April 13, 1965 G. A. CARRUTHERS 3,177,931

APPARATUS FOR TREATING YARN

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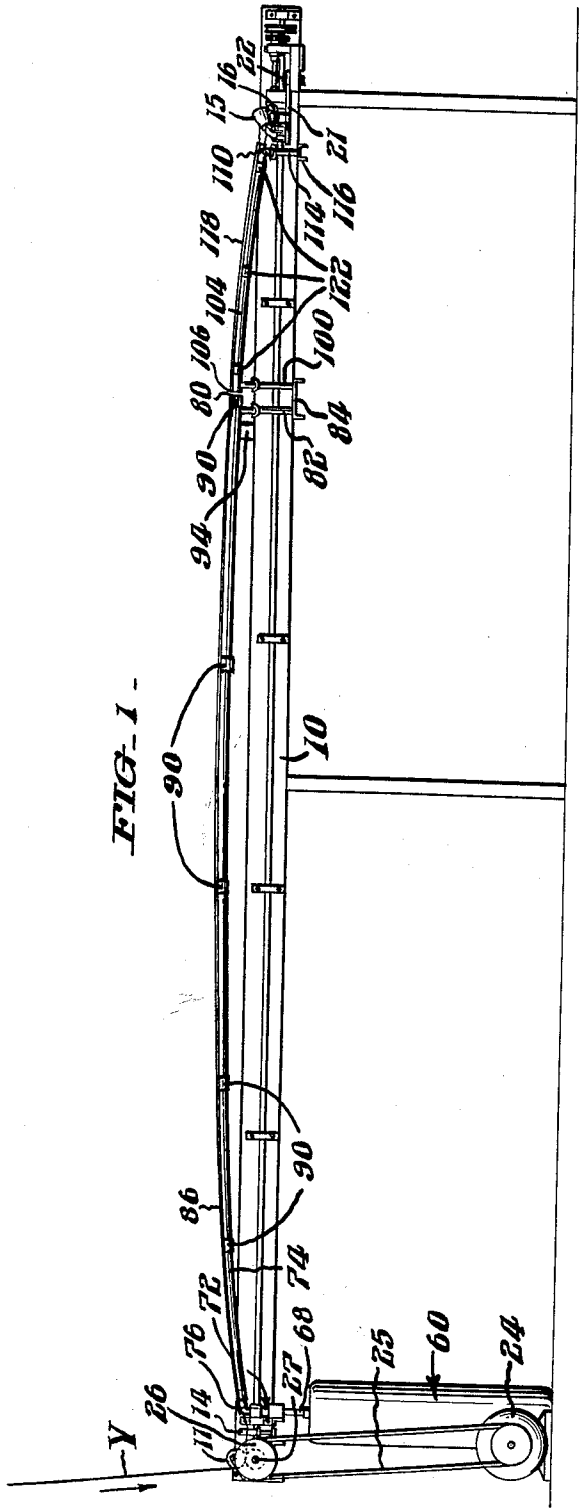


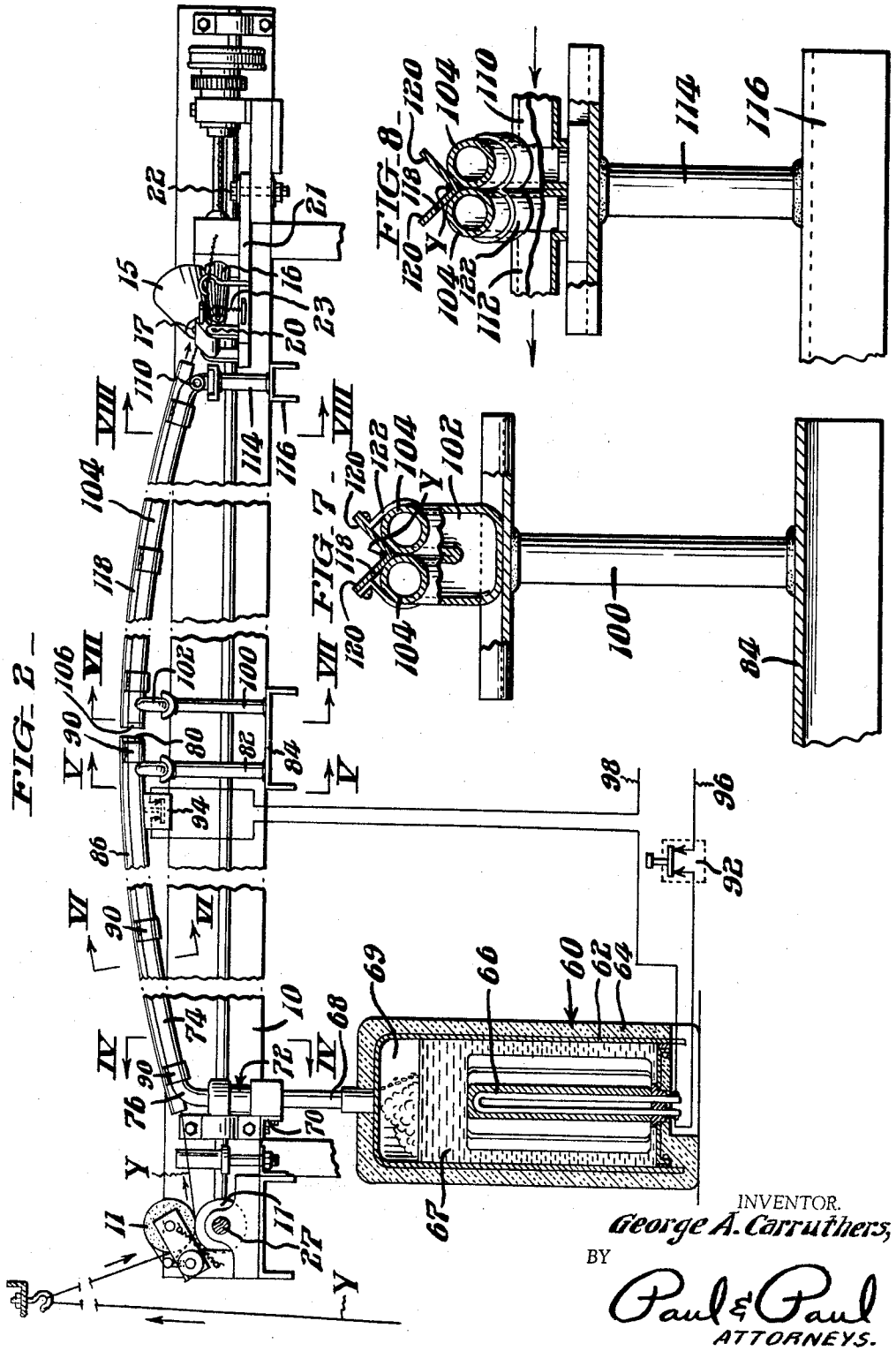
FIG. 1

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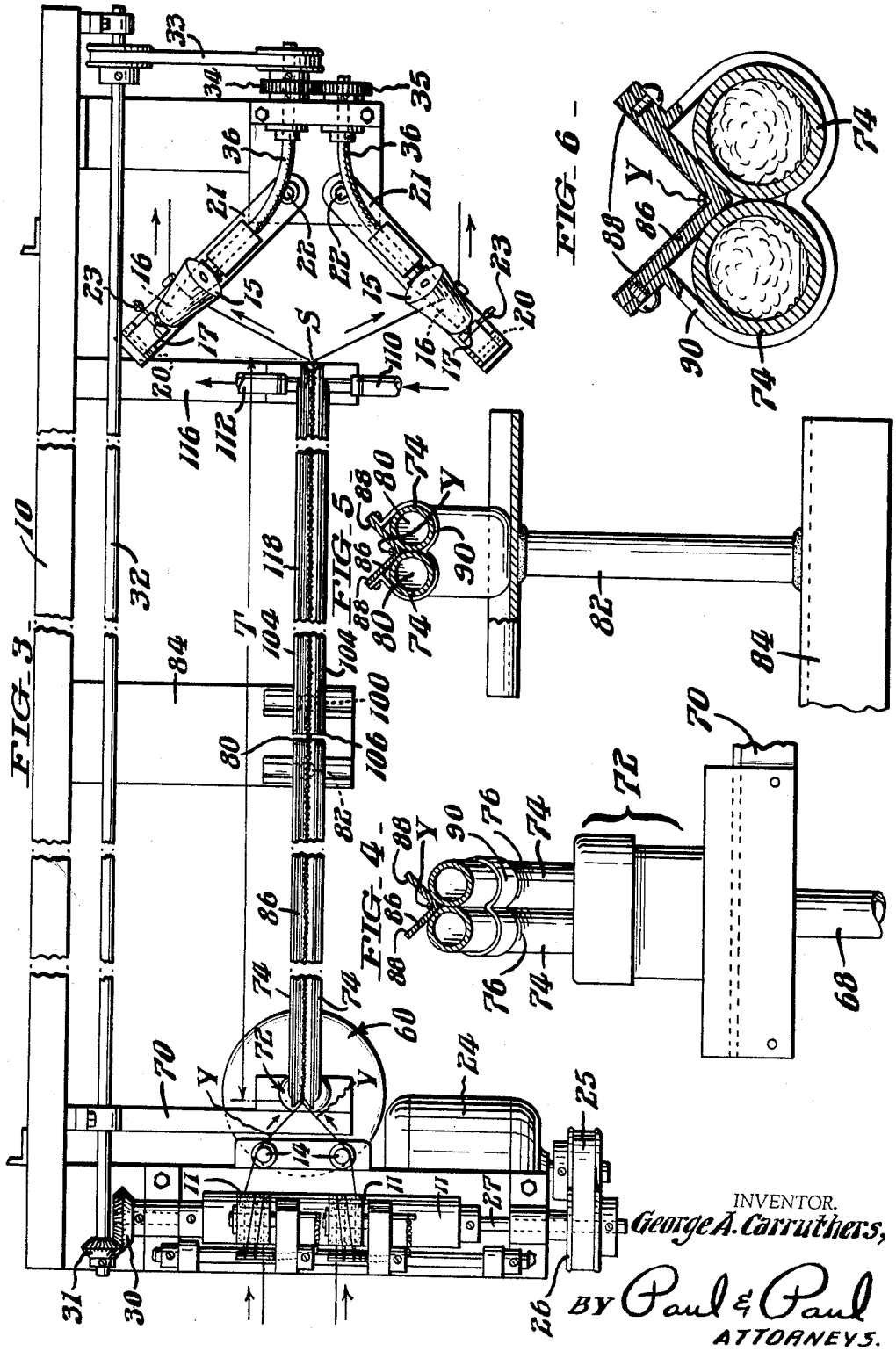


FIG. 3

FIG. 6

FIG. 5

FIG. 4

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APPARATUS FOR TREATING YARN

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5 Claims. (Cl. 165—65)

This invention relates generally to apparatus for modifying synthetic heat-settable yarn, and particularly to such apparatus having improved means for heating and cooling the yarn.

False twisting apparatus is known for feeding yarns separately, twisting them together to form a twisted zone along a predetermined longitudinal axis, separating the yarns and drawing them off to opposite sides of the separation point. This type of apparatus is operated at exceedingly high speed, and slight variations of friction, as well as slight vibrations and the like, tend to cause a wandering of the point of separation because the yarn is substantially suspended under tension between the feed rolls and the withdrawal rolls. The normal tendency is for one yarn to be withdrawn momentarily somewhat faster than the other, thus drawing the point of separation off to one side or the other of the normal axis of the twisted yarn. Ultimately both withdrawn yarns are caught in the nip of the same rolls, causing a time-consuming and costly shutdown and also damaging substantial quantities of yarn. In addition, the yarn suspended under tension between the feed rolls and the withdrawal rolls has a tendency to start vibrating violently which, of course, interferes with proper operation of the apparatus. Accordingly, an important object of the present invention is to provide false twisting apparatus having yarn heating and cooling means operative to help control wandering of the yarn separation point and violent vibration of the twisted yarn.

Another object is to provide yarn heating means operative to engage with a long length of yarn and which is maintained at the same temperature along its entire length.

Other objects of the invention will become apparent when the following specification is read with reference to the accompanying drawings, in which:

FIG. 1 is a front elevation of apparatus constructed in accordance with the invention;

FIG. 2 is an enlarged view similar to FIG. 1, part being shown in section and part diagrammatically;

FIG. 3 is a plan view of the apparatus shown in FIG. 2; and

FIGS. 4, 5, 6, 7 and 8 are, respectively, enlarged sections on lines IV—IV, V—V, VI—VI, VII—VII and VIII—VIII in FIG. 2.

The following description is directed to the specific form of the invention illustrated in the drawings and is not intended to be addressed to the scope of the invention itself, which may be practiced in other forms and arrangements.

Referring to the drawings, a frame 10 carries feed rolls 11 for feeding separate ends of yarn Y, from pirns (not shown), in the direction indicated by the arrows. Each yarn is nipped between upper and lower rolls 11.

The yarns pass around separating pins 14 and converge, being then pre-twisted to form a twisted zone T extending along a predetermined longitudinal axis. The yarns, which are twisted to one another to a point of separation S, are directed to opposite sides of the longitudinal axis of the twisted zone, each passing through the nip between a conical roll 15 and a conical roll 16. The roll 15 is mounted upon a shaft 17, pivoted at 20 to a support 21 which is in turn pivoted at 22 to the

frame 10. The roll 15 is spring-urged downwardly toward the roll 16 by a spring 23.

Means are provided for driving the feed rolls 11 and the withdrawal rolls 16. This drive means includes a motor 24, belt 25 and sprocket 26 which is secured on the lower feed roll shaft 27. At the opposite end of shaft 27 is a bevelled gear 30 meshing with a gear 31 fixed on a shaft 32, which at its opposite end drives a belt 33 connected through gears 34, 35 to flexible drive shafts 36 drivingly connected to the conical roll 16. Thus, the conical withdrawal rolls 15, 16 are driven in timed relation with respect to the feed rolls 11, in a manner to maintain the yarn under a limited and predetermined amount of tension. Preferably, the peripheral speeds at approximately the longitudinal centers of the withdrawal rolls are equal to the peripheral speeds of the feed rolls.

As thus far described, the apparatus is identical with that described and illustrated in my United States Patent No. 3,091,908, issued June 4, 1963, to which reference may be had for a fuller description.

Referring particularly to FIG. 2, the means for heating the yarn includes a heating unit generally designated 60. The unit includes a closed vessel 62 encased in insulation 64. Mounted within the vessel 62 is a heating element 66. The vessel 62 is filled with water 67 to a level sufficient for covering the heating element 66, leaving a space 69 at the top of the vessel. It is important to observe that, before filling with water, the internal surfaces of the unit are thoroughly cleaned to remove all substances (e.g., oil and grease) which in decomposing could produce incondensable gases, and that air is substantially completely removed by evacuation at high vacuum. Removal of all such incondensable gases is important because they would interfere with the attainment of uniform temperatures throughout the entire length of the heater. Extending upwardly from the top of the vessel 62 is a conduit 68 which is tied into the frame 10 by means of a bar 70. A coupling 72 connects the conduit 68 to a pair of conduits 74 which are bent, as at 76, and extend upwardly to the right, their extremities being closed, as at 80. The closed ends of the conduits 74 are supported upon a standard 82 which is in turn carried by a bracket 84 extending from the frame 10. The conduits 74 are parallel to each other and are disposed in side-by-side relation. Thus they form a cradle for a conduit or trough 86 seated directly upon the conduits 74 and between the same. The trough 86 is V-shaped in transverse section and the upwardly facing surfaces are chrome-plated, as at 88. The trough 86 is removably secured to the conduits 74 by means of straps 90.

The heating element 66 is connected in electric circuit with a main power switch 92 and a thermocouple or heat-sensitive cutoff switch 94 by wires 96 and 98. The switch 94 is mounted directly upon the conduits 74.

Also mounted upon the bracket 84 is a standard 100, at the head of which is a U-shaped fitting 102 interconnecting corresponding ends of a pair of conduits 104 closed, as at 106. From the ends 106, the conduits 104 slope downwardly toward the discharge end of the apparatus, and the ends thereof are connected respectively to an inlet conduit 110 and an outlet conduit 112. The conduits 110 and 112 are supported upon a standard 114, which in turn is carried by a bracket 116 extending from the frame 10. The conduits 104 are parallel to each other and are disposed in side-by-side relation. Thus they form a cradle for a conduit or trough 118 seated directly upon the conduits 104 and between the same. The trough 118 is V-shaped in transverse section and the upwardly facing surfaces are chrome-plated, as at 120. The trough 118 is removably secured to the conduits 104 by straps 122.

In operation of the apparatus, the yarns from separate nips between feed rolls 11 extend around the pins 14.

The yarns are then pre-twisted by the operator. They may receive any number of desired turns either clockwise or counterclockwise, being then placed in the troughs 86 and 118. Each yarn is then placed at random in the nip between the associated rolls 15 and 16 and then slightly tensioned.

Now the main power switch 92 may be closed. Steam is generated and passes upwardly through conduit 68, coupling 72 and conduits 74 to the caps 80. Steam which condenses flows back to the heater through the conduits 74 and 68.

It will be understood that in setting up the heating unit air is purged from the interior thereof, i.e., from the interior of the vessel 62 and communicating conduits 68 and 74 before the unit is hermetically sealed. The steam heats conduits 74 throughout the length thereof and in turn the conduits 74 heat the trough 86 uniformly throughout the length thereof. The temperature of the trough 86 is maintained at a desired level by operation of heat-sensitive switch 94 which opens whenever the temperature exceeds a predetermined desired maximum temperature and recloses whenever the temperature falls below the desired temperature. The heating unit is, as mentioned before, hermetically sealed. The internal pressure may amount to several hundred pounds per square inch, and the temperature will be in the order of 350° to 400° F.

Cold water is introduced through inlet 110 and flows upwardly through one of the conduits 104, over to the other conduit 104 through the fitting 102 and then back down through the other conduit 104 to the outlet 112. The trough 118 is cooled by the conduits 104.

The twisted yarns are kept away from the trough 86 so long as the yarns are not moving. The apparatus may be started up by energizing motor 24 and immediately allowing the twisted yarns to contact the troughs 86 and 118. It will be understood that the yarn moves at tremendous speed, for example, in the order of 1510 feet per minute or even faster. The wear on the troughs is considerable and necessitates renewing or reconditioning the troughs periodically. To facilitate this, the troughs are bolted down so that they may be removed for reconditioning or replacement without difficulty.

It will be apparent that since the yarns are drawn through the troughs 86 and 118, wandering of the point S from side to side and vibration of the yarns is closely controlled.

The arched form of the troughs assures that the yarn will make contact therewith and at the same time the slope of the conduits 74 provides for drainage of the condensate back into the vessel 62.

While replaceable heater surfaces as shown and described are advantageous in many circumstances, they may be dispensed with or attached permanently in others.

For making balanced yarn, two twisted pairs may be carried side-by-side along the heater (one S twist and one Z twist) and the trough should then be provided with two separate channels, one for each twisted pair.

It is often most advantageous to provide multiple heaters in a common machine, each heating separate thread lines, and to provide a single evaporator which is connected to all heaters. This assures precise temperature uniformity for all the heaters of the group. On the other hand, many evaporators may be used in parallel, with interconnecting steam and water lines, each evaporator connected for supplying steam to its own yarn heater. In such an arrangement only one temperature controller need be used for the entire system.

It is to be understood that the advantages of this invention are not limited to the use of long heaters as shown herein, but apply in many cases to short heaters with or without the cooling element, in any multi-position machine which includes a yarn heat-treating step, such as a draw-twister for polyester yarns, for example.

I claim:

1. In apparatus for modifying heat-settable yarns, the combination comprising closed means including a source of vaporized heating fluid substantially completely free of incondensable gases, and a plurality of tubular members for receiving said fluid from said source, said tubular members being disposed in close adjacent side-by-side relation and being inclined for drainage of condensate back to said source, a yarn guide conduit in the form of an open trough generally V-shaped in transverse section and extending along and seated directly upon said tubular members with opposite sides thereof respectively engaging said tubular members for being heated thereby, and means for drawing said yarn lengthwise of said tubular means and conduit in contact with the latter for being heated thereby.

2. The combination defined in claim 1 wherein the yarn guide conduit is detachable from the tubular members without any necessity for opening any of the fluid source and tubular members.

3. In apparatus for modifying heat-settable yarns, the combination comprising closed means including a source of vaporized heating fluid substantially completely free of incondensable gases, and a first plurality of tubular members for receiving said fluid from said source, said first tubular members being disposed in close adjacent side-by-side relation and being inclined for drainage of condensate back to said source, a first yarn guide conduit in the form of an open trough generally V-shaped in transverse section and extending along and seated directly upon said first tubular members with opposite sides thereof respectively engaging said tubular members for being heated thereby, a second plurality of tubular members arranged for passage of a fluid coolant therethrough, said second tubular members being disposed in close adjacent side-by-side relation, a second yarn guide conduit in the form of an open trough generally V-shaped in transverse section and extending along and seated directly upon said second tubular members with opposite sides thereof respectively engaging said tubular members for being heated thereby, said first tubular members and conduit and said second tubular members and conduit being disposed in end-to-end relation along a predetermined path, and means for drawing said yarn along said path first in contact with said first yarn guide conduit for being heated thereby and then in contact with said second yarn guide conduit for being cooled thereby.

4. The combination defined in claim 3 wherein the first yarn guide conduit is detachable from the first tubular members without any necessity for opening any of the fluid source and first tubular members, and the second yarn guide conduit is detachable from the second tubular members without any necessity for interrupting circulation of fluid coolant through the latter.

5. The combination defined in claim 3 wherein the predetermined path of the tubular and conduit means is in the form of a long sweeping arch.

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