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APPARATUS FOR TREATING YARN, THREAD, RIBBONS AND THE LIKE ELONGATED MATERIAL CAPABLE OF BEING STRETCHED

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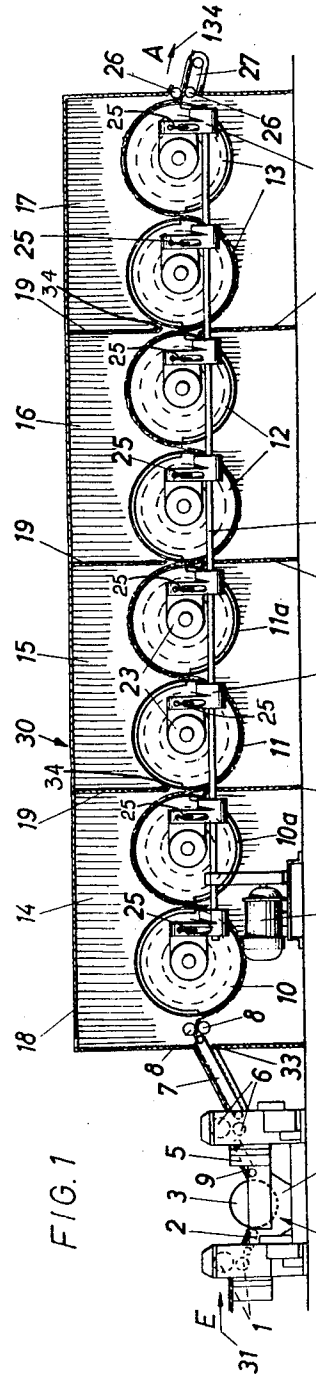


FIG. 1

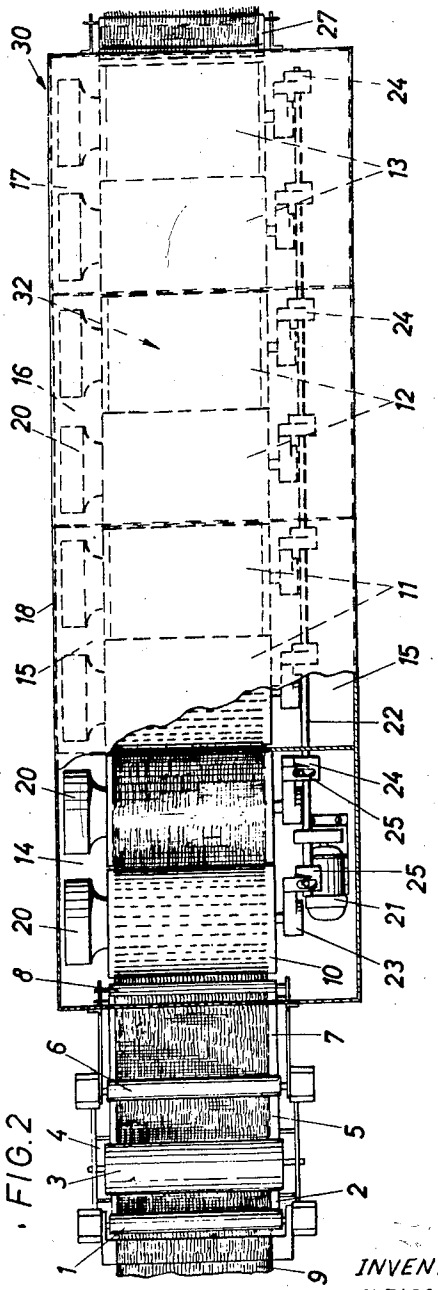


FIG. 2

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APPARATUS FOR TREATING YARN, THREAD, RIBBONS AND THE LIKE ELONGATED MATERIAL CAPABLE OF BEING STRETCHED

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The present invention relates to apparatus for treating, as by washing, drying, drawing, shrinking, fixing, etc. fiber ribbons or continuous filament yarns, hereinafter referred to as cables or spinning cables (that is, uncut filament yarns or cables as they are discharged from the spinning nozzle) particularly fully synthetic material.

Washing units are used for washing, drying, drawing and fixing endless ribbons of fibrous material wherein the ribbons must be first threaded by hand and thereafter are conducted by hand to drawing rolls. These drawing rolls are arranged either in heated chambers kept at very high temperatures or the rolls are heated from the inside with steam and the ribbons are thus brought to the temperatures necessary for a drawing operation.

It is very difficult to feed endless ribbons or filament yarns to these rolls into hot chambers.

Since the rolls tend to wind and bulge, it is very difficult, due to the high temperatures, to keep the internally heated rolls clean. Subsequently all fibers are drawn or elongated by dual, triple or quintuple delivery units. After drawing, the fibrous threads are fixed at high temperature.

Each time that the apparatus is started, all these operations must be performed by hand and any additional ribbon, that is to be supplied later, must also be introduced by hand into all units or machines. These operations are very time consuming and, to a great extent, jeopardize the continuous operation of the fiber trains. Since these fiber trains must work for weeks in continuous operation without interruption, any disturbance and any stoppage results in high expenses.

It is therefore an object of the present invention to provide means conducive to an automatic and controlled performance of all the aforesaid operations.

The cables are introduced or fed at the inlet to wash-bath means and travel completely automatically through the washing apparatus and the drier.

In order to be able to also make the drawing process automatic, special screen drums having special drives are provided. For this purpose a heating zone is attached to the drier. The material to be processed is conducted over screen drums and brought to the drawing drums, completely and uniformly heated by air current.

Pursuant to another object of the present invention, one-sided heating of the fiber ribbons, as was the case with prior art internally heated drawing rolls, is avoided whereby the quality of the materials to be drawn is substantially improved.

In this connection, it is a further object to provide means obviating the necessity to overheat the outer surfaces of the fiber ribbons before the desired temperature is attained in the interior of the fiber ribbons.

Due to this measure it is possible to automatize the entire operation, because the ribbons are now automatically taken over by the drums.

Since great stresses develop during the drawing operation, it is necessary to increase the thickness of the screen drums and particularly to smooth the surfaces thereof. All drives for these drums must be variable and they must be sturdy.

Provision is made for a drawing compartment which

is followed by a cooling compartment. The thermoplastic fibrous material, which is rendered plastic in the drawing compartment, is returned to the solid state in the cooling compartment. After the drawing operation the fibers are again heated, while stress-free, and are fixed. These operations are also carried out on screen drums and the fibers can be applied thereto in a completely relaxed and stress-free condition, due to regulation of the speed of the drums.

The function of the fixing operation is to keep the fibers in their required form. The danger that they will contract again is thereby obviated. The difference between drawing and fixing is that in drawing the fibers are subjected to stress and their diameters are reduced by drawing to about one-fifth of normal. However, in the fixing operation the fiber is heated in a stress-free condition.

It is another object of the present invention to provide means resulting in the completely automatic guidance of the fiber ribbons or filament yarns, without any winding during the drawing process.

It is a further object of the present invention to provide means affording drawing, shrinking, fixing of the fibers with temperatures which can be kept much lower than in prior art heated rolls. This results in a greater protection of the fibers.

The drums can also have a grooved surface provided with perforations. Individual drums can be equipped with a free-wheeling system to adjust them to a velocity increase caused by the drawing operation. It is possible to disconnect the free-wheeling system.

These and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawings, showing preferred embodiments of the invention.

In the drawings which illustrate the best mode presently contemplated for carrying out the invention:

FIG. 1 is a schematic view in elevation, partly in section, of an apparatus pursuant to the present invention.

FIG. 2 is a top plan view of the apparatus, with a portion thereof broken away for purposes of clarity.

Referring now to the drawings in detail, there is shown a somewhat schematic representation of an apparatus **30**, pursuant to the present invention, for treating fibrous material such as, for example, continuos filament yarns, to effect washing, drying, drawing and shrinking thereof in a tandem arrangement.

The fibrous material **9**, which is to be treated by the apparatus of the present invention is introduced thereinto at the inlet E, as shown by the arrow **31**.

At the inlet E the material **9** is engaged initially by a pair of companion feed rolls **1—1** from which it is fed to an endless belt conveyor device **2** which delivers the material to a wash bath *4a*. The wash bath *4a* consists of screen drum **3** operable in a wash trough **4** provided with a siutable wash fluid.

A pair of cooperating squeeze rollers **6—6** are located behind the wash bath *4a*, in the direction of travel of the material **9**. An endless belt conveyor **5** carries the material from the wash bath *4a* to the squeeze rollers which remove the wash liquid from the material.

From the squeeze rollers **6**, the material is conducted over a duckboard or latticework **7**to a drying apparatus **30** by means of deflecting feed rolls **8—8**, the inlet to said apparatus being indicated at **33**. The apparatus **30** is provided with a housing **18** which is divided by partitions **19** into four zones or compartments designated **14**, **15**, **16** and **17**, respectively.

The partitions are provided with central slots **34** so that the material **9** can pass therethrough. The compartment or chamber **14** constitutes a heating chamber, suitable

means (not illustrated) being provided to effect a heated air current flow therein.

A pair of screen or perforated drums **10** and **10***a* is provided in compartment **14**. The material **9** is carried under drum **10** and over drum **10***a* to effect the drying of the material by hot air current flow.

The compartment **15** comprises a drawing zone having the screen or perforated drums **11** and **11***a*. The material passes through the slot **34** of the partition **19** common to chambers **14** and **15** passing under drum **11** and over drum **11***a*.

During the drawing operation, which is accomplished between drums **11** and **11***a*, the heated fibers are stretched and the diameter is reduced to substantially one-fifth of the prior diameter. This requires thick-wall drums having a particularly smooth surface. The drums **11—11***a* have a variable drive so that their relative rotational speeds can be regulated. Due to the arrangement of the screen drums **10—10***a* and **11—11***a*, the material **9** can be both dried and heated uniformly from the inside and the outside, warm air passing through the perforated or screen drums.

From the drawing compartment **15**, the material passes into the cooling compartment **16** through the corresponding slot **34** in the partition **19** common to the drawing and cooling compartments. In the cooling compartment **16**, the air temperature is lower than in the preceding compartments so that the material, which had been rendered thermoplastic in zones **14** and **15**, again reverts in compartment **16** to a solid or non-plastic state or condition. The material thereafter passes into the last chamber **17** which is a fixing or shrinking zone. Here the fibers are fixed in their required form. This is effected by heating the fibers, in a stress-free condition, as they pass under and over the screen drums **13—13** of the shrinking chamber **17**.

The drive for all the screen drums is effected by a motor **21** which drives a transmission shaft **22** journalled in a support or bracket **24** associated with each drum. A variable speed transmission **25**, provided for each drum, permits adjustment of the speed of rotation thereof.

Provision is also made for an exhaust fan **20** for each drum.

As the material leaves the fixing chamber **17**, it moves through the outlet A, in the direction of arrow **134** by discharge rolls **26** which move it onto an endless belt conveyor **27**.

If desired, companion take-up and drawing rolls may be interposed between the rolls **3** and **6** to keep the material under any desired tension.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. Apparatus for treating coherent yarns, threads, ribbons and the like elongated material capable of being stretched, comprising in combination: a housing, partitioning means for partitioning each of said housing into at least four adjacent compartments, rotatable feed means in each of said compartments, said rotatable feed means cooperating with each other so as to continuously advance the elongated material through said compartments, means for heating said material in the first of said compartments, said rotatable means in the second of said compartments comprising a pair of speed adjustable screen drums for stretching the material, means for cooling said material in the third of said compartments, and means for fixing said material in the fourth of said compartments.

2. Apparatus as claimed in claim 1, wherein said rotatable feed means in the first of said compartments comprises two closely adjacent screen drums.

3. Apparatus as claimed in claim 1, wherein said rotatable feed means in said third compartment comprises two closely adjacent screen drums.

4. Apparatus as claimed in claim 1, wherein said rotatable feed means in said fourth compartment comprises two closely adjacent screen drums.

5. Apparatus as claimed in claim 1, wherein the rotatable feed means in each of said compartments comprises two closely adjacent screen drums driven from a common drive.

6. Apparatus as claimed in claim 1, wherein said screen drums in said second compartment have smooth surfaces.

7. Apparatus as claimed in claim 1, wherein the rotatable feed means in each of said compartments comprises two closely adjacent screen drums, said screen drums in said second compartment adapted to stretch the material having a smooth thick-walled surface.

8. Apparatus as claimed in claim 1, wherein the rotatable feed means in each of said compartments comprises two closely adjacent screen drums, and means to vary the speed of rotation of said screen drums.

9. Apparatus as claimed in claim 1, further comprising washing means for washing said material before entering said first compartment, and means for feeding said washed material from said washing means to the feed means in said first compartment.

10. Apparatus as claimed in claim 9, wherein squeezing means are arranged between said washing means and said first compartment for squeezing liquid from said washed material.

11. Apparatus for treating coherent yarns, threads, ribbons and the like elongated material capable of being stretched, comprising in combination: a housing, partitioning means for partitioning said housing into at least four communicating adjacent chambers, a pair of closely adjacent screen drums in the first of said chambers, means for heating said first chamber, a pair of closely adjacent screen drums in said second chamber, a pair of closely adjacent screen drums in said third chamber, cooling means for cooling said third chamber, a pair of closely adjacent screen drums in said fourth chamber, means for heating said fourth chamber, all of said screen drums being speed adjustable and being driven from a common drive, said screen drums cooperating so that material entering the first of said chambers is conveyed by said screen drums in an undulating path through said four chambers to be heated in said first chamber, to be stretched in said second chamber, to be cooled in said third chamber and to be fixed in said fourth chamber.

12. Apparatus as claimed in claim 11, wherein washing means are arranged adjacent said first chamber for washing the material prior to entering said first chamber.

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