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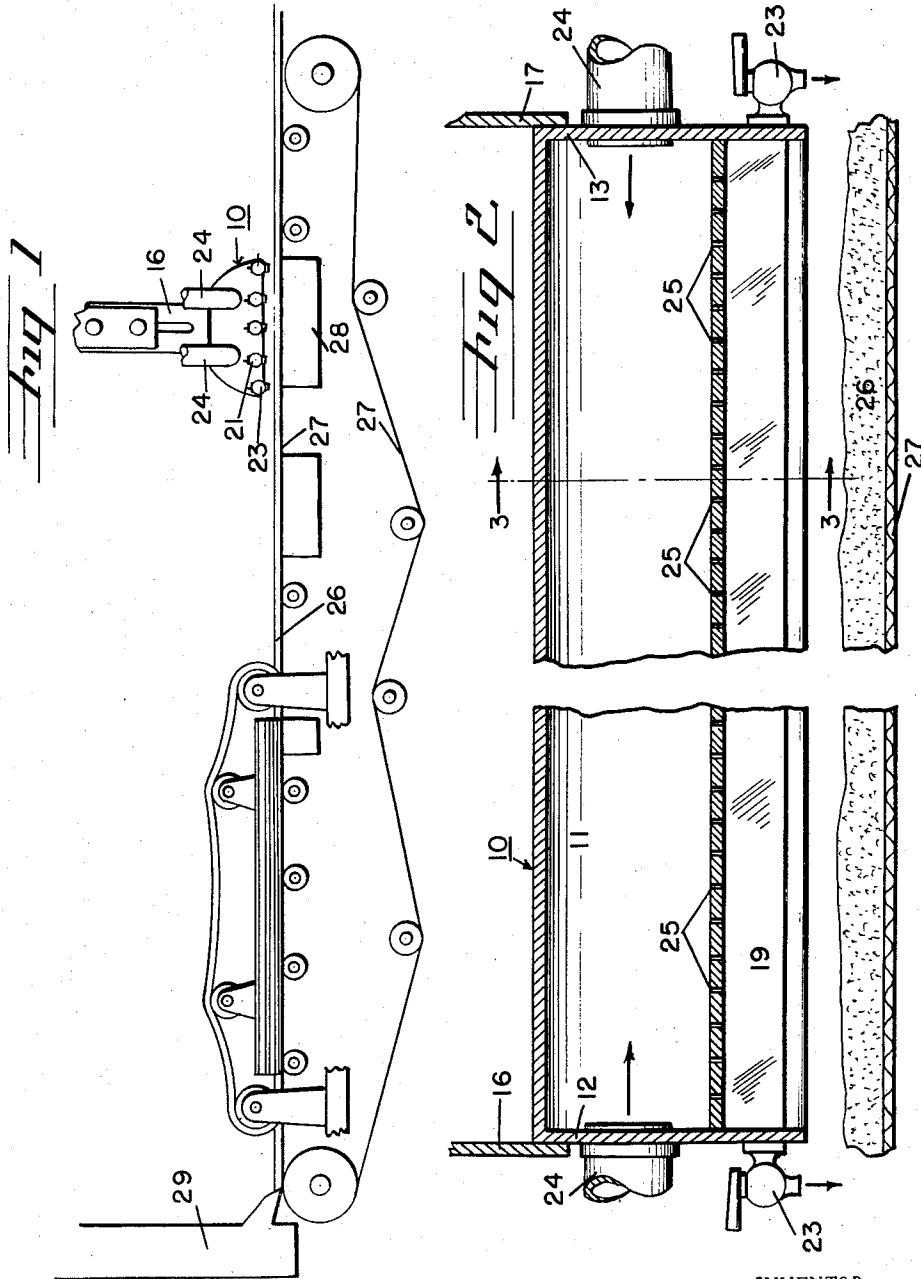
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APPARATUS FOR APPLYING DRIED STEAM TO A PULP
MAT TO EVAPORATE WATER THEREFROM

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2 Sheets-Sheet 1



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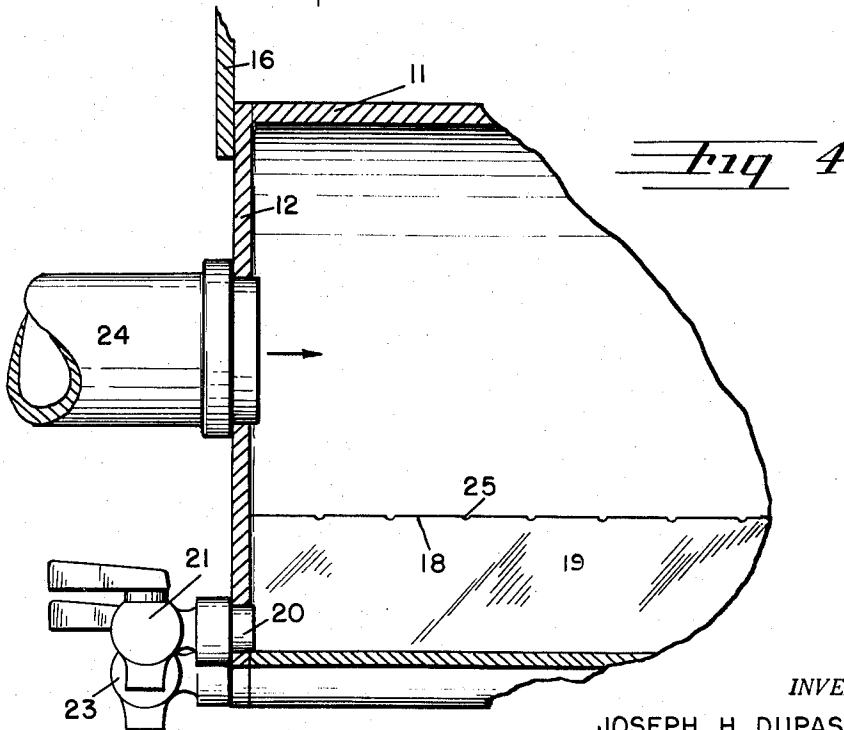
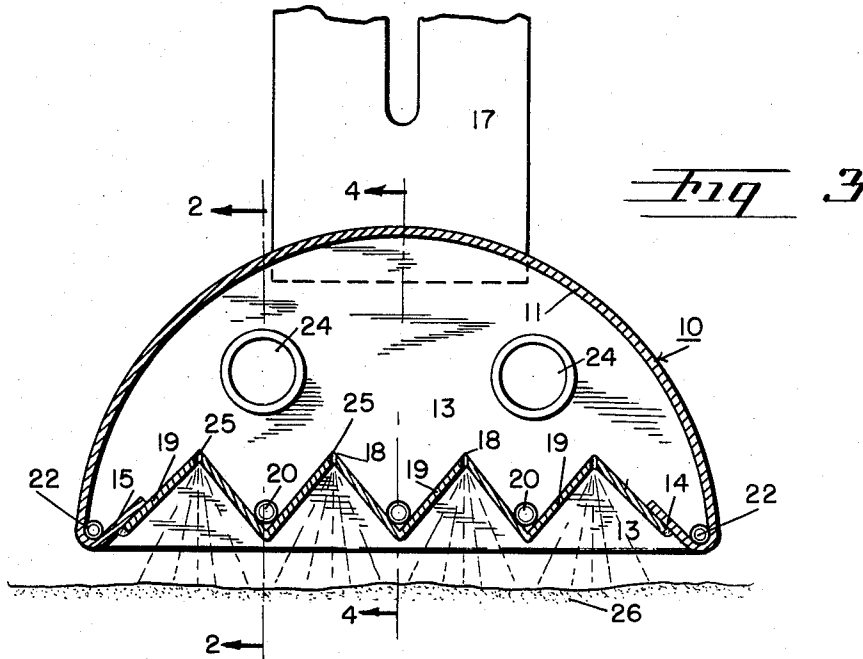
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APPARATUS FOR APPLYING DRIED STEAM TO A PULP MAT TO EVAPORATE WATER THEREFROM

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2 Claims. (Cl. 92—38)

This invention relates to the manufacture of paper on Fourdrinier types of machines wherein the pulp mat is first formed on the moving belt of screen mesh known as the Fourdrinier wire. As the pulp is carried along on the wire a considerable amount of the water in the pulp is drained through the wire, and this withdrawal of water and moisture from the pulp mat is customarily increased by having the wire with the pulp thereon pass over suction boxes and generally also over a suction couch roll at the end of the path of the wire. The pulp mat then proceeds through the press sections of the machine and finally the resulting paper web receives the necessary drying in the dryer section of the machine by contact with heated drums until a desired degree of dryness for the finished paper is attained.

In modern high speed machines rapid as well as uniform drying is essential. Obviously if the paper web contains less moisture upon its passage into the dryer section less drying time in the dryer section is required. An object of the present invention is to achieve this advantage by increasing the withdrawal of moisture from the pulp mat before as well as during its travel through the press sections.

I have found that the withdrawal of moisture from the pulp mat while the mat is still on the Fourdrinier wire can be considerably increased by the application of heat to the mat, and that such early application of heat to the mat also increases the extent to which the mat and the resulting paper web will lose moisture during the subsequent period of travel through the press sections.

Accordingly, a further object of the invention is to provide a suitable method of applying heat to the pulp mat on the Fourdrinier wire and suitable means for doing the same.

In my opinion the most satisfactory manner in which such heating of the pulp mat can be accomplished for the purpose of facilitating and increasing the loss of moisture, and without likelihood of any detriment to the mat or paper web, is with the application of heat to the mat in the form of dry steam. An additional and more specific object of the invention therefore is to provide simple and practical means by which dry steam can be employed for this purpose.

The construction and operation of the means employed in the carrying out of this invention and the manner in which the desired increased withdrawal of moisture from the pulp mat is achieved will be understood from the following brief description with reference to the accompanying drawings.

In the drawings:

Figure 1 is a diagrammatic elevation of the Fourdrinier wire section of a paper making machine illustrating the manner in which and the means by which the invention is performed;

Figure 2 is a sectional elevation taken transversely across the pulp mat and Fourdrinier wire, this section being taken on the line indicated at 2—2 in Figure 3;

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Figure 3 is a section taken on the line indicated at 3—3 in Figure 2; and

Figure 4 is a fragmentary enlarged section taken on the line indicated at 4—4 in Figure 3.

In Figure 1 the pulp mat, indicated at 26, is formed in the usual manner by the delivery of pulp from the flow box 29 upon the moving Fourdrinier wire 27. As the pulp mat is moved along with the wire (from left to right, as viewed in Figure 1) it passes over suction boxes as is customary, one of these being indicated at 28, which aid in the draining or withdrawal of water from the pulp down through the wire. The device by which dry steam is applied to the pulp mat in the carrying out of the present invention is indicated in general by the reference character 10 and comprises a steam chest or chamber extending transversely across the pulp mat and Fourdrinier wire, spaced a slight distance above the mat, supplied with steam from a suitable source (not shown) and having orifices, as later described, through which jets of dry steam are delivered down onto the pulp for the purpose of heating the pulp.

Referring to Figures 2 and 3, the steam chest or chamber has a semi-cylindrical top wall or shell 11 and a pair of semi-circular end walls 12 and 13. The bottom of the chamber is formed of a plurality of angle iron members 19 (there being 4 such members in the device as illustrated), which are arranged side by side in inverted-V position with their ridges 18 uppermost and with the bottom edges of their abutting side walls welded together. The bottom edge portions of the cylindrical top wall 11 are turned inwardly and upwardly, as shown at 14 and 15 in Figure 3, and the adjacent side walls of the two outer angle iron members are welded to these inward-turned edge portions 14 and 15. The ends of the angle iron members are also welded to the end walls 12 and 13 of the chamber and all the joints of the chamber are made thoroughly tight and leak proof so that no steam can escape through the seams or joints.

The bottom of the steam chamber is thus formed with identical parallel ridges and with corresponding valleys or troughs between the ridges. Preferably, but not necessarily, the angle iron members 19 are so arranged and mounted that the bottom edges of their side walls, and thus the valleys between the ridges, will lie in a horizontal plane spaced a slight distance above the horizontal plane of the bottom edges of the end walls 12 and 13 and the lowermost side portions of the semi-cylindrical shell 11.

Steam is delivered into this steam chamber through pipes 24 which are connected to the end walls 12 and 13 and which thus deliver the steam into the chamber at both ends from a suitable source (not shown). Mounting plates 16 and 17, welded to the end walls 12 and 13, are adjustably secured to a pair of suitable supporting standards (not shown) positioned on opposite sides of the Fourdrinier wire so as to enable the device to be set at the desired height with respect to the pulp mat on the wire. Generally I have found it best to have the bottom of the device, that is to say the plane of the bottom edges of the end walls and lowest portions of the semi-cylindrical shell 11, positioned about $\frac{3}{4}$ of an inch above the top face of the pulp mat.

Along each of the top ridges 18 of the bottom wall assembly a plurality of identical equally spaced orifices 25 are provided through which steam jets are directed down onto the moving pulp mat as illustrated in Figure 3. The axes of the orifices in the row along each ridge extend in a substantially vertical plane.

Drain outlets 20 are provided in the end walls 12 and 13 in the ends of each of the valleys or troughs between the ridges 18 and a drain tap 21 (Figures 1 and 4) is provided for each drain outlet 20. Similarly the end walls 12 and 13 are provided with drain outlets 22 (Figure 3) at

the ends of the lower outer troughs formed by the in-turned edge portions 14 and 15 of the semi-cylindrical top wall 11, and corresponding drain taps 23 are mounted in these outer or lower drain outlets.

Any water which may collect in the steam chest or chamber will settle in the troughs or valleys in the chamber bottom from which the collected water can be quickly drained off from time to time upon the opening of the taps 21 and 23, or, if desired, these taps may be left partly open and act as bleeders for any water collecting in the steam chamber. Since the orifices for the steam jets are restricted to the ridges in the bottom of the chamber, and since water particles or any water condensate striking against the sloping walls of the ridges will tend to separate out from the steam and run down the sloping walls of the ridges instead of passing through the orifices at the tops of the ridges and such water be collected in the valleys or troughs, the steam which is discharged through the orifices onto the pulp mat below the steam chamber will be substantially free from drops of water or condensate particles which otherwise might be discharged onto the pulp mat.

Thus, as the pulp mat 26 (Figures 1 and 3) passes along under the device, dry hot steam is applied to the pulp. A considerable portion of this dry hot steam will penetrate the pulp, and the fact that the bottom edges of the end walls 12 and 13 and the lowest side edge portions of the semi-cylindrical top wall 11 are positioned so close to the top face of the pulp mat, will aid in confining the discharged steam within the area determined by the bottom of the device so that the pulp mat as it passes under the device receives maximum heating effect from the discharged steam.

The immediate result of the heating of the pulp mat by the dry steam is to lower the viscosity of the water in the pulp mat and consequently to facilitate the drainage of water from the mat, and, in particular to increase the effectiveness of the suction boxes and suction couch roll in drawing water and moisture from the mat through the wire. Also, since the pulp mat is heated, the water which is drawn off by the suction boxes and couch roll, and which is generally known by the term "white water," will be heated to some extent, and, since the drawn off "white water" is customarily reused in the mill and is heated for such reuse, this incidental heating of the water being drawn off by the suction boxes and couch roll is an additional economy.

Not only does the application of steam to the pulp mat in the manner described increase the amount of water which can immediately be drawn off through the medium of the suction boxes and suction couch roll while the pulp mat is still on the Fourdrinier wire, but the heating of the mat also results in increased evaporation of moisture from the web formed from the mat as the web proceeds on its course through the press sections. The total result is that the paper web, upon reaching the dryer section of the machine, has a considerably lower moisture content. Consequently the final drying of the paper web in the dryer section of the machine is speeded up.

Since the loss of moisture from the pulp mat on the Fourdrinier wire is increased, the pulp mat has a lower moisture content as it enters the press section. As a result the felts which carry the pulp mat in its course through the press section will become less saturated, and the fact that this improved operating felt condition increases the normal life of the felts is a further incidental advantage.

I claim:

1. In a paper making machine having a Fourdrinier wire section, means for heating the pulp mat on the Fourdrinier wire to facilitate the withdrawal of moisture therefrom, said means including a completely enclosed steam chamber positioned above said wire and extending transversely from one side of said wire to the other, said chamber having a bottom wall formed into a series of identical, V-shaped sections forming alternate ridges and valleys extending from one end of said chamber to the other, said ridges lying in a substantially horizontal plane parallel to said wire and said valleys similarly lying in a substantially horizontal plane parallel to said wire, each of said ridges having a row of steam jet orifices discharging downwardly, means for delivering steam under pressure into said chamber, and a drain outlet and tap at an end of each of said valleys for removing moisture from said valleys and chamber and thereby causing the steam discharged onto the pulp mat beneath said bottom wall of said chamber to be relatively dry.

2. In a paper making machine having a Fourdrinier wire section, means for heating the pulp mat on the Fourdrinier wire to facilitate the withdrawal of moisture therefrom, said means consisting of a completely enclosed steam chamber positioned above said wire and extending transversely from one side of said wire to the other, said chamber having a bottom wall, a pair of end walls and a semi-cylindrical top wall, said end walls being substantially parallel to the side edges of the said wire, said bottom wall formed into a series of identical, parallel, V-shaped sections forming alternate ridges and valleys extending from one end of said chamber to the other and extending transversely with respect to said wire, said ridges lying in a substantially horizontal plane parallel to said wire and said valleys similarly lying in a substantially horizontal plane parallel to said wire, each of said ridges having a row of steam jet orifices, the axes of said jet orifices being substantially vertical, the bottom edges of said end walls and the bottom edges of said semi-cylindrical top wall lying in a horizontal plane spaced a slight distance below the plane of said valleys, means for delivering steam under pressure into each end of said chamber through said end walls, and a drain outlet and tap at each end of each of said valleys in the end walls of said chamber for removing moisture from said valleys and chamber and thereby causing the steam discharged onto the pulp mat beneath said bottom wall of said chamber to be relatively dry.

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