AIR DELIVERY DEVICE FOR PRINTING AND COATING APPLICATIONS

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ABSTRACT

An air delivery device and printing or coating machinery using the same. In one configuration, the air delivery device is an air knife that cooperates with a printing device such as a printing press, coating machine or the like. In a particular configuration, the air knife is situated adjacent a set of cylinders in the printing device such that upon a sheet or related piece of printed substrate being put in an air flowpath created by the air knife, one or more operations can be performed on the still wet printed or coated sheet to minimize the chance of contact of the wet sheet surface with sheet delivery or related components. Examples of such operations may include turning, bending or folding the sheet, as well as drying the ink or coating placed on the sheet by the printing machinery.
AIR DELIVERY DEVICE FOR PRINTING AND COATING APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Ser. No. 60/914,842, filed Apr. 30, 2007.

BACKGROUND OF THE INVENTION

[0002] The present invention relates generally to using an air delivery device for flexible substrate printing and coating processes, and more particularly to integrating an air knife into printing presses and related printing or coating machinery such that an air curtain produced by the air knife can be used to manipulate the printed or coated sheets produced by the machinery.

[0003] Conventional air delivery devices (also known as air delivery bars) are well-known in the art as a way to direct a stream of compressed or high-velocity air through an orifice such that the air can impinge onto a workpiece. One particular form of the air delivery device is the air knife (also referred to as an air amplifier or the like), which can leverage a primary stream of air through a slotted nozzle such that external air is entrained by a localized vacuum formed on a surface adjacent the nozzle into the primary stream through the Coanda effect to produce a well-defined sheet of laminar airflow. Significant amplifications of air (on the order of thirty or forty to one) are possible with such devices. Air delivery devices in general and air knives in particular are often configured as elongate linear structures that can straddle a conveyor belt so that articles carried on the conveyor can be dried or cleaned by the scrubbing action of the airflow.

[0004] There are various ways to produce printed substrate, in particular printed and coated paper. One form, known as offset printing, involves providing sheets of paper or related substrate to a printing station that includes a series of cylinders (typically referred to as a plate cylinder, blanket or offset cylinder and impression cylinder, collectively referred to as printing cylinders) that together impart the printed pattern onto the sheet. A chute, chain-driven conveyor or related delivery device (for example, a delivery station) takes the newly printed sheets to a subsequent printing station, stacking station or the like. Typically, in the case of a conveyor, shafts, gears, sprockets, chains, gripper bars, belts and other equipment are used to coordinate the rotation of the cylinders and the conveyor. In one form, the chain is part of a conveyor that supports the gripper bars that grasp the leading edge of a sheet or related substrate coming off an impression cylinder. Some of these components, especially the shafts that extend across the width of the cylinders, are often in the path of the newly printed or coated sheets on their way from the cylinders to the conveyor. Contact with the shaft is deleterious to the newly printed or coated page, as smudging of the wet ink or coating may occur. In configurations involving a chute, the operation is generally similar, with the exception of not having a chain with attached gripper bars. Sheets that have passed through the various cylinders are ejected directly from a cylinder into a catch tray (also known as a chute). As with the chain-based conveyor system, the air bar helps guide the sheet onto the conveyor in a manner so the wet coated surface does not contact anything.

[0005] To ameliorate this condition, one or more contacting wheels (often called a delivery wheel, skeleton wheel or a star wheel) may be placed on the rotating shaft, thereby minimizing contact with the newly printed or coated sheet. Such improvement is at best incremental, as there may be circumstances where contact with even the limited surface area of the star wheel cannot be avoided. In another configuration, an anti-marking fabric covering system for use on one or more of the printing cylinders can be used to reduce the likelihood of ink smudging or smearing. In such a system, a smoothed surface (typically metal) cylinder is covered by an ink and water repelling net such that together, the low-friction cylinder surface and net reduce the likelihood of marking. A sheet leaving the cylinder is removed by the gripper bar such that little or no marking is produced. Unfortunately, the cloth tends to wear out over time, necessitating additional equipment and maintenance expenses.

[0006] Another shortcoming of conventional printing presses and coating machines is that equipment currently used to bend and turn the sheets is of a fixed dimension. If sheets of differing length, width or thickness are used, changing or reconfiguring such equipment to accommodate such sheets necessitates downtime, with attendant cost increases and reduction in machinery duty cycle. One way to overcome such fixed dimension concerns, as well as to preventing contact of wet sheets in a printing press is to use conventional air delivery techniques, such as an air blast device.

[0007] Thus, it is desirable that an air delivery device that can be integrated into printing or coating machinery to manipulate sheets of paper or related printable material be invented. It is further desirable that such device facilitate smudge-free printing or coating of the sheets. It is additionally desirable that such a device have the ability to operate on sheets of varying dimensions and thicknesses such that machine down-time associated with reconfiguring the device be avoided. It is further desirable that such device be inexpensive to manufacture and operate.

SUMMARY OF THE INVENTION

[0008] These desires are met by the present invention, whereby an air knife cooperates with a printing device, such as a printing press or related piece of printing or coating machinery, such that flexible sheets that have just received printing or coating thereon from the machinery can be bent, turned or dried by the air knife. It will be appreciated that some of the components used in the printing device will be common regardless of whether the device is a printing press or coating machine. The numerous printing cylinders used in offset printing are an example of such commonality.

[0009] According to a first embodiment of the invention, an air knife can be used as part of a printing press or coating machine, either of which may be possessive of numerous printing cylinders and delivery means for withdrawing printed or coated sheets from the printing cylinders. The air knife is arranged relative to the printing device to prevent the still-wet sheets coming from the device from contacting the delivery means components. The air knife includes a housing with a plenum, air inlet and an air outlet. The exterior of the housing includes one or more convex surfaces, while a fairing is attachable to the housing to cover the air outlet. In addition, the fairing is spaced relative to the housing such that a gap formed between the two permits air from the plenum that passes through the air outlet to be discharged through the gap and along the one or more convex surfaces. Means for varying the thickness of the gap are also provided such that upon passage of a flow of air from the plenum and discharge through the gap, the fairing cooperates with the one or more convex surfaces to provide a Coanda effect on the discharged
flow. The fairing and the one or more convex surfaces cooperate aerodynamically with one another. In this way, the Coanda effect imparted to the discharged flow entrains at least some of the ambient air surrounding at least one of the housing and the fairing. This allows the discharged flow and the entrained ambient air to flow substantially together in a generally sheet-like pattern. Such operation acts like an air amplifier. In the present context, the term "substantially" refers to an arrangement of elements or features that, while in theory would be expected to exhibit exact correspondence or behavior, may, in practice embody something less than exact. As such, the term denotes the degree by which a quantitative value, measurement or other related representation may vary from a stated reference without resulting in a change in the basic function of the subject matter at issue.

[0010] Optionally, the air knife also includes means for changing the angular orientation of the air knife relative to the machine. In this way, the angle of the sheet-like flow of air being discharged from the air knife can be tailored to the particular qualities of the printed or coated sheet. The means for varying the thickness of the gap of the air knife may be a sheet of material that is placed between the air outlet of the housing and the surface of the air outlet. The sheet of material may include one or more flow channels formed in it such that the passage of a flow of air from the plenum and discharge through the gap takes place through the flow channel. Multiple such channels means that the discharged air flow can be spread across the width of the gap between the housing and fairing. The sheet of material may be made up of mylar or some other suitable material. In another option, a switching mechanism is placed in cooperative arrangement with the air knife in order that it can selectively operate the air discharged through the gap of the knife. More particularly, the switching mechanism includes one or more sensors placed in signal communication with one or more of the drive wheels, conveyor and gripper bar (or bars). A controller is placed in signal or related electrical communication with the sensor or sensors such that upon receipt of a control signal from the sensor, the controller selectively enables or disables a supply of air to the air knife.

[0011] According to another embodiment of the present invention, a delivery system for a printing device with rotatable printing cylinders is disclosed. The delivery system includes an air knife such as described above. In addition, the delivery system includes a conveying mechanism (for example, a chute, chain-driven conveyor or the like) and numerous drive wheels rotatably mountable adjacent the rotatable printing cylinders. In this way, the delivery system is situated in such a way to readily receive a freshly printed or freshly coated sheet of paper coming from the printing mechanism. The conveying mechanism, which, for example, is of an endless, closed-loop construction, is coupled to the drive wheels so that when the wheels turn, they induce the mechanism to move. When the conveying mechanism is a chain-driven conveyor, one or more gripper bars are coupled to the conveyor so that one or more grippers mounted onto the bar can grasp or otherwise engage the sheet that comes from the rotatable printing cylinders. The conveyor transports the sheet from a first end of the delivery system (which is adjacent the rotatable printing cylinders) to a second end (which is away from the rotatable printing cylinders) and an air knife fluidly coupled to the first end of the delivery system. The air knife is generally similar to that discussed in the previous aspect. When the conveying mechanism is a chute-based system, no gripper bar is used. Nevertheless, the air knife still helps the sheet make it onto the conveyor without damaging the wet coated side of the printed sheet.

[0012] Optionally, the drive wheels are rigidly coupled to one another with a rotating shaft that extends between them. The width of the rigidly coupled drive wheels define a delivery path that is substantially the same width as the adjacent rotatable printing cylinders. The air knife can be disposed relative to the rotating shaft such that upon discharge of the generally sheet-like pattern of air from the air knife, the sheet that is engaged by the gripper avoids contact with the rotating shaft. In another option, an air regulator can be used to vary the volume of flow of air entering into the plenum.

[0013] According to another aspect of the present invention, a printing device is disclosed. The printing device includes a sheet feeder station, a sheet receiving station, a sheet delivery station operatively situated between the sheet feeder and the sheet receiving stations, a printing station, and the sheet delivery station. The printing station includes an air knife fluidly coupled to the final end of the delivery system. As described above, the sheet delivery station includes drive wheels, a conveyor coupled to the drive wheels and at least one gripper bar (with grippers) coupled to the conveyor. By engaging the sheet, the conveyors transports the sheet from a first end of the delivery station to a second end. The air knife is generally similar to that previously discussed, and functions such that the discharged flow and the entrained ambient air flow substantially together in a generally sheet-like pattern toward the printing station.

[0014] In one option, the printing device is a printing press, while in another it is a coating machine. The conveyor may comprise an endless conveyor. The air knife may be equipped with a device (for example, a motor or a pivoting bracket with numerous preset angular positions) such that the angular orientation of the generally sheet-like pattern of air flow being directed toward the printing station can be varied. In this way, the printing device can accommodate sheets of varying thickness, rigidity, size or the like.

[0015] According to another embodiment of the present invention, a method of supporting and conveying a wet sheet that has been discharged from a printing device is disclosed. The method includes receiving the sheet from one or more rotatable printing cylinders (for example, a printing press impression cylinder), transporting the sheet away from the rotatable printing cylinder(s) with a delivery system such that an air knife cooperative with the delivery system imparts an airflow to the sheet. The air discharged from the air knife helps the sheet substantially avoid contact with the delivery system and other components from the time it leaves the last printing cylinder until the sheet is engaged by the delivery system's gripper. As previously discussed, the air knife includes a housing with a plenum, an air inlet and an air outlet. At least a portion of the outer surface of the housing is of a convex shape. A fairing covers and is spaced relative to the air outlet such that it is gap formed between them permits air passing through the air outlet to be discharged through the gap and along the convex surface. The air knife is configured to take advantage of the Coanda effect to entrain at least a portion of ambient air surrounding the air knife. In this way, the discharged flow and the entrained ambient air cooperate to flow substantially together in a generally sheet-like pattern that can be delivered to the sheet leaving the rotating cylinder.
Optionally, the method further includes varying the thickness of the gap such that the generally sheet-like pattern of airflow being delivered by the air knife is optimized for a particular sheet. The method further includes varying the angular orientation of the air knife relative to the sheet through a pivotal mounting of the air knife. In another option, the method includes varying the linear placement of the air knife along the delivery device, thereby allowing additional adjustability. In a more particular form, such linear adjustment can be through a mounting bracket where sliding or related adjustment features can be included. The delivery system may be formed from a conveyor in general, and an endless conveyor in particular, where the conveyor is cooperative with the rotatable printing cylinder(s). As previously mentioned, the conveyor may be a chain-based system, where numerous wheels in the form of sprockets can be rotated to move the chain. A gripper bar assembly (which includes one or more individual grippers) can be connected to the conveyor to effect grasping or related engaging of the wet sheets that come off the printing cylinder(s). In addition, the amount of flow of air entering into the plenum can be varied through operation of an air regulator.

Other advantages and aspects of the present invention will become apparent upon reading the following description of the drawings in conjunction with the detailed description of the invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The following detailed description of the preferred embodiments of the present invention can be best understood when read in conjunction with the following drawings, where like structure is indicated with like reference numerals and in which:

- **[0019]** FIG. 1 shows a conventional offset printing press with an optional coating unit, both of which can cooperate with the present invention;
- **[0020]** FIG. 2A shows a conventional delivery wheel used to minimize contact of the newly printed sheets to a conveyor shaft according to the prior art;
- **[0021]** FIG. 2B shows a conventional air blast device used to minimize contact of the newly printed sheets to a conveyor shaft according to the prior art;
- **[0022]** FIG. 3 is a view of an air delivery bar installed in place of a delivery wheel, according to a first embodiment of the present invention;
- **[0023]** FIG. 4 is a perspective view of the air delivery bar of the present invention, configured as an air knife; and
- **[0024]** FIG. 5 is a schematic view of the placement and movement of the air knife of FIG. 4 in a paper path of a printing press, coating machine or related system.

**DETAILED DESCRIPTION**

Referring first to FIG. 1, a conventional printing device configured as an offset printing press 10 is made up of a sheet feeder station 20, printed sheet receiving station 30, printed sheet delivery station (alternately referred to as a delivery system) 40 and printing station 50. Individual sheets 1 to be printed are stacked in the sheet feeder station 20 and fed into the printing station 50, where numerous cylinders, including a plate cylinder 52, blanket cylinder 54 and impression cylinder 56 cooperate to selectively impart printing to sheet 1. Specifically, ink and water rollers 58 are used to coat parts of the paper 1 with their respective fluids, such as is known in the lithographic process. For example, ink is imparted to plate cylinder 52 from a respective ink roller. The blanket cylinder 54 (which may include a rubber mat or blanket mounted on its outer periphery) becomes coated with ink that it picks up from plate cylinder 52, then transfers the image to the impression cylinder 56. The image is then transferred to the paper sheets 1 from the impression cylinder 56. Delivery station 40 includes a pair of chains 42 driven by sprockets 44 that are mounted to shafts 46. One end of the delivery station 40 is juxtaposed with the impression cylinder 56 such that an upper run of the parallel-mounted chains is drawn toward the impression cylinder 56, while the lower run is drawn away. Grippers (also known as gripper bars) 48 mounted to the chains 42 grasp and hold the wet sheet 1 as it passes through the cylinders 54 and 56 on its way to the delivery station 40 where, after dried, the printed sheets are stacked for subsequent removal. Although only one gripper 48 is shown, it will be appreciated that in a preferable embodiment, more grippers 48 (for example, three) will be attached to the chains 42. Location A within the delivery station 40 occupies a generally hollow space between the sprockets 44 such that equipment for minimizing contact of the wet sheets 1 with the delivery station 40 can be placed.

An optional coating unit 200 can be readily attached to the printing press 10 in order to meter dampening solution on the printing press 10. The coating unit 200 includes a substantially smooth-surfaced form roller 210 in contact with the plate cylinder 52, and a substantially smooth-surfaced metering roller 220 in contact with the form roller 210. Both rollers 210 and 220 are shown with an external drive gears that mesh with one another to ensure a one-to-one rate of rotation between the rollers. Adjustment devices (not shown) can be used to selectively move the metering roller 220 toward or away from the form roller 210 without the need for tools, and while printing press 10 is operating. This allows for the deposition of an aqueous coating (for example, a protective finish) to material being printed by the printing press 10 without requiring a dryer or separate ink train.

Referring next to FIG. 2A, one form of wet sheet contact avoidance approach according to the prior art is depicted. The present view is looking along the path of the delivery system from a downstream end to an upstream end, the latter adjacent the output of the one or more printing cylinders in general and the impression cylinder 56 in general. In such an approach, one or more delivery wheels 45 (which may alternately be in the form of a star wheel, skeleton wheel or the like) is mounted onto rotating shaft 46. The shaft 46 also connects sprockets 44 through gears 47A that are meshed with complementary gears 47B on impression cylinder 56 to allow sympathetic rotation between them. Sprockets 44 engage with chains 42 such that gripper bars 49 with spring-loaded grippers 48 are attached to the chains 42 that move in conjunction with impression cylinder 56 and other rotatably coupled parts of printing press 10. When newly printed sheet 1 or related substrate (such as that shown in FIG. 1) is discharged from the impression cylinder 56, the delivery wheel 45 keeps the wet ink on the sheet from contacting the shaft 46 and other components. The delivery wheel 45 also can help guide the paper to stations or components downstream of the delivery system 40 such as that shown in FIG. 1. Depending on whether the machine is configured as a printing press 10 or a coating machine (not shown), the gripper bars 49 with spring-loaded grippers 48 take the sheet from the impression cylinder 56 and transport it to a stacked pile (for a
printing press) or another conveyer (for a coating machine). Depending on the size of the sheet to be printed, the position of the delivery wheel 45 needs to be adjusted, thereby requiring that the press 10 be stopped. In some circumstances, especially where the delivery wheel 45 defines a very small contact area, the delivery wheel 45 may lead to tearing of the freshly printed sheet 1.

[0028] Referring next to FIG. 2B, another form of wet sheet contact avoidance approach according to the prior art is depicted, where instead of the delivery wheel 45, an air blast device 41 is employed. The air blast device 41 includes a generally T-shaped manifold into which numerous apertures (not shown) are formed. Pressurized air passes through the device 41 and apertures such that the air impinges onto sheet 1 in order to push the sheet 1 away from the shaft 46 used to turn sprockets 44. The ejection of the air from the apertures is generally normal to the generally cylindrical surface of the device 41. Such a discharge pattern, while useful to have a flow of pressurized air impinge on the wet sheet 1 exiting the impression cylinder 56, cannot take advantage of external air entrainment through the Coanda effect or related phenomena where the tendency of the boundary layer of a stream of air or other fluid is to remain attached to a curvaceously (specifically convex) rather than proceed along the fluid’s original direction. By not being able to effectively leverage or amplify the surrounding air, the air blast device 41 may require a significant amount of energy to supply the compressed air needed to keep the sheet 1 away from shaft 46 or other delivery station 40 components.

[0029] Referring next to FIGS. 3 and 4, an embodiment of the device of the present invention is shown, utilizing an air delivery bar in the form of an air knife 100 in place of the delivery wheel 45 of FIG. 2A or the air blast device 41 of FIG. 2B. The air knife 100 includes an aerodynamically-shaped fairing 111A which sandwiches a piece of mylar or related spacing material 111B between it and a housing 111C, to create a very thin gap 112. Housing 111C includes a plenum formed in its interior. The plenum forms as the fluid connection between an air inlet 113 and one or more air outlets (not shown) that may be in the form of apertures or related orifices in the housing 111C. In one form, the plenum can be fluidly coupled to an external air source, such as a compressor. Apertures and flow channels (not shown) can be formed in spacing material 111B to allow fluid communication between the air outlet(s) formed in the housing 111C and the fairing 111A. The thickness of spacing material 111B can be changed to vary the amount of air required, which may be necessary for sheets of differing thickness or rigidity. For example, if a user is frequently running heavy sheet stock through the printing press or coating machine, a thicker piece of spacing material 111B may be installed.

[0030] As mentioned above, air inlet 113 allows (typically compressed) air to pass through the internal plenum such that air that comes from a pressurized air source is routed through air inlet 113 and discharged through gap 112. The high speed travel of the compressed air through gap 112 entrains resident ambient air 115, thereby acting as an airflow amplifier. At least some of the air passing through gap 112 follows a curved surface formed on housing 111C by the well-known Coanda effect; this air creates a curtain 114 (made up of the expelled compressed air through gap 112 in conjunction with the entrained ambient air 115) that, when directed to a coated or printed sheet 1, helps to transition such sheet 1 into the delivery area of the coater or printing press without contact of conveyor parts, thus preventing a mark or scratch on the coated and/or printed surface. As can be seen by arrow R, the air knife 100 can be made to rotate, such as by pivoting about an axis that generally coincides with the lateral dimension of the housing 111C and fairing 111A. Such rotation can be effected by automated (for example a motor) or manual means.

[0031] As shown with particularity in FIG. 3, a proximity switch 60 that includes a pair of sensors 60A and 60B that are connected to a control member (such as a solenoid, not shown) and the air compressor or related external air source (not shown) is used to reduce the duty cycle of the external air source. Specifically, as a gripper passes under first sensor 60A, the change in reflection causes the sensor 60A to send a signal to the controller to cause the air supply to the air knife 100 to be cut off, thereby avoiding the unnecessary consumption of power to provide air during a period of operation when pressurized air is not required at the air knife 100. Conversely, as a gripper passes under second sensor 60B, the change in reflection causes the sensor 60B to send a signal to the controller to turn the air supply on, thereby providing compressed air to the air knife 100 during a period of operation when pressurized air is required.

[0032] Referring next to FIG. 5, a pivoting mount 120 can be used to connect air knife 100 to a bracket 122 that can be mounted within the conveyer or delivery chains of the printing device. The combination of pivoting mount 120 and bracket 122 permits the air knife 100 to be positioned at the appropriate angle to cause the sheet 1 to turn into the delivery station 40 without contact. The bracket 122 used for air knife 100 has adjustments (including the ability to use various thicknesses of mylar or related spacing material 111B as discussed above) to enable the operator to change the air curtain 114 for varying stock sizes and weights. The use of the bracket 122 and pivoting mount 120 allow the air knife 100 to rotate R about its widthwise axis. Such angle may vary with the nature of the sheet 1 being printed or coated, and can be used to promote turning or bending of the sheet at a desirable time or position without contact of conveyor components. The avoidance of wet ink or coating contact with the underlying machinery also eliminates the need for the operator to clean delivery wheels and related components.

[0033] The operator can also regulate the amount of air that travels through the air knife 100 via regulator (not shown) that is placed on the outside of the machine for different stock sizes and weights. Likewise, varying the angle of impingement of the air curtain 114 can assist in ink or coating drying. The cushion of air eliminates the possibility of damage to the surface of the printed or coated sheet. In addition to paper sheets, the air knife 100 is suitable for use on plastic or other material, including various sizes and thicknesses.

[0034] Other modifications of this invention beyond these embodiments specifically described herein may be made without departing from the spirit of the invention. Accordingly, such modifications are considered within the scope of the invention as limited solely by the appended claims.

What is claimed is:
1. In combination with a printing or coating machine possessing of a plurality of printing cylinders and delivery means for withdrawing printed or coated sheets from the printing cylinders, an air knife for preventing the sheets from contacting components making up the delivery means of the machine while the sheets are still wet, said air knife comprising:
a housing comprising a plenum with an air inlet and an air outlet formed therein, said housing comprising at least one convex surface thereof;

a fairing configured to cover said air outlet and spaced relative thereto such that a gap formed between them permits air passing through said air outlet to be discharged through said gap and along said at least one convex surface; and

means for varying the thickness of said gap such that upon passage of a flow of air from said plenum and discharge through said gap, the fairing cooperates with said at least one convex surface further aerodynamically cooperative with one another such that the Coanda effect imparted to the discharged flow further entrains at least a portion of ambient air surrounding at least one of said housing and said fairing such that said discharged flow and said entrained ambient air flow substantially together in a generally sheet-like pattern.

2. The air knife of claim 1, further comprising means for changing the angular orientation of said air knife relative to the machine.

3. The air knife of claim 1, wherein said means for varying the thickness of said gap comprises a sheet of material placed between opposing surfaces of said fairing and said housing.

4. The air knife of claim 3, wherein said sheet of material includes at least one flow channel formed therein such that said passage of a flow of air from said plenum and discharge through said gap takes place through said flow channel.

5. The air knife of claim 4, wherein said sheet of material comprises mylar.

6. A delivery system for a printing device with rotatable printing cylinders, said delivery system comprising:

a plurality of drive wheels at least one of which is rotatably mountable adjacent the rotatable printing cylinders;

a conveyor coupled to said plurality of drive wheels and responsive thereto;

at least one gripper bar coupled to said conveyor, said at least one gripper bar comprising at least one gripper thereon such that upon receipt of a sheet from the rotatable printing cylinders, said at least one gripper engages the sheet so that said conveyor transports the sheet from a first end of said delivery system adjacent the rotatable printing cylinders to a second end away from the rotatable printing cylinders; and

an air knife fluidly coupled to said first end of said delivery system, said air knife comprising:

a housing comprising a plenum with an air inlet and an air outlet formed therein, said housing comprising at least one convex surface thereof;

a fairing configured to cover said air outlet and spaced relative thereto such that a gap formed between them permits air passing through said air outlet to be discharged through said gap and along said at least one convex surface; and

means for varying the thickness of said gap such that upon passage of a flow of air from said plenum and discharge through said gap, the fairing cooperates with said at least one convex surface further aerodynamically cooperative with one another such that the Coanda effect imparted to the discharged flow further entrains at least a portion of ambient air surrounding at least one of said housing and said fairing such that said discharged flow and said entrained ambient air flow substantially together in a generally sheet-like pattern.

7. The delivery system of claim 6, wherein said plurality of a plurality of drive wheels are rigidly coupled to one another with a rotating shaft that extends between them, said rigidly coupled plurality of drive wheels defining a delivery path that is substantially the same width as the adjacent rotatable printing cylinders, and wherein said air knife is disposed relative to said rotating shaft such that upon discharge of said generally sheet-like pattern of air from said air knife, the sheet that is engaged by said at least one gripper avoids contact with said rotating shaft.

8. The delivery system of claim 6, further comprising an air regulator for varying the amount of flow of air entering into said plenum.

9. The delivery system of claim 8, further comprising a switching mechanism cooperative therewith to selectively operate said air discharged through said gap.

10. The delivery system of claim 9, wherein said switching mechanism comprises:

at least one sensor placed in signal communication with at least one of said plurality of drive wheels, conveyor and at least one gripper bar; and

a controller responsive to said at least one sensor such that upon receipt of a control signal therefrom, said controller selectively enables or disables a supply of air to said air knife.

11. A printing device comprising:

a sheet feeder station;
a sheet receiving station;
a sheet delivery station operatively situated between said sheet feeder and said sheet receiving stations, said sheet delivery station comprising:
a plurality of drive wheels;
a conveyor coupled to said plurality of drive wheels and responsive thereto; and

at least one gripper bar comprising said at least one gripper bar configured to engage the sheet so that said conveyor transports the sheet from a first end of said delivery station to a second end;

a printing station comprising a plurality of rotatable cylinders for imparting at least one of a printing and a coating to the sheet, said printing station configured to cooperate with said sheet feeder station and said sheet delivery station to deliver a printed sheet to said sheet delivery station; and

an air knife fluidly coupled to said first end of said delivery system, said air knife comprising:

a housing comprising a plenum with an air inlet and an air outlet formed therein, said housing comprising at least one convex surface thereof;

a fairing configured to cover said air outlet and spaced relative thereto such that a gap formed between them permits air passing through said air outlet to be discharged through said gap and along said at least one convex surface; and

means for varying the thickness of said gap such that upon passage of a flow of air from said plenum and discharge through said gap, the fairing cooperates with said at least one convex surface further aerodynamically cooperative with one another such that the Coanda effect imparted to the discharged flow further entrains at least a portion of ambient air surrounding at least one of said housing and said fairing such that said discharged flow and said entrained ambient air flow substantially together in a generally sheet-like pattern.
Coanda effect on the discharged flow, said fairing and said at least one convex surface further aerodynamically cooperative with one another such that the Coanda effect imparted to the discharged flow further entrains at least a portion of ambient air surrounding at least one of said housing and said fairing such that said discharged flow and said entrained ambient air flow substantially together in a generally sheet-like pattern toward said printing station.

12. The printing device of claim 11, wherein said printing device comprises a printing press.

13. The printing device of claim 11, wherein said printing device comprises a coating machine.

14. The printing device of claim 11, wherein said conveyor comprises an endless conveyor.

15. The printing device of claim 11, further comprising a device coupled to said air knife such that the angular orientation of said generally sheet-like pattern of air flow being directed toward said printing station can be varied.

16. A method for supporting and conveying a wet sheet which has been discharged from a printing device, said method comprising:

- receiving said sheet from at least one rotatable printing cylinder;
- transporting said sheet away from said at least one rotatable printing cylinder with a delivery system such that an air knife cooperative with said delivery system imparts an airflow to said sheet so that said sheet avoids contact substantially from the time it leaves the at least one rotatable printing cylinder until said sheet is engaged by at least one gripper on said delivery system, said air knife comprising:
  - a housing comprising a plenum with an air inlet and an air outlet formed therein, said housing comprising at least one convex surface thereon;
  - a fairing configured to cover said air outlet and spaced relative thereto such that a gap formed between them permits air passing through said air outlet to be discharged through said gap and along said at least one convex surface; and
- means for varying the thickness of said gap such that upon passage of a flow of air from said plenum and discharge through said gap, the fairing cooperates with said at least one convex surface to provide a Coanda effect on the discharged flow, said fairing and said at least one convex surface further aerodynamically cooperative with one another such that the Coanda effect imparted to the discharged flow further entrains at least a portion of ambient air surrounding at least one of said housing and said fairing such that said discharged flow and said entrained ambient air flow substantially together in a generally sheet-like pattern; and
delivering a source of pressurized air to said sheet through said air knife.

17. The method of claim 16, further comprising varying the thickness of said gap such that said generally sheet-like pattern of airflow being delivered by said air knife is optimized for a particular sheet.

18. The method of claim 16, further comprising varying the angular orientation of said air knife relative to said sheet through a pivotal mounting of said air knife.

19. The method of claim 16, further comprising varying the linear placement of said air knife along said delivery device.

20. The method of claim 19, wherein said varying the linear placement of said air knife along said delivery device is through a linearly adjustable mounting bracket.

21. The method of claim 16, wherein said delivery system comprises an endless conveyor cooperative with the at least one rotatable printing cylinder.

22. The method of claim 16, further comprising varying the amount of flow of air entering into said plenum through operation of an air regulator.

23. The method of claim 16, further comprising operating a switching mechanism to selectively operate an air source used to provide air to said air knife.

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