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H. FLEISSNER
PROCESS AND APPARATUS FOR DRYING AND
SHRINKING TEXTILE MATERIALS

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2 Sheets-Sheet 1

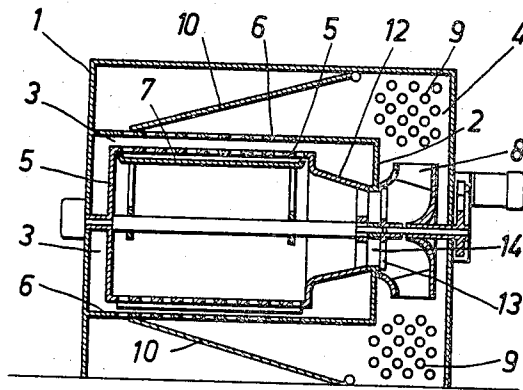


Fig. 1

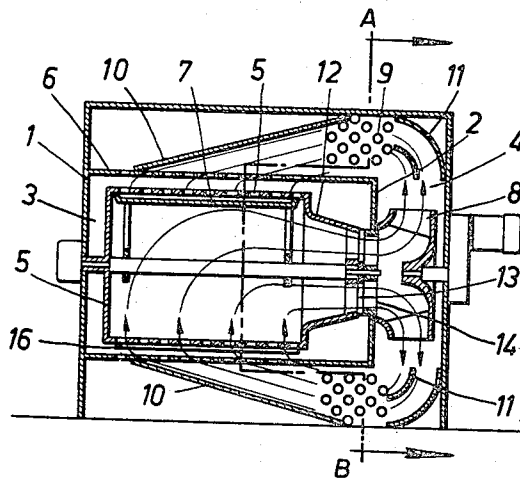


Fig. 2

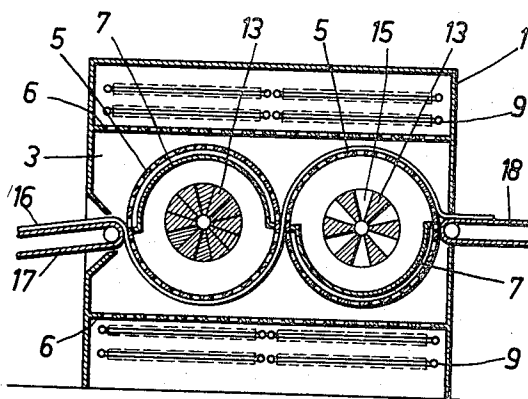


Fig. 3

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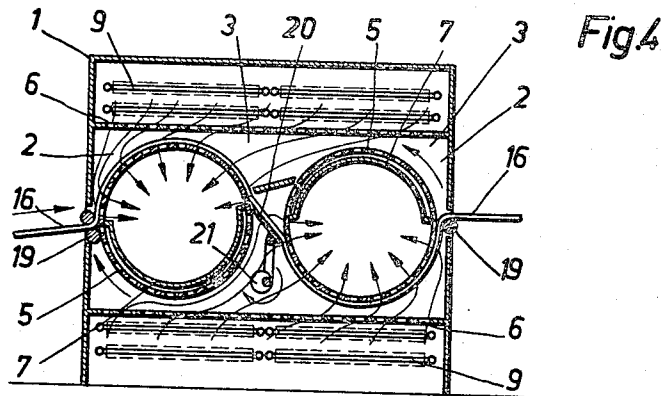
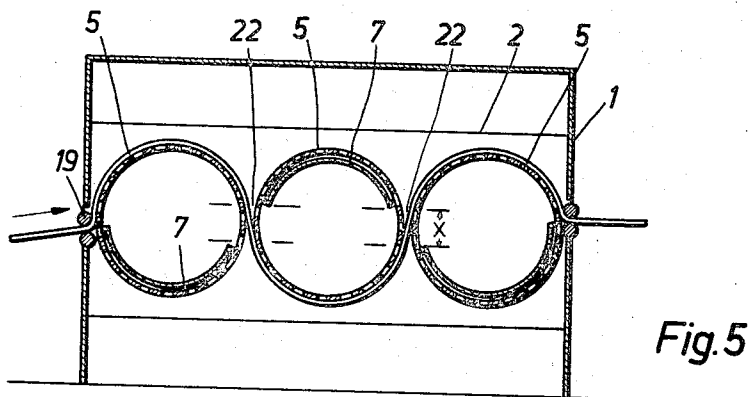
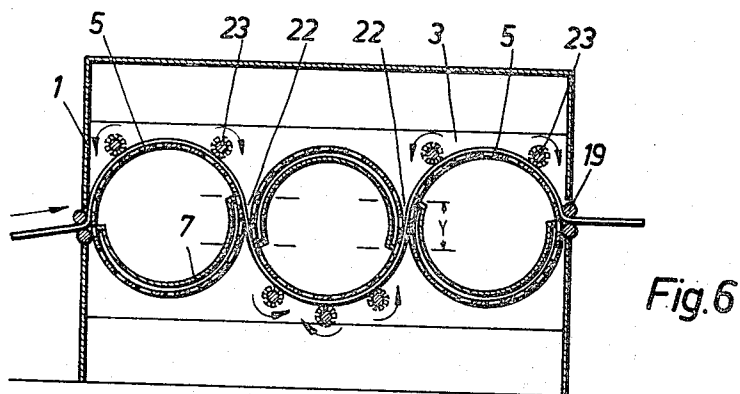
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ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a process and apparatus for drying and shrinking textile materials, such as for example, knit goods, fabrics and the like, wherein a treatment medium, for example, air is brought into contact with, and advantageously drawn through the tensionless guided textile material as it is guided through a heat treating apparatus. The apparatus is provided with means for achieving a pulsating treatment medium flow and in a fluttering of the material to be treated.

Background of the invention

In the manufacture of textile materials, such as for example, knit goods, fabrics and the like, tension differences in the individual threads are caused by varying yarn twist, unequal yarn feed and different processing, which results in a non-uniform appearance of the goods. In compensating for these tensions, it is well known to subject the length of textile material alternately to a lengthwise and transverse stress or to guide the textile material, tension-free during a steaming process. In the case of wet treatment plants, it is also known to guide the length of textile material wave-like and/or folded through the treatment bath. It is also known to beat the textile material during the washing process to obtain a more intense cleaning effect.

In all of the aforementioned known textile treatments, satisfactory results regarding the equalization and relaxation of the textile lengths are not obtained. Another disadvantage of the prior art processes is that for shrinking the textile material, a special steam treatment or an extended wet treatment is generally required.

An object of the present invention is to avoid the disadvantages of the prior art heat treating processes and apparatus.

Another object of the present invention is to provide an improved process and apparatus for heat-treating various types of materials, for example, textile materials.

A further object of the present invention is to provide a process and apparatus for drying and shrinking textile materials wherein a separate treatment for equalizing and relaxing the textile lengths is avoided and a good equalization and relaxation of the textile material is obtained during the drying process.

Still another object of the present invention is to provide a process and apparatus for drying and shrinking textile materials wherein a special steam treatment or an extended wet treatment of the textile materials is not required.

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.

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Summary of the invention

Pursuant to the present invention an improved drying process and apparatus has been provided wherein the textile material being treated is guided in a tensionless manner and subjected, at least during part of the drying process, to a vibration, a beating, or pushing step. Particularly favorable results can be obtained if the textile material is brushed during drying. According to the present invention, it has been determined that in order to obtain good shrinkage, it is not only desirable to guide the textile material tensionless during drying but also to move the textile material constantly. When moving the textile material, the compensation of the tension differences in the fibers is facilitated.

According to one embodiment of the present invention, the tensionless guided textile material can be kept moving during drying by passing a pulsating flow of the treatment medium, for example, drying gas or drying air, to and/or through the textile material. It is essential for good shrinkage, equalization, and relaxation of the textile material, that the textile material is moved during drying, that is, that the textile material flutters as much as possible. Thus, the textile material can be moved by the pulsating drying medium alone and/or by the influence of mechanical means.

Advantageously the treatment of the textile material can be carried out in an apparatus comprising a closed housing, an air-permeable, preferably perforated conveying means subjected to a suction draft, for example, sieve drums, wherein the suction draft is provided by fans for drawing through and circulating the drying medium and/or the drying air, said fans being correlated to the conveying means. Furthermore, additional means are provided which are correlated to the fan and/or fans, and which in conjunction with the fans, produce a pulsating current of the drying air or the treatment medium. An expedient design of these means is obtained if they are arranged within the suction range of the fan and/or fans. Advantageously, these additional means are composed of two disc-shaped bodies which rotate relative to each other and which are provided with recesses for the passage of the drying air and/or the drying gases. Because of these relative motions, the recesses of these discs are alternately and rhythmically opened and closed. By rhythmically closing the exhaust sockets, a pulsating drying air flow is necessarily produced and the suction draft at the conveying elements is rhythmically interrupted or at least considerably weakened so that in conjunction with the treatment medium which flows pulsatingly against the material, a constant movement of the material is effected.

According to a further embodiment of the present invention, an apparatus comprising sieve drums as conveying elements and fans correlated to the bases of the sieve drums is provided wherein the sieve drums are supported on a cast-iron spider on the fan side, said cast-iron spider being provided with sector-shaped openings which are desirably equal in size and which become larger towards their outer periphery. Immediately in front of or behind the cast-iron spider a disc-shaped body of similar design is provided which makes a rotating movement. In the case of high speed of material passage, that is, at high sieve drum speeds, it is advantageous to mount the rotating disc-shaped body to the sieve drum or to design the sieve drum bottom accordingly. If the frequency of the pulsating drying medium flow is to be varied independently of the speed of material passage, it is desirable to mount the rotating disc-shaped body on a shaft which is also supported in the cast-iron spider. The shaft is then provided with a separate drive means which preferably is passed outwardly through the fan wheel and

the hollow driving shaft of the fan. However, a separate drive for the rotating disc-shaped body can be dispensed with if the rotating disc-shaped body is designed blade-like or provided with blades, so that the suction draft, that is the treatment medium drawn towards the fan, rotates the disc-shaped body.

Another means for achieving a pulsating treatment medium flow is to provide in the suction socket of the sieve drum a valve body which rhythmatically opens and closes. An effective design can be obtained if the suction socket is conically restricted towards the fan wheel, and if the valve body is designed in accordance with optimum fluid flow techniques, for example, in the form of a double cone and/or a double truncated cone which alternately closes and opens the suction socket. With certain types of construction it may be more desirable to keep the suction opening completely free from the aforescribed means. For such designs it is effective to arrange around one fan wheel and/or around each fan wheel a stationary guide ring and around that guide-ring a rotating guide ring, and to design the two guide rings in such a way that they rhythmatically interrupt the air flow discharged by the fan wheel, preferably a radial fan wheel.

Furthermore, it has often proved favorable to arrange the sieve drums at a distance from each other such that the material between the sieve drums is not in contact with the sieve drums for a distance of at least about 10 centimeters. This causes the material to flutter in this free distance, and thus particularly good shrinkage is obtained. Another way to obtain a fluttering of the material when it is passed from one sieve drum to the next one is to adjust the baffle which at least partially interrupts the suction draft on that portion of the sieve drum which is not covered with the textile material, in such a way that within the range of passage from one sieve drum to the next, the suction draft is effective on both sieve drums. Alternatively, within this range of passage, the suction draft can be interrupted at both sieve drums. By using either of these measures, a strong fluttering of the material is obtained even if the drying air flow does not itself pulsate. It is often expedient to provide at least a distance of about 10 centimeters for the range of passage in which the material flutters. A larger range of passage is often more advantageous.

In order to obtain automatic material passage it was considered desirable to align the baffles in such a way that the suction zone of one sieve drum ends where the suction zone of another sieve drum begins. However, according to the present invention a fluttering of the material at the point of passage from one sieve drum to another can be obtained if the baffles are slightly swivelled from their original position. Thus, in an apparatus comprising at least three sieve drums with staggered arrangement of the baffles, there exists at the point of passage between adjacent sieve drums a range in which the suction draft of both sieve drums is effective and at an adjacent point of passage, a range in which the suction draft of both sieve drums is interrupted. As a result of the wedge-shaped restriction of the free space between two sieve drums, which space is subdivided by the material into an upper wedge-shaped space and a lower wedge-shaped space, a vigorous fluttering of the material being treated is obtained by the treatment medium which is blown against the sieve drums. Also, the fluttering effect is obtained by a uniformly circulated treatment medium flow. With a pulsating treatment medium flow, the fluttering is even more vigorous.

When treating heavy and stiff textile material, it is often advantageous to provide a guiding sheet, preferably in the form of a chute, between two sieve drums. This guiding sheet may be perforated so that the air can be blown against the material from below through the guiding sheet. Another effective feature is to design the guiding sheet in the form of stairs. By the step design alone, a movement of the material can be obtained. The movement of the textile material can be considerably increased if the guiding sheet

is connected with a vibrating device so that the guiding sheet vibrates. Furthermore, it is preferable if the guiding sheet vibrates parallel to the drum axis of the sieve drum. Thus, a particularly good equalization can be achieved.

According to another feature of the present invention, it has been found effective to cause the textile material to sag in the form of loops between two sieve drums and to provide beneath the point of passage from one sieve drum to the next a beating and/or pushing device on which the material loop rests, said device thus acting upon the material loop. Furthermore, it is also desirable to arrange at least one vibrating roller between two sieve drums. The vibrations of the roller may be lifting and lowering motions and/or reciprocating motions in the direction of the drum axis. Instead of a vibrating roller, however, push rods may be arranged between the sieve drums said push rods making several lifting and lowering motions and/or reciprocating motions.

Another embodiment of the present invention is to brush the material during the drying process. This can be done by arranging brushing rollers at the sieve drum, the bristles of said brushing rollers acting upon the textile material resting on the sieve drums. Because of the action of the bristles upon the textile material, a plurality of small movements is produced. Thus, all connecting points of the individual fibers are uniformly seized and a compensating effect is rapidly obtained. According to the invention, the brushing can be done with or without the aforementioned measures. When using several measures and/or treatments according to the present invention, the treatment effect is correspondingly intensified. When high speed production is desired, it is advantageous to use several measures in combination.

When using roller brushes, it is suggested to arrange the bristles in a spiral form on the rollers and to have the brushing rollers arranged one behind the other acting upon the textile material alternately, in opposite directions, as seen in the direction of material passage. This can be achieved by having the brushing rollers rotate alternately in opposite directions. In another favorable design, the circular rows of bristles of the brushing rollers are arranged on the brushing roller oblique to each other whereby the textile material is alternately shoved and stretched as seen in the direction of the drum axis. Furthermore, it is often advantageous to provide the aforescribed chute which is arranged between adjacent sieve drums with such bristles and/or with a vibrating device. Instead of or in addition to the vibrating device, a brushing roller may be correlated to the bristle chute above the textile material. The bristles of the brushing rollers and also the brushing chute can be made of plastic. The brushing effect can be intensified by having the brushing rollers produce floating and/or vibrating motions. The sieve drum may also be provided with vibrating motions and/or be subjected to torsional and/or axial vibrations. This can be simply effected by supporting the sieve drum and/or the brushing rollers resiliently and/or by suspending them on springs.

According to the present invention, the air circulation can be improved and the air distribution over the entire working width of the sieve drum can be substantially equalized by arranging deflecting sheets at both sides (above and below) the fans and by arranging heater batteries between the deflecting sheets within the transition range between the fan and treatment chambers.

Brief description of the drawings

The present invention will become fully understood from the detailed description hereinbelow and the accompanying drawings which are given for purposes of illustration only and thus are not to be considered as limiting, and wherein:

FIGURE 1 is a cross-sectional view of a sieve drum dryer according to the present invention;

FIGURE 2 is a cross-sectional view of another embodi-

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ment of the sieve drum dryer according to the present invention;

FIGURE 3 is a longitudinal sectional view of the heat treating apparatus taken along line A-B of FIGURE 2;

FIGURE 4 is a longitudinal sectional view of another embodiment of the sieve drum dryer according to the present invention;

FIGURE 5 is a longitudinal sectional view of a sieve drum dryer according to yet another embodiment of the present invention; and

FIGURE 6 is a longitudinal sectional view of a sieve drum dryer similar to that of FIGURE 5.

Description of the preferred embodiment

The sieve drum dryer of the present invention comprises a closed housing 1, the interior of which is subdivided into a treatment chamber 3 and a fan chamber 4 by a partition 2. Arranged in the treatment chamber are sieve drums 5 subjected to a suction draft, and sieve bottoms 6 located above and below the sieve drums. The suction draft in the sieve drums is partially interrupted by a baffle means 7 located at that portion of the sieve drum not covered with the material being treated. The suction draft in the sieve drums is produced by means of radial fan wheels 8 which are arranged in the fan chamber and correlated to the faces of the sieve drums. The fan wheels return the treatment medium drawn through heater batteries 9 into the treatment or fan chamber. For an equal distribution of the air, oblique bottoms 10 are correlated to the sieve bottoms. For an improved flow and for equalization of the air distribution, the embodiment according to FIGURE 2 is provided wherein deflecting sheets 11 are positioned between the radial fan wheels and the heater batteries, the heater batteries being arranged in the transition range between the fan and the treatment chambers.

In the apparatus shown in FIGURES 1 to 3, a pulsating air flow which is constantly circulated in the treatment chamber and passed or drawn through the material to be processed is produced by disc-shaped body 13 which is correlated to the sieve drum cross 14 at the suction socket 12 of each sieve drum. This disc-shaped body as well as the sieve drum cross are provided with sector-shaped openings 15 which are preferably of equal size and which becomes larger toward their periphery. The openings of the sieve drum cross as well as those of the disc-shaped body are correlated in such a way that they can temporarily coincide while the disc-shaped body rotates. In this position, the treatment medium can be drawn off. In another position, the openings at least partially overlap and thus the passage of the drying air is completely or at least partially interrupted. By constantly changing the free cross section, a pulsating effect is produced and a pulsating flow of the treatment medium is effected. As shown in FIGURE 3, the through flow cross section of the left hand drum is illustrated as being closed and the through flow cross section of the right hand drum is illustrated as being open. As a result of this pulsating flow of the treatment medium, the material being treated makes small movements corresponding to the pulsating frequency, said movements promoting shrinking of the material and a compensation of the tensions in the fibers. In order to permit tensionless processing during drying, it is advantageous if the material 16 to be dried is fed to the sieve drums at a slightly higher conveying speed than that of the sieve drums, for example, through the use of a conveyor belt 17 or a pair of rollers 19 as shown in FIGURES 4-6. Because of this over-feed, the length of textile material being treated is allowed to shrink freely and through the loose tensionless material support, the individual threads and/or fibers of the material can freely move according to the flow frequency of the pulsating treatment medium. In the apparatus as shown in FIGURE 3, a conveyor belt 18 is used for discharging the material. Instead of the conveyor belt, a pair of rollers 19 or only one roller or a chute may also be provided. The move-

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ment and thus a good shrinkage of the material is also made possible in a different manner in the apparatus according to FIGURE 4. In this embodiment, a perforated chute 20 is provided between the two sieve drums which vibrates by means of an eccentric gear 21. This means can be used in addition to or instead of a pulsating air flow.

A fluttering of the material as it is passed from one sieve drum to the next can be obtained in another manner, such as shown in the embodiment of FIGURE 5. According to this embodiment, the baffle 7 is designed in such a way that in the area where the material being treated is transferred from one sieve drum to another, the suction draft of two adjacent sieve drums is produced. Thus a distance X in FIGURE 5 does not have a baffle means in any of the sieve drums and accordingly the suction draft of both drums is effective upon the material passing therethrough. Consequently, the material traveling through this point is pulled to and fro. It has been found that due to the bilateral suction draft created in this material passage, unstable air flow conditions prevail which cause an intense fluttering of the textile material in this range. Because of this fluttering, a good shrinkage is in turn obtained.

Another way to produce material flutter in the area of passage from one sieve drum to another is shown in the apparatus according to FIGURE 6, wherein a reverse effect from that described above occurs as a result of both drums being provided with a baffle means along a distance y so that the material passing through this point is free from any suction effect. In this embodiment the suction draft in the passage range is interrupted by a baffle 7 on both sieve drums. The fluttering of the material being treated is obtained by the air flowing against the sieve drums, that is flowing into wedge 22 formed by two adjacent sieve drums. Furthermore, in this embodiment brushing rollers 23 are provided at the sieve drums. It has been found that by using brushing rollers which alternately may rotate in opposite directions, a good shrinkage and equalization of fabrics and similar lengths of textile material are obtained.

Since modifications of this invention will be apparent to those skilled in the art, it is not desired to limit the invention to the exact constitution shown and described. Accordingly, all suitable modifications and equivalents may be resorted to which fall within the scope of the appended claims.

I claim:

1. An apparatus for drying and shrinking textile materials which comprises a closed housing, at least one cylindrical sieve drum rotatably disposed within said housing, the cylindrical surface of said sieve drum serving as a perforated conveying means, inlet means for introducing the material to be treated to said conveying means, vacuum means communicating with the interior of the cylindrical sieve drum for directing a treatment medium to the inside of said drum from the space surrounding said drum, heating means provided within the circulation of the treatment medium, pulsating means correlated to the vacuum means which, in conjunction with the vacuum means, produces a pulsating flow of the treatment medium, and means for removing the treated material from the sieve drum.

2. The apparatus of claim 1, wherein the pulsating means are disposed in the suction range of the vacuum means.

3. The apparatus of claim 1, wherein the pulsating means are composed of two disc-shaped bodies which are provided with recesses for passage of the treatment medium, said disc-shaped bodies rotating relative to each other such that the recesses are alternately and rhythmically opened and closed.

4. The apparatus of claim 1, wherein the sieve drum is supported on the vacuum means side in a cast-iron spider provided with sector-shaped openings which are substantially equal to each other in size and become larger

at their periphery, and wherein a rotating disc-shaped pulsating means of similar shape to that of the cast-iron spider containing sector-shaped openings, is provided in front of or behind said spider.

5 The apparatus of claim 4, wherein the rotating disc-shaped body is mounted to the sieve drum or formed by the sieve drum bottom.

6 The apparatus of claim 4, wherein the rotating, disc-shaped body is mounted to a shaft which is supported in the cast-iron spider, said shaft passing outwards through the vacuum means and its hollow driving shaft and connected to a separate drive means.

7 The apparatus of claim 4, wherein the rotating disc has the form of a blade or is provided with blades.

8 The apparatus of claim 1, wherein the pulsating means is a valve body which is disposed in a suction socket of the sieve drum and which alternately and rhythmically opens and closes the suction socket.

9 The apparatus of claim 1, wherein the sieve drums are arranged at a distance from each other such that the material being transferred from one sieve drum to another is not in contact with the sieve drums over a distance of at least about 10 centimeters.

10 The apparatus of claim 1, wherein a baffle means is disposed on the inside of the sieve drum such that there is no interruption in the suction draft in the area of material passage from one sieve drum to an adjacent sieve drum.

11 The apparatus of claim 1, wherein a baffle means is disposed on the inside of the sieve drum such that there is at least partial interruption of the suction draft in the area of material passage from one sieve drum to an adjacent sieve drum.

12 The apparatus of claim 1, wherein at least three sieve drums are utilized, and baffle means are provided in such a way that in one area of material passage from one sieve drum to an adjacent sieve drum the suction draft is interrupted whereas in the adjacent material passage point the suction draft is not interrupted.

13 The apparatus of claim 1, wherein a guiding chute is provided between two adjacent sieve drums.

14 The apparatus of claim 13, wherein the guiding chute is perforated to provide for air which is blown against the material being treated from below, through the guiding chute.

15 The apparatus of claim 14, wherein the guiding chute is stepped.

16 The apparatus of claim 13, wherein the guiding chute is connected to a vibrating means.

17 The apparatus of claim 1, wherein the textile material being treated is permitted to sag in the form of a loop between two adjacent sieve drums, said material loop resting upon a beating or pushing means.

18 The apparatus of claim 1, wherein a roller means which makes lifting, lowering and vibrating motions, is arranged between adjacent sieve drums.

19. The apparatus of claim 1, wherein brushing rollers are disposed at the periphery of the sieve drum, the bristles of said brushing rollers acting upon the textile material resting on the sieve drums.

20. The apparatus of claim 19, wherein the bristles are arranged in the form of a spiral on the rollers and wherein the brushing rollers are arranged one behind the other in the direction of the material passage.

21. The apparatus of claim 20, wherein the brushing rollers are arranged alternately such that one roller rotates in the direction of material passage and one roller rotates opposite to the direction of material passage.

22. The apparatus of claim 19, wherein circular bristle rows are arranged oblique to each other on the brushing roller.

23. The apparatus of claim 22, wherein between adjacent sieve drums a chute fitted with bristles is provided, said chute being connected to a vibrating means.

24. The apparatus of claim 23, wherein the brushing rollers are correlated to the bristle chute.

25 The apparatus of claim 24, wherein the bristles of the brushing rollers or the bristle chute are plastic.

26. The apparatus of claim 25, wherein the brushing rollers produce swinging and vibrating motions.

27. The apparatus of claim 19, wherein the sieve drum and the brushing rollers are resiliently supported and suspended on springs.

28. The apparatus of claim 1, wherein deflecting sheets are arranged between the vacuum means and the cylindrical surface of said sieve drum.

29. The apparatus of claim 28, wherein heating means are provided between the vacuum means and the deflecting sheets.

30. A process for drying and shrinking textile materials which comprises introducing the material to be treated onto a perforated conveying surface, providing a pulsating gaseous treatment medium in contact with said material, heating said pulsating gaseous treatment medium and drawing said medium through said material, and recovering the dry material.

31. The process of claim 30, wherein mechanical means are used to cause the material being treated to flutter.

32. The process of claim 31, wherein the material being treated is brushed during drying.

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