described with reference to the drawings are conventional.

5 In accordance with the invention, two ceramic-bodied radiant heaters 21,22 are mounted on a frame 23 to direct heat generally horizontally towards the horizontally outwards facing portions of the heating drums. It should be noted that as is conventional the heating drums are internally heated to approximately 80°C with hot water. The radiant heating is additional.

10 The frame comprises upper and lower steel boxes 24,25, which are open on their sides facing the heating drums, at which the heaters are mounted. Fans 26 are provided in the opposite sides of the boxes for blowing air into the boxes, to keep them from over-heating to the detriment of cables supplying current to the heaters.

15 The frame is mounted on the rods 27 of four actuators 28 provided in the machine for advancing the heaters 21,22 towards the drums for use and away after use.

20 For use of the machine in laminating film onto both sides of the material S, it is led from the rolls 11,12 around the guide rollers 16,17 and the drums 14,15 and then between the nip rollers 3 and the transport rollers 4,5. The machine is set to an approximate use speed, with the drums 14,15 and rollers 3,4,5 all being driven and minimal drag on the rolls 11,12. The substrate material is fed to the nip rollers, between the two runs of the lamination film. The speed of the machine and the
25 temperature of the drums are set at levels such that increase in temperature or slowing of the machine appears liable to cause the biodegradable sheet of the film to become unstable and shrink. With the nip and transport rollers separated, the drums and the radiant heaters are brought up to temperature, with the radiant heaters in their withdrawn position. To start operation of the machine, the nip and transport rollers
30 are brought together and driven. The radiant heaters are advanced. The temperature of the drums alone will not heat the material sufficiently to melt the adhesive to full tackiness, although it may begin to soften. The radiant heaters are adjusted via a power control 31 to cause the hot melt adhesive to reach full tackiness, changing



appearance from mat (shown dashed) towards transparency (shown chain-dotted). Should the sheet show a tendency to become unstable, the speed of the machine is increased, to allow less time on the drum for it to pick up heat by conduction from the drum.

5

These operating conditions can achieve an adhesive temperature slightly higher than the sheet material so that lamination can proceed with the sheet just below its shrink temperature and the hot melt adhesive molten or at least sufficiently tacky for adherence to the substrate material. It is believed that in supporting the film at the drums, these act to control the temperature of the sheet material. It is believed that they operate as follows:

1. With the temperature of the drums being controlled, they heat the sheet to their temperature which is close to its shrink temperature and they determine the position of the sheet with respect to the heaters whereby these irradiate the adhesive to a controllable extent;
2. They reflect heat passing through the film back towards the radiant heaters;
3. They continue to hold the sheet at their temperature in a short region 32 of contact after the more direct radiation region 33 before the sheet passes unsupported to the nip rollers (the full extent of a region 34 in which the film is heated being between the points 35,36 at which the film meets the periphery of the drum and leaves it again);
4. Although the sheet is under minimal tension, they hold it by friction against shrinkage.

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Typically, the biodegradable sheet polyester used in the film is not bi-directionally oriented and has shrink temperature of 75° to 85°C and the hot melt adhesive – be it polyethylene or EVA (Ethylene-Vinyl Acetate) – has a melt temperature of 80° to 95°C.

CLAIMS:

1. A lamination machine for lamination of film onto a substrate, the lamination film comprising a laminating sheet with hot melt adhesive applied to one side, the machine comprising:

- 5
- means for feeding a substrate along a substrate path;
 - means for supplying lamination film towards the substrate path along a film path;
 - radiant means to one side of the film path for heating the hot melt adhesive of the lamination film by radiation onto the adhesive at a heating extent of
- 10
- the film path;
 - conduction means on the other side of the film path for heating the laminating sheet of the lamination film by conduction to the film at the heating extent of the film path;
 - a support member movable with the film on the conduction side thereof at
- 15
- the heating extent of the film path;
 - a nip roller for applying the film to the substrate.

2. A lamination machine as claimed in claim 1, wherein the machine comprises:

- 20
- one means for feeding a substrate along a substrate path;
 - two means for supplying lamination film towards to the substrate path along two film paths;
 - radiant means to one side of each film path for heating the hot melt adhesive of each lamination film by radiation onto the adhesive at a heating extent of each film path;
- 25
- conduction means on the other side of each film path for heating the laminating sheets of the lamination film by conduction to the film at the heating extent of each film path;
 - a support member movable with each film on the conduction side thereof at the heating extent of each film path;
 - a pair of nip rollers for applying the film to the substrate.

30 3. A lamination machine as claimed in claim 1 or claim 2, wherein the support member forms part of the means for conduction of heat to the film.

4. A lamination machine as claimed in claim 1 or claim 2, wherein the conduction means is arranged in an up-stream portion of the heating extent of the or each film

path, with the radiant heating means being arranged down-stream towards the nip rollers.

5 5. A lamination machine as claimed in claim 3, wherein the or each support member is an internally heated roller, acting as the conduction means to conduct heat to each film.

6. A lamination machine as claimed in claim 5, wherein the or each support member is a further roller between the internally heated roller and the nip roller.

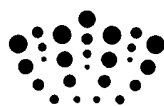
10 7. A lamination machine as claimed in claim 1 or claim 2, wherein the or each support member is a web loop, extending behind the or each film at least opposite the radiant means.

8. A lamination machine as claimed in claim 7, wherein the or each web loop is of metallic or elastomeric material

15 9. A lamination machine as claimed in claim 5, claim 6 or claim 7, wherein the internally heated roller, the further roller or the web loop, when arranged opposite the radiant means, is reflective, to reflect radiant heat back to the hot melt adhesive.

20 10. A lamination machine as claimed in any preceding claim, wherein the or each radiant means is provided with actuation means for moving it away from the or each film when the machine is stopped.

11. A lamination machine as claimed in any preceding claim, wherein the or each radiant means is provided with a power control for adjusting its output.



Application No: GB0903885.2

Examiner: Mr Rhys J. Williams

Claims searched: 1-11

Date of search: 15 June 2010

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-6 & 9-11	GB 1380307 A (KOEPP) See the figure and page 4 lines 89-92.
X	1 at least	FR 2581929 A1 (STOUVENOT) See WPI abstract no. 1987-001746 and figure 5 particularly.
X	1-6 & 9-11	US 3994769 A (GERSBECK) See figure 3 and column 2 lines 56-65.
X	1-6 & 9-11	US 3627613 A (STOLKI) See figure 3 and column 10 lines 50-65.
X	1-6 & 9-11	WO 00/27636 A1 (ALFAS) See figure 1 and page 8 line 26 - page 9 line 3.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

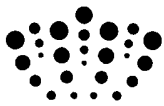
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Worldwide search of patent documents classified in the following areas of the IPC

B32B

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC



International Classification:

Subclass	Subgroup	Valid From
B32B	0038/00	01/01/2006
B32B	0037/06	01/01/2006
B32B	0037/12	01/01/2006