June 7, 1966 C. J. STALEGO 3,254,482

APPARATUS FOR FORMING AND PROCESSING FIBERS

Original Filed July 25, 1957 4 Sheets-Sheet 1

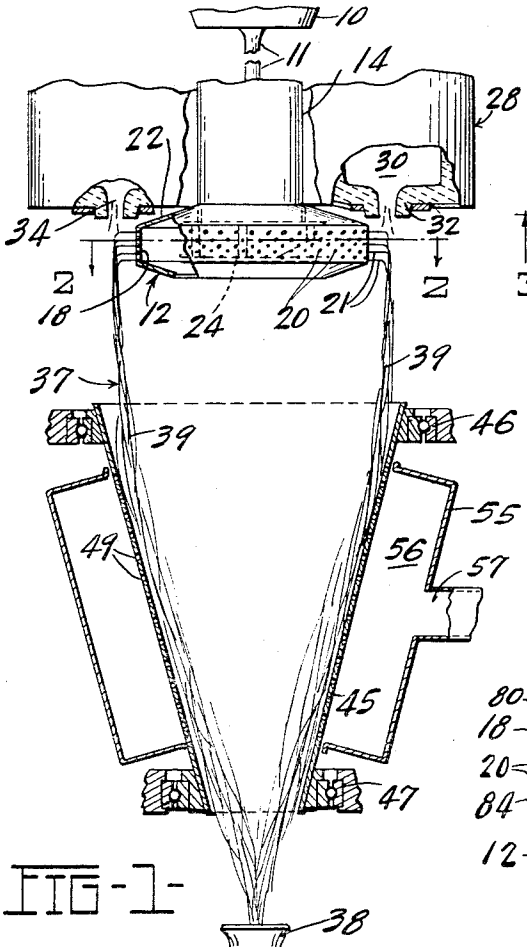


FIG-1-

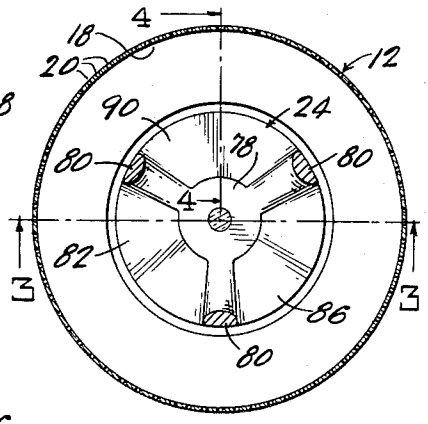


FIG-2-

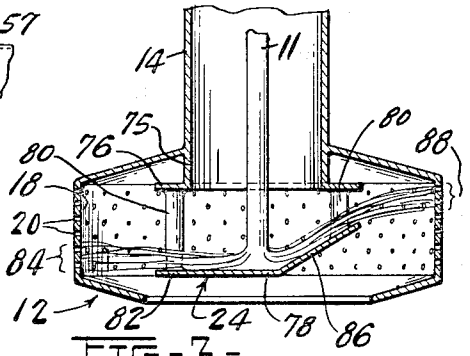


FIG-3-

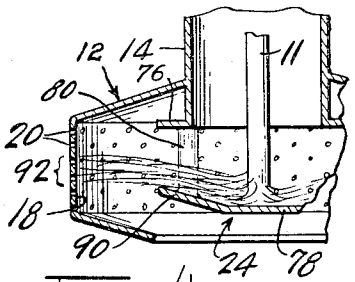


FIG-4-

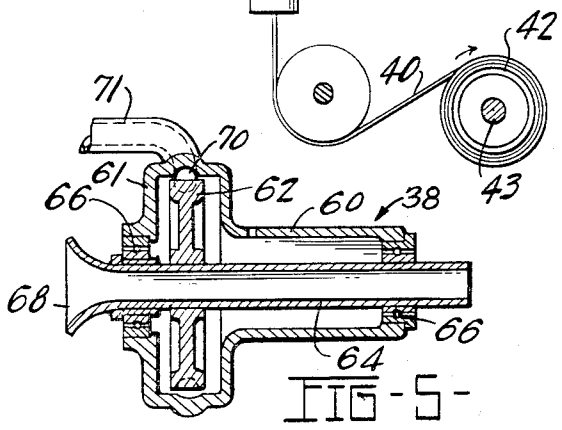


FIG-5-

INVENTOR:
Charles J. Stalego.
BY
ATT'YS.

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APPARATUS FOR FORMING AND PROCESSING FIBERS

Original Filed July 25, 1957 4 Sheets-Sheet 2

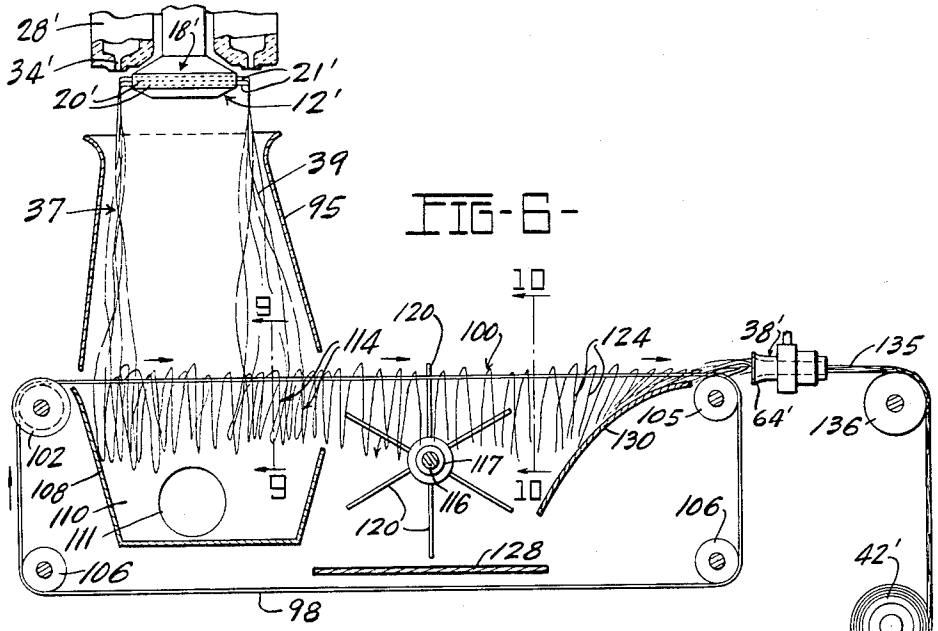


FIG-6-

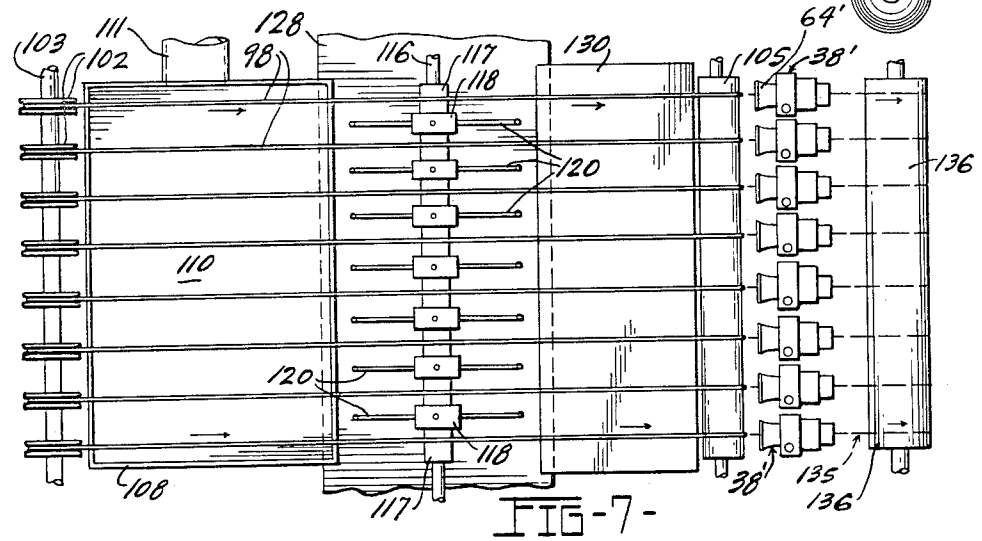


FIG-7-

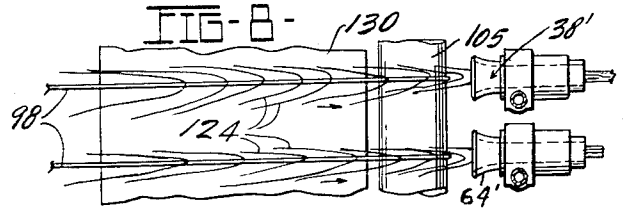


FIG-8-

INVENTOR:
Charles J. Stalego.
BY Stalego & Quinn
ATT'YS.

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APPARATUS FOR FORMING AND PROCESSING FIBERS

Original Filed July 25, 1957 4 Sheets-Sheet 3

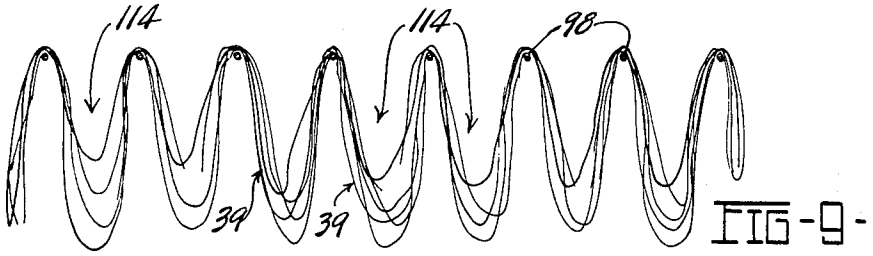


FIG-9-

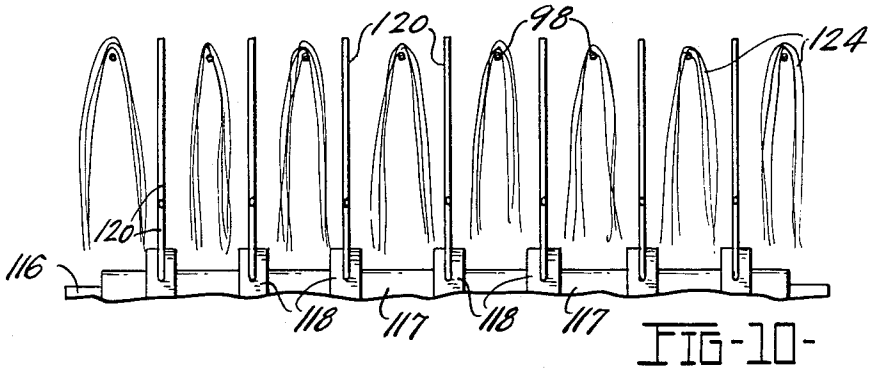


FIG-10-

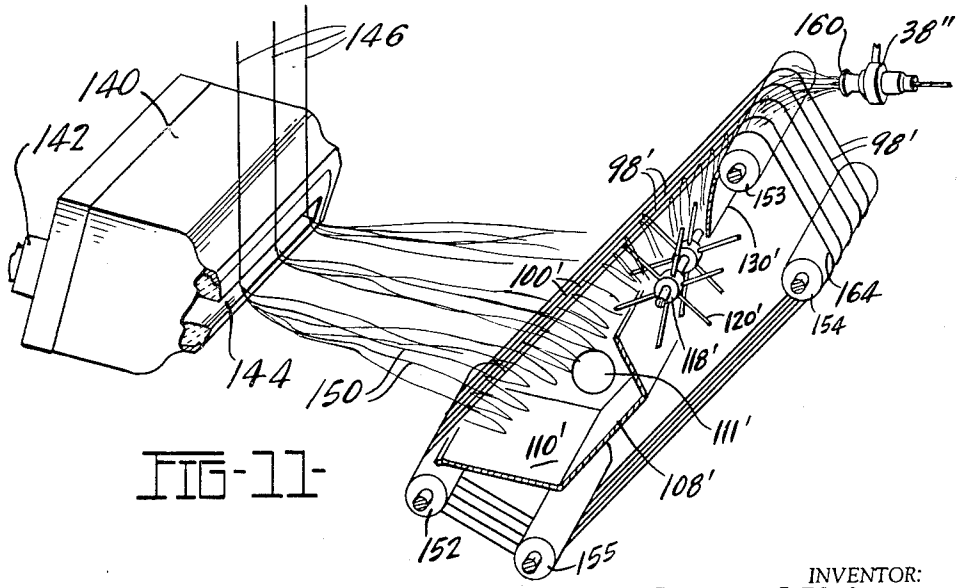


FIG-11-

INVENTOR:
Charles J. Stalego.
BY Stachi & Oberman
ATT'YS.

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Original Filed July 25, 1957 4 Sheets-Sheet 4

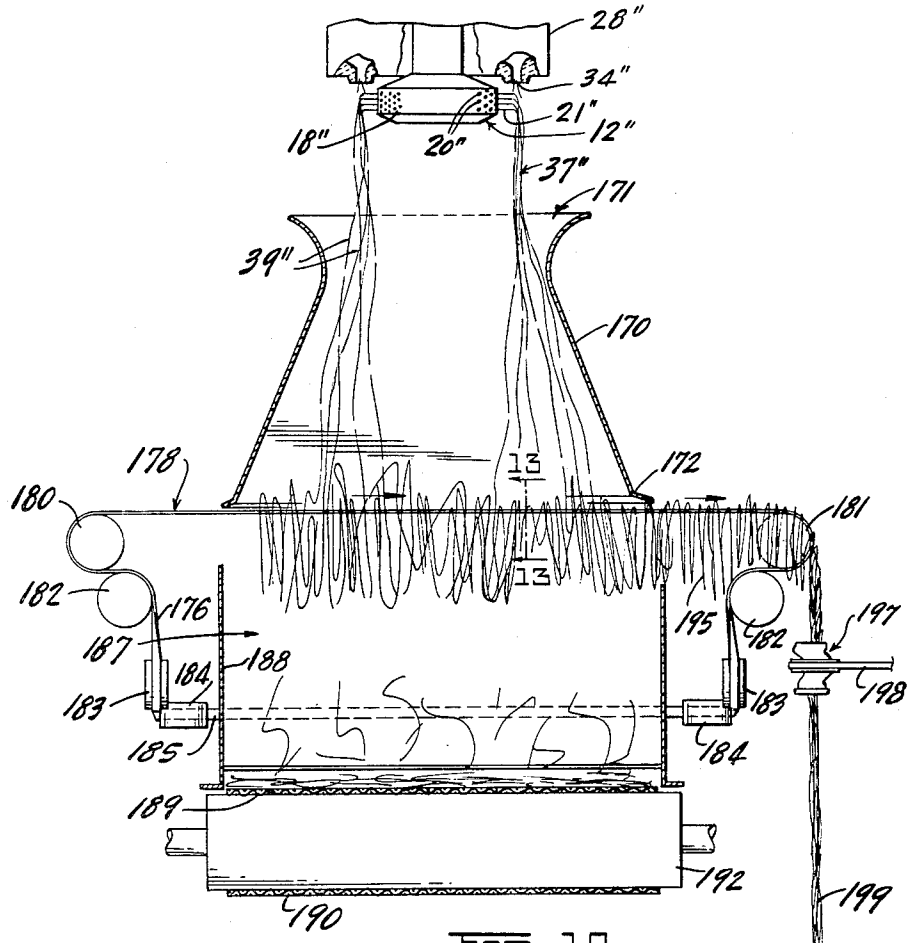


FIG-12-

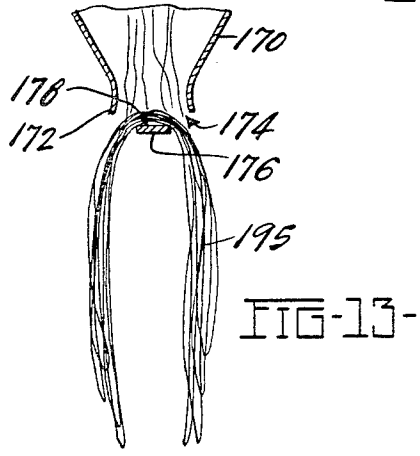
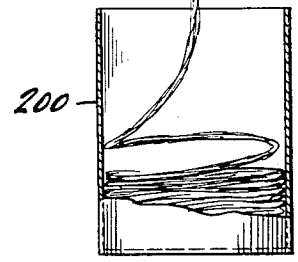


FIG-13-



INVENTOR:
Charles J. Stalego.

BY Stachi & Quesman

ATT'YS.

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3,254,482

APPARATUS FOR FORMING AND PROCESSING FIBERS

Charles J. Stalego, Newark, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Application Aug. 8, 1960, Ser. No. 48,017, now Patent No. 3,161,920, dated Dec. 22, 1964, which is a division of application Ser. No. 674,227, July 25, 1957. Divided and this application Dec. 9, 1964, Ser. No. 417,021

10 Claims. (Cl. 57—58.95)

This application is a division of my copending application, Serial No. 48,017 filed August 8, 1960, now U.S. Patent No. 3,161,920 which is a division of my application Serial No. 674,227, filed July 25, 1957, now abandoned.

This invention relates to novel method and apparatus for forming and processing fibers or filaments and more especially to a method and apparatus for manufacturing sliver from fine fibers or filaments attenuated from mineral materials through the utilization of centrifugal forces and an attenuating blast for producing the fibers.

Various methods have been employed in gathering and compacting staple fibers into sliver, thread or yarn formation but difficulties have been encountered in orienting haphazardly arranged fibers into a sliver or linear group in a manner whereby the staple fibers are uniformly distributed lengthwise of the sliver and in attaining an end product which is of substantially uniform diameter and of smooth contour throughout its length. The U.S. patent to Lannam and Vanucci 2,239,722 is an example of one method of collecting fibers on a conveyor and subsequently passing them through a die for compacting the fibers into a sliver and during the compacting operation to modify the cross-sectional configuration of the sliver and impart a false twist thereto.

This arrangement of this patent is utilized for forming a strand or sliver of steam blown fibers formed from glass streams delivered from a fixed feeder, the fibers being collected in haphazard orientation, a condition which fosters the formation of a sliver of non-uniform diameter.

The present invention embraces a method of forming a sliver of fibers wherein the natural orientation of the fibers established by the attenuating operation is utilized in processing the fibers into a sliver of substantially uniform size.

An object of the invention resides in a method wherein fibers formed by the attenuation of centrifuged bodies of heat-softened mineral material and oriented into a hollow beam formation are conveyed into a rotating fiber compactor or device to form a sliver of substantially uniform size and in which protruding fibers or loose fibers are wrapped or folded into the sliver to form a smooth sliver.

Another object of the invention is the provision of a method wherein fibers of a hollow beam formation are collected in loop configurations without impairing the orientation of the fibers and continuously conveying the loops of fibers into a compactor to form a sliver in which successive loops of fibers are arranged in echelon along the sliver.

Another object of the invention resides in an apparatus for converging a hollow beam of fibers into a rotating compactor whereby the rotation compacts the fibers into a smooth surfaced sliver.

Another object of the invention resides in the provision of an apparatus for collecting fibers directly from an attenuating zone without materially disturbing the natural orientation of the fibers established by attenuation and drawing the fibers through a rotating tubular member to lick in loose or protruding fibers into a smooth linear body.

Still another object of the invention is the provision of an apparatus for collecting fibers in successive loops and continuously conveying the loops of fibers into a turbinizer to form the loops of fibers into a smooth-surfaced high strength sliver.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is a semidiagrammatic elevational view of an apparatus for carrying out the method of forming and compacting fibers into a sliver;

FIGURE 2 is a sectional view through the rotor and material distributing arrangement of FIGURE 1, the view being taken substantially on the line **2—2** of FIGURE 1;

FIGURE 3 is a detail sectional view taken substantially on the line **3—3** of FIGURE 2;

FIGURE 4 is a detail sectional view taken substantially on the line **4—4** of FIGURE 2;

FIGURE 5 is a semidiagrammatic view illustrating a form of fiber compacting and sliver smoothing means;

FIGURE 6 is a semidiagrammatic sectional view illustrating a rotary fiber-forming apparatus and means for collecting and compacting the fibers into a plurality of slivers;

FIGURE 7 is a plan view of the fiber collecting and conveying arrangement shown in FIGURE 6;

FIGURE 8 is a plan view illustrating loops of fibers conveyed into a fiber compacting means for forming slivers;

FIGURE 9 is an enlarged transverse sectional view taken substantially on the line **9—9** of FIGURE 6;

FIGURE 10 is an enlarged transverse sectional view taken substantially on the line **10—10** of FIGURE 6;

FIGURE 11 illustrates a modified form of fiber attenuation and fiber collecting and conveying means;

FIGURE 12 is a diagrammatic sectional view showing another method of collecting, conveying and forming fibers into a sliver, and

FIGURE 13 is an enlarged fragmentary sectional view illustrating the fiber collecting means shown in FIGURE 12, the section being taken on the line **13—13** of FIGURE 12.

While the invention has been illustrated as particularly usable in forming molten glass into fibers and processing the fibers to form a smooth sliver or strand, it is to be understood that the method and apparatus may be utilized for forming and processing other kinds of fibers if desired.

Referring to the drawings in detail, FIGURE 1 illustrates a structural arrangement for carrying out or performing the steps in the method of the invention. In this arrangement the fiber-forming material is discharged outwardly from a rotor and the discharged material attenuated into fibers through the utilization of a high velocity gaseous blast. The stream **11** of molten glass or other heat-softened fiber-forming material flows from an orifice in a feeder **10** which is associated with a forehearth (not shown) containing a supply of molten glass.

Disposed beneath the feeder **10** is a rotor **12** having a cylindrical sleeve-like portion **14** which is journally supported in suitable bearings (not shown). The rotor **12** is adapted to be rotated by a motor or other suitable means (not shown). The rotor is fashioned with a peripheral wall **18** formed with a large number of small

orifices or openings **20** through which the heat-softened glass within the rotor is discharged in the form of discrete bodies or primary filaments **21** moving outwardly under the influence of the centrifugal forces of rotation.

The sleeve portion **14** of the rotor is connected with the peripheral wall **18** by a frusto-conically shaped portion **22**. A glass distributing or dispersing means **24** is contained within the rotor and one form of the means **24** is illustrated in FIGURES 2 through 4. Surrounding the sleeve **14** of the rotor is an annularly shaped burner construction **28** which is formed with an annular combustion chamber or confined zone **30** in which a combustible mixture, such as fuel gas and air, is adapted to be burned. The fuel gas and air is admitted to the chamber **30** through a manifold (not shown).

The lower wall portion **32** of the burner construction is formed with an annularly shaped slot or orifice **34** through which the burned gases or products of combustion from the chamber **30** are discharged in the form of a high velocity gaseous blast. The annularly-shaped blast emanating from the orifice **34** is directed into engagement with the outwardly moving bodies or primaries **21** attenuating them into fine fibers. While the gaseous blast of burned gases is of a temperature well above the attenuating temperature of the glass, it is to be understood that air, steam or other gas moving at sufficient velocities to effect attenuation of the primaries **21** to fibers may be employed as attenuating mediums.

By reason of the annular character of the attenuating region established at the zone of engagement of the gases of the blast with the primaries, the attenuated fibers move downwardly in directions substantially parallel with the axis of the rotor **12** in the form of a substantially hollow beam or web **37** of fibers **39**.

A feature of the invention is the formation of a sliver from the fibers of the beam by converging the fibers into a continuous sliver or linear bundle. Due to the fact that the attenuating operation provides a natural orientation of the fibers in the hollow beam formation whereby they are generally in parallelism, a sliver or strand **40** may be formed from the fibers without material modification or impairment of their natural orientation in the beam.

The bundle of fibers, sliver or strand may be fed through a fiber compacting device or means **38** for folding in or licking down any loose fibers or projecting fiber ends. The sliver **40** formed from the fibers **39** may be collected in any suitable manner, as for example, the sliver may be wound upon a sleeve **42** mounted upon a rotatable shaft **43** to form a package.

The arrangement shown in FIGURE 1 preferably embodies a means for assisting in converging the fibers of the hollow beam **37** into a strand or sliver formation. Surrounding the beam of fibers is a frusto-conically shaped element **45** which is supported adjacent its respective ends by means of bearings **46** and **47**, the angularity or degree of convergence of the fibers of the beam being generally coincident with the inner surface of the frusto-conically shaped guide member **45**. The thin-walled member **45** is provided with a comparatively large number of comparatively small openings **49** through which the gases from the blast may flow away from the converging group of fibers.

Means may be provided for establishing a subatmospheric or reduced pressure adjacent the member **45** in order to facilitate the disposal of the spent gases of the blast through the openings **49**. Surrounding the member **45** is an annular receptacle **55** connected by means of a pipe or tubular member **57** with a suction blower or other suitable source of reduced pressure. Thus the subatmospheric pressure within the chamber **56** provided by the annular receptacle **55** establishes suction which fosters the flow of spent gases of the blast though the openings **49** and away from the region of travel of the fibers.

A form of sliver guide and fiber compacting means **38** is illustrated in FIGURE 5. The arrangement is inclusive of a housing **60** having an enlarged circular portion **61** enclosing a plurality of turbine blades or vanes **62**. The turbine blades are connected with or supported by a tubular member **64**, the latter being journally supported in bearings **66** carried by the housing **60**. The entrance end **68** of the tubular member **64** is preferably flared or bellmouthed shape to facilitate the delivery of the group of fibers, sliver or strand into the member **64**.

The interior diameter of the tubular member **64** at a region spaced from the entrance end **68** is of a dimension to snugly receive the sliver or fiber group so that rotation of the tubular member **64** functions to wrap in, fold in or lick down any projecting fibers or loose fibers so as to produce a compact sliver having a smooth exterior surface which is free from fuzziness. The housing portion **61** is provided with a tangentially arranged inlet **70** which is in communication with a tube **71** connected with a source of gas under pressure, such as compressed air, whereby a jet or stream of compressed air or other gas is directed against the blades or vanes **62** for rotating the tubular member or fiber compactor **64**.

While the member **64** is illustrated as being driven or rotated by a turbine construction, it is to be understood that the tubular member may be driven by other means such as an electric motor wherein the motor shaft may be of tubular construction to accommodate the sliver and function as a sliver smoothing means.

Where the beam **37** of fibers is directed through the frusto-conically shaped member **45** and the latter remains in static condition, no twisting of the linear group of fibers will take place in the rotating compactor **38**. By rotating the member **45** a twist may be imparted to the group of fibers as they converge into sliver formation adjacent the entrance of the compactor **38** by reason of the subatmospheric pressure in chamber **56**, causing the fibers to adhere to the inner conically shaped surface whereby the fibers are slidably moved toward the region of convergence by the interadherence or interfelting of the fibers in the beam.

Thus while the fibers within the frusto-conically shaped member **45** may be urged into engagement with the inner surface thereof with considerable lateral force under the influence of the suction in chamber **56**, only a comparatively small amount of tension or force is required to slide the fibers downwardly along the inner surface of member **45**.

FIGURES 2 through 4 illustrate the configuration of a material distributing member **24** disposed within the rotor **12** for redirecting the glass or material of the stream **11** being dispersed or distributed laterally of the axis of rotation by centrifugal forces. The member **24** is of generally circular configuration as shown in FIGURE 2 and is fashioned with an upwardly extending sleeve portion **75** which is joined by a suitable means to the rotor **12**. The sleeve portion **75** is joined to a circular flange **76**.

The member **24** is formed with a centrally disposed bottom wall or planar portion **78** preferably of circular configuration, the stream **11** of glass impinging upon the portion **78**. The lower wall configuration surrounding the planar central portion **78** is shaped to provide for the outward discharge of glass on three different horizontal levels so as to effect a substantially equal distribution of the glass along the inner surface of the perforated peripheral wall **18** throughout the vertical dimension of the wall.

As shown in FIGURE 2, the bottom wall portion of the glass distributor is joined to the flange **76** by means of three posts or struts **80** which are preferably peripherally equally spaced and are positioned at the zones of transition of the bottom wall portions to the trilevel distribution zones. With particular reference to FIGURES 2 and 3, the sector-shaped region **82** of the bottom wall is arranged in the same plane as the central portion **78** and is disposed so as to distribute the glass in the form of a band of a

depth equal to approximately one-third of the vertical dimension of the perforated wall **18** as indicated at **84**.

As particularly shown in FIGURE 3, the sector-shaped region **86** of the bottom wall is angularly disposed or slanted upwardly to direct the outwardly moving glass into engagement with the upper third of the vertical dimension of the perforated wall **18** as indicated at **88**.

FIGURE 4 illustrates the third sector-shaped region or portion **90** of the bottom wall angularly disposed and slanted upwardly from the central portion to direct the outwardly moving glass into contact with the central portion of the perforated peripheral wall **18** as indicated at **92** intermediate the zones **84** and **88** of engagement of the glass with the rotor wall. The distributing member **24** is illustrated as being rotatable with the motor **12**, but it is to be understood that the distributor may be rotated independently of the rotor. Through this arrangement the glass or fiber-forming material of the stream **11** is substantially equally distributed over the perforated wall **18** so as to provide an ample supply of glass adjacent all of the orifices **20**.

FIGURES 6 through 10 illustrate an arrangement for carrying on or performing the method of the invention wherein the fibers of the hollow beam are collected in loop formations and the loop of fibers oriented into a strand or sliver. The fiber attenuating method is similar to that carried out by the arrangement shown in FIGURE 1 and includes a rotor **12'** having a peripheral vertical wall **18'** provided with a plurality of orifices **20'** through which molten glass or other material on the interior of the rotor is projected by centrifugal forces of rotation of the rotor forming primary filaments or discrete bodies **21'**.

An annularly-shaped burner **28'** surrounds and is disposed above the rotor **12'**. The burner is provided with a combustion chamber, the lower wall of which is formed with an annular restricted slot or orifice **34'** through which a high velocity blast of burned gases resulting from combustion of a fuel and air mixture in the chamber is discharged into engagement with the primary filaments **21'** attenuating them into fibers **39** which move away from the rotor in a hollow beam formation **37**.

Disposed adjacent the rotor and surrounding the beam of fibers **37** is a hood or enclosure **95** which may be of circular or rectangular cross-section for guiding the fibers toward a collecting means. In this form of the invention, the fibers are collected on transversely spaced linear supports arranged to collect the fibers in a plurality of caternary-like configurations as shown in FIGURE 9. As particularly shown in FIGURES 6 and 7, the fiber collecting arrangement includes a plurality of flexible wires, cords or cables **98** of endless type disposed in transversely spaced relation.

The flexible wires or cables **98** are supported to form an upper flight **100** by means of a group of grooved rollers or sheaves **102** which are mounted upon a transversely arranged shaft **103**, the grooves in the sheaves **102** functioning to maintain the fiber collectors **98** in spaced relation. The cables at the end region of the flight **100** pass around a roller **105** so as to maintain the regions of the cables forming flight **100** substantially in a single plane.

The wires or cables **98** are in constant tension and take over or pass around rolls **106**, one of which may be driven to advance the upper flight **100** of the cables in a right-hand direction as viewed in FIGURE 6. A receptacle **108** is disposed beneath the flight **100** and is in registration with the hood or enclosure **95**, the receptacle forming a chamber **110** connected by means of a tube or pipe **111** with a suction blower or means for establishing reduced pressure in the chamber **110**.

The suction or subatmospheric pressure in chamber **110** assists in the deposition of the fibers upon the cables **98** and conveys away the spent gases of the attenuating blast from the burner **28'** or other gases utilized as an attenuating blast. The fibers formed by the apparatus shown in FIGURE 6 are of varying lengths and a large portion of the fibers are of sufficient length to be disposed astraddle several of the cables **98** and the shorter length fibers supported by the longer fibers in the general orientation illustrated in FIGURE 9.

Means is provided for severing the bight regions of the caternary-like configurations **114** of the collected fibers. With partciular reference to FIGURES 6, 7 and 10, there is provided a transversely extending shaft **116** supporting a sleeve **117** carrying a plurality of hubs **118**, each hub being equipped with a plurality of radially extending bars, rods or knives **120**. As shown in FIGURE 7, the hub and rod assemblies are disposed whereby the blades rotate in regions midway between adjacent cables **98** of the flight **100**.

The hubs **118** are secured upon the sleeve **117** which is fixed upon the shaft **116** whereby all of the hub and rod assemblies are rotated by the shaft driven by any suitable means. It should be noted from FIGURE 2 that the blades or rods **120** are of sufficient length whereby the extremities thereof traverse a path whose upper limit is above the flight **100** so that during rotation of the shaft **116** in a counterclockwise direction as viewed in FIGURE 6, the blades or rods engage the bight regions of the caternary-like configurations **114** and sever the fibers whereby the fibers are suspended by the cables **98** in the upper flight **100** in inverted U-shaped loops as shown in FIGURE 10.

Disposed beneath the assemblies of hubs **118** and blades or rods **120** is a transversely moving conveyor **128** of the endless belt type which is arranged to receive any loose fibers or short fibers which may be dislodged from the caternary configurations **114** during the fiber severing operations and convey such collected fibers to a zone remote from the fiber severing region.

The fibers in inverted U-shaped formations are assembled into a linear bundle, sliver or strand formation. Disposed between the fiber severing rod or blade assemblies and the cable guiding roll **105** is a plate-like member or baffle **130** preferably of curved configuration as shown in FIGURE 6, the upper edge region of which terminates adjacent the zone of engagement of the cables **98** with the roller **105**. The plate or fiber guiding member **130** is adapted to engage the parallel leg regions of the inverted U-shaped fiber groups or loops causing them to approach a horizontal position as viewed in FIGURE 6 or a position in substantial parallelism with the cables **98** of the flight **100**.

Disposed in transversely spaced relation adjacent the roller **105** and in alignment with each of the advancing loops of fibers **124** is a fiber compactor or turbinizer **38'** of the character shown in FIGURE 5. The loop or bight regions of the transversely spaced loops of fibers **124** enter the tubular means of the sliver compacting devices **38'** in advance of the trailing fibers which are smoothed down and compacted in the rotating compactors to form a smooth surfaced sliver **135** in which any loose fibers or projecting fiber ends are wrapped or folded into or licked down into the sliver.

As the interfelted U-shaped fiber groups **124** are disposed substantially uniformly along the upper flights of cables **98**, the groups successively enter the fiber compactor **38'** and in the finished sliver the groups of fibers are arranged in echelon formation in substantially uniform linear spacing. The slivers take over a guide roll **136** and may be wound on sleeves **42'** to form packages, the winding tension assisting in advancing the groups **124** of fibers into the compactor through the frictional interadherence or interfelting of the fibers.

If desired, a lubricant, binder or other coating material may be delivered onto the fibers within the hood or enclosure **95** and a coating on the fibers tends to augment the integration of the fibers into slivers as they enter and move through the tubular members **64'** of the fiber compactors **38**.

By reasons of the formation of the slivers by loops of fibers oriented in echelon relation, a high strength sliver is produced and the fibers are substantially uniformly distributed lengthwise of the sliver with the fibers of the loops in substantially parallel relation. A sliver of this character is admirably suited for formation into threads and yarns for textile purposes by reason of the uniform size and smoothness of the surface.

FIGURE 11 is illustrative of a modified method of fiber attenuation and arrangement for collecting the fibers. FIGURE 11 illustrates a relatively stationary elongated burner **140** provided with a combustion chamber or confined zone in which a combustible mixture supplied through a manifold **142** is completely burned and the product of combustion or burned gases projected as a high velocity blast through an elongated restricted orifice **144**. The gases of the blast are at temperatures well above the softening point or attenuating temperature of glass.

Substantially rigid rods or primary filaments **146** of glass are fed endwise into the blast at regions adjacent the elongated orifice **144**. The intensely hot gases of the blast soften the advancing extremities of the rods and the softened glass attenuates to fibers **150** by the velocity of the gases of the blast.

The fibers **150** are conveyed by the blast onto a plurality of flexible cables or wires **98'** providing a flight **100'** of a fiber collecting and advancing arrangement. The cables **98'** are supported upon rolls **152, 153, 154** and **155**, one or more of which are grooved to hold or maintain the cables **98'** in transversely spaced relation. Any number of cables may be utilized dependent upon the number of transversely arranged groups of fibers to be formed.

A suction chamber **110'** provided by a receptacle **108'** is connected with a suitable source of reduced pressure through a pipe **111'** to assist in collecting the fibers **150** on the cables **98'** in catenary-like shapes as shown in FIGURE 9. In this arrangement the fibers supported in undulated or caternary shape are severed in the bight regions of the catenaries by rotating rods **120'** carried by hubs **118'** as they are advanced in an upwardly inclined direction as shown in FIGURE 11 by the fiber supporting cables **98'**. A curved baffle or blade **130'** serves to direct the catenary-like loops of fibers into a plurality of compactors **38''**, one of which is shown in FIGURE 11, to form slivers.

The loops of fibers may be oriented into a mat. This may be accomplished by collecting the advancing loops of fibers on an endless belt-like conveyor having a collecting region adjacent the cable guiding roll **153** in lieu of the fiber compacting devices **38''**. The fibers of a mat of this character are substantially uniformly distributed lengthwise of the mat and the same is endowed with exceptional strength characteristics in a lengthwise direction by reason of the substantially parallel orientation of the fibers.

FIGURES 12 and 13 illustrate an arrangement or apparatus for carrying out the method of the invention wherein the fibers are collected upon a comparatively narrow belt and the collected fibers advanced into a twisting mechanism for twisting the fibers in a sliver.

As particularly shown in FIGURE 12, a rotor **12''** is adapted to receive a stream of glass or other flowable fiber-forming material, the rotation of the rotor projecting the molten glass through orifices or openings **20''** formed in the rotor wall **18''**.

A burner **28''** supplies an annularly shaped blast of intensely hot burned gases projected through an annularly shaped restricted orifice or slot **34''**, the blast engaging the extruded bodies or primary filaments **21''** and attenuating the same into a hollow beam **37''** of fibers **39''**. The beam **37''** of fibers is delivered into a hood or enclosure **170** having an upper entrance **171** to receive the fibers, the lower region or portion **172** of the hood **170** being shaped to form a rectangular discharge outlet **174** elongated in the direction of movement of a fiber collecting belt **176**.

The upper flight **178** of the belt **176** is advanced in a right-hand direction as viewed in FIGURE 12 by suitable driving means (not shown). The end regions of the upper flight **178** of the fiber collecting belt or element **176** pass over rollers **180** and **181** thence around two group of guide rollers, the rollers of each group being designated **182, 183** and **184**. A major number of the fibers moving through the hood **170** are interrupted and collected upon the flight **178** of belt **176**, the fibers being looped upon and supported by the belt in the manner illustrated in FIGURE 13.

Disposed beneath the conveyor flight **178** is a walled chamber **187** and beneath the chamber is the upper flight **189** of an endless belt conveyor **190** which moves adjacent the region defined by the wall **188**, the conveyor **190** being carried on rolls **192**, one of which is illustrated in FIGURE 12. The conveyor **190** may be driven by means (not shown) connected with one of the supporting rollers. The return flight **185** of the fiber-collecting band **176** is directed exteriorly of the chamber **187** by the groups of guide rollers **183** and **184**.

While the major number of fibers moving through the enclosure **170**, are deposited on the band or belt **176**, some of the fibers pass the flight **178** of the belt and are collected upon the flight **189** of the secondary conveyor and conveyed away for processing into mats or other products.

The fibers deposited upon the flight **178** of the band **176** are oriented generally in superposed loops as indicated at **195** in FIGURE 13. The length of the loops in a substantial measure is influenced by the lengths of the fibers deposited on the belt, and as the fibers are collected on a single band, no severing operation is required to remove the loops from the belt. As shown in FIGURE 12, the loops of fibers **195** conveyed by the flight **178** in a right-hand direction are discharged from the belt at the region of the roller **181** into a twister **197** of conventional construction driven by a belt **198** from a motor (not shown) which imparts a partial twist to the fibers of the sliver or strand **199** which may be collected in a receptacle **200** or the sliver may be wound into a package.

The fiber loops **195** may be directed through a fiber compactor such as that indicated at **38** in FIGURE 1 in addition to the sliver being passed through the twister **198** or, if a plain sliver is desired, the twister **198** is not used. The fibers continuously collected on the band **176** are delivered for formation into a sliver at a uniform rate and hence the sliver formed therefrom is of uniform diameter. The belt **176** may be approximately one inch in width for formation of a satisfactory sliver, but it is to be understood that a belt of any width may be utilized or a series of belts arranged in parallelism may be employed for concomitantly producing several slivers in the manner described.

While combustion burners have been shown herein for producing fiber attenuating blasts of intensely hot products of combustion, other gases under pressure, such as steam or air, may be utilized for attenuating the glass or other material to fibers.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. Apparatus of the character disclosed in combination with means for attenuating fiber-forming material into fibers oriented in a generally cylindrical beam formation, a collector including a linear member disposed in the path of the beam of fibers whereby the fibers are collected astraddle the member, a tubular member, means for rotating the tubular member, and means for moving

the member to deliver the collected fibers into the tubular member whereby the fibers are compacted by the tubular member into a sliver.

2. Apparatus of the character disclosed, in combination, means for establishing a gaseous blast, means for delivering bodies of fiber-forming mineral material into the blast whereby the bodies are attenuated to fibers by the blast, a linear conveyor of comparatively narrow width disposed in the path of the fibers whereby the fibers are collected thereon in U-shaped loops, an element formed with a passage, means for advancing the conveyor to continuously deliver the U-shaped loops into the passage, and means for rotating said element for compacting the U-shaped loops of fibers into a sliver.

3. Apparatus of the character disclosed, in combination, means for establishing a gaseous balst, means for delivering bodies of fiber-forming mineral material into the blast whereby the bodies are attenuated to fibers by the blast, a plurality of transversely spaced linear conveyors disposed in the path of the attenuated fibers whereby the fibers are collected thereon, means engageable with the fibers carried by the conveyors at regions between adjacent conveyors for separating the fibers into groups whereby a group is supported on each of the conveyors, a plurality of tubular members, means for moving the conveyors in directions to deliver the fibers collected on the conveyors into the tubular members to form the individual groups of fibers into slivers.

4. Apparatus of the character disclosed, in combination, a support, a hollow rotor journaled on the support having a wall formed with orifices, means for delivering heat-softened fiber-forming material into the rotor, means for rotating the rotor whereby the material therein is projected by centrifugal forces through the orifices to form discrete bodies, means for directing an annularly-shaped gaseous blast into engagement with the bodies to attenuate the same to fibers oriented in a hollow beam formation, a linear conveyor of comparatively narrow width disposed in the path of the beam of fibers whereby the fibers are collected thereon in U-shaped loops, an element formed with a passage, means for advancing the conveyor to continuously deliver the U-shaped loops into the passage, and means for rotating said element for compacting the U-shaped loops of fibers into a sliver.

5. Apparatus of the character disclosed, in combination, a support, a hollow rotor journaled on the support having a wall formed with orifices, means for delivering heat-softened fiber-forming material into the rotor, means for rotating the rotor whereby the material therein is projected by centrifugal forces through the orifices to form discrete bodies, means for directing a gaseous blast into engagement with the bodies to attenuate the same to fibers oriented in a hollow beam formation, a plurality of linear conveyors disposed in the path of the hollow beam of fibers whereby the fibers are collected thereon, means engageable with the fibers on the conveyors at regions between adjacent conveyors for separating the fibers into individual groups, a plurality of tubular members, means for moving the conveyors in directions to deliver the fibers collected on the conveyors into the tubular members to form the individual groups of fibers into slivers, and means for rotating the tubular members to smooth the sliver.

6. Apparatus of the character disclosed, in combination, means for establishing a gaseous blast, means for delivering bodies of fiber-forming mineral material into the blast whereby the bodies are attenuated by the blast to fibers of varying lengths, a flexible cable disposed in the path of movement of the fibers whereby the fibers are collected in loops astraddle the flexible cable, and means for assembling the loops of fibers into a linear bundle.

7. Apparatus of the character disclosed, in combination, means for establishing a gaseous blast, means for delivering bodies of fiber-forming mineral material into the blast whereby the bodies are attenuated by the blast to fibers, a plurality of transversely-spaced linear conveyors disposed in the path of movement of the fibers away from the attenuating blast whereby the fibers are collected on the conveyors, and rotatable means engageable with the fibers on the conveyors at regions between adjacent conveyors for severing the fibers into individual groups.

8. Apparatus for collecting fibers for use with means for attenuating heat-softened fiber-forming material into fibers by a gaseous attenuating blast including, in combination, a walled fiber-receiving hood having an entrance shaped to receive the fibers and the gases of the attenuating blast, the walls of the hood at the exit end thereof providing an elongated narrow fiber discharge opening, and a fiber-receiving conveyor of a width less than the width of discharge opening of the hood disposed at the discharge opening and movable in the direction of the length of the opening to convey the collected fibers away from the hood.

9. Apparatus for collecting fibers for use with means for attenuating heat-softened fiber-forming material into fibers by a gaseous attenuating blast including, in combination, a walled fiber-receiving hood having an entrance shaped to receive the fibers and the gases of the attenuating blast, the walls of the hood at the exit end thereof providing an elongated narrow fiber discharge opening, a narrow endless band of a width less than the width of discharge opening of the hood, a flight of said band being disposed adjacent the discharge opening and movable lengthwise of said discharge opening and in the path of the attenuated fibers whereby the fibers are collected on the band in U-shaped loops, said band being continuously movable to convey the collected fibers away from the hood.

10. Apparatus for collecting fibers for use with means for attenuating heat-softened fiber-forming material into fibers by a gaseous attenuating blast including, in combination, a walled fiber-receiving hood having an entrance shaped to receive the fibers and the gases of the attenuating blast, the walls of the hood at the exit end providing an elongated narrow fiber discharge opening, a narrow endless band of a width less than the width of discharge opening of the hood, a flight of said band being disposed adjacent the discharge opening and movable lengthwise of said discharge opening and in the path of the attenuated fibers whereby the fibers are collected on the band in U-shaped loops, and a rotatable fiber compacting means, said band being arranged to convey the collected fibers to the fiber compacting means.

References Cited by the Examiner

UNITED STATES PATENTS

2,361,309	10/1944	Miller	19—150
2,431,205	11/1947	Slayter	65—15
2,468,827	5/1949	Kennedy et al.	19—150 X
2,799,898	7/1957	Roncin	19—12

DONALL H. SYLVESTER, *Primary Examiner.*