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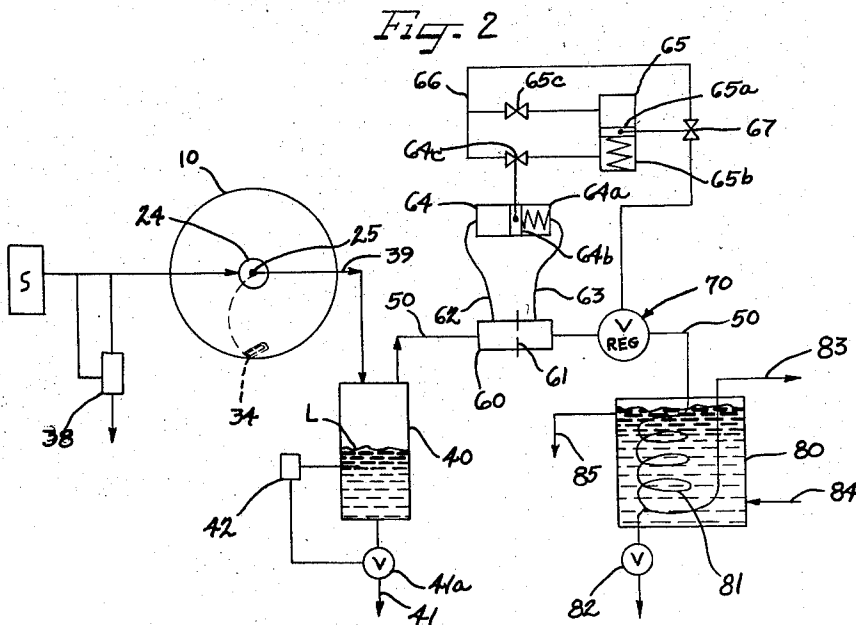
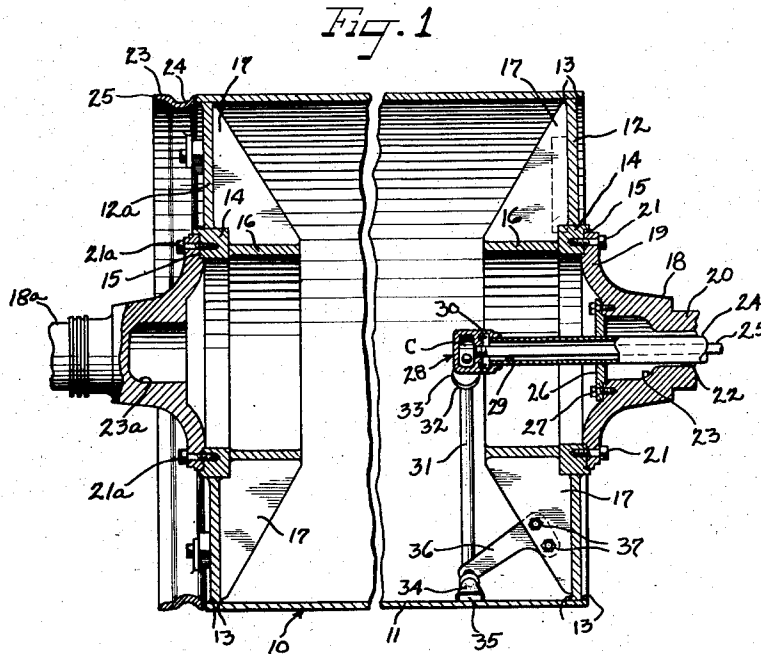
E. J. JUSTUS

2,869,248

CONDENSATE REMOVAL CONTROL FOR PAPER MACHINE DRYERS

Filed Oct. 17, 1955

2 Sheets-Sheet 1



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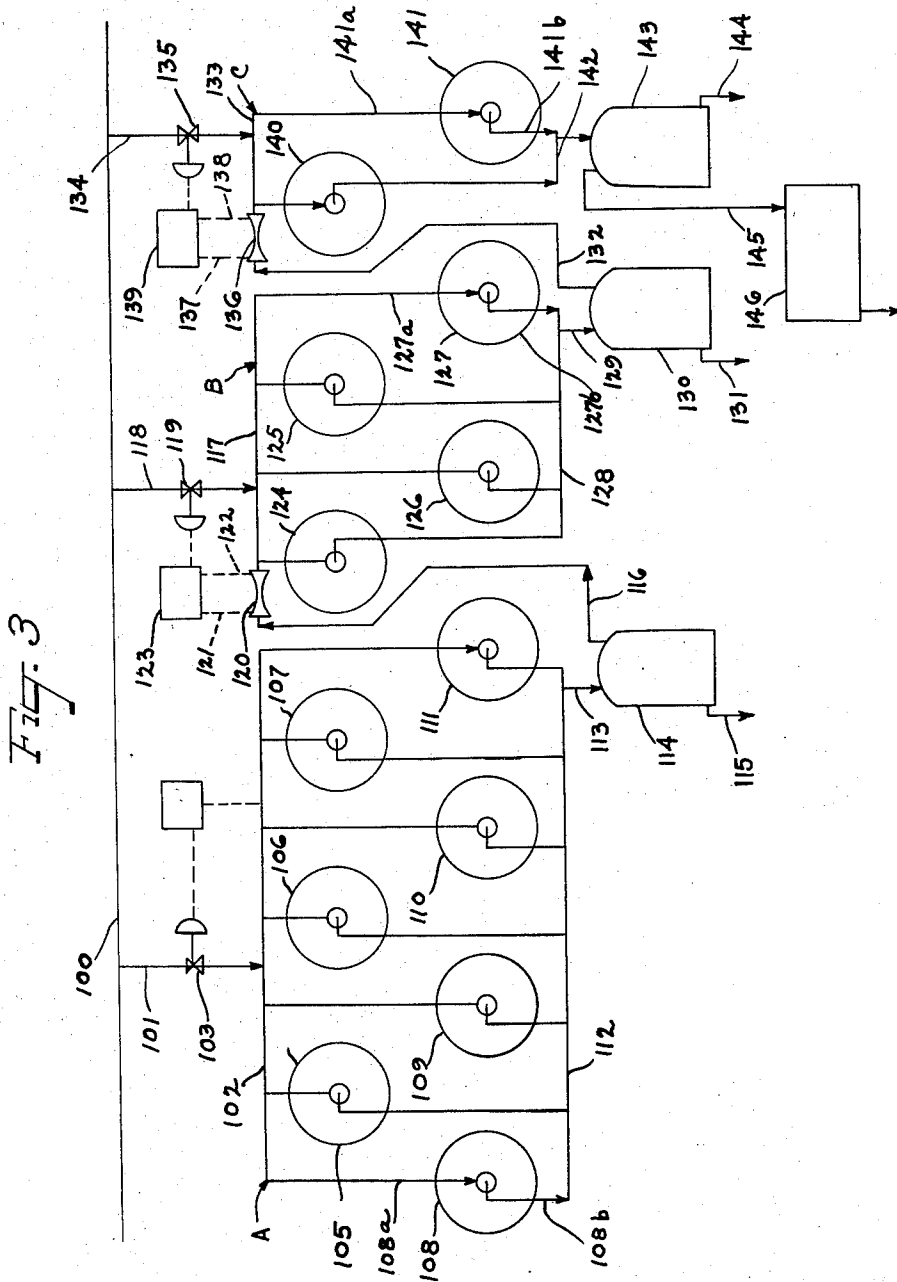
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CONDENSATE REMOVAL CONTROL FOR PAPER MACHINE DRYERS

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2 Sheets-Sheet 2



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CONDENSATE REMOVAL CONTROL FOR PAPER MACHINE DRYERS

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Application October 17, 1955, Serial No. 540,903

5 Claims. (Cl. 34—54)

The instant invention relates to dryer drums in a paper machine dryer section, and more particularly, to a device for controlling the flow of steam through a dryer drum in a paper machine.

Although the instant invention may have application in connection with the control of flow of steam in various other devices, it is particularly well adapted to use in connection with a paper machine dryer drum and will be described hereinafter primarily with respect to this use. A dryer drum of a paper machine comprises a generally cylindrical shell, spaced heads extending radially across the shell to close the open ends thereof and carrying means for journaling the shell for rotation, means for introducing a heat exchange fluid such as steam into the interior of the shell, and means for withdrawing condensate from the interior of the shell. In the dryer section a number of such shells are spaced relatively closely and the paper web travels over a substantial portion of the surface of each whereupon it is dried by the heat furnished from the shell. As will be appreciated, when the paper machine is in operation a substantial amount of steam condensation takes place in each shell because of the heat required to volatilize the moisture in the web. The condensate takeoff line extends from near the bottom of the shell outwardly (and axially) from the shell and this line was heretofore connected to a trap or similar means for permitting removal of condensate from the interior of the drum.

As will be appreciated, the steam in the interior of the drum is under a substantial pressure and this pressure is reduced slightly across the drum because of steam condensation therein during full operation, so that in full load operation the pressure on the condensate line is substantially the same as the pressure within the dryer drum itself and control means in the condensate line could be provided which would operate to maintain a constant back pressure (and therefore a constant steam pressure and temperature within the drum). The difficulty here is that during a break in the paper web, or during startup of the paper machine, there is no load on the dryer drum and condensation takes place very slowly, if at all. The drawoff line is thus filled only with steam, which results in "blowing out" of substantial amounts of steam through a trap or similar type of condensate flow control means or valve. As will further be appreciated, the type of valve which might be used to control the flow of liquid condensate (permitting an appreciable volume of liquid therethrough) is ordinarily not adequate to control the flow of live steam under pressure. Also, control merely by maintaining a constant back pressure in a dryer drum is not sufficient, because the dryer drum could be substantially filled with condensate and a relatively small amount of live steam could still exert the "control" back pressure on the entire body of condensate in the drum.

In view of the foregoing, control of dryer drum operation has involved a number of problems for the prior art workers. The instant invention affords a solution to

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these problems by providing a new and different type of control arrangement which is readily responsive to abrupt load changes in the operation of the dryer drum and which is effective in preventing excessive steam losses in the operation of the dryer drum. In essence, the instant invention involves a control means comprising an initial separator which separates the condensate and live steam removed by the condensate drawoff line, followed by a flow measuring device which measures the rate of flow of steam (in the absence of the condensate) coming out of the separator, next followed by a flow control valve which operates in response to the rate of flow measured by the measuring device. In this way the flow rate of live steam in the absence of condensate actually being withdrawn from the drum may be measured or controlled (if the steam passes therefrom to another drum). A certain minimum amount of steam flow rate indicates that there is no appreciable condensate level; and a certain maximum steam flow rate indicates that excessive steam losses are being caused. Accordingly, the control valve is actuated to open or close in order to maintain the desired conditions in the drum.

It is, therefore, an important object of the instant invention to provide an improved paper machine dryer drum arrangement, and more particularly, an improved device for controlling the flow of steam through a paper machine dryer drum.

It is another object of the instant invention to provide an improved device for controlling the flow of steam through a dryer drum in a paper machine, comprising a separator connected to the drum for drawing off steam and condensate therefrom, said separator maintaining a condensate level therein, a conduit connected to said separator above the condensate level for drawing off steam therefrom and a valve in the conduit responsive to the rate of flow of steam in said conduit.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

Figure 1 is a sectional elevational view of a dryer drum employed in the invention;

Figure 2 is essentially a diagrammatic view showing the control device employed in the practice of the instant invention; and

Figure 3 is a diagrammatic view of a dryer arrangement embodying the invention.

As shown on the drawings:

In Figure 1, the reference numeral 10 refers generally to a dryer drum of the present invention including a cylindrical shell 11 having open ends closed by annular heads 12 and 12a welded thereto as at 13 and extending radially thereacross.

Each of the annular heads 12 and 12a, respectively, has welded thereto about its inner periphery an annular journal ring 14 having outer annular recesses 15 formed therein for a purpose to be hereinafter more fully described. A generally cylindrical collar 16 is secured to the inner face of each of the rings 14, the collar 16 extending interiorally of and concentrically with the shell 11. A plurality of radially extending generally triangular reinforcing ribs 17 are positioned between each of the collars 16 and the associated head 12 or 12a to reinforce the heads against the axial and radial loads imposed thereon. It is to be noted that the shell 11, heads 12 and 12a, collars 16, 16 and reinforcing ribs 17 are all of the same thickness and are all welded into a single assembly.

A journal 18 having a peripheral mounting flange 19 and an axially extended axle portion 20 is secured to the

journal ring 14 of the head 12. The journal 18, secured to the head 12 by means of screws 21, is provided with an axially extending bore 22 and an enlarged, countersunk bore recess 23 concentric with the bore 22 and opening toward the interior space defined by the shell 11. A similar journal 18a is similarly secured to the opposing head 12a by bolts 21a in axial alignment with the first journal 18, the journal 18a having a bore recess 23a but no axially extending bore.

The bore 22 of the journal 18 receives a pair of concentric conduits, namely, a steam inlet line 24 (connected to a suitable source of steam under pressure which is not shown) and a nesting condensate drain line 25 extending axially therethrough. The conduits 24 and 25 are secured in the bore by a conduit centering plate 26 seated in a countersunk recess concentric with and surrounding the bore 23, the plate 26 being secured to the journal 18 by means of screws 27 extending through the plate 26 and into the journal 18.

A conduit terminal block 28 is mounted upon the terminal end of the concentric conduits 24 and 25 extending into the interior of the shell 11. The block 28 is generally cylindrical in outline and includes an interiorly threaded recess 29 receiving a correspondingly threaded end of the steam inlet line 24. The steam inlet line 24 threaded into the opening 29 communicates with the interior of the drum 11 through radially aligned openings 30 in the block 28. A condensate chamber C, separate and apart from the steam inlet line 24, is defined by the block 28 and the extremity of the condensate header 25 threadedly received by the block 28.

A dipper conduit 31 extends radially across the interior of the shell 11. The dipper conduit has a reduced end 32 seated in a tapered mouth 33 communicating with the chamber C and it extends generally radially of the shell to terminate in a dipper 34 having an open intake mouth 35. The dipper 34 is held in position by a clamp member 36 suitably secured to one of the supports 17 by bolts 37 so that the mouth of the dipper 34 will remain close to the inside of the shell 11.

The instant dryer drum steam inlet and condensate outlet arrangement is described in detail in Lloyd Hornbostel Patent No. 2,651,114 and need not be further described herein since it is not the specific feature of this particular arrangement which constitutes the instant invention. Instead, referring to Figure 2, the instant invention comprises a dryer drum 10, first means 24 connected to a source of steam S under pressure feeding steam into the interior of the drum 10, second means 25 extending from the interior of the drum 10 and receiving steam and condensate from the drum 10, a separator 40 connected to the second means or conduit 25 to receive steam and condensate to maintain a condensate level L therein, a first drawoff conduit 41 taking condensate out from the bottom of the separator 40, a second drawoff conduit 50 taking steam out from above the condensate level L in the separator 40, flow measuring means 60 in the second conduit 50 and a valve 70 in the second conduit 50 responsive to the flow measuring means 60.

Referring to Figure 2 in detail, it will be noted that steam flows from the source S past a suitable trap 38 into the steam inlet conduit 24. The condensate formed, plus a certain amount of steam, is picked up in the dipper 34 and flows out through the condensate conduit 25 through a line 39 into the separator 40. The separator 40 is an ordinary liquid-vapor separator of sufficient volume to permit the condensate to fall to the bottom and be maintained at a level L therein by means of level control means 42 actuating a letdown or drain valve 41a in the drain conduit 41. The steam remaining in the separator 40 then flows out the top or out the drawoff line 50 communicating with the separator 40 above the liquid level L and through a flow measuring means 60. As here shown, the flow measuring means comprises an orifice 61 through which the steam in the line 50 flows and high

pressure and low pressure taps 62 and 63 above and below the orifice 61 communicating with a pressure differential sensing control box 64. The pressure differential sensed by the control box 64 indicates the rate of steam flow through the orifice 61. The rate of steam flow through the orifice 61 indicates the amount of live steam that is being removed with the condensate in the condensate header 25. As will be appreciated, it is desired to operate the dryer drums with a minimum amount of condensate therein, so that all portions of the periphery of the drum 10 will be exposed to live steam under the pressure desired so as to impart the same approximate temperature to all points in the drum periphery 10. The presence of some condensate in the drum 10 is, of course, inevitable during normal operating conditions but this condensate is removed with a certain amount of live steam to help force the condensate or carry the condensate out to the header 25. A certain minimum amount of steam flow through the measuring device 60 is thus desired to show that there is no appreciable condensate level in the drum 10. As will be appreciated, if there were a condensate level in the drum 10 only condensate would flow into the separator 40 and no steam flow would be registered in the measuring device 60. In such case, the pressure differential box 64 would signal to the main control 65 for the valve 70 and the main control 65 would then open the valve 70, which would relieve any pressure holding the condensate back in the header 25 and permit maximum flow of condensate through the header 25. This is, of course, an extreme condition and the condensate header 25 is designed to be of sufficient size to permit the flow of much more condensate than would expect to be formed in a drum 10, so that any level of condensate in the drum 10 would be very quickly removed.

If, on the other hand, the paper web in the machine breaks or for some other reason a wet web is no longer applied to the surface of the drum 10, condensate formation therein falls off rapidly and substantially only live steam flows out through the condensate header 25. This results in a high flow rate through the measuring device 60, and a noticeable pressure drop across the orifice 61. The pressure drop sensing box 64 then signals the main control box 65 which in turn closes the valve 70 to permit some pressure to be built up (either by throttling the valve 70 or by actually closing the valve) in the separator 40 to resist the flow of live steam through the condensate header 25. Here again, the main control box 65 requires a signal of at least a minimum pressure differential or it will open the valve 70, so a minimum amount of live steam flow will be permitted under circumstances when no paper load is applied to the drum 10. This minimum amount of steam flow is, however, merely enough to keep the lines open and does not involve great losses of steam such as were experienced in connection with the prior art devices for controlling the flow of steam through a dryer drum. The pressure differential sensing box 64 is, of course, standard control equipment for an orifice-type control and need not be described further. The main control box 65 is also a standard piece of equipment of the type which controls the valve in response to a given signal. In this case, the control box 65, which may actuate the control valve 70 with compressed air or other suitable actuating means holds the valve 70 open when the pressure differential signal from the box 64 indicates a pressure differential within a given range. If the pressure differential falls below the range, the control box 65 urges the valve 70 toward open position and if the pressure differential signal indicates that the pressure differential is above the given range then the control box 65 urges the valve 70 toward closed position.

Without limiting the invention to any particular control means, it will be noted in Figure 2 that the upstream and downstream taps 62 and 63 communicate

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with opposite ends of a cylinder 64a containing therein an axially movable spring-urged piston 64b which moves to the right when the upstream pressure is too great and to the left when the upstream pressure is too little. Movement of the piston 64b to the right opens a valve 64c communicating with control air under pressure in a header 66, and movement of the piston in the opposite direction closes the valve 64c. Opening or closing of the valve 64c communicates increased or decreased air pressure to the spring-urged side of a piston 65a within the cylinder 65b in the main control box 65. On the opposite side of the spring-urged cylinder 65a is a chamber which is in communication through a throttle valve 65c with the control air header 66 so as to resist movement of the piston 65 upwardly. Movement of the piston 65a upwardly opens a control valve 67 also communicating with the air pressure header 66 which in turn imparts greater control pressure to the valve 70 urging the valve 70 closed. Movement of the piston 65a downwardly serves to throttle the valve 67 relieving pressure applied to the regulating valve 70 causing the valve to open.

The instant control device is also provided with a condenser 80 at the end of the steam drawoff line 50. The steam drawoff line 50 after taking steam through the measuring device 60 and the regulating valve 70 feeds into a coil 81 wherein the steam is condensed and taken off through a drain valve 82, or a trap (not shown) and any air or other uncondensable gas in the steam passes through the coil 81 and out the vent line 83. The coil 81 is arranged for heat exchange with cooling water fed into the condenser 80 through the line 84 and discharged through the line 85. The condenser 80, of course, functions to avoid blowing live steam into the atmosphere of the plant, but it has another important function. The condenser 80 removes all live steam that has flown through the drawoff line 50 in the coils so as to drastically reduce the pressure at this point. This drastic pressure reduction effects the entire flow rate of steam through the drawoff line 50 and through the flow measuring device 60. In other words, if a substantial amount of air is contained in the steam being drawn off this air will create a slight back pressure even in the coils 81 so that flow of gas through the measuring device 60 will be slower. This slower flow through the measuring device 60 will cause signals to be sent to the control boxes 64 and 65 so that the valve 70 will remain open, which is desirable in order to purge air from the system and also because air lost to the atmosphere is not an economic loss such as steam lost to the atmosphere. The condenser 80 thus functions to introduce the quality of the vapor passing through the regulating valve 70 as a function of the control.

The arrangement of Figure 2 hereinbefore described shows the use of the instant control device for controlling steam withdrawn from an individual dryer drum so as to prevent excessive loss of steam during no-load operation. In contrast, in Figure 3, an arrangement is shown for the use of the instant control device in the operation of an entire dryer section comprising a plurality of dryer drums.

In Figure 3, there is shown a main steam header 100 which supplies steam to a first section A of the dryer through a steam line 101 and into a secondary header 102. The steam flow from the main header 100 to the secondary header 102 is controlled by a control valve 103 which in turn is controlled by a control box 104 operated in response to the steam pressure in the secondary header 102 (as indicated by dotted lines). As an operating example the control box 104 operates the control valve 103 to maintain constantly a steam pressure of eight pounds (gauge) per square inch in the secondary header 102.

The secondary header 102 feeds steam to the first

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section of dryer drums which is defined by the drums 105, 106, 107, 108, 109, 110 and 111. As is indicated in connection with the first drum 108, live steam enters from the header 102 through the inlet line 108a and steam and condensate are removed from the drum 108 through the outlet line 108b which feeds into a condensate header 112 receiving condensate from all of the drums 105-111, inclusive, as the diagrammatic view in Figure 3 shows. Heretofore, the flow of steam through the bank of dryer drums 105-111, inclusive, was controlled by maintaining a desired pressure differential across the secondary header 102 and the condensate header 112 so as to maintain, for example, about 3 pounds (gauge) pressure in the condensate header 112. As hereinbefore explained, this leads to operation difficulties.

In the instant invention, the steam and condensate from the condensate header 112 are fed through a line 113 into a vapor liquid separator 114 provided with a trap device 115 for drawing off liquid at the bottom thereof. Steam from the separator 114 is led off through a line 116 (above the condensate level in the separator 114) and into a steam header 117 for the second section, or section B of the dryer. As will be noted, the main steam header 100 also feeds steam into the section B steam header 117 through a line 118 and the steam flow through the line 118 is controlled by a control valve 119. The valve 119 in the conduit system 117-118 thus is in control of the flow of steam through the section B header 117, even though additional steam is passed into the header 117 from the line 116 connected to the separator 114.

The line 116 is provided with a flow measuring device in the form of an orifice 120, which is here shown diagrammatically but which may be the same as the orifice 61 (or the control means 60) shown in Figure 2, with suitable upstream and downstream taps 121 and 122 connecting to a control box 123 which in turn actuates the control valve 119.

It will be appreciated that a certain minimum of steam is required to keep each of the dryer drums cleaned out even under no-load operation. This minimum amount is multiplied by the number of dryer drums in the first section, section A, and this figure in flow rate of steam is the minimum amount of steam flow which the control box 123 will permit through the orifice 120. On this basis if less than the minimum amount of steam flow is passing through the orifice 120 the control box 123 starts to close the control valve 119. On the other hand, if the amount of steam flow through the orifice 120 reaches a predetermined maximum amount, then the control box 123 starts to open the valve 119 so as to increase the back pressure against the line 116 and decrease the flow rate (in pounds of steam) through section A.

Since a minimum amount of steam flow through section A is required to keep the dryer drums cleaned out, the instant arrangement affords the advantage of using this minimum amount of steam (plus whatever additional steam may be required) in the dryer section B, thereby avoiding waste of the so-called "minimum" amount of steam required to clean out the dryer drums of section A.

In section B, there is a plurality of dryer drums 124, 125, 126, and 127. As indicated in connection with the drum 127 live steam feeds through the inlet line 127a from the header 117 and condensate is withdrawn from the condensate line 127b into a condensate header 128. The steam flows from the condensate header through a drop line 129 into another liquid vapor separator 130 equipped with a suitable condensate removing trap 131. Live steam free from condensate flows out of the separator 130 through a conduit 132 and into a third header 133 for the third dryer section C. The steam is also fed into the section C header 133 through an inlet line 134 containing a control valve 135. A flow measuring device in the form of an orifice 136 with upstream 137 and downstream taps 138 communicating with a control box

139 measures the rate of steam flow from the conduit 132 into the header 133; and the control box 139 actuates the control valve 135 in response to such rate of flow in the manner hereinbefore described.

In section C a minimum number of dryer drums is employed. Preferably only two or three dryer drums will be employed in the last section so that a minimum loss of steam therethrough occurs, although it will be appreciated that even this minimum loss of steam can be substantially eliminated by using the device shown in Figure 2 to control steam flow through section C, but this arrangement is not shown in Figure 3 for the purpose of simplification. Instead, in Figure 3 a pair of dryer drums 140 and 141 are shown and steam flows, as indicated in connection with the drum 141, from the header 133 through steam inlet line 141a into the drum 141 and out a condensate line 141b to a condensate header 142, and from there into a separator 143. The separator is equipped with the usual condensate removing trap 144, and live steam flows out of the separator 143 through a conduit 145 and into a condenser 146. The live steam flowing through the conduit 145 and into the condenser 146 is, of course, substantially wasted (and as mentioned hereinbefore the amount of steam thus wasted may be held at a minimum by using the device shown specifically in Figure 2). This amount of waste steam is, however, only approximately the amount absolutely necessary to blow through the dryer drums 140 and 141 to keep the lines cleared.

It must be appreciated that in actual practice the first section A may contain as many as thirty dryer drums and at a minimum rate of approximately 100 pounds of steam per drum in order to keep the lines clear, some 3,000 pounds of steam must pass through the conduit 116 as a minimum figure. In contrast, at the same minimum rate of approximately 100 pounds of steam per dryer drum, only a minimum of 200 pounds of steam must pass through the dryer drums 140 and 141 in order to keep the lines clean. All the rest of the steam is consumed usefully in the dryer arrangement. The second section B will preferably contain about one dozen dryer drums which can adequately dispose of the minimum amount of steam flow required at the exit of section A; and as mentioned, the third section C will contain in actual practice two or three drums which can adequately take care of the minimum amount of flow coming at the exit of section B.

Previous workers in the art have recognized that a steam trap did not offer the proper characteristics for insuring that paper machine dryers were properly drained and ventilated or circulated with steam. For this reason systems have been set up wherein a fixed difference in pressure was maintained between the inlet and outlet of the dryers of each section. This system has been very satisfactory in speeds up to approximately 1500 F. P. M. At 1500 F. P. M. speeds and below a difference in pressure of approximately 3 pounds per square inch is sufficient. However, at speeds of 2000 F. P. M. and greater the difference in pressure across the dryers may have to be 8 p. s. i. or greater. The amount of difference in pressure across the dryer required to give drainage is a function of the speed or centrifugal force and the rate of condensing or percentage of steam and water passing up the condensate pipe. In high speed dryers the condensate pipes rotate with the dryer for mechanical design reasons. At low speeds and low condensing rates the pressure differential across a dryer can be quite low and still insure drainage and adequate circulation. However, both increased speed and increased condensating rate require increased differential. On new high speed machines where sufficient differences in pressure was set and controlled across the dryers to insure drainage at high speed and high condensing loads, the quantities of steam blown through the dryers and out the condensate pipes has been far excessive when

the speed and condensing rate was lowered. Since a fixed amount of blow through will insure proper ventilation and drainage of condensate this invention proposed to use the flow measurement as the controlled variable and automatically adjust the pressure drop across the dryers in order to achieve the correct amount of flow. Such a system automatically adjusts itself for different speeds and condensing conditions and results in a considerable saving in steam. It also prevents the loss of control and drainage on the system by passing too much steam to the succeeding sections and thus causing clogging of the system.

It is thus apparent that the instant invention involves a paper machine dryer section wherein the differential pressure across a dryer section is automatically adjusted by suitable control means as a function of the uncondensed blow-through steam of the dryers of said section.

A specific embodiment of the invention involves a cascaded paper machine dryer drainage system (Figure 3) comprising sections of one or more dryers supplied by supply and discharge headers for each section, each dryer supplied with a rotating steam fit for separation of inlet and outlet flows, each dryer supplied with a syphon system 31, 34 through which must pass the condensate and the blow-through steam, a condensate separator for separating blow-through steam and condensate, means for removing the condensate, a duct leading from the separator to the supply header of the next dryer section, a valve supplying steam to the said supply header, flow measuring means in said flow duct wherein said valve is regulated by suitable control means to control the flow of steam in said duct to a relatively constant value regardless of speed or condensing rate of dryers of said first section.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. A device for controlling the flow of steam through a dryer drum in a paper machine, comprising a separator connected to the drum for drawing off steam and condensate therefrom, said separator maintaining a condensate level therein, a conduit connected to said separator above the condensate level for drawing off steam therefrom, a valve in said conduit in control of flow of steam therethrough, and means in said conduit responsive to flow rate of steam in the conduit in control of said valve to selectively move the valve toward closed position in response to an increase in the flow rate of steam in the conduit and move the valve toward open position in response to a decrease in the flow rate of steam in the conduit.

2. A device for controlling the flow of steam through a dryer drum in a paper machine, comprising a separator connected to the drum for drawing off steam and condensate therefrom, said separator maintaining a condensate level therein, a conduit connected to said separator above the condensate level for drawing off steam therefrom, an orifice in said conduit between said valve and said separator, and means responsive to the pressure drop across said orifice in control of said valve to selectively move the valve toward closed position in response to an increase in pressure drop across said orifice and move the valve toward open position in response to a decrease in pressure drop across said orifice.

3. In a paper machine dryer section, a dryer drum, first means connected to a source of steam under pressure feeding steam into the interior of said drum, second means extending from the interior of said drum receiving steam and condensate from the drum, a separator connected to the second means to receive steam and condensate and to maintain a condensate level in the separator, a first drawoff conduit taking condensate out from the bottom of the separator, a second drawoff conduit taking steam out from above the condensate level in the separator

tor, flow rate measuring means in said second conduit, and a valve in said second conduit responsive to said flow rate measuring means, said flow rate measuring means actuating said valve to selectively move the valve toward closed position in response to an increase in the flow rate of steam in the conduit and move the valve toward open position in response to a decrease in the flow rate of steam in the conduit.

4. In a paper machine dryer section, a dryer drum, first means connected to a source of steam under pressure feeding steam into the interior of said drum, second means extending from the interior of said drum receiving steam and condensate from the drum, a separator connected to the second means to receive steam and condensate and to maintain a condensate level in the separator, a first drawoff conduit taking condensate out from the bottom of the separator, a second drawoff conduit taking steam out from above the condensate level in the separator and feeding the steam into a condenser, a valve in control of steam flow in said second conduit between said separator and said condenser, and flow rate measuring means in said second conduit between said separator and said valve and in control of said valve to selectively move the valve toward closed position in response to an increase in the flow rate of steam in the conduit and move the valve toward open position in response to a decrease in the flow rate of steam in the conduit.

5. A dryer drainage system comprising a first dryer section including a plurality of dryer drums, first steam means feeding steam into the drums of said first section, first condensate means removing condensate and steam from the drums of said first section, a second dryer section including another plurality of dryer drums, second steam means feeding steam into the drums of said second section, second condensate means removing condensate and steam from the drums of said second section, a valve controlling flow of steam into said second steam means, a conduit feeding steam from said first condensate means to said second steam means, and means responsive to flow rate of steam in said conduit in control of said valve to selectively move the valve toward closed position in response to an increase in the flow rate of steam in the conduit and move the valve toward open position in response to a decrease in the flow rate of steam in the conduit.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,869,248

January 20, 1959

Edgar J. Justus

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 59, after "therefrom" and before the comma, insert -- , a valve in said conduit in control of flow of steam therethrough --.

Signed and sealed this 17th day of November 1959.

(SEAL)
Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents