Nov. 21, 1944. G. M. LANNAN ET AL 2,363,470

METHOD FOR MAKING SLIVERS

Original Filed May 21, 1937 3 Sheets-Sheet 1

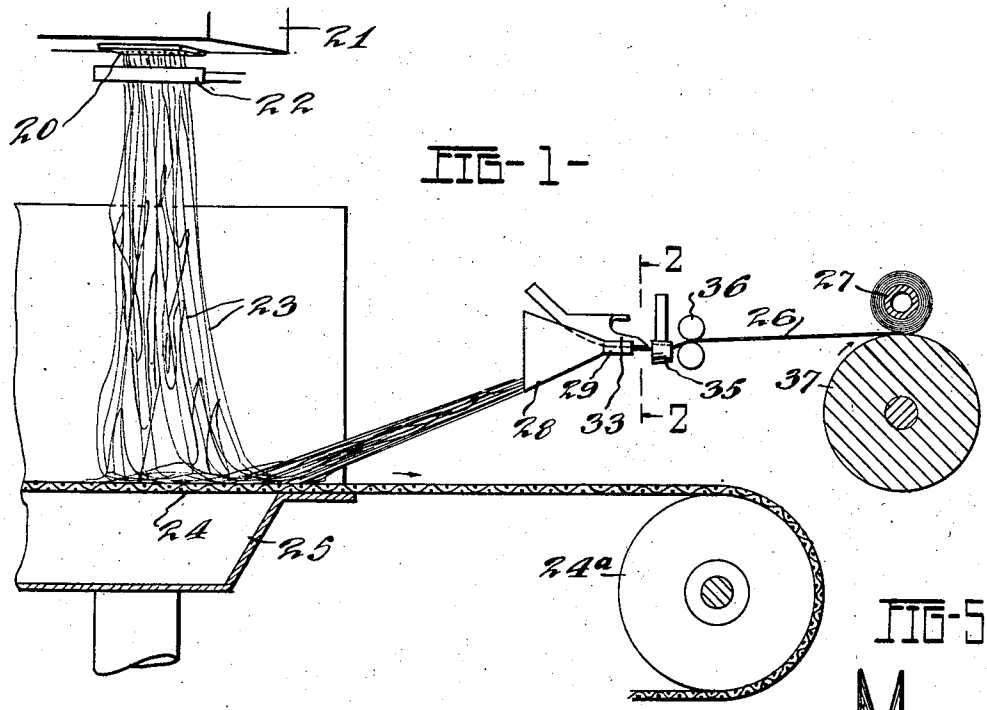


FIG-1-

FIG-5-

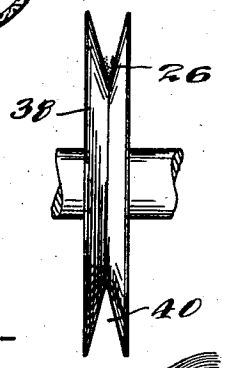


FIG-2-

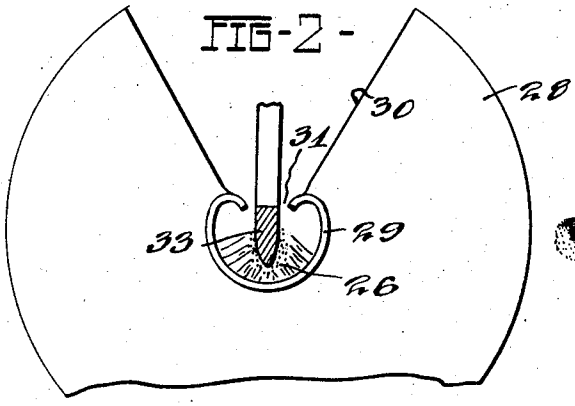




FIG-3-

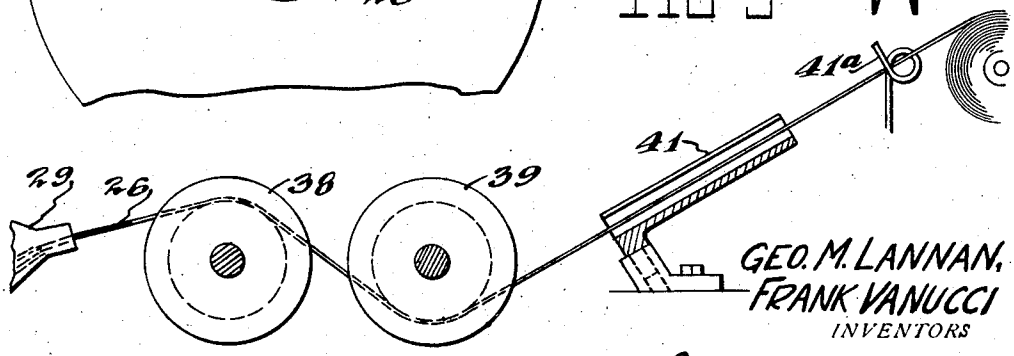


FIG-4-

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FIG-6-

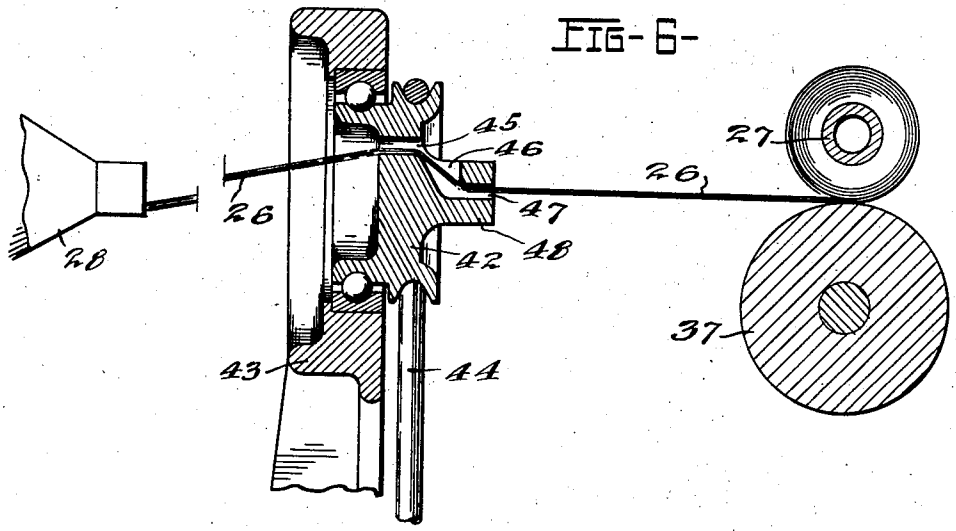


FIG-7-

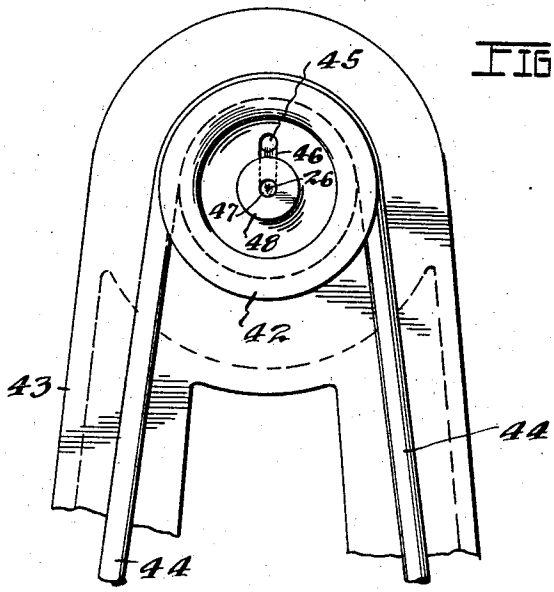
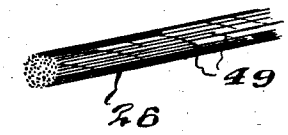


FIG-8-



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FIG-9-

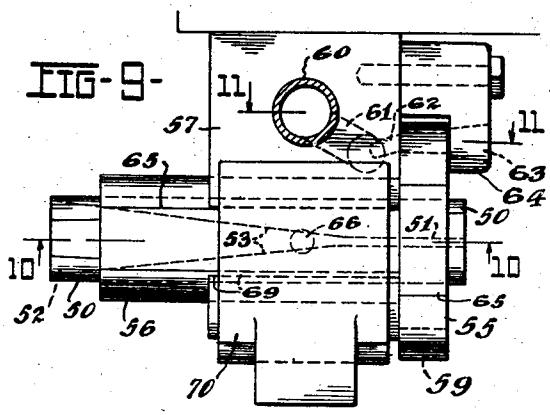


FIG-11-

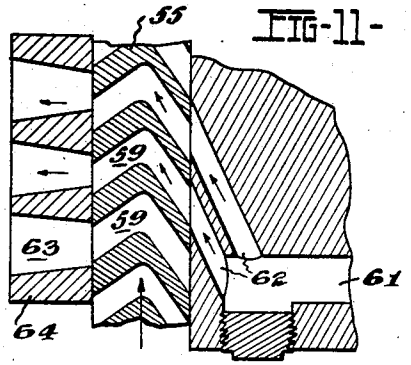


FIG-10-

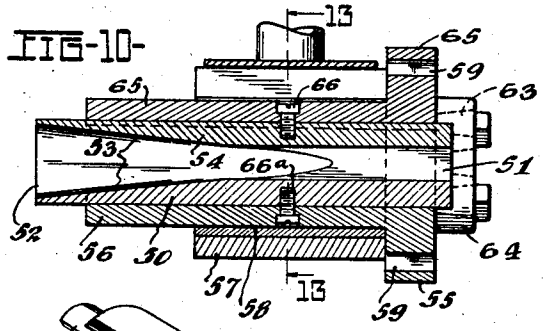


FIG-12-

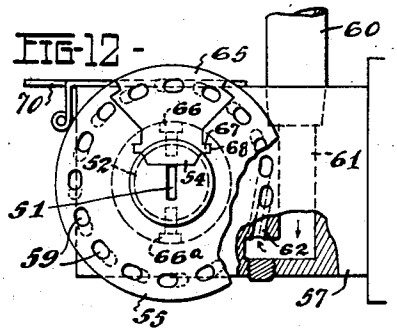


FIG-14-

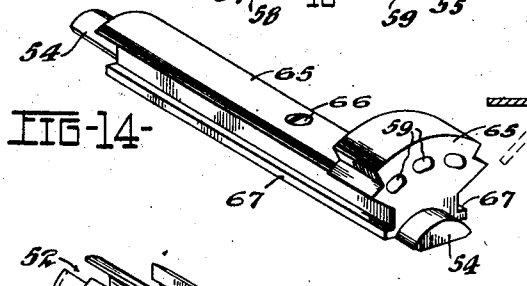


FIG-13-

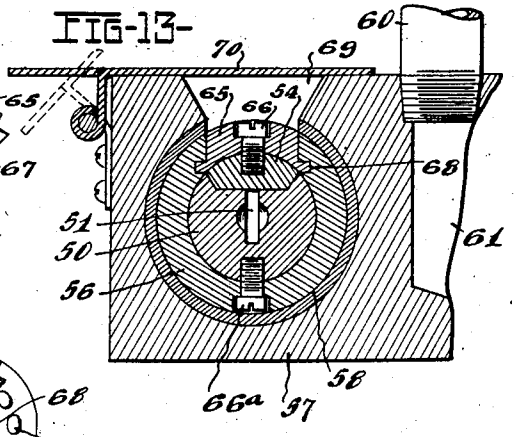
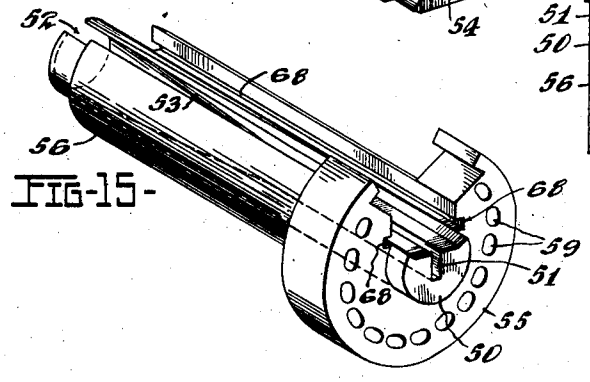


FIG-15-



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UNITED STATES PATENT OFFICE

2,363,470

METHOD FOR MAKING SLIVER

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Original application May 21, 1937, Serial No. 144,024, now Patent No. 2,239,722, dated April 29, 1941. Divided and this application July 9, 1940, Serial No. 344,524

3 Claims. (Cl. 19—150)

Our invention relates to a novel method for manufacturing and roving sliver for yarns. The method is particularly adapted for use in the manufacture of sliver consisting of fine fibers made of glass or similar material which is melted, drawn into fine fibers and formed into a strand or sliver by a continuous process. The invention, however, is adapted or use with other materials.

This application is a division of our copending application, Serial Number 144,024, filed May 21, 1937, and issued April 29, 1941, as Patent No. 2,239,722.

It is an object of the present invention to provide a novel method of producing a smooth sliver in which any ragged edges or loose fiber ends are folded into or enmeshed in the main body of the sliver so that the latter is smooth and free from projecting ends or loose fuzz.

In the manufacture of sliver consisting of fibers of glass or similar material, a method for making the sliver by a continuous process is described and claimed in the copending application of Tucker and Lannan, Serial Number 52,085, filed November 29, 1935, now Patent No. 2,264,345. In this method, the molten material is caused to flow in a multiplicity of fine streams which are continuously drawn to extremely fine filaments by the application thereto of a blast of steam or other gas. The fibers as they are produced are accumulated in the form of a web which is continuously drawn through a trumpet or the like by which the fibers are caused to assume the form of a sliver which is continuously wound on a roll or tube.

As the web of filaments is drafted into a sliver, there is a tendency to leave ragged edges and much loose fuzz or protruding fiber ends so that the resulting sliver is more or less uneven and fuzzy.

A further object of the invention is to provide a method for roving or producing more or less of a false twist of the sliver by which loose fiber ends are folded in or wrapped around the body of the sliver and by which the strength and elasticity of the sliver are greatly increased and an improved product obtained.

Other objects of the invention will appear hereinafter.

In the accompanying drawings several embodiments of apparatus by means of which the method of the present invention may be carried out are shown. In these drawings:

Figure 1 is a diagrammatic part-sectional elevation view of an appratus for making glass sliver in accordance with our invention;

Figure 2 is a sectional elevation on a larger scale, the section being taken at the line 2—2 on Figure 1;

Figure 3 is a perspective view of a fragment of sliver made with the apparatus shown in Figures 1 and 2;

Figure 4 is a sectional elevation of a modified for of apparatus;

Figure 5 is an edge view of one of the shaping rolls shown in Figure 4;

Figure 6 is a sectional elevation of a further modification including a rotating element or twister;

Figure 7 is an elevation of the twister shown in Figure 6;

Figure 8 is a perspective view of a fragment of sliver produced with the apparatus shown in Figures 6 and 7;

Figures 9 to 15 inclusive illustrate still another form of apparatus comprising rotating means for treating the sliver;

Figure 9 is a plan view of such apparatus;

Figure 10 is a sectional elevation, the section being taken at the line 10—10 on Figure 9;

Figure 11 is a fragmentary sectional view on a larger scale, the section being taken substantially at the line 11—11 on Figure 9;

Figure 12 is an end view of the apparatus shown in Figures 9 and 10, parts being broken away to more fully show the construction;

Figure 13 is a section at the line 13—13 on Figure 10; and

Figures 14 and 15 are perspective views of the disassembled parts of the spinner shown in Figures 9 to 13.

Figures 1 and 2 illustrate one form of apparatus which could be employed in the Tucker and Lannan method for continuously flowing small streams of molten glass or other material, reducing the material to fine fibers, collecting and drawing them in the form of a strand, or sliver, and winding the sliver on a spool or roll. The molten glass flows continuously in a multiplicity of fine streams from outlets 20 in the floor of a glass melting and refining tank or other container 21. The streams of molten glass flow downward through a blower 22 which may be of conventional construction, to which steam or other gas at high pressure is supplied. The streams of molten glass, as they flow downward through the blower, are enveloped in a steam blast or blasts issuing from the blower, and are thereby drawn out and attenuated to the form

of extremely fine fibers 23 which are immediately cooled and solidified by the enveloping medium.

These fibers may be only a few microns in diameter and some of them are practically continuous or of great length. They are carried downward by the force of the blast and deposited on a foraminous support 24, here shown as a wire screen in the form of a traveling conveyor, preferably an endless conveyor which passes over a driving roll 24a and is driven continuously thereby. A suction box 25 is located beneath the conveyor. The air or gas is continuously exhausted from the suction box, thereby maintaining a down draft through the screen which supplements the action of the steam blast in drawing and depositing the fibers on the screen. The fibers accumulate in the form of a thin mat or web on the surface of the conveyor.

The speed of the conveyor 24 is many times less than the velocity imparted to the fibers by the steam last, so that the individual fibers as they are deposited on the screen are doubled back and forth in zigzag or more or less irregular formation. This results in the group of fibers taken as a whole being distributed quite evenly on the screen in a ribbon-like network or web in which the fibers are matted and interwoven to some extent. The web or ribbon of fibers may be very thin and of open texture, comparable to a ribbon of gauze, the fibers for the most part lying substantially in a single plane. This web is continuously drawn from the screen by a process which reforms the web into a strand or sliver in which the fibers for the most part extend lengthwise of the sliver in substantial parallelism, as indicated in Figure 3, which shows a fragmentary section of the sliver 26 on an enlarged scale.

The sliver 26 as it is formed is wound on a rapidly rotating spool or roll 27 which serves as a drafting means for drawing the web continuously from the screen conveyor, the web being transformed into the form of a sliver during its passage from the conveyor to the spool 27 by means which will presently be described. During the drawing process, the web of fibers which, as formed on the screen may be of considerable width, for example, from a few inches to a foot or more in width, is converged or narrowed down, folded or rolled together with the edges of the web folded and embedded within the body of the web, and compacted to form the sliver.

The surface speed of the roll 27 and the accumulated material thereon may be many times greater than that of the conveyor 24, although usually many times less than the speed imparted to the fibers by the blower 22. As a result, the web during its transition to the form of a sliver is subjected to a drawing or roving process by which the individual fibers are straightened out to some degree to bring them into line with the sliver. During this drawing operation the suction within the box 25 serves as an anchor to hold the web against the screen. Owing to the great velocity with which the fibers are drawn out and projected onto the screen, each individual fiber when incorporated in the sliver will be doubled back and forth in a considerable number of lengths, which may either remain united or the fiber may be broken up to a greater or less degree into separate lengths. It will also be noted that the above described method produces a sliver in which the number of individual fibers in a cross-section thereof is many times greater than the number of fibers which are being produced by the action of the blower and deposited on the screen but may also be much less than the number of fibers in a cross-section of the web as it leaves the screen.

When a web of glass fibers such as herein disclosed, is drafted from the screen conveyor by means heretofore used, there is a tendency to leave ragged edges, projecting fiber ends and loose fuzz, so that the resulting sliver is uneven, fuzzy, and its commercial value for some uses thereby lowered. In order to overcome these objections, the present invention provides a method in which the web is drawn through a trumpet-shaped die 28 designed to roll the web into rounded, compact form, fold in the ragged edges of the web and enmesh the loose fibers in the main body of the sliver. The trumpet 28 is funnel-shaped, the smaller end portion 29 thereof being approximately a cardioid or substantially heart-shaped in cross-section, as shown in Figure 2. The upper side of the trumpet is open or cut away, providing downwardly convergent walls 30 terminating in an opening 31. This construction permits the web or strand to be readily positioned within the trumpet when initiating the drawing operations. A toe 33 is positioned within and extends lengthwise of the constricted end 29 of the trumpet. As the web is drawn through the trumpet, the die 29 compacts the web, rolling the edges inwardly in cardioid form, so that they are embedded in the body of the sliver. During this formation of the sliver the web is wrapped around the toe 33, which materially assists in shaping the sliver and in folding in any loose fiber ends or ragged edges. The die also licks down any loose fibers or projecting fiber ends, so that the resulting sliver or strand is smooth, of even diameter and free from fuzziness or loose fibers.

As the sliver advances beyond the die, it is passed through a guiding ring 35. Thence it is led between a pair of iron rolls 36 or the like, by which it is compressed into a smooth flat sliver. A driving roll 37 cooperates with the roll 27 for winding the sliver.

Figures 4 and 5 illustrate a modified form of apparatus by means of which our method may be carried out and for handling the sliver after it passes beyond the shaping die. As here shown, the sliver after it leaves the die 29 is drawn over shaping rolls 38 and 39. The roll 38, as shown in Figure 5, is formed with a peripheral groove or recess 40 which is substantially V-shaped in cross-section, the sides of the recess preferably converging at an acute angle. The roll 39 is of the same construction. As the sliver passes over the roll 38 it is compacted by the walls of the angular groove 40, which tend to fold in any loose fibers or protruding ends. After leaving the roll 38 the sliver traverses the lower surface of the roll 39, passing through the groove 40 therein, which completes the operation of smoothing or ironing out the sliver. Beyond the roll 39 the sliver is directed through an oscillating guide 41 and thence through a reciprocating guide 41a by which the sliver is distributed on the winding spool.

Figures 6 and 7 illustrate another construction for carrying out our method, embodying a rotor or rotating die 42 which operates to give a false twist to the sliver. The rotor is in the form of a pulley mounted for rotation in a standard 43, and is driven at a high speed by a belt 44. The sliver 26 after passing through the trumpet 28 is di-

rected through an opening 45 which extends through the rotor eccentrically of its axis. From the opening 45 the sliver is guided diagonally downward through a channel 46 to a central opening 47 in a hub or extension 48 of the rotor. From thence the sliver extends to the winding roll 27.

As the sliver is drawn through the rapidly spinning die 42, the latter operates to wrap any ragged edges of the web or sliver, and any loose fibers or protruding fiber ends, around the main body of the sliver, licking down any loose fibers. This operation results in a smooth, even, compact, well rounded sliver free from fuzziness, loose fibers or protruding fiber ends. As indicated in Figure 8, any loose fibers 49 are licked down or wrapped spirally around the body of the sliver in a manner to impart to the sliver a well rounded, smooth finish.

Figures 9 to 15, inclusive, illustrate a modified form of rotor or die, driven by an air turbine. In this construction, the die 50, which is circular in cross-section, is provided with an opening 51 extending lengthwise therethrough, through which the sliver is drawn. The opening 51 at the discharge end of the die is rectangular in cross-section and preferably quite narrow, being only of sufficient width to allow the free passage of the sliver therethrough. At the entrance 52 at the opposite end of the die, the opening is circular and approximately the full diameter of the die. The walls 53 are tapered or converge from the entrance 52 in conical formation and merge into the walls of the rectangular channel 51. The die 50 is divided lengthwise into two separable sections, the upper or cover section 54 being removable in the manner hereinafter described to facilitate the placing of the sliver therein.

Surrounding the die 50 is a turbine comprising a head portion 55 and a tubular extension or body 56 which surrounds the die 50. The turbine is journaled in a stationary bearing block 57 having a cylindrical opening 58 extending therethrough to receive the hub extension 56 of the turbine. The turbine head 55 is formed with an annular series of angular channels 59 extending transversely therethrough and arranged in herring-bone fashion, for the passage of air, steam or other gas for driving the turbine. Air under pressure may be supplied to the turbine through a pipe 60 opening into a chamber or channel 61 from which branch passageways 62 extend diagonally and open through the wall of the bearing block in juxtaposition to the rotating turbine head 55. The inclined passageways 62 are arranged to register with the correspondingly inclined openings 59 in the turbine, so that the latter is driven by the air pressure. The air as discharged from the channels 59 passes through openings 63 formed in a guard plate 64 bolted to the bearing block and overhanging the head 55. The plate 64 serves to prevent endwise movement of the turbine.

The turbine is divided lengthwise into two separable sections including an upper or cover section 65 corresponding to the two sections of the die 50. The cover section 65 is attached by a screw 66 to the cover section 54 of the die. A screw 66a secures the die 50 in place within the turbine. The cover piece 65 is formed with ribs 67 extending lengthwise thereof, which fit in corresponding grooves or guideways 68 formed in the main section or body of the turbine. The cover sections 54 and 65 may be removed as a unit by sliding them lengthwise of the turbine. An opening 69 is formed in the upper part of the bearing block 57 to permit access to the turbine and to the passageway 51 when the covers 54, 65 are removed. A hinged lid 70 covers the opening 69. The die illustrated in Figures 9 to 15 operates on the sliver in a manner substantially similar to that above described in connection with the die shown in Figures 6 and 7. Any loose fibers or fiber ends are licked down and wrapped about the body of the sliver, the latter being compacted and given an even shape and smooth surface by the action of the rotating die.

Modifications may be resorted to within the spirit and scope of our invention.

We claim:

1. The method which comprises continuously supplying a multiplicity of glass fibers and collecting them in haphazard arrangement in a ribbon-like web and forcibly and releasably holding said fibers in said arrangement, applying a drawing force to the web by which the web is continuously advanced and continuously elongated against the force holding the fibers in haphazard arrangement to thereby form a sliver, folding said sliver on itself along its length as it advances and exerting positive pressure on the sliver along a line extending centrally lengthwise of the sliver to aid in folding the longitudinal edges of the sliver into the center of the sliver, and thereafter applying to the sliver inwardly directed pressure spirally about its body and progressively lengthwise thereof to lick down and wrap loose fiber ends about the body.

2. The method which comprises continuously supplying a multiplicity of glass fibers and collecting them in haphazard arrangement in a ribbon-like web and forcibly and releasably holding said fibers in said arrangement, applying a drawing force to the web by which the web is continuously advanced and continuously elongated against the force holding the fibers in haphazard arrangement to thereby form a sliver, folding said sliver on itself along its length as it advances and exerting positive pressure on the sliver along a line extending centrally lengthwise of the sliver to aid in folding the longitudinal edges of the sliver into the center of the sliver, thereby compacting said sliver into a smooth body of fibrous glass in which the fibers are predominantly parallel and extend lengthwise of the sliver, and thereafter passing the sliver through an elongated axial passage in a rapidly rotating member to lick and wipe down loose fibers and loose projecting fiber ends.

3. The method which comprises continuously supplying a multiplicity of glass fibers and collecting them in haphazard arrangement in a ribbon-like web and releasably and forcibly holding said fibers in said arrangement, applying a drawing force to the web by which the web is continuously advanced and continuously elongated against the force holding the fibers in haphazard arrangement to thereby form a sliver, folding said sliver on itself along its length as it advances and exerting positive pressure on the sliver along a line extending centrally lengthwise of the sliver to aid in folding the longitudinal edges of the sliver into the center of the sliver, and thereafter falsely twisting said sliver.

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