June 20, 1944. A. E. ARMSTRONG 2,351,733

DRIER CONTROL AND DRAINAGE MEANS.

Filed March 13, 1943

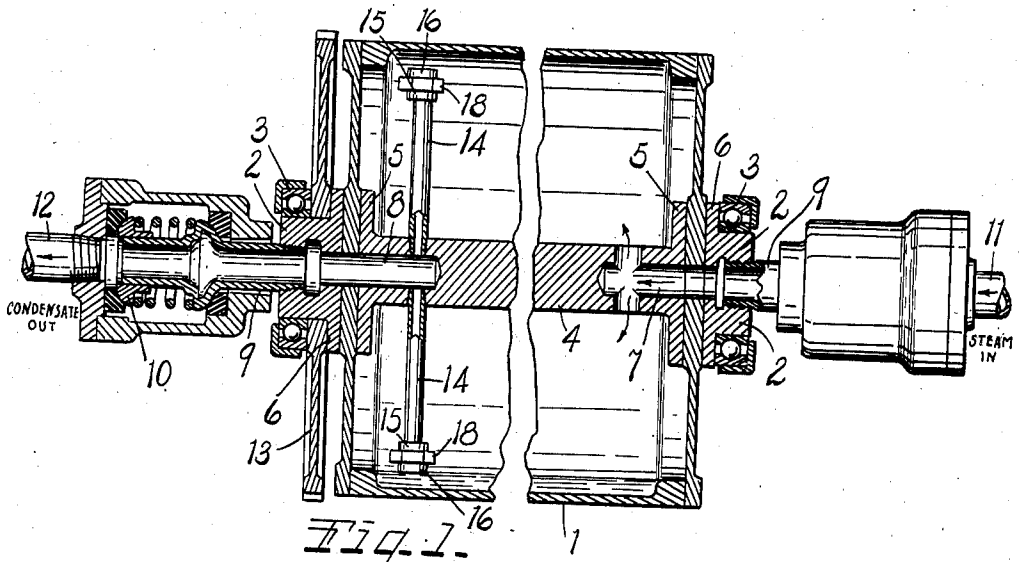


Fig. 1.

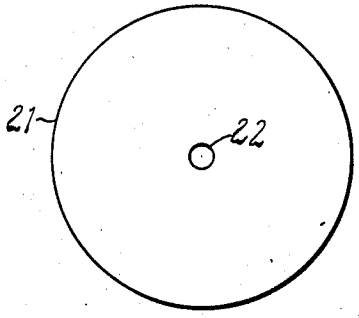


Fig. 3.

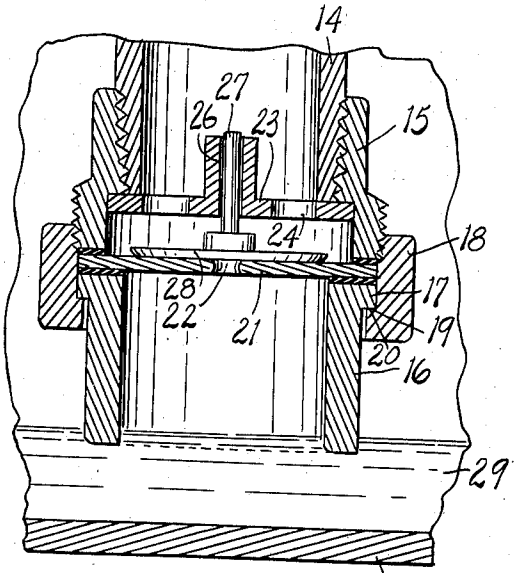


Fig. 2.

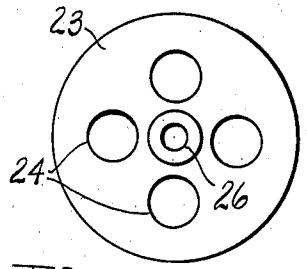


Fig. 4.

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DRIER CONTROL AND DRAINAGE MEANS

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9 Claims. (Cl. 34—125)

This application is a continuation in part of my application for patent filed August 19, 1940, Serial No. 353,268. The main objects of the invention are:

First, to provide in a drier of the drum type an improved drainage means or means for removing condensate.

Second, to provide a condensate removing means which is highly suitable for driers of the type known as "cotton slashers," in which the walls of the drum are thin and there is relatively large amount of condensate to be disposed of.

Third, to provide a structure in which, while the condensate is effectively removed, little loss of steam results.

Further objects relating to details and economies of construction will appear from the description to follow. The invention is defined in the claims. A preferred embodiment of the invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a fragmentary view, mainly in longitudinal section, of a drying element or unit embodying the features of the invention.

Fig. 2 is an enlarged fragmentary section through one of the condensate trap elements and its conduit, illustrating it in partially submerged relation to the condensate.

Fig. 3 is a plan view of one of the outer siphon elements.

Fig. 4 is a plan view of one of the inner siphon elements.

In certain types of drier apparatus, particularly in machines known as "cotton slashers" for drying wet sized fibrous strands or cords, it is customary to utilize cylinders or drums having quite thin heat radiating shells or walls. The thinness of these walls necessitates considerable interior bracing and supporting provisions such as spiders rotating with the shells, so that the ordinary fixed siphon type condensate discharges are not practical due to the said rotatable bracing elements or spiders. As such features are known in the art they are not illustrated herein.

Likewise, it has been found that certain other types of condensate removers, such as the bucket discharge type, are not well adapted for this type of drier. The present invention therefore is particularly concerned with the provision of a novel condensate removing structure which is well adapted to this type of drier. In the accompanying drawing a single drum or drier unit has been illustrated, but in practice two or more are commonly used, the strands or webs to be dried being trained around these drums.

The drum 1 is provided with journals 2, bearings for the journals being conventionally illustrated at 3. The drum is provided with a central shaft 4 which has flanges 5 at the ends thereof associated with the drum heads and the corresponding flanges 6 of the journals. The connecting means for the flanges are not illustrated. The shaft 4 has an inlet passage 7 at one end and a condensate discharge passage 8 at the other end. These passages communicate with discharge conduits 9 which have suitable packings 10 provided with a rotary sealed connection to the steam inlet 11 and the condensate discharge 12. Inasmuch as these rotary packing connections are or may be the same, only one is illustrated. Means for controlling the inlet of steam are not illustrated. The drum is provided with a driven gear 13.

The condensate removing tubes 14 are mounted on the shaft 4 with the inner ends opening to the condensate discharge passage 8, preferably two or more of these tubes being provided. Each condensate tube terminates adjacent the periphery of the drum and is provided at its outer end with a condensate or siphon trap of the type illustrated in Fig. 2. This trap consists of a casing or housing comprising the adapter 15 which is threaded upon the end of the tube 14 and a nozzle element 16 flanged at 17 to be engaged by the collar 18 which is threaded upon the member 15. The nozzle or tip member 16 is provided with an external shoulder 19 engaged by the internal shoulder 20 of the collar or nut 18.

A disk-like orifice member 21 is clamped between the inner end of the nozzle member 16 and the outer end of the adapter member 15, suitable gaskets being provided to form a sealed joint. The member 21 has a single restricted centrally positioned orifice 22. The spider 23 is provided with a plurality of openings 24. This member is preferably press fitted into the adapter element 15, being seated against the internal shoulder 25 thereof. This spider is provided with a central guide 26 for the stem 27 of the disk valve 28 which normally seats upon the disk-like valve seat member 21, closing the orifice 22 thereof. It will be noted that the diameter of the valve greatly exceeds the diameter of the orifice.

In operation these siphon traps carried by the condensate tubes are rotated with the drum and successively swing into and through the condensate that may be collected at the bottom of the drum, as indicated at 29. These condensate exhaust or siphon tubes are in constant com-

munication with the condensate discharge passage 8.

A peculiarity of the siphon trap illustrated and described is that while it has the property of passing liquid such as the condensate referred to, the valve 28 opening and admitting the liquid through the orifice 27 under the pressure existent in the drum, it will not pass any substantial amount of gas or vapor such as steam or air. The latter apparently tends to create a vacuum or suction holding the valve to its seat. It is believed the explanation for this action is as follows:

In operation the fluid pressure in the drier tends to lift the valve from its seated position, closing the orifice 22. As steam or any gas flows through the orifice, then outward between the valve and the plate 21, the velocity is greatly increased. It is a well understood fact that such increase in velocity will be accompanied by corresponding decrease in static pressure. In this case, the decrease is so great that the pressure on the upper side of the valve is sufficient to urge the same to and hold it against its seat on the orifice plate, thus permitting only a small, if any, flow of steam. From actual experience applicant has observed that this action seems to be the case when cold water flows through the orifice. However, when hot condensate is discharged the pressure drop immediately causes some of the water to flash into steam and the greatly increased volume resulting from this flashing prevents the great increase in velocity of travel which happens in the case of steam, hence the pressure between the valve and the plate never drops to a point low enough to keep the valve from being fully raised from its seat during the condensate flow or siphoning action.

This action exists whatever the position of the siphon tube, and applicant believes it explains why the valve will discharge condensate and practically shut off the flow of steam. In any event, whatever the explanation may be, the valve will pass condensate and the collected condensate at the bottom of the cylinder is discharged. When the nozzle of the trap or siphon unit leaves the condensate, due to the rotation of the drum, the valve closes the orifice, effectively preventing the discharge of any substantial quantity of steam.

While the apparatus is very simple, it is highly efficient. I have illustrated and described the invention in a practical embodiment thereof, and have not attempted to illustrate or describe other embodiments or adaptations, as it is believed this disclosure will enable those skilled in the art to adapt the invention as may be desired.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination of a thin-walled drum, means for supplying steam to the interior of said drum, condensate discharge means associated with the drum, and means for removing condensate from the interior of said drum to said discharge means comprising a plurality of hollow radial tubes rotatable with the drum and in communication with said condensate discharge means, and an open-ended casing connected to the outer end of each tube and disposed closely adjacent said drum for immersal in condensate in the drum, an apertured orifice member in said casing, and a disk valve slidably mounted in the casing axially thereof and radially of the drum for sealing engagement with the aperture in said member, said valve sealingly engaging said orifice member to prevent passage of substantial amounts of steam through the aperture therein, but exposing the aperture under the influence of condensate blown into the casing when the latter is immersed in the condensate to thereby pass the condensate to said tubes, said valve being freely mounted to be opened by the flow of condensate or restrictedly opened by flow of steam through the aperture of said orifice member.

2. The combination with a drum of means for supplying steam to the interior of said drum, condensate discharge means associated with the drum, and means for removing condensate from the interior of said drum to said discharge means comprising a plurality of hollow radial tubes communicating with said condensate discharge means, and means on the outer end of said tubes disposed closely adjacent said drum and adapted to be immersed in condensate in said drum, said last named means having a restricted orifice in communication with the interior of the tube, and a radially shiftable valve adjacent said orifice, said valve passing the condensate through the orifice and the tube in rotation thereof when the last named means is immersed in the condensate and preventing passage of an appreciable amount of vapor, said valve being freely mounted to be opened by flow of condensate or restrictedly opened by flow of steam, through said orifice.

3. The combination with a rotatable drum of means for supplying steam to the interior of said drum, condensate discharge means associated with the drum, and means for removing condensate from the interior of said drum to said discharge means comprising a hollow tube disposed radially in the drum and rotatable therewith, said tube communicating at the inner end thereof with said condensate discharge means, an open-ended casing connected to the outer end of said tube adjacent the inner surface of the drum so as to pass through and be immersed in condensate collected in the drum, an apertured orifice member in said casing, and a disk valve slidably mounted in the casing axially thereof and radially of the drum for sealing engagement with the aperture in said member, said valve sealingly engaging said orifice member to prevent passage of substantial amounts of steam through the aperture therein, but exposing the aperture under the influence of condensate blown into the casing when the latter is immersed to thereby pass the condensate to said tube, said valve being freely mounted to be opened by the flow of condensate or restrictedly opened by flow of steam through the aperture of said orifice member.

4. The combination in a drying machine of a rotatable drier drum, means for supplying steam to the interior of said drum, condensate discharge means associated with the drum, and means for removing condensate from the interior of said drum to said discharge means comprising a hollow tube disposed radially in the drum and rotatable therewith, said tube communicating at the inner end thereof with said condensate discharge means, said tube having an open outer end disposed adjacent the inner surface of the drum to sweep through condensate collected therein, and a valve slidable radially of said tube for coaction with the open end thereof, for passing condensate through the tube in the rotation when the outer end is immersed in condensate in the drum, and for preventing passage of an appreciable amount of vapor, said valve being freely mounted to be opened by flow of the condensate through said tube.

5. The combination in a drying machine hav-

ing a rotatable drum, of means for feeding steam to the interior of said drum, condensate discharge means associated with the drum, and means for removing condensate from the interior of said drum to said discharge means comprising a hollow tube disposed radially in the drum and rotatable therewith, means for intermittently communicating the inner end thereof with said condensate discharge means, said tube having an open outer end disposed adjacent the inner surface of the drum to sweep through condensate collected therein, and a valve slidable radially of said tube for coacting with the open end thereof, for passing condensate through the tube in the rotation thereof when the outer end is immersed in condensate in the drum, and for preventing passage of an appreciable amount of vapor, said valve being freely mounted to be opened by flow of the condensate through said tube.

6. The combination of a rotatable steam heated drier drum, a conduit disposed concentrically of said drum, a radial tube mounted interiorly of said drum for rotation therewith and in communication with the interior of said conduit, and an open-ended casing on the outer end of said tube positioned adjacent the inner surface of the unit so as to sweep through condensate collected therein, said casing having an orifice therein, and a disk valve slidable lengthwise of the tube and coacting with said orifice, said disk valve being actuated to expose the orifice for the passage of condensate entering the casing under pressure when the casing is immersed in condensate in the unit, but closing the orifice when the casing is exposed to steam in the unit whereby to prevent passage of an appreciable amount of steam through the tube, said valve being freely mounted to be opened by flow of condensate or restrictedly opened by flow of steam, through said orifice.

7. A device for removing condensate from the interior of a rotatable steam heated drum comprising a hollow condensate discharge member mounted for rotation with the drum, having an orifice therein, said member being positioned adjacent the surface of the drum so as to sweep through and be immersed at its outer end in condensate collected in the drum, means communicating said member with the interior of the drum to remove condensate from the drum, and means on the member for permitting condensate to enter and traverse the same while preventing the passage of an appreciable amount of steam therethrough comprising a disk valve slidably mounted in said member for limited movement transversely of the orifice thereof to engage and disengage the latter, and means in said member for guiding said valve, said valve being pressure actuated to expose said orifice when the member is immersed in condensate traversed by the member during the rotation of the drum but substantially sealing said orifice under the influence of steam in the drum during the remainder of said rotation, said valve being freely mounted to be opened by flow of condensate or restrictedly opened by flow of steam, through said orifice.

8. A device for removing condensate from the interior of a rotatable steam heated drum unit comprising a hollow condensate discharge member mounted for rotation with the unit and having an orifice therein, said member being positioned adjacent the surface of the unit so as to sweep through and be immersed at its outer end in condensate collected in the unit, means communicating said member with the interior of the unit to remove condensate from the member, and means on the member for permitting condensate to enter and traverse the same while preventing the passage of steam therethrough comprising a valve mounted in said member for limited movement transversely of the orifice thereof to engage and disengage the latter, said valve being pressure actuated to expose said orifice when the member is immersed in condensate traversed by the member during the rotation of the unit but substantially sealing said orifice under the influence of steam in the unit during the remainder of said rotation, said valve being freely mounted to be opened by flow of condensate or restrictedly opened by flow of steam, through said orifice.

9. A device for removing condensate from the interior of a rotatable steam heated drum unit comprising a hollow condensate discharge member mounted for rotation with the unit and having an orifice therein, said member being positioned adjacent the surface of the unit so as to sweep through and be immersed at its outer end in condensate collected in the unit, means communicating said member with the interior of the unit to remove condensate from the member, and valve means on the member shiftably coacting with the orifice of the member, said valve means disengaging the orifice when the member is immersed in condensate, for permitting condensate to enter and traverse the same, and restrictedly opening the orifice to prevent the passage of an appreciable amount of steam therethrough when the member leaves the condensate in the unit, said valve means being freely mounted to be opened by flow of condensate or restrictedly opened by flow of steam, through said orifice.

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