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COATING DEVICE FOR STRANDS

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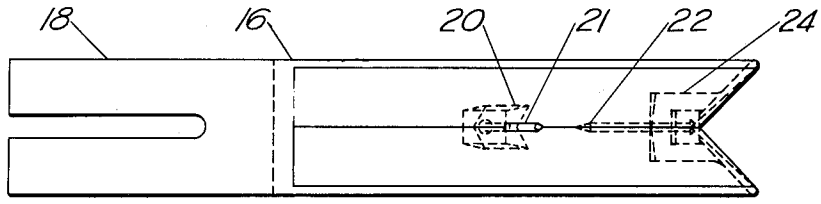


FIG. 3

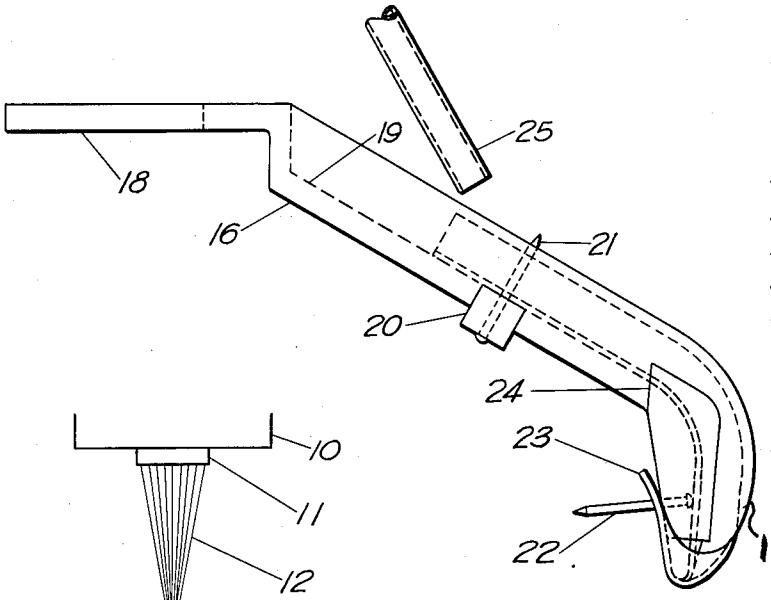


FIG. 2

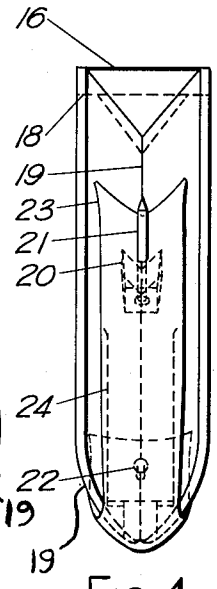


FIG. 4

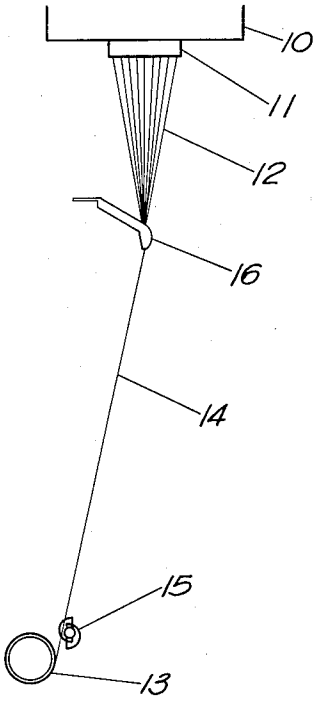


FIG. 1

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COATING DEVICE FOR STRANDS

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5 Claims. (Cl. 154—1.7)

This invention relates generally to the art of manufacturing slivers, strands and yarns of materials capable of being drawn into fine fibers when in viscous condition and refers more particularly to an improved device for applying a lubricant or coating the fibers after attenuation and before being collected as by being wound into a package.

One method which has been used in producing threads or strands consists of drawing a plurality of substantially continuous fibers from a molten body of the selected material and collecting the fibers in strand form by passing the same over a pad or guide. The pad is usually of soft cloth material such as a woven wool fabric and beside gathering the fibers in strand form, usually performs the additional function of applying a lubricant and/or binding substance to the individual fibers herein also termed a "size" or "sizing" in accordance with terminology of the textile art.

The application of a lubricant on the fibers is particularly important in cases where the fibers are formed of glass or similar material. The lubricant reduces the abrasive action of the material and prevents adjacent fibers from scratching each other. Binding material such as starch, resin and the like is often mixed with the lubricant to secure the fibers together in the strand.

The pad in being of soft wool-like material is absorbent and acts as a wick or reservoir to feed the lubricant and binder to the fibers. The size material thus fed may be readily supplied to the pad material from a simple tube arrangement connected with a larger central storage reservoir of sizing fluid for a number of pads. The fluid may be fed to each pad in a constant or intermittent flow whichever proves most convenient under the circumstances of equipment availability confronted. The pad material in either case is intended to be maintained in a moist condition, particularly at its point of contact with the fibers. The cloth material is usually held in place by a metal holder having a groove within which the material is fixed.

The efficiency of operation and associated economy of manufacture of textile strand products is particularly dependent upon the maintenance of continuity in operation with the least amount of down time during the unavoidable interruptions that do occur. The fibers are drawn over the cloth material at a very high rate of speed which results in considerable wear of the cloth by reason of the rubbing or frictional forces exerted by the fibers. Such wearing away of the cloth eventually results in a wearing through so that the fibers are either pinched within a narrow groove of the cloth or drawn over bare material of the holder, resulting in breakage of the fibers and a consequent shut-down period while the pad material is being replaced. Since, as mentioned, the speed of production is very high it is of utmost importance that this down time be minimized as much as possible.

Speeds of draw in the order of 10,000 feet per minute and to 15,000 feet per minute are not uncommon.

In view of these speeds, even periods of one second down time are costly.

In view of the foregoing it is an important object of the present invention to provide a pad holder for coating of fibers on which the life of the pad material is appreciably prolonged.

Another important object is to provide a pad holder in which worn pad material may be readily replaced in a minimum of time without need for more than a minimum of adjustment, permitting even unskilled personnel to make replacements efficiently.

A further object is to provide a pad holder in which the amount of size fluid as well as pad material required to effect efficient coating of fibers is considerably reduced to promote economies in the consumption of such materials.

In accordance with the present invention, a pad holder is provided which increases the life of the pad material, and consequently prolongs the periods between shut-down for pad replacements by mounting the pad material in an angular position such that the pad is maintained moist for application of lubricant to the filaments regardless of the peculiar characteristics of air turbulence which heretofore hindered high speed drawing operations. The holder, in addition is provided with the securing means for the pad material which greatly facilitates high speed replacement of the material without the need for extensive adjustments.

Still further, the amount of pad material required to effect efficient coating of the filaments is reduced considerably by the particular securing means utilized, thereby resulting in the furtherance of important and appreciable economies in plant installations where large numbers of strand-forming units are in operation.

The foregoing, as well as other objects, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawing, wherein:

Figure 1 is a diagrammatic elevational view of fiber-producing equipment embodying a pad holder constructed in accordance with this invention;

Figure 2 is a side elevational view of the improved pad holder forming the subject matter of this invention showing in dotted lines the groove within which the pad material is held and showing also the pin members by which such material is secured in the groove;

Figure 3 is a plan view of the pad-holder structure shown in Figure 2;

Figure 4 is a front view of the pad-holder structure shown in Figure 2.

The present invention may be advantageously used in the fabrication of slivers, strands or yarns from any one of a number of materials such as those in the group defined as thermoplastic which by way of example includes glass, cellulose acetate, artificial silk, nylon, and vinylidene chloride resin.

In the present instance, however, glass is selected for the purpose of illustration because the invention has proven especially advantageous in fiber production with this material. The abrasive characteristics of glass tends to effect the above-mentioned difficulties with pad materials installed in pad holders previously used.

Referring to the drawing in greater detail, Figure 1 shows the container **10** of conventional type in which molten glass is stored and which has a bushing or feeder **11** at its bottom through which the molten glass flows in the form of a multiplicity of fine continuous streams **12**. The streams are drawn or attenuated at a high rate of speed to form substantially endless relatively fine fibers by a winding drum or spool **13** rotated by any suitable driving mechanism not shown herein. The fibers are gathered into a strand **14** prior to winding on the

spool 13 and the latter is traversed by the strand 14 to form a package on the spool. The traversing mechanism may be any of a number of conventional devices, but herein is illustrated by an offset spiral-wire traverse 15.

The fibers are grouped into a strand by the pad 23 which is held in the pad holder 16. The pad holder is suitably supported between the feeder 11 and winding spool 13 in a position to contact the streams of glass issuing from the feeder after the streams have been attenuated and solidified to form fibers.

The pad holder 16 comprises essentially an elongated trough-like member having a tip end 19 angularly disposed with respect to the longitudinal body portion to promote contact of the filaments by the pad material held therein over a definite desired length of the path over which the filaments travel. A bifurcated mounting section 18 is provided at the other end to permit fixed securement of the entire holder to a suitable foundation means not shown herein. The bifurcated section is of particular advantage because it permits adjustment of pressure contact of the pad material with the filaments in allowing forward and backward positioning from a fixed point.

An embossment 20 is provided on the under side of the body portion of the holder having an aperture therethrough to accommodate a pad-holding pin 21 in tight-fit fixed relation generally perpendicularly to the length of the longitudinal section. The embossment provides a foundation which assures positive securement of the pin 21 to the holder. The pin projects through from the under side of the body at a point midway between the edges thereof and thus projects upwardly from the bottom of the V groove forming the trough.

Another embossment 24 is provided on the under part of the holder just below the angularly disposed filament-engaging portion 19 through which a second pad-securing pin 22 passes from within the groove to the under side of the holder. Each of the pins 21 and 22 is provided with a point and is designed with sufficient length that it can readily pierce pad material pressed thereover.

A feature of the invention lies in the fact that the pad securing means has been so simplified that the elements effecting the securement require no special design and can be conveniently made of ordinary nails driven through apertures of slightly smaller diameter than the diameter of the nail shanks.

In the holder chosen to exemplify the principles of this invention the V-shaped groove has an angle of 90° between its side walls. This relation is maintained throughout the length of the trough to the very end of the tip where the walls are curved down in height to a rounded tip. It has been found that if the angle is less than 90°, buckling of the pad material and pinching of the strand occurs. If the angle is greater than 90°, then the groove fails to draw filaments together to the degree of integrity desired. In addition, if the pad is too narrow a tendency exists for the filaments to bounce from the pad area during insertion and operation. If individual filaments stray from the pad they are subjected to greater tension and tend to break, causing them to fly about and break the remaining filaments.

The pad material 23 is extended from the front or bottom pin 22 down and around and then over the tip of the holder. It is thus drawn into the portion of the groove for the length of the filament-engaging portion 19 and then over a portion of the longitudinal body portion to a point just beyond the pin 22 by which the material is pierced.

The installation of pad material may be accomplished in this order, that is, by first fixing the bottom or tip end on pin 22 and then drawing it over the tip of the holder to secure the back end of the material on pin 22. Although this is the preferred method of installing the pad, because of the amount of material which may be conveniently grasped once the front end is fixed, and because of the leverage permissible in drawing it under tension to the other pin 21, the installation is not limited to this procedure but, if desired, may be accomplished in reverse order by first piercing the material with pin 21 and then fixing the front end by piercing engagement with pin 22.

Once installed, the pad material receives sizing material supplied from a tube 25 conveniently located above the back end of the pad. A large variety of sizing materials may be used such for example as starch, gelatin, hydrogenated vegetable oil, etc. The sizing fluid upon introduction to the pad material is absorbed and caused to flow downwardly to the filament-engaging portion 19. This portion of the holder is arranged to have a straight bottom portion substantially equal in length to that over which the filaments are desired to be contacted by the pad. Correspondingly the straight bottom of the groove is arranged to be directed in line with the path taken by the filaments gathered into strand form. That is, the filament engaging portion is so shaped that the bottom of the groove is aligned with the path taken by the filaments over a given length, rather than merely making point contact therewith.

The coating function thus is not merely at a single point, but over a number of points distributed over a line of contact. In this respect, the line taken by the bottom of the groove in the engaging portion 19 is arranged to differ slightly from vertical in that it is slanted slightly backward to match the path of filament travel to the tube on which they are wound in strand form.

The minimum width of the pad 23 is fixed by the operation of aligning or engaging the filaments 12 in their path over pad material. If the pad is too narrow, the aligning operation becomes so critical and time-consuming as to be totally out of proportion and costly with respect to the high speed production that it does not warrant the savings in cost in material effected. By way of example, it has been found that at ordinary speeds of operation in the present status of the art, the pad width should be a minimum of ¾ inch wide. It has been discovered, however, that if the pad width is made so great as to cause it to overhang the edges of the groove along the body portion of the holder, that the wicking action of the pad material causes sizing material to be carried upwardly and over the edges of the groove or trough and along the outside edges of the holder to points where the fluid will freely drip without being coated on the fibers for which it was intended. This condition was a frequent occurrence in the earlier use of pad material and resulted in considerable waste leakage. In the present pad holder, however, the trough is made sufficiently wide that the minimum width of the pad material will reside within the trough for the length of the longitudinal body portion and thereby assure that wicking and the carrying of size over the edges thereof will not result.

By reason of the curvilinear reduction in height of the walls of the trough along the length of the portion 19, the pad material 23 in its final installed position gradually emerges from the end of the trough and passes around the tip end so that it smoothly follows the curvilinear contours of the tip. In smoothly emerging from the trough in this manner, buckling of the pad material is prevented and any tendency toward excess of binder from tube 25 is caused to accumulate at the tip in the form of a drop about the point where the strand emerges from contact with the pad material. Thus, the strand follows a path directly through any excess of binder and thereby assures that the sizing is fully utilized for the purpose intended, correspondingly eliminating waste dripping of sizing from the pad holder. Most efficient usage of sizing is therefore assured in view of all such fluid being directed toward being coated on the strands.

In addition to promoting efficient size usage, the gradually curved contour at the tip, by reason of its associa-

tion with the proper angle of the V groove in preventing buckling of the pad material in the groove, prevents the pad material from wiping the strand free of the size as was the experience with previous pad holders having sharp contours at the tip. In comparing operation of the present pad holder with sharper tipped holders it is found that more positive size application is effected by reason of its gradual sloping of the pad which assures that coating of size, rather than wiping away of the size occurs.

A further important feature of the pad holder herein disclosed lies in the angle of disposition of the pad along the longitudinal body portion behind the part of the pad material residing within the filament-engaging portion **19**. Previous pad holders were made with a much more shallow slope. Shallow angles it was believed reduced the problem of size waste described above. In the high speed production of strand length, however, difficulties were experienced in the feeding of size to the contact portion to the extent that it was deemed impossible to permit the use of the present type of holder at the extremely high speeds of fiber production being resorted to. More specifically, it was found that when filaments were drawn through the contact portion of the pad holder at speeds of approximately 11,000 feet per minute or more, the filaments caused a downward flow of air which impinged the trough of the holder with such force that it prevented the flow of size thereover. The impinging air, actually caused a splattering and throwing out of the fluid, substantially reducing the flow for availability of size at the contact area for the coating function.

In the present pad holder, however, the angle of disposition of the pad material is matched to high attenuation speeds so that at the high speeds an areodynamic condition is established which promotes positive flow of size for application to the filaments rather than retarding it. This is accomplished by making the angle of disposition steeper, and as in the embodiment illustrated is made in the order of 30°. If the angle is made less than 20°, the detrimental retarding force occurs.

With the angle being in the order of 30°, however, the air drawn down by the filaments toward the engaging portion **19** is actually caused to flow down along the length of the trough to aid gravity in causing flow to the filaments. In other words, the fact that turbulence exists by reason of high speed attenuation has been taken advantage of to aid the flow of size rather than retard it as experienced with shallow angled pad holders. By so using air to transmit size along the pad, as the speed of attenuation continues to reach higher speeds, more and more air is moved along the pad to exert forces promoting more rapid transmission of size to the filaments. Thus, the rate of size flow is automatically increased in accordance with the need for increased speed of coating.

The pin structure incorporated in the member cooperates to facilitate flow of air in the desired manner in that it offers negligible obstruction to such flow while still positively securing the pad in place. The pin structure in addition promotes a positive lay of the pad material in the base of the groove, thereby causing the side portions of the pad to lie flat against the sides of the groove resulting in the pad conforming generally in shape to the V groove. Thus, the entire pad lays smoothly and offers negligible obstruction to aerodynamic flow.

While I have shown and described a single embodiment of my invention, it will of course, be understood that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover all such modifications that fall within the true spirit and scope of my invention.

I claim:

1. A pad-holding device for grouping a plurality of filaments into strand form comprising a longitudinal member having a tip portion across which filaments are drawn for grouping, said member having a size-saturable pad strip associated therewith and being shaped with a longitudinal groove therein for accommodation of the pad strip therein, said tip portion being gradually narrowed to substantially a blunt point at its end, a pair of pad-securing pins to piercingly engage said pad strip to hold it within the groove, one of said pins being fixed on said member a substantial distance from said tip portion, said one pin projecting vertically upward from the base of said groove and generally perpendicular to said member, the other of said pins extending downwardly from the base of said groove and projecting from the back of said tip portion, said pad strip being held in the groove of said holder by being extended in drawn relationship from behind said tip portion over its end along the length of said groove to said one pin to form a projecting point of fold-over of the pad material.

2. Apparatus for sizing a multiplicity of continuous filaments of mineral material after their attenuation and while they are being grouped into strand form, comprising a pad holding member having a longitudinal body portion with a tip portion at one end and a mounting portion at the other end, said body and tip portions being grooved to accommodate a strip of pad material, a soft flexible strip of size-saturable pad material of generally uniform width extended in drawn relation from behind said tip portion over the end thereof into said groove in conforming relation with the surfaces thereof, means for supplying sizing fluid to said pad strip, the body portion of said member being angularly related to said mounting portion such that the portion of groove therein slopes downwardly when the mounting portion is disposed horizontally, said tip portion being angularly related to said body portion such that the portion of groove therein extends in a generally vertical direction when said mounting portion is disposed horizontally, said tip portion being narrowed at its end to cause the pad to overlap the edges of said groove at the tip end to form a downwardly projected zone of fold-over of pad material at the tip end at which excesses of sizing material will accumulate when said pad holder is in operating position.

3. A pad holder as claimed in claim 2 in which the angular association between the mounting portion and body portion are such that the operating angle of disposition of the body portion is at least 20° to the horizontal.

4. A pad holder for holding a pad of material for grouping a plurality of glass filaments in strand form and application of sizing fluid thereto comprising a member having a longitudinal body portion with a tip portion at one end and a mounting portion at the other end, said body and tip portions having a single continuous groove extending thereover to accommodate a strip of size-saturable pad material therein, said tip portion being inclined downwardly and having a straight line section at the base of the groove to permit establishment of an engaging relationship between a portion of a pad strip accommodated therein and a length of filaments drawn thereover, said tip portion also having a gradually diminishing groove width at its end, and a pair of pad-securing pins for making piercing engagement with pad strips installed within the groove, one of said pins being fixed on said body portion a substantial distance from said tip portion, said one pin projecting vertically upward from the base of said groove generally perpendicular to said body portion, the other of said pins extending from the base of said groove and projecting from the back of said tip portion generally perpendicular to the base of said groove.

5. A pad assembly for grouping a plurality of glass filaments in strand form and for application of sizing fluid thereto comprising a member having a longitudinal body portion with a tip portion at which grouping of filaments is effected extending from and inclined relative to said body portion, said body and tip portions having angularly related walls defining a continuous groove extending

through said portions, a strip of size-saturable pad material of generally uniform width extended in drawn relation from behind said tip portion over the end thereof into said groove in conforming relation with the internal surfaces thereof, the portion of the groove in said body portion being sufficiently wide to permit full accommodation of the pad material within the boundaries defining its edges, said tip portion having a gradually diminishing groove width formed by a gradual reduction in dimension of the walls defining said groove at its end, and a pair of pad-securing pins making piercing engagement with the pad strip installed within the groove, one of said pins being fixed on said body portion a substantial distance from said tip portion, said one pin projecting from the base of said groove in a direction generally perpendicular to said body portion, the other of said pins projecting from the back of said tip portion in a direction generally perpendicular to the base of said groove, the dimensions of the walls at said tip end diminishing sufficiently toward said end to cause the sides of said pad strip to overlap

the edges of said walls to form a projected point of fold-over of the pad material at said end for the accumulation of excesses of sizing fluid introduced to said pad, whereby said excesses are disposed for application to filaments gathered at said tip portion.

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