

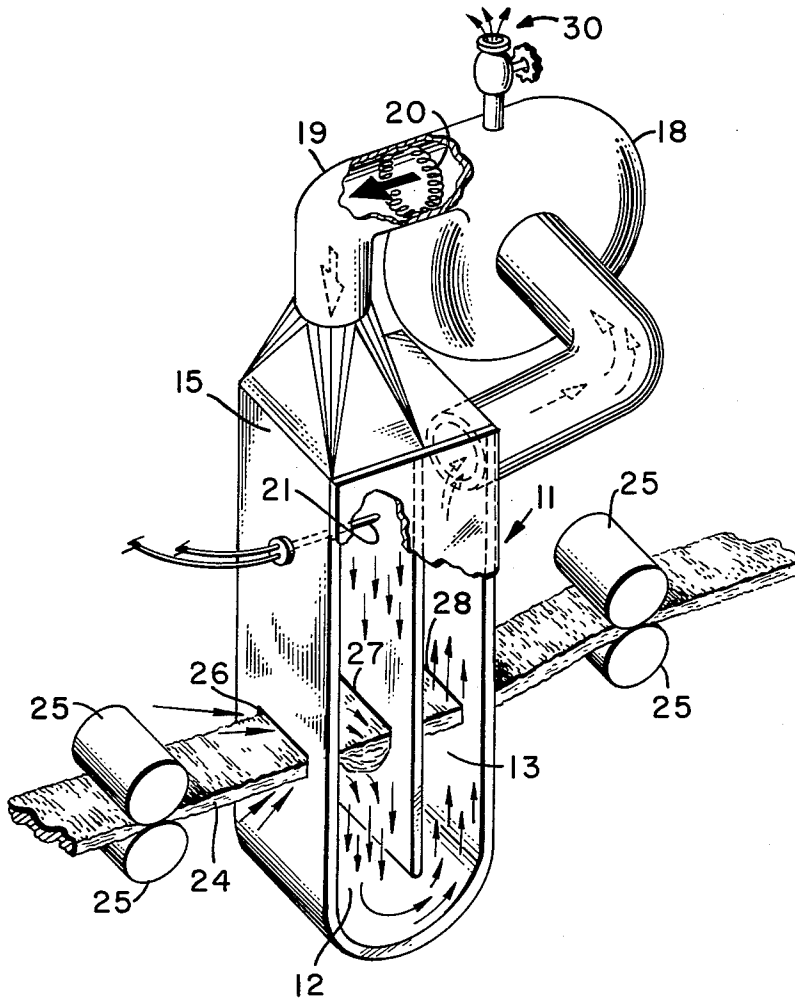
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STRAND ANNEALERS

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3,209,467

STRAND ANNEALERS

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4 Claims. (Cl. 34—155)

This invention relates to strand annealers and more particularly to apparatus for annealing a tow of thermoplastic filaments.

Conventional designs of continuous heated air annealers for bundles or tows of thermoplastic filaments have given poor results for the reason that these annealers are not sufficiently air tight. It has been extremely difficult to provide efficient seals to prevent leakage of hot air out of the annealer or cold air into the annealer. Since leakage of cold air into the annealer would affect the annealing operation, attempts have been made to utilize hot air at higher pressures. These have not been very successful for the reason that, in the apparatus used in the past, the loss of heated air has been excessive. The present invention proposes to utilize this air leakage situation to produce a differentially annealed tow.

For many uses it is necessary that the tow from which yarn is made be annealed uniformly throughout. For other uses, such as in some bulky or novelty yarns, it is desirable that only portions of the tow be annealed. An object of this invention is to provide an apparatus for differentially annealing a strand.

Another object of this invention is to provide an apparatus wherein heated air impinges on and anneals one side of a tow while leakage of cold air into the apparatus prevents annealing of the other side of the tow.

A further object of this invention is to provide an apparatus for fully annealing one side of a bundle of thermoplastic filaments while maintaining the other side in an unannealed state.

Still another object of this invention is to provide an apparatus having walls defining a U-shaped passageway through which air flows as a bundle of thermoplastic filaments is advanced through apertures in the walls along a path normal to the air flow.

One embodiment of the invention contemplates a tow annealer having a pair of vertical passageways connected in series in such a way that air flowing downward in the first passageway flows upward in the second passageway. The walls of the chamber are provided with apertures which are aligned to define a tow path perpendicular to the air flow. Heated air flowing downward in the first passageway engages and anneals the upper portion of the tow while cold air leaking into the chamber past the tow prevents annealing of the lower portion of the tow in the first passageway.

Other objects and advantages of the invention will become apparent when the following detailed description is read in conjunction with the drawing, in which the single figure is an enlarged perspective view of one embodiment of the invention showing the construction of the annealing chamber.

Referring now in detail to the drawing, a U-shaped annealing chamber 11 is shown having first and second vertical passageways indicated by reference numerals 12 and 13, respectively. The passageways are connected in series in such a way that heated air flowing downward in the first passageway 12 flows upward in the second passageway 13. The passageways are formed by the walls of a tubular member or duct 15 having a rectangular cross section. The member 15, which is bent back upon itself in the form of a U, might be defined as retroflexed, the bend in the duct 15 being such that the passageways 12 and 13 are parallel to each other.

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A centrifugal fan 18 is connected by a duct 19 to the chamber 11 to force air therethrough. A resistance heater 20 is positioned in the duct 19 for heating the air entering the passageway 12. A probe of a well known type mounted in the upper portion of the passageway 12 senses the temperature of the air and controls the heater 20 in a well known way. The system for sensing the air temperature and controlling the operation of the heater 20 is so well known that it is not described in detail here. A valve 30 is placed in the outlet or pressure side of the fan 18 to vent a portion of the air and place the remainder of the circulation system under a negative air pressure. The amount of air exhausted through the valve 30 is made up by an equal amount of air which is drawn into the closed system through apertures 26 and 28.

A tow 24 or bundle of thermoplastic filaments is advanced by rolls 25 through apertures 26, 27 and 28 in the walls of the chamber 11. The apertures 26-28 are aligned in such a manner that the tow 24 travels along a straight path normal to the air flow in the tow passageways.

In operation of the apparatus, heated air travelling downward in the passageway 12 impinges on and anneals the filaments in the upper portion of the tow 24 in the passageway 12. Cold air leaking through the aperture 26 into the first passageway 12 around the entering tow flows across the lower portion of the tow 24 and prevents annealing of the filaments in this portion of the tow. Hot air impinging on the upper side of the tow 24 minimizes the effect of the cold air on the top portion of the tow. Also, the lower portion of the tow is shielded from the heated air by the upper portion thereof. The cold air leaking into the chamber above the tow 24 has no effect on the annealing of the upper surface of the tow, since it is swept away by the flow of hot air.

The cold air entering into the first passageway 12 around the tow 24 is mixed with and lowers the temperature of the heated air sufficiently that no further annealing takes place in the second passageway 13. In the second passageway 13 the air flows upward against the moving tow 24. This upward air movement lifts the tow off the lower wall of the aperture 27 to prevent undue "scrubbing" of the tow against this wall. Heated air leaking into the passageway 13 from the passageway 12, through the aperture 27, may further anneal the upper portion of the tow to a certain extent. However, the upward flow of air in this second passageway prevents any annealing of the lower portion of the tow.

It can readily be seen that this apparatus differentially anneals a tow or bundle of thermoplastic filaments. The annealing does not extend throughout the tow, but is carried out only on the filaments in the upper portion of the tow. The unannealed filaments in the tow will have different shrinkage characteristics from the annealed filaments. A heat treatment of a yarn made from the tow will produce an unusual bulkiness in the yarn.

It is to be understood that the embodiment of the invention disclosed herein is merely illustrative and may be modified or amended and that numerous other embodiments may be contemplated which will fall within the spirit and scope of the invention.

What is claimed is:

1. Apparatus for annealing tow, comprising an elongated chamber having one end enclosed by an arcuated portion, a dividing plate mounted in the chamber and extending along the major plane of the elongated chamber to divide the chamber into a pair of parallel subchambers having similar cross-sectional dimensions substantially lesser than the longitudinal dimensions of the subchambers, said plate terminating at a point spaced from the arcuated portion, said chamber and plate having therein aligned apertures lying in a single plane trans-

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versely of said major plane for advancing a tow through said chamber, said apertures being adapted to admit ambient air to reach the lower portion of the tow and spaced at approximately the midpoint of the chamber to provide an extended path between separate sections of the tow, and means for forcing an annealing fluid sequentially through one of the sub-chambers in one direction, thence through the other sub-chamber in the other direction to impart a differential shrinkage characteristic to the tow.

2. Apparatus for annealing a tow comprising an elongated vertically arranged chamber having an arcuated lower end portion, said chamber having a divider plate disposed centrally therein and spaced from said arcuated end portion to form a pair of elongated, parallel sub-chambers, slotted apertures in the opposite side walls of said chamber and said divider plate occupying a single plane transverse to said elongated chamber with one of said elongated chamber apertures being enlarged with respect to cross-sectional area of the tow to provide an air intake, a pair of rollers positioned on each side of said chamber for advancing the tow through said slotted apertures, a duct connected to said elongated chamber by a first conduit and a second conduit to form a single closed loop, a fan disposed in said duct for circulating a heated annealing medium through the closed loop, a heater disposed in the duct for heating the annealing medium, a temperature element positioned downstream from said enlarged aperture for monitoring the temperature therein, and a control valve in the duct for exhausting air from said duct to control leakage of the air into the chamber through said enlarged aperture and for reducing the temperature of the heated annealing medium thereby imparting a differential shrinkage characteristic to the tow.

3. Apparatus for stratified annealing of a tow comprising an elongated vertically arranged chamber having an arcuated lower end portion, said chamber being divided into a sub-chambers by a divider plate centrally disposed between opposite side walls of the said chamber, said divider plate terminating at a point spaced above the arcuate lower end portion; slotted apertures in said opposite side walls and said divider plate wherein at least one of said slotted apertures in said opposite side walls is adapted to provide an air intake allowing ambient air to reach the lower portion of the tow causing differential

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shrinkage between the lower portion and upper portion thereof; means for advancing said tow through said apertures; a duct interconnecting the sub-chambers to form a closed loop for circulating an annealing medium through the tow from opposite directions; means for circulating and heating said annealing medium; means for monitoring the temperature in said closed loop; and, adjustable means in said duct for exhausting air from said duct to vary the amount of ambient air entertained with said annealing medium.

4. Apparatus for differentially annealing a tow comprising a chamber having an arcuated lower end portion; a divider plate centrally disposed in said chamber to form a first sub-chamber and a second sub-chamber, said divider plate terminating at a point spaced above the arcuated lower end portion; slotted apertures in opposite side walls of said chamber and said divider plate, said apertures being in a single plane and adapted to be larger in cross-sectional area than the cross-sectional area of the tow to admit ambient air into said first sub-chamber underneath the tow; a duct interconnecting in close proximity said first sub-chamber and said second sub-chamber above the slotted apertures to form a single closed loop; means for circulating and heating an annealing medium; and, means for exhausting fluid from said duct to vary the amount of ambient air entrained in said loop whereby only a portion of said tow is annealed.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,209,467

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 31, strike out "the"; line 39, strike out "a", first occurrence; same column 3, line 42, for "arcuate" read -- arcuated --.

Signed and sealed this 12th day of July 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

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Commissioner of Patents