Oct. 11, 1966 R. M. ROEDER ETAL 3,277,537

YARN GUIDE FOR SHAPING TOW

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FIG. 1a

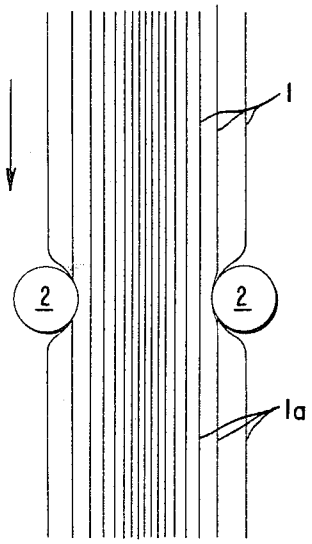


FIG. 1b

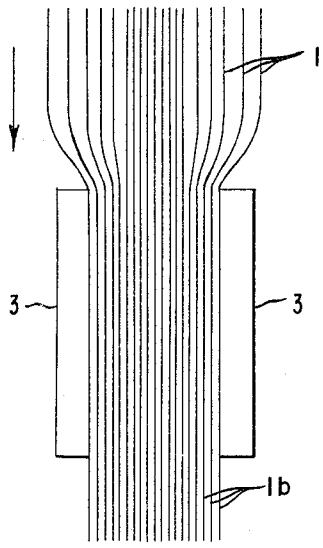


FIG. 3

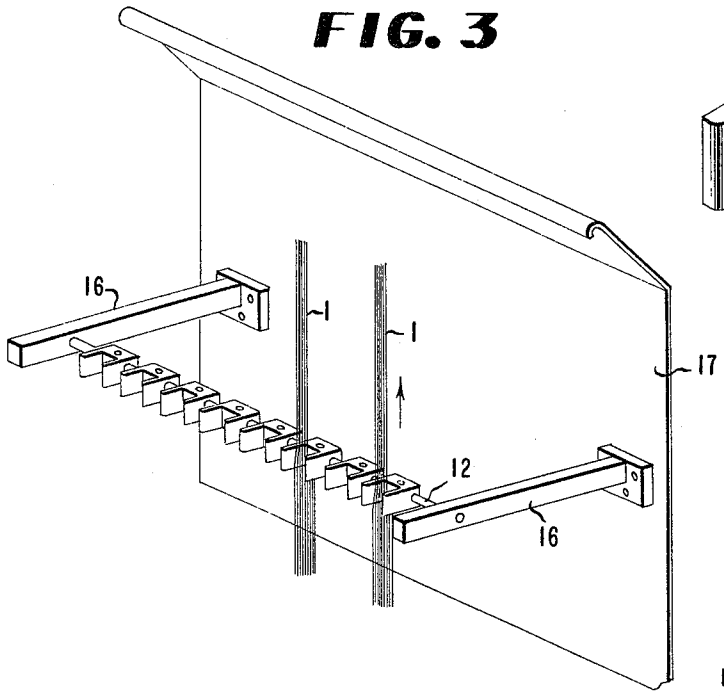
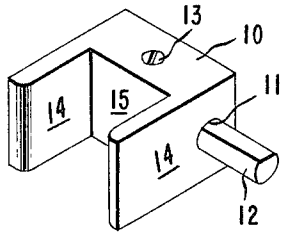


FIG. 2



INVENTORS

RICHARD M. ROEDER

DAVID DONALD DRUMMOND, JR.

BY David Katz.

ATTORNEY

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FIG. 4

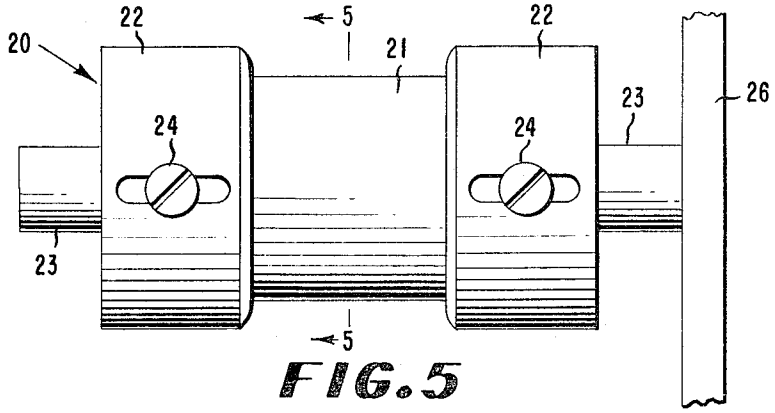


FIG. 5

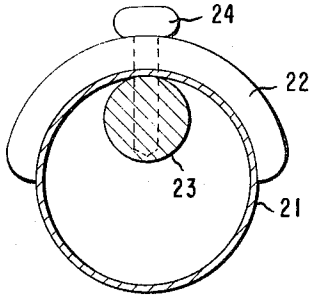
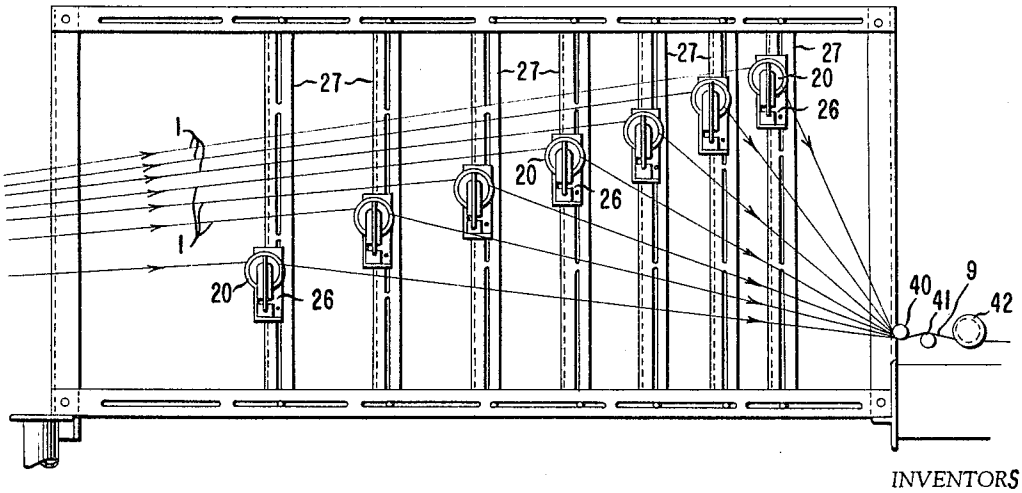


FIG. 6



INVENTORS
RICHARD M. ROEDER
DAVID DONALD DRUMMOND, JR.

BY David Katz.

ATTORNEY

Oct. 11, 1966 R. M. ROEDER ETAL 3,277,537

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FIG. 7

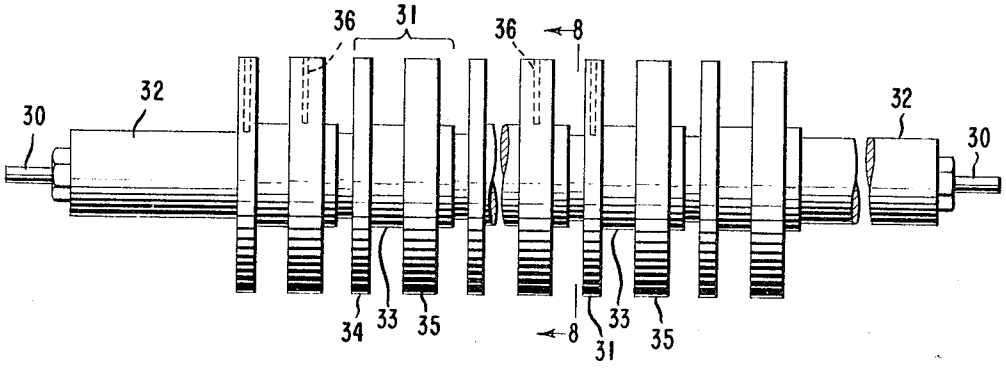
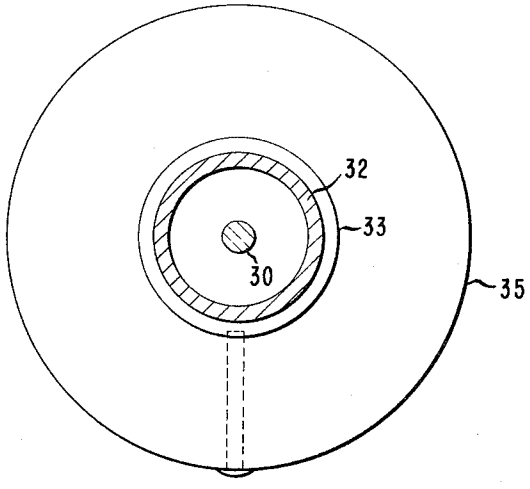


FIG. 8



INVENTORS
RICHARD M. ROEDER
DAVID DONALD DRUMMOND, JR

BY David Katz.

ATTORNEY

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YARN GUIDE FOR SHAPING TOW

Richard M. Roeder and David Donald Drummond, Jr., Camden, S.C., assignors to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Mar. 2, 1964, Ser. No. 348,529
1 Claim. (Cl. 19—161)

This invention relates to the production of synthetic fibers. It is particularly concerned with that phase of fiber production involving the formation of tow and the improvement of tow quality.

Tows of synthetic fibers are formed by combining several ribbons of fibers, each ribbon being made up of continuous, discrete fibers obtained from a number of spinnerets. A tow usually has a denier in the hundreds of thousands. The tow is made up by carefully arranging the ribbons so that the tow will be even in thickness from side to side. In this form the tow is passed through a stuffer box crimper to impart crimp to the individual fibers. The crimped tow may then be cut into staple or used for direct spinning into a yarn. In the latter case the tow may first be hot stretched and randomly broken on a Turbo Stapler, or randomly cut on a Pacific Converter, then spun into yarn.

Regardless of how the tow is to be used it is important that it be uniform in fiber properties and in fiber distribution. All the fibers should have the same crimp frequency and the same crimp amplitude or crimp index. The fiber density should be constant across the tow and the fibers should be intermingled to the same extent throughout so that the tow will be coherent. The individual fibers should not be damaged or broken.

One common fault of the tows which causes difficulty in converting into uniform yarns is their tendency to split apart. Another is the appearance of thick and thin spots in the tow, often associated with split tows, damaged fibers, and unevenly crimped fibers.

In order to produce spun yarns and fabrics of uniform appearance and uniform properties it is necessary to make a uniform tow. To make a uniform tow, it is necessary to form the same from ribbons which have an essentially uniform thickness throughout their width, whereby they can be laid out side by side without gaps, thin places, or overlapping, unduly thick places. The practical problem arises from the fact that ordinarliy moving ribbons of filaments tend to acquire a more or less pancake cross section. That is, they are thick and reasonably uniform throughout the major portion of their width but tend to thin out at the edges.

Heretofore, little effort has been made to control the width, thickness or shape of ribbons that go into the formation of tow. In some cases, ribbons of textile filaments have been passed between pins or posts spaced apart for a distance slightly less than the width of the entering ribbon of filaments. Such passage, however, does not permanently constrict the width of the ribbon, and the edges spread out to essentially their original width and thinness immediately after passing through the pins.

Accordingly, it is an object of this invention to provide apparatus for shaping the cross section of a moving ribbon-like mass of essentially aligned, loose, continuous textile filaments whereby to impart thereto a lasting, essentially rectangular cross section of reasonably uniform thickness throughout its width. Other objects and achievements of this invention will appear as the description proceeds.

In a general way, the objects of this invention are achieved by passing the moving ribbon-like mass through a rigid body which comprises an essentially U-shaped

channel portion therein, said portion having considerable extent along the line of the moving filament mass, compared to its width. In other words, while constricting the ribbon laterally in essentially the same manner as a pair of pins would, the apparatus of our invention holds the mass in its constricted form for a measurable interval of its travel, whereby the individual edge filaments which have been crowded together are given a chance to enmesh, intertangle or otherwise acquire an influence on each other to make it easier for them to stay together than to separate.

The required length of the channel portion for the aforegoing purpose cannot readily be expressed with reference to its width or the width of the passing ribbon, because ribbons will differ in width over a wide range in different plants, or from one time to another in the same plant, depending on the needs of the particular production. The constrictive effect of the channel walls, however, exerts its influence principally on filaments lying close to the edge (say within ¼ inch from the edge), there being no transmission of force from the edge filaments inwards until the edge filaments have become excessively crowded. It is possible, however, to define the requisite length of the channel in terms of its time of contact with the moving ribbon. We have found that satisfactory results are obtained, if the length of the restricting channel is such that it is in contact with the moving ribbon for at least 0.002 second. For instance, if the ribbon moves at the rate of 7 yards (6.4 meters) per second, satisfactory results are obtainable with channels which will provide from 0.5 to 10.0 inches (1.27 to 25.4 cm.) of contacting length with the ribbon.

For a clearer understanding of this invention, reference is now made to the accompanying drawings, in which:

FIG. 1 is a diagram in two parts, *a* and *b*, to illustrate the fundamental observations on which this invention is based.

FIG. 2 is a perspective view of one form of this invention, situated in a position for passing therethrough a vertically moving ribbon.

FIG. 3 is a perspective view of an assembly of the channels of this type on the inside wall of the last tank of a wash-draw machine, whereby a plurality of the washed ribbons are withdrawn from the tank, side-by-side, in a vertical direction.

FIGS. 4 and 5 are, respectively, a top view and an end view of another form of this invention.

FIG. 6 is a side view of a bank of guides of this modified type arranged in a vertical frame for transmitting a plurality of essentially horizontal ribbons and simultaneously changing the course of each individually so as to direct the assembly toward a single stacking (i.e. tow forming) device.

FIG. 7 is a side view of still another modification of this invention, showing a bank of guides in which each member is essentially a full-circle spool and the entire bank is mounted on an axle for free rotation in suitable bearings.

FIG. 8 is a vertical section along line **8—8** of FIG. 7.

Taking up now the drawings in detail, part *a* of FIG. 1 shows the behavior of a ribbon like mass **1** of essentially aligned, discrete and continuous textile filaments as it passes through two restricting pins **2**, **2**, in the direction of the arrow. Immediately after passing, the ribbon spreads out to essentially its initial width, as indicated at **1***a*.

In part *b*, the same type of a ribbon **1** is passed in the direction of the arrow through two restricting walls **3**, **3** of substantial extent in the direction of the ribbon movement. The emerging ribbon then retains its restricted width for a considerable distance as indicated at **1***b*.

The remaining figures deal with several mechanisms according to this invention for putting the above observations to practical use.

The embodiment shown in FIG. 2 has a solid or hollow base portion **10**, drilled at **11** for mounting on a horizontal shaft **12** and provided with a set screw **13** for fastening the base to said shaft. Extending forward from the base are sidewall portions **14** which together with face **15** form a channel for shaping a filamentary ribbon as the latter is passed through the channel.

Because of its simplicity of structure, this modification is best suited for use on the inside of the wash-draw tank, and may for this purpose be mounted, through shaft **12** and brackets **16** on the inside of wall **17** of the last tank in a wash-draw system, as shown in FIG. 3.

In this modification of FIG. 2, the floor portion of the channel is constituted by the flat, vertical face **15** of base **10**, and the ribbon moves through the channel in a straight line.

In the modification shown in FIGS. 4 and 5, the ribbon moves around the circular shank **21** of a spool like member **20**, whose flanges **22** may or may not run completely around the shank, but should extend at least over an arc of sufficient magnitude to provide lateral support for the moving filamentary ribbon for an interval of time not less than the minimum above indicated. As a thumb rule generalization, it is recommended that the flanges extend for somewhere between 20 and 180° of arc.

Each spool **20** may be adjustably fastened over a horizontal shaft **23** which projects from a vertical back-plate **26**, in turn fitted to slide over a vertical post **27** (FIG. 6). The flanges **22** are made slideable over shank **21**; screws **24** and longitudinal slots in the broadened tops of said flanges serve simultaneously for fastening the flanges at an optional distance from each other and for fastening the entire spool at an optional distance from back-plate **26**. Or, if desired, positioning with respect to the back-plate may be achieved by means of a slideable, arcuate supporting plate, as shown in FIG. 2 of J. C. Resor's U.S. Patent Number 3,145,429. A plurality of spools **20** may in this fashion be spaced off both along a vertical plane and in a horizontal dimension at right angles to the vertical plane (FIG. 6) so as to cause a plurality of filament ribbons **1** to come together over a system of stacking rolls **40**, **41** and **42** in the precise formation required to form a single tow **9** of essentially uniform thickness throughout its width.

It is clear from the last remark that this modification of ribbon channel is best adapted for use in the last stages of the ribbon movement just prior to stacking a plurality of them into a single tow.

In FIGS. 7 and 8, the entire plurality of guide channels is mounted on a single horizontal shaft **30** which is mounted for rotation in suitable bearings. Each spool **31** possesses a shank portion **33** which can slide for the purpose of proper positioning over a horizontal barrel **32** and is then fastened to said barrel. The latter is fastened to axle **30** and rotates therewith. The flanges of each spool run in a complete circle around shank **33**,

one of them (for instance flange **34**) being made integral with the shank if desired, while the other one (**35**) is made slideable over shank **33** and is provided with a set screw **36** for fastening it in a selected position on shank **33**.

This modification may be used either inside the last tank of the wash-draw system or at any subsequent stage in moving the ribbons toward the stacking rolls for making tow, and has the advantage over the other modifications that, because of the rotatability of the spools, wear upon them is at a minimum and they stay accurate for a long time.

It will be understood that the drawings above discussed are merely illustrative and are not entended to limit the invention. For instance, while the walls **14** of the U-channel in FIG. 2 have been shown as rising perpendicularly from the bottom **15**, they may deviate slightly from the perpendicular, say an angles up to 15° outwards, so that the two walls may diverge with respect to each other at a total angle of up to 30°. The same is true of the flanges shown in the spool-like modifications of FIGS. 4 and 7. Other variations and modification of this invention will be readily apparent to those skilled in the art.

We claim as our invention:

Apparatus for shaping the cross section of a moving ribbon-like mass of essentially aligned, loose, continuous textile filaments of an initial cross section which is thinner at the edges than in the middle, whereby to produce a ribbon of substantially uniform thickness throughout its width, which comprises a rigid body having an essentially U-shaped channel portion therein, said channel portion having a floor portion and sidewall portions and being positioned in the path of the ribbon whereby to intercept and confine said ribbon for a stretch along its path, the sidewalls of said channel portion being spaced apart at a distance equal to that estimated for the width of the desired, uniformly thick ribbon and having a sufficient extent in the direction of the motion of the ribbon to contact the edge portions of said ribbon for a period of time not less than 0.002 second, said channel being formed by a segment of an essentially spool-like body having adjustable circumferential flanges, said flanges each having a slot therein, and screws operably associated with said slots to allow individual adjustment of said flanges in the axial direction of said spool.

References Cited by the Examiner

UNITED STATES PATENTS

2,208,174	7/1940	Weinberger.	
2,345,544	3/1944	Worthington.	
2,377,173	5/1945	Nelson	242—157
2,621,376	12/1952	Cottom et al.	19—157
3,130,453	4/1964	Haigler	19—65
3,131,843	5/1964	Bentley	226—196 X
3,145,429	8/1964	Resor	19—157
3,231,958	2/1966	Chadwick	19—150 X

ROBERT R. MACKEY, *Primary Examiner.*