Feb. 5, 1957 R. H. ROUGHSEDGE ET AL 2,780,346

TREATMENT OF FILAMENTS

Filed April 15, 1953 2 Sheets-Sheet 1

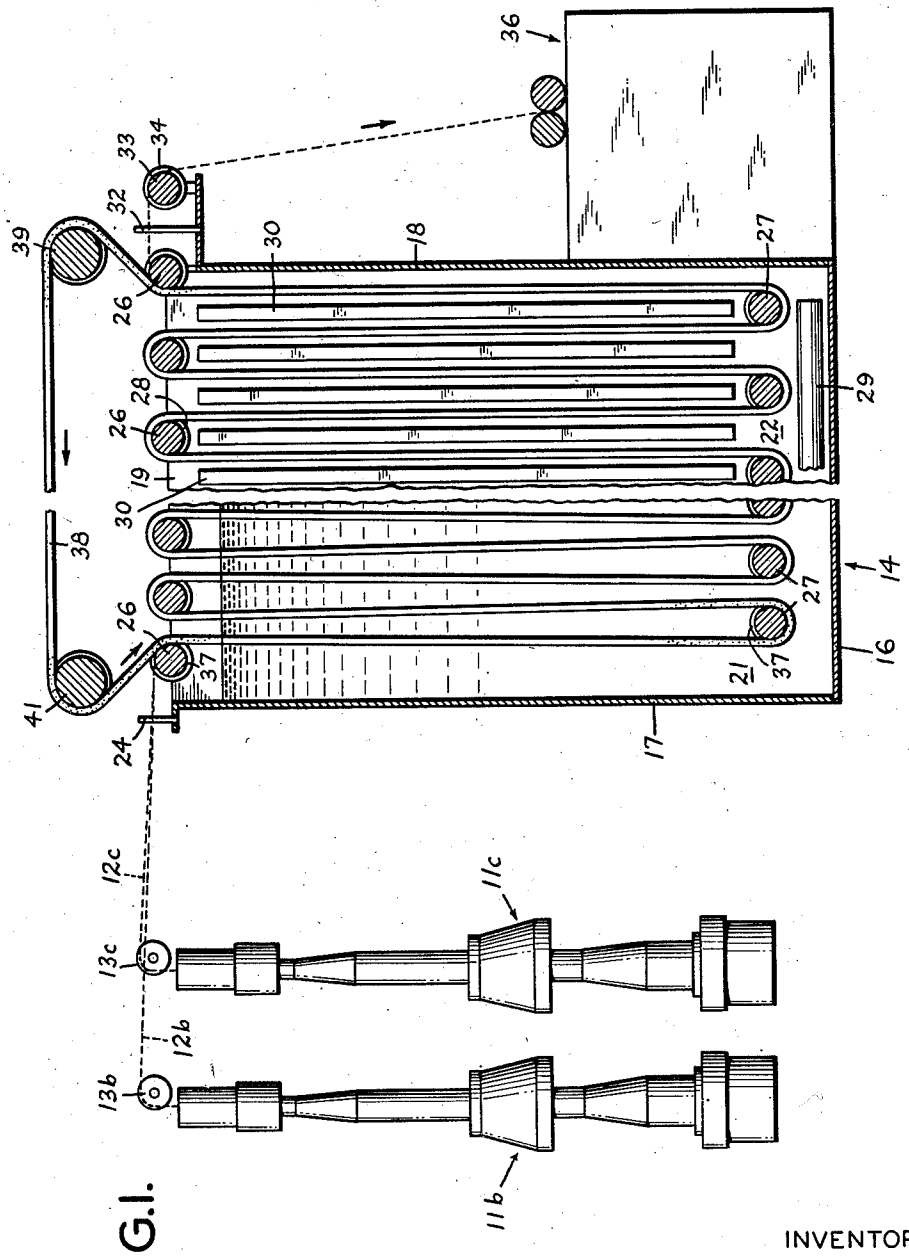


FIG. I.

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Filed April 15, 1953 2 Sheets-Sheet 2

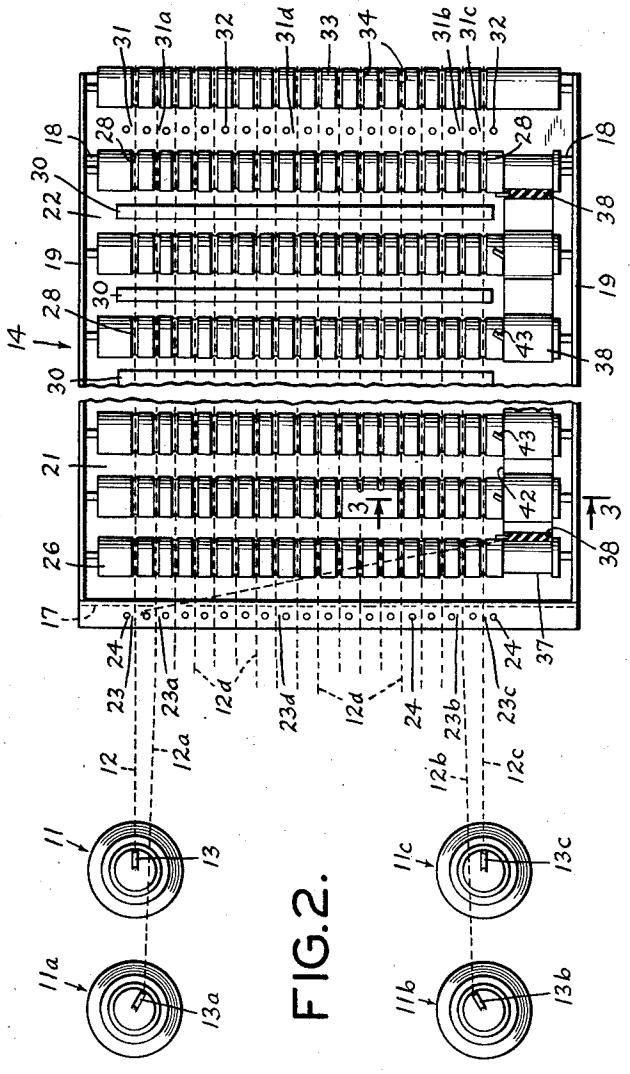


FIG. 2.

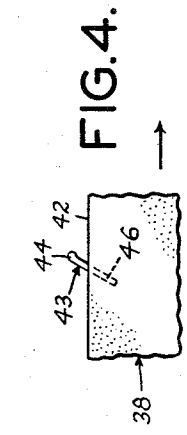


FIG. 4.

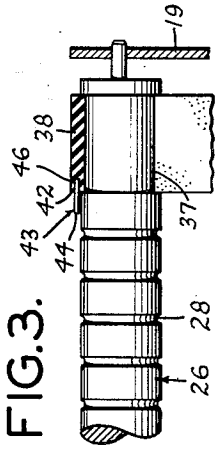


FIG. 3.

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2,780,346

TREATMENT OF FILAMENTS

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Application April 15, 1953, Serial No. 349,040

8 Claims. (Cl. 203—67)

This invention relates to filamentary material and relates more particularly to an improved apparatus for the treatment of filamentary material.

In the production and processing of filamentary material, such as filaments, yarns, threads and the like, it is necessary to treat the said material with various media. For example, in the production of high tenacity regenerated cellulose filamentary material, a solution or dope of cellulose acetate or other organic acid ester of cellulose is extruded into a liquid coagulating medium, and, as the filamentary material passes through the coagulating medium, it is placed under tension to increase its length by from 200, 400 or 600 up to 1,000 or 2,000 percent, or more. The stretched filamentary material may, if desired, be washed to remove the coagulating medium therefrom, and is then saponified to convert the cellulose ester to cellulose, washed and dried. To carry out this process in an economical manner, the successive treatments should be applied to the filamentary material as it moves continuously through the processing apparatus so as to avoid the necessity of winding and rewinding the filamentary material into package form between treatments and to avoid the necessity of handling such packages, which would increase the expense of such treatments and multiply the danger of damaging the filamentary materials. To this end the processing apparatus may be so constructed that the filamentary material moves continuously through said apparatus in a tortuous path. However, when such an apparatus is employed for the treatment of a number of strands of filamentary material, the operation of threading the numerous individual strands of yarn through the apparatus is quite difficult and time-consuming.

It is an important object of this invention to provide an apparatus for the treatment of filamentary material which will be free from the foregoing and other difficulties, and which will be especially simple in construction and efficient in operation.

A further object of this invention is to provide an apparatus for the simultaneous treatment of a plurality of strands of filamentary material, which apparatus is so constructed that the individual strands of yarn may be easily and quickly threaded therethrough.

Other objects of this invention, together with certain details of construction and combinations of parts, will be apparent from the following detailed description and claims.

According to our invention, the apparatus for the treatment of filamentary material comprises means defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of said filamentary material through the treatment apparatus, a flexible element, such as a belt, mounted for movement in a path substantially parallel to said tortuous paths, and means on said flexible element for engaging the ends of said strands.

More particularly, the apparatus of this invention comprises a plurality of spinning assemblies, each of which

produces a single yarn, and a treating section having a plurality of compartments in which the yarns from the spinning assemblies are subjected to successive fluid treatments. The treating section also includes a series of guides at the entrance to said section, and a series of upper and lower rolls provided with parallel circumferential grooves, at least some of which rolls are positively driven. During operation, the yarns pass from the spinning assemblies, through the guides and then over and under the rolls, with a single yarn in each groove of each roll, so that the yarns move through the compartments of the treating section in tortuous parallel paths. After leaving the last roll in the treating section the yarns pass through a set of rear guides and are then individually wound on any convenient type of winding device. Also trained around the rolls and within the treating section is an endless flexible belt provided with a series of projecting pins or hooks. When it is desired to thread the yarns through the treating section at the start of operations, the rolls are driven to move the endless belt through the apparatus and the operator of the apparatus introduces one of the individual yarns into the treating section by passing said yarn between the appropriate guides, i. e. those guides which are at the entrance to the treating section and which are furthest from the belt, and then attaching said yarn to one of the hooks on said belt. The movement of the belt carries the attached yarn through the treating section. When this yarn reaches the last roll adjacent to the guides at the exit end the operator detaches it from the hook, lifts it over the latter guides, and then places it, either before or after it is engaged by the winding device, in its appropriate position between those of said guides which are furthest from the belt. After the yarn has been moved in this fashion it will automatically adjust itself to reach its proper position, furthest from the belt, in the compartments of the treating section, since it is under some tension, due to the operation of the driven rolls and the winding device, and will therefore tend to move to a position where its path through said said treating section is as short as possible. The same operation as described above is repeated successively with the yarns which are to pass through the treating section in paths closer to the belt, until all of the yarns have been threaded through the treating section. It is to be understood, of course, that the operator need not wait until one yarn has passed completely through the treating section before attaching the next yarn to one of the hooks on the belt, but may secure the next yarn to a hook as soon as the preceding yarn has been attached to a preceding hook. In this manner a great number of yarns may be threaded through the treating section very easily and in a short period of time.

The apparatus of this invention will now be described specifically in connection with the production of high-tenacity regenerated cellulose yarn by the saponification, washing and drying of stretched filamentary materials of cellulose acetate or other organic derivative of cellulose, to which it is specially adapted. It may, however, also be employed generally for the treatment of filamentary materials of all types with various media.

A preferred embodiment of this invention is shown in the accompanying drawing wherein

Fig. 1 is a side view, partly in section, of the apparatus of this invention,

Fig. 2 is a plan view, partly in section, of a portion of the apparatus,

Fig. 3 is a view taken along the line 3—3 of Fig. 2, and

Fig. 4 is a view of a portion of the belt showing the shape and position of one of the projecting hooks.

Referring now to the drawings, the reference numerals

11, 11*a*, 11*b* and 11*c* (see Fig. 2) designate four identical spinning assemblies, which may be of the type shown in Bradshaw et al., application Serial No. 285,238, filed April 30, 1952, from which yarns 12, 12*a*, 12*b* and 12*c* emerge and pass over guide rolls 13, 13*a*, 13*b* and 13*c*. In the interest of simplicity, only four such spinning assemblies are shown in the drawings. It is to be understood that any desired number of additional spinning assemblies, producing any desired number of additional yarns 12*d*, may be provided. From the spinning assemblies the yarns enter a treating section, indicated generally by reference numeral 14, comprising a bottom 16, a front wall 17, a rear wall 18, side walls 19, a plurality of treating compartments 21 (only one treating compartment 21 is shown), and a drying compartment 22. The yarns enter the treating section 14, passing through spaces 23, 23*a*, 23*b*, 23*c*, 23*d* between guide pins 24 mounted on the front wall 17, and then pass through the compartments 21 and 22 over a series of upper rolls 26 driven by any suitable means (not shown), and under a series of lower idler rolls 27. The rolls 26 and 27 are provided with a series of circumferential grooves 28, which grooves are closely spaced and parallel to one another and aligned with the spaces 23, 23*a*, 23*b*, 23*c*, 23*d* between the individual guide pins 24. In the compartments 21 the yarns are saponified and then washed thoroughly, after which they enter the drying compartment 22 which is provided with a convection heater 29 and with a plurality of radiant heaters 30 positioned vertically between the successive loops of the yarns, as shown in Figs. 1 and 2. The dried yarns leaving the compartment 22 pass through spaces 31, 31*a*, 31*b*, 31*c*, 31*d* between rear guide pins 32, said spaces being aligned with the grooves 28 of the last roll 26, then over a driven roll 33 having yarn-receiving grooves or depressions 34, and finally to a winding apparatus of conventional construction, indicated generally by reference numeral 36, where said yarns are taken up in package form.

Each of the rolls 26 and 27 is provided, at one side thereof, with a grooved portion 37 adapted to receive an endless flexible rubber belt 38, which is trained alternately over the upper rolls 26 and under the lower rolls 27 from the inlet to the outlet of the treating section 14, thus following a path similar to the paths of the yarns 12, 12*a*, 12*b*, 12*c*, 12*d*. The belt 38 is guided back to the inlet of the treating section by idler rolls 38 and 41 mounted above the treating section 14. Along its edge 42 (Figs. 3 and 4) which is closest to the paths of the yarns the belt 38 caries a series of hooks 43 having enlarged heads 44 and bases 46, said bases being fixed firmly in the belt 38. If desired, each hook 43 may be arranged in such a manner that its head 44 projects forward of its base 46 in the direction of motion of the belt 38 (Fig. 4).

When it is desired to thread the yarns through the treating section 14 at the start of operations, the rolls 26 are caused to rotate and the yarn 12 from assembly 11, shown at the top of Fig. 2, is passed through the space 23 between front guide pins 24, which space is furthest from the belt 38, and is then attached, in any suitable manner, to hook 43 adjacent to that upper roll 26 which is nearest to the front wall 17, the position of the yarn at this point being indicated by the dotted line (Fig. 2) running diagonally across the front portion of the compartment 21. The movement of the belt 38 carries the yarn 12 through the treating section 14. When the yarn 12 reaches that upper roll 26 which is closest to the rear wall 18 the yarn 12 is removed from the hook 43, is lifted by the operator over the guide pins 32 and is placed, either before or after it is engaged by the winding device 36, in the appropriate space between the guide pins 32, this space being, in the case of yarn 12, the space 31 furthest from the belt. After the yarn 12 is moved in this fashion, it will automatically adjust itself to engage in the proper grooves 34 in the

rolls 26 and 27, since it is under some tension in passing through the treating section 14 and will therefore tend to move to a position where its path through said treating section is as short as possible. The same operation as described above is repeated with yarn 12*a* and then successively with yarns 12*d* and 12*b*, which are to run closer to the belt 38, until the yarn 12*c* is reached. It is to be understood, of course, that the operator need not wait until one yarn has passed completely through the treating section 14 before attaching the next yarn to a hook 43, but may secure the next yarn to one of the hooks 43 as soon as the preceding yarn has been attached to a preceding hook. In this manner a great number of yarns may be threaded through the treating section 14 very easily in a short period of time.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the treatment apparatus, a flexible element mounted for movement in a path substantially parallel to and spaced from said tortuous paths, and means on said element and moving in said spaced path for engaging the ends of said strands.

2. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means, including a plurality of spaced rolls, defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the treatment apparatus, an endless flexible element mounted for movement around said rolls in a path substantially parallel to and spaced from said tortuous paths, and a plurality of means on said element and moving in said spaced path for engaging the ends of said strands.

3. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the treatment apparatus, a flexible element mounted for movement in a path substantially parallel to and spaced from said tortuous paths, and projections on said element and moving in said spaced path for engaging the ends of said strands.

4. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising a plurality of compartments, means, including a plurality of spaced rolls, defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the said compartments, an endless flexible element mounted for movement around said rolls in said compartments in a path substantially parallel to and spaced from said tortuous paths, and a plurality of means on said element and moving in said spaced path for engaging the ends of said strands.

5. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the treatment apparatus, individual guide means for each strand at the beginnings and ends of said paths, a flexible element mounted for movement in a path substantially parallel to and spaced from said tortuous paths, and means on said element and moving in said spaced path for engaging the ends of said strands.

6. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means, including a plurality of spaced rolls, defining a plurality of substantially parallel tortuous paths for

the passage of spaced strands of filamentary material through the treatment apparatus, individual guide means for each strand at the beginnings and ends of said paths, a flexible element mounted for movement in a path substantially parallel to and spaced from said tortuous paths, and means on said element and moving in said spaced path for engaging the ends of said strands.

7. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means, including a plurality of spaced grooved rolls, defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material through the treatment apparatus, individual guide means for each strand at the beginnings and ends of said paths, a flexible element mounted for movement in a path substantially parallel to and spaced from said tortuous paths, and a plurality of projections on said element for engaging the ends of said strands.

8. An apparatus for the treatment of a plurality of strands of filamentary material, said apparatus comprising means, including a plurality of spaced grooved rolls, defining a plurality of substantially parallel tortuous paths for the passage of spaced strands of filamentary material

through the treatment apparatus, individual guide means for each strand at the beginnings and ends of said paths, an endless rubber belt mounted for movement around said rolls in a path substantially parallel to and spaced from said tortuous paths, and a plurality of hooks on said belt for engaging the ends of said strands.

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