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APPARATUS FOR DRYING SHEET MATERIAL

Filed April 16, 1949

2 SHEETS—SHEET 1

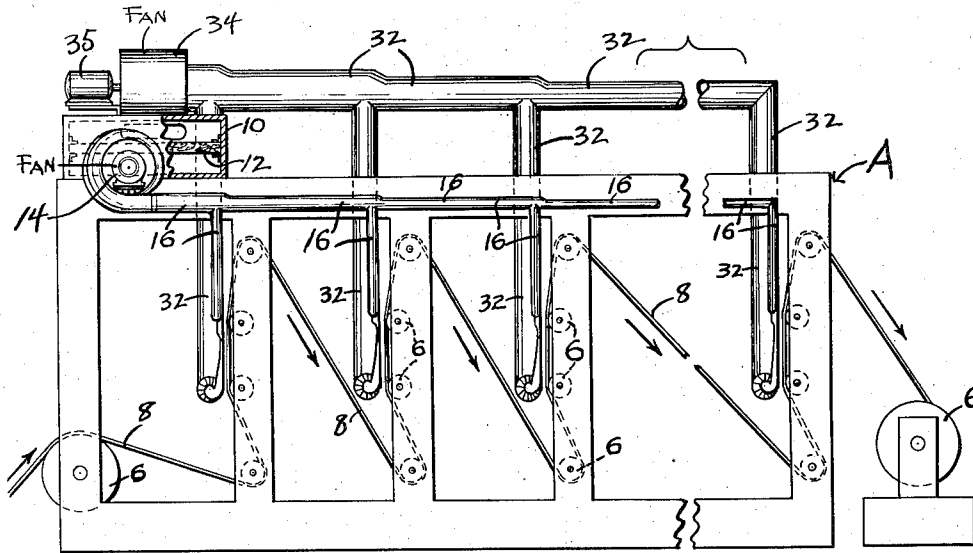


FIG. 1.

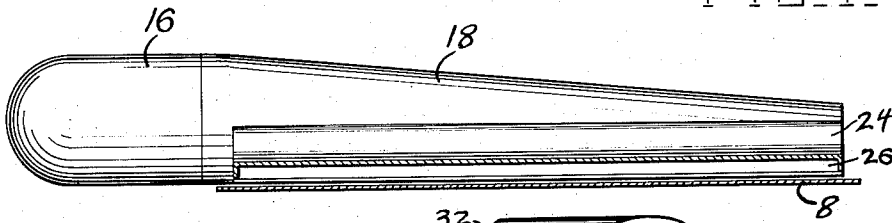


FIG. 2.

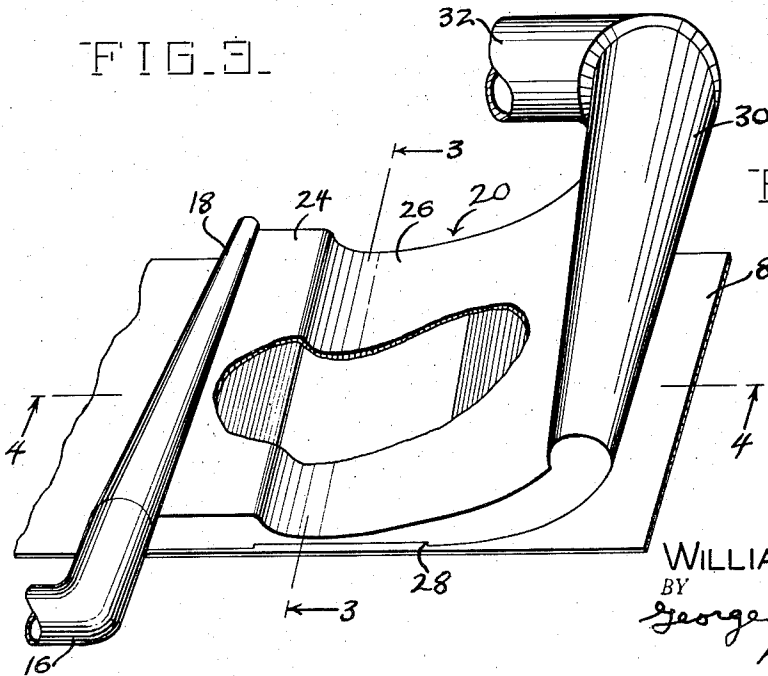


FIG. 3.

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2 SHEETS—SHEET 2

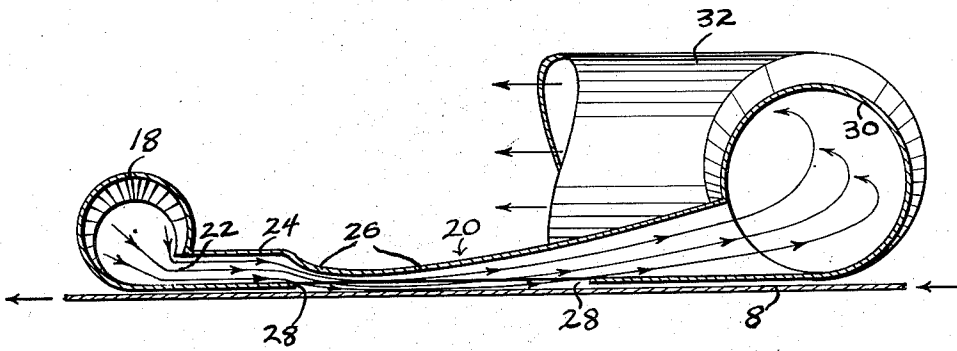


FIG. 4.

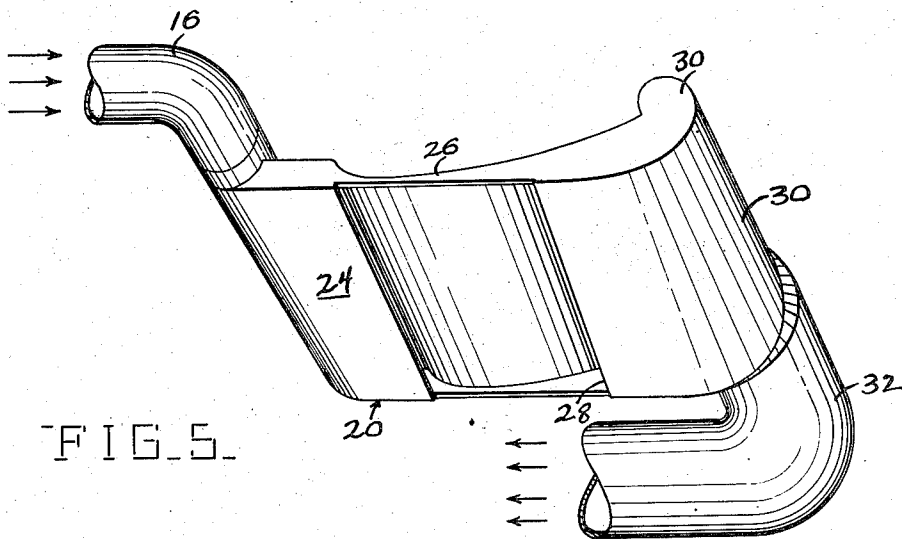


FIG. 5.

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APPARATUS FOR DRYING SHEET MATERIAL

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3 Claims. (Cl. 34-159)

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This invention relates to an improved apparatus and method for drying the surface of moving continuous sheet or strip material on which a wet film has been deposited, such as the printing ink applied by a printing press to the surface of paper, cellophane or cloth webs.

Various methods and devices have been used for drying printing ink, one being the conditioning or dehumidifying of the air in the entire room where the printing press is operated. Another method is to run the printed web or strip through a closed chamber containing air dried by application of heat, or by other means, completely surrounding the web in contact with both of its surfaces. These methods require the use of cumbersome apparatus which is expensive to install and operate and necessitate the treating of a much larger volume of air than is actually needed for drying purposes. Thus, much of this treated air is wasted since the only air effective in the drying process is that which actually contacts the printed or inked surface of the web, being a relatively small portion of the total quantity of air that is conditioned.

A further disadvantage of these methods is that the drying process is comparatively slow, which materially limits the output that the printing press is capable of delivering, since each application of ink must be thoroughly dried before successive applications can be made or the web rolled or folded in the final operation. In addition, it is often difficult to obtain an even and uniform distribution of the treated air over the printed surface of the web, resulting in uneven and incomplete drying.

It is an object of the present invention to provide an improved apparatus and method for drying the wetted surface of moving continuous sheet material, such as the printed web of printing presses, which requires the treatment or drying of only a minimum amount of air and in which the maximum amount of the treated air is effectively used in the drying process.

Another object of the invention is the provision of an apparatus and method as above described in which a relatively thin layer of dehydrated air is passed over the surface to be dried at high velocity, resulting in the rapid and even drying of the surface.

Still another object of the invention is to provide an apparatus of the character described which occupies a minimum amount of space and which may be installed for use with existing presses or similar machines without modification or alteration of the machine.

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A further object of the invention is to provide an apparatus as above described in which a maximum amount of the air that is treated is recovered and reconditioned for continuous reuse.

These and other objects of the invention will be apparent to those skilled in the art from a study of the following description and accompanying drawings, in which:

Figure 1 is a side elevational view showing the apparatus installed for use with a printing press or similar machine where the drying of a wet film applied to the surface of moving continuous sheet material is required.

Figure 2 is a fragmentary perspective view of the apparatus taken from a point above it and looking towards the top portion thereof.

Figure 3 is a sectional view taken on line 3-3 of Figure 2.

Figure 4 is a sectional view taken on line 4-4 of Figure 2.

Figure 5 is a fragmentary perspective view similar to Figure 2, but taken from a point below the apparatus looking towards the bottom portion thereof.

Referring now more in detail to the drawings, the apparatus is shown in Figure 1 as installed for use with a printing press, diagrammatically represented at A, having rollers 6 over which travels, in the direction indicated by the arrows, a printed web 8 or similar continuous sheet material to be dried. Figure 1 shows a multiple application of the apparatus installed for successively drying four separate printing ink or color applications, but this is merely for purposes of illustration since the apparatus may be adapted for use in drying any desired number of separate printing or color applications.

The apparatus comprises an enclosed air drying chamber 10 suitably mounted on the press A and containing a bed 12 of dehydrating agent, such as silica gel or similar substance. A motor driven fan assembly 14 is provided for drawing air from the lower part of chamber 10 after it has passed through the bed 12 of drying agent, into a supply conduit 16 connected with a delivery cone or funnel 18. This delivery cone 18, as shown in Figures 2 and 4, forms part of a casing generally indicated at 20 located adjacent to and of substantially the same width as the printed web surface to be dried. The delivery cone is formed with an elongated slot or orifice 22 extending lengthwise of the cone and opening into an air inlet duct 24 of relatively shallow rectangular cross-section. The inlet duct 22

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leads into and merges with the central portion of the casing 20, the top wall of which is formed at this point in the shape of a semi-Venturi tube section 26. The bottom wall of casing 20 directly beneath the Venturi section 26 is formed with an opening 28 arranged in overlying spaced relation to the surface of the web 8, as more clearly shown in Figures 2 and 4. The semi-Venturi section 26 extends beyond the opening 28 and leads into an air recovery cone 30, generally similar in shape to the delivery cone 18, but much larger and tapering in the opposite direction. The outlet or large end of the recovery cone 30 is connected with a return conduit 32 leading back into the drying chamber 10 at the upper part thereof above the bed 12 of the dehydrating agent, a fan indicated at 34 driven by motor 35 being provided in the conduit for forcibly drawing the air back into the chamber and through the bed of dehydrating agent for redrying and reuse.

The apparatus is closed to the atmosphere except at the opening 28 through which a quantity of air sufficient for operation of the apparatus will enter. In operation, the two motor driven fans 14 and 34 are started, the fan 14 being of sufficient power to force air from the drying chamber 10 after being drawn through bed 12, into the delivery conduit 16, as indicated by the arrows in Figure 5, at a slightly positive pressure. The dry air reaching the entrance end of the delivery cone 18 will, therefore, be slightly compressed and, of course, will be relieved through the orifice 22 into the air inlet duct 24, as indicated by the arrows in Figure 4. Due to the shape of cone 18, gradually reduced in capacity toward its tapering end, the air pressure will remain uniform throughout the length of the cone, resulting in an even flow of air at all points along the orifice 22 into air inlet duct 24. The relative capacities of the cone 18 and inlet duct 24 are such that the latter will hold a volume of air at atmospheric pressure substantially equal to the volume of air held by the cone at a slightly positive pressure. The air will thus be received and uniformly distributed in the inlet duct 24 at atmospheric pressure and in the form of a flat layer due to the shape of the duct. The layer of dried air then enters the Venturi section 26 flowing in a direction counter to the direction of travel of web 8 as indicated by the arrows in Figure 4, passing over and contacting the surface of the web exposed to it through the opening 28. Due to the well-known characteristic of the venturi, the velocity of the air will be greatly increased at this point and also the thickness of the layer of flowing air will be reduced. The same volume of air will flow over the web surface 8 as is contained in inlet duct 24 but in a shorter time due to its higher velocity, resulting in faster drying than otherwise would be the case. Moreover, a maximum percentage of the dry air will actually contact the web surface 8 in the drying process due to the reduced thickness of the layer of air, resulting in a more effective and economical use of the air. In addition, the uniform distribution of the air in contact with the web surface results in even drying.

After passing over and absorbing moisture from the web surface 8, the humid air now flows through the flared or after-portion of the semi-Venturi section into the recovery cone 30 where it expands due to the relatively larger space provided by the cone that the air then has to

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occupy. This expansion of the air into the relative large volume of the recovery cone 30 and from there into the large return conduit 32 lowers its pressure to a degree producing suction in this part of the apparatus, further increasing the speed of the flowing air in its passage over the web surface 8. Since the layer of air is flowing at high velocity at atmospheric pressure and in laminar flow and due to the shape of the after portion of the Venturi section 26, the air is induced to enter recovery cone 30. In other words, due to another well-known characteristic of the venturi, substantially all of the flowing air will tend to follow or be guided by the flared wall of the Venturi section into the recovery cone. Thus, the loss of dry air escaping to the atmosphere and the entry of untreated atmospheric air through opening 28 into the apparatus are reduced to a minimum. In addition, the drawing power of fan 34 is such as to be sufficient of itself to produce suction in return conduit 32, thus further assuring recovery of substantially all of the air for return to and redrying in the chamber 10 by passage through the bed 12 of dehydrating agent for reuse.

Supplying the air to the delivery cone under pressure permits the use of the comparatively small conduit 16. With this arrangement the air is received in inlet duct 24 at substantially atmospheric pressure and in the form of a flat layer prior to passage through Venturi section 26 and over the web surface 8, avoiding the necessity of providing large cumbersome air ducts for this purpose. Another important advantage of the apparatus is the faster drying process resulting from an increase in the velocity of the dry air flowing over the wet surface and in a direction counter to the direction of travel of the web surface. A drying apparatus has been provided in which only a minimum quantity of air is required to be conditioned and in which a maximum amount of the conditioned air is effectively used in the drying process, resulting in economical operation. Further economy of operation is obtained by the redrying and reuse of the air, the only moisture absorbed by the bed 12 of dehydrating agent from the flowing air being confined substantially to only that absorbed by the air from the web surface 8. In other words, since only a minimum amount of outside or atmospheric air enters the apparatus during operation, substantially the same air is continuously redried and reused. Thus a smaller amount of dehydrating agent is required and this can be used for a longer period of time before it has to be regenerated.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

What is claimed is:

1. In an apparatus for progressively drying a wetted surface of continuous sheet material, in combination with means for moving said material, a casing having a bottom wall formed with an opening in overlying spaced relation to said surface, means for continuously delivering a layer of flowing dehydrated air to one side of said casing in contact with said surface through the casing opening, said casing having a top wall formed as a semi-Venturi tube section above opening whereby to simultaneously increase the velocity and reduce the thickness of said flowing layer of dehydrated air contacting said surface

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as the sheet material is moved along its path beneath the opening, and cone-shaped outlet means at the other side of the casing acting to recover said air therefrom by suction after it has contacted said surface of the sheet material.

2. An apparatus for progressively drying a wetted surface of continuous moving sheet material comprising a casing of substantially the same width as said material having a bottom opening spaced from and overlying said surface and including an air delivery cone and an air recovery cone, an air dehydrating chamber, means for continuously supplying dehydrated air from said chamber to said delivery cone under pressure, said air being received by said casing at reduced pressure in the form of a layer, said casing being formed with means for simultaneously increasing the velocity of and thinning said layer of flowing air as it contacts said surface through the casing opening, said recovery cone being of greater air capacity than said delivery cone and extending in the opposite direction whereby to recover said air by suction after flowing over said surface, and means for returning said air from said recovery cone back to said chamber for redrying and reuse.

3. In an apparatus for progressively drying a wetted surface of continuous moving sheet material, a casing of substantially the same width as said material provided in its central portion with a bottom opening spaced from and overlying said surface, said casing being formed as a semi-Ven-

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turi section over said opening and including an air inlet duct, an air delivery cone opening into said duct, an air recovery cone leading from said semi-Venturi section, an air dehydrating chamber, means for continuously supplying dry air from said chamber to said delivery cone under pressure, said inlet duct being adapted to receive air from said delivery cone at reduced pressure in the form of a layer, said semi-Venturi section acting to simultaneously increase the velocity of and thin said layer of flowing air as it passes over in contact with said surface through the casing opening, said recovery cone acting to produce suction whereby said air is recovered after passing over said surface, and means for returning said air from said recovery cone back to said chamber for redrying and reuse.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,349,590	Tensfeldt	Aug. 17, 1920
1,847,915	Bailey	Mar. 1, 1932
2,205,391	Brunkow	June 25, 1940

FOREIGN PATENTS

Number	Country	Date
427,028	Great Britain	Apr. 15, 1935