

March 24, 1959

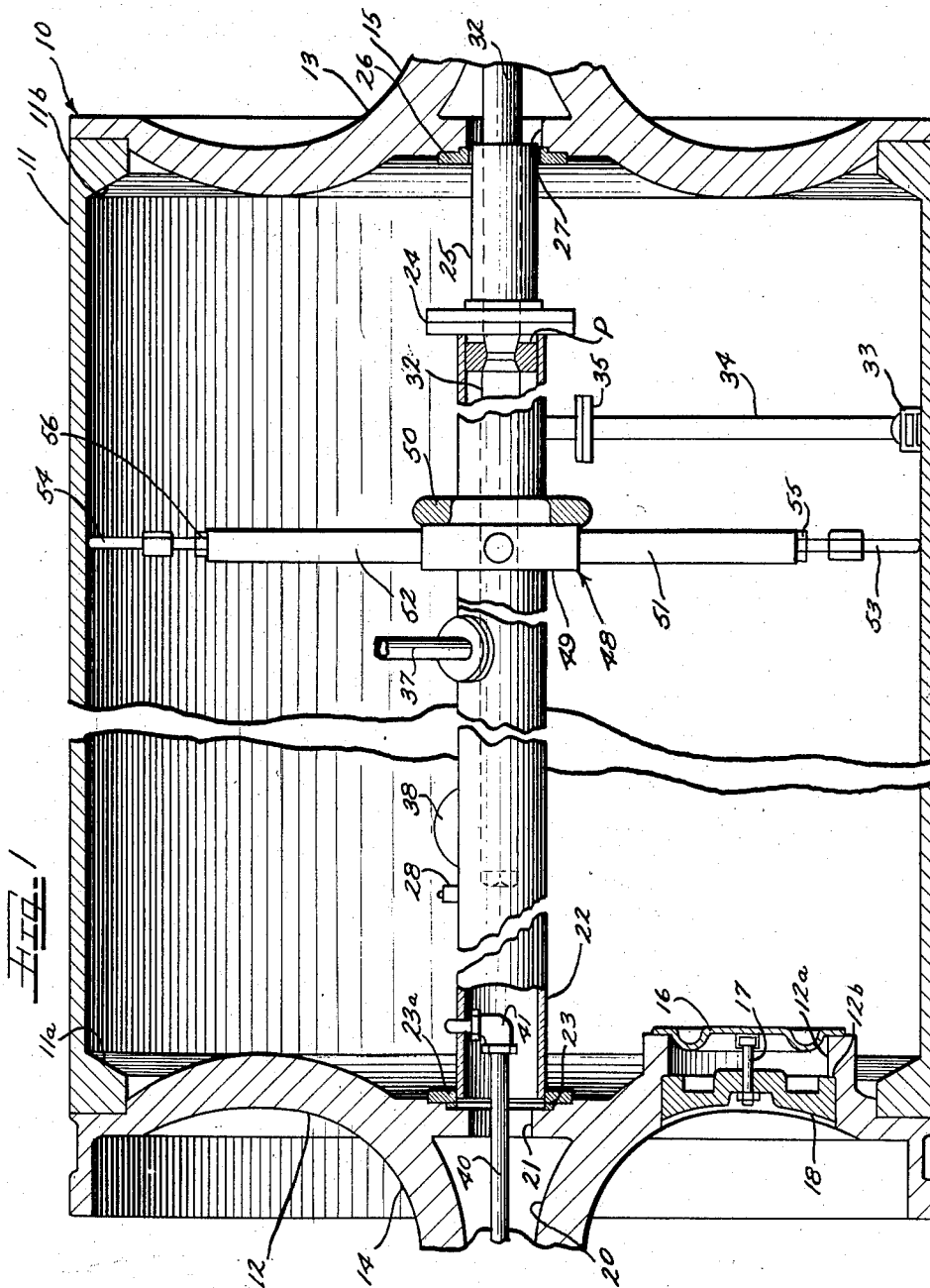
E. S. SKINNER

2,879,039

PAPER MACHINE DRUM ARRANGEMENT

Filed Jan. 18, 1957

2 Sheets-Sheet 1



Inventor
EUGENE STERLING SKINNER

Lee, Sherman, Morris, Chase & Simpson Attys

March 24, 1959

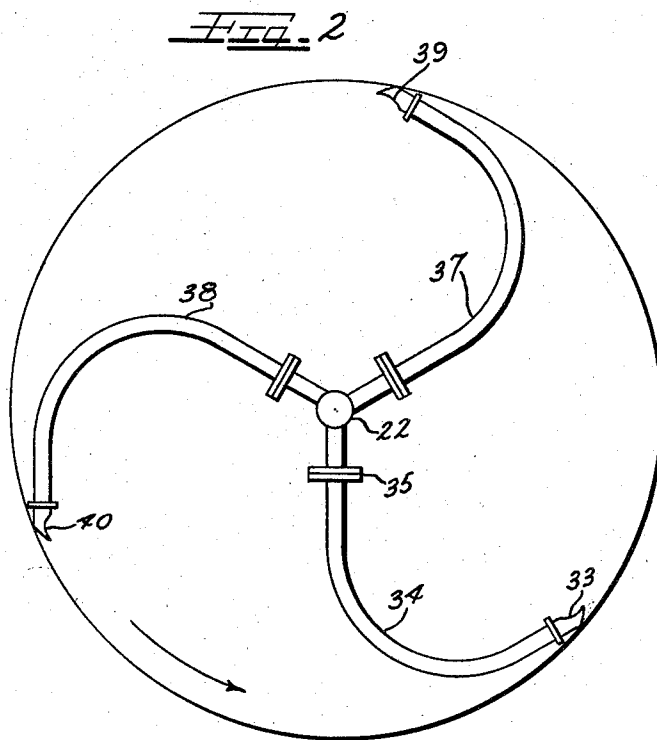
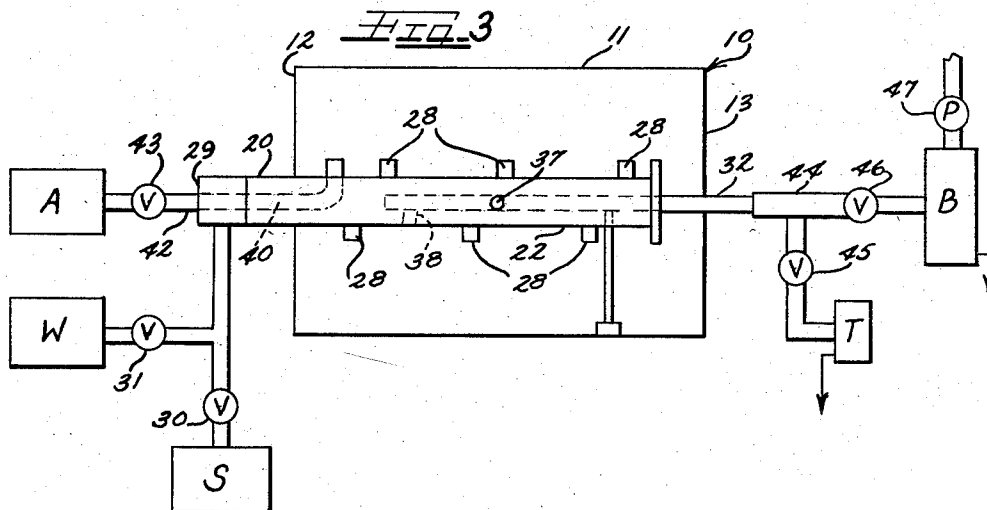
E. S. SKINNER

2,879,039

PAPER MACHINE DRUM ARRANGEMENT

Filed Jan. 18, 1957

2 Sheets-Sheet 2



Inventor
EUGENE STERLING SKINNER

Att By Herbert M. Mearns, Charles E. Simpson

Attus

1

2,879,039

PAPER MACHINE DRUM ARRANGEMENT

Eugene Sterling Skinner, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application January 18, 1957, Serial No. 634,997

4 Claims. (Cl. 257-95)

This invention relates to a paper machine drum, and more particularly, to a drum that may be used in paper machines as a dryer drum or a cooling drum.

As conventionally employed in the art, dryer drums for paper machine drying sections generally consist of a cylindrical shell, spaced heads extending radially across the shell to close the open ends thereof and carrying means for journaling the shell for rotation, and means for introducing a heat exchange fluid into the interior of the shell. Since steam is the heat exchange fluid normally employed, means are also provided for removing the aqueous condensate from the interior of the drum during use.

The instant drum is adapted for use as a dryer drum as well as a cooling drum, in that the instant drum is provided with inlet means for steam or cooling water. In addition, the instant drum has certain structural features which permit its use with either steam or water. The instant drum also is provided with an additional conduit inlet for air, so that a pressure differential may be maintained across the dippers which ordinarily pick up the drainage fluid from the drum.

It is, therefore, an important object of the instant invention to provide an improved paper machine drum structure.

It is a further object of the instant invention to provide a paper machine drum for use with a temperature controlling fluid which comprises a cylindrical shell, end heads on said shell, concentric fluid inlet and drainage conduits mounted in said shell, a plurality of axially spaced nozzles on said inlet conduit communicating with the shell interior, a plurality of axially spaced dippers engaging the inner periphery of the shell, and individual dipper conduits affording communication between each dipper and said drainage conduit.

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

On the drawings:

Figure 1 is a sectional elevational view taken substantially along the longitudinal axis of rotation of a paper machine drum embodying the instant invention, with parts broken away and parts shown in section;

Figure 2 is essentially a diagrammatic view taken from one end of the dryer drum of Fig. 1 showing the dipper and dipper conduit arrangement in the drum; and

Figure 3 is essentially a diagrammatic view corresponding to the view of Fig. 1, but showing the fluid inlet and drainage arrangements.

As shown on the drawings:

A drum embodying the instant invention, indicated generally by the reference numeral 10, comprises a generally cylindrical shell 11 having its open ends closed by annular heads 12 and 13 with journals (shown partially) 14 and 15, respectively, mounted thereon to mount the drum 10 for rotation about its axis. As here

2

shown, the head 12 and journal 14 are integral, and the same is true for the head 13 and journal 15. The heads 12 and 13 are suitably secured to end flange portions 11a and 11b, respectively, of the cylinder 11 by screws (not shown) or similar mounting means. The head 12 is provided with a manhole 12a sealed with a sealing member 16 held in position by a bolt 17 carried on a clamp 18 urged against a flange portion 12b in the aperture 12a.

It will be noted that the journal 14 is hollow so as to define an inlet conduit portion 20 and the head 12 merged with the journal 14 also has a central aperture 21 opening into the drum. An inlet header 22 is mounted at the mouth of the opening 21 and suitably sealed thereat by screws (not shown) mounting a gasket 23 and ring 23a. The header 22 extends axially through the central portion of the drum 10 substantially to the other head 13 where it is closed off by packing P and a flange mounted closure plate 24 (secured by bolts not shown) that is also mounted on a short pipe section 25 which in turn is supported by an apertured plate 26 mounted in an aperture 27 in the head 13.

Securely mounted in the manner described in the shell 11, the header 22 receives incoming heat exchange fluid in the form of steam or water and sprays the same into the interior of the drum through a plurality of axially spaced nozzles 28. Only one of the nozzles 28 is shown in Fig. 1, but in Fig. 3, it will be seen that the nozzles 28 are axially spaced and also peripherally spaced about the outer peripheral surface of the header 22, so as to spray in all directions. This arrangement is particularly effective for use with water when cooling of the drum 10 is desired and it is also effective for use with steam when heating of the drum 10 is desired. Referring again to Fig. 3, it will be seen that the header 22 communicates with the journal conduit 20 (which is, of course, mounted for rotation) which in turn communicates with a non-rotatable block 29 sealingly engaging the journal conduit 20 and affording a non-rotating continuation thereof. The block 29 communicates with the source of steam S through one valve 30 or a source of cooling water W through a different valve 31, so that either water or steam may be fed into the block 29, journal conduit 20 and header 22.

Referring to Fig. 1, it will be noted that a drainage conduit 32 extends through the hollow journal 15 and the aperture 27 in the head 13 into the drum 11. The drainage conduit 32 extends concentrically through the pipe support 25, the inlet conduit closure plate 24 and the inlet conduit 22 substantially to the opposite head 12. A dipper 33 is mounted engaging the bottom periphery of the cylinder 11 and an individual dipper conduit 34 (with the flange joint 35 therein) affords communication between the drainage conduit 32 and the dipper 33. The dipper conduit 34 maintains the dipper 33 in fixed position against the inner periphery of the shell 11 and it passes through the wall of the inlet header 22 and connects with the drainage conduit 32 within the inlet header 22 (via welded joints).

Actually, there are three dippers each with an individual dipper conduit (the remaining two being shown partially at 37 and 38 in Figs. 1 and 3). These dippers and dipper conduits are axially spaced as shown in Figs. 1 and 3 and, as shown in Fig. 2, the dippers 33, 39 and 40 are also peripherally spaced. The peripheral spacing is substantially equal, that is, approximately 120° between adjacent dippers. The axial spacing between the dippers is also approximately equal, with the dippers 33, 39 and 40 being spaced apart axially about one-third of the axial dimension of the drum. In this way sufficient capacity is provided to remove all drainage liquid when cooling water is used rather than steam in the drum 10.

It will further be noted from Fig. 1 that a second

3

inlet conduit 41 is mounted concentrically within the hollow journal 20 and head aperture 21 and the inlet header 22. Then the inlet 40 turns through an elbow 41 and opens through the wall of the conduit 22 into the interior of the drum 10. As indicated in Fig. 3, this second inlet conduit 40 makes sealing engagement with a conduit 42 which is a continuation thereof in and through the block 29. A valve 43 in the continuation conduit 42 controls the flow of air from a source of air under pressure A through the conduit 42, the conduit 40 and directly into the interior of the drum 10.

As indicated in Fig. 3 when steam is to be employed within the drum 10, the valves 31 and 43 are closed and the valve 30 is opened so that the steam may flow into the inlet header 22 and out the nozzle 28. Condensate then forms along the inner periphery of the drum 10 and is picked up by the dippers 33, 39 and 40 from which it is fed into the drainage conduit 32 mounted within the head 13 and journal 15. From the drainage conduit 32 steam and condensate flow into a non-rotating T 44 then through valve 45 and a trap T which separates the steam from the condensate.

When water rather than steam is used in the drum 10, the valve 30 is closed and the valve 31 is opened so that water may flow into the inlet header 22 and through the nozzles 28. At the operating speed of the drum 10 the water is urged against the inner periphery of the cylinder 11 and held there in the form of a film or layer of water. Water is collected from this film by the dippers 33, 39 and 40 and conducted into the drainage conduit 32. From there the water passes through the stationary T 44, a valve 46 and into a gas water separator B.

Means are provided for maintaining a pressure differential between the interior of the shell 11 and the drainage conduit 32 or the separator B. One way of accomplishing this is to open the separator to the ambient atmosphere and bleed air under pressure through the valve 43 and the inlet conduit 40 directly into the interior of the drum 10. In this way the pressure within the drum 10 is slightly above atmospheric pressure and the water is urged through the dippers 33, 39 and 40 via the drainage conduit 32 into the separator B. Another way of accomplishing this is to actuate a suction pump 47 to evacuate the separator B, thus creating subatmospheric pressure in the separator B and drainage conduit 32. In either case, improved control of the operation is obtained, because the pressure differential can be correlated with the rate of water intake to the drum 10 through the nozzles 28 so that a combination of air and water is continuously passing through the valve 46 into the separator B. In this way the operator is assured of maintaining a film of water along the inner periphery of the drum 10 that is less than the height of the dipper opening.

Referring again to Figure 1, it will be noted that a centrally positioned spider element indicated generally by the reference numeral 48 supports the concentric inlet and drainage conduits 22 and 32. The support 48 comprises a ring 49 surrounding the conduit 22 and secured to a flange element 50 mounted on the conduit 22, plus a plurality of radially extending braces 51, 52 which have adjustable rods 53 and 54 threadedly received therein and fixed in position by lock nuts 55 and 56, respectively, so that the rods 53 and 54 will engage and support the cylinder 11. Preferably three or more supporting arms, such as the arms 51, 52 are employed in the central supporting member 48.

As mentioned, the instant roll has the advantage that it may operate either with steam or cooling water and that such operations can be changed back and forth merely by the manipulation of valves without any major mechanical changes. The cooling dryer (which is usually referred to as the "sweat" dryer) is used to cool and to moisten the web as it comes from the dryer part of the machine. In certain instances cooling is necessary to prevent subsequent deterioration of the sheet in the

4

mill roll. The sweat dryer in operation is usually maintained below the dew point of the surrounding air and thus condenses atmospheric moisture on its surface. This moisture is used to increase the moisture in the sheet to prevent brittleness in subsequent operations and to increase the effectiveness of the calendering operation. Heretofore, the usual procedure was to operate a dryer drum half full of water. This requires more power and may result in surges of power (at certain speeds) which will upset the stability of the machine drive. In addition, the circulation of cooling water in the dryer is uncertain and difficult to control. Also, if the operation of the machine is changed so as to require conversion of the sweat dryer to a heated dryer, complicated mechanical changes are frequently necessary. The instant device solves these various problems by the use of a relatively small amount of water in the drum at any time, when it is operated as a sweat dryer. Also, the instant invention permits the change from the sweat dryer to a heated dryer or vice versa merely by the manipulation of valves.

Another important point to consider is that the instant device, when operated as a sweat dryer, permits very accurate control of the actual thickness of the water film retained against the inner periphery of the drum. By the use of compressed air in the interior of the drum it is possible to maintain a water layer in the drum that is controlled by the position of the dipper mouth. If the water level rises too high the buildup of compressed air will drive the level down; whereas if the level of the water goes below the dipper the pressure of the compressed air will be relieved through the dipper. In addition, a comparable result may be obtained using a vacuum pump to draw water through the dipper. This operation has a further advantage in that evaporation of water within the dryer drum results in the creation of a vacuum therein and this causes a reduction of the water temperature in the film along the periphery of the drum. A resulting improved cooling effect is obtained.

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

I claim as my invention:

1. A paper machine drum for use with a temperature controlling fluid which comprises a cylindrical shell, end heads on said shell, an inlet conduit carried by one head and extending axially substantially to the other head within the shell, a drainage conduit carried by one head and extending axially substantially to the other head within the inlet conduit, a third conduit extending concentrically within one of said conduits and then through the wall of said one of said conduits within the drum, a plurality of axially spaced nozzles on said inlet conduit communicating with the shell interior, a plurality of axially spaced dippers engaging the inner periphery of the shell, and individual dipper conduits affording communication between each dipper and said drainage conduit.

2. A paper machine drum for use with a temperature controlling fluid which comprises a cylindrical shell, end heads on said shell, an inlet conduit carried by one head and extending axially substantially to the other head within the shell, a drainage conduit carried by the other head and extending substantially to the one head within said inlet conduit, a third conduit extending concentrically within the inlet conduit and then through a wall of the inlet conduit within the drum, a plurality of axially spaced nozzles on said inlet conduit communicating with the shell interior, a plurality of axially spaced dippers engaging the inner periphery of the shell, and individual dipper conduits affording communication between each dipper and said drainage conduit.

3. A paper machine drum for use with a temperature controlling fluid which comprises a cylindrical shell, end heads on said shell, concentric fluid inlet and drainage conduits mounted in said shell, a plurality of axially spaced nozzles on said inlet conduit communicating with

5

the shell interior, a plurality of axially spaced dippers engaging the inner periphery of the shell, individual dipper conduits affording communication between each dipper and said drainage conduit, and pump means communicating with the drainage conduit and creating a pressure differential between the shell interior and the drainage conduit.

4. A paper machine drum for use with a temperature controlling fluid which comprises a cylindrical shell, end heads on said shell, an inlet conduit carried by one head and extending axially substantially to the other head within the shell, a drainage conduit carried by the other head and extending substantially to the one head within said inlet conduit, pump means communicating with the drainage conduit and creating a pressure differential be-

6

tween the shell interior and the drainage conduit, a third conduit extending concentrically within the inlet conduit and then through a wall of the inlet conduit within the drum, a plurality of axially spaced nozzles on said inlet conduit communicating with the shell interior, a plurality of axially spaced dippers engaging the inner periphery of the shell, and individual dipper conduits affording communication between each dipper and said drainage conduit.

References Cited in the file of this patent

UNITED STATES PATENTS

2,703,224	Robinson	Mar. 1, 1955
2,707,836	Garrett	May 10, 1955