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WASHING APPARATUS

Ernest A. Taylor, Jr., Decatur, Ala., assignor to Monsanto Company, St. Louis, Mo., a corporation of Delaware
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ABSTRACT OF THE DISCLOSURE

This invention provides an apparatus for continuously washing a moving tow of synthetic filaments. The apparatus is provided with an elongated chamber through which the tow, in flat ribbon form, and water pass. Opposite walls of the chamber are provided with spaced deflecting plates which deflect the water back and forth through the tow from one side of the chamber to the other.

This invention relates to washing apparatus and more particularly to apparatus for washing a moving tow.

In some wet spinning operations the freshly spun synthetic fiber tow is passed through a bath of hot water to remove the residual solvent from the filaments making up the tow. A major disadvantage of this process is that the washing process is somewhat inefficient. This inefficiency apparently stems from the fact that circulation of the hot water around and through the moving tow is poor. Apparently, the wash water clings to the tow to form a boundary layer of water which impedes the washing process. This problem is overcome in the present invention by forcing the water to travel back and forth through the tow from one side to the other to thereby break up this boundary layer and thereby better expose the filaments in the tow to the water. Heating the water assists somewhat in solvent removal. The efficiency of this invention makes it possible to use even cold water and still obtain satisfactory solvent removal, although heated water may be used.

One object of this invention is to provide a novel and improved apparatus for washing a moving strand.

Another object of this invention is to provide an apparatus which thoroughly and efficiently washes a tow by forcing water to flow back and forth through a tow from one side to the other to separate the filaments in the tow from each other and thereby better expose the individual filaments to the water.

A further object of this invention is to provide an apparatus for washing a moving tow wherein the tow moves through a water carrying passage in the apparatus, the passageway having on opposite walls thereof a plurality of spaced protuberances which force the moving water to sweep back and forth from one side of the passageway to the other through the tow to thereby penetrate the tow and break up the boundary layer of water clinging to the filaments in the tow.

A still further object of this invention is to provide a tow washing apparatus having a rectangular passageway through which the tow and water are passed, opposite walls of the rectangular passageway having thereon a plurality of spaced deflection plates which cause the water to sweep back and forth from one side of the passageway to the other along a substantially sinusoidal path. The water and the tow enter the chamber through a venturi shaped port. The water emerges from a narrow slot at a high velocity in the general direction of the tow. Its velocity and momentum serve to pull the tow into the chamber and to create a forward pressure which prevents a reverse flow of water. The momentum of the stream is sufficient to carry the water and tow through the chamber 12.

Other objects and advantages of the present invention

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will become apparent when the following detailed description is read in conjunction with the appended drawing, in which:

FIGURE 1 is a perspective view of one embodiment of the invention with portions cut away to show a passageway for carrying a moving tow and water,

FIGURE 2 is a cross-sectional view taken on line 2—2 of FIGURE 1 showing the cross-sectional configuration of the passageway, and

FIGURE 3 is a cross-sectional view of a portion of the apparatus showing the venturi shaped throat through which a tow enters the treating chamber and the narrow slot at the edge of the venturi through which water enters at a high velocity.

One embodiment of the present invention contemplates a tow washing apparatus having an elongated chamber through which a tow, in the form of a flat ribbon of synthetic filaments, passes. The chamber is provided with a plurality of spaced deflection plates secured to the interior of the chamber above and below the tow path, each of the deflection plates being raked in the direction of movement of the tow so that these plates force water passing through the chamber to move back and forth through the tow from one side thereof to the other. Water is forced into the chamber through a narrow slot to give it a high velocity which also serves to assist in moving the tow into the chamber.

Referring now in detail to the drawing, there is shown a tow washing apparatus having an elongated chamber 12 which has a rectangular cross-sectional configuration as shown in FIGURE 2 of the drawing. A tow 13 in the form of a thin, wide ribbon of synthetic filaments is moved through the chamber 12 by pairs of nipped rolls 14 (only the lower rolls being shown) in the direction shown in FIGURE 1, the tow exiting from the chamber 12 through an opening 15 in the downstream end thereof.

The chamber 12 is provided with a plurality of raked or inclined deflecting plates 18 and 19 secured to the upper and lower walls, respectively, of the chamber 12. The purpose of the deflecting plates 18 and 19 is to force water moving through the chamber to move from one side of the tow path to the other and thereby thoroughly penetrate the tow. Water from a supply 22 is forced into the chamber 12 through a narrow opening 23 and exits from the chamber 12 through an opening 24 at the downstream end of the chamber 12.

It will be noted from the FIGURES 1 and 3 that the tow path intersects the slot opening 23 so that the effect is similar to that of a venturi in assisting the pulling of the tow 13 to enter the chamber 12. It will also be noticed that the narrow opening 23 is "aimed" at the upstream deflection plate 18 at substantially the same angle at which each of the deflection plates 18 is "aimed" at the following lower deflection plates 19 and vice versa. The purpose of this arrangement is to insure that the rapidly moving water engages the upstream deflection plate 18 at substantially the same angle at which it engages the remaining deflection plates 18 and 19 to thereby minimize turbulence in the water moving through the chamber.

It will be noted that the ends of the deflection plates 18 and 19 terminate in spaced horizontal planes, these planes being designated by the reference numerals 30 and 31 respectively. The planes 30 and 31 are spaced apart the distance A, the dimension A being 1—4 times the thickness of the tow 13. The deflection plates 18 and 19 extend from the outer walls of the chamber toward the tow 13 a distance H and are spaced longitudinally apart a distance W. Each of the deflection plates 18 and 19 is positioned at an angle θ relative to the planes 30 and 31. Measured in terms of A, the dimension W may be from 6A—40A and is preferably from 12—28A. The dimension

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H may be from 3A-20A but is preferably from 6-10A. The angle θ may vary from 15-110° but is preferably 35-55°. Much superior results are obtained if the various dimensions are maintained within the preferred ranges.

In operation of the apparatus, the tow 13, which is in the form of a thin ribbon of filaments, is moved through the chamber 12 by the rolls 14. Water is forced from the supply 22 through the narrow opening of the slot 23 and into the chamber 12, the venturi effect serving to assist in pulling the tow 13 into the chamber. Each of the deflection plates 18 and 19 is inclined at its free end in a downstream direction in order to deflect the water back and forth from one side of the chamber to the other and thereby through the tow. This insures that the water thoroughly penetrates the tow repeatedly to achieve a superior washing result.

While this apparatus has been described in connection with washing a tow of synthetic filaments to remove the residual solvent therefrom, it is to be understood that this apparatus may also be used for treating a tow or a fabric with either a liquid or gaseous medium as, for example, in the dyeing of a fabric, in drying and in other such processes.

It is to be understood that the embodiment disclosed herein may be amended or altered and that numerous other embodiments can be contemplated without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for washing a strand, comprising an elongated chamber, said chamber having an opening therethrough for the passage of the strand, said chamber having on opposite walls thereof a plurality of plates extending toward the strand for deflecting water from one

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side of the chamber to the other past the strand, said plates terminating in parallel planes, said planes being spaced apart a distance A, said plates each being positioned at an angle θ relative to the walls, the angle θ being measured on the downstream side of the plate, said plates on each side of the chamber being spaced apart a distance W, each said plate extending a distance A from its respective wall, wherein

A=1-4 times strand thickness

$\theta=15-110^\circ$

W=6-40A

H=3-20A.

2. The apparatus of claim 1 wherein

A=1-4 times strand thickness

$\theta=35-55^\circ$

W=12-28A

H=6-10A.

3. The apparatus of claim 1 wherein the chamber is provided with a narrow water inlet which intersects the strand path at an angle so that water entering the chamber at a high velocity will assist in moving the strand into said chamber.

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IRVING BUNEVICH, *Primary Examiner*.