

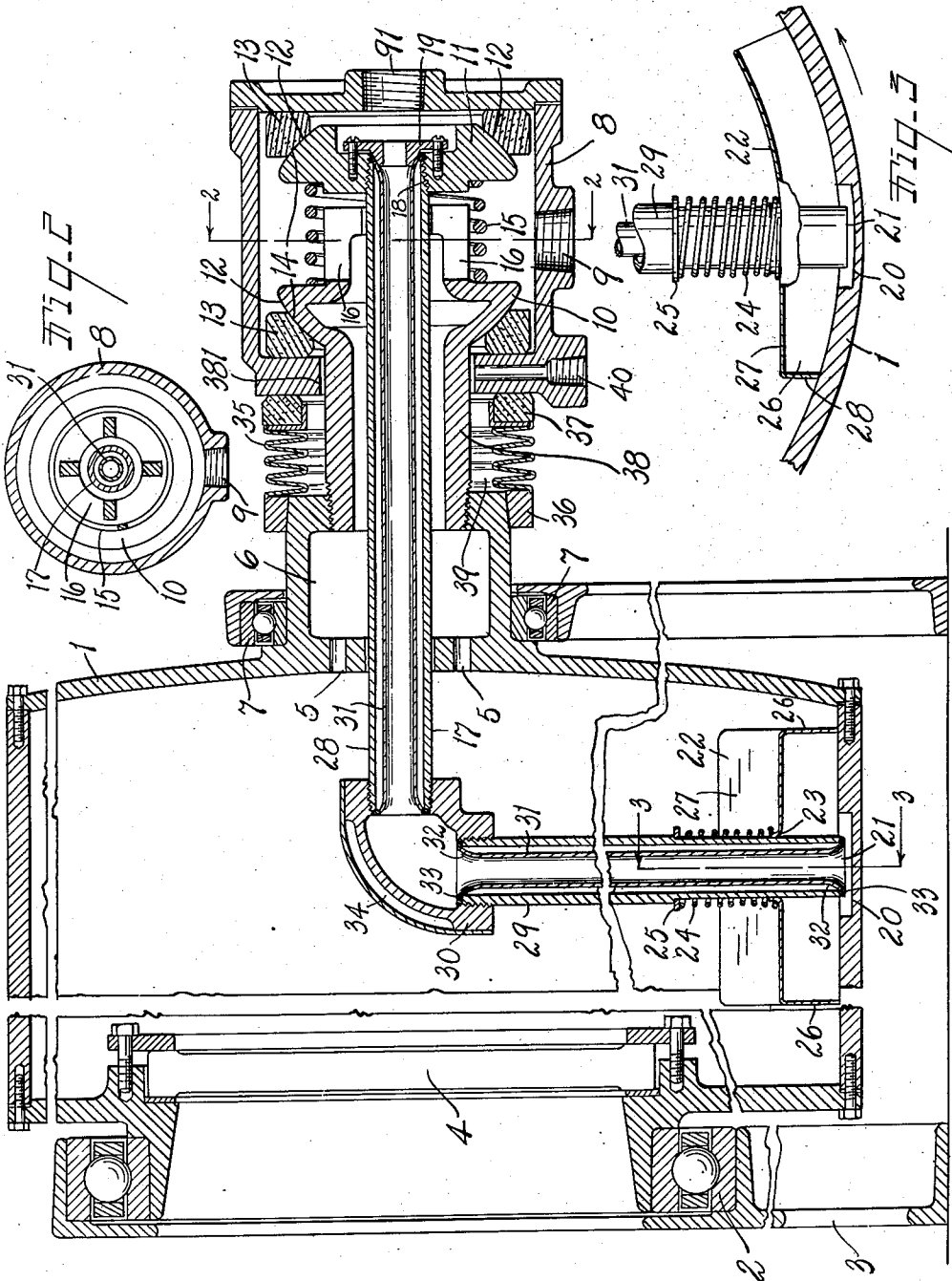
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DRAINAGE DEVICE FOR WEB DRYING MACHINES

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DRAINAGE DEVICE FOR WEB DRYING MACHINES

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This invention relates to improvements in drainage devices for web drying machines.

The main objects of our invention are:

First, to provide improved structure for effectively draining condensate from the steam heated drying cylinders of a drying machine.

Second, to provide a device of the type described, wherein the effective drainage of the cylinder is made possible regardless of whether the cylinder is rotating rapidly or relatively slowly.

Third, to provide a siphon type drainage device for web drying cylinders, which is well adapted for association with automatic temperature or pressure devices, whereby the latter are accurately responsive to variations in the temperature at the periphery of the cylinder.

Fourth, to provide a novel steam supply and drainage device for a drying machine cylinder having provision for effectively preventing the entry of air into the cylinder, particularly in cases where a vacuum condition exists inside the cylinder.

Further objects relating to details and economies of our invention will appear from the description to follow. The invention is defined in the claims.

A structure embodying the features of our invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a fragmentary view broken away and in vertical axial section through a drying cylinder or drum illustrating the novel provisions of our invention associated with the drum for the purposes referred to above.

Fig. 2 is a view in section on line 2—2 of Fig. 1, particularly illustrating the structure and arrangement of certain of the parts.

Fig. 3 is a fragmentary view in section on line 3—3 of Fig. 1, further illustrating certain of the condensate drainage provisions constituting a part of the present invention.

In general, the subject matter of the present application relates to a drainage system for paper or web drying machines and more particularly to machines of this type which include a siphon tube extending radially of the drying cylinder or drum and rotating with the latter.

In machines of this type, wherein the drums are rotated at high surface speeds, i. e., in excess of 700 ft. and up to 1300 ft. per minute, difficulty has been experienced in effectively removing all the steam condensate from the interior of the drum, because of the fact that this condensate is thrown with considerable centrifugal

force against the periphery of the drum or cylinder. It is common practice to utilize siphon tubes for removing condensate. However, at high speed unless large amounts of steam at a high differential in pressure between the drum and the siphon tube are employed to sweep the condensate from the interior of the drum into the siphon tube, it is hard to remove the same and the use of such high differential requires a large amount of steam and is very wasteful. One aspect of our invention relates to novel means for overcoming this difficulty, so that the drum or cylinder may be effectively drained in an economical manner.

A further refinement of the invention relates to a device associated with the siphon tube to render its action more effective when the drum or cylinder is operating at a lesser surface speed, at which speed the centrifugal force exerted on the condensate is not so great as at higher speeds. The aforesaid refinements make possible the removal of large quantities of the condensate under these conditions.

A still further phase of our invention relates to the provision of a novel combination of a rotary seal between the siphon tube and the fixed steam supply chamber or chest, with means for preventing the admission of atmospheric air to the said chest and interior of the drum in the event that the latter is being operated under a vacuum condition. This is particularly important in cases where an automatic supply of steam is contemplated, in which case the presence of air in substantial quantities inside of the cylinder or drum would render the functioning of the automatic steam supply means inaccurate and undependable. Furthermore, the siphon tube is of a novel insulated construction which particularly adapts the same for use in connection with an automatic supply device of the general type described, wherein it is desirable to control certain instrumentalities by the temperature of the drum interior immediately adjacent the periphery thereof. A siphon tube of the particular type herein shown and described makes it possible to take a sample of the steam at this point and apply it to temperature and pressure responsive instrumentalities for the purpose of effecting an automatic control of the temperature of the drum without inaccuracies creeping in which would render the whole operation unsatisfactory. In a drainage of the rotating siphon type, such provisions are invaluable.

Referring to the drawing, reference numeral 1

indicates a drum or cylinder of a rotary web drying machine, which is journaled by a ball bearing 2 in one side of the frame 3 of the machine. This end of the drum is provided with a suitable closure 4 clamped in place and the other end thereof has steam admission openings 5 formed therein adjacent the axis and communicating with a steam admission box 6 integral with the end of the drum and journaled on frame 3 by means of a ball bearing 7.

The reference numeral 8 indicates a fixed steam supply chest or chamber which is supplied with steam through a suitable tapped admission port 9. The steam may be supplied at pressure greater or less than atmospheric. A further tapped opening 91 axially of the chest is employed for connecting the drainage device to be described with automatic steam supply instrumentalities which, per se, constitute no part of the present invention, hence have not been illustrated.

Communication of the interior of the drum 1 with the fixed steam supply chamber 8 is established through a hollow, elongated sleeve-like sealing member 10 constituting one of a pair of such sealing members, the other of which is designated by the reference numeral 11. These sealing members have oppositely facing rounded or convex surfaces 12 coacting with suitable sealing or packing rings 13 of graphite or other suitable material. These packing rings have the mutually facing concaved or curved surfaces 14 coacting with the convex surfaces 12 of the sealing members. The compression spring 15 is interposed between the members 10 and 11. It will be observed that member 10 is threadedly connected to the steam admission box 6 of the drum, hence rotates therewith. The other sealing member 11 also rotates with the drum, and a fluid-tight seal is effected at the coacting meeting surfaces 12, 14 of the members and rings respectively. Communication of the interior of member 10 with the interior of the steam chest or chamber 6 is established through radial passages 16 formed in the right hand end of the member. As illustrated in Fig. 2, the member 10 has radially extending wings separating these passages and serving to center spring 15.

The sealing member 11 has secured thereto one end of the L-shaped siphon tube, which is generally designated by the reference numeral 17. The particular construction of this tube will be referred to in detail. However, for the present it is sufficient to state that it is secured to the sealing member 11 by threading at 18 and is associated with an apertured disk 19 concentric with the sealing member and secured thereto by screws. This disk has a conical axial projection which extends into one extremity of the siphon tube, for a purpose to be described.

The opposite end or radial portion of the L-shaped siphon tube extends adjacent the periphery of drum 1 for removal of condensate therefrom. Previously, it has been proposed to blow steam condensate out through the tube by steam under pressure inside of the drum. However, as pointed out above, this practice is very wasteful and costly, since in a drum running at high surface speeds, say from 700 ft. per minute to 1500 ft. per minute, the condensate is thrown against the drum periphery with considerable force, so that it is very difficult to remove it and large amounts of high pressure steam are thus wasted. To overcome this difficulty, we have provided the periphery of the drum with

a small square or circular sump or depression 20 into which the tip 21 of the siphon tube projects. This is much more effective than any possible attempt to space the tip of the tube extremely close to the front surface, for it allows a considerable area of opening between the drum surface and siphon tube into which the condensate may flow. Since the tip or end of the tube lies at a greater radial distance from the drum axis than the inner drum surface and since the sump fills with water under the influence of centrifugal force, the extremity of the tube at all times extends into this condensate and the removal thereof is accordingly greatly facilitated.

The foregoing structure is very effective in removing condensate during the web drying operation when the drum or cylinder 1 rotates at high speeds. However, when the speed of the drum is less, for example, approximately 500 ft. per minute, inasmuch as the centrifugal force is less, the condensate tends to flow downwardly from the drum walls and collect at the bottom-most point of the rotating drum. Under such conditions, the rotating siphon tube would normally pass through the collected water at the bottom of the drum only once per revolution, and as the sump 20 travels upwardly, the condensate would be drawn out from the same so that for a great portion of the revolution there would be no condensate adjacent the siphon tube. To remedy this objection, we have provided an auxiliary scoop or dam element generally designated 22, in the form of a sheet metal member having an aperture 23 receiving the extremity of the siphon tube. The scoop is resiliently urged against the inner drum periphery by means of a coil spring 24 which encircles the tube, engaging the scoop 22 at one end and a thrust ring 25 on the tube at the other end. The scoop is clearly illustrated in Figs. 1 and 3, having spaced side walls 26, a top wall 27 spaced a predetermined distance from the drum periphery, and a rear wall 28. The advance side or front of the scoop is open in the direction of rotation of the drum.

Assuming that the drum rotates in the direction indicated by the arrow in Fig. 3, the dam element operates to trap a quantity of condensate and maintain the same in the vicinity of sump 20 as the sump passes the lower-most point of its travel and begins to ascend. Thus, this condensate is retained adjacent the sump to keep the same filled during a large portion of the upward travel of the drum, for example, approximately two-thirds of the vertical dimension of the drum. By this expedient, immersion of the siphon tube extremity in the condensate is maintained through a much longer period, with the result that the tube continues to siphon condensate from the drum interior instead of merely siphoning steam, and the drainage of the drum is greatly enhanced.

In certain drainage systems, we have found it desirable to utilize a small boiler filled with a volatile liquid which is adapted to be heated to the same temperature as the interior of the drum immediately adjacent the periphery thereof. Such an element, associated with a siphon tube of the stationary type, is illustrated in the co-pending application of Adam E. Armstrong, Serial No. 353,270, filed August 19, 1940. However, when a rotating type siphon tube is employed, it is impractical to mount the boiler element on or adjacent the tube, as illustrated in the aforesaid application, and it becomes neces-

sary to dispose the same exteriorly of the drum. If this is done, however, a possibility for error is introduced, because of the fact that the interior of drum 1 is not always at the same temperature at all radial points therein. On the contrary, if air is present with steam, the gases in the drum tend to stratify with the temperature thereof increasing towards the center of the drum, which is caused, of course, by the fact that the drum cools first at its periphery where the drying work is done. Hence, if the steam utilized in connection with the heating of the boiler were taken from a point adjacent the periphery of the drum and led radially and outwardly of the drum, this steam would become heated above the temperature actually present at the drum periphery, so that by the time it reached the boiler element, it would be at a higher temperature than the correct periphery temperature.

To enable accurate operation of an acetone boiler element, such as we have described, or other control device, we therefore provide a special type thermally insulated siphon element 17 made up of two outer pipe sections 28, 29, disposed horizontally and radially respectively and connected by the special elbow 30. The pipe sections 28, 29 have disposed interiorly and concentrically thereof the tubes 31 which are flared at the ends thereof, as indicated by the reference numeral 32, and connected to the pipe sections 28, 29 by welding 33. The space between the tubes 31 and the pipe sections 28, 29 respectively is evacuated of air prior to completion of the members, thereby producing a pair of insulated conduit members similar in their insulating properties to the well known thermos bottle. As described above, the section 28 of the siphon tube 17 is threadedly connected to the sealing member 11 and the two sections 28, 29 are threadedly connected with the special elbow 30, thereby constituting the L-shaped siphon tube 17. Elbow 30 likewise has vacuum type insulating provisions in the form of an evacuated space 34, so that heat transmission through the wall of the element at this point is avoided.

By the foregoing provision, steam taken from the periphery of the rotating drum is transmitted to the temperature responsive boiler or other control element referred to without being reheated by the hotter gases adjacent the center of the drum. The result is that its action on the element corresponds accurately to the action which would be exerted by the steam if the element were disposed immediately adjacent and interiorly of the drum periphery.

In many instances, it is desirable to operate a drying drum of the type described under a vacuum condition and in such cases it is also desirable to prevent the uncontrolled admission of atmospheric air to the interior of the drum. This is likely to happen, particularly over a long period of operation and where relatively fixed and rotatable sealing members are present, and if it does, the resultant mixture of air with the steam in the drum causes unreliability in the control of the temperature of the drum, since the temperature can no longer be predicted from the drum vapor pressure.

In order to prevent the admission of air to the drum, we provide an exterior sealing element for the connection between the rotating steam admission box 6 and the fixed steam chamber or chest 8 in the form of a spring bellows member 35 which has a ring-like coupling element 36 secured to one end thereof and fixedly engaging the rotat-

ing box by friction or secured thereto by other means, if desired. The other end of the hollow spring element 35 carries a graphite sealing ring 37 generally similar to the rings 13, which is resiliently urged by the bellows spring element against the exterior of the steam admission chamber 8. Since the sleeve 38 of the rotating sealing member 10 extends through the aperture 381 in chamber 8 with considerable clearance, in order to enable possible misalignment of the housing and the drum to be accommodated, the space 39 between the resilient bellows member 35 and the elongated sleeve 38 is in communication with the small space in chamber 8 immediately to the right of the aperture 381, as illustrated in Fig. 1. Assuming a vacuum condition, i. e., less than atmospheric pressure, to exist in the drum and steam chamber 8, it is evident that were no precautions taken, there would be a tendency for atmospheric air to leak between the sealing ring 13 and either the surface of the chamber 8 or the surface 12 of the sealing member with which the same coacts, likewise that the same possibility of leakage would be present between the rotating ring 37 and the exterior of the chamber 8. In order to eliminate such possibility, we provide an opening 40 in the wall of chamber or chest 8 communicating with the space 39, being preferably formed in the casting from which the chest is made and extending to the aperture 381. This opening is provided with a tapped outlet adapted to be connected to a source of water or steam at a relatively low pressure, but greater, however, than atmospheric pressure, so that the fluid entering opening 40 and the space 39 fills this space and all of the space in communication therewith, thereby preventing the admission of air thereto and the possibility of leakage of such air past the sealing surfaces. Alternatively, the opening 40 might be connected with a source of vacuum greater than that existing in chamber 8, with the result that if any air or other vapor were to enter the space 39, it would be drawn out by the vacuum source and would not enter the drum.

The foregoing construction features all contribute to a drainage system which is highly effective in operation, to the production of a drying element of high thermal efficiency, and to a steam control which is very accurate and reliable. Whether operating at high or low speeds, the amount of condensate drained from the drum is increased without the use of high differential pressures and amounts of steam and the entry of air to the drum interior is prevented. It is possible at all times to get an exact indication of the temperature of the vapor at the drum periphery, by which the need for further regulation of the drum temperature must be ascertained, if accuracy of control is to be had. In view of the manifold improvements made possible thereby, the structure of the present invention is exceedingly simple and inexpensive and moreover may be readily applied to existing drying drums.

We have illustrated and described our improvements in an embodiment which is very practical. We 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 embody or adapt our improvements as may be desired.

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

1. In a drainage system for a drying cylinder, an insulated double walled siphon tube extending

radially and axially of said cylinder and rotating therewith, the radial extremity of said tube being adjacent the periphery of the cylinder and said periphery having a sump into which said extremity extends, a scoop element mounted on said tube and having side and rear walls in spaced relation to the tube and engaging said cylinder for collecting condensate during the rotation of the cylinder and maintaining condensate in the vicinity of said sump, spring means for resiliently urging said scoop element against the cylinder periphery, a fixed steam admission housing, a sealing element concentric with the axial portion of said siphon tube, having a sealing surface in said housing and a portion extending through an aperture in the housing and fixedly connected to the cylinder for rotation therewith, said sealing element being hollow for the purpose of transmitting steam from said housing to the interior of said cylinder, a further sealing element coaxial with and connected to said axial portion of the tube for rotation therewith, spring means interposed between said sealing elements to urge the same axially in opposite directions, sealing rings interposed between said sealing elements and the respective opposite walls of the housing whereby to provide seals between the housing and the rotating sealing surfaces of said elements, and means for preventing the admission of atmospheric air to said housing.

2. In a drainage system for a drying cylinder, an insulated siphon tube extending radially and axially of said cylinder and rotating therewith, the radial extremity of said tube being adjacent the periphery of the cylinder and said periphery having a sump into which said extremity extends, a scoop element mounted on said tube and having side and rear walls in spaced relation to the tube and engaging said cylinder for collecting condensate during the rotation of the cylinder and maintaining condensate in the vicinity of said sump, spring means for resiliently urging said scoop element against the cylinder periphery, a fixed steam admission housing, a sealing element concentric with the axial portion of said siphon tube, having a sealing surface in said housing and a portion extending through an aperture in the housing and fixedly connected to the cylinder for rotation therewith, said sealing element being hollow for the purpose of transmitting steam from said housing to the interior of said cylinder, a further sealing element coaxial with and connected to said axial portion of the tube for rotation therewith, spring means interposed between said sealing elements to urge the same axially in opposite directions, and sealing rings interposed between said sealing elements and the housing whereby to provide seals between the housing and the rotating sealing surfaces of said elements.

3. In a drainage for a drying cylinder, a siphon tube extending radially and axially of said cylinder and rotating therewith, a fixed steam admission housing, a sealing element concentric with the axial portion of said siphon tube, said element having a sealing surface in said housing and an axial portion extending through an aperture in the housing and fixedly connected to the cylinder for rotation therewith, said sealing element being hollow for the purpose of transmitting steam from said housing to the interior of said cylinder, a further sealing element coaxial with and connected to said axial portion of the tube for rotation therewith, spring means interposed between said sealing elements to urge the same axially in opposite directions, sealing rings

interposed between said sealing elements and the housing whereby to provide seals between the housing and the rotating sealing surfaces of said elements, and a steam supply connection to said housing supplying steam thereto at a point between said sealing elements, the interior of said first named hollow sealing element communicating with the housing at said last named point.

4. In a drainage system for a drying cylinder, an insulated siphon tube extending radially and axially of said cylinder and rotating therewith, the radial extremity of said tube being adjacent the periphery of the cylinder and said periphery having a sump into which said extremity extends, a scoop element mounted on said tube and having side and rear walls in spaced relation to the tube and engaging said cylinder for collecting condensate during the rotation of the cylinder and maintaining condensate in the vicinity of said sump, and spring means for resiliently urging said scoop element against the cylinder periphery.

5. In a drainage system for a drying cylinder, a siphon tube extending radially and axially of said cylinder and rotating therewith, the radial extremity of said tube being closely adjacent the periphery of the cylinder, and normally effective to remove condensate by suction in the tube, a scoop element mounted on said tube and engaging said cylinder for collecting condensate during the rotation of the cylinder and maintaining condensate in the vicinity of said extremity, and means for maintaining said scoop element against the cylinder periphery, said scoop element being open at its radially outermost side in substantial radial alignment with said tube for direct communication of the scoop element with the cylinder periphery adjacent the tube.

6. In a drainage system for a web drying drum, a siphon tube extending radially and axially of said drum and rotating therewith, said tube having the radial extremity thereof adjacent the periphery of the drum and the said periphery having a sump into which said extremity extends, a scoop element mounted adjacent said tube and engaging said drum for collecting condensate during the rotation of the drum and maintaining the condensate in the vicinity of said sump, means for maintaining said scoop element against the drum periphery, a fixed steam admission housing, a sealing element concentric with the axial portion of said siphon tube, said last named element having a sealing surface in said housing and a portion extending through an aperture in the housing and fixedly connected to the drum for rotation therewith, means for transmitting steam from said housing to the interior of said drum, a further sealing element coaxial with and connected to said axial portion of the tube for rotation therewith, means interposed between said sealing elements to urge the sealing members axially in opposite directions into sealing relation to the housing, and means coacting with said sealing elements to seal the housing.

7. In a drainage system for a web drying drum, a siphon tube extending radially and axially of said drum and rotating therewith, a fixed steam admission housing, a sealing element externally concentric with the axial portion of said siphon tube, said last named element having a sealing surface in said housing and a portion extending through an aperture in the housing and fixedly connected to the drum for rotation therewith, said sealing element being hollow and communicating with the drum interior for transmitting

steam from said housing to the interior of said drum, a further sealing element coaxial with and connected to said axial portion of the tube for rotation therewith, means interposed between said sealing elements to urge the sealing members axially in opposite directions into sealing relation to the housing, means coacting with said sealing elements to seal the housing, and a steam supply connection to said housing supplying steam thereto at a point between said sealing elements, the interior of said first named hollow sealing element communicating with the housing at said last named point.

8. In a drainage system for a web drying drum, a siphon tube extending radially and axially of said drum and rotating therewith, said tube having the radial extremity thereof adjacent the periphery of the drum and the said periphery having a sump into which said extremity extends, a scoop element mounted adjacent said tube and engaging said drum for collecting condensate during the rotation of the drum and maintaining the condensate in the vicinity of said sump, and means for maintaining said scoop element against the drum periphery.

9. In a rotating drying drum having means for supplying steam thereto, a siphon tube for removing condensate from the drum and adapted to rotate with said drum, comprising radial and axial double walled insulated pipe sections having means communicating the same, said tube being connected to the drum for rotation therewith, said drum having a sump in the wall thereof into which said radial portion extends, whereby to collect condensate during high speed rotation of the drum and maintain the extremity of the radial portion immersed therein, a scoop element carried by said radial portion and having a wall in spaced relation to said portion and sump serving to collect and maintain condensate adjacent the sump as the drum rotates at slower speed whereby the extremity of the radial portion is maintained in condensate in the sump for a relatively large portion of its upward travel, and spring means coacting with said radial portion and scoop element to resiliently urge the latter against the drum wall.

10. In a rotating drying drum having means for supplying steam thereto, and a siphon tube for removing condensate from the drum and adapted to rotate with said drum, comprising radial and axial double walled insulated pipe sections having means communicating the same, said tube being connected to the drum for rotation therewith, said drum having an annularly restricted sump in the wall thereof in general radial alignment with the tube into which said radial portion extends, whereby to collect condensate during high speed rotation of the drum and maintain the extremity of the radial portion immersed therein.

11. In a rotating drying drum having means for supplying steam thereto, and a radially extending siphon tube for removing condensate from the drum and adapted to rotate with said drum, said drum having an annularly restricted sump in the wall thereof in general radial alignment with the tube into which the radial portion thereof extends, whereby to collect condensate during high speed rotation of the drum and maintain the extremity of the radial portion immersed therein.

12. In combination with a rotary drying drum, a condensate drainage system for said drum com-

prising an insulated siphon tube having radial and axial portions, said tube comprising an outer hollow section and an inner hollow section disposed concentrically of the outer section to define a space therebetween, air being evacuated from said space and the ends of said sections being secured together to hermetically seal the same and increase the efficiency of the tube as a thermal insulator, whereby to prevent reheating of steam traversing the tube from a point adjacent the inner periphery of the drum to the exterior of the drum.

13. A drainage system for a rotating drying drum comprising a fixed housing for supplying steam to the drum, said housing having a steam inlet, an open ended hollow siphon tube having portions disposed radially and axially of said drum and adapted to rotate therewith, a hollow, steam transmitting member having a sealing element and a sleeve-like portion coaxially secured to said drum for rotation therewith and internally receiving the axial portion of said siphon tube, the space between said element and axial portion constituting a steam admission passage in communication with the interior of the housing and drum, a further sealing element connected to said axial portion for rotation therewith, said elements being disposed within said housing and said sleeve-like portion extending through an opening in one of the housing walls, there being a further opening in the housing receiving condensate drainage means in communication with said siphon tube, sealing means disposed in said housing between the housing walls and the respective elements, and means for urging the elements and sealing means in opposite directions against said walls whereby to fluid seal the housing at said openings from the escape of steam therethrough.

14. In a steam supply device for a rotating drying drum, a steam supply housing for supplying steam to the drum, a hollow sealing member carried by said drum disposed interiorly of said housing adjacent an opening therein and coacting therewith to fluid seal the housing at the opening, said member communicating the housing with the drum, and means for preventing the admission of atmospheric air to said housing and drum when the latter is operated under a vacuum condition, comprising a hollow member secured concentrically of said first named member to the drum for rotation therewith and having a sealing element in rotatable thrust engagement with the exterior of said housing adjacent said opening to thereby define a space in communication with said housing opening and the exterior side of said first named sealing member, and means for communicating said space with a source of fluid under pressure greater than atmosphere or with a source of vacuum greater than the vacuum condition in the housing and drum.

15. A drainage system for a rotating drying drum having a fixed housing for supplying steam thereto, comprising a siphon tube having portions disposed radially and axially of said drum, a hollow sealing element coaxially secured to said drum for rotation therewith and receiving the axial portion of said siphon tube internally thereof, said element extending through an opening in the housing for communication with the drum interior, sealing surfaces disposed within said housing and connected respectively to said element and siphon tube, said surfaces coacting with further sealing means in the housing to seal the

same, means for maintaining said element and last named means in operative sealing engagement, means for supplying steam to the housing at a point between said surfaces, and condensate drainage means connected to the housing on the side of said surfaces remote from the drum in communication with said siphon tube.

16. Steam supply means for a rotating drying drum, comprising a fixed steam chest, a member having a sealing portion disposed interiorly of said chest and a portion extending through an opening in the chest axially of said drum and fixedly secured to the drum for rotation therewith, said member being hollow in its interior and communicating the chest with the drum interior, means coacting with said sealing portion for providing a rotatable seal for the chest adjacent said opening, and means for preventing the admission of air to the chest and drum through said opening when the drum is operated at less than atmospheric pressure, comprising means carried by the drum having sealing engagement with said fixed chest and defining a space surrounding said axially extending portion and in communication with the chest opening, and means for communicating said space with the source of fluid pressure greater than atmospheric or, with a source of vacuum whereby to prevent admission or maintenance of air in said space.

17. Steam supply means for a rotating drying drum, comprising a fixed steam chest, a member having a sealing portion disposed interiorly of said chest and a portion extending through an opening in the chest axially of said drum and fixedly secured to the drum for rotation therewith, said member being hollow in its interior and communicating the chest with the drum interior, means coacting with said sealing portion for providing a rotatable seal for the chest adjacent said opening, and means for preventing the ad-

mission of air to the chest and drum particularly when the latter is operated at less than atmospheric pressure, comprising means having sealing engagement with said drum and chest and defining a space surrounding said axially extending portion and in communication with the chest opening, and means for communicating said space with a source of fluid pressure different in magnitude from atmospheric, whereby to prevent admission or maintenance of air in said space.

18. In a drainage system for a rotating drying drum having a steam supply housing for supplying steam thereto, a siphon tube extending from said housing into said drum, a sealing member carried by said drum and disposed interiorly of said housing, the sealing member having a hollow sleeve-like portion concentrically receiving the tube attached to the drum and extending through an opening in the housing for passage of steam from the housing to the drum, said member coacting with said housing to fluid seal the latter at said opening, and means for preventing the admission of atmospheric air to said housing and drum when the latter is operated under a vacuum condition, comprising a hollow bellows spring member enclosing said sleeve-like portion and secured to the drum for rotation therewith, said last named member having a sealing ring rotatably engaging the exterior of said housing to thereby define a space in communication with the housing on the exterior side of said drum carried sealing member, and means for communicating said space with a source of fluid under pressure greater than atmosphere or with a source of vacuum greater than the vacuum condition in the housing and drum, whereby to prevent the entry of air in said space.

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