March 2, 1926. 1,575,249

E. E. BERRY ET AL

APPARATUS FOR REMOVING CONDENSATE FROM REVOLVING DRIERS

Filed Dec. 15, 1923 2 Sheets-Sheet 1

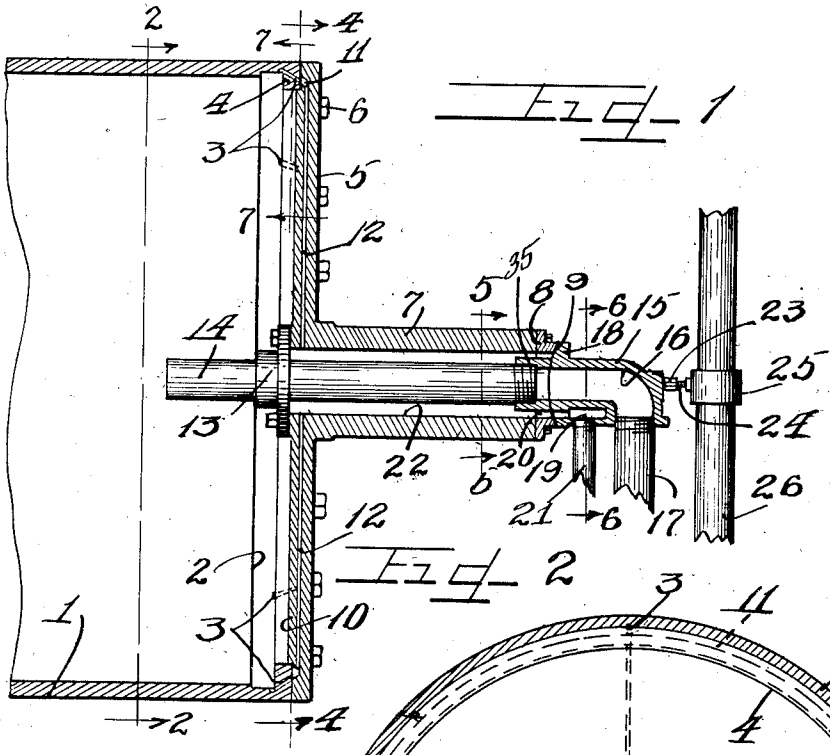


Fig. 1

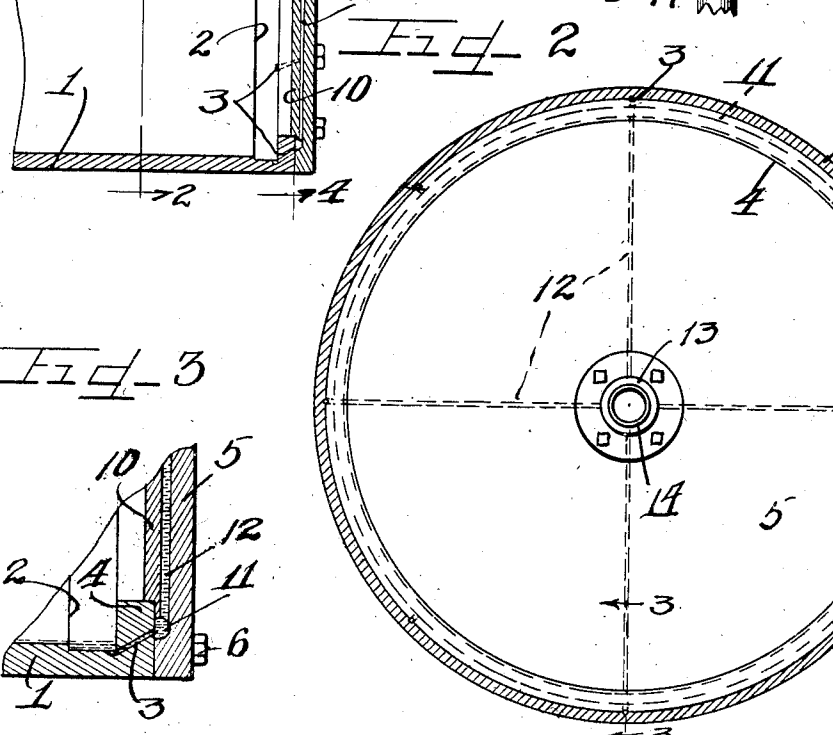


Fig. 2

Fig. 3

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Fig. 8

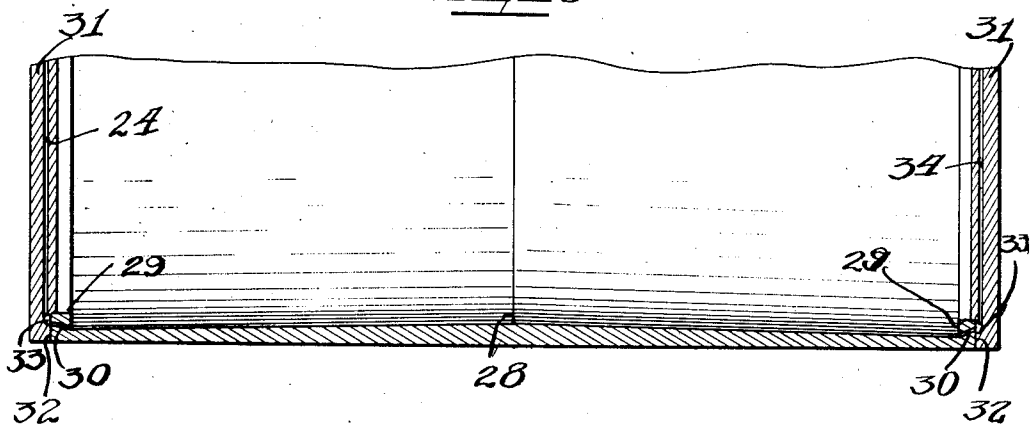


Fig. 5

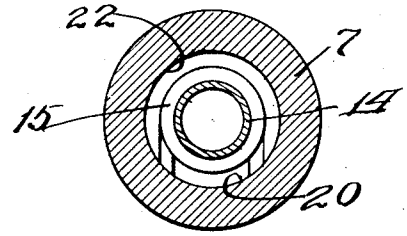


Fig. 6

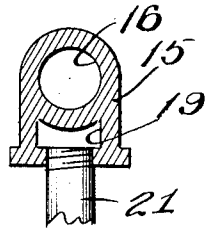


Fig. 4

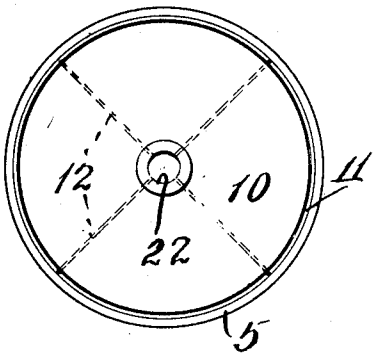
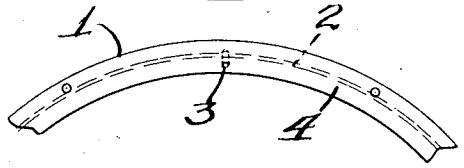


Fig. 7



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UNITED STATES PATENT OFFICE.

EARL ELWIN BERRY AND HAMILTON N. ROSS, OF BELOIT, WISCONSIN, ASSIGNORS TO BELOIT IRON WORKS, OF BELOIT, WISCONSIN.

APPARATUS FOR REMOVING CONDENSATE FROM REVOLVING DRIERS.

Application filed December 15, 1923. Serial No. 680,821.

To all whom it may concern:

Be it known that we, EARL E. BERRY and HAMILTON N. ROSS, citizens of the United States, and residents of the city of Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in an Apparatus for Removing Condensate from Revolving Driers; and we hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

In paper making machines the web after passing through the wet end of the machine during which time a part of the water is removed from the web, is conducted over a series of heated cylindrical driers which act to evaporate most of the remaining moisture from the web to produce paper. The cylinders are usually heated by steam which enters through the cylinder journals and heats the cylinders, the drying of the web causing the steam in the cylinders to condense. In drying machines of the type now extensively in use the condensed steam or water from each cylinder is removed by dippers or by means of a radially directed pipe which is bent to lead out through one of the cylinder journals. The method of removing the condensate from the cylinder out through a siphon pipe has not proven very satisfactory at high speeds since the water of condensation in the revolving drying cylinder, which usually ponds in the lower portion of the cylinder, is distributed by centrifugal force in a film around the inner peripheral wall of the cylinder and therefore makes it impossible to rapidly draw off the condensate. The condensate when not removed rapidly enough accumulates to such an extent at high speeds that the film of the condensate soon becomes thick enough to seriously impair the proper radiation of heat from the steam to the walls of the cylinders thereby interfering with the proper drying of the web.

This invention relates more particularly to an improved type of a paper machine drying cylinder so constructed that at high speeds the condensate is distributed in a thin film around the inner surface of the cylinder and is discharged rapidly enough through suitably arranged outlet grooves and passages in the end of the cylinder through which grooves and passages the condensate is forced by the pressure of the steam in the drying cylinder.

It is an object of this invention to provide an improved paper drying machine drying cylinder wherein the condensate is adapted to be rapidly discharged through a plurality of passages provided in the ends of the cylinder and communicating with peripheral grooves in the end portions of the inner surface of the cylinder to receive the condensate when the same is distributed in a film against the inner surface of the cylinder when the same rotates at high speeds, thereby maintaining the distributed film as thin as possible thus causing no material obstruction to the proper radiation of heat from the steam to the cylinder walls.

It is also an object of the invention to provide a method of rapidly discharging the condensate of a steam heated paper drying cylinder out through passages communicating with grooves in the inner peripheral surface of the cylinder.

It is an important object of the invention to provide a paper drying machine drying cylinder of simple and improved construction adapted to discharge a condensate out through outlets connected with the inner peripheral grooves of the cylinder to maintain the interior of the cylinder substantially free from accumulations of the condensate so that at high speeds the thickness of the film of condensate is maintained at a minimum so as not to interfere with the proper radiation of heat.

Other and further important objects of this invention will be apparent from the disclosures in the specification and accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a fragmentary longitudinal section through one end of a paper drying machine, drying cylinder embodying the principles of this invention.

Figure 2 is a transverse section taken on line 2—2 of Figure 1.

Figure 3 is a fragmentary detail section taken on line 3—3 of Figure 2.

Figure 4 is a reduced view of the inner face of the cylinder end plate taken on line 4—4 of Figure 1.

Figure 5 is an enlarged detail section taken on line 5—5 of Figure 1.

Figure 6 is an enlarged detail section taken on line 6—6 of Figure 1.

Figure 7 is a fragmentary detail view taken on line 7—7 of Figure 1.

Figure 8 is a fragmentary longitudinal section through a modified form of cylinder.

As shown on the drawings:

The reference numeral 1 indicates a paper making machine drying cylinder one end of which is closed by an end plate provided with a suitable journal for mounting the cylinder. The inner peripheral surface near the other end of the cylinder is provided with a peripheral groove 2 having the inner ends of a plurality of condensate outlet passages 3 communicating therewith. The outlet passages 3 incline outwardly toward the axis of the cylinder and are formed in a flange 4 integral with the end of the cylinder.

The cylinder is closed by means of an end closure plate 5 rigidly secured to the cylinder flange 4 by screw bolts 6. Integrally formed centrally on the closure plate 5 is a journal sleeve 7 having a journal ring 8 secured on the end thereof. The journal ring 8 is formed with an inwardly rounded end surface 9. The end plate 5 is cut away around the outer edge of the inner surface thereof to afford a boss 10 which projects into the ring flange 4 of the cylinder. A circular groove 11 is provided in the cut out portion of the end plate and has communicating therewith a plurality of radial passages 12 which open into the passage 22.

Rigidly secured by screw bolts or other means against the central portion of the end plate 5 is a flanged bearing ring 13 through which a stationary steam inlet pipe 14 projects into the cylinder. The pipe 14 projects through the journal sleeve 7 and has a bearing nipple or collar 35 secured on the end thereof and ground to afford a bearing surface which lies in the curved plane of the rounded surface 9. A bearing elbow 15 is provided at the outside of the bearing ring 8 and has a steam inlet passage 16 to which a steam supply pipe 17 is connected. Integrally formed on the elbow 15 is a bearing flange 18 having a round bearing surface against which the rounded surface 9 of the journal ring 8 and the rounded bearing surface of the collar 35 engage. Also formed in the elbow 15 is a condensate outlet passage 19 which registers with a condensate outlet opening 20 provided in the journal ring 8 (Figure 1). A discharge pipe 21 is connected with the elbow 15 and communicates with the condensate outlet passage 19. The rounded bearing flange 18 is adapted to be held against the rounded bearing surfaces of the members 8 and 35 by means of an adjustable nut 23 engaged on a screw 24 supported on a collar 25 mounted on a stationary pipe or post 26. The post 26 is located adjacent the end of the elbow 15.

Figure 8 illustrates a modified form of a paper drying cylinder 27 the walls of which are thickest at the middle of the cylinder at the point 28 and gradually taper toward both ends terminating against end flanges 29 each having a plurality of outlet passages 30 therein.

Each end of the cylinder 27 is closed by an end plate 31 which is cut away at the outer margin of the inner face at 32 and is provided with a ring groove 33 with which the passages 30 communicate. Each end plate 31 is also provided with a plurality of radial condensate outlet passages 34 the inner ends of which connect up with the condensate outlet passage in the journal sleeve of the cylinder similar to the arrangement illustrated in Figure 1.

The operation is as follows:—

Steam from the supply pipe 17 enters the paper drying cylinder 1 through the passage 16 of the elbow 15 and through the steam inlet pipe 14. The cylinder is heated by the steam and acts to dry a paper web which passes over the outer peripheral surface of the cylinder when the cylinder is rotated. During the drying process of the paper web the steam within the cylinder condenses and it is therefore necessary that the condensate be removed from the cylinder as rapidly and as completely as possible to permit proper radiation of heat from the steam to the cylinders. The condensate in the cylinder at high speeds is distributed in a film around the inner surface of the cylinder and tends to seek its lowest level and consequently flows into the inner peripheral groove 2 from where it together with any entrapped steam is forced by steam pressure within the cylinder out through the outlet passages 3 into the ring groove 11 and then through the radial passages 12 into the outlet passage 22 of the journal sleeve 7. From the passage 22 the differential pressure in the discharge pipe 21 continues to discharge the condensate and steam through the journal ring opening 20 and the elbow passage 19 into the pipe 21 from which the condensate and steam is discharged or returned into the system.

The condensate from the cylinder 1 is thus rapidly conducted out of the cylinder thereby obviating any tendency of the condensate remaining in the cylinder long enough to permit a film of any considerable thickness to form on the inner peripheral walls of the cylinder sufficient to interfere with the proper radiation of heat.

In the modified form of cylinder 27 illus-

trated in Figure 8 the condensate runs outwardly in both directions from the raised center portion 28 into the outlet passages 30 through which the condensate and steam is forced through the ring groove 33 and the radial passages 34 out through the journal sleeve and discharge pipe similar to the method already described in connection with the disclosure of Figure 1.

We are aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

We claim as our invention:—

1. A paper machine drier comprising a cylinder having a plurality of outlet passages at the end thereof, and an end closure plate secured to the cylinder and cut away to project therein, said closure plate having a plurality of radial outlet passages therein and a ring groove which registers with the cylinder outlet passages and with the closure plate radial outlet passages.

2. A paper machine drier comprising a cylinder having an inner peripheral groove therein, a ring flange integrally formed at the end of the cylinder having a plurality of outlet passages therein communicating with said inner peripheral groove, an end closure plate secured to the cylinder ring flange and cut away to project therein, and a journal sleeve formed on the closure plate, said closure plate having a plurality of radial outlet passages therein connected with the journal sleeve and a ring groove in the cut away portion which registers with the cylinder flange outlet passages and with the closure plate radial passages.

3. A paper machine drier comprising a cylinder having an inner peripheral groove, a ring flange integral with the end of the cylinder and having a plurality of outlet passages therein connected with said groove, an end plate secured to the cylinder flange and having a ring groove which registers with said outlet passages, a journal sleeve integrally formed on said plate, said plate also having a plurality of passages therein connecting said ring groove with said journal sleeve, and a beveled journal ring secured on the end of said sleeve.

4. A paper machine drier comprising a cylinder having an inner peripheral groove therein and a plurality of outlet passages leading from said groove, a closure plate secured to the cylinder having a ring groove and a plurality of outlet passages leading from said ring groove, said ring groove registering with the cylinder outlet passages, a journal sleeve formed on the closure plate, a beveled journal ring secured to the end of said journal sleeve, a steam inlet elbow, said elbow having a steam inlet passage and a condensate outlet passage therein, a rounded bearing flange integral on said elbow and contacting the beveled journal ring, means for adjusting the bearing flange with respect to said beveled journal ring, a steam supply pipe connected with the steam inlet passage of said elbow, a discharge pipe connected with the condensate outlet passage of said elbow, a steam pipe projecting through the journal sleeve into the cylinder, a bearing collar on said steam pipe adapted to bear against the bearing flange on the steam elbow, and a bearing member for said steam inlet pipe rigidly secured to the inner surface of said closure plate.

5. A paper machine drier comprising a cylinder having a groove and outlet passages therein, an end plate secured to the cylinder having passages therein communicating with the cylinder outlet passages, a journal sleeve on said plate, a beveled journal ring secured thereon, a bearing member in said cylinder secured to the inner end of said sleeve, a steam inlet pipe projecting through said journal ring, sleeve and bearing member, and a rounded bearing flange on said steam pipe bearing against the beveled journal ring and against one end of said steam inlet pipe.

6. A paper machine drier comprising a cylinder having a groove and outlet passages therein, an end closure plate secured to the cylinder and having a groove and outlet passages therein communicating with the cylinder groove and passages, a journal sleeve integrally formed on said plate, a steam inlet pipe projecting through said sleeve and plate into the cylinder, and a bearing member frictionally contacting said sleeve and pipe.

7. The combination with a paper drying cylinder and a journal sleeve formed thereon, of a journal ring secured to the sleeve having a curved bearing surface, a steam inlet elbow projecting through the ring into the sleeve, said elbow having a steam inlet passage and a condensate outlet passage therein, a flange on said elbow having a rounded bearing surface contacting the curved bearing surface of the journal ring, a steam supply pipe connected with the steam inlet passage of the elbow, a discharge pipe connected with the condensate outlet passage of the elbow, and adjustable means for varying the pressure of the rounded flange on the curved bearing surface of the journal ring.

8. The combination with a paper drying cylinder and a journal sleeve formed thereon, of a beveled journal ring secured to the sleeve, a steam inlet elbow, said elbow having a steam inlet passage and a condensate outlet passage therein, a supporting member

secured to the inner end of said sleeve within the cylinder, a pipe projecting through said sleeve and supporting member into the cylinder, a bearing collar on the outer end of said pipe, a rounded flange on said elbow contacting the beveled journal ring and said collar, a steam supply pipe connected with the outer end of the elbow steam inlet passage, a suction pipe connected with the condensate outlet passage of the elbow, and adjustable means for varying the pressure of the rounded elbow flange on said beveled journal ring and with said bearing collar.

9. The combination with a paper machine drier of a cylinder having an inner peripheral groove, of a flange integrally formed in the cylinder and having a plurality of pasages therein leading from said cylinder groove to the outer side of the flange.

10. In a drying machine a grooved cylinder having condensate outlet passages in the end thereof communicating with the grooves of the cylinder.

11. In a paper drying machine an internally grooved drying cylinder, a steam inlet pipe projecting therein, said cylinder having condensate outlet passages therein independent of the steam inlet pipe.

12. In a paper drying machine a drying cylinder having an inner peripheral groove permitting a film of condensate formed within the cylinder when rotating at high speed to seek the level of the groove and be drawn off.

In testimony whereof we have hereunto subscribed our names.

EARL ELWIN BERRY.
HAMILTON N. ROSS.