Oct. 30, 1962 G. SLAYTER 3,060,674

METHOD FOR PRODUCING GLASS ROVING

Filed Dec. 19, 1957 2 Sheets-Sheet 1

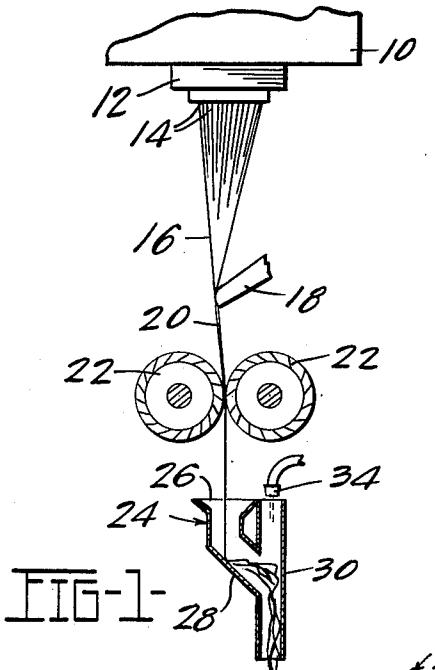


FIG-1-

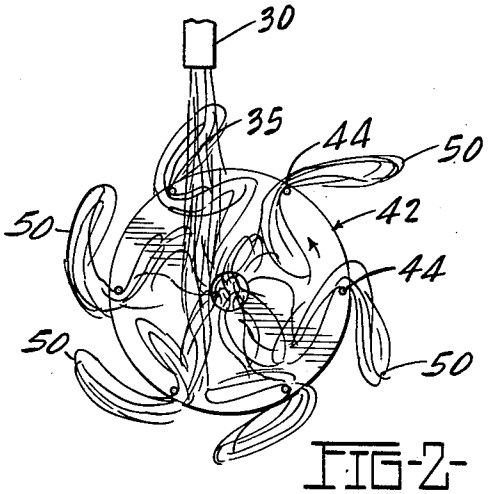


FIG-2-

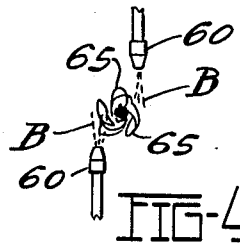


FIG-4-

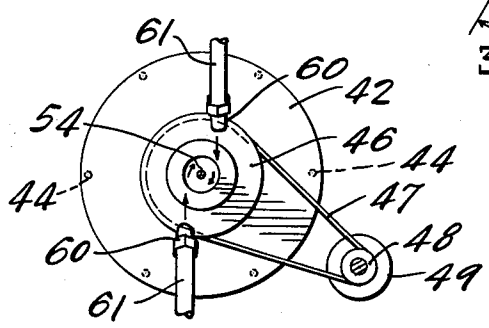


FIG-3-

INVENTOR:
GAMES SLAYTER.
BY Starkweather & Overman
ATTORNEYS.

Oct. 30, 1962 G. SLAYTER 3,060,674

METHOD FOR PRODUCING GLASS ROVING

Filed Dec. 19, 1957 2 Sheets-Sheet 2

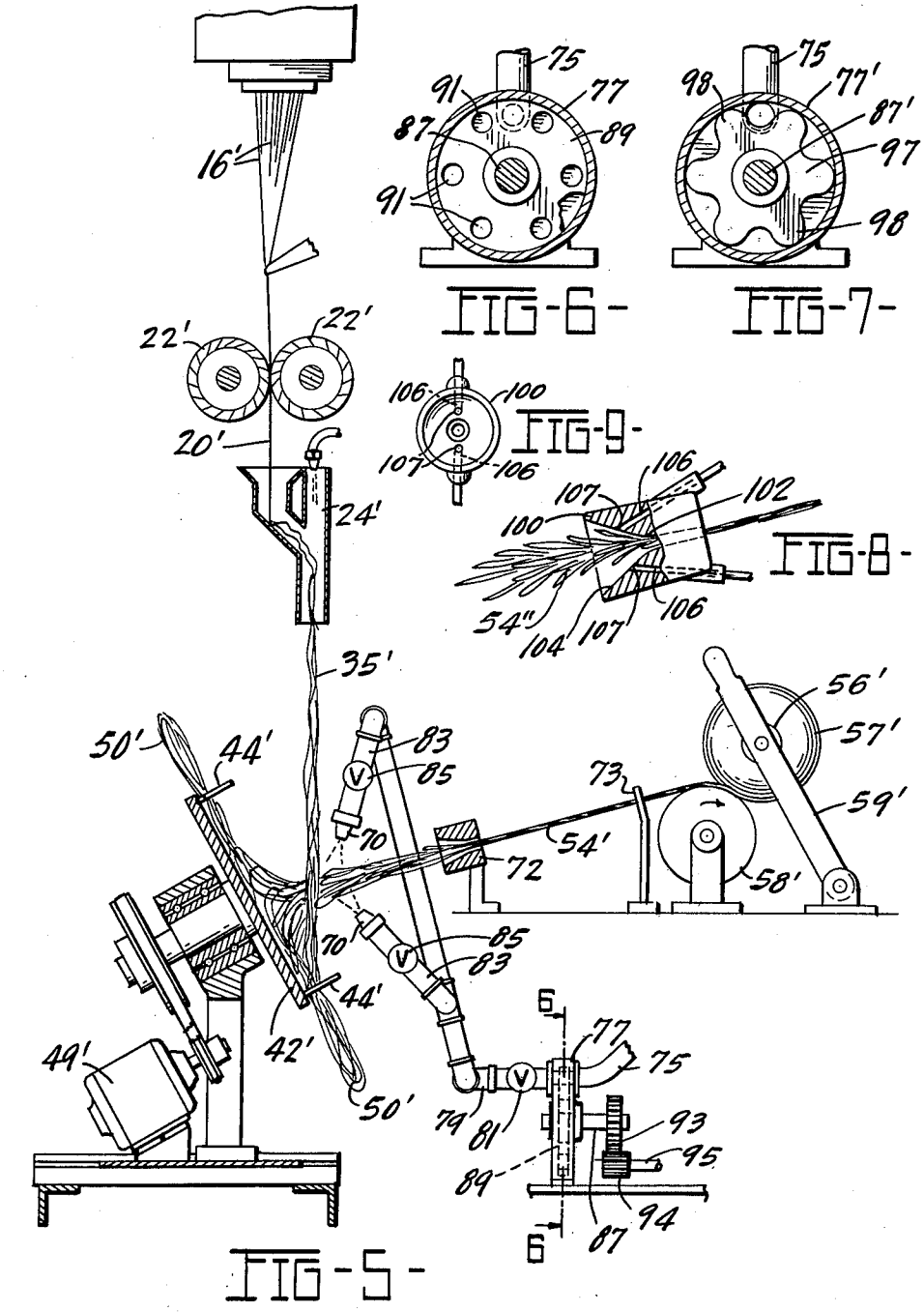


FIG-5-

FIG-6-

FIG-7-

FIG-9-

FIG-8-

INVENTOR:
GAMES SLAYTER.
BY Hackin & Overman
ATTORNEYS.

United States Patent Office 3,060,674 Patented Oct. 30, 1962

3,060,674

METHOD FOR PRODUCING GLASS ROVING

Games Slayter, Newark, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Filed Dec. 19, 1957, Ser. No. 703,819
6 Claims. (Cl. 57—157)

This invention relates to a method of and apparatus for producing roving wherein filaments or strand of filaments are arranged in overlapping loops intermatted and intertwisted to form a product having a high bulk factor and high tensile strength.

Roving has been manufactured wherein loops of continuous filament strand are gathered to form a linear body wherein the loops in the roving are arranged in overlapping relation lengthwise of the roving. In the methods heretofore employed the loops of strand acquire a twist to intermat or intertwist the loops together in the formation of the ultimate product. In the roving heretofore produced, the loops of the roving at the outer surface are not twisted into the core of the roving but remain as loose loops of strand in a substantially free condition resulting in a product that is rough and nonuniform and of comparatively low tensile strength.

The present invention embraces a method of producing a roving of overlapping loops of filaments wherein forces are applied to the roving during its formation for folding or twisting the loops into the core of the roving to reduce or substantially eliminate the loose loops at the surface region of the roving.

An object of the invention is the provision of a method of forming a roving preferably of multifilaments of heat-softenable mineral materials, such as glass filaments, wherein a strand or bundle of filaments is subjected to forces adapted to filamentize or loosen the filaments of the strand while maintaining the filaments in a generally linear mass, and applying forces to the linear mass of loose or individualized filaments to form successive loops gathered into a roving and twisting all of the loops to integrate the loops, resulting in a roving of substantially uniform characteristics having a high bulk factor and high tensile strength.

Another object of the invention resides in a method of forming continuous roving involving collecting a linear group of filaments in overlapping loops and subjecting the assembly of overlapping loops to air blasts or fluid streams directed or applied to the linear bundle of overlapping loops so as to fold in, intertwist or intermat the outer loops into the core of the roving providing a more uniform surface and substantially eliminating loose loops in the roving.

Another object of the invention resides in a method of forming roving of loops of strand which loops acquire a degree of twist in the loop collecting operation and applying additional twisting forces directed generally toward the exterior surface regions of the roving to more effectively twist the outermost loops into the core of the roving.

Another object of the invention resides in a method of applying blasts of air or fluid in angular directions impinging the outer surface regions of a roving formed of successive overlapping loops of strand for integrating the loops more firmly in the roving.

A further object of the invention is the provision of an apparatus adapted to form roving of overlapping loops of strand embodying means for twisting or integrating the overlapping loops into a compact roving.

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 structures, 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 diagrammatic view of an apparatus or arrangement for performing the steps of the method of the invention;

FIGURE 2 is a view taken on the line 2—2 of FIGURE 1 particularly illustrating the loop forming step in the method;

FIGURE 3 is a view taken substantially on the line 3—3 of FIGURE 1 particularly illustrating an arrangement for folding in or twisting surface loops into the core of the roving;

FIGURE 4 is a schematic view illustrating the action of the twisting forces applied to the roving;

FIGURE 5 is a diagrammatic view illustrating a modification of steps in the methods;

FIGURE 6 is a detail sectional view taken substantially on the line 6—6 of FIGURE 5;

FIGURE 7 is a view of a modified form of the construction shown in FIGURE 6;

FIGURE 8 is an elevational view partly in section of a roving guiding means embodying an arrangement for twisting loops of filaments into the roving, and

FIGURE 9 is an end view of the arrangement shown in FIGURE 8.

While the method and apparatus of the invention are particularly adaptable for forming and processing roving or a roving-like product of filaments attenuated from heat-softened glass, it is to be understood that the invention may be utilized in forming and processing roving of fibers or filaments formed from other heat-softenable mineral materials or resins.

Referring initially to FIGURES 1 through 3, there is illustrated an apparatus particularly adapted for forming and processing roving from continuous fibers or filaments of glass. In FIGURE 1 there is shown diagrammatically a conventional filament-forming arrangement which may include a forehearth or receptacle **10** adapted to contain a supply of heat-softened glass and a bushing or feeder **12** formed with orifices through which streams **14** of glass flow to form filaments or fibers **16**.

The continuous fibers or filaments **16** are collected together in strand, sliver or linear bundle formation **20** by means of a guide member or gathering eye **18**.

The strand or bundle **20** is directed downwardly between the adjacent peripheries of a pair of high speed pulling wheels **22** or other means for attenuating the streams into filaments or fibers. The pulling wheels **22** apply tractive force to the linear group of fibers or filaments which attenuates the glass streams at a high linear speed of ten thousand or more feet per minute.

The strand or bundle of filaments **20** may be delivered to a device **24** at which forces may be applied to loosen or individualize the continuous filaments or fibers of the strand so as to provide a bulk factor in the roving to be formed from the strand. In the embodiment illustrated in FIGURE 1, the strand **20** enters the mouth **26** of the device or means **24** and impinges upon a member or surface **28** arranged at an angle oblique to the direction of travel of the strand **20**.

The impingement of the strand on the surface **28** tends to break-up, separate or individualize to some extent the filaments of the strand and the filaments are deflected laterally as shown in FIGURE 1 into a tubular means **30** forming a component of the device **24**. A gas stream or blast, such as a stream or jet of compressed air, is delivered by a nozzle **34** into the tube at its upper end, the force of the blast of air or other fluid further separating or individualizing the filaments of the strand and caus-

ing them to move in undulating generally vertical paths through the tube 30 as a bundle or strand 35 of loosened filaments.

The linear group of loose filaments is delivered to a rotating means shaped to form the linear group 35 into successive loops. As shown in FIGURE 1, the rotatable means is inclusive of a tubular hub or hollow shaft 38 journalled in bearings 39 mounted in a support 40. Secured to the tubular hub 38 is a spinner plate or member 42 provided at its peripheral region with a plurality of circumferentially spaced projections or pins 44 which preferably extend in directions parallel to the axis of rotation of the plate or spinner 42. The hub or tube 38 is equipped with a pulley 46 driven by a belt 47 from a pulley 48 rotated by a motor 49.

During rotation of the spinner or rotor 42, the pegs or pins 44 are successively swung across the path of projection of the linear bundle or group 35 of individualized filaments so that the group is successively engaged by each of the pegs 44 causing the linear group to be formed into successive loops 50 which are carried or rotated with the pegs 44 on which they are collected. By regulating the speed of rotation of the spinner 42 with respect to the linear speed of the filament group 35, the degree of "doubling up" of the linear group on the pegs 44 can be accurately controlled.

At the start of rotation of the spinner 42, the operator directs the group of filaments 35 through the tubular hub 38 and the roving 54 formed from the loops of filament is collected upon a drum or spool 56. The linear rate of withdrawal of the overlapping loops of filaments through the hub 38 is many times less than the linear speed at which the filament group is deposited upon the pegs 44.

Through this method, the loops 50 are continuously withdrawn through the hub 38 in overlapping echelon or staggered relation and the loops are twisted into a roving by reason of the rotation of the spinner 42.

Under the twisting action set up by the rotation of the spinner, the major portions of the overlapping loops are twisted together. The roving 54 is drawn from the spinner by means by a roll 58 engaging the periphery of the collected roving on the mandrel or spool 56, the roll 58 being driven by suitable means (not shown). The collecting roll 56 for the roving is supported upon a pivotally mounted frame 59 and is driven by roll 58 at a peripheral speed which is proportional to the linear speed of the filament group 35 by a factor equal to the "doubling up" of the loops 50 whereby the roving so formed comprises a desired number of generally parallel loops in lengthwise overlapping relation twisted together.

Rotation of the spinner 42 projects the loops 50 outwardly distributing the filament group 35 over the entire surface of the spinner or plate 42 and, as the loop are withdrawn through the hub 38, twists the loops together so that the roving 54 is endowed with a true twist. The degree of twist of the roving is dependent upon the differential in the speed of rotation of the spinner 42 and the linear speed of the roving 54.

It has been found that due to centrifugal forces and the fact that the roving is formed of successive overlapping loops, the bight portions of the outer loops are not completely twisted into the core of the roving.

Hence the loose loops render the surface of the roving nonuniform and impair the linear strength of the roving. The present invention is inclusive of a method of applying additional forces to the surface region of the roving in order to fold in or twist the closed ends of the loops into the roving whereby the strength characteristics of the roving are greatly improved, the cross-sectional cnnfiguration made more uniform and the surface rendered more smooth.

In the method exemplified in FIGURES 1 through 4, this step is carried out or performed by applying blasts or jets B of fluid, such as air or other gas, into engagement with the loose loop portions at the surface of the roving as the roving advances from the tubular hub 38. As shown in FIGURES 1, 3 and 4, nozzles 60 are positioned at generally opposite sides of the roving, each connected by tube 61 with a source of compressed air or other fluid under pressure.

The nozzles 60 are provided with orifices arranged to discharge blasts or streams B of air or other gas in angular converging directions in which the the nozzles are arranged at acute angles with respect to the direction of withdrawal of the roving from the spinner 42. As shown in FIGURE 3, the respective axes of the nozzles 60 are arranged in parallel planes and the trajectories of the blasts from the nozzles form an X pattern, the blasts being directed in brushing relation with the surface regions of the roving so as to engage any loose loop portions that are not folded into the roving by the twisting influence of the rotating spinner 42.

Thus, the forces of the air blasts or jets of fluid from the nozzles 60 fold in, twist or intermesh any loose portions 65 of the filament loops into the core or body of the roving as indicated in FIGURE 4. By applying additional twisting forces through the medium of the air blasts or fluid jets, the loose loops are twisted or integrated into the final roving so that the same is of uniform cross-section with a smooth surface and has improved strength characteristics.

FIGURE 5 illustrates a modified arrangement for performing the method of the invention. In this arrangement the filaments 16' are attenuated from glass streams by pulling wheels 22' and the strand 20' delivered into a filament separating device 24'. The linear group 35' of separated filaments is delivered onto the surface of the spinner 42' which is provided with the pegs or projections 44'. The spinner 42' is driven by a motor 49' through a belt and pulley arrangement.

Under the influence of rotation of the spinner 42', the loops 50' of the filament group 35' are formed by engagement of the pegs 44' with the filament group 35'. In this form, the loops 50' are withdrawn from the surface of the spinner forwardly of the pegs 44' from the central or axial region of the spinner. The loops 50' forming the roving are arranged in substantial parallelism and in staggered overlapping relation in substantially the same form as the roving produced by the apparatus shown in FIGURE 1. The rotation of the spinner 42' twists the loops as they are withdrawn from the spinner to form the roving.

The arrangement shown in FIGURE 5 includes means for directing jets or blasts of fluid, such as compressed air through suitable orifices of nozzles 70 in brushing relation with the surface regions of the roving to twist or fold in any loose portions or trailing bight portions of the overlapping loops of filaments into the body or core of the roving 54'. The nozzles 70 are preferably disposed to direct blasts in converging directions in crossing relation and the roving 54' moves through the crossing zone of the blasts, the latter straddling the roving in the same manner as indicated in FIGURE 4.

The newly formed roving moves in a generally rectilinear path away from the axial or central region of the rotatable member 42' and is guided by a suitable bushing 72 and a guide eye 73. The roving 54' engages the peripery of a driven roll 58' and is collected upon a mandrel or spool 56' forming a package 57'. The collecting means 56' is journalled upon a pivotally mounted frame 59' to accommodate the enlargement of the package 57' as the roving accumulates on the roll 56'. Traction is imparted to the roving through rotation of the roll 58' providing the means for continuously withdrawing the loops of strand or linear bundle of filaments from the member 42' to form the roving.

In the formation of the roving through the use of the apparatus illustrated in FIGURE 5 the successive loops of the strand or linear bundle of filaments may be readily

withdrawn from an axial or central region of the member 42' at which the strand is substantially unaffected by centrifugal forces.

The centrifugal forces function to maintain the successive loops 50' and the intermediate portions of the strand connecting the loops in a plane parallel to the plane of rotation of member 42' and hence such forces resist withdrawal of the strand except at the central or axial region.

The blasts of air or other fluid from the nozzles 70 may be continuous or they may be intermittent. FIGURES 5 and 6 illustrate a means providing intermittent blasts for engagement with the surface regions of the roving as it is formed. A pipe or tube 75 is adapted to be connected with a supply of compressed air, the tube being connected with a circular disk-like housing or casing 77 at a region adjacent the periphery of the casing 77. Aligned with tube 75 is a second tube or manifold 79 which supplies compressed air to both of the nozzles 70.

Valve means 81 may be provided connected with the tube 79 to regulate the compressed air supplied to both nozzles. Each of the tubes 83, which supply the nozzles with compressed air from the manifold tube 79, may be provided with a valve 85 for individually regulating the blast from each of the nozzles. Journally supported at the axial region of the casing 77 is a shaft 87 and mounted upon the shaft and disposed within the casing 77 is a valve means in the form of a rotatable plate or disk 89 formed with circumferentially spaced openings or ports 91 as particularly shown in FIGURE 6.

The shaft 87 may be driven by suitable means such as a gear 93 enmeshed with a pinion 94 mounted upon a shaft 95 driven by a motor or other suitable means (not shown) for rotating the disk 89 at the desired speed. During rotation of the disk 89, the ports or openings 91 therein are moved into successive registration with the passages provided by the tubes 75 and 79 whereby during the registration of each opening with the tubes, compressed air is delivered to the nozzles 70, and the blast interrupted when an unperforated portion of the disk 89 blocks the flow of compressed air from tube 75 to the manifold tube 79.

Through continuous rotation of the disk 89 intermittent blasts are projected from the orifices or nozzles 70 and serve to twist or fold in any loose loops at the outermost regions of the roving being formed. The blasts may be made continuous by supplying compressed air or fluid under pressure directly to the manifold tube 79 without utilizing the rotary valve means provided by the perforated disk 89.

FIGURE 7 is illustrative of a modified form of valve means for intermittently blocking the flow of compressed air to the nozzles. In this form the shaft 87' journalled on the casing 77' is equipped with a generally star-shaped rotor or valve member 97, the radial projections 98 of which form valve or blocking means for interrupting flow of compressed air through the passage provided by the tubes 75 and 79 when the projections 98 are moved successively into registration with the tube passages. The rotor or valve member 97 may be rotated in the same manner as illustrated in FIGURE 5.

While the ports 91 formed in the valve member 89 shown in FIGURE 6 and the projections 98 formed on the rotor 97 shown in FIGURE 7 are uniformly circumferentially spaced, it is to be understood that the ports 91 or the projections 98 may be irregularly spaced if it is desired to provide blasts at irregular intervals.

FIGURES 8 and 9 illustrate a modified arrangement for directing blasts of compressed air or other fluid under pressure into engagement with the roving for folding or twisting loose loops into the core of the roving. This arrangement is inclusive of a guide member or fitting 100 formed with a tapered passage 102 preferably provided with a flared entrance or mouth 104 which receives the newly formed roving of overlapping loops from the spinner. The member 100 may be disposed adjacent the

central region of the rotating member upon which the loops of strand are formed.

The member 100 is formed with convergently arranged passages 106 having outlets or orifices 107 for directing blasts or jets of air in generally convergent directions into contact or engagement with the surface regions of the strand 54'' for folding or twisting in loose loops of strand into the roving. As shown in FIGURE 9, the blasts may be directed in a common plane in contact with regions of the strand in the plane of the blasts. It is to be understood that the passages 106 in the fitting or member 100 may be arranged to direct the blasts from the orifices 107 in crossing or X-like relation of the character illustrated in FIGURE 4 and in brushing relation with the surface regions of the roving for folding in loose loops.

It is to be understood that the strand may be processed to form a roving without opening the strand by omitting the use of the filamentizing or filament separating devices 24 or 24' where a close filament strand roving of less bulk is desired.

While the method of the invention is especially suitable for processing strands or bundles of filaments formed of mineral materials, such as glass, slag or fusible rock, it is to be understood that the method of the invention may be utilized in processing strands of filaments formed of resins or natural fibers into roving.

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. A method for forming a roving from continuous filaments including the steps of advancing a linear bundle of filaments in a defined path, subjecting the linear bundle to forces to loosen the filaments in the bundle, diverting spaced portions of the linear bundle of loosened filaments into a circular path while feeding the linear bundle between the spaced portions thereby to form successive connected loops of loose filaments, concomitantly and successively drawing the loops away from the circular path while rotating the bundle of loops of filaments to form a twisted roving of the loops of filaments, and applying blasts of gas in brushing engagement with the surface regions of the rotating roving to fold loose outer loops of filaments into the core of the roving.

2. A method for forming a roving from continuous filaments including the steps of continuously advancing a linear bundle of filaments, impinging the linear bundle against a surface to loosen the filaments in the bundle, directing the bundle of loosened filaments along a linear path, diverting spaced portions of the bundle into a circular path while feeding the bundle between the spaced portions thereby to form connected loops in the linear bundle of loosened filaments, continuously drawing the loops radially inwardly and along a second linear path substantially normal to the circular path and rotating the bundle of loops of filaments to form a twisted roving of the loops of filaments arranged in overlapping relation, and applying blasts of gas in angular directions in brushing relation with the surface regions of the roving to fold in loose loops of filaments into the core of the roving.

3. A method of forming roving from continuous filaments including feeding a linear bundle of filaments in a linear path, subjecting the linear bundle to forces to loosen the filaments in the bundle, diverting spaced portions of the bundle of loosened filaments into a circular path while feeding the bundle between such spaced portions thereby forming connected loops in the bundle and progressively and concomitantly moving the loops along a second linear path away from the circular path and rotating the bundle of loops of filaments forming a twisted roving in which the loops are arranged in overlapping echelon relation, and intermittently engaging gaseous blasts in brushing

relation with the surface regions of the rotating roving to twist loose loops into the core of the roving.

4. A method for forming a roving from continuous filaments including the steps of advancing a linear bundle of filaments, impinging the linear bundle against a surface to loosen the filaments in a bundle, engaging the bundle of loosened filaments with a gaseous blast to convey the bundle of loosened filaments along a linear path, diverting spaced portions of the bundle into a circular path while feeding the bundle between the spaced portions thereby to form connected loops of loosened filaments, concomitantly and successively drawing the loops away from the circular path in overlapping relation and rotating the bundle of loops of filaments to form a twisted roving, and directing streams of gas in engaging relation with loops of loose filaments at the exterior surface regions of the roving to twist such loops of loose filaments into the rotating roving.

5. A method of forming roving from continuous filaments including feeding a linear bundle of filaments in a linear path, subjecting the linear bundle to forces to loosen the filaments in the bundle, diverting spaced portions of the bundle of loosened filaments into a circular path while feeding the bundle between such spaced portions thereby forming connected loops in the bundle and progressively and concomitantly moving the loops along a second linear path away from the circular path and rotating the bundle of loops of filaments forming a twisted roving in which the loops are arranged in overlapping echelon relation, establishing gaseous blasts moving in

side-by-side relation in angularly related paths, and drawing the rotating roving between and in engagement with the blasts whereby the forces of the blasts fold loose loops of filaments into the core of the roving.

6. A method for forming a roving from continuous filaments including the steps of advancing a linear bundle of filaments, impinging the linear bundle against a surface to loosen the filaments in the bundle, diverting spaced portions of the linear bundle of loosened filaments into a circular path while feeding the linear bundle between the spaced portions thereby to form successive connected loops of loose filaments, concomitantly and successively drawing the loops away from the circular path while rotating the bundle of loops of filaments to form a twisted roving of the loops of filaments, and applying blasts of gas in brushing engagement with the surface regions of the rotating roving to fold loose outer loops of filaments into the core of the roving.

References Cited in the file of this patent

UNITED STATES PATENTS

984,195	Cooper	Feb. 14, 1911
2,302,790	Modigliani	Nov. 24, 1942
2,356,518	Heberlin	Aug. 22, 1944
2,361,999	Frey	Nov. 7, 1944
2,453,802	Maxham	Nov. 16, 1948
2,515,299	Foster et al.	July 18, 1950
2,598,185	Maxham	May 27, 1952
2,719,352	Slayter et al.	Oct. 4, 1955
2,869,967	Breen	Jan. 20, 1959