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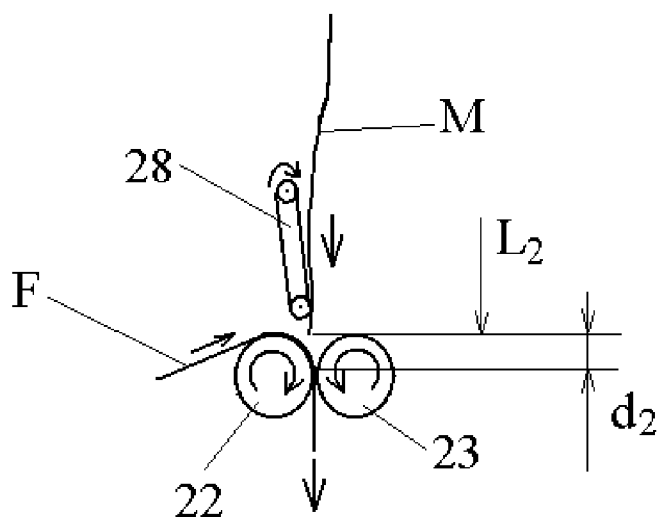
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(54) Title: A METHOD FOR FEEDING MEDIA TO A LAMINATING NIP



(57) Abstract: A method for feeding media (M) to a laminating nip (22.23), comprising providing at least one laminating film (F) engaged in the nip; advancing towards the nip, at a predetermined media speed, the leading edge of a media to be laminated; and advancing the film through the nip at a film speed that is higher than the media speed, such that upon contact of the media edge with the film (F), the film tends to pull the media edge towards the laminating nip by friction.

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A METHOD FOR FEEDING MEDIA TO A LAMINATING NIP

The present invention relates to method for feeding media to a laminating nip, and also to a laminating apparatus.

The applicant has developed an apparatus which is able to laminate plots that are outputted by a printing device, in a continuous operation, as described in co-owned US20040017466 and US20040007320.

In such an apparatus there are times in which it is necessary to feed to the laminator the leading edge of a printed media. The introduction of the media into the laminator has to be accurate; amongst other requirements, it is desirable that the media enters the laminator without skew.

Indeed, skew of the media at the inlet of the laminator cannot be corrected once the media has been caught in the nip, and causes a lateral displacement or travelling of the media towards one side, with respect to the nip and the film, as it advances: such lateral travelling has the effect that after an unknown length of media one of the lateral edges of the media is offset from the film, so the media cannot be laminated in all its width.

It will thus be understood that it is desirable to avoid media skew at the entrance of the laminator as much as possible, because it limits the length of media that can be laminated in one operation, i.e. without cutting the media.

US20040007320 cited above addresses the problem of feeding media to the laminator and provides a system with conveyor belts and fans which are operated inter alia to control the position of the leading edge of the media when

leaving the printer and approaching the laminator.

However, when the media leaves the conveyor and is in the region immediately upstream of the laminating nip and close to it, the leading edge may not enter straight
5 into the nip: the media tends to form wrinkles and to curl when it is released from the printer, to a greater or smaller extent and in an irregular way along its edge, due for example to different ink density in different regions of the plotted image, or irregular air flow and conveying
10 effect along the media width in the feeding device.

Since the laminating film is sticky and has a high coefficient of friction, it may happen that contact of the media edge with the film causes the media to stop against the film, even if the conveyors are pushing the media
15 downwards; furthermore, the media edge can be stopped against the film in a skewed position, because the irregular curling mentioned above may cause contact between the film and the media edge at positions along the media width that are not aligned with the line of the nip.

20 In this situation, when the laminating operation is started, the media could enter the laminating nip with skew, with the consequences described above.

Thus, it has now been found that it is desirable to exert a more precise control of the feeding operation
25 when the leading edge of the media comes very near the laminating nip, in order to reduce skew and thus lateral travelling of the media.

According to a first aspect, the invention relates
30 to a method for feeding media to a laminating nip, comprising

providing at least one laminating film engaged in the nip;

advancing towards the nip, at a predetermined
35 media speed, the leading edge of a media to be laminated;

and

advancing the film through the nip at a film speed that is higher than the media speed, such that upon contact of the media edge with the film, the film tends to pull the media edge towards the laminating nip by friction.

The higher speed of the film and the friction of the media with the film provide a pulling force on the media edge, which tends to be straightened and pulled towards the nip: this allows reducing the media curling and skew.

As a consequence, the laminated plots can be longer, because lateral travelling of the media in the laminator due to skew is reduced. The possibility of laminating longer plots provides several advantages, in terms of reliability, and media and time saving; this is especially true in case of a laminator that operates in-line with a printer, as in the apparatus described in the prior art.

According to a second aspect, the invention relates to a laminating apparatus comprising a laminating nip for applying at least one laminating film to a media, and feeding means for feeding the media to the laminating nip, the media feeding means comprising means for advancing the film through the nip at a film speed that is higher than the media speed, such that upon contact of the media edge with the film, the film tends to pull the media edge towards the laminating nip by friction.

Particular embodiments of the present invention will be described in the following, only by way of non-limiting example, with reference to the appended drawings, in which:

figure 1 is a schematic view in side elevation of a printing and laminating apparatus in which a method

according to the invention may be applied;

figures 2 and 3 show the leading edge of the media in two positions approaching the laminating nip, in the apparatus of figure 1; and

5 figures 4 and 5 are partial views of the region of the laminating nip, showing the leading edge of the media in two steps of a method according to an embodiment of the present invention.

10 Figure 1 shows an apparatus according to co-owned US20040007320, to which reference can be made for a more complete description, with a printing device 1, a laminator device 2 and a feeding device between the printer outlet 10 and the laminator inlet 20, said device
15 comprising conveyor belts 28 and fans 29 arranged along the path of a web of media M.

The laminator 2 comprises a pair of laminator rollers 22 and 23, which can also be referred to as a laminating nip, between which the media M is conducted
20 together with at least one laminating film F unwound from a film roll 21 in order to adhere the film to the printed media.

Another film (not shown) can be fed over roller 23 if it is desired to laminate the two sides of the media.
25 Indeed, in embodiments of the invention two laminating films will be provided, one over each laminating roller.

The portion of the laminating film F that is in contact with the laminating rollers 22,23 is sticky, either because its adhesive has been thermally activated
30 in its travel over the rollers themselves (in the case of hot lamination), or because the adhesive is permanently active (in cold lamination).

Downstream of the laminating nip there are driving rollers 24,25 that pull the laminated media MF through the
35 nip, and a take-up roller 26.

When a new sheet or web of media starts to be printed, or when the web of media has been cut and the leading edge of a new plot leaves the outlet 10 of the printer, this leading edge of the media is fed towards the laminator by generating an air stream with the fans 29 such as to urge the media towards the conveyor belts 28, while the latter are set in motion to cause the advance of the leading edge of the media relatively straight, as shown in figures 2 and 3.

10 The media advances at the outlet of the printer at a speed V_m , typically between 1 mm/s and 8 mm/s; during the steps shown in figures 2 and 3 the conveyors are driven at a high speed V_{cl} of about 10 mm/s.

In the case of a printing and laminating apparatus 15 in which the printer is incremental, e.g. an inkjet printer, the advance of the media is stepwise; in this case, the media speed V_m is an average speed, taking into account the advance and the stops of the media.

As the leading edge of the media approaches the 20 laminating nip, after the position of figure 3, it loses contact with the conveyors, since the latter cannot be arranged at a very short distance from the nip.

At this stage, the nip rollers will usually be open, i.e. separate from each other, and stationary 25 ($V_{r1}=0$).

The subsequent stages of the feeding operation of this edge of the media to the nip will be now described with reference to figures 4 and 5.

When the edge of the media, after losing contact 30 with the conveyors, comes within a predetermined distance d_2 from the nip line (this line being defined herein as the line where the surfaces of the two rollers meet each other to press the media and film together), the nip is closed and set in motion. The laminator thus starts 35 advancing film and laminating, even though there is no

media in the nip yet.

By way of example, the distance d_2 (see figure 4) between the nip line and the media edge when the nip is closed and set in motion can be of around 40 or 50 mm, even though this depends of course on the geometry of the apparatus.

At this stage the nip rollers are rotated such that their tangential speed V_{r2} is higher than the media speed V_m ; as a consequence, the laminating film on the rollers also advances at this speed V_{r2} . At the same time the conveyors are advanced at a speed V_{c2} that is slightly higher than that of the rollers and film V_{r2} , so as to urge the leading edge of the media towards the film.

The effect of the advance of the film faster than the media is that the film tends to pull the media edge downwards; this effect is enhanced by virtue of the high coefficient of friction due to the fact that the film is sticky. The pulling action of the film tends to straighten the media and undo curling; this facilitates a more uniform alignment and positioning of the media edge along all its width with respect to the nip, and reduces the risk of skew when the edge is caught in the nip.

Any nip roller speed V_{r2} higher than the media speed V_m could be employed at this stage; however, it has been found that a nip speed that is about twice the media speed performs the feeding function and at the same time avoids a large waste of film.

This stage of the method in which the film tends to pull the media edge downwards is performed until the edge of the media has advanced to a position in which it is about to be caught in the nip, for example when there is a distance d_3 (see figure 5) of about 5 mm between the media edge and the nip line.

This position of the edge of the media will be referred to as alignment position, since it is assumed

that the pulling action of the film will have caused it to become satisfactorily aligned.

The speed of the nip rollers is then changed to a speed Vr3 more adequate for the laminating operation; in this example, it starts being synchronised with that of the media outputted by the printer as described in US20040007320.

This is done slightly before the edge of the media enters the nip, in order to avoid the risk of the media being pulled abruptly by the nip if the latter is rotating at a relatively high speed: such abrupt pulling could cause defects in the plot being printed.

However, this may not be a problem if the media that has to enter the laminating nip is being fed from another kind of apparatus; therefore, the point in time or the position of the edge of the media for which the nip speed switches from Vr2 to a laminating speed Vr3 as required for the laminating operation may be varied, depending on the requirements of each case.

At this point, when the edge of the media is entering the laminating nip, the conveyors are advanced at a high speed Vc3, for example between 8 and 10 mm/s, and in any case at a speed at least equal to Vc2, during a predetermined period of time, e.g. 10 seconds.

This has the effect of urging during some more time the media edge downwards towards the nip and thus helping to absorb tolerances and ensure that the edge enters the nip.

After this, the conveyors are driven at a lower speed, in order to form the media buffer that will absorb the difference in speeds between the printer and the laminator, as explained in US20040007320.

By way of example, in a printing and laminating apparatus such as that of US20040007320 typical values for the speeds that can be applied to perform embodiments of

the method are as follows:

Media speed $V_m = 4$ mm/s

$V_{c1} = 10$ mm/s

$V_{r2} = 2 \cdot V_m = 8$ mm/s

5 $V_{c2} = 1.1 \cdot V_{r2} = 8.8$ mm/s

$V_{r3} = V_m = 4$ mm/s

$V_{c3} = 8$ mm/s

It has to be pointed out that, in practice, when synchronisation between the laminator and the printer
10 begins, there is a transitional period of time in which the speed of the laminating rollers V_{r3} is lower than that of the media V_m , in order to form the desired media buffer between the printer and the laminator, as described in US20040007320.

15 In the case of an incremental printer, in which V_m is an average speed, what happens in practice in the advance between d_2 and d_3 is that there are small intervals of time in which the media advances faster than the film (the media is advancing), and in those small
20 intervals a small media buffer is formed between the printer and the conveyor; the conveyor then causes this buffer to travel downwards, between the conveyor and the nip. Between the intervals in which the media advances, the media makes stops (while the printer is printing a
25 swath), and during these stops the film "catches up" with the media and starts entraining it downwards by friction.

It may be pointed out that the distances d_2 and d_3 at which the speeds of the conveyor and laminating nip are varied may be determined by means of sensors, but they can
30 also be estimated by monitoring the advance of the media to determine when the media has advanced corresponding lengths L_2 and L_3 (see figures 4 and 5), to the points where its alignment by friction with the film is started and finished. This can be appropriate for example in a
35 printing and laminating apparatus such as that of figure

1.

Embodiments of an apparatus in which the above method is performed will be provided with appropriate driving means for one or both of the rollers of the laminating nip, and with control means to monitor and drive the conveyors, nip rollers, driving rollers, etc.

The apparatus may include sensor means to control when the leading edge of the media reaches the position close to the nip where the nip rollers are set in motion, and the position in which the rollers start being synchronised with the printer; alternatively one or both of these positions may be estimated by monitoring the advance of media in the printer, as known, or in any other position or device upstream of the laminator.

15 As explained above, the laminating film is sticky when travelling over the laminating rollers both in cold and in hot lamination, so a method according to the invention can be employed with both kinds of laminator.

It will also be understood that a feeding method and a device such as described above may be employed for feeding to a laminator the leading edge of a media coming from several kinds of upstream devices, such as a sheet stacker or a take-up reel, and not only from an inkjet printer as in the above example.

CLAIMS

1. A method for feeding media to a laminating nip
5 (22,23), comprising
 providing at least one laminating film (F) engaged
 in the nip;
 advancing towards the nip, at a predetermined
 media speed, the leading edge of a media (M) to be
10 laminated; and
 advancing the film (F) through the nip (22,23) at
 a film speed (Vr2) that is higher than the media speed
 (Vm), such that upon contact of the media edge with the
 film, the film tends to pull the media edge towards the
15 laminating nip (22,23) by friction.
2. A method as claimed in claim 1, wherein the
 laminating film (F) has an exposed sticky side at least in
 the region where the edge of the media (M) comes into
20 contact with the film (F).
3. A method as claimed in claims 1 or 2, wherein
 the advance of the film (F) through the nip (22,23) at a
 speed (Vr2) higher than the media speed (Vm) is performed
25 with the laminating nip (22,23) closed in a laminating
 position.
4. A method as claimed in any of claims 1 to 3,
 further comprising providing, upstream of the laminating
30 nip (22,23), means (28) for driving the media (M) by
 friction.
5. A method as claimed in claim 4, wherein the
 means for driving the media (M) by friction comprise at
35 least one conveyor belt (28).

6. A method as claimed in claims 4 or 5, wherein the means (28) for driving the media (M) by friction upstream of the laminating nip (22,23) are operated at a speed (Vc2) that is higher than the media speed (Vm).

7. A method as claimed in claim 6, wherein the speed (Vc2) of the means (28) for driving the media (M) by friction upstream of the laminating nip (22,23) is higher than the speed (Vr2) of advance of the film through the nip.

8. A method as claimed in any of the preceding claims, wherein the film (F) is advanced at a film speed (Vr2) that is higher than the media speed (Vm) until the leading edge of the media (M) is in an alignment position in which the edge of the media is at a distance (d3) of between 3 and 10 mm from entering the laminating nip (22,23).

20

9. A method as claimed in claim 8, wherein once the media edge has reached the alignment position the laminating film is driven at a laminating speed (Vr3) synchronised with the media speed (Vm) upstream of the laminating nip (22,23).

10. A method as claimed in any of claims 6 to 9, wherein the means (28) for driving the media (M) by friction continue being operated at a speed (Vc3) that is higher than the media speed (Vm), during a predetermined period of time after the media edge has entered the laminating nip (22,23).

11. A method as claimed in any of the previous claims, wherein the media (M) to be laminated is outputted

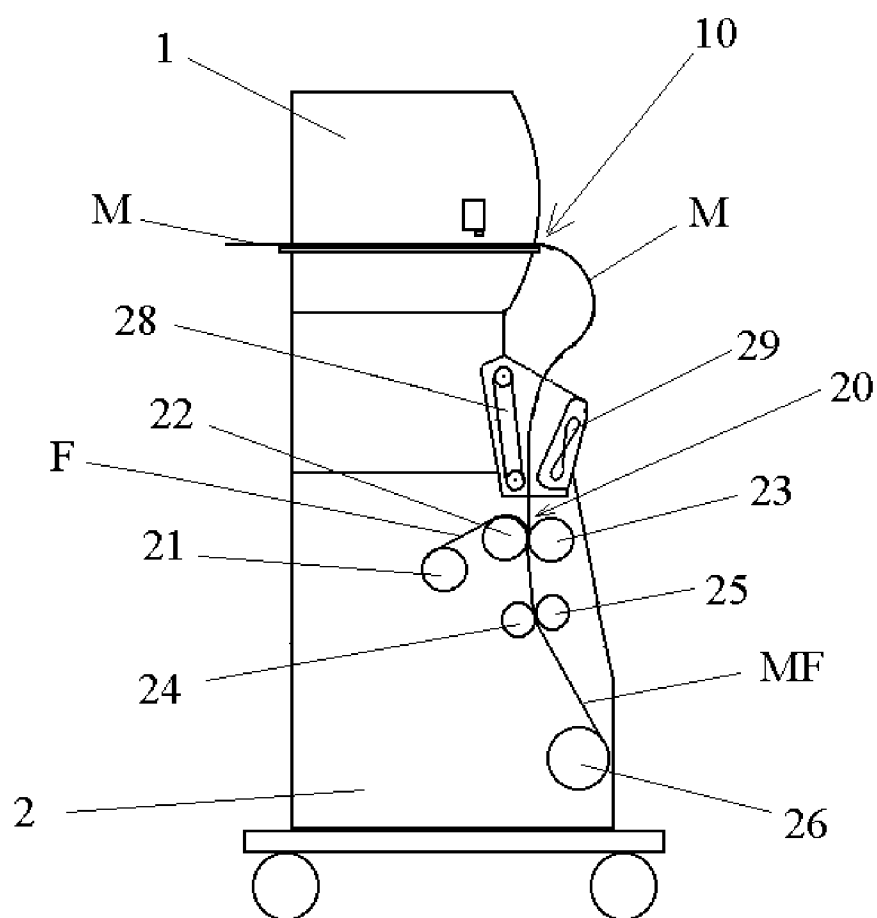
from a printing apparatus (1) that operates in line with the laminating nip.

12. A laminating apparatus (2) comprising a
5 laminating nip (22,23) for applying at least one laminating film (F) to a media (M), and feeding means for feeding the media to the laminating nip, the media feeding means comprising means for advancing the film (F) through
10 the nip (22,23) at a film speed (V_r2) that is higher than the media speed (V_m), such that upon contact of the media edge with the film, the film (F) tends to pull the media edge towards the laminating nip (22,23) by friction.

13. A laminating apparatus as claimed in claim 12,
15 wherein the feeding means for feeding the media to the laminating nip further comprise means (28) for driving the media (M) by friction upstream of the laminating nip (22,23).

20 14. A laminating apparatus as claimed in any of claims 12 or 13, further comprising a printing device (1) arranged upstream of the laminating nip (22,23), such that the printing device outputs the media (M) to be laminated in the laminating nip (22,23) in a continuous operation.

FIG. 1



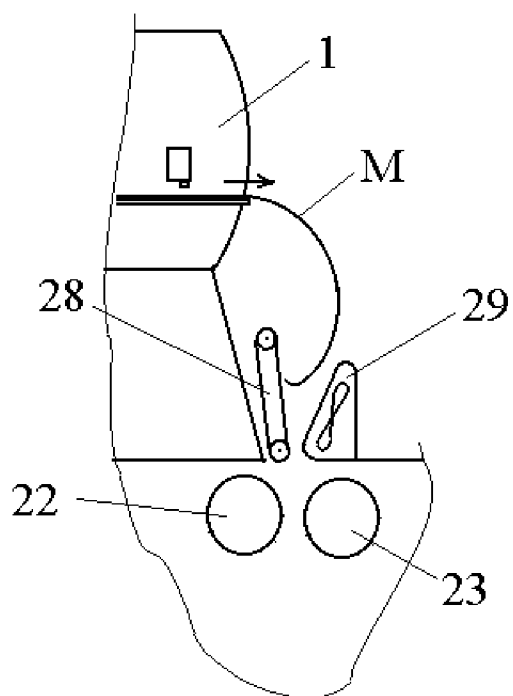


FIG. 2

FIG. 3

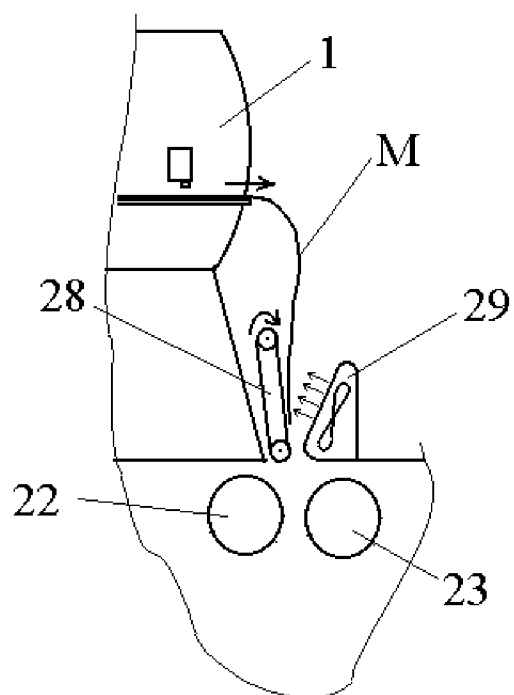


FIG. 4

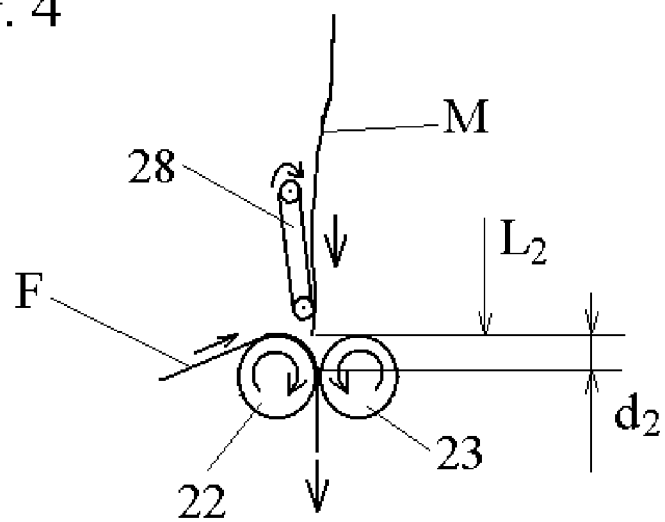
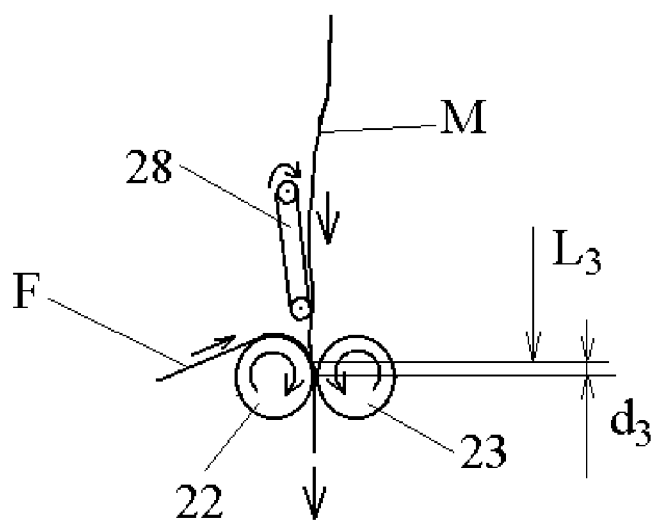


FIG. 5



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

B32B37/14 B32B38/18 B32B37/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No

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Information on patent family members

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