

June 13, 1961

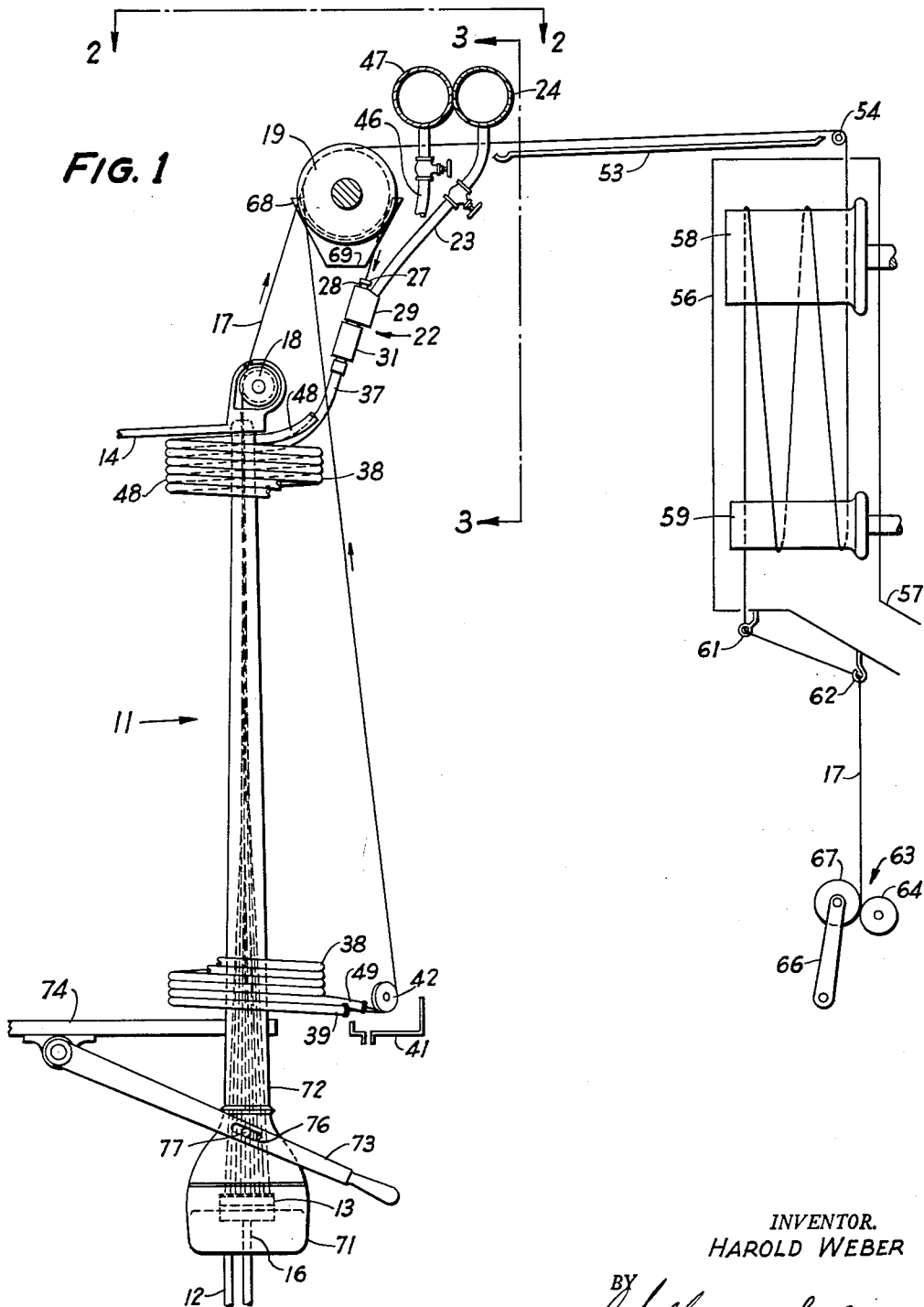
H. WEBER

2,987,764

APPARATUS FOR THE PRODUCTION AND TREATMENT OF FILAMENTS

Filed Oct. 8, 1953

2 Sheets-Sheet 1



INVENTOR.  
HAROLD WEBER

BY  
*J. H. [Signature]*  
ATTORNEYS.

June 13, 1961

H. WEBER

2,987,764

APPARATUS FOR THE PRODUCTION AND TREATMENT OF FILAMENTS

Filed Oct. 8, 1953

2 Sheets-Sheet 2

FIG. 2

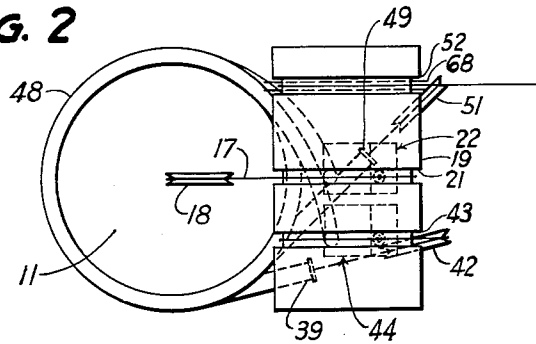


FIG. 4

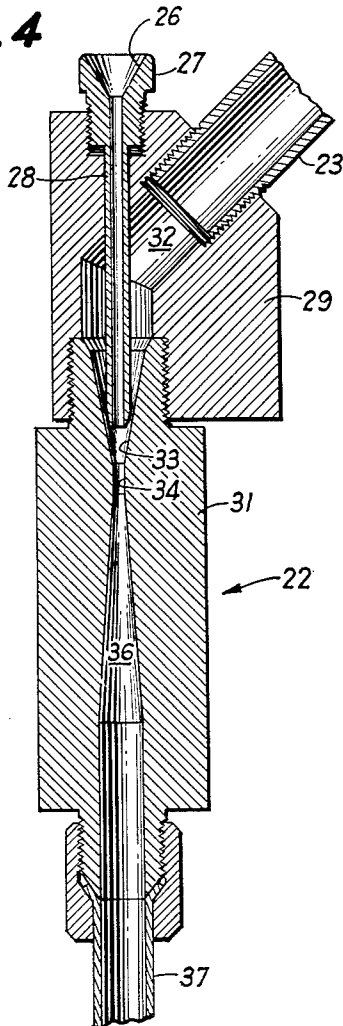
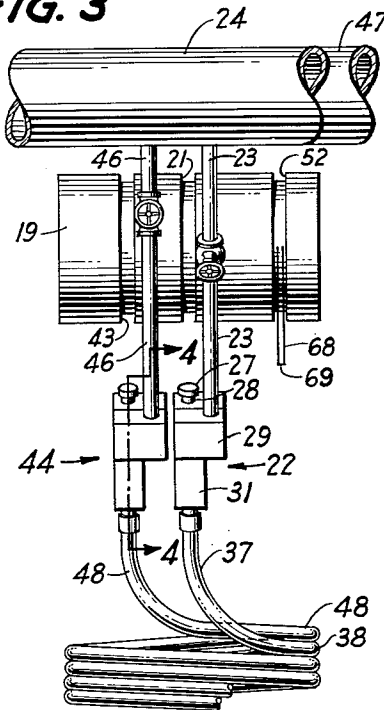


FIG. 3



INVENTOR.  
HAROLD WEBER

BY  
*J. M. ... & ...*  
ATTORNEYS.

1

2,987,764

## APPARATUS FOR THE PRODUCTION AND TREATMENT OF FILAMENTS

Harold Weber, Bloomfield, N.J., assignor to Celanese Corporation of America, New York, N.Y., a corporation of Delaware

Filed Oct. 8, 1953, Ser. No. 385,000

8 Claims. (Cl. 18-8)

This invention relates to filamentary material and relates more particularly to a novel 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 one process for 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 setting zone containing 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 increase the danger of damaging the filamentary materials. To this end the processing apparatus may be so constructed that the filamentary material moves continuously through a series of tanks containing the treating agents, which tanks are provided with a plurality of upper and lower rollers for defining a tortuous path for the passage of filamentary material therethrough. However, the use of such tanks has several disadvantages. Thus, the tanks occupy a considerable amount of floor space, it is difficult to thread the filamentary material around the numerous rollers, and the filamentary material in contact with the rollers may become abraded and damaged thereby.

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

Other objects of this invention will be apparent from the following detailed description and claims.

According to this invention, a filamentary material is formed continuously by extruding a spinning solution into a setting zone, the resulting filamentary material is then incorporated into a stream of a treating fluid, and said stream and said filamentary material travel together in a coiled path. Most advantageously the stream of treating fluid and the filamentary material travel together in a coiled path around said setting zone.

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

FIG. 1 is a side view, with parts in section and with parts broken away, of the apparatus of this invention,

FIG. 2 is a plan view of a portion of the apparatus looking in the direction shown by the arrows 2—2 in FIG. 1,

FIG. 3 is an elevation of a portion of the apparatus,

2

looking in the direction shown by the arrows 3—3 in FIG. 1, and

FIG. 4 is a cross-sectional view taken along the lines 4—4 in FIG. 3.

Referring now to the drawings, reference numeral 11 designates generally a tapered spinning column, into the bottom of which are led a spinning solution, e.g., a solution of cellulose acetate in acetone, and a coagulating medium or spin bath, e.g. a mixture of acetone or water. The spin bath enters the column 11 through a pipe 12, flows upwardly through said column, past a spinnerette 13, and leaves the column through a pipe 14 at the top of said column. The spinning solution enters the column 11 through a pipe 16 and passes through the holes in the spinnerette 13, from which it emerges as a plurality of fine, upwardly flowing streams which are attenuated by the pull exerted by the more rapidly flowing spin bath. At the same time the spin bath acts to coagulate the streams of spinning solution to form filaments of cellulose acetate. The filaments leave the top of the column 11 in the form of a bundle, or yarn, 17, and pass over a guide pulley 18 and then in contact with a grooved driven roll 19 where they are engaged in a central groove 21 (FIGS. 2 and 3) of said roll. During their passage through the spinning column 11 the still-plastic filaments are stretched a considerable extent due to the tension exerted by the rotation of the roll 19, which moves the filaments at a linear speed considerably greater than the speed of the upwardly flowing spin bath.

From the roll 19 the yarn travels downward into an eductor 22 (shown in cross-section in FIG. 4) to which a stream of a liquid saponification medium, such as a solution of sodium hydroxide, is supplied through a line 23 leading from a header 24. The yarn enters the eductor 22 through a flared opening 26 in the enlarged head 27 of a long inlet tube 28 mounted in an entrance block 29 of said eductor, which block is connected to a venturi tube 31. The saponification medium enters the eductor through a passageway 32 in the block 29, then flows through a portion of said passageway concentric with the inlet tube 28, and then enters the venturi tube 31.

The venturi tube 31 is of conventional construction, being provided with a portion of decreasing cross-section 33, a throat 34, and a portion of increasing cross-section 36. As is well known, the pressure of a liquid flowing through a venturi tube decreases in the portion of decreasing cross-section and is lowest at the throat of said tube. The yarn enters the venturi tube 31 near the point of minimum pressure, since the yarn inlet tube 28 extends into the portion of decreasing cross-section 33, almost to throat 34. Accordingly, when an end of yarn is placed in the yarn inlet tube 28 it will be sucked into the venturi tube 31 by the action of the flowing saponification medium. The yarn is carried through the venturi tube 31 by the flowing saponification medium and then both the medium and the yarn carried thereby pass downwardly through a coiled pipe 37 the helical convolutions 38 of which encircle the spinning column 11. In the pipe 37 the yarn and the saponification medium react so that the cellulose acetate yarn is converted to cellulose.

After passing through the convolutions 38, the yarn and saponification medium emerge from an outlet 39 at the bottom of the pipe 37. The saponification medium falls from said outlet into a drain 41 while the yarn passes under a pulley 42 and then travels upward to the roll 19, where it is engaged in a second groove 43 of said roll. From the groove 43 the yarn passes downward to a second eductor 44 (FIGS. 2 and 3), which is similar in construction to the eductor 22, mounted alongside said eductor 22. The upper part of the second eductor 44 is connected to a water supply line 46 leading from a header 47, while the lower part of said eductor is connected to

a coiled pipe 48 similar in construction to the coiled pipe 37, the convolutions of the pipe 48 being fitted between the convolutions of the pipe 37. Wash water enters the second eductor 44 from the line 46, carries the yarn with it through the coiled pipe 48, emerges from an outlet 49 at the bottom of said pipe, and falls into a drain (not shown). The washed yarn emerging from the outlet 49 passes under a pulley 51 (see FIG. 2), then up and around the roll 19, where it engages in another groove 52, then horizontally over a drip pan 53 (FIG. 1), around a pulley 54 and down into a drying cabinet 56, equipped with a duct 57 for drawing off moist air. In the drying cabinet 56 the yarn travels back and forth between a driven, steam-heated roll 58 and a lower driven roll 59, after which it leaves said cabinet and passes, over guides 61 and 62, to a winding device 63. The winding device 63 is of the usual type comprising a drive roll 64 and a pivoted lever 66, which lever carries at one end thereof a yarn package support 67 and is biased so as to urge said yarn package support towards the drive roll 64.

During the operation of the apparatus it is evident that the yarn carries three different liquids, i.e. spin bath, saponification medium and wash water, as it makes its three spaced turns around the grooved roll 19. In order to prevent these liquids from mingling with each other and from wetting other portions of the yarn there is provided for each groove 21, 43 and 52 a pair of spaced splash plates 68 (FIGS. 1, 2 and 3), only one pair of such plates (in groove 52) being shown. These plates are mounted in close proximity to the lower portion of roll 19 and fit within the grooves 21, 43 and 52 so that the yarn passes between said plates at the beginning and end of its travel within each groove. The lower portions of each pair of plates 68 are joined together to form a trough 69 which may be connected to any suitable drain (not shown).

Returning now to a consideration of the spinning column 11 (FIG. 1), this column is made in two parts: a lower portion 71 housing the spinnerette 13, and an upper portion 72 resting on said lower portion. The upper portion 72 is adapted to be lifted upward by the action of a lever 73, which lever is pivoted to a frame member 74 and is provided with a slot 76 for engaging a pin 77 projecting from the upper portion 72. When it is desired to have access to the interior of the spinning column 11, e.g. for the purpose of cleaning or changing a spinnerette, the lever 73 may be moved manually to lift the upper portion 72 away from the lower portion 71 of the spinning column.

While only one spinning column and one set of coiled tubes have been shown, it is to be understood that this invention may be practiced using a plurality of spinning columns, preferably arranged side by side, and a plurality of tubes coiled around said columns.

The apparatus of this invention occupies a relatively small floor area, is economical to construct, and operates easily and effectively with little danger of damage to the yarn.

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 my invention.

Having described my invention what I desire to secure by Letters Patent is:

1. Apparatus for the production and treatment of filamentary material, said apparatus comprising a vertical spinning column for forming said filamentary material, means for passing spin bath and means for passing spinning solution into the bottom of said column and means for withdrawing spin bath and filamentary material from the top thereof, a roll above said column, said roll having grooves in its outer surface for receiving in one of said grooves the filamentary material from said column, an eductor for drawing said filamentary material from

said roll into a stream of fluid, a tube for the passage of said filamentary material and said stream, means for directing the filamentary material from said tube into another groove in said roll, a second eductor for drawing the filamentary material from said tube into a stream of another fluid, and a tube for the passage of said filamentary material and the latter stream, each of said tubes being coiled helically around said column, the coils of said tubes being interfitted, each of said eductors comprising a venturi tube, means for directing the filamentary material from the second tube into a third groove in said roll to prevent the mingling of said fluids, shielding means around each groove in said roll, and means for receiving and drying the filamentary material after it leaves said third groove.

2. Apparatus for the production and treatment of filamentary material, said apparatus comprising a vertical spinning column for forming said filamentary material, means for passing spin bath and means for passing spinning solution into the bottom of said column and means for withdrawing spin bath and filamentary material from the top thereof, and a tube for treating said filamentary material with a fluid, said tube being coiled around said vertical spinning column.

3. Apparatus for the production and treatment of filamentary material, said apparatus comprising a vertical spinning column for forming said filamentary material, means for passing spin bath and means for passing spinning solution into the bottom of said column and means for withdrawing spin bath and filamentary material from the top thereof, a roll above said column for receiving the filamentary material from said column, and a tube for treating said filamentary material with a fluid adapted to receive the filamentary material from said roll, said tube being coiled around said vertical spinning column.

4. Apparatus for the production and treatment of filamentary material, said apparatus comprising a vertical spinning column for forming said filamentary material, means for passing spin bath and means for passing spinning solution into the bottom of said column and means for withdrawing spin bath and filamentary material from the top thereof, a roll above said column for receiving the filamentary material from said column, an eductor for drawing said filamentary material from said roll into a stream of fluid, and a tube for the passage of said filamentary material and said stream, said tube being coiled around said vertical spinning column.

5. Apparatus for the production and treatment of filamentary material, said apparatus comprising an extended spinning column for forming filamentary material, means for passing spin bath and means for passing spinning solution into one end of said column and means for withdrawing spin bath and filamentary material from the other end thereof, and a tube for treating said filamentary material with a fluid, said tube being coiled around said spinning column.

6. Apparatus for the production and treatment of filamentary material, said apparatus comprising an extended spinning column for forming filamentary material, means for passing spin bath and means for passing spinning solution into one end of said column and means for withdrawing spin bath and filamentary material from the other end thereof, means for bringing said filamentary material into contact with a stream of fluid, and a coiled tube for the passage of said filamentary material and said stream, said tube being coiled around said column.

7. Apparatus for the production and treatment of filamentary material, said apparatus comprising an extended spinning column for forming filamentary material, means for passing spin bath and means for passing spinning solution into one end of said column and means for withdrawing spin bath and filamentary material from the other end thereof, an eductor for drawing filamentary material into a stream of fluid, and a tube for the passage

5

of said filamentary material and said stream, said tube being coiled around said column.

8. Apparatus for the production and treatment of filamentary material, said apparatus comprising an extended spinning column for forming filamentary material, means for passing spin bath and means for passing spinning solution into one end of said column and means for withdrawing spin bath and filamentary material from the other end thereof, an eductor for drawing filamentary material into a stream of fluid, a tube for the passage of filamentary material and said stream, a second eductor for drawing the filamentary material from said tube into a stream of another fluid, and a tube for the passage of

5

10

6

said filamentary material into latter stream, each of said tubes being coiled around said column.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

827,434	Friedrich	July 31, 1906
1,153,004	Althouse	Sept. 7, 1915
1,871,100	Walton	Aug. 9, 1932
2,203,793	Lovett	June 11, 1940
2,565,935	Tetlow	Aug. 28, 1951
2,725,276	Griset	Nov. 29, 1955
2,758,909	Taylor	Aug. 14, 1956