May 3, 1966 J. M. CURRENT 3,249,312

METHOD AND APPARATUS FOR WINDING STRAND MATERIAL

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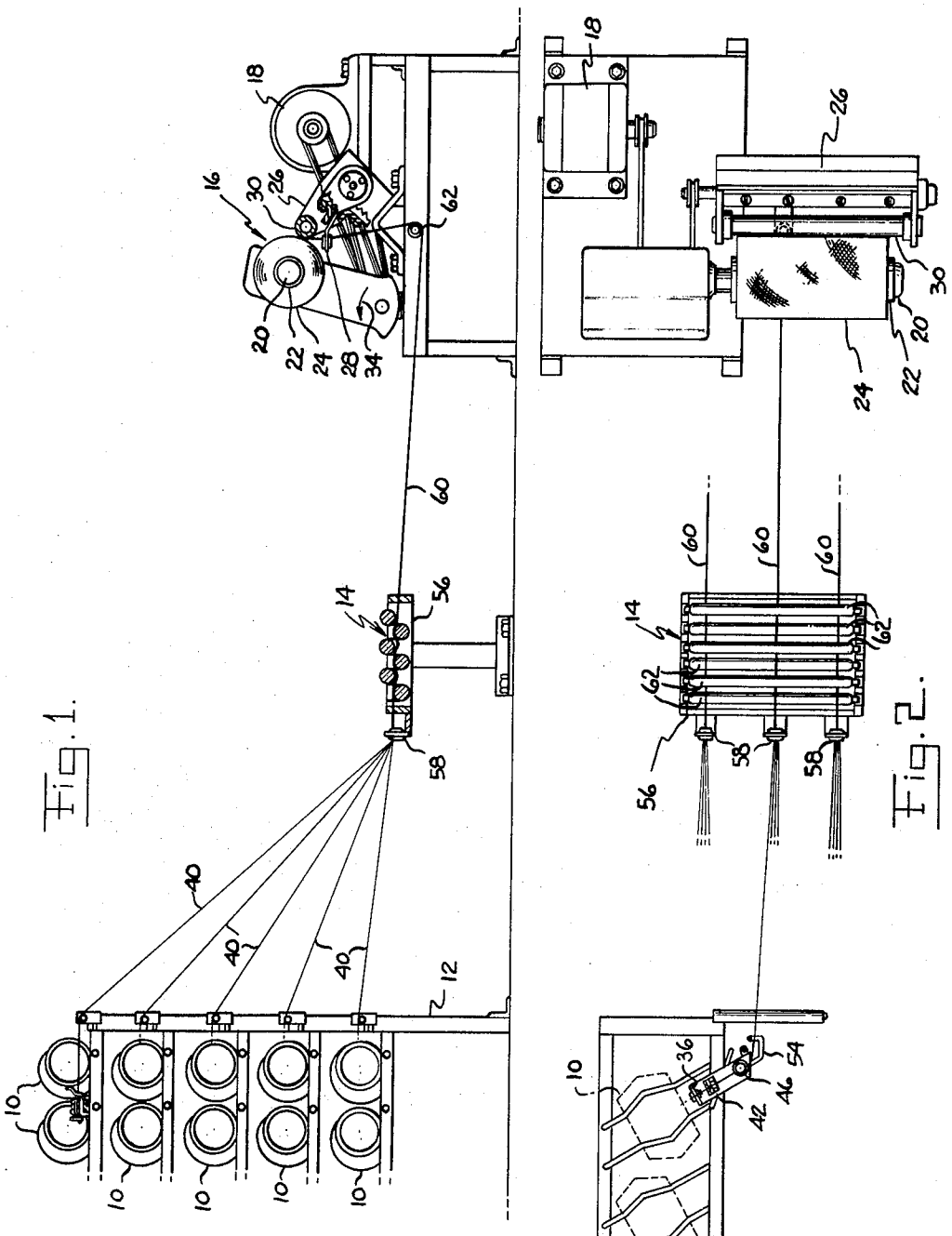


Fig. 1.

Fig. 2.

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Fig. 3.

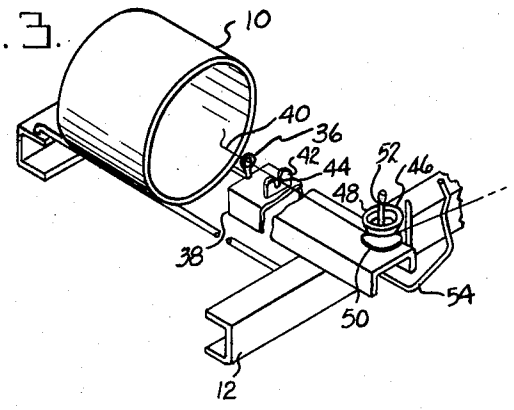
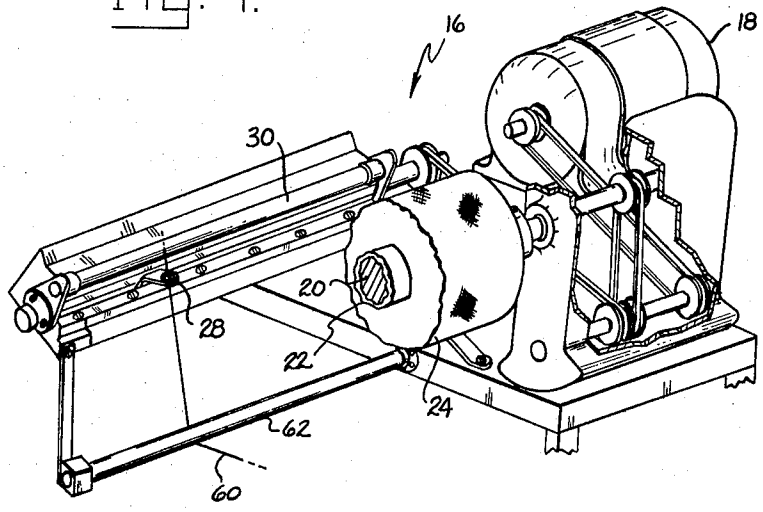
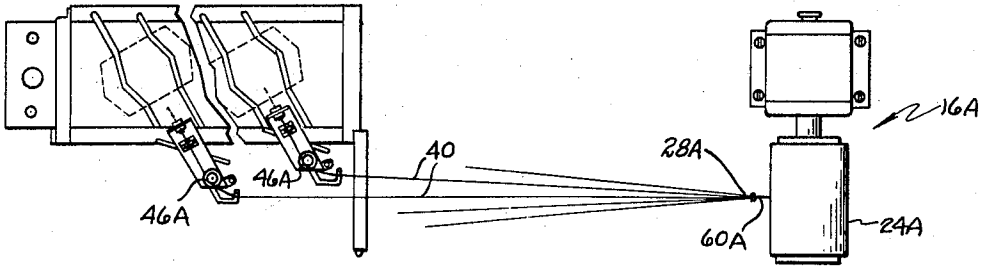


Fig. 4.





PRIOR ART

Fig. 5.

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Fig. 6.

PRIOR ART

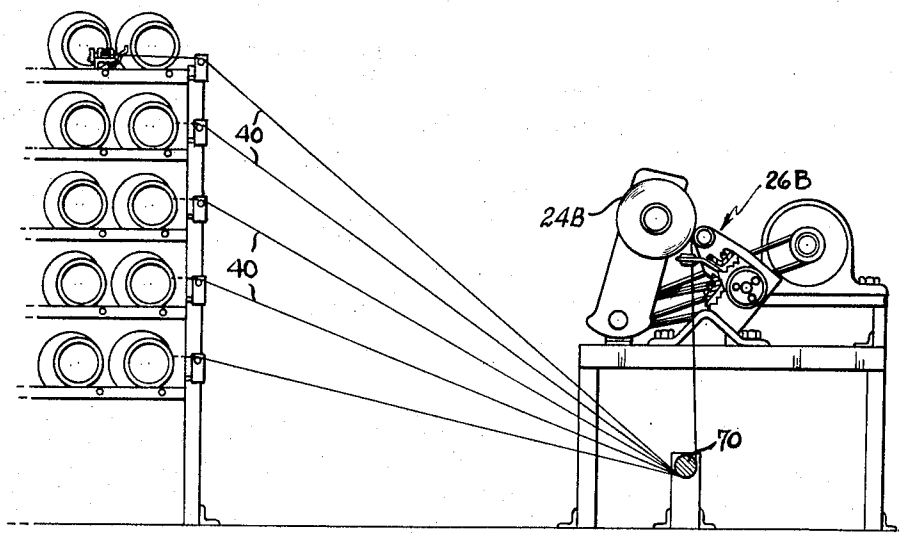
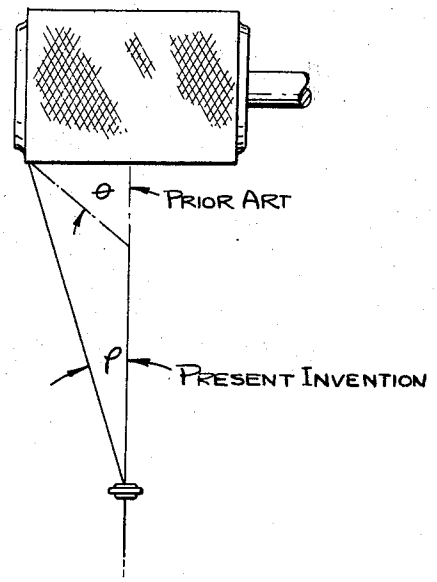


Fig. 7.



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METHOD AND APPARATUS FOR WINDING STRAND MATERIAL

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5 Claims. (Cl. 242—42)

This invention relates to strand winding apparatus and particularly to the production of wound packages wherein a plurality of strands from individual primary packages are wound together to form a roving or secondary package. More particularly, this invention relates to the production of roving packages whereby the formation of loops, catenaries, and other usually attendant problems are minimized.

A roving as defined in the glass fiber art comprises a plurality of untwisted continuous glass strands, each containing a multiplicity of continuous glass fibers, wherein the strands are arranged in parallel contacting relation as a single large strand.

In the glass fiber industry, there is frequently need to wind off definite predetermined yardage from primary packages of strand to form rovings or secondary packages of predetermined lengths and having no loops, catenaries, ridges and wherein the individual strands are maintained under the same even tension. It is with these difficulties that this invention is primarily concerned and which it seeks to obviate. The occurrence of any of these will reduce the quality of the secondary package and may also interfere with or disrupt subsequent production operations.

It is the usual practice in conjunction with conventional roving winding procedures to gather or converge a plurality of strands at a point which is relatively close, usually in the order of 30 inches, to the traverse guide which traverses the strand across the face of the package being formed. Thus with a package of a given width, the distance from the center of the package to a terminal end thereof represents a relatively large angular deviation, as measured from the converging point about which the roving pivots, and a corresponding deviation in roving tension.

It has also been the usual practice to apply tension to the individual strands only as they are unwound from their respective primary packages. It is thus most difficult, if not impossible, to attain uniform tension among the several strands comprising a roving. This is due, at least partially, to the fact that the strand packages are, of necessity, placed at different distances from the converging point. As the distance between the support points of a strand increases, there is an increased tendency for the strand to sag or form a catenary.

It is an object of this invention to provide method and apparatus for producing roving packages of uniform quality.

It is another object to provide method and apparatus for rewinding strand material without the attendant disadvantages referred to above.

It is a further object to provide method and apparatus for winding roving packages wherein the individual strands comprising a roving are wound at substantially the same uniform tension.

It is a still further object to provide method and apparatus for winding a roving package wherein the roving tension differential across the face of the package of minimized.

It has been found that the above objectives may be attained by the provision of a tension device which applies tension to the roving collectively, rather than to the individual strands only, and by the provision of a compensator bar adjacent to the secondary package being formed and in conjunction with a pivoting point which is relatively removed a considerable distance from the secondary package.

A preferred embodiment of the apparatus of this invention is adapted for use in conjunction with winding equipment for winding a roving or secondary package from a plurality of strand packages. In accordance with the preferred embodiment of the invention, a plurality of strands are withdrawn from the interiors of their respective primary strand packages through corresponding detection devices, which sense the absence and/or reduced-tension of a strand. The individual strands are advanced to a tension applying device which applies tension to the strands after they have been converged into a roving. A guide eye mounted a short distance behind, or upstream, of the tension applying device serves as the converger and pivot point for the resulting roving. A series of bars, preferably round in cross section, form the roving tension applying device. Depending upon the desired degree of tension, the roving as it passes from the converger is woven through two or more of a series of bars comprising the tension device. From the tension device, the roving is advanced to a compensator bar positioned subjacent to the winding spindle. The compensator bar is also parallel to the winding spindle and to the roller bail and is preferably set 2 to 10 inches, most preferably 5¾ inches, from the roller bail. The function of the compensator bar is to facilitate the changing of direction of the roving about a line transverse to the normal linear path and with slidable movement therealong without interfering with the pivotal movement of the strand about the converging point.

Further objects and advantages of this invention may appear from the following description of prior art devices and of preferred species of this invention and from the accompanying drawings.

FIG. 1 is a front elevational view of the apparatus of this invention which may comprise a primary supply section, a roving tension section; and a winding section;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged isometric view disclosing the details of "take-off" mechanism in conjunction with an individual primary strand package, which mechanism may optionally include a strand tension device;

FIG. 4 is a perspective view, partially broken away, of the secondary package, traverser, and compensating bar of the winding section;

FIG. 5 is a plan view of a prior art arrangement of winding apparatus for winding secondary strand packages wherein the traverser forms the eye for gathering the individual strands into a roving;

FIG. 6 is an elevational view of the winding section of another prior art winding apparatus, wherein the pivot point for the strands being traversed is positioned beneath but relatively close to the traverser of the winder; and

FIG. 7 is a schematic comparative representation of the angle of traverse of the apparatus shown in FIGS. 1 and 2 with the angle of traverse of the apparatus shown in FIG. 6.

Referring to FIG. 1, a plurality of primary strand packages **10** are suitably supported by a rack or creel **12**. Rack **12** supports banks of packages **10** and forms the primary supply section for providing strand material to the tension device **14** and subsequently to the winding section **16**.

The strand winding section **16** includes a power source such as motor **18** operatively associated with spindle **20** upon which is mounted, for rotation therewith, winding tube **22**. The winding tube **22** forms the core for the

secondary package 24 being newly formed. Although only one motor 18, spindle 20 and tube 22 are shown, it is to be understood that sufficient tubes 22, spindles 20 and cooperating driving means may be provided to correspond in number to the number of strand packages desired to be formed.

Associated with each winding spindle 20 is a traverser 26, which is illustrated as being in the form of a guide eye 28 reciprocable in a linear path parallel to the axis of rotation of the spindle 20 and to the face of the package 24 being formed. In conjunction with the spindle 20, there is also illustrated a roller bail 30, which bail 30 serves to maintain the outer periphery 32 of the package 24 at a fixed distance from traverser 26 by urging the package 24 as it builds up away from the traverser 26 in a path designated by the arrow 34.

As may be more clearly viewed in FIG. 3 there is preferably associated with each package 10 a guide eye 36 suitably secured to support member 38 and adapted to receive the strand 40, shown to be extending from the interior of package 10. From the guide eye 36 the strand 40 may be advanced through gob stop 42. Stop 42 is provided with an aperture 44 of a selected size to preclude entangled masses (gobs) or strand of undesirable diameter from passing into winding section 16. The strand 40 is then normally directed to a tension device 46. One form of tension device 46 that may be employed is to be in the form of a pair of tension discs 48 and 50 suitably mounted on post 52. The degree of tension exerted by the strand 40 at this stage may be controlled by adjusting the friction between the discs 48 and 50. Control of the strand tension is usually provided at this stage to compensate for the varying tension built in the primary package 10 when originally wound and for that occasioned by the constantly changing relative distance between the guide eye 36 and the point where the strand 40 leaves the package 10. However, the provision of the tension devices 46 for the individual primary packages is not so critical in the system of the instant invention for reasons hereinafter explained.

As the individual strands 40 leave their respective primary packages 10, they may be brought into engagement with feeler mechanisms 54 which detect the presence of a running strand 40. The feeler mechanism 54 may be of the type described in the copending and commonly assigned application Serial No. 224,390 of Svend A. Petersen, filed September 18, 1962.

Preliminary to the winding operation and after leaving the primary supply section, the strands 40 are advanced to a common tension device 56, which forms an important aspect of this invention. A short distance, preferably 3 to 6 inches, "up stream" of, or just prior to entering the tension applying device 56, per se, the strands 40 are converged by gathering eye 58. The gathering eye 58 in addition to serving to collect the strands 40 into a roving 60, also serves as a pivot point for the roving 60 as it is traversed across the face of the package 24.

It is difficult, if not impossible, to match the tensions of the several individual strands 40 by means of the tension devices 46 provided at the primary supply section. Furthermore, it should be appreciated that many of the strands 40 must travel fifty feet or more before reaching the winding section 16 and that in most arrangements the several strands 40 travel different distances. Consequently, even though the strands 40 may start out from the primary packages 10 at matched tension, by the time the strands 40 reach the winding section 16, they are being wound at varying tensions. Since the lengths between supports for the strands 40 vary, the tendency to sag, or to form catenaries, varies among the several strands 40. In order to minimize the catenary effect, it is necessary to keep the individual ends or strands 40 substantially parallel to one another as they are advanced to the winding section 16.

Heretofore, the individual strands 40 were allowed to collect or converge into a bundle without passing through a common tensioning device. Loops frequently occurred in packages wound in such manner because some of the individual strands were subjected to less tension than others of the group comprising a single roving. The ends that were subjected to less tension sagged but became entangled and carried with a srtand subjected to greater tension and thus caused loops.

In a preferred arrangement of the instant invention, the tension device 56, common to at least all of the strands 40 comprising a single roving 60, is provided intermediate, though not necessarily midway, of the primary supply section and the winding section. A preferred form of the tension device 56 comprises a series of bars 62 arranged so that the strands 40, as a roving 60, may be interwoven therewith; i.e., laced successively over one and under another. The degree of tension imposed on the roving 60 may be regulated by interweaving with more or less of the bars 62. The bars 62 preferably have a highly polished arcuate surface of metal, such as brass, for contacting the roving.

Also, preferably, the distance between the gathering eye 58 and the winder guide eye 28 of the winder section 16 should be in the general range of 8 to 17 feet. When building a secondary package of about 8 inches in length, a distance of about 10 feet is most preferred. It is undesirable to space the pivot point or gathering eye 58 from the winder eye 28 at a distance beyond 17 feet because of the increased tendency for the roving 60 to whip between these points. It is undesirable to space the pivot point or gathering eye 58 from the winder eye 28 at distances less than 8 feet because the increase in angular deviation between the ends of the package being formed is accompanied by a corresponding increase in roving tension deviation.

The pivot point of the traversing roving 60 is substantially removed from traverse guide 28 in the arrangement of the instant invention as compared with prior art practice and as may be observed in FIG. 7. Consequently, in an arrangement wherein the roving 60 approaches the winding section 16 in a generally horizontal plane, a compensator bar or element 62 is provided to accommodate the increased distance by changing the directional approach to the traverse guide 28 without creating a new pivot point or otherwise interfering with the winding operation as a secondary package 24 is produced.

In order to more fully describe the significance of this invention, a review of some of the prior art devices follows:

FIG. 5 illustrates an arrangement wherein a plurality of primary strands 40 are individually subjected to a corresponding number of tension applying devices 46 and are subsequently converged at the guide eye 28A forming a part of a roving traverser. The roving 60A is not formed until the collection of strands 40 nearly reach the secondary package 24A. No means is provided to subject the strands 40 collectively to the same tension. Hence, loops, catenaries and other defects arise.

In FIG. 6 is illustrated another form of prior art winding device wherein the strands 40 are collected or converged at a pivot point defined by a roller element 70 positioned directly below and at a relatively short distance, in the order of 30 inches, from the package traverser 26B. The angular relation between the ends of a package 24B, having a length equal to the package 24, and the pivot point is much greater in the apparatus of FIG. 6 than in the apparatus of the instant invention as may be observed in FIG. 7 where the angle θ is that produced by the apparatus of FIG. 6 and the angle φ is that produced by the apparatus of the instant invention. Hence, the difference in tension of the roving when in a mid position and when in an end position is correspondingly greater on the roving being wound on the apparatus of FIG. 6.

While the apparatus of the instant invention has been illustrated and described in connection with the advance-

ment of a plurality of strands 40 and of a resultant roving 60 in a mainly horizontal path, it will be understood that the primary supply section or creel 12 may be positioned vertically above the winding section and the strands 40 advanced in a generally vertical path. In such event, the compensator bar 62 may correspondingly change the directional approach to the traverser 26 from a generally vertical plane to a generally horizontal plane.

It will be noted that the instant invention overcomes the difficulties noted and accomplishes the stated objects. In the winding of the secondary strand or roving packages by the method and apparatus described, the formation of loops, catenaries, and other defects (which usually accompany the winding of strands, defining a roving, which are subjected to tension compensating forces individually as opposed to collectively) are minimized. Considerable production time and effort is saved by the elimination of defective packages not only in the secondary winding operation but also in subsequent operations which utilize the secondary packages.

Although the method and apparatus have been described in detail as to their component steps and parts, it will be understood that such detail is for the purpose of illustration and not by way of limitation. The appended claims are therefore intended to cover any such modifications coming within the true scope of the invention.

What I claim:

1. The method of rewinding a plurality of strands to form a roving, which comprises:
   (a) advancing a plurality of strands from the interiors of a corresponding number of primary strand packages;
   (b) imposing a preferred degree of tension upon each of said strands individually;
   (c) collecting said strands into a roving at a converger;
   (d) passing the roving through a tension device and subjecting each of the strands comprising the roving to substantially the same tension;
   (e) further advancing the roving in a linear path while oscillating said roving about a point at said converger and thereby traversing said roving along a line transverse to said linear path; and
   (f) winding the roving about a revolving core to form a secondary package.

2. The method as described in claim 1, wherein: the distance the roving is advanced in said linear path is between 8 and 17 feet.

3. The method of rewinding a plurality of glass fiber strands to form a roving, which comprises the following steps in the recited sequential order:
   (a) simultaneously withdrawing a plurality of strands from the interiors of a corresponding number of primary strand packages;
   (b) imposing a preferred degree of tension upon each of said strands individually;
   (c) collecting said strands into a roving;
   (d) imposing a preferred degree of tension upon the formed roving;
   (e) advancing the formed roving toward the winding station in a first linear path in the order of 8 to 17 feet in length;
   (f) further advancing said roving in a second linear path transverse to said first path;
   (g) oscillating said roving about a point at the start of said first linear path and thereby traversing said roving along a line transverse to said linear paths; and
   (h) winding the roving about a revolving core to form a secondary package.

4. Apparatus for winding strand material comprising:
   (a) a source of strand in the form of a plurality of wound primary packages;
   (b) tension means for imposing a preferred degree of tension upon each of said strands individually;
   (c) powered strand winding mechanism including a rotatable spindle, a strand receiving spool mounted on said spindle, driving means for rotating said spindle and thereby advance said strand from said packages to said spool, and traversing means for traversing the strand across the face of the package being formed;
   (d) converging means for converging the strand from the plurality of packages into a roving;
   (e) tension imposing means for imposing tension on the strand comprising said roving, said tension imposing means being positioned adjacent to said converging means and in the path of said roving as it advances from said converging means to said winding mechanism, and
   (f) said traversing means and said converging means being arranged in a manner whereby the formed roving is oscillated about a point at said converging means as the roving is traversed across the face of the package.

5. Apparatus as described in claim 4, which further comprises:
   (a) a bar element positioned in the advancing path of the strand between said converger and said winding mechanism, but closer to said winding mechanism, and adapted to change the directional movement of the advancing formed roving;
   (b) said bar having an arcuate surface along which said roving slides as it is traversed across the face of the package being formed.

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