VENTILATING APPARATUS FOR PAPER MACHINE POCKET

My invention relates to ventilating apparatus for relatively inaccessible locations and more particularly to an improved low pressure apparatus for ventilating a paper machine dryer pocket, which apparatus has a long life and which is economical as compared with ventilating apparatus of the prior art.

For effective operation of the drying section of a paper or board-making machine, it is essential that the moisture removed from the sheet during the drying operation be carried away from the dryer. It is usual to provide the dryer with a hood through which hot air is circulated to carry off moisture generated during the drying operation. While the dryer hood is generally effective for this purpose, it does not satisfactorily remove moisture which is trapped in relatively inaccessible spaces within the dryer. Such spaces or “pockets” are formed, for example, by the length of the paper web extending between the upper and lower dryer rolls and the portions of the felts extending from the dryer rolls to the felt rolls.

Various attempts have been made in the prior art to remove moisture from the pocket. For example, in one system heated air at a relatively high pressure is forced radially outwardly of the dryer roll through the machine felt and into the pocket. This system requires a source of high pressure air as well as seals between relatively movable parts. Such an arrangement obviously adds appreciably to the cost of the installation.

Other systems have been proposed wherein air is directed into the pocket from an end at one side of the machine. While satisfactory in some instances, these systems are unsatisfactory for others in that they produce uneven drying.

I have invented ventilating apparatus which effectively removes moisture from a relatively inaccessible space such, for example, as the pocket of a paper machine dryer. My apparatus does not require high pressure air. It promotes even drying of the sheet. My system has a relatively long life. It is effective, efficient and economical. My apparatus does not involve any physical contact between relatively moving parts.

One object of my invention is to provide ventilating apparatus for efficiently and effectively removing moisture from the pocket of a paper machine dryer.

Another object of my invention is to provide a dryer pocket ventilating apparatus which does not require high pressure air.

Still another object of my invention is to provide ventilating apparatus for removing moisture from a paper machine pocket which is economical in construction and in operation.

Yet another object of my invention is to provide dryer pocket ventilating apparatus which promotes even drying.

A further object of my invention is to provide ventilating apparatus for a paper machine pocket, which apparatus has a long life.

A still further object of my invention is to provide ventilating apparatus for a paper machine pocket which does not involve frictional contact between relatively moving parts.

Other and further objects of my invention will appear from the following description.

In general my invention contemplates the provision of ventilating apparatus wherein a plenum chamber positioned in spaced relationship to a highly permeable dryer fabric outside the dryer pocket and supplied with relatively low pressure air has means for forming a curtain of relatively high velocity air providing an air seal with the fabric around a predetermined area to confine secondary air directed through the fabric area and into the pocket.

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIGURE 1 is a schematic view of a portion of the dryer section of a paper making machine illustrating the relationship of my ventilating apparatus to other parts of the machine.

FIGURE 2 is a fragmentary elevation of a portion of the machine shown in FIGURE 1 drawn on an enlarged scale to illustrate the manner in which my apparatus supplies scavenging air to pockets of the machine.

FIGURE 3 is a perspective view of my ventilating apparatus for a paper machine pocket showing its relationship to the felt or fabric of the machine.

FIGURE 4 is a sectional view of my apparatus taken along the line 4—4 of FIGURE 1.

Referring now to the drawings, my ventilating apparatus is especially adapted for use with a paper machine dryer section indicated generally by the reference character 10 of a type known to the art. The dryer section 10 includes a plurality of upper dryer rolls 12 and a plurality of lower dryer rolls 14. These dryer rolls are heated in a manner known to the art by steam or the like to supply the heat required to remove moisture from the paper. The wet sheet or web 16 passes alternately around an upper dryer roll 12 and a lower dryer roll 14 throughout the dryer section 10 of the machine. The dryer section 10 is provided with an upper dryer felt 18 which passes over the top of a dryer roll 12, then around a felt roll 20 and up over the top of the next dryer roll 12. The lower felt 22 of the machine alternately passes under a lower dryer roll 14 and over a lower felt roll 24 throughout the dryer section of the machine.

As is known in the art, the felts 18 and 22 serve the function of holding the sheet 16 in close contact with the dryer rolls 12 and 14 as the sheet passes through the dryer section 10. In applying my ventilating apparatus to the dryer section 10, I employ a relatively highly permeable fabric for the felts 18 and 22. One example of a fabric which may be employed in connection with my ventilating apparatus is an open mesh monofilament fabric having a relatively high permeability of from about 100 to about 800 cubic feet per minute of air at half-inch pressure differential across the fabric.

As the web 16 passes between the upper and lower dryer rolls, it separates from the felts 18 and 22 to form...
a plurality of pockets, indicated generally by the reference character 26, along the machine. Specifically a pocket 26 is defined by the portion of the upper fabric 18 extending around the upper felt roll 20, the lengths of the sheet 16 extending forward of the roller 12 and the lower dryer roll 14 and the upper surface of the lower dryer roll 14. It will readily be apparent that moisture tends to collect in the pockets 26. For effective drying of the sheet 16 it is necessary that this moisture be removed.

Attempts to remove the moisture by blowing air along the pockets 26 at the end of the hood to the other result in an uneven drying across the width of the sheet 16. Moreover, as has been explained hereinabove, attempts to force air through the felt roll 20 intermediate the ends of the pocket require a high pressure source, mechanical air seals and makes the installation so expensive as to be prohibitive.

My ventilating system includes a plurality of units indicated generally by the reference character 28 disposed outside the pockets 26 adjacent the corresponding felt rolls 20 or 24. I employ any suitable means for mounting the units 28 on the frame 30 of the machine. For example, I may employ U-bolts 32 secured to angle irons 34 mounted on the frame.

As is known in the art, the upper fabric or felt 18 assists in drying one side of the sheet 16 while the lower fabric or felt 22 assists in drying the other side of the sheet. I have discovered that while I need not provide one of my units 28 for every pocket 26 in the dryer section of the machine, it is necessary to distribute the units between pockets 26 associated with upper felt rolls and pockets 26 associated with lower felt rolls 24. In this manner I balance the ventilating effect between the fabrics 18 and 22 associated with the respective sides of the sheet 16. Owing to the fact that the construction of a unit 28 associated with an upper felt roll 20 is substantially the same as that of a unit 28 associated with a lower felt roll 24, I will describe only a unit 28 associated with an upper felt roll 20.

Each of the units 28 is generally boxlike in shape having a top 26, a bottom 36 and ends 40 and 42. I bend the longitudinal edges of both the top 36 and the bottom 38 to form flanges 41 and 43 at each side of the unit and provide similarly bent legs 44 and 46 which connect the flanges at the ends thereof. These flanges 41, 43, 44 and 46 form openings 45 in which I mount side plates 52 secured in the openings by any suitable means such as by tabs 56 secured to the underside of the corresponding flange. I provide each of the side plates 52 with inwardly directed flanges 58, 60, 62 and 64 which cooperate with the flanges 41, 43, 44 and 46 to form a generally continuous nozzle defined by the space between the edge of plate 52 and the opening 48. It will be appreciated that the only interruptions in the nozzle are by the tabs 56 which are required to support the side plates 52.

I provide the ends 40 and 42 with openings 64 and 66 to permit a supply pipe 68 to pass therethrough. Seals 70 surrounding the pipe 68 at each end of the unit 28 are retained in position by any appropriate means such as by flanges 72 on the end plates 40 and 42 of unit 28. These seals 70 support the unit 28 in hermetically sealed relationship on pipe 68 while permitting it to be shifted laterally thereof. I provide each of the plates 52 and 54 with a plurality of the perforations 74.

Pipe 68 has a pair of generally diametrically disposed openings 76 and 78. I supply relatively low pressure heated air to one end 80 of the supply pipe 68 from any suitable source such as a blower 81 feeding a heater 83.

The other end of the pipe 68 carries a blank flange on plate 52 which prevents air from escaping from that end of the pipe. When air is supplied to the pipe 82, it passes radially outwardly through openings 76 and 78 to the interior of the unit 28. The nozzle formed by the plates 52 and the bent-over edges of the top 36 and bottom 38 produces a curtain of relatively high velocity air directed toward the surface of fabric 18. Secondary low pressure air flows through the perforations 74 toward the fabric 18.

I have discovered that by properly proportioning the aggregate area of the openings 74 with relation to the area of the perforations 74 a relatively high velocity air curtain emanating from the nozzle forms an effective seal with the fabric 18 to confine the air flowing through the openings 74 to the area of the fabric 18 within the curtain. In an experimental installation I have arranged wherein the plenum formed by the chamber is 24" long and provided with a 0.040" slot providing a curtain about 22" by about 4" and with thirty-two 3/4" holes in the side plate 52, for example, the ratio of hole area to nozzle area is about five-to-one. It will readily be understood that this ratio will vary from installation to installation but the optimum area can readily be determined.

In operation of my ventilating apparatus for a paper machine dryer pocket, I provide as many units 28 associated with either an upper felt roll 20 or a lower felt roll 24 as are necessary for effective ventilation. I then supply air at a relatively low pressure to the supply pipes 68 through the ends 80. The closures 82 prevent escape of air through the other ends of the pipes and constrain the air supplied to the pipes to pass outwardly therethrough through the openings 76 and 78 and into the unit chamber. This air emerges through the perforated forms of plates 52 and 54 and bent-over edges of the top and bottom with a relatively high velocity effectively to form a seal for containing the secondary air passing through the openings 74. Air passing through the perforations 74 within the high velocity air curtain then enters the pocket 26 through the permeable felt and then passes laterally outwardly of the pocket to the hood (not shown) of the dryer. Preferably, I make each unit of a length which is about two-thirds of the width of the fabric 18. If for any reason it is desired to ventilate one portion of the sheet across its width more than others, I can shift the unit 28 along the pipe 68 without destroying the air seals. It is for that reason that I locate the openings 76 and 78 generally centrally of the sheet 18. It is to be noted that my system not only does not require high pressure air but, also, it does not require any mechanical seals. Moreover, the units 28 are so positioned as to be readily accessible.

It will be seen that I have accomplished the objects of my invention. I have provided ventilating apparatus for a paper machine dryer pocket which does not require high pressure air. It does not require any mechanical air seals between parts moving relative to each other in the normal operation of the machine. It is relatively simple and inexpensive for the result achieved thereby. It promotes even drying of the sheet across the width thereof.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. In a paper making machine dryer having a pocket with a wall of gas permeable material extending around a roll, means located outside said pocket for directing scavenging air into said pocket over a predetermined area of said wall means for forming a curtain of relatively high velocity air surrounding said area to confine scavenging air to said predetermined area and a source of lower velocity air for supplying air to said directing means and to said curtain-forming means,

2. In a dryer as in claim 1 including means mounting
said directing means for movement relative to said wall.

3. In a dryer as in claim 1 in which said directing means comprises a plenum chamber having a perforated wall, and in which said supplying means comprises a supply duct having an outlet in its wall and means mounting said chamber for adjustment with respect to said duct.

4. In a dryer as in claim 1 in which said directing means comprises a plenum chamber having a perforated wall and in which said curtain forming means comprises means forming an elongated nozzle surrounding said perforated wall, and in which said supplying means supplies said chamber.

5. In a dryer as in claim 4 in which said supplying means comprises a supply duct having an outlet opening and means mounting said chamber for movement relative to said outlet opening.

6. In a dryer as in claim 4 in which said perforated wall is a side wall and in which said chamber comprises top and bottom and end walls, said nozzle forming means including a peripheral flange on said perforated wall and flanges on said side and end walls.

7. In a dryer as in claim 4 in which the area of the opening of said nozzle is a predetermined fraction of the aggregate area of said wall perforations.

8. In a paper machine dryer having a pocket with spaced walls of a gas permeable material extending around a felt roll, ventilating apparatus including a plenum chamber having spaced walls, openings in said spaced chamber walls for permitting the passage of scavenging air therethrough, means mounting said plenum chamber between said pocket walls with said chamber wall openings facing said pocket walls over respective areas thereof, means for forming curtains of relatively high velocity air surrounding the respective areas to confine scavenging air to said areas, and a source of relative-

85

ly lower velocity air for supply air to said chamber and said curtain forming means.

9. Ventilating apparatus as in claim 8 in which said curtain forming means comprises means forming elongated nozzles in the respective plenum chamber walls around the holes of said walls.

10. Ventilating apparatus as in claim 8 in which said air supplying means comprises a duct having respective openings associated with said chamber walls.

11. Ventilating apparatus as in claim 8 in which said air supplying means comprises a duct having an opening therein communicating with said chamber and in which said mounting means comprises seals between said chamber and said duct for adjustably mounting said chamber on said duct for relative movement with respect to said opening.

References Cited

UNITED STATES PATENTS

3,250,019 5/1966 Beachler __________ 34—117
3,279,977 10/1966 Cirrito __________ 34—156 XR
3,337,968 8/1967 Krikorian et al. ______ 34—111
1,199,394 9/1916 Liebeck __________ 34—111
1,853,408 4/1932 Crozier __________ 158—2 XR
3,161,482 12/1964 Gschwind et al. __ 34—155 XR
3,263,344 8/1966 Sickle __________ 34—122 XR
3,319,354 5/1967 Herling et al. ______ 34—155

FOREIGN PATENTS

51,705 10/1932 Norway.

FREDERICK L. MATTESON, Jr., Primary Examiner.
H. B. RAMEY, Assistant Examiner.