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FELT DRYING ROLLERS AND THE LIKE

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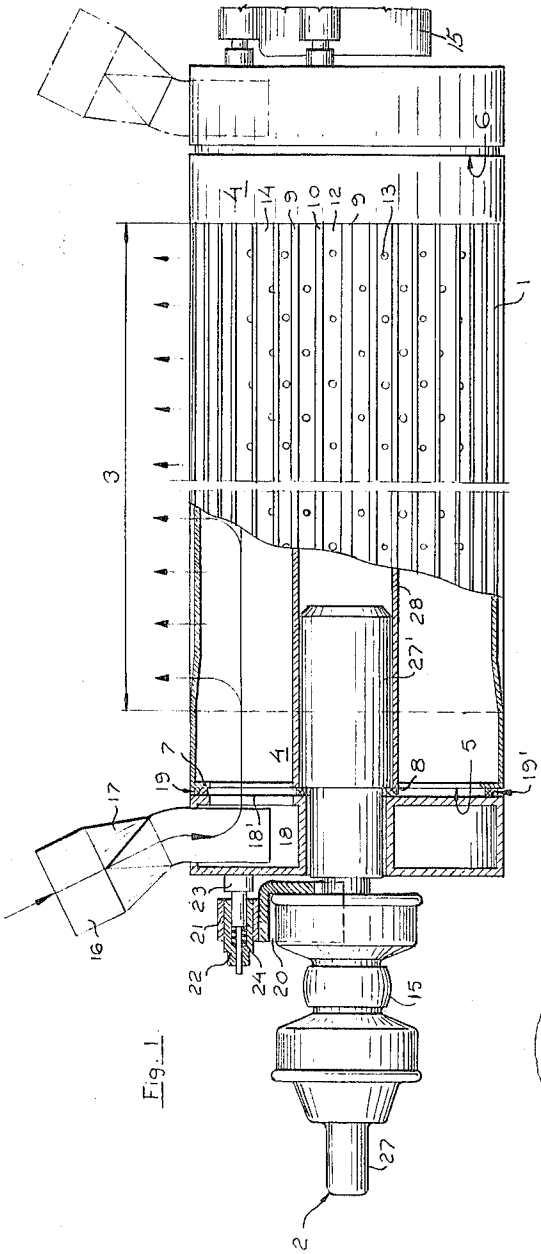


Fig. 1

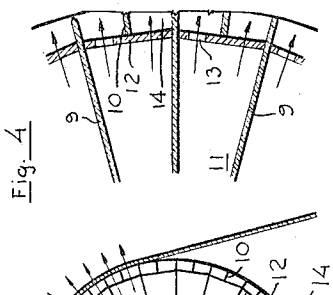


Fig. 4

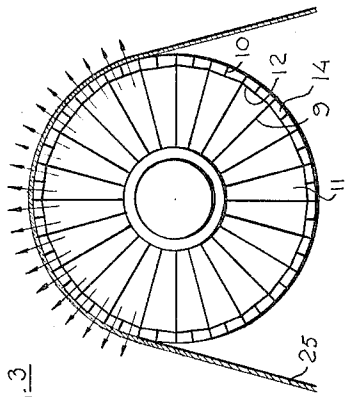


Fig. 3

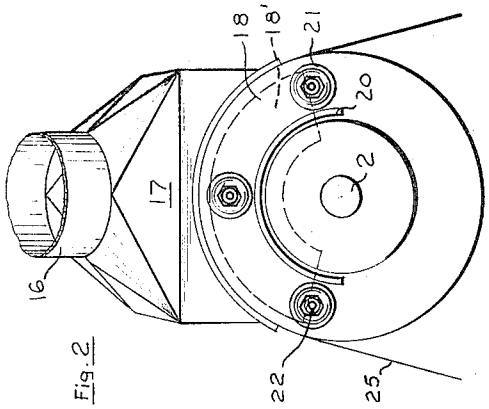


Fig. 2

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FELT DRYING ROLLERS AND THE LIKE

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This invention relates to drying rollers, for drying felt or other web material that have channels extending longitudinally of the roller for the purpose of passing a drying medium such as air either from the inside of the roller through the part of the web in contact with the periphery of the roller or in the opposite direction from the outside through the roller periphery, whereby in the former instance the drying medium is fed into the roller through one or both ends thereof, and in the other instance the medium is extracted at one or both of said ends of the roller.

More particularly the invention relates to a drying roller having groove-shaped channels running longitudinally for the passage of a gaseous drying medium, and means for transferring the drying medium to or from said channels at least at one end of the roller.

Such blowing or drying rollers have been known for many decades, and they are employed not only for drying felts but also for drying other web materials of a structure such that it can be permeated by a gaseous drying medium, usually hot air, at desired flow density without excessive permeation resistance—that is in the order of 100 mm. water column.

Other designs of blowing or drying rollers are also known, for instance, such rollers the complete interior of which constitutes either a pressure chamber or a suction chamber. It is evident that the web can only engage the shell of the roller periphery over a limited arc, and the device must be such, that the passage of air outside the area of contact between the roller and the web is prevented. In rollers of this type, a masking device must be provided blocking off those sections of the perforated surface of the roller, through which air is not allowed to pass.

In rollers with longitudinal passages or channels, the supply or extraction of air at the end of the roller is effected only for those channels momentarily embraced by the area of contact of the web. For all types of rollers of this class the supply to or extraction from the roller of the drying air involves a complicated design problem. Many different solutions of that problem have been suggested, one of which is disclosed in German patent specification No. 817,074. According to that specification the supply or extraction of the air is effected by means of a labyrinth device embracing the end of the roller. Even if such a design is functionally satisfactory, it suffers from many inconveniences, for example the necessity of special bearings for the roller and the inaccessibility of the encased roller end.

According to the present invention a simplified arrangement is attained that permits the use of ordinary bearings, as well as waist type bearings, which for different reasons are often preferable for rollers of this kind. The roller end remains accessible to the requisite extent; and the means for the supply or extraction of the air can easily be removed for inspection, cleaning and the like. Another feature is the particular design of that part of the roller intended for the air permeation of the felt or the like.

The invention is characterized in that radially extending plates form the channel walls the outer edges of said plates being disposed at the circumference of the roller and in that at least one longitudinal vane is interposed between every pair of adjacent channel walls, the outer

edges of said vanes being disposed at the circumference of the roller.

The foregoing and other features will be fully understood from the following description of one embodiment of the invention which is illustrated on the accompanying drawings, in which

FIGURE 1 shows a side elevation of a roller with parts broken away and with a waist type bearing at the left end and an ordinary bearing at the right end;

FIGURE 2 is an end view as seen from the left of FIGURE 1;

FIGURE 3 represents a cross-section through the middle of the roller; and

FIGURE 4 is a detail of FIGURE 3 on a larger scale.

Referring to FIGURE 1 reference numeral **1** denotes the roller, which is supported by a shaft **2** provided with journalling means in the shape of a double stub shaft **27**, **27'** at the left end and shaped as a tube **28** within the roller. The roller has a perforated central portion **3** between two imperforate end portions **4**, the latter affording contact surfaces for the edges of the felt or web for sealing purpose. The end planes **5** and **6** of the roller are parallel to each other and perpendicular to the axis of rotation. The end planes each have an outer contact ring **7** and an inner contact ring **8**. Spaced plates **9** extend radially and axially or longitudinally from the tubular part of the shaft **2** to the periphery of the roller (FIGURE 3). Between these plates intermediate vanes **10** are located which also extend axially and the outer edges of which lie on the roller periphery. The spaces **11** between the plates **9** form channels having sector-shaped cross sections. These channels form the transport passages for the air along the length of the roller. For the purpose of stiffening the plates or walls **9** perpendicular strips **12** (FIG. 4) are inserted between every two adjacent walls, and the intermediate vanes **10** are attached to the strips. The strips **12** are perforated as at **13** to afford passages for the air. The perforations may be formed as circular holes as shown or as slots extending in the longitudinal direction of the roller. By selecting the number, size and distribution of the perforations, it is possible to obtain a uniform or otherwise predetermined flow of the air through a web contacting the roller. This is important especially for web materials with a low permeation resistance. For materials that have a high permeation resistance, the web itself acts as an equalizer for the flow, and for such materials the spaces **14** between the walls or plates **9** and the vanes **10** need no additional walls or strips **12**, provided the flow is uniformly distributed.

The following description is restricted to a blowing type roller. (For suction rollers the conditions are reversed.) The roller with its shaft and journals is supported by the bearings **15**, the left bearing being a waist type bearing while the right one is an ordinary bearing. In other respects both ends of the roller are exactly alike, and therefore the description can be restricted to the left part. Arrows indicate the principal air flow paths.

The air is supplied through a preferably flexible tube **16**, the end of which is connected by a union **17** with a manifold **18**. The manifold is provided with a sector-shaped opening **18'** (see especially FIGURE 2) communicating with the channels **11** when in front of the opening. A sealing member **19** is inserted between the side of the manifold around the opening **18'** and the roller end **5**. This sealing member **19** seals the space between the manifold and the roller end plane and permits the roller to rotate although the manifold is stationary. A uniform contact pressure is achieved by means of a resilient suspension of the manifold **18**. A bracket **20** is rigidly fixed to the bearing housing or support and carries three internally threaded sleeves **21**.

An inner sleeve **22** is screwed into each of the sleeves **21** and accommodates a stud **23** which is rigidly secured to the manifold. A compression spring **24** in the sleeve **22** exerts pressure against the roller end through the stud **23**. The contact pressure can be adjusted by screwing the sleeve **22** in or out of the sleeve **21**.

The drying roller structure is preferably made of steel and assembled in the following way. Around the central tubular portion **28** of the shaft **2**, in the ends of which the stub shafts **27'** are pressed in, the channel partition walls **9** are welded to the tube **28** with their inner edges and distributed uniformly in a star-shaped manner. The spacing between the partition walls in the circumferential direction depends on the diameter of the roller. The greater the diameter, the smaller the circumferential spacing. An angle of about 20° is normally adequate for rollers of ordinary size, that is having a length of 300–500 cm. and a diameter of approximately 25–36 cm.

Between every two adjacent partition walls **9** the flat iron strips **12** are inserted, their longitudinal edges being welded to the corresponding faces of the partition walls **9**. The strips **12** should be located somewhat inside the circumference of the roller. These strips **12** welded to the partition walls **9** which are in their turn welded to the tube **28** form a rigid roller frame giving the entire roller a great strength. The strips **12** are provided with holes, slots or the like as at **13** for providing a uniform or otherwise desired distribution of the air flow. Especially when a uniform air flow along the roller is required, which is generally the case, the strips **12** ought to be sufficiently retracted radially inwards from the roller circumference as to form real longitudinal grooves or spaces **14** in which the air flow can be finally equalized for a uniform drying of the web.

The intermediate vanes **10** running lengthwise in the groove-shaped spaces **14** are preferably flat steel ribs, the inner edge of which is welded to the outer face of the respective strips **12**.

After the entire structure has been welded together in this way, it is put up in a lathe and turned until it has got the required even circular-cylindrical circumference. The aforementioned chamfering or bevelling of the edges of the walls **9** and of the vanes **10** can be made before or after the turning of the roller structure.

When operating as a drying roller, the roller has a felt or other web **25** engaging a portion of its circumference corresponding to the sector-shaped opening **18'**. The air supply means may be provided at both ends of the roller, or at one end only, depending on the length of the roller. The air flows into and along the roller through the channels **11** and out of the roller through the spaces **14** into and through the web, the tension of which has to be sufficient to keep the web in close contact with the roller against the action of the air pressure. In the case of suction the drying medium flows, of course, in the opposite direction and the outside air presses the web against the roller.

In the embodiment illustrated the manifold **18** is annular with the shaft **2** passing through the central opening. In this instance the air supply may be provided below the shaft or laterally thereof the opening **18** remaining in the place shown. If the air is supplied from above, the manifold **18** may be limited to a sector-shaped structure surrounding the sector opening **18'**.

It is unavoidable that the sealing member **19** diminishes in thickness due to wear. This is compensated in the first place by means of the spring loading and in the second place by adjustment of the sleeves **22**. When required, replacement of the sealing member is easily effected. For that purpose the manifold is released by unscrewing the sleeves **22** so that the sealing member is made accessible. According to FIGURE 1 there is another sealing member **19'** below the shaft. This member normally has no sealing purpose but acts as a balance weight for the member **19**; however, the second sealing member **19'** may replace in case of emergency the actual sealing member **19**, should the latter become damaged.

Drying rollers with longitudinal channels have previously been designed with longitudinal strips placed across the edges of the walls **9** whereby an enlarged area for the felt is obtained compared with the design according to the drawing. At the same time, however, the flow area of the drying air is diminished and it is indispensable to use a higher air pressure for a given quantity of air per unit of time. This is of less importance in such drying rollers as have a shell labyrinth for sealing. According to the invention, higher air pressures than necessary should be avoided, since the contact pressure between the manifold and the roller can then be kept lower, reducing the wear of the sealing member. The construction of the roller according to FIGURE 4 admits a great ratio between the injection area and the total area of the web. Chamfering of the outer edges of the walls **9** and the vanes **10** permits the said ratio to approach 1.

Many modifications are possible within the scope of the invention. For instance, the number of vanes **10** per strip **12** may be two, three or even greater, instead of one. With supply or extraction of the air at both ends of the roller the channels may be divided by means of a partition wall at the centre permitting individual control of the two air flows. The rings **7** and **8** may be provided with grooves, or they may be replaced by conical or other rotational surfaces or may deviate by some other shape from the end plane.

The sealing member **19** may be dispensed with, provided that the end of the roller is permitted to slide directly against the manifold sector with the help of any suitable antifriction means. The subtended angle of about 120° of the manifold sector as shown in the drawing may be modified according to local conditions and other requirements and possibilities.

When the roller rotates relatively to the stationary manifold, when the air is supplied by blowing, air leakage may occur at the sides of the radial edges of the manifold. This is a matter for adjustment. Not even narrow radial edges according to the drawing do, as a rule, give rise to any leakage problems. Should such a problem arise, however, it is a simple matter to widen the edges so that no passage of air can take place, not even theoretically.

If the devices for the supply or extraction of air are provided at both roller ends with the channels divided in the middle by means of a partition wall, it is possible to allow a certain angle of displacement between the two opposite sectors **18**.

At normal rotation speeds and ordinary air velocities the position of the manifold opening **18'** may be disposed symmetrically. If, however, the speed of the roller is high an adjustment of the position of the manifold and/or the width of the manifold opening may be required for the purpose of compensating additional dynamic factors.

What I claim is:

1. A rotatable drying roller for drying a web, running over part of the circumference of said drying roller in engagement therewith, comprising in combination:

a rotatable shaft carrying said drying roller;

a pair of journalling means for said shaft;

a duct for the passage of hot, gaseous drying medium;

a stationary manifold into which one end of said duct opens, said manifold being located at one end of said drying roller in close juxtaposition thereto and having an opening for the passage of said drying medium in that one of its walls which faces said drying roller;

a plurality of axially extending walls forming part of said drying roller and having their inner, longitudinal edge secured to said shaft and their outer, longitudinal edge located substantially on the circumfer-

ence of said roller for momentary engagement with the web while said roller rotates, said walls thus defining an equal plurality of axially extending channels which are in momentary communication with said manifold for the passage of drying medium therethrough and through the portion of the web being in momentary engagement with the drying roller;

an equal plurality of axially extending strips, each located in an individual channel and having its longitudinal edges secured to said walls of the channel, said strips being provided with perforations of such a number, size and distribution as to ensure a predetermined distribution of the flow of the drying medium through the web while in momentary engagement with the drying roller; and

a plurality of axially extending vanes, each vane being disposed in one of said channels and having its inner, longitudinal edge secured to the strip located in its channel and its outer longitudinal edge located substantially on the circumference of said roller for momentary engagement with the web while said roller rotates.

2. A drying roller as claimed in claim 1, in which the outer edges of said channel walls are chamfered.

3. A drying roller as claimed in claim 1, in which the outer edges of said vanes are chamfered.

4. A drying roller as claimed in claim 1, in which only one vane is secured to each strip.

5. A rotatable drying roller for drying a web, running over part of the circumference of said drying roller in engagement therewith, comprising in combination a rotatable shaft carrying said drying roller, a pair of journalling means for said shaft, two ducts for the passage of hot, gaseous drying medium and two stationary manifolds, each manifold being in communication with a respective one of said ducts, said manifolds being located at opposite ends of said drying roller in close juxtaposition

thereto and having each an opening for the passage of said drying medium in that one of its respective side walls which faces said drying roller; a plurality of axially extending walls forming part of said drying roller and having their inner, longitudinal edge secured to said shaft and their outer, longitudinal edge located substantially on the circumference of said roller for momentary engagement with the web while said roller rotates, said walls thus defining an equal plurality of axially extending channels which are in momentary communication with said manifolds for the passage of drying medium therethrough and through the portion of the web being in momentary engagement with the drying roller; an equal plurality of axially extending strips, each located in an individual channel and having its longitudinal edges secured to said walls of the channel, said strips being provided with perforations of such a number, size and distribution as to ensure a predetermined distribution of the flow of the drying medium through the web while in momentary engagement with the drying roller; and a plurality of axially extending vanes, each vane being disposed in one of said channels and having its inner, longitudinal edge secured to the strip located in its channel and its outer longitudinal edge located on the circumference of said roller for momentary engagement with the web while said roller rotates.

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