

March 28, 1950

C. DE BRABANDER

2,502,129

METHOD OF TREATING FILAMENTARY MATERIALS

Filed July 29, 1944

2 Sheets-Sheet 1

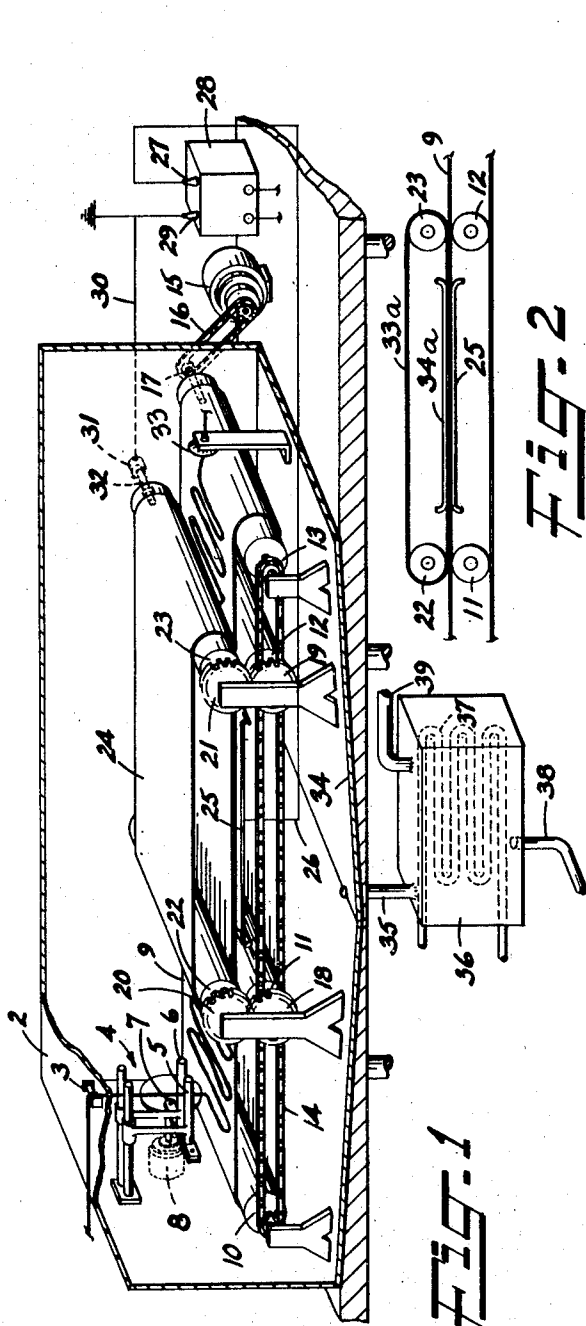
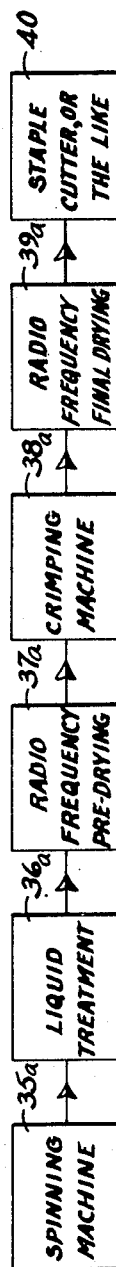


FIG-2



INVENTOR.
Camille de Brabander
BY *Carl A. Castellon*
ATTORNEY

March 28, 1950

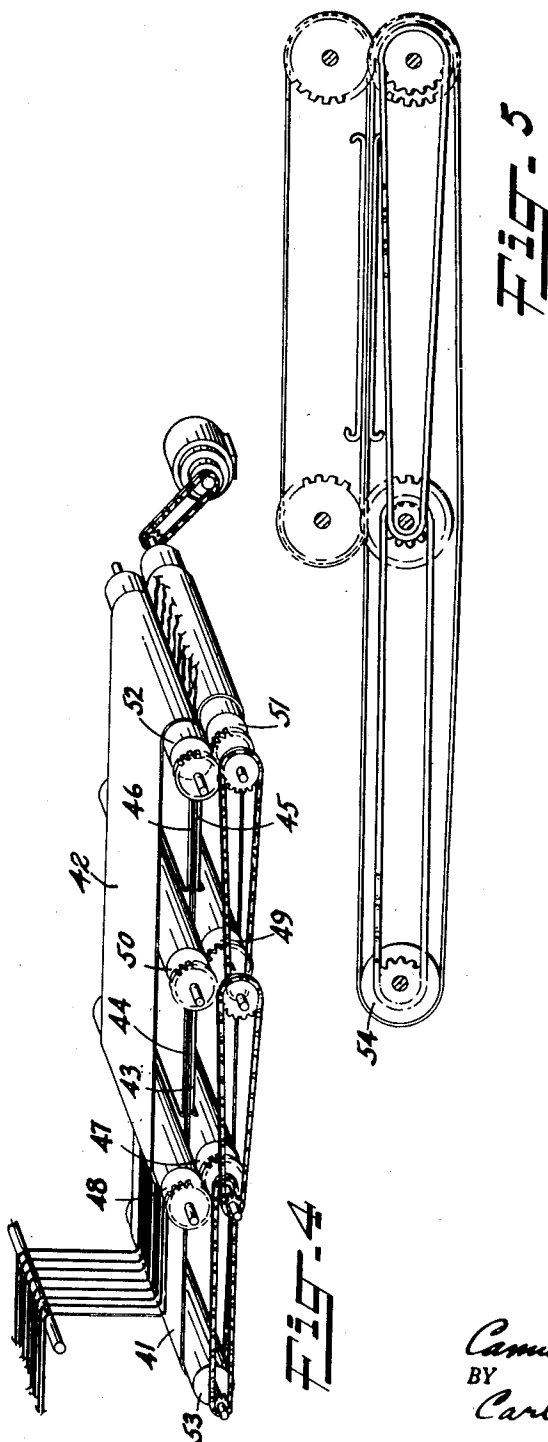
C. DE BRABANDER

2,502,129

METHOD OF TREATING FILAMENTARY MATERIALS

Filed July 29, 1944

2 Sheets-Sheet 2



INVENTOR.
Camil de Brabander
BY
Carl A. Castellon
ATTORNEY

UNITED STATES PATENT OFFICE

2,502,129

METHOD OF TREATING FILAMENTARY MATERIALS

Camiel de Brabander, Newport, Del., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

Application July 29, 1944, Serial No. 547,207

14 Claims. (Cl. 19—66)

1

This invention relates to improvements in methods of heating filamentary material in the form of large continuously running tows or wound packages for various purposes, such as drying, partial drying, setting distortion, such as setting crimp, setting twist, etc. This application is a continuation-in-part of my copending application Serial No. 438,420, filed April 10, 1942, now Patent No. 2,390,572, issued December 11, 1945.

In the manufacture of staple fiber from artificial filaments, it is common practice to assemble the filaments produced from numerous spinnerets during or immediately after coagulation into a large bundle or tow having a size of 30,000 to 100,000 denier or more. Such tows are then processed by appropriate liquids and cut to staple fiber, or are cut to staple fiber before such liquid treatment. The drying has heretofore been delayed until after the staple fiber has been cut, because of the impossibility of heating the tows uniformly throughout and with sufficient rapidity to keep up with the continuous travel of the tow as it is delivered from the spinning and processing stages.

In the drawing illustrative of the invention—

Figure 1 is a perspective view of one form of device for the application of the invention with parts in cross-section;

Figure 2 shows a modification;

Figure 3 is a flow sheet showing one example of a process in which the invention, such as by means of the devices of Figures 1 and 2, may be employed;

Figure 4 shows a modification of the invention for crimping and setting the crimp; and

Figure 5 shows a modification of the arrangement of Figure 4.

The device shown in Figure 1 is particularly adapted to the heating in accordance with the present invention of tows of artificial filaments, such as of viscose, to set any distortion thereof or to dry them. The device is housed within a suitable casing or chamber 2 which is substantially gas-tight, at least sufficiently so that a considerably reduced pressure may be readily maintained within the chamber. The tow or filamentary material enters the chamber through any suitable air-lock or air-sealing aperture 3, such as may be provided by a pair of tightly pressed rolls covered with sponge rubber, dense felt, or fur. It then proceeds to the piling mechanism 4 of any suitable form, such as the two guide rods 5 and 6 which are oscillated back and forth by means of a suitable eccentric mechanism 7. The motor 8 for this mechanism may be housed with-

2

in the chamber 2, or its shaft may extend through an air-seal in the wall of the chamber. The tow is thus laid down in known manner upon the moving endless belt 9 which is of insulating material, preferably permeable in character, such as a woven glass fabric belt, a porous rubber belt, or the like. This belt is driven by and around the four rolls 10, 11, 12 and 13 which are connected and positively driven by a chain 14 through sprockets on the shafts of the rolls. A suitable motor 15 drives the last roll 13 by means of suitable sprockets and the chain 16. The shaft 17 of this roll may extend through a gas-tight seal in the wall of the chamber, or the motor may be enclosed within the chamber.

The two shafts of the intermediate rolls 11 and 12 are provided with gears 18 and 19 which mesh with gears 20 and 21 for driving two rolls 22 and 23 which are superposed over the lower two 11 and 12. A metallic foil or fabric belt 24, such as of a bronze ribbon, of copper gauze or the like, is driven by the two upper rolls 22 and 23 which press it into contact with the tow or filamentary material and the lower belt 9 which proceed beneath the metallic belt at the same rate of speed and in the same direction. Beneath the insulating belt 9 and between the two intermediate rolls 11 and 12, there is placed a metallic sheet or plate 25 which is electrically connected by means of the conductor 26 to one pole 27 of a high frequency electric current generator 28, such as a radio frequency oscillator. The other pole 29 of this oscillator is connected by the conductor 30 to the metallic belt 24 through a suitable brush or collar contact 31 with the shaft 32 of the roll 23 which must be conductive or have a conductive surface connected to the shaft. As the tow leaves the belt 9, it proceeds through a suitable funnel-shaped guide 33 through a suitable air-sealing opening within the wall of the casing to the next point of operation, which may be a twisting, winding, staplizing, or staple fiber cutting mechanism.

The floor 34 of the chamber is preferably sloped, such as in the manner shown, a drain 35 of substantial diameter being provided at the lower point. This drain is connected to a condenser housing 36 provided with a condenser coil 37, a discharge pipe 38 being provided for the removal of any condensate which may be accomplished by means of a suitable pump attached thereto. A vacuum pump may be attached to a second pipe 39 connected to the condenser chamber as shown. If desired, a branch of this pipe 39 may be connected directly into the main chamber 2,

3

preferably to the upper regions thereof, so that a vacuum may be more easily attained within the main chamber.

In operation of the device, a partial vacuum, preferably of substantial extent such as from 10 to 15 inches of mercury, is maintained within the main chamber in order to reduce the boiling point of water or liquid contained in the tow to a point below the critical temperature (softening or decomposition) of the product. However, it is of even greater importance to remove the vapors as rapidly as possible from the permeable belts to reduce the possibility of flashover through the material at a given temperature and also to make possible the use of higher voltages in order to reduce the moisture content to a lower figure. The electrode 25 may be in direct contact with the belt 9 or just slightly therebelow. Preferably, it is pressed into contact therewith in order to reduce the distance between the metallic belt 24 and the lower electrode 25 and thereby reduce the voltage needed. The insulating belt 9 serves to prevent any possibility of direct conductive contact between the metallic foil belt 24 and the metallic electrode 25 should the tow be broken at any point or sufficiently separated so that the metallic foil belt could sag toward the metallic electrode therebeneath. In addition, the moving belts prevent any abrasion of the filaments which would occur if the filamentary material were forced to move relative to stationary electrodes.

Figure 2 shows a modification in which the metallic belt is replaced by an insulating belt 33a, such as of glass fabric or rubber, and an upper metallic plate 34a serves as the opposite electrode in place of the metallic belt.

Figure 3 shows a sequence of processing steps for the manufacture of staple fiber or continuous filamentary material in which the artificial filaments are produced in the spinning machine 35a at the first stage and treated at 36a with liquids which depend upon the particular material being dealt with. For example, for viscose the treatment generally comprises an acid washing, desulfurizing, and soaping. The wet tow is then subjected to pre-drying at 37a by means of the radio frequency dryer just disclosed, the partially dried tow being then distorted by crimping at 38a, after which it is subjected to a final drying 39a by the radio frequency equipment just described, from which it may proceed to any other device 40, such as a staple fiber cutter specifically mentioned in the drawing. This sequence of steps is only one example of a number of procedures possible to be employed in conjunction with the device of the invention. Instead, the crimping may be omitted, in which case the dryer of the invention may be employed in a single step to reduce the moisture to the final dryness desired. The device may be constituted of a plurality of pairs of electrostatic electrodes (analogous to 24 and 25 of Figure 1 and 25 and 33a of Figure 2) spaced along the belts and operated at successively higher voltages in the direction of travel of the tow. Additional variations are possible in applying the invention to the crimping of filamentary tow, such as by the method and apparatus shown in the application of Bruenner et al., Serial No. 399,440, filed June 24, 1941, now Patent 2,368,637, these modifications being illustrated by Figures 4 and 5 hereinafter.

As shown in Figure 4, a plurality of filamentary tows, side by side, are fed to the lower belt 41 so they extend longitudinally thereof and pass between the upper and lower belts 42 and 41 oper-

4

ated and arranged to effect crimping by virtue of contraction of the belts which are necessarily of an elastic character in this example. Both the upper and lower belts are preferably of rubber and may be porous to facilitate removal of vapor and gas developed between the belts by means of the high frequency current applied to the opposite electrodes 43, 45 and 44, 46 on either side of the belts. The tow enters between the two belts into the nip between a pair of rolls 47 and 48 which are pressed together and which are operated at a higher rate of speed than the next pair of rolls 49 and 50 forming the next nip between which the belts with the tow therebetween proceed, so that contraction occurs between the two pairs of rolls, thus effecting crimping of the tow. While this crimping is proceeding, the tow is heated by means of the high frequency electrodes 43 and 44, thus preparing the tow for rapid subsequent setting of the crimp therein. From the second pair of rolls, the tow and belts proceed to a third pair of rolls 51 and 52, which in turn rotate at a lower speed than the second pair, heating occurring as a result of a high frequency current applied to the two electrodes 45 and 46 so that the crimp is set substantially by the time it leaves the last pair of rolls. The rolls of each pair are preferably tilted out of vertical alignment, as shown. The arrangement for positively driving the several pairs of rolls at the desired speed differentials are clearly shown in the drawing as constituted of suitable gears, sprockets and chains. Preferably roll 53 is driven at the same speed as rolls 47 and 48.

In Figure 5, there is shown an arrangement similar to Figure 4, except for the fact that only two pairs of pressure rolls are used, in which case the rolls may be directly super-imposed instead of having the nips tilted or offset as shown in Figure 4. Roll 54 is driven at the same speed as the first pair of rolls. With the crimping arrangements of Figures 4 and 5, as in Figures 1 and 2, it is preferred to operate the mechanism within a vacuum chamber.

While preferred embodiments of the invention have been disclosed, the description is intended to be illustrative only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A method of treating moisture-carrying artificial filamentary material comprising continuously passing the moist material while disposed in regular formation to assure substantially uniform impedance through the material through a partial vacuum such that the liquid carried by the material will evaporate therein at a temperature below the critical temperature of the material and, while the material thus disposed is passing through the vacuum, crimping the material and subjecting the crimped material uniformly to a high frequency electric current to thereby effect heating and evaporation of moisture therein.

2. A method of treating a water-wet filamentary material of regenerated cellulose comprising continuously passing the wet material while disposed in regular formation to assure substantially uniform impedance through the material through a partial vacuum such that water will boil therein at a temperature below the critical temperature of decomposition of the material and,

5

while the material thus disposed is passing through the vacuum, crimping the material and subjecting the crimped material uniformly to a high frequency electric current to thereby effect heating and evaporation of moisture therein.

3. A method comprising the steps of crimping a moisture-containing filamentary material, and subjecting the crimped material to a high frequency electric field to effect simultaneously (1) heating and evaporation of moisture therein, and (2) setting the crimp thereof.

4. A method comprising the steps of partially drying a wet filamentary material, crimping the partially dried material, and subjecting the crimped material to a high frequency electric field to effect simultaneously (1) heating and evaporation of moisture to dry the material and (2) setting the crimp therein.

5. A method in accordance with claim 3 in which the material comprises a multi-filament bundle of artificially produced filaments.

6. A method in accordance with claim 3 in which the material comprises a multi-filament bundle of regenerated cellulose filaments.

7. A method in accordance with claim 4 in which the material comprises a multi-filament bundle of artificially produced filaments.

8. A method in accordance with claim 4 in which the material comprises a multi-filament bundle of regenerated cellulose filaments.

9. A method comprising the steps of partially drying a wet multi-filament bundle of filamentary material, distorting the filaments in the partially dried material, and subjecting the distorted material to a high frequency electric field to effect simultaneously (1) heating and evaporation of moisture to dry the material and (2) setting the distortion therein.

10. A method comprising the steps of distorting the filaments in a pre-dried, moisture-con-

6

taining multi-filament bundle, and subjecting the pre-dried moisture-containing filamentary bundle while in distorted condition to a high frequency electric field to effect simultaneously (1) heating and evaporation of moisture therein, and (2) setting the distortion thereof.

11. A method in accordance with claim 9 in which the material comprises a multi-filament bundle of artificially produced filaments.

12. A method in accordance with claim 9 in which the material comprises a multi-filament bundle of regenerated cellulose filaments.

13. A method in accordance with claim 10 in which the material comprises a multi-filament bundle of artificially produced filaments.

14. A method in accordance with claim 10 in which the material comprises a multi-filament bundle of regenerated cellulose filaments.

CAMIEL DE BRABANDER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,035,464	Dreyfus	Mar. 31, 1936
2,124,012	Smith	July 19, 1938
2,217,113	Hardy	Oct. 8, 1940
2,263,681	Hart	Nov. 25, 1941
2,291,807	Hart	Aug. 4, 1942
2,300,791	Lodge	Nov. 3, 1942
2,303,983	Brown	Dec. 1, 1942
2,311,174	Hitt	Feb. 16, 1943
2,325,652	Bierwirth	Aug. 3, 1943
2,360,108	Christie	Oct. 10, 1944
2,390,572	De Brabander	Dec. 11, 1945
2,421,334	Kline	May 27, 1947