The present invention obviates the use of a vacuum while providing reliable release of thin coated sheets from roller coating machines. Reliable release of a coated sheet is achieved by using dual sets of air nozzles, one set producing a constant flow of a sheet of air and the other producing a short pulse of a sheet of air at an appropriate time in the travel of the front edge of the sheet through the rollers. An optical sensor is employed to provide the properly timed signal to initiate the pulsed air blast. The respective sets of nozzles are configured to position the nozzles in two rows, one above the other, with offset or alternating horizontal positioning so that nozzles of one set do not interfere with nozzles of the other set. Each set of nozzles is connected to a common plenum or air bar extending in parallel relation to the rollers. Each such plenum or air bar is connected to an air pressure source by suitable regulators, filters, solenoids, valves, hoses and connectors.
APPARATUS FOR RELEASE OF THIN COATED SHEETS FROM A ROLLER COATING MACHINE

BACKGROUND OF THE INVENTION

[0001] Field of the Invention

[0002] The present invention relates to an apparatus used with roller coating machines to facilitate release of thin coated sheets from the rollers and deposition of those sheets onto a conveyor belt adjacent the rollers. More specifically, the invention disclosed herein relates to the improved use of directed air flow to release a coated thin sheet from a roller so that it may be transported on an adjacent conveyor belt.

[0003] 2. Background Art

[0004] The most relevant prior art appears to be U.S. Pat. No. 4,397,258 to Dremel. Dremel discloses an apparatus that accomplishes the same function as the present invention. It accomplishes this function by employing an air nozzle and a vacuum pump in combination. They operate together to force a coated thin sheet from the roller and attract the sheet onto the conveyor belt. Unfortunately, there are a number of distinct disadvantages to using a vacuum to assist the sheet release process. First and foremost, employing a suction device in an inherently dusty environment creates maintenance problems. The vacuum pump also attracts dust and debris which has to be filtered or otherwise cleaned regularly to avoid clogging and reduction in performance. Secondly, a vacuum is more difficult to achieve and to locate accurately, particularly over an extensive area. Thirdly, the conveyor belt has to be designed to permit air flow therethrough to allow suction to affect the sheets.

[0005] For these and other reasons, it would be highly advantageous if it were possible to achieve reliable thin sheet release from a roller coating machine without the need to use a vacuum.

SUMMARY OF THE INVENTION

[0006] The present invention obviates the use of a vacuum while providing reliable release of thin coated sheets from roller coating machines. It accomplishes this advantageous avoidance of the use of a vacuum pump by employing a novel combination of air output nozzles positioned in close proximity to the coated sheet as it exits between upper and lower coating rollers. It has been found that reliable release of a coated sheet is achieved by using dual sets of air nozzles, one set producing a constant flow of a sheet of air and the other producing a short pulse of a sheet of air at an appropriate time in the travel of the front edge of the sheet through the rollers. An optical sensor is employed to provide the properly timed signal to initiate the pulsed air blast. The respective sets of nozzles are configured to position the nozzles in two rows, one above the other, with offset or alternating horizontal positioning so that nozzles of one set do not interfere with nozzles of the other set. Each set of nozzles is connected to a common plenum or air bar extending in parallel relation to the rollers. Each such plenum or air bar is connected to an air pressure source by suitable regulators, filters, solenoids, valves, hoses and connectors. Because there is no need for a vacuum, maintenance is required less frequently, all air flow effects can be positioned close to the edge of the exiting sheet and the conveyor belt design does not have to accommodate air flow through the belt.

[0007] As used herein the terms “layer of air” and “sheet of air” refer to air flow in a generally planar configuration achieved by employing an array of nozzles each having a linear distribution of nozzle jets or orifices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The various embodiments, features and advances of the present invention will be understood more completely hereinafter as a result of a detailed description thereof in which reference will be made to the following drawings:

[0009] FIG. 1 is a three-dimensional view of a preferred embodiment of the present invention;
[0010] FIG. 2 is a top view of the preferred embodiment;
[0011] FIG. 3 is an elevation view thereof;
[0012] FIG. 4 is a cross-sectional view taken along lines 44 of FIG. 3;
[0013] FIG. 5 is a back mechanical layout drawing of the preferred embodiment;
[0014] FIG. 6 is a front mechanical layout drawing thereof; and
[0015] FIG. 7 is a graph of air blast timing of the preferred embodiment.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0016] Referring to the accompanying figures and specifically to FIGS. 1-6, it will be seen that a roller coating machine 10 comprises three rollers 12 (including conventional metering, application and opposed rollers) configured between structural members 14 and 16 for coating one side of a thin sheet and depositing it on a moving conveyor belt 18.

[0017] The invention herein comprises an air sheet release system 15 which in the preferred embodiment utilizes plenums 20 and 22 positioned adjacent the rollers and having respective sets of air nozzles 24 and 26 pointed at the edge of each sheet as the sheets exit the rollers as seen best in FIG. 4. As will be seen hereinafter in conjunction with FIG. 7, the upper nozzles 24 emit a timed pulse of air while the lower nozzles 26 emit a constant or steady state air flow to prevent each sheet from failing to release from the rollers 12.

[0018] As seen best in FIGS. 5 and 6, (only one plenum is shown for clarity) each plenum 20 and 22 terminates at its respective ends in connector elbows 32 which are, in turn, connected to air hoses 34 joined at a tee 36. The tee 36 is connected to an air source through a filter 38, a regulator 40 and a solenoid valve 42. In addition, each air nozzle 24, 26 may preferably comprise an adjustment valve 30 to permit contouring of the various nozzle air flows to have the desired effect on reliable sheet release. The individual nozzles are preferably of the type having a linear array of apertures so that the combined air flow is in the form of a sheet of air that runs parallel to the front edge of the coated sheet exiting from rollers 12.

[0019] In the preferred embodiment of the present invention, each of the air nozzles 24, 26 is a LECHLER Model 600.130.BC plastic pneumatic spray nozzle which has a linear array of sixteen one millimeter orifices.
As shown graphically in FIG. 7, in the preferred embodiment of the present invention, the lower set of air nozzles 26 emit a constant flow at about 10 psi while the upper set of nozzles 24 emit a single pulse of air flow at about 20 psi. The single air pulse is emitted in response to a sensor positioned relative to rollers 12 to emit a signal indicating the imminent travel of a sheet through the rollers. This signal is transferred to a monostable multivibrator (not shown) and solenoid valve 42 responds to the multivibrator to enable a single air pulse for a selected length of time as the sheet edge begins to exit the rollers as shown in FIG. 14. The constant air flow nozzles 26 do not require a sensor or multivibrator since they need not respond to each individual sheet.

Having thus disclosed a preferred embodiment, it will be understood that variations are contemplated including for example the number and position of air nozzles as well as the air pressures and timing. Accordingly, the scope hereof is to be limited only by the appended claims and their equivalents.

We claim:

1. In a roller coating machine having a plurality of rollers for coating thin sheets of material and a conveyor belt for transporting the sheets as they exit the rollers, an apparatus for promoting release of the sheets from the rollers for transfer onto the conveyor belt; the apparatus comprising:

   a first plurality of air nozzles positioned adjacent said rollers where each said coated sheet exits said rollers, said first plurality of air nozzles creating a layer of constant air flow towards each said sheet; and

   a second plurality of air nozzles positioned adjacent said rollers where each said coated sheet exits said rollers, said second plurality of air nozzles creating a layer of pulsed air flow towards a front edge of each said sheet.

2. The apparatus recited in claim 1 wherein said first and second pluralities of nozzles are positioned adjacent one another.

3. The apparatus recited in claim 1 wherein said first and second pluralities of nozzles are positioned one above the other relative to each said coated sheet.

4. The apparatus recited in claim 1 wherein said first and second pluralities of nozzles are positioned in an alternating configuration so that air layers of the respective pluralities of nozzles do not substantially affect each other.

5. The apparatus recited in claim 1 wherein each of said pluralities of nozzles is connected to a respective air plenum for delivering pressureized air to said nozzles.

6. The apparatus recited in claim 5 wherein each said air plenum is positioned in parallel to the axes of said rollers.

7. The apparatus recited in claim 5 wherein each said air plenum is connected at its respective ends to a source of pressureized air.

8. The apparatus recited in claim 5 wherein each said air plenum is connected to a source of pressureized air through a solenoid valve for selectively switching air flow to said plenum on and off.

9. The apparatus recited in claim 1 further comprising a sensor for generating a signal in response to passage of each said sheet through said rollers and means for receiving said signal to initiate said pulsed air flow of said second plurality of air nozzles.

10. A method for releasing thin coated sheets from the rollers of a roller coating machine, the method comprising the following steps:

    directing a layer of constant air flow toward each said coated sheet as the sheet exits the rollers; and

    directing a layer of pulsed air flow toward a front edge of each said coated sheet as the sheet exits the rollers.

11. The method recited in claim 10 wherein each of said directing steps is carried out simultaneously during said pulsed air flow.

12. The method recited in claim 10 further comprising the step of sensing the passage of each said sheet through said rollers for initiating said pulsed air flow.

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