March 23, 1926. 1,577,839

A. E. F. MOONE

WEB DRYING DEVICE

Filed March 17, 1925 2 Sheets-Sheet 1

Fig. 1.

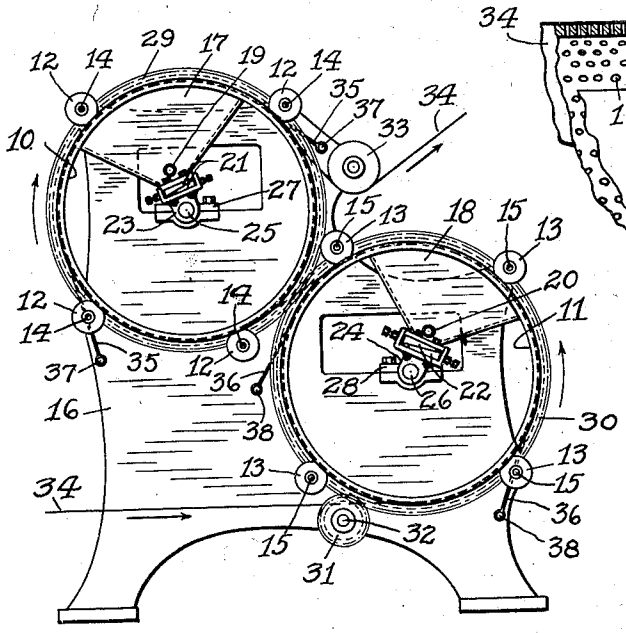



Fig. 2.

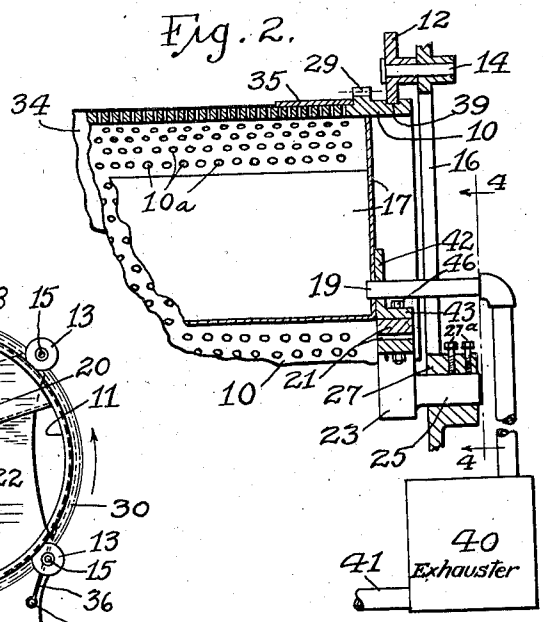



Fig. 3.

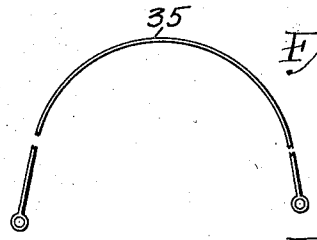



Fig. 5.

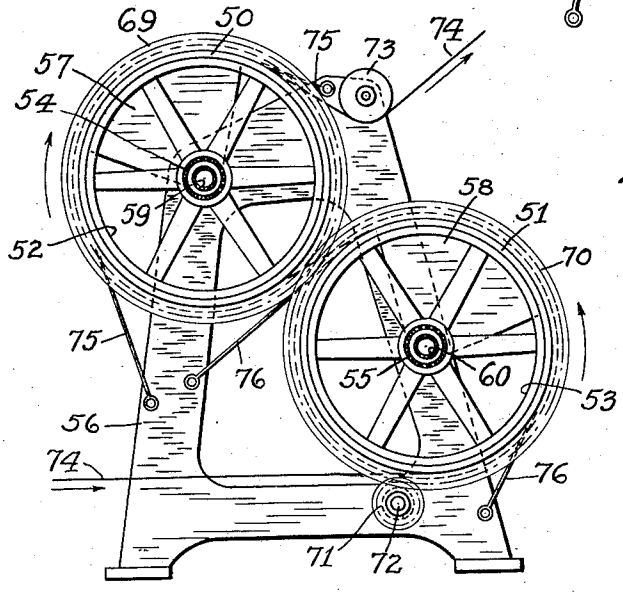
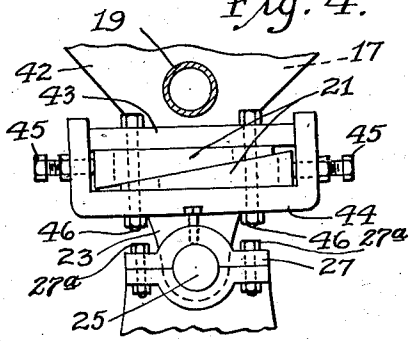



Fig. 4.




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March 23, 1926. 1,577,839

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Filed March 17, 1925 2 Sheets-Sheet 2

Fig. 6.

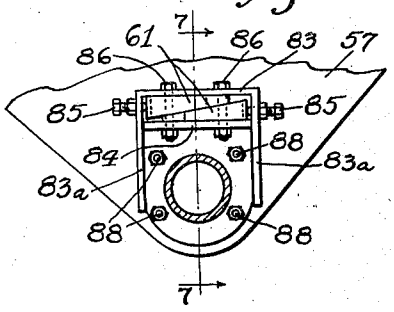



Fig. 7.

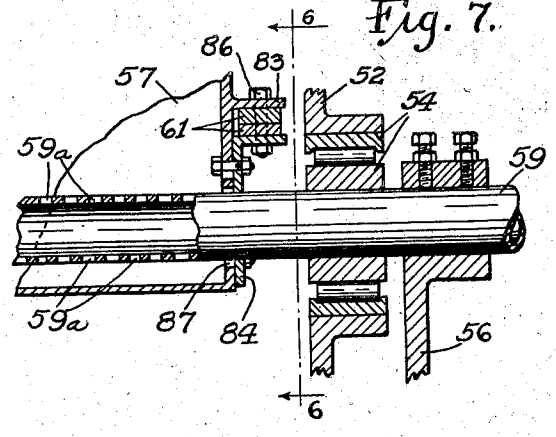



Fig. 9.

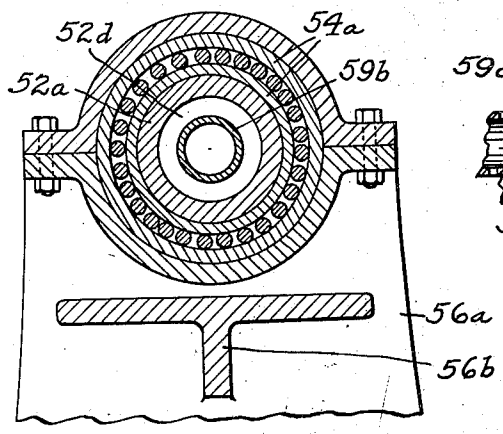



Fig. 8.

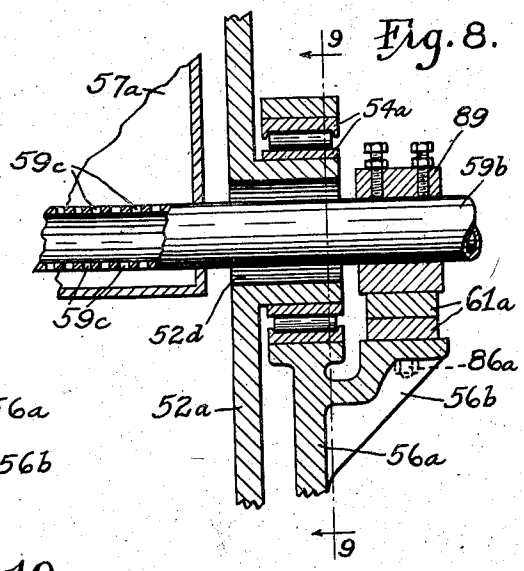
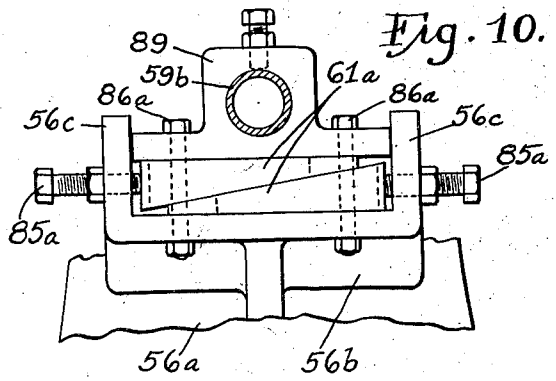



Fig. 10.




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Patented Mar. 23, 1926. 1,577,839

# UNITED STATES PATENT OFFICE.

ALBERT E. F. MOONE, OF CHICAGO, ILLINOIS.

## WEB-DRYING DEVICE.

Application filed March 17, 1925. Serial No. 16,100.

*To all whom it may concern:*

Be it known that I, ALBERT E. F. MOONE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Web-Drying Devices, of which the following is a specification.

My invention relates to an improved mechanism for drying webs of paper pulp and felt in the course of their manufacture, by which the web is effectively and rapidly dried, or nearly dried, by suction devices arranged to remove the moisture from the web as it passes through the machine by the action of a difference in atmospheric pressure on the two sides of the web, or more specifically by the action of atmospheric pressure on one side of the web and sub-atmospheric pressure on the other thereof.

As is well known in connection with the manufacture of paper and sheet felt, the web in either case, after it is collected and formed in any suitable manner by devices well known in the art, carries a great deal of moisture which must be removed in order that the web may pass through the remaining steps of manufacture to result in the finished product. The means most commonly used to accomplish this result, consists of revolving heated drums over which the web passes to dry it. This mode of drying is open to either one of two objections; first, slow motion must be imparted to the web if but few heating drums are employed, or second, a large number of drums must be used if a rapid motion is imparted to the web, on account of the temperatures necessarily being limited if the web is to be uninjured, and the relatively small amount of drying possible with each drum unless the motion of the web is so slow in passing over it as to be prohibitive from the standpoint of commercial manufacture. I am aware that it has been proposed heretofore to employ vacuum devices of one kind or another to in part remove the moisture from the web. As far as I am aware however, these devices are open to the objection that the sub-atmospheric pressure employed has not been effectively applied to the web for the maximum possible time interval represented by the passage of the web through the vacuum devices. More specifically, the devices heretofore proposed, have employed a perforated drying drum or drums over which the web in wet condition is passed and a zone of sub-atmospheric pressure has been produced, of relatively limited extent as to its application to the web, and further, the devices employed have resulted in marked fluctuation of the sub-atmospheric effect on the web, due to the nature of the devices employed for reducing the atmospheric pressure throughout the vacuum zone, as a result of which, with a degree of sub-atmospheric pressure that will not injure the web, but small drying results, and where the sub-atmospheric pressure is high enough for drying the web, the pressure is not uniformly applied to the web and danger of tearing results. Thus in either case the action is not efficient.

In carrying out my invention I employ a perforated drum or drums and means for feeding the wet web over the surface of said drum or drums, and provide a sub-atmospheric pressure chamber directly in contact with the inner surface of the drum in each case, so that the desired condition of sub-atmospheric pressure is uniformly maintained in the chamber and uniformly applied to the web being dried throughout its entire passage through the vacuum zone. Furthermore, by my construction the wet web is caused to engage the perforated drum in each case, before its entry into the vacuum zone, it is introduced into the vacuum zone without dangerous air pressure being exerted upon it, and after passing completely through the vacuum zone, during which it is continuously subjected to the maximum sub-atmospheric pressure permitted by the nature of the web being dried without injuring it, the web passes from the vacuum zone still in contact with the perforated drum, so that it is readily removed therefrom in leaving the machine or passing to the next perforated drum, and without danger of tearing the web. An important feature of my present invention is arranging two perforated drums of the kind referred to so that the web first passes over one of said drums and through its vacuum zone and thereafter leaves the first perfo-

rated drum and passes around the surface of the second perforated drum and through its vacuum zone, in such a manner that one surface of the web engages the first drum and the other surface of the web engages the second drum. In this manner I remove the moisture from both surfaces of the web by sub-atmospheric pressure and I find that this produces a highly efficient extraction of moisture from the web, for I have found that where it is attempted to remove the moisture from the web by sub-atmospheric pressure exerted on but one side of it, the other side of the web is left relatively wet, this being particularly true where the web is relatively dense, as is the case with webs formed from certain kinds of paper stock, although the same thing is true to a less degree with more porous webs, for example webs of felt stock. By my invention I also provide means for readily adjusting the position of the vacuum zone relatively to each perforated drum so that the vacuum zone may be given the most effective relation to the arc of contact of the web on the drum; I further provide devices for readily adjusting the vacuum chamber to compensate for wear and to insure effective relation between the vacuum chamber and the inner surface of the drum.

My invention will best be understood by reference to the accompanying drawings showing preferred embodiments thereof in which

Fig. 1 shows one form of my drying machine in end elevation with the end frame nearer the observer removed for the sake of clearance,

Fig. 2 shows in longitudinal, vertical, sectional view and to an enlarged scale, a part of one of the perforated drums shown in Fig. 1 and a corresponding part of the vacuum chamber and associated devices for removing the moisture,

Fig. 3 shows in end view one of the shields adapted for use in connection with the perforated drums,

Fig. 4 is a detail view to an enlarged scale of the supporting devices shown in Fig. 2, taken along the line 4—4 in said figure,

Fig. 5 shows in a view similar to Fig. 1 the preferred general form of my drying machine,

Fig. 6 shows in a view similar to Fig. 4, and on an enlarged scale, the vacuum chamber supporting devices employed with the construction shown in Fig. 5, this view being taken along the line 6—6 in Fig. 7,

Fig. 7 shows in a view similar to Fig. 2 and on enlarged scale, the supporting devices employed in connection with the construction shown in Fig. 5, this view being taken along the line 7—7 in Fig. 6,

Fig. 8 shows in a view similar to Fig. 7, a modified arrangement of supporting devices for use with the construction of the general nature illustrated in Fig. 5,

Fig. 9 is a sectional view of the parts shown in Fig. 8, taken along the line 9—9, and

Fig. 10 is an end view of the pipe supporting devices shown in Fig. 8.

Similar numerals refer to similar parts throughout the several views.

As shown in Fig. 1, my machine consists of two tubular drums 10 and 11 mounted for rotation on supporting and retaining rollers 12, 12 for the drum 10 and 13, 13 for the drum 11, said rollers engaging the outer surfaces of the drums so that they may turn freely on said rollers, said rollers in turn being supported on suitable stud shafts 14 and 15 from the end frames 16 of the machine, the end frame nearer the observer being removed to more clearly show the construction of the machine.

The drums 10 and 11 have located inside of them and extending longitudinally thereof, vacuum chambers 17 and 18 provided with cylindrical outer edge surfaces to closely fit with sliding engagement the inner surfaces of the drums 10 and 11, the latter being preferably provided with true and smooth cylindrical inner surfaces to permit the fit referred to. The chambers 17 and 18 are provided with outlet pipes 19 and 20 respectively for withdrawing moisture and air from said chambers. As indicated in Fig. 2 for the drum 10, each of the drums is perforated throughout its entire length, excepting adjacent its end supporting and driving portion, said perforations being indicated in Fig. 2 at $10^a$, to form the only inlet for air and moisture to the corresponding vacuum chamber. The perforations are preferably small diameter holes extending entirely through the drum radially and placed as close together as practical conditions of manufacture will permit. The end and side walls of each vacuum chamber are imperforate, as a result of which any condition of sub-atmospheric pressure which may be produced in either chamber, is communicated through the drum perforations in line with the chamber to the web that may be on the outer surface of the drum and thus the atmospheric pressure on the outer surface of the web is effective in forcing moisture from the web through the perforations into the vacuum chamber, the side walls of which are inclined to collect the moisture and direct it to the bottom part of the chamber so that it may be withdrawn from the outlet pipe connected with the chamber.

The chambers 17 and 18 are supported at their lowermost portions by wedges 21 and 22 from brackets 23 and 24 respectively, said brackets being in turn mounted on trunnion supports 25 and 26, engaged and rigidly supported by clamping caps 27 and 28 respec-

tively, carried by the frame members 16, said caps being provided with set screws 27ª for this purpose.

The drums 10 and 11 carry near one end thereof external gear rings indicated diagrammatically in Fig. 1 at 29 and 30, which intermesh as indicated, the gear ring 30 also meshing with a pinion 31 similarly indicated in Fig. 1, said pinion being rigidly secured to a shaft 32 carried in suitable bearings therefor on the end frames 16, to drive the machine.

The frame members 16 also support between them by suitable bearings, a guide roller 33 for directing the web as it leaves the machine.

The web to be dried by the machine is indicated at 34 and as shown, on entering the machine engages the lower surface of the drum 11 around which it passes until it is adjacent the drum 10, being then led around the bottom and upwardly on the outer surface of the drum 10 until it is adjacent the roller 33 around which it passes to be delivered from the machine as indicated. The direction of rotation of the drums and the direction of motion of the web is indicated by the arrows.

The web may be any web of fibrous material made by collecting the fibers from solution in any manner known to the art, whether the resulting web is of paper pulp, felt fiber or otherwise, the web being in wet condition when it is delivered to the machine under consideration. As the web passes around the drum 11 the sub-atmospheric pressure in the chamber 18 is effective in causing the flow of moisture from the web under the action of atmospheric pressure on the outside of the web, through the perforations in the drum and into the chamber 18 from which the air and moisture are continously removed from the outlet pipe 20 by suitable pumping means. This operation is effective in removing practically all of the moisture from that surface of the web in contact with the drum 11. The outer surface of the web however, still contains considerable moisture and this surface of the web, which is outermost in its passage around the drum 11, becomes the innermost surface of the web in its passage around the drum 10, where the now inner surface of the web is subjected to the same action above referred to by the sub-atmospheric pressure in the chamber 17. In this manner practically all of the moisture is removed from the web and the nearly dry web may be subsequently completely dried by heated drums in the usual manner, the advantage being that the number of heated drums required to thoroughly dry the web after the extraction of moisture from it just described, is small, even for high velocity of the web, whereas without the extraction of moisture in the manner described, a very large number of such heated drums is required to completely remove the moisture from the web, accompanied by a correspondingly large expense for fuel to generate the steam required to heat the many drying drums.

In carrying out my invention the drums 10 and 11 are made of a sufficient length to accommodate the widest web to be dried by the machine. To accommodate webs of less width I employ cover strips 35 and 36 encircling the drums around the portions thereof in angular alignment with the vacuum chambers, these cover strips being preferably placed at the ends of the drums and having their ends secured by suitable retaining devices, for example pins 37 and 38, to the frame members 16 in such a manner that the cover strips, which are preferably of thin sheet metal, will prevent practically all air flow through the perforations under them into the vacuum chambers and yet at the same time permit the drums to rotate freely under them. The cover strips are taken of a width to cover that part of the outer surfaces of the drums that is not covered by the web being dried. The cover strips are of similar construction, one of them for example a cover strip 35 being shown in end elevation in Fig. 3.

The vacuum chambers 17 and 18 are of substantially the same construction as each other and they are similarly supported on the frame members of the machine so that detail reference to the manner of supporting but one of them will suffice. As indicated in Fig. 2 the drum 10 is provided on its outer surface near its end with a groove 39 to receive the rollers 12 located at that end of the drum. The relation of the gear ring 29 to the rollers 12 and to a cover strip 35 that may be employed as desired, is indicated in Fig. 2. As shown in this figure, the pipe 19 is extended outside of the machine to connect with any desired form of pumping mechanism, indicated diagrammatically at 40 from which a discharge pipe 41 extends. It is immaterial what form of pumping mechanism is employed, the only requisite being that it shall have sufficient capacity to produce the desired condition of sub-atmospheric pressure in the chamber 17 and remove from the chamber 17 all of the moisture that may collect in it adjacent the end of the pipe 19.

As indicated in Fig. 2, the end wall of the chamber 17 has secured thereto in any suitable manner, a reinforcing plate 42 through which the pipe 19 extends, said plate carrying at its lower edge an outwardly projecting flange 43. As indicated in Figs. 2 and 4, the trunnion 25 is securely held in place by a cap 27 through which set screws may extend if desired as indicated to further restrain the trunnion from rotary movement

in its support. The inner end of the trunnion 25 has rigidly secured thereto a bracket 23 carrying on its upper end a U-shaped flange member 44 forming a supporting surface for the wedges 21 disposed between the flange member 44 and the flange 43 secured to the vacuum chamber. The flange member 44 carries adjusting screws 45 in line with the wedges 21 to move them to desired position so that the outer edge surfaces of the chamber 17 will make sliding engagemennt with the inner surface of the drum 10. Clamping bolts 46 extend through the flange 43, the wedges 21 and the flange member 44, to clamp the parts together in any desired adjustment.

It will be understood that the construction of supporting devices described for the chamber 17 in connection with Figs. 2 and 4, is duplicated at the other end of chamber 17. As a result of the construction described, it will be observed that the chamber 17 may be given any desired angular adustment by releasing the caps 27 and set screws carried thereby, without modifying the fit of the chamber against the inner surface of the drum, since the trunnions 25 are co-axial with the drum. In this manner the chamber 17 may be given such an angular relation to the web being dried as to most effectively remove the moisture therefrom. In any event it is desirable that the leading edge surface of the vacuum chamber shall be in advance of the leading engagement of the web with the outer surface of the drum, so that the web will not be pulled violently into engagement with the drum by the suction effects produced through the perforations; it is also desirable that the trailing edge of the vacuum chamber shall be sufficiently back of the line of departure of the web from the surface of the drum, to insure that the web is in engagement with the outer surface of the drum for at least a small angle after passing from the zone of sub-atmospheric pressure, so that there will be no tendency to tear the web by attempting to remove it from the surface of the drum while it is subject to the action of the sub-atmospheric pressure.

It will also be understood from the description just made in connection with Figs. 2 and 4 that each end of the vacuum chamber may be adjusted radially of the drum independently of the other end, and without changing the angular position of the chamber, either to secure the sliding engagement described between the vacuum chamber and the inner surface of the drum, or to move the vacuum chamber slightly to compensate for wear that may occur after continued use of the machine.

In making the perforations in the drum, it is desirable that said perforations shall be of sufficiently small diameter so that a required degree of sub-atmospheric pressure may be produced in the vacuum chamber to effectively remove the moisture from the web, without however appreciably disturbing the material of the web by the suction action upon it. Where the web is composed of material having long fibers, the perforations may be relatively large, particularly if the web is of substantial thickness; on the other hand, where the web is thin and consists of relatively short fibers, for example where the web is of paper stock, it is desirable that the perforations $10^a$ be of very small diameter. For any diameter of the perforations $10^a$, required for the drying of webs of any particular kind, it is desirable that as many perforations shall be made through the drum as permitted by mechanical considerations, to the end that as much as possible of the surface of the web passing over the vacuum chamber, shall be subject to the suction action.

In the construction of machine shown in Fig. 5 which is the preferred embodiment of my machine as to its general construction, the drums 50 and 51, intermeshing gear rings 69 and 70, cover strips 75 and 76, driving pinion 71 and driving shaft 72, and vacuum chambers 57 and 58 are of similar construction and operate in substantially the same manner to remove moisture from the web 74, and the web is led around the drums and around the guiding roller 73 in substantially the same manner as described above, the differences in this case being in the manner of supporting the drums 50 and 51 and the vacuum chambers 57 and 58 from the frame members 56. In this construction the drums 50 and 51 are provided with end supports 52 and 53 in the form of pulleys or wheels having central bearings 54 and 55 preferably of the roller type, carried by pipes 59 and 60, which pipes are rigidly supported from the frame members and constitute the outlet pipes from the chambers 57 and 58.

The construction of the two drums is the same, as is also the construction of the two vacuum chambers 57 and 58, and it is therefore necessary to describe but one of them. The manner of supporting the drum 50 is indicated in Fig. 7 for one end only of said drum, since both ends are similarly supported, both ends of the vacuum chamber 57 being similarly mounted on the pipe 59. This figure indicates somewhat more clearly than Fig. 5, the relation of the frame member 56 to the wheel 52 supporting one end of the drum. Suitable set screws may be employed to hold the pipe 59 rigidly in place in the frame member 56. In this construction as indicated in Figs. 6 and 7, the end wall of the vacuum chamber 57 is provided with a flange member 83 extending in inverted U-shaped formation as indicated at

83[a] in Fig. 6, to receive the wedges 61 between the mid portion of said flange member and a flange member 84 rigidly secured to the pipe 59. The end wall of the vacuum chamber 57 is provided with a clearance opening 87 around the pipe 59 for adjustment purposes and the flange member 84 is of sufficient extent to cover and close said clearance opening, clamping bolts 88 being provided to hold the flange member 84 securely to the end wall of the vacuum chamber 57 for any particular adjustment. The wedges 61 are provided with adjusting screws 85 through the flanges 83[a], by which any desired adjustment of the wedges may be effected to move the vacuum chamber 57 radially relatively to the pipe 59 to secure the fit described above in connection with the drum 10, between the outer cylindrical edge surfaces of the vacuum chamber and the inner surface of the drum. Clamping bolts 86 extending through the flange members 83 and 84 and through the wedges 61, serve to clamp these parts together in any desired adjustment. With this construction, in order to afford a substantial support for the vacuum chamber 57 and the corresponding drum 50, the pipe 59 extends completely through the machine and is therefore provided in the chamber 57 with perforations 59[a] through which the air and moisture taken from the chamber 57 by the pump connected with the pipe 59 may flow into said pipe, the water flowing through the lowermost perforations and the air flowing through the uppermost perforations in said pipe. A pumping mechanism similar to that indicated in Fig. 2, may be connected with both ends of the pipe 59, outside of the frame work of the machine, or if preferred, said mechanism may be connected only to one end of the pipe and the other end of said pipe may be closed.

In the construction illustrated in Figs. 8, 9 and 10, I show a second manner of supporting vacuum chambers and drums of the general construction shown in Fig. 5, this construction serving to avoid any necessity of adjusting the vacuum chamber relatively to the supporting pipe. In this construction the supporting wheel 52[a] is provided with a substantial clearance opening 52[d] around the pipe 59[b] and the wheel 52[a] is extended to form a hub around which the roller bearing 54[a] is disposed, said bearing being supported by the frame member 56[a]. In this manner the corresponding drum, which may be of the same construction as that above described and similarly related to the vacuum chamber 57[a], has supporting bearings carried directly by the frame members of the machine. With this construction the pipe 59[b] extends through the vacuum chamber 57[a] and forms a tight fit with the end walls of the vacuum chamber to support it; said pipe is provided with perforations 59[c] in the vacuum chamber in substantially the manner and for the purpose described in connection with the pipe 59 in Fig. 7. In the construction of Figs. 8 to 10 inclusive, the outer end of the pipe 59[b] has rigidly secured thereto by suitable set screws as indicated, a block 89 between which and a bracket 56[b] extending from the frame member 56[a], adjusting wedges 61[a] are disposed. The bracket 56[b] is provided with upwardly extending flanges 56[c] as indicated in Fig. 10, to receive screws 85[a] in line with the wedges 61[a] to adjust them, and clamping bolts 86[a] are provided for clamping the block 89, the wedges 61[a] and the bracket 56[b] together in any desired adjustment. As a result of the construction described, the wedges 61[a] affords a means for moving the chamber 57[a] and its supporting pipe 59[b] radially, to secure the desired fit between the outer cylindrical edges of the vacuum chamber and the inner surface of the drum, and when it is desired to move either the vacuum chamber 57 or the vacuum chamber 57[a] angularly for adjustment purposes, this may be accomplished by releasing the set screws holding the pipe 59 or the pipe 59[b] in place, as the case may be, and turning the vacuum chamber and pipe in the frame member 56 or the supporting block 89 as the case may be, which will accomplish this adjustment without material change of the fit of the vacuum chamber against the inner surface of the drum, since in each case the supporting pipe is mounted co-axially with the drum. The set screws referred to serve to hold the pipe in either case, and thus the vacuum chamber carried by it, in any desired angular adjustment.

While I have shown my invention in the particular embodiment above described, it will be understood that I do not limit myself to this exact construction as I may employ equivalents known to the art at the time of the filing of this application without departing from the scope of the appended claims.

What I claim is:

1. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, and devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber.

2. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed

by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, and devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, the angular extent of said web adjacent said drum being greater than the angular extent of the open side of said chamber.

3. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, supports for said chamber permitting angular movement thereof for purposes of adjustment, and clamping devices for holding said chamber in desired angular position.

4. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, supports for said chamber including devices for effecting radial movement of said chamber relatively to said drum for purposes of adjustment, and clamping devices for holding said chamber in desired radial position.

5. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, supports for said chamber including devices for effecting radial movement of said chamber relatively to said drum for purposes of adjustment, clamping devices for holding said chamber in desired radial position, said supports permitting angular movement of said chamber for purposes of adjustment, and second clamping devices for holding said chamber in desired angular position.

6. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, a cover strip on the outer surface of the drum over a part of its surface opposite the open side of said chamber, and devices restraining said strip from rotation and permitting rotation of the drum under it, whereby the web to be dried may be of narrower width as desired than the length of the open side of said chamber.

7. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, and devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums.

8. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, and devices permitting a change in the angular relation of said vacuum means to the portion of the web presented to the corresponding drum for adjustment purposes and retaining said vacuum means in desired angular position.

9. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, and devices permitting a change in the angular relation of said vacuum means to the portion of the web presented to the corresponding drum for adjustment purposes and retaining said vacuum means in desired angular position, the angular extent of the action of said vacuum means on said perforations being less than the angular extent of the portion of the web presented to the corresponding drum.

10. In a web drying machine, the combination of two tubular drums each having

perforations through its cylindrical wall, devices rotatably supporting said drum, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, and devices permitting movement of said vacuum means towards and from the corresponding drum for adjustment purposes and retaining said vacuum means in desired position radially of the drum.

11. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, devices permitting a change in the angular relation of said vacuum means to the portion of the web presented to the corresponding drum for adjustment purposes and retaining said vacuum means in desired angular position, and second devices permitting movement of said vacuum means towards and from the corresponding drum for adjustment purposes and retaining said vacuum means in desired position radially of the drum.

12. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, and cover means restricting the vacuum zone of the corresponding drum longitudinally of said drum as desired.

13. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, and cover means restricting the vacuum zone of said drum longitudinally thereof as desired.

14. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, cover strips for engaging the outer surfaces of said drums opposite said vacuum means, and devices retaining said strips in place and permitting rotation of said drums relatively thereto, whereby the web to be dried may be narrower than the extent of said vacuum means longitudinally of said drums.

15. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, and devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers.

16. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, and devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, the angular extent of said web adjacent each drum being greater than the angular extent of the side opening of the corresponding vacuum chamber.

17. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from

each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, supports for holding each vacuum chamber in place in its drum including devices permitting angular movement of said chamber for adjustment purposes and retaining said chamber in any desired angular position.

18. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, supports for holding each vacuum chamber in place in its drum including devices permitting radial movement of said chamber for adjustment purposes and retaining said chamber in any desired radial position.

19. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, supports for holding each vacuum chamber in place in its drum including devices permitting radial movement of said chamber for adjustment purposes and retaining said chamber in any desired radial position, and including also other devices permitting angular movement of said chamber for adjustment purposes and retaining said chamber in any desired angular position.

20. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the augular extent of said inner surface, a delivery pipe extending from each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, and cover means over the perforations in said drums for part of the longitudinal extent of the side openings in said chambers permitting the drying of webs narrower as desired than the length of said openings.

21. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, cover strips around said drums over said side openings permitting the drying of webs narrower as desired than the length of said side openings, and supports for said strips permitting rotation in them of said drums.

22. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, and a cover band around said drum decreasing the vacuum zone as desired longitudinally of the drum.

23. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, devices rotatably supporting said drums, vacuum means communicating with the inner ends of said perforations in each drum, devices for feeding a web to be dried around the outer surfaces of said drums opposite said vacuum means and presenting one side of said web to the action of the perforations of one of said drums and its other side to the action of the perforations of the other of said drums, and cover bands around said drums decreasing the vacuum zones as desired longitudinally of said drums.

24. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extend-

ing from said chamber, and devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supporting devices comprising rollers disposed around said drum at its end portions.

25. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supporting devices comprising rollers disposed around said drum at its end portions, supports for said chamber comprising wedges for adjusting said chamber radially of the drum, and devices for retaining said wedges in desired position.

26. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, supports for said chamber comprising wedges for adjusting said chamber radially of the drum, and devices for retaining said wedges in desired position.

27. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, and devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supports comprising end wheels and bearings coaxial with said drum.

28. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supports comprising end wheels and bearings coaxial with said drum, supports for said chamber comprising wedges for adjusting said chamber radially of the drum, and devices for retaining said wedges in desired position.

29. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, supports for said chamber comprising trunnions coaxial with said drum, and devices permitting rotary movement of said trunnions for adjustment purposes and retaining said trunnions in desired angular position, said pipe extending through said chamber and constituting said trunnions and perforated within said chamber.

30. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supports comprising end wheels and bearings coaxial with said drum, supports for said chamber comprising trunnions coaxial with said drum, and devices permitting rotary movement of said trunnions for adjustment purposes and retaining said trunnions in desired angular position, said pipe extending through said chamber and constituting said trunnions and perforated within said chamber.

31. In a web drying machine, the combination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supports comprising end wheels and bearings coaxial with said drum, supports for said chamber comprising trunnions coaxial with said drum, devices permitting rotary movement of said trunnions for adjustment purposes and retaining said trunnions in desired angular position, wedges for adjusting said chamber radially of the drum, and devices for retaining said wedges in desired position, said pipe extending through said chamber and constituting said trunnions and perforated within said chamber, said wedges being between said trunnions and said chamber.

32. In a web drying machine, the com-

bination of a tubular drum having perforations through its cylindrical wall, devices rotatably supporting said drum, a stationary vacuum chamber having an open side closed by contact with the inner cylindrical surface of the drum, a delivery pipe extending from said chamber, devices for feeding a web to be dried around the outer surface of said drum opposite the open side of said chamber, said supports comprising end wheels and bearings coaxial with said drum, supports for said chamber comprising trunnions coaxial with said drum, devices permitting rotary movement of said trunnions for adjustment purposes and retaining said trunnions in desired agular position, wedges for adjusting said chamber radially of the drum, and devices for retaining said wedges in desired position, said pipe extending through said chamber and constituting said trunnions and perforated within said chamber, said wedges supporting said trunnions, there being clearance openings between said pipe and the end bearings of said drum.

33. In a web drying machine, the combination of two tubular drums each having perforations through its cylindrical wall, a vacuum chamber in each of said drums extending longitudinally thereof and having an open side enclosed by the inner surface of the corresponding drum and embracing but part of the angular extent of said inner surface, a delivery pipe extending from each of said chambers, devices for feeding a web to be dried around said drums to present one side of said web to the action of one of said vacuum chambers and the other side thereof to the action of the other of said vacuum chambers, bearing supports for said drums permitting rotation thereof, and gears carried by said drums and intermeshing with each other.

In witness whereof, I hereunto subscribe my name this 7th day of March, A. D. 1925.

ALBERT E. F. MOONE.