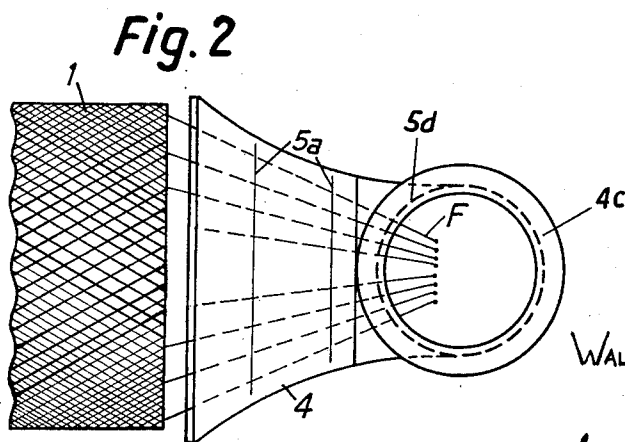
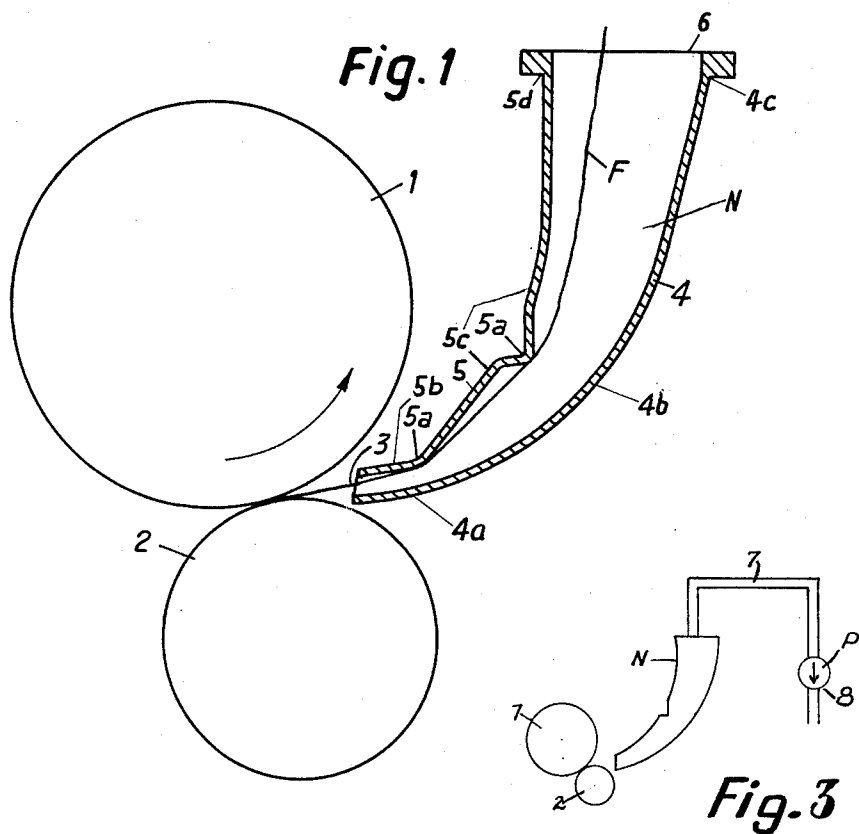


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METHOD AND APPARATUS FOR HANDLING THREAD IN
AN AUTOMATIC THREAD WINDING MACHINE
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METHOD AND APPARATUS FOR HANDLING THREAD IN AN AUTOMATIC THREAD WIND- ING MACHINE

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The present invention relates generally to the handling and subsequent treatment of fibrous material, and more particularly to an improved method of, and apparatus for, engaging and controlling the movement of thread ends for use in conjunction with an automatic thread winding machine.

Generally when thread breakage occurs during the operation of an automatic thread winding machine, it is necessary to engage the free end of the thread and bring it into controlled contact with a knotting device. Although methods of, and devices for, accomplishing this result are known in the prior art, their employment has marked disadvantages, one of which is considerable physical weakening and damage to the thread fibers in the area to be knotted. Normally the prior art devices constitute curved nozzles or suction funnels located adjacent the point of thread breakage. Thread drawn into the nozzle by the flow of air therethrough normally maintains contact with an inner surface thereof due to the relatively low velocity of air flowing adjacent such surface. As thread is drawn into the nozzle particularly from a cross-wound thread package, contact with this surface causes considerable surface friction and results in untwisting or weakening of the thread fibers. The present invention contemplates overcoming these disadvantages by providing an improved suction nozzle having means on an inner, curved surface thereof for diverting airflow away from the surface, thereby drawing thread away from contact therewith.

Accordingly, it is an important object of this invention to provide an improved method of handling fibrous material without causing undue physical damage thereto.

Another important object of this invention is to provide an improved method of handling thread ends which comprises controlling the flow of air through a suction nozzle to thereby control the position of the thread and prevent undue physical damage thereto.

Still another important object of this invention is the provision of a novel suction control nozzle having means for diverting the flow of air therethrough so as to orient thread ends along a streamline of air flow thus diverted.

Still another important object of this invention is the provision of a novel suction device for engaging and handling thread ends in a controlled manner so as to prevent adherence of the thread to an inner surface thereof.

Other important objects of this invention will be apparent to those skilled in the art from the detailed description hereinbelow. While the accompanying drawings illustrate a preferred embodiment of the invention, it is to be understood that the same is merely illustrative and that the invention is capable of modification and change, and comprehends other details or construction

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without departing from the spirit thereof or the scope of the appended claims.

In the accompanying drawings

FIG. 1 is a side elevation showing in detail the improved suction nozzle;

FIG. 2 is a top plan view of the device according to FIG. 1; and

FIGURE 3 schematically illustrates the improved nozzle arrangement employed in conjunction with a suction device, such as a pump or blower for example.

Referring now to the drawings, the apparatus comprises a winding bobbin 1 upon which is wound a thread package. The winding bobbin 1 is rotated by a slotted, self-winding driving head 2 of any desired construction. Located adjacent the winding bobbin 1 is a displaceable nozzle or tubular suction funnel N.

In a known manner, such as that disclosed in United States Patent 2,365,701 filed February 7, 1942, and assigned to the Universal Winding Company, thread is drawn from a suitable cop past a tension sensing device and into engagement with a driving head, whereupon it is guided onto a winding bobbin to form a thread package. In the event of thread breakage, the tension sensing device will be shifted from its sensing position into its actuating position where, by means of suitable linkage it disengages the driving head from the winding bobbin. Thereupon, the rotation of the winding bobbin is reversed from its normal winding direction into its unwinding direction, as indicated by the arrow in FIG. 1. Through suitable pivoting or reciprocating control linkage the suction nozzle N is moved into its thread engaging position adjacent the winding bobbin 1 as shown in FIG. 1. As suction is applied to the suction nozzle N, the free end of a thread F is drawn thereinto, after which the suction nozzle N is moved from its position adjacent the winding bobbin 1, thereby exposing a section of the free end of the thread F to a suitable automatic knotting device, not shown nor constituting a part of the present invention. Actuation of the knotting device causes recycling of the driving operation and return of the tension sensing device from its actuating position to its thread sensing position.

Referring now more particularly to the novel features constituting the present invention, it is to be seen that the nozzle or tubular suction nozzle N is curved as shown in FIGS. 1 and 2. At one end of the nozzle N there is provided an elongated mouth or inlet port 3 which is oriented in a first plane extending substantially laterally of the length of the winding bobbin 1, taken in a plane perpendicular to the plane of the paper in FIG. 2, when the nozzle N is in its thread engaging position. The elongated shape of the inlet port 3, which extends at least the length of the winding bobbin 1, eliminates the necessity of moving the nozzle N laterally of the winding bobbin 1 in order to accommodate the entrance of the thread F into the nozzle N as it is unwound from the thread package and drawn thereinto by means of suction.

At the other end of the nozzle N there is provided a circular mouth or outlet port 6 which is oriented in a second plane transverse to the plane of the elongated inlet port 3, taken in the plane of the paper in FIG. 2, and to which a conventional suction device is attached. Communicating the inlet port 3 with the outlet port 6 is a funnel shaped channel defined by a plurality of wall por-

tions, of which two are illustrated in section at 4 and 5 of FIG. 1. Adjacent the inlet port 3 the wall portions 4 and 5 define an elongated passage of substantially uniform cross-sectional area as shown at 4a, 5b. The wall portions 4 and 5 then diverge to define an intermediate passage 4b, 5c, the section 5c of wall portion 5 having the smallest radius of curvature, as clearly shown in FIG. 1. Adjacent the outlet port 6 the wall portions 4 and 5 taper to define a circular passage of substantially uniform cross-sectional area as shown at 4c, 5d.

The wall portion 5 is shaped so as to provide a plurality of spaced, inwardly projecting ribs 5a elongated in a direction substantially parallel to the plane of the inlet port 3 and thus transverse to the direction of the air stream flowing through the nozzle N. One rib 5a is disposed on wall portion 5 so as to protrude into or be in registry with the elongated passage 4a, 5b, while another rib 5a is similarly disposed on wall portion 5 so as to protrude into the elongated passage 4b, 5c. In FIGURE 3 there is schematically illustrated the nozzle N in operative arrangement with a suitable suction device, such as a blower or pump 8 via the conduit member 7. The suction device 8 provides an air flow through the nozzle N to draw the thread F into said nozzle.

Engagement of the free end of the thread F is accomplished as follows. Upon movement of nozzle N into its thread engaging position in a manner such as that disclosed in the aforementioned United States Patent 2,365,701, suction is first applied through the nozzle N in order to draw the thread F through the inlet port 3. The velocity of air flowing through the nozzle N will vary according to the general laws of fluid mechanics, reaching a maximum in a centrally oriented streamline and a minimum approaching theoretical zero in a stream line adjacent each wall portion. Due to the curvature of the nozzle N, the thread F will initially be carried along a streamline of minimum air velocity adjacent the wall portion 5 having the smallest radius of curvature, as shown in FIG. 1. Air flow is thereafter diverted away from the wall portion 5 by the ribs 5a, thus drawing the thread F into a streamline of greater air velocity remote from the wall portion 5, where it is held by the controlled flow of air. In this position, undesirable surface friction between the thread F and the wall portion 5 is eliminated, surface contact being maintained only at the thin edge surfaces of ribs 5a. As the thread F is unwound, particularly from a cross-wound thread package, and drawn into the nozzle N, the resultant reduced surface friction will prevent untwisting or weakening of the thread fibers.

The method of the present invention should thus be apparent. First the thread F is drawn into the nozzle N by application of a suction pressure. Thereafter the thread F is drawn away from contact with the inner surface of curved wall portion 5 of nozzle N by means of deflecting air from a region of relatively low air velocity into a region of relatively high air velocity.

While the description hereinabove relates primarily to the handling of thread, it is to be understood that the method disclosed and the apparatus for its performance may be used in conjunction with the handling of any fibrous material in a controlled manner.

What I claim as new and desire to be secured by United States Letters Patent is:

1. A method of engaging a thread that is broken as it is wound on a winding bobbin during the operation of an automatic thread winding machine which comprises: initially creating an air flow within a nozzle thereby drawing a thread thereinto in close proximity to one surface thereof, and thereafter deflecting at least a portion of the thread away from close proximity to said one surface.

2. A method of engaging a thread that is broken as it is wound on a winding bobbin during the operation of an automatic thread winding machine which comprises: creating a suction within a suction nozzle to draw a thread thereinto in an initial position of minimum air velocity, and thereafter deflecting at least a portion of the thread

from its initial position to a position of greater air velocity within said suction nozzle.

3. A method of engaging a thread that is broken as it is wound on a winding bobbin during the operation of an automatic thread winding machine which comprises: initially creating an air flow within a nozzle thereby drawing a thread thereinto in close proximity to one surface thereof, and thereafter deflecting the flow of air within the nozzle thereby drawing at least a portion of the thread away from close proximity to said one surface.

4. A method of engaging a thread that is broken as it is wound on a winding bobbin during the operation of an automatic thread winding machine which comprises: creating a suction within a suction nozzle to draw a thread thereinto in an initial position of minimum air velocity, and thereafter deflecting the flow of air within the suction nozzle thereby drawing at least a portion of the thread from its initial position to a position of greater air velocity within the suction nozzle.

5. In a device of the character described, a tubular suction nozzle provided with an elongated inlet port oriented in a first plane and a circular outlet port remote from said inlet port and oriented in a second plane, said tubular suction nozzle including a plurality of wall portions communicating said elongated inlet port with said circular outlet port; said wall portions defining an elongated passage of substantially uniform cross-sectional area adjacent said elongated inlet port, a circular passage of substantially uniform cross-sectional area adjacent said circular outlet port, and a curved, diverging passage intermediate said elongated passage and said circular passage; the radius of curvature of one of said wall portions being smaller than the radius of curvature of any other of said wall portions, said one wall portion having a plurality of spaced, inwardly projecting ribs elongated in a direction substantially parallel to said first plane, at least one of said ribs being in registry with said elongated passage and at least another of said ribs being disposed in said diverging passage, whereby a streamline of air flowing through said tubular suction nozzle is deflected away from said one wall portion by said ribs.

6. The combination comprising a bobbin, a thread wound on said bobbin, a suction nozzle provided with an elongated inlet port oriented in a first plane adjacent said bobbin and an outlet port remote from said inlet port and oriented in a second plane, said suction nozzle including a plurality of curved wall portions diverging from said elongated inlet port toward said outlet port, the radius of curvature of one of said wall portions being smaller than the radius of curvature of any other of said wall portions, said one wall portion having at least one elongated rib projecting inwardly therefrom and extending in a direction substantially parallel to said first plane, and suction means for providing an air flow through said suction nozzle to draw said thread into said suction nozzle along a streamline of air adjacent said one wall portion, whereby said streamline is deflected away from said one wall portion by said elongated rib resulting in deflection of said thread away from said one wall portion.

7. The combination according to claim 6, wherein said thread is cross-wound on said bobbin and said elongated inlet port is located laterally of said cross-winding, whereby said thread unwinds from said bobbin and oscillates laterally within said elongated inlet port as it is drawn into said suction nozzle, thereby minimizing contact between said thread and said suction nozzle in order to prevent untwisting or weakening of said thread.

8. A device of the character described, comprising a tubular suction nozzle provided with an inlet port and an outlet port, said tubular suction nozzle including a plurality of curved wall portions diverging from said inlet port toward said outlet port, the radius of curvature of one of said wall portions being smaller than the radius of curvature of any other of said wall portions, said one wall portion having at least one inwardly projecting rib adjacent

the innermost end of said inlet port, said inlet port being elongated and oriented in a predetermined plane with said inwardly projecting rib being elongated in a direction substantially parallel to said predetermined plane and transverse to the direction of the streamline of air flowing through said tubular suction nozzle, whereby a streamline of air flowing through said tubular suction nozzle adjacent said one wall portion is deflected away from said one wall portion by said rib.

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