United States Patent

Bense

[15] **3,672,588**

[45] **June 27, 1972**

[54] STRAND CONTROL APPARATUS

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[22] Filed: **Sept. 8, 1970**

[21] Appl. No.: **70,004**

[52] **U.S. Cl.**.....**242/45,** 242/147 A, 242/157 R

[51] **Int. Cl.**.....**B65h 57/00**

[58] **Field of Search**.....242/45, 147 A, 147 R, 147 M, 242/157 R, 149, 75.3, 75.53; 226/95, 97, 198

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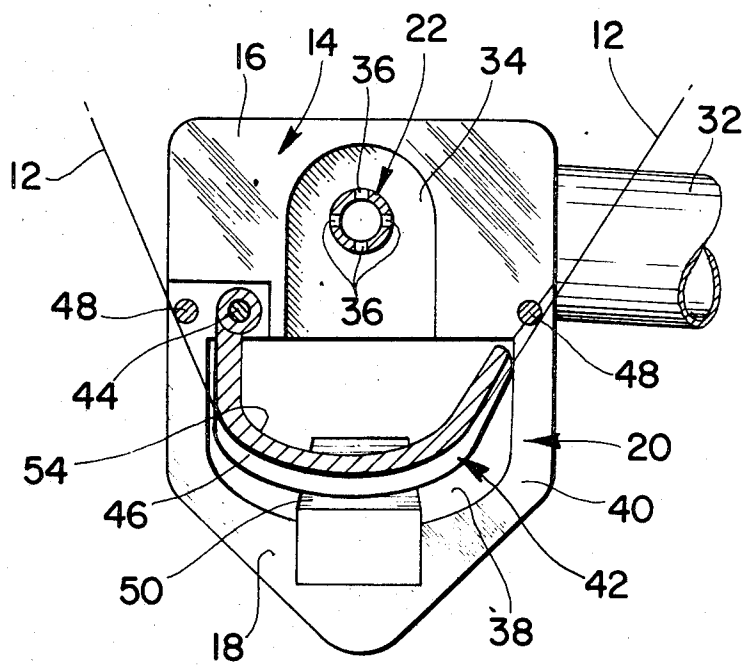
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[57] **ABSTRACT**

An apparatus and a method embodied in a guide for an advancing strand of yarn. The guide retains the strand on a receiver which is supported on a cushion of air. The receiver is pivotally retained between opposed members extending from a base of the guide. The strand urges the receiver toward the base and the cushion of air, which is introduced between the members proximate the base, urges the receiver away from the base. As the air is vented about the receiver the advancing strand is substantially out of contact with the air to prevent removal of coatings from the strand or entanglement of filaments of the strand. Response of the receiver to variations in the force exerted thereon by the strand may be programmed by regulating venting of the air about the receiver.

18 Claims, 7 Drawing Figures



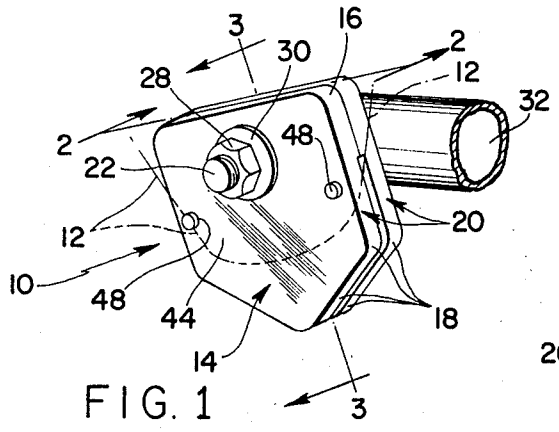


FIG. 1

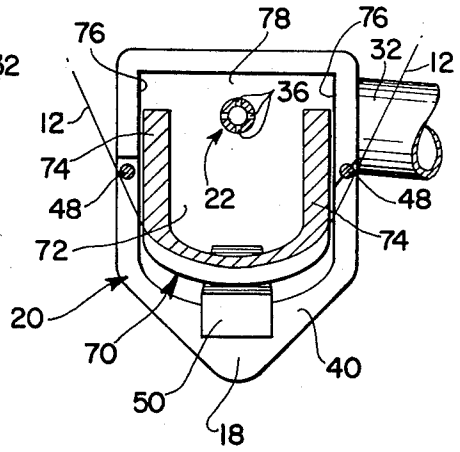


FIG. 7

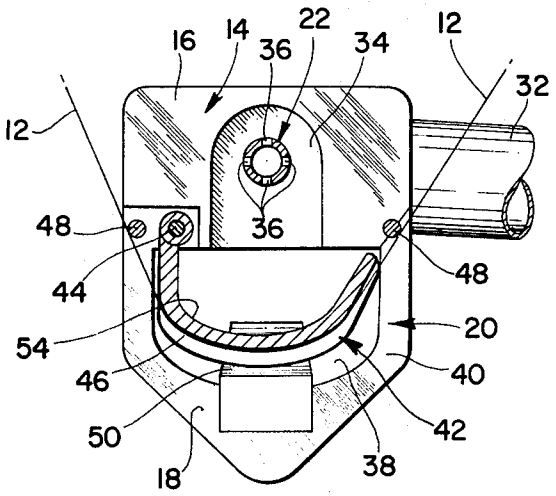


FIG. 2

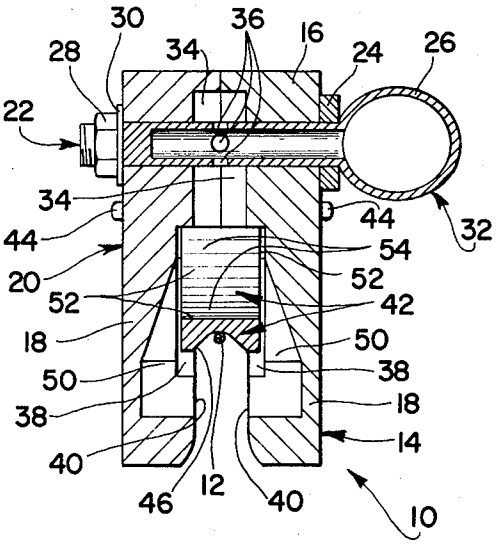


FIG. 3

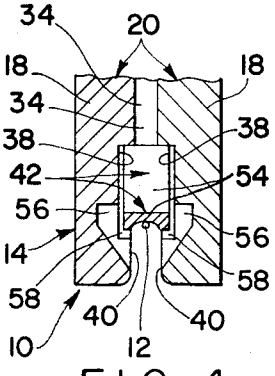


FIG. 4

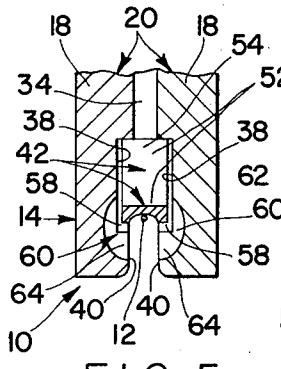


FIG. 5

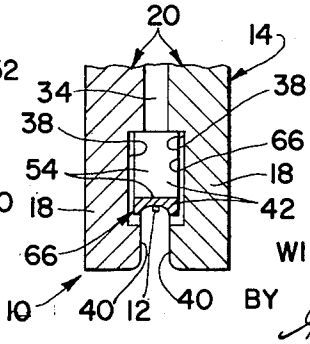


FIG. 6

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STRAND CONTROL APPARATUS

This invention relates generally to strand handling apparatus and, more particularly, to apparatus and a method for guiding a strand.

As used herein the term "yarn" means any type of strandular material, whether textile or otherwise.

The invention is related to a "Strand Control Apparatus" disclosed in a Leesona Corporation U.S. Pat. No. 3,393,880, granted July 23, 1968; and to co-pending Lessona Corporation U.S. Pat. applications, Ser. No. 712,142, filed Mar. 11, 1968, now U.S. Pat. No. 3,534,922, Ser. No. 3,580, filed Jan. 8, 1970, and Ser. No. 37,442, filed May 15, 1970 and this patent and these applications are incorporated by reference.

The above indicated patent and applications are directed to a yarn guide which supports an advancing strand of yarn on a cushion of air. As the strand passes through the guide, the cushion of air causes the strand to arch so that variations in the tension of the strand result in variations in the shape of the arch, increasing tension tending to flatten the arch and reduced tension resulting in a deeper arch. Such guides are particularly useful on compensator arms of high speed take-up machines for counteracting fluctuations in yarn tension resulting from traversing of the yarn as it is wound onto a take-up package. Otherwise, such fluctuations might be reflected in erratic and unwanted movement of the compensator arm. Additionally, guiding or supporting the advancing strand on a cushion of air is particularly advantageous in false twist heaters since such guides permit the yarn to be directed in a circuitous path through the heater and the twist to pass about the guides, thus substantially shortening the overall heater length which would be required to obtain the same length of yarn heating path in a straight through heater. These and other advantages are more fully discussed in the previously noted patent. It is desirable to conserve compressed air, or other fluid which provides the cushion, and to prevent unwanted release of the strand of yarn from the guide, and these matters are discussed at greater length in the co-pending application Ser. No. 712,142.

The invention is, in brief, directed to apparatus for handling an advancing strand supported on a fluid cushion and maintained substantially out of direct contact with the fluid cushion. More particularly, the strand is supported on a receiver which is supported on the cushion. Response of the receiver to the force exerted thereon by the strand may be programmed.

It is a primary object of this invention to provide a new and improved apparatus and method for handling a strand.

Another object is to provide a new and improved apparatus and method for handling a strand, the strand being supported by a cushion of fluid and maintained substantially out of contact with the fluid.

Still another object is provision of new and improved strand handling apparatus and method in which a receiver for a strand is retained for movement in opposite directions and, responsive to a strand being operatively urged against the receiver, for movement in a first of the directions, with provision for urging the receiver in the other of the directions, and provision for programming the response of the receiver to the strand. Related objects include: provision for programming the response of the receiver by controlling the rate at which the receiver responds to variations in the force with which the strand is urged against the receiver; provision for supporting the receiver on a fluid bed and programming the receiver by venting the fluid about the receiver and substantially out of contact with the strand.

A further object is provision of new and improved strand handling apparatus including a base with opposed spaced apart members extending in the same general direction from the base, and a receiver for the strand mounted between the members for movement toward and away from the base and, responsive to the strand being urged against the receiver, for movement toward the base, and further including provision for urging the receiver away from the base. Related objects include: provision of an outlet proximate the base for the passage of fluid against the receiver to urge the receiver away from the base; provision for relief of the fluid about the receiver and substantially out of contact with the strand; provision for low frictional drag between the receiver and the strand as the strand is advanced across the receiver; and provision for programming the response of the receiver to variations in the force which the strand exerts against the receiver.

These and other objects and advantages of the invention will be apparent from the following description and the accompanying drawing, in which:

FIG. 1 is a fragmentary perspective view of a preferred embodiment of the invention;

FIGS. 2 and 3 are enlarged sectional views taken generally along the lines 2—2 and 3—3, respectively, in FIG. 1;

FIGS. 4, 5 and 6 are fragmentary sectional views, similar to FIG. 3 but to a reduced scale, each illustrating other embodiments of the invention; and

FIG. 7 is a sectional view, similar to FIG. 2 but to a reduced scale of another embodiment of the invention.

As shown in the embodiment of FIGS. 1–3 of the drawing, a guide **10** for a strand **12** of yarn has a body **14** with a base **16** and extending therefrom a pair of opposed members **18** between which the strand **12** is axially advanced. The body **14** may be formed as a two-part unit, each part **20** including half of the base **16** and one of the members **18**. The parts **20** are clamped together as by a hollow threaded stud **22** extending through the base **16** and carrying a washer **24** (FIG. 3) between a head **26** (FIG. 3) and an outer face of one of the parts **20**, with a nut **28** on the threaded and closed end of the stud **22** tightly clamped against a washer **30** and an outer face of the other part **20**. As illustrated in the drawing, the stud head **26** is in the form of a closed end of a hollow compensator arm **32** having an opposite end secured to a journalled shaft (not shown) of a speed control mechanism (not shown) and having a connector (not shown) at the shaft end for the flow of a suitable compress fluid, such as air, through the arm **32** and into the hollow stud **22**.

The inner portions of the parts **20** are formed to provide a chamber **34** (FIGS. 2 and 3) in the base **16**. Radial passages **36** (FIGS. 2 and 3) through the stud **22** provide an outlet for the air into the chamber **34**. From the chamber **34** the air passes into an enlarged recess **38** formed in the parts **20** and opening through opposed inner faces **40** of the two members **18**. The air engages a strand receiver **42** (FIGS. 2 and 3) which is movably retained (such as pivotally or freely slidably retained) between the members **18** for movement toward and away from the base **16**. In the illustrated embodiment the receiver **42** is pivotally retained and to this end, one end of the receiver **42** has an eye receiving a pivot pin **44** retained in apertures in the parts **20**. Thus, the receiver **42** may move in opposite directions toward and away from the base **16**.

The advancing strand of yarn **12** is positioned between the opposed members **18** and is seated in a groove **46** in the receiver **42**. The strand **12** preferably passes about guide and sealing pins **48** (FIGS. 1 and 2) seated in the parts **20** outwardly of opposite ends of the receiver **42**. The surface of the groove **46** preferably has a low co-efficient of running friction relative to the advancing strand **12**. For example if the strand is glass fiber the groove surface may be carbon, and if the advancing strand is undrawn dacron, nylon, or acetate, the groove surface may be aluminum oxide or titanium dioxide.

As the tension of the strand **12** increases, the force of the strand against the receiver pivots the receiver **42** toward the base **16**. As the tension of the strand decreases, the receiver is pivoted outwardly away from the base and toward the free ends of the opposed members **18** by the air within the recess **38**. In order to substantially prevent the air from removing emulsion or other coating from the strand of yarn, or from entangling filaments of a multifilament strand, the receiver **42** extends substantially across the entire fluid passage between the pins **48** and the air is vented from the recess **38** and flows generally between the receiver **42** and the members **18** and substantially out of contact with the strand of yarn which is

protected within a groove which face away from the base 16 and downstream of the venting fluid.

In order to provide various desired responses of the receiver 42 to variations in tension of the strand 12, which results in a force urging the strand against the receiver, a relief passage may be provided in one of the parts 20, or relief passages 50 (FIGS. 2 and 3) may be provided in both of the parts 20, as illustrated. The passages open into the associated recesses 38, and below the recesses 38 they open through the inner faces 40 of the members. For example, as shown in FIGS. 2 and 3 the passages 50 diverge in a direction from the base 16 toward the receiver 42 and the free ends of the members 18, and the opening between the inner edges 52 (FIG. 3) of the receiver 42 and the walls of passages 50 increases as the receiver 42 moves downwardly so that the rate of venting of the air pressure acting on the inner face 54 (FIGS. 2 and 3) of the receiver increases as the yarn tension decreases and the receiver moves outwardly toward the free ends of the members 18.

In the embodiments of FIGS. 4–7, the same reference numerals as in the embodiment of FIGS. 1–3 are used to indicate features which are substantially the same as in FIGS. 1–3. In FIG. 4 passages 56, in lieu of passages 50 in FIGS. 1–3, converge in a direction from the base 16 toward the receiver 42 and the free ends of the members 18 and the rate of venting of the air decreases between the walls of the passages 50 and outer edges 58 of the receiver 42 as the receiver moves away from the base 16, so that the air pressure urging the receiver outwardly increases as the tension of the strand of yarn 12 decrease. In FIG. 5 arcuate concave passages 60, in lieu of the previously noted passages 50 or 56, provide both diverging and converging portions in a direction from the base 16 toward the receiver 42 and the free ends of the members 18. The (upper diverging portions 62 coact with the upper edges 52 of the receiver 42 and the (lower) converging portions 64 coact with the outer edges 58 of the receiver 42 so a fluctuating rate of venting of the air pressure first increases and then decreases as the receiver 42 moves toward the free ends of the members 18. Thus, the air pressure against the inner face 54 of the receiver first decreases and then increases as the tension of the strand decreases. In FIG. 6 a uniform rate of venting of the air pressure acting on the inner face 54 of the receiver 42 is provided by flat, parallel opposed faces 66 of the recesses 38 and the opposed parallel sides of the receiver 42 or, alternately, uniform cross-sectional passages (not shown) may be provided in lieu of the previously noted passages.

The receiver 42 is preferably as light as possible to hold its momentum as low as possible as it moves toward and away from the base 16 of the guide 10, so that it is as sensitive as possible to variations in yarn tension. It should also be noted that by provision of the above described receiver 42, the guide body 14 need not be adjustable to vary the spacing between the opposed members 18 for most changes in yarn denier or diameter.

With reference to the embodiment shown in FIG. 7, a receiver 70, in lieu of the receiver 42, is slidably retained in a large recess 72 (which includes the previously described chamber 34 and recess 38) in the base parts 20. The receiver 70 is generally U-shaped with parallel legs 74 closely slidably retained between pairs of opposed surfaces 76 and 78 (only one visible). A relief passage or passages may be provided, in any suitable form as previously described. As illustrated in FIG. 7, relief passages 50 (only one visible) are provided.

While this invention has been described with reference to particular embodiments in a particular environment, various changes may be apparent to one skilled in the art and the invention is therefore not to be limited to such embodiments or environment, except as set forth in the appended claims.

What is claimed is:

1. Strand control mechanism for guiding an advancing strand comprising, a member having a confined area defining a strand passageway therein, said passageway opening outwardly from said member to provide a free end of said passageway, said passageway being wider than said strand to permit free advance of the strand therethrough, inlet means opening into said passageway at a location spaced from said free end and operable to emit pressurized fluid toward said free end, strand engaging means positioned in said passageway intermediate said inlet means and said free end, said strand engaging means having a first surface toward said inlet means against which the pressurized fluid is directed and a second surface on the opposite side of the strand engaging means over which said strand moves during its advance through said passageway, means mounting said strand engaging means for movement in a zone intermediate said inlet means and said free end, said strand engaging means being biased toward said inlet means in response to tension in the advancing strand and said strand engaging means being biased toward said free end in response to said pressurized fluid, and means cooperable with said strand engaging means for defining a venting passage for controlled release of said pressurized fluid from said zone to thereby control the biasing force of said pressurized fluid on said strand engaging means.

2. Apparatus as set forth in claim 1 wherein said means cooperable with said strand engaging means for defining said venting passage includes at least one wall area in said passageway spaced a predetermined distance from said strand engaging means.

3. Apparatus as set forth in claim 2 wherein said wall area is elongated and is of varying depths in a direction from said inlet means to said free end to thereby provide a venting passage of varying size as said strand engaging means moves progressively toward said free end.

4. Apparatus as set forth in claim 2 wherein said wall area is elongated and increases in depth in a direction from said inlet means to said free end to thereby provide a venting passage of increasing size as said strand engaging means moves progressively toward said free end.

5. Apparatus as set forth in claim 2 wherein said wall area is elongated and decreases in depth in a direction from said inlet means to said free end to thereby provide a venting passage of decreasing size as said strand engaging means moves progressively toward said free end.

6. Apparatus as set forth in claim 2 wherein said strand engaging means is an elongated element, and said mounting means includes pivot means engageable with one end of the element to permit said element to rock about said pivot means in said zone.

7. Apparatus as set forth in claim 2 wherein said strand engaging means is an elongated element and said zone includes a recess in which said element is freely slidable.

8. Apparatus as set forth in claim 1 wherein said member is mounted on an arm, said arm including a conduit for delivering the pressurized fluid to said fluid emitting means.

9. Apparatus as set forth in claim 1 wherein said member includes a pair of guides fixed in juxtaposed relationship, said passageway being between said guides, said guides being joined together at respective first ends to define a base of the member, said inlet means being located in said base.

10. Strand control mechanism for guiding an advancing strand comprising, a pair of guides fixed together at first ends thereof to define a base of the mechanism and having a confined strand passageway between said guides through which said strand is advanced, said guides being unconnected at respective second ends thereof to provide a free end of the passageway, inlet means opening into said passageway from a position proximate said base and operating to direct a fluid stream toward said free end, strand engaging means positioned in said passageway intermediate said base and said free end, said strand engaging means having a first surface toward said inlet means against which the fluid stream is directed and a second surface on the opposite side from said first surface over which the strand moves during its advance through said passageway, means mounting the strand engaging means for movement in a restricted zone in said passageway, and side walls in said zone spaced from and confronting opposite sides

of said strand engaging means to provide a clearance space between said sidewalls and said opposite sides for the passage of fluid from said inlet means during advance of the strand over said strand engaging means.

11. Apparatus as set forth in claim **10** including means for preventing movement of said strand engaging means out of said free end.

12. Apparatus as set forth in claim **10** wherein said fluid stream is pressurized air.

13. Apparatus as set forth in claim **10** wherein said side walls are elongated and are of varying depths in a direction from said inlet means to said free end.

14. Apparatus as set forth in claim **10** wherein said side walls are elongated and increase in depth in a direction from said inlet means to said free end.

15. Apparatus as set forth in claim **10** wherein said side walls are elongated and decrease in depth in a direction from said inlet means to said free end.

16. Apparatus as set forth in claim **10** wherein said strand engaging means is an elongated element, and said mounting means includes pivot means engageable with one end of the element to permit said element to rock about said pivot means in said zone.

17. Apparatus as set forth in claim **10** wherein said strand engaging means is an elongated element, and said zone defines a recess in which said element is freely slidable.

18. Apparatus as set forth in claim **10** wherein said guides are mounted on an elongated arm, said arm including a conduit for delivering the pressurized fluid to the fluid emitting means.

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