April 23, 1957 H. A. SCHRENK 2,789,366

METHOD AND APPARATUS FOR TREATING TEXTILE MATERIAL

Filed Aug. 11, 1952

Fig. 1.

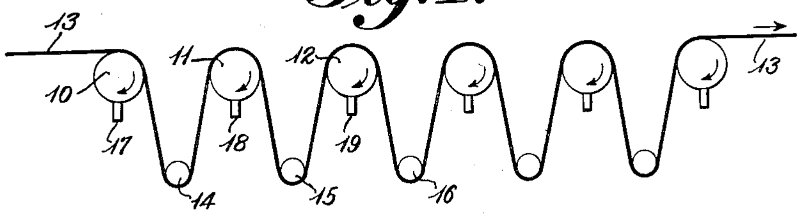


Fig. 2.

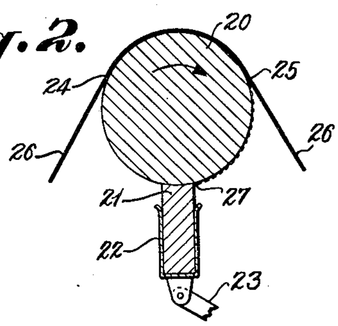


Fig. 3.

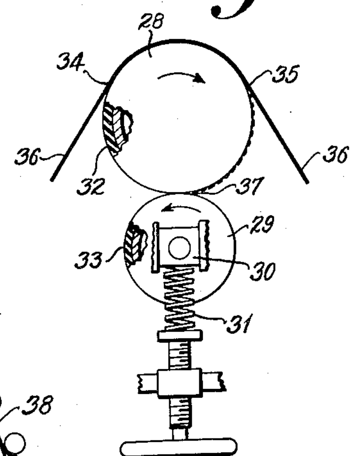


Fig. 4.

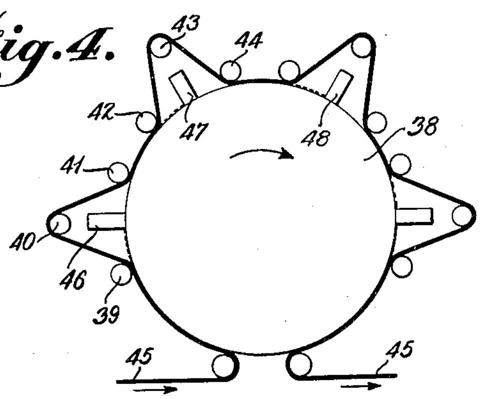
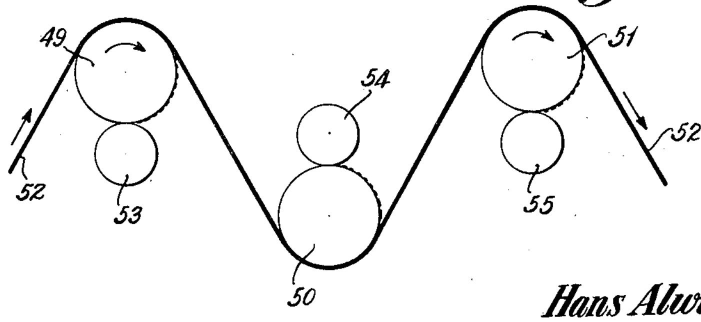


Fig. 5.



INVENTOR

Hans Alwin Schrenk

BY *Mel R. Poston*

ATTORNEY

United States Patent Office 2,789,366 Patented Apr. 23, 1957

1

2,789,366

METHOD AND APPARATUS FOR TREATING TEXTILE MATERIAL

Hans Alwin Schrenk, Arnhem, Netherlands, assignor to American Enka Corporation, Enka, N. C., a corporation of Delaware

Application August 11, 1952, Serial No. 303,747

Claims priority, application Netherlands August 24, 1951

4 Claims. (Cl. 34—9)

This invention relates to the continuous production of textile materials and more particularly to a method and apparatus for reducing the moisture content in an endless length of textile material.

In manufacturing artificial threads by a continuous system, the drying of the wet thread has always been acknowledged to be an important step in the process. For example, when a freshly spun continuous thread of viscose rayon leaves the last washing bath or treatment roller it may have a weight of 5 to 8 times the weight of the dry thread. In order to evaporate all of this water a large heat supply is required and special measures have to be taken if the evaporation is to be accomplished in a relatively short time. Such rapid evaporation tends to deposit salts present in the water on the dried thread, often in an undesirable quantity.

Another problem is encountered in the continuous drying of a large number of threads moving in the shape of a flat sheet at a speed of 80–100 meters per minute or more. It is particularly difficult to obtain an even drying of all of these rapidly moving threads loaded with large quantities of water.

Various methods are used for drying such threads. For example, the threads are passed through a space in which hot air is circulating in order to dry them. Another method that is used involves passing the threads over heated rollers. The foregoing methods are also used for drying woven fabrics and sized warps, etc. It is obvious that when using any of these methods of drying, it is preferable to supply the threads to the actual drying apparatus with as low a moisture content as possible. It is for this reason that the textile material, either in the form of a sheet of threads, or a single thread, or in the form of a warp or fabric, is often subjected to a preliminary moisture reducing treatment before it comes into contact with the actual drying system proper. Such a preliminary treatment, for example, may consist of passing threads over guiding members which strip off a large part of the adhering moisture.

Another method of reducing the moisture content involves passing the threads between pressure rollers in order to mechanically remove adhering moisture. Such treatments, however, often exert adverse influences on the final product. For example, unfavorable secondary actions are sometimes exerted on thread because of the friction created when the thread is passed over guiding members or because of the high pressure applied when thread is passed between pressure rollers in order to remove adhering water.

By means of pressure rollers it is possible to reduce the water content of a freshly spun cellulose thread to about 275%, calculated on the dry substance. A great disadvantage of such a treatment, particularly when treating a sheet of parallel threads, is that differences in moisture content may arise between the individual threads of the sheet. Some threads, for example, are pressed out to a moisture content of 250% while others are pressed out to

2

a moisture content of 300%. Similar variations also occur with other moisture reducing arrangements, such as the guiding members described above. Since the treated sheet of threads is dried immediately after the moisture-reduction treatment it is clear that even very small differences in the water content of the threads will cause the drying process to proceed unevenly. As a result, different degrees of tension occur in the various threads of the sheet during drying with the ultimate result that the final properties of the threads obtained are not uniform. For example, variations in the final moisture content, shrinking capacity, extensibility, dyeing and luster occur.

This invention has as an object to overcome the above disadvantages in reducing the liquid content of a continuously moving textile material.

A further object is to provide a method and apparatus for reducing the liquid content in an endless length of textile material within very narrow limits.

A still further object is to provide a method and apparatus for reducing the moisture content in a moving textile material without exerting undesirable influences on the material.

Another object of this invention is to provide a method and apparatus for reducing the moisture content in a sheet of viscose rayon threads manufactured according to a continuous process.

Other objects and advantages of this invention will appear from the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagrammatic elevation of a general scheme for practicing the invention;

Figure 2 is a sectional view through a dehydrating roller from which the moisture is removed by means of a stripping member with sucking action;

Figure 3 is a schematic drawing showing a dehydrating roller from which the water is removed by means of a pressure roller held in place against the dehydrating roller by spring tension;

Figure 4 is a diagrammatic elevation showing a modified form of the invention; and

Figure 5 is a diagrammatic elevation of a drying scheme wherein the material contacts the dehydrating rollers alternately on one side and then on the other.

In accordance with this invention the textile material is caused to move into contact with a rotating dehydration roller while the moisture which is deposited on the roller is continuously removed or extracted from the roller at a location where the textile material is not in contact with the roller. If desired, more than one such dehydration roller may be used.

In the simplest form of the invention, the thread or other textile material is caused to move in contact with a single dehydrating roller as, for example, by passing the material over lower guiding rollers disposed on each side of the dehydrating roller. The rollers may be positively driven, but it is also possible to construct the rollers and especially the guiding rollers as freely rotatable rollers so that they are rotated by the threads. The dehydration roller is constructed of some material which is readily wetted out by the film forming liquid being removed from the thread or other textile material.

The liquid film deposited on the dehydrating roller is regularly and continuously removed from the roller by means of a stripping member disposed at its lower side or at any other location around the roller except where the textile material contacts the roller.

In many cases one dehydrating roller gives such a reduction in moisture content that in practice no additional dehydration is needed. If, after passing over one dehydration roller the threads still contain "free water," i. e., water which is not present in colloidal form in the fibers but in capillary form between the single filaments of the threads, additional dehydration rollers may be needed.

By stripping off the water film on that part of the dehydration roller where no textile material contacts the roller a surprisingly continuous, even dehydration of the material is effected. The uniformity of the moisture content in different parts of the material or in different threads moving in parallel sheets is enhanced by using more than one such dehydrating roller.

Referring now to Figure 1, a series of spaced rotatable cylindrical dehydration rollers, **10**, **11**, **12**, etc., are suitably mounted for rotation about their respective axes. Dehydration rollers **10**, **11**, **12**, etc., are connected to suitable driving means (not shown) so that the continuous length of textile material **13** will be conveyed from one roller to the next. Disposed between dehydration rollers **10**, **11**, **12**, etc., are freely rotating guiding rollers **14**, **15**, **16**, etc., which serve to properly position the moving textile material for contact with each dehydration roller. Dehydration rollers **10**, **11**, **12**, etc., may be constructed of completely smooth stainless steel or any other suitable material. The surface of these rollers may, if desired, be covered with a layer of smooth rubber.

Mounted beneath cylindrical dehydration rollers **10**, **11**, **12**, etc., in abutting relation therewith are porous wiping members **17**, **18**, **19**, etc. Wiping members **17**, **18**, **19**, etc., extend throughout the length of the respective rollers and are preferably constructed of a porous elastic material such as sponge rubber. It will be readily understood that the dehydration rollers, all of which rotate in one direction, remove liquid from the textile material **13**. The liquid which is taken up on the dehydration rollers **10**, **11**, **12**, etc., is in turn removed from these rollers by wiping members **17**, **18**, **19**, etc., respectively, so that the textile material **13** contacts a substantially dry surface as it initially touches each dehydration roller.

It has been found that more favorable results are obtained if the peripheral speed of at least one dehydration roller is greater than the linear speed of the textile material, so that the material runs in such a way that slippage occurs over at least one of the rollers. In some cases also it has been found advantageous to heat the dehydration rollers to increase the tendency of the liquid to spread over the roller surface. For example, the rollers may be heated by circulating hot water or steam into the interior thereof, or they may be electrically heated.

The assembly just described will of course be positioned immediately in front of the final drying apparatus in a process for treating an endless length of textile material.

Figure 2 illustrates a dehydration roller **20** provided with a wiping member **21**, such as the ones described above. Wiping member **21**, which extends the length of dehydration roller **20** is mounted in a box-like housing **22**. A discharge tube **23** is connected to the bottom of housing **22**. Discharge tube **23**, may, if desired, be connected to a source of vacuum (not shown). In the zone **24**—**25**, where the textile material **26** is in contact with the roller **20**, liquid is transferred to the roller and is carried along as far as point **27**. At point **27** the porous wiping member **21** absorbs the excess liquid from dehydration roller **20** and the liquid is carried downward through the porous wiping member **21** by means of gravity. The liquid removed from the roller **20** eventually flows into discharge tube **23**. When discharge tube **23** is connected to a source of vacuum, it is not necessary for wiping member **21** to be disposed at the lowest point of roller **20** since the vacuum will keep the wiping member **21** in a reasonably dry condition at all times.

Figure 3 illustrates another method for removing the liquid from the dehydration roller. Here, driven dehydration roller **28** is mounted in abutting relation with a freely rotatable pressure roller **29**. The axle of pressure roller **29** is mounted in sliding bearings **30**. Tension is applied to sliding bearings **30** by means of adjustable pressure spring **31**. Thus pressure roller **29** is urged against dehydration roller **28** with an adjustable force. In this embodiment, dehydration roller **28** is made of stainless steel and is provided with an outer surface layer **32** of rubber. The outer surface **33** of pressure roller **29** is also made of rubber, as a result of which an uninterrupted line of contact between the rollers is insured. Outer surface **33** of pressure roller **29** may be made of felt or other yieldable material, if desired, instead of rubber.

Liquid accumulating on dehydration roller **28** moves, just as in Figure 2, over the zone **34**—**35** in the same direction as the dehydration roller, but cannot pass the line of contact between dehydration roller **28** and pressure roller **29**. The liquid removed from the textile material **36** collects in the narrow space between the rollers designated at **37**. Removal of this liquid is effected by a self-adjusting axial flow toward the outer ends of the rollers where, if desired, a stripping or suction member (not shown) may be provided in order to prevent splashing and to expedite the flow of liquid.

It is possible to apply a particularly high pressure to the pressure rollers **29** because there are no threads between the pressure roller and the dehydration roller which are subject to being damaged by the pressure. The pressure roller, extending over the entire length of the dehydration roller, can be pressed against it with any desired pressure to obtain a satisfactory seal. The degree of pressure applied is limited principally by the load on the bearings and the material of which the rollers are constructed.

By the use of a relatively small number of dehydration rollers which are kept dry by pressure rollers, it has been found to be possible to reduce the moisture content extremely uniformly throughout most textile materials to a final concentration of 250% or less. In the case of materials which have not previously been dried, such as freshly spun rayon threads produced by a continuous spinning machine, the limit usually lies at about 250%. In the case of material which has been previously dried and then remoistened, such as sized warp or dyed fabric, much lower liquid concentrations can be obtained, for example, 100–150%. In any case a final water content is obtained which is not greater than that found to be possible in the most favorable cases where the textile material is directly pressed between rollers to remove the moisture.

Figure 4 shows an embodiment of the invention where a single larger driven dehydration roller **38** is used to perform the function of a plurality of dehydration rollers, such as those in the arrangement shown in Figure 1. Disposed around the periphery of dehydration roller **38** are a series of spaced guide rollers **39**, **40**, **41**, **42**, **43**, **44**, etc., so arranged that the thread **45** is alternately passed into and out of contact with rotating dehydration roller **38**. Between adjacent contact areas around the periphery of dehydration roller **38** are mounted wiping members **46**, **47**, **48**, etc. Wiping members **46**, **47**, **48**, etc., are of the general type described in Figure 1 and are mounted in abutting relation with roller **38**. In this embodiment the rollers **39**, **41**, **42**, **44**, etc., do not press against dehydration roller **38** but are mounted sufficiently close thereto to insure that the thread **45** will pass in contact with the dehydration roller. Except for dehydration roller **38**, which is mechanically driven, the other rollers can be driven by the moving textile material, although the other rollers may be mechanically driven, if desired, as for example, in the case where roller **38** is driven more rapidly than the moving textile material.

The embodiment shown in Figure 5 is in principle the same as that shown in Figure 3. Here a series of spaced driven cylindrical dehydration rollers **49**, **50**, **51**, are disposed so that alternately one side and then the other of the textile material 52 comes in contact with the dehydration rollers. Freely rotatable pressure rollers 53, 54, 55, of the type shown in Figure 3, are mounted in abutting relation with corresponding dehydration rollers 49, 50, 51. This embodiment is particularly advantageous in dehydrating thicker thread bundles or textile materials moving at a high rate of speed.

Since the apparatus of this invention is especially useful in dehydrating textile materials moving at a speed of 60–100 m. per minute or more it will be understood that the diameter of the rollers must be chosen so that at these excessive speeds the liquid is not centrifuged from the rollers. The textile material treated according to this invention may consist of a fabric, a warp, or warp-like combination of threads.

It will be understood that the above-described method and apparatus is in general not intended to completely remove the moisture from textile materials but primarily functions to reduce the moisture content in such materials to a uniform, low concentration throughout such material for final drying by other means. Since an even moisture content is obtained throughout the textile material, the objective of obtaining a subsequent even drying is particularly facilitated and a considerable improvement in the quality of the continuously dried threads or other textile material is achieved. Moreover, the material, especially in the case of individual threads, is not subject to damage by mechanical action during pressing.

While several embodiments of the present invention are disclosed above, various modifications will be apparent to those skilled in the art without departing from the spirit or scope of the invention. Therefore it is intended to limit the invention only by the scope of the appended claims.

What is claimed is:

1. In the continuous production of synthetic yarn, a process for reducing the liquid content in an endless sheet of threads comprising the steps of continuously grinding said material into substantial surface contact with each of a plurality of spaced rotating rollers, rotating at least one of said rollers so that its peripheral speed is higher than the linear speed of said material, and continuously removing the moisture without scraping from each of said rollers at a location on the outside periphery of each of said rollers where said material is not in contact with said rollers.

2. Apparatus for reducing the liquid content in an endless length of textile material comprising a series of spaced rotatable rollers, each of said rollers being disposed so said material may be passed in contact with a portion of the periphery thereof, suction means for continuously removing moisture from each of said rollers, the inlet of said suction means being disposed on the outside periphery of each of said rollers at a location where said material is not in contact with said rollers, and means for driving at least one of said rollers so that its peripheral speed is higher than the linear speed of said material.

3. Apparatus for reducing the liquid content in an endless length of textile material comprising a rotatable roller, means for guiding said material into contact with a plurality of separate contact areas around the periphery of said rotatable roller, means disposed intermediate said areas of contact for continuously removing the moisture without scraping from said rotatable roller, and means for rotating said rotatable roller.

4. A process for reducing the liquid content in a sheet of saturated thread material of indefinite length comprising the steps of guiding said material alternately into and out of engagement with a plurality of contact areas around the periphery of a rotating roller whereby the liquid is transferred from the material to the roller, driving said roller and continuously removing the liquid from the outer surface of the roller at areas not contacted by the material.

References Cited in the file of this patent

UNITED STATES PATENTS

1,660,640	Asten	Feb. 28, 1928
2,209,758	Berry	July 30, 1940
2,209,759	Berry	July 30, 1940
2,253,511	Eitzen	Aug. 26, 1941
2,317,144	Grant	Apr. 20, 1943
2,381,766	Mayer	Aug. 7, 1945
2,433,122	Hornbostel	Dec. 23, 1947
2,436,028	Wiegerink	Feb. 17, 1948
2,465,214	Ewing	Mar. 22, 1949