May 12, 1970 H. FLEISSNER 3,510,955

PROCESS AND APPARATUS FOR HEAT-TREATING TEXTILE MATERIAL LENGTHS

Filed Jan. 5, 1968 2 Sheets-Sheet 1

Fig. 1

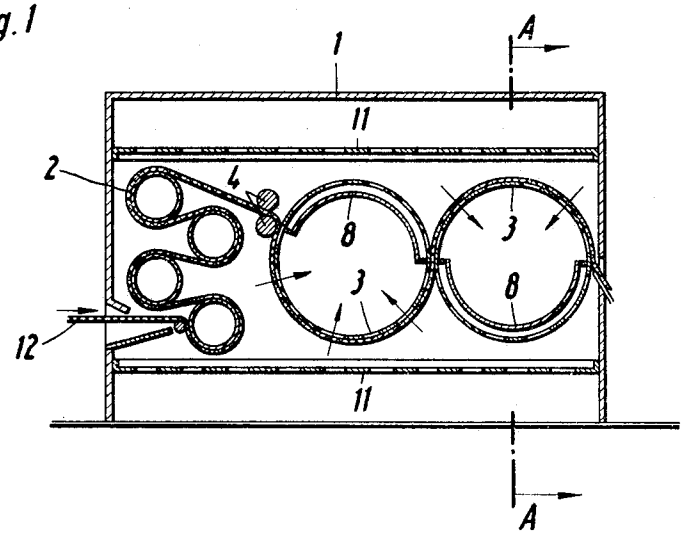
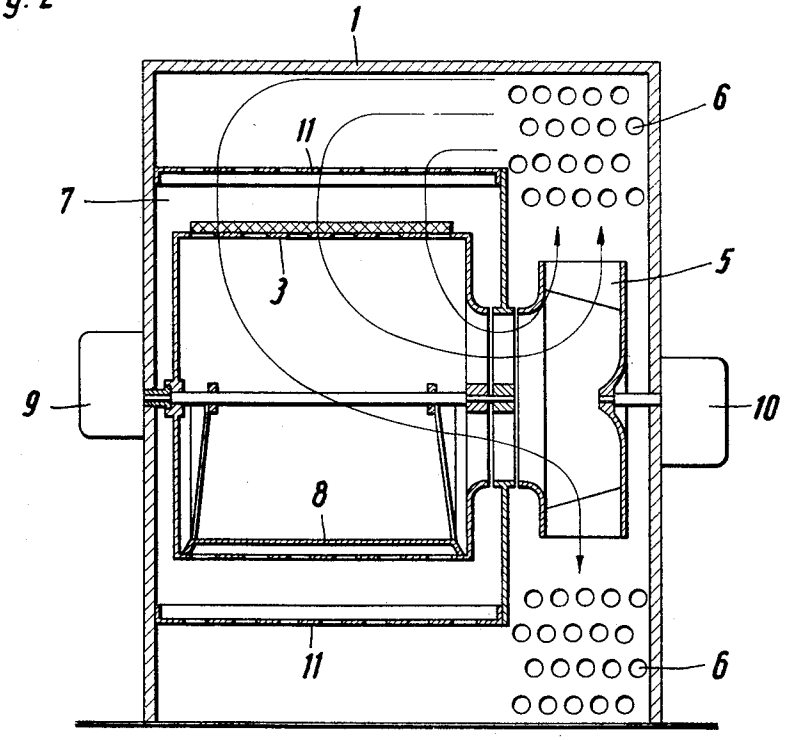


Fig. 2



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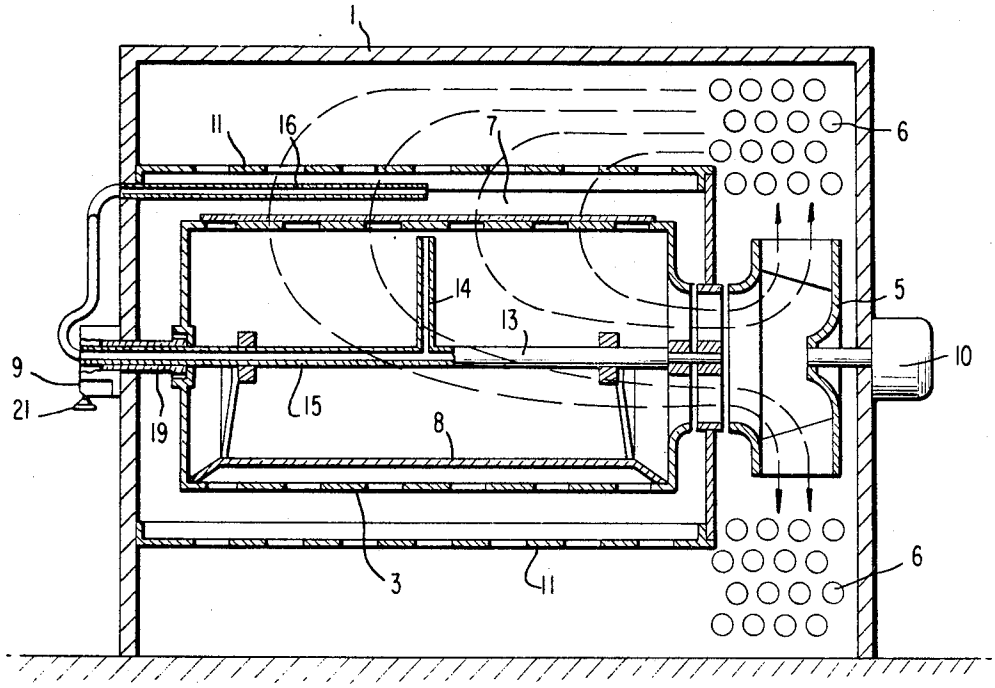


FIG. 3

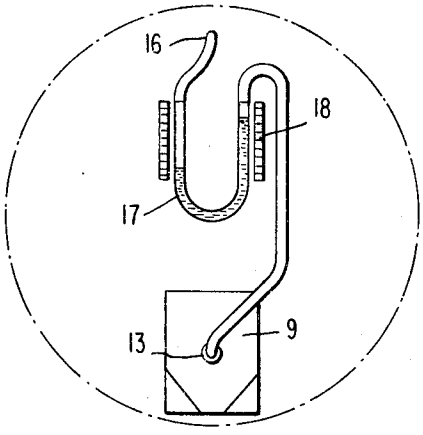
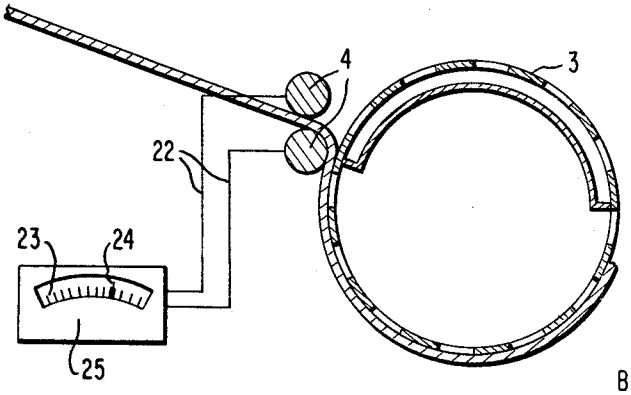


FIG. 4

FIG. 5



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PROCESS AND APPARATUS FOR HEAT-TREATING TEXTILE MATERIAL LENGTHS

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U.S. Cl. 34—23 14 Claims

ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a process and apparatus for heat-treating textile material lengths, for example sliver-type textile materials which comprises introducing the material to be treated into a drying chamber, partially drying said material by contact heat transfer on the surface of heated rotating cylinder means and finally drying said material on the surface of at least one sieve drum means subjected to a suction draft or to a positive pressure wherein the treatment medium is passed through the material being treated.

BACKGROUND OF THE INVENTION

The present invention relates to a process and apparatus for drying textile material lengths, for example sliver-type textile materials, wherein the material to be treated is passed in a drying chamber over rotating cylinders and heated up by means of contact heat transfer and by means of a gaseous treatment medium, such as drying air. The evaporated liquid is lead off by means of the treatment medium flowing around and through the material being treated.

It is well known to use driers with heated cylinders for drying tow, slivers, belts and fabrics. Drying is affected by contact heat transfer at the surfaces of the material being treated. Drying is not uniform or at least not as uniform as it is when passing the air through the material. Contact heat transfer is of advantage for very wet textiles. If the surfaces are already substantially dehydrated by drying, further drying takes place very slowly since the liquid from the interior layers must first migrate to the surface. Furthermore, it is not possible with heated cylinders to guide the material without any tension. Thus full material shrinkage is not ensured.

For drying textile materials, devices with sieve drums subjected to a suction draft are also well known. In these driers the drying air is drawn through the fabric and is thus passed around each individual fiber. Drying is completely uniform and very efficient. With air-permeable materials the drying capacity is substantially higher than with contact drying or drying by jetting. However, the prerequisite for high drying capacity is the air-permeability of the material. However, it has now been found that viscose linings, velvet, tow, non-wovens and other flat-shaped articles are practically impermeable to air until they are dried down to a certain moisture content. Thus, the drying capacity on sieve drums subjected to a suction draft is low since in the first drying section the drying air flows only around the material length. However, the drying air can flow around the material length only if at both sides of the sieve drum there is an air-permeable margin which is not covered with the material or if openings for the passage of the drying air are provided in the faces of the sieve drum. Here special sieve drum driers for slightly air-permeable materials are provided.

SUMMARY OF THE INVENTION

An object of the present invention is to avoid the prior art disadvantages in the heat-treatment of wet textile materials.

Another object of the present invention is to provide an improved process and apparatus for drying textile materials which, in a wet condition, are impermeable to air but which become more permeable to air as they are dried down to a certain moisture content.

A further object of the present invention is to provide for a completely tensionless material guidance on the sieve drums to allow the material to shrink fully during drying.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

Pursuant to the present invention, it has been found that the above-mentioned disadvantages may be eliminated and a much improved process and apparatus for the heat-treatment of textile material lengths, for example, sliver-type textile materials, can be obtained by subdividing the drying process into two drying stages, and by predrying the material in the first drying stage by means of contact heat transfer until it is air permeable when a suction draft of about 50 to 100 mm. water column is employed, and then by drying the material on sieve drums by means of a treatment medium which flows through the material. In the first drying section, the material should be dried down to such an extent that it lets through at least about 1000 $m.^3/hr.$ of drying air per square meter of material being treated with a suction draft (that is, a differential to pressure from outside to inside of the drum) of about 50 to 100 mm. water column. The air-permeable textile material can then be finally dried on sieve drums by passing the treatment medium, for example air, through the material and with a high evaporative power.

For carrying out the process according to the present invention, an apparatus is provided comprising heated cylinders at the inlet of the drier housing followed by sieve drums subjected to a suction draft or to an excess pressure, as guiding elements. A blower device is correlated to these sieve drums in a well known way which produces the partial vacuum and/or the excess pressure in the sieve drums and which ensures the circulation of the treatment medium in the drier housing.

In order to provide for a completely tensionless material guidance on the sieve drums and in order to allow the material to shrink fully during drying, it is suggested, according to another feature of the present invention, to arrange between the last heated cylinder and the first sieve drum a device, for example a pair of rollers, by means of which the textile material can be overfed to the first sieve drum. Instead of a pair of rollers, a suction roller can also be used.

For optimum drying it is furthermore suggested to arrange an instrument for measuring the air-permeability and/or the moisture content between the heated cylinders and the sieve drums. As a feeler for measuring the air permeability, the suction roller with which a material overfeed can be obtained, may be used. Here it is necessary only to measure the air quantity drawn in by the

suction roller. For measuring the humidity, a pair of rollers may be used in a well known way. Also, the material overfeed can be effected by this pair of rollers at the same time. The measured value can now be evaluated either by adjusting the speed of the drier according to a certain air-permeability or by connecting the measuring instrument with a control instrument which regulates the speed of material passage according to the moisture content of the fabric and/or according to the air-permeability of the fabric.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only and thus are not limitative of the present invention and wherein,

FIG. 1 is a longitudinal section of the apparatus of the present invention;

FIG. 2 is a cross section of the apparatus of FIG. 1 taken along line A—A.

FIG. 3 shows the means for measuring the air permeability of the material being treated using a pressure difference;

FIG. 4 shows the gauge used to measure the pressure difference in accordance with FIG. 3; and

FIG. 5 shows the moisture measuring system used in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference numerals are used throughout the various views to designate like parts, the apparatus of the present invention comprises a heat-insulated housing **1** in which heated cylinders are provided at the inlet and sieve drums **3** are disposed behind said cylinders. To the first sieve drum **3** a pair of rollers **4** is correlated for overfeeding the material. The speed of the pair of rollers together with that of the heated cylinders **2** can be adjusted independently of the speed of the sieve drums **3**. To one face of each sieve drum, fans **5** are correlated in a well known way (FIG. 2). These fans draw the air out of the sieve drum and recirculate it upwards and downwards via heaters **6** into a treatment chamber **7**. The suction draft is interrupted by means of baffles **8** at that portion of the sieve drums which is not covered with the material being treated. A drive means **9** for the sieve drums **3** and a drive means **10** for the fan wheels **5** are mounted to the outside of the housing **1**. For an equal air distribution, sieve sheets **11** are provided above and below the sieve drums **3** and the heated cylinders **2**. The drying air which is circulated by the fan of the first sieve drum **3** partially flows back into the treatment chamber **7** above and beneath the heated cylinders **2** and removes the moisture which is evaporated from the material length **12** on the cylinders **2**.

The material length **12** is alternately guided around the heated cylinders **2** thereby evaporating part of the moisture. The material length which is now air-permeable can then be overfed by means of a pair of rollers **4** on the sieve drums **3**, so that the material is free to shrink fully during the subsequent final drying stage. In general, overfeeding will be effected by having the subsequent sieve drums run at a speed which is, by the desired percentage, slower than that of the heated cylinders **2** and the pair of rollers **4**. In this manner full shrinkage of the fabric or of the other textile materials is ensured. With this device an absolutely uniform drying is effected which is usually only obtained with sieve drum driers, that is with driers in which the air is passed through the material. The handle of the material is soft and the material is voluminous. The undesired luster and the board-like handle which is the result of drying on heated cylinders is not encountered with this treatment.

In the suction drum or suction roller **3**, as shown in FIG. 3, the shaft **13** is provided with a bore **15** and a tube **14** in communication with said bore. External of the sieve drum **3**, that is, on the side of the drum covered by the material being treated, an additional tube **16** is disposed. The tube **16**, as well as the drum axle **13** provided with bore **15** are in communication with a liquid-filled U-pipe **17** shown in FIG. 4, arranged on the outside and at the front end of the housing **1**. The U-pipe serves for indicating the pressure difference on both sides of the material being treated. The pressure difference can be read from a scale **18** associated with the U-pipe. The pressure difference is a measure of the air permeability. The drum is driven by a hollow shaft **19** in communication with the drive assembly **9**. Thus the speed of the drums can be adjusted by way of the handwheel **21** by means of the drive assembly.

FIG. 5 shows the moisture measuring system used in the present invention. The moist material **12** passes through rolls **4**, both rolls being fashioned as electrodes. The more moist the web of material **12** becomes, the higher the electrical conductivity; whereas the drier the web of material becomes the lower the electrical conductivity. Two lines **22** transmit the electrical impulse to the combined moisture measuring and control device **25**. The degree of moisture is indicated on a scale **23** by means of an indicator **24**. Thus, the measurement is based on the principle of electrical conductivity. The device **25**, which is also fashioned as a control device, makes it possible to regulate the speed at which the material travels in accordance with the moisture present in the fabric.

In addition to drying, the apparatus of the present invention can also be used for Thermosol-dyeing and for fiber setting. On the heated cylinders the material which has been impregnated with the dyeing liquor is dried down to a residual moisture content of about 20 to 30% and on the sieve drums the material is then finally dried and heat-set. The device offers the advantage that a predrying duct with infrared radiators may be dispensed with.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications are intended to be included within the scope of the following claims.

It is claimed:

1. A process for drying textile materials which are substantially impermeable to air when containing a high degree of moisture which comprises introducing the moisture-containing material to be treated into a drying chamber, partially drying said material by contact heat transfer to air-permeability at a suction draft of about 50 to 100 mm. water by conveying the material on the surface of at least one heated rotating cylinder and finally drying said material by connection heat-transfer by conveying the material on the surface of at least one sieve drum means subjected to a suction draft or to a positive pressure wherein a heated treatment medium is passed through the material being treated.

2. The process of claim **1**, wherein liquid evaporated from the textile material is removed by means of the treatment medium which flows around and through the material.

3. The process of claim **1**, wherein the partially dried material being treated is overfed to the first sieve drum.

4. The process of claim **1**, wherein the air-permeability of the material being treated is measured between the heated cylinders and the sieve drums, the extent of air-permeability in said material being used to regulate the speed of material passage.

5. The process of claim **1**, wherein the moisture content of the material being treated is measured between the heated cylinders and the sieve drums, the amount of mois-

ture present in said material being used to regulate the speed of material passage.

6. The process of claim **1**, wherein the material is partially dried down to a permeability of about 1000 $m.^3/hr.$ of treatment medium per $m.^2$ of material being treated.

7. The process of claim **3**, wherein the overfeed is effected by rotating the sieve drums at a speed slower than that of the heated cylinders.

8. An apparatus for heat-treating textile materials which comprises a substantially closed housing, at least one cylinder means rotatably disposed within said housing at the inlet thereof, means for heating said cylinder means disposed in said housing at least one sieve drum means subjected to a suction draft or to a positive pressure rotatably disposed within said housing behind said heated cylinder means, inlet means for introducing the material to be treated to the housing and outlet means for removing the material.

9. The apparatus of claim **8**, wherein means are associated with the first sieve drum means to provide an overfeed to said sieve drum means.

10. The apparatus of claim **9**, wherein the overfeed means is a pair of rollers.

11. The apparatus of claim **9**, wherein the overfeed means is a suction roller.

12. The apparatus of claim **10**, wherein the roller means are used for measuring the humidity of the material being treated.

13. The apparatus of claim **11**, wherein the suction roller is used as a feeler for measuring the air permeability.

14. The apparatus of claim **8**, wherein sieve sheets are provided above and below the sieve drums and the heated cylinders in the housing.

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KENNETH W. SPRAGUE, Primary Examiner

U.S. Cl. X.R.

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