Nov. 15, 1966 N. J. HAIGHT 3,284,995

SELF-SIZING TORSION BAR ORIFICE ASSEMBLY

Filed June 9, 1964

2 Sheets-Sheet 1

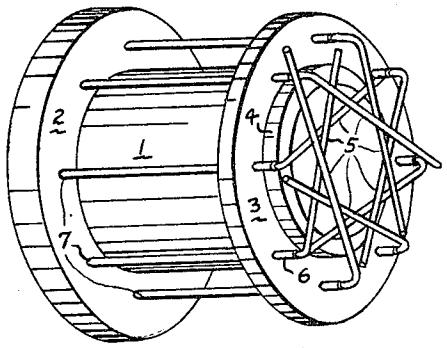


Fig-1

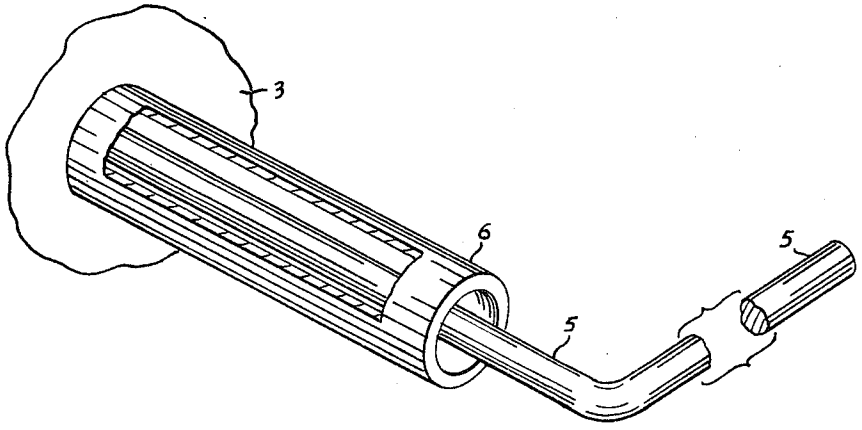


Fig-2

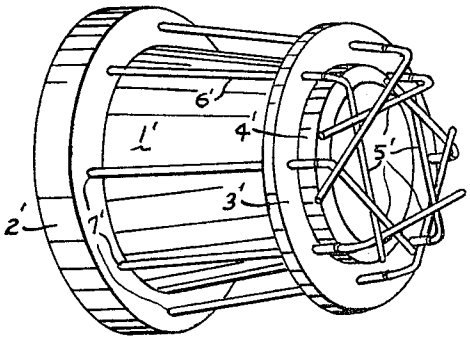


Fig-3

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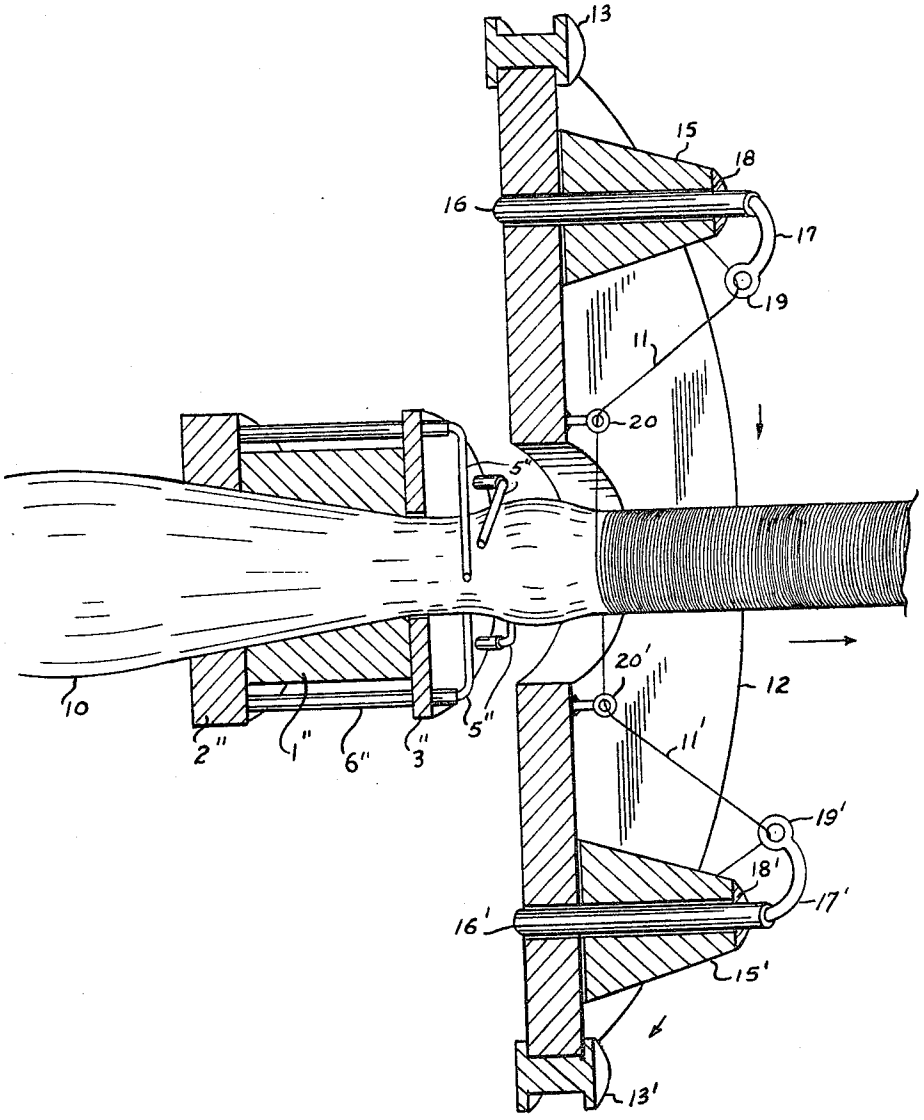


Fig-4

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SELF-SIZING TORSION BAR ORIFICE ASSEMBLY

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This invention concerns a mechanical orifice device that adjusts automatically to minor variations from a predetermined orifice size of the yielding resilience of a desired plurality of cantilever mounted torsion bars, and automatic spiral winding apparatus associated therewith.

Such a device is particularly useful in an arrangement for providing a continuously moving compact group of strands while restraining means such as a tape, thread, or strand of wire or roving or the like is wrapped around the group to maintain the compact relationship. More specifically, the device may be utilized; for example, in forming an article of synthetic resinous polymer reinforced with the strands, but this article is not part of the present invention.

The device has been utilized to provide a compact group of strands, some of which have been coated with metal. The strands are formed into a compact substantially cylindrical group as they pass through the device of the invention, and are spirally wrapped with one or more threads formed of glass filaments while the group is in compact form. The compact group thus formed is utilized in subsequent processes which form no part of the invention.

One example of a prior art device for providing a compact group of strands is an elastomeric washer, through the center aperture of which a plurality of strands are passed. Such a device is objectionable in that it provides considerable friction on the strands which are at the surface of the group. Due to the friction forces arising from such frictional engagement, the resistance to passage through the device is high, and abrasion of the strands in contact with the device is considerable. In the device of the invention, frictional forces and therefore abrasion of surface fibers in the group and the back tension introduced into the group as a whole are low.

It is, therefore, an object of the present invention to provide a device which maintains a group of moving strands in compact form.

Another object is to provide such a device which maintains a group of strands in compact adjacent form so that restraining means may be wrapped spirally around the group as it travels out of the device.

Another object is to provide such a device which automatically adjusts itself to variance in size of the compacted group as my result from variances in the dimensions of the individual strands comprising the group, or from variation in the number of strands in the group.

Another object is to provide such a device which has a low friction with the group and therefore abrades the surface fibers of the group very little and introduces very little back tension into the group.

In the accompanying drawings, where unprimed, primed and double primed numerals that are alike designate similar parts:

FIG. 1 is a perspective view of a cylindrical orifice device that embodies part of the present invention;

FIG. 2 is an enlarged, fragmentary view, partly cut away and in section, of a torsion bar in its sleeve part of the device in FIG. 1;

FIG. 3 is a perspective view of a different embodiment of the invention employing a frusto-conical orifice device; and

FIG. 4 is a perspective view of a further modified orifice device in combination with an assembly applying a spiral winding of discrete fibers on the outside of the cable drawn through the orifice.

In the accompanying drawings, the orifice device in FIG. 1 is of a spool-like shape and comprises a tubular member having a cylindrical portion **1** with a heavy securing flange **2** at an entrance end of the tubular member and with a lighter flange **3** set back axially to provide the rim **4** at an exit end of the tubular member remote from its securing flange **2**. The tubular member is apertured axially for the passage therethrough of a cable of fibers from the entrance end to the exit end of the tubular member as shown in FIG. 4.

A desired plurality of cantilever mounted resilient torsion bars **5** are separately mounted in protective sleeves **6** outwardly from the cylinder **1** as shown. Each torsion bar **5** has its attached or proximal end **7** secured firmly by anchoring means such as welding or the like, along with its sleeve **6** to the securing flange **2** to serve as an anchor plate for the torsion bar. Each torsion bar sleeve **6** is also welded to both the securing flange **2** and to the lighter flange **3**, through which the bar and its sleeve preferably pass, as shown. Each torsion bar is bent at right angles just beyond its emergence from its sleeve to form first and second sections. The first sections provide laterally extending friction portions extending across the exit end of said tubular member to define an orifice next to the exit end of the tubular member. The torsion bar distal end friction portion may be straight or curved to follow a desired contour, within the concept of the present invention. Rotations of the first sections or distal end friction portions of said bars in directions that enlarge the orifice formed thereby produce torques in the anchored second sections of said bars which oppose said rotations.

The torsion bars **5** are mounted to assume torsion forces from their secured ends **7** to the points of application of the forces and to be kept free for that service by sleeves **6**.

The group of torsion bars in FIGS. 1, 3 and 4 are arranged such that their friction ends extend tangentially to the fiber bundle and provide an opening centrally in the orifice device, through which a bundle **10** of fibers are drawn. The tension force applied to the fiber bundle **10** is adequate to overcome friction between the fibers in the bundle **10** and the frusto-conical inside surface of the orifice device, as well as the friction portion of the torsion bar.

On emerging from the orifice device in FIG. 4, the fiber bundle **10** dilates slightly and then preferably is confined to a uniform diameter by suitable means, such as by a desired plurality of restraining cords **11**, **11'** etc. that are wound spirally around the fiber bundle **10** with the rotation of the winding wheel **12**. The winding wheel **12** is commonly provided with gear teeth (not shown) along its periphery and rotates through supported guides **13**, **13'** that control its path as a driven wheel.

The rotation of the winding wheel **12** combined with the travel of the wound cable away from the orifice device, indicated by arrows in FIG. 4 of the drawings, are adjusted to position of the restraining cords **11**, **11'** uniformly along the wound cable in spiral configuration.

The winding wheel **12** carries a desired plurality of cord supplying spools **15**, **15'** that are rotatably mounted on pins **16**, **16'**. Each pin **16**, **16'** has a mounting end that removably seats in an aperture in the winding wheel **12**, an axially apertured end to removably receive a swivel cord guide **17** remote from the wheel **12**, and friction collars **18**, **18'** that engage and end of the spools **15**, **15'**. The cords **11**, **11'**, respectively, feed from the spools **15**, **15'**, pass through the eyes **19**, **19'** of the swivel cord guides **17**, **17'** and through the eyes of fixed cord guides **20**, **20'** that are welded to the winding wheel **12**,

and then are both wound spirally on the cylindrical bundle of fibers **10**.

The tension of the cord **11, 11'** passing steadily through the eyes **19, 19'** of the swivel cord guides **17, 17'** with the rotation of the driven winding wheel **12**, appears to produce a resultant force toward the wheel **12** and to maintain the parts assembled. A spool replacement is accomplished easily by the removal of the pins **16, 16'** replacing the exhausted spools with full spools, and continuing the operation. The operation is otherwise continuous.

It is to be understood that the apparatus and the process that are described herein are submitted as a successfully operative embodiment of the present invention and that modifications may be made in the apparatus and in the described procedure without departing from the spirit and the scope of the present invention.

I claim:

1. A self-sizing torsion bar orifice device comprising a tubular member having at least one flange at one end thereof with an orifice extending axially therethrough, one end of said tubular member having a rim portion extending axially beyond said one flange a plurality of torsion bars passing through said one flange, said bars having free ends remote from the tubular member and extending substantially tangential to the orifice in said one flange and axially spaced beyond the rim portion, and means for anchoring the other ends of said torsion bars to said tubular member at points remote from said one flange.

2. The self-sizing torsion bar orifice assembly for use in forming and spirally wrapping a continuously drawn bundle of fibers, comprising an axially apertured cylinder with a flange on each opposite end of the cylinder, a plurality of torsion bars having unsupported free friction ends spaced axially from a discharge end of the cylinder and extending in substantially tangential directions to a projection of the cylinder aperture for frictionally engaging bundled fibers passed through the cylinders orifice and the torsion bars cantilever supported by the cylinder flanges, and means continuously spirally wrapping the bundled fibers drawn through the aperture in the cylinders as frictionally and tangentially curbed by the plurality of torsion bars.

3. The assembly defined by the claim **2** comprising a centrally apertured mechanically driven winding wheel through which central aperture the bundle of fibers is drawn, a plurality of cord bearing spool pins each having a mounting end removably inserted in an aperture in the winding wheel spaced between the periphery of the wheel and the aperture centrally thereof and each pin providing a swivel cord guide socket at the pin end remote from the pin mounting end and a spool retaining collar adjacent to the socket end of the pin, a cord guide swivel having

a mounting end removably insertable in the socket in the end of the spool pin remote from the wheel and the cord guide swivel having a cord guiding eye in its end remote from its mounting end for guiding the cord withdrawn from the spool, and a fixed cord guide with a mounting end secured to the winding wheel adjacent the aperture centrally therein for guiding the cord just prior to feeding it on the surface of the bundled fibers being drawn through the aperture centrally of the driven wheel.

4. A device for maintaining a group of strands in compact relationship as they are moved through the device comprising a tubular member having an entrance end and an exit end through which said strands are passed, at least three torsion bars, each of said bars having first and second sections that form an angle with respect to each other, the first sections of said bars extending across the exit end of said tubular member to define an orifice through which said strands are passed upon leaving said tubular member, said first sections being adapted to lie in tangentially engaging relationship with said strands as the strands pass through said orifice, said second sections of said bars being resilient and extending generally longitudinally of said tubular member, and means for anchoring the second sections of said bars to said tubualr member at points remote form said first sections of said bars whereby rotations of said first sections in directions that enlarge said orifice produce torques in said second sections which oppose said rotations.

5. The device set forth in claim **4**, further including protective sleeves surrounding the second sections of said torsion bars, respectively, and means for anchoring one ends of said sleeves which are farthest from the first sections of said torsion bars to said tubular member.

6. The device set forth in claim **5**, wherein said means for anchoring said second sections of said bars and the one ends of said sleeves to said tubular member include a first flange secured to said tubular member at the entrance end thereof, and a second flange secured to said tubular member adjacent to the exit end thereof, said second flange providing a support for the other ends of said sleeves.

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