Oct. 7, 1958 W. W. DRUMMOND 2,854,731

METHOD AND MEANS FOR PACKAGING A CONTINUOUS STRAND

Filed March 19, 1954 2 Sheets-Sheet 1

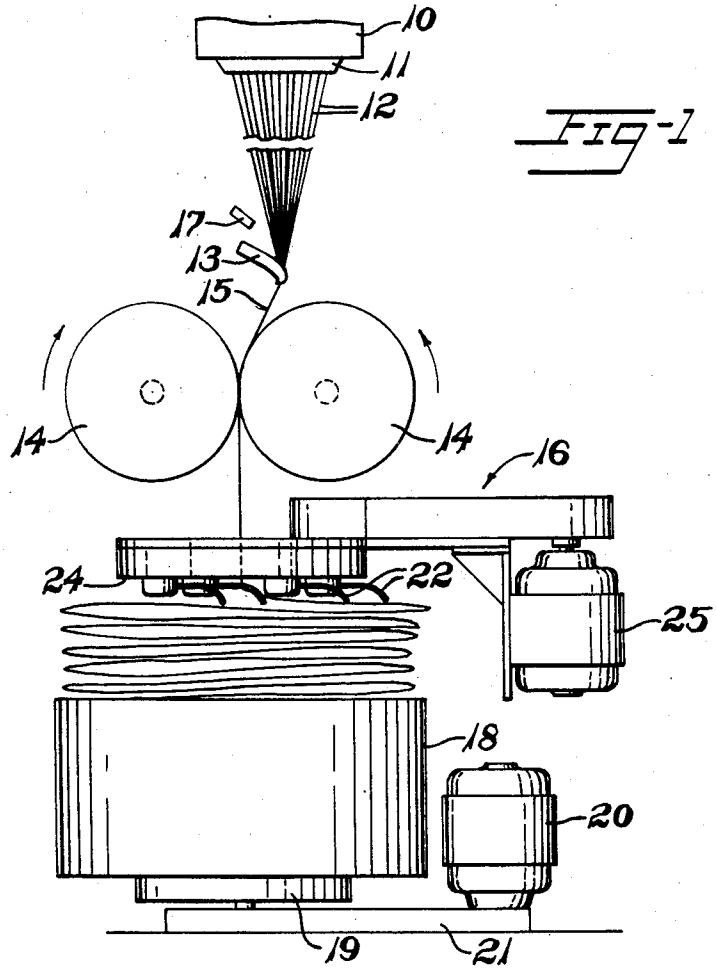


Fig-1

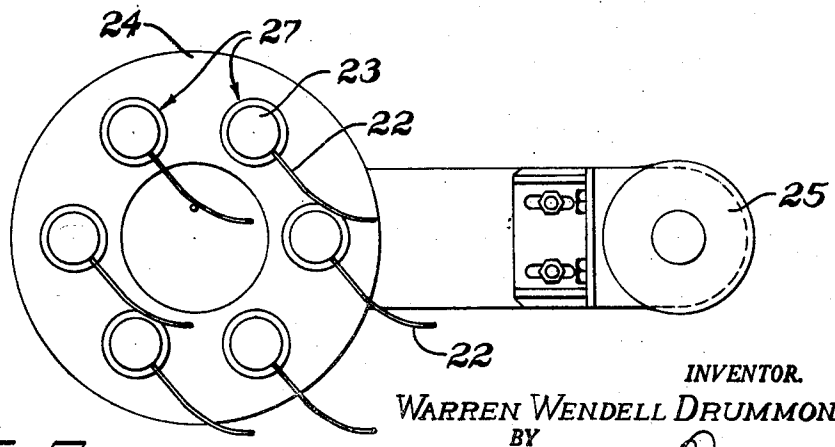


Fig-2

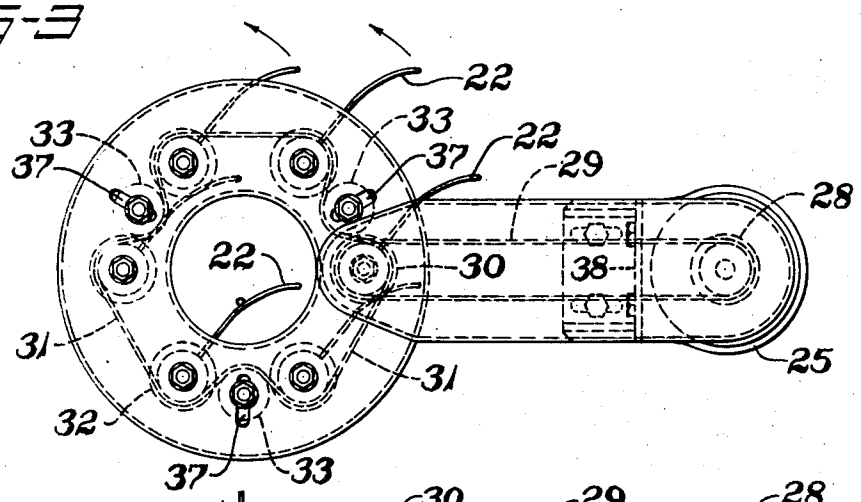
INVENTOR.
WARREN WENDELL DRUMMOND
BY
Staelin & Overmier
ATTYS.

Oct. 7, 1958 W. W. DRUMMOND 2,854,731

METHOD AND MEANS FOR PACKAGING A CONTINUOUS STRAND

Filed March 19, 1954 2 Sheets-Sheet 2

Fig-3



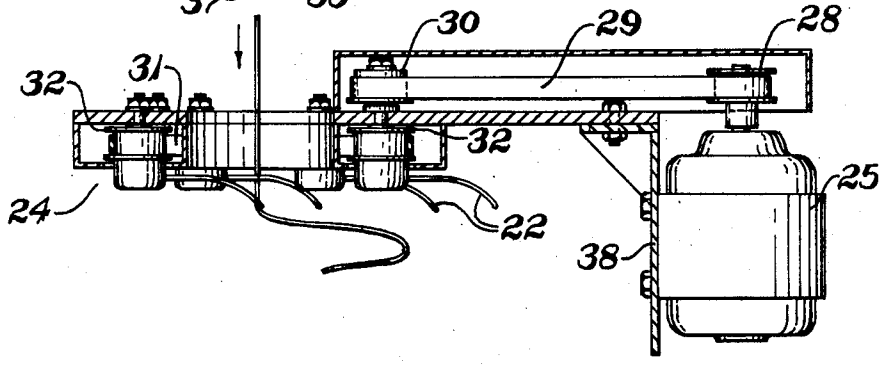


Fig-4

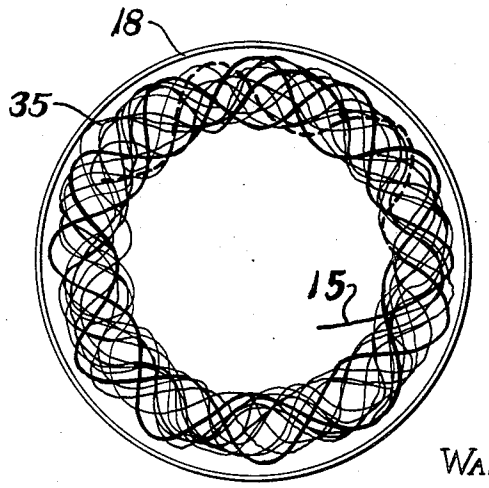


Fig-5

INVENTOR.
WARREN WENDELL DRUMMOND
BY
Stachin & Overman
ATTYS.

United States Patent Office 2,854,731 Patented Oct. 7, 1958

2,854,731

METHOD AND MEANS FOR PACKAGING A CONTINUOUS STRAND

Warren Wendell Drummond, Anderson, S. C., assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Application March 19, 1954, Serial No. 417,319

6 Claims. (Cl. 28—21)

This invention relates to packaging of continuously fed continuous strand material such as strands of textile fiber made of rayon, nylon or mineral material such as glass, and more particularly, to improvements in packaging of such strand-like materials moving at extremely high linear rates of speed.

To facilitate description, the invention is herein described in relation to packaging of glass strands which can be formed at the extremely high rates of speed to which the invention lends itself most advantageously. The term "strand" as herein used is used in its broad sense to include yarns, roving, cords and other continuous flexible textile forms.

The art of producing textile strands has in recent years reached such tremendous rates of speed that conventional methods of collection and packaging no longer are capable of meeting the increased pace. Glass strands, for example, can be made at scheduled production rates in excess of 15,000 feet per minute while conventional collection means such as collet winding mechanisms in which the material is wound on a tubular form are limited to continuous practical limits much lower in speed. As a natural consequence, other collection and packaging methods and means have been devised and tested among which are pile-up packaging methods and means into which category the present invention falls.

In the simplest form of pile package, the strand is merely accumulated as a pile in a container into which it is introduced at the high rate of speed. Although well adapted to rapid collection, a principal objection to this form of package is the difficulty which it presents to run-off or, in other words, withdrawal of the strand from the package. Such packages usually include nests or tangled masses which do not readily lend themselves to free continuous withdrawal of the strand with a minimum of effort and without separate treatment or handling to prevent snagging during further use or fabrication processes consuming the strand.

Accordingly it is an object of the present invention to provide an economical high speed method and means for collection of a strand into a convenient pile package adapted to easy handling and unwinding for further processing.

It is another object to provide collection apparatus for forming packages of strand at high rates of speed, the apparatus being such as to be readily adapted to association with existing strand-supplying or forming equipment.

A further object is to provide a method of high-speed packaging of strand which will not damage the strand and in which the apparatus may be of rugged and durable construction.

It is still another object of this invention to provide a new strand package into which a strand may be collected at a high lineal rate of speed and which is readily adapted to easy handling and unwinding for further processing.

To accomplish these objects, this invention provides a new method and means for high-speed packaging of continuous strand in which a package is formed by effecting a lateral displacement of spaced portions of the strand with fingered spinners to form serially connected loops as it is moved longitudinally along a linear path from a high-speed pulling source such as pulling wheels. Groups of the laterally displaced portions or loops are arranged circumferentially to be deposited as layers of the package being formed, while the package is slowly rotated to provide an overlapping of layers to prevent the undesired nested intermingling of spaced portions of the strand. Thus, a package is formed in which the strand is laid in layers such that strand portions of each layer do not tie themselves, or do not interminglingly make engagement with other strand portions which might promote entanglement or tight nested accumulations in the package. Instead, the strand is arranged in overlapping-loop relation such that the package may be easily unwound by reason of the individual independence and separability of the loop portions therein.

A feature of this invention is that a large winding can be produced with moving elements, each of which move through linear distances in rotation much less than the circumferential length of the winding itself.

Another feature of the invention is the possibility of winding the strand with low inertia moving parts, thereby permitting adoption of the apparatus to quick start-up and shut down.

Still another feature is that the method and apparatus is such that finished packages may be readily and rapidly removed from the apparatus without disrupting continuity of winding operations.

A still further feature is that packages of various configurations can be produced with a given number of spinners by merely modifying the finger configurations as desired.

Other features which I believe to be characteristic of my invention are set forth in the appended claims. My invention, however, both in organization and manner of construction together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a partially diagrammatic elevational view of glass-fiber forming and packaging apparatus incorporating the principles of the present invention;

Figure 2 is a bottom plan view of the package-forming unit of Figure 1;

Figure 3 is a top view of the package-forming unit of Figure 2 showing in dotted lines the internal arrangement of drive elements of the unit;

Figure 4 is an elevational view in cross section of the package-forming unit also showing the arrangement of drive elements; and

Figure 5 is a plan view of the package of this invention illustrating in part the overlapping arrangement of loops in the different layers.

Turning to the drawings in greater detail, Figure 1 discloses the winding apparatus of the invention in combination with conventional glass-fiber forming apparatus. The glass fibers or filaments **12** are drawn from a multiple-orifice feeder or bushing **11** supplied with glass from a glass-melting tank **10**. The fibers are drawn downwardly and over a gathering shoe **13** where they are grouped into strand form and simultaneously coated with a sizing material fed from a tube **17** supplied by an external source not shown.

The pulling force for drawing the fibers from the bushing and to effect the gathering is provided by high-speed pulling rollers or wheels **14** of the type disclosed

and described in Drummond et al. application, Serial Number 302,201, filed on August 1, 1952, now abandoned. The wheel-type pullers in the present instance have the advantage that they can pull strands at the extremely high rates of speed for which the invention is advantageously adapted.

The shoe **13** is made of material such as graphite having a low coefficient of friction such that the fibers may be drawn at the high rate of speed desired without deleteriously affecting the strand **15** formed by the gathered fibers. The free end of the strand 15 is thrown downwardly by the pulling wheels **14** in a path generally through the center of an annular loop-forming portion **24** of the winder **16** and is then deposited in a container **18** mounted on a rotatable platform **19**. The container **18** is rotated as desired by the drive motor 20 which operates to rotate the platform **19** through suitable connecting mechanism such as a belt, chain or gear drive in housing **21**.

A number of spinners **27** each comprising a strand-engaging member **22** associated with a rotary hub **23** are circumferentially disposed at equal distances apart about the under-portion of the annular structure **24**. The strand-engaging member **22** of each of the spinners is a peg or finger fixedly associated with the hub and extending radially therefrom to be swept about the center of the hub as the spinner rotates. The fingers **22** are of a length such that when taken in connection with their respective hubs they extend a distance from the center of the hubs slightly greater than the radius of the circle of disposition of the spinners on the annular portion **24**.

The spinners are aligned so that all the members **22** extend generally in the same direction at any given time and all are arranged to be swept in unison in this general relation during rotation. In other words, each of the fingers is rotated about its own axis in phase with the others to effect a sweeping rotary engagement with the strand. The end of each finger **22** is curved slightly backward with respect to its direction of rotation to facilitate release of the strand after engagement therewith. The end of the finger is also curved downwardly sufficiently to clear adjacent hubs on full 360° rotation of the spinner. The fingers make engagement with the strand in sequence as each sweeps past the path of the strand through the annular portion **24**. That is, the fingers **22** engage or pluck the strand one after another sequentially as part of a complete cycle in which each spinner makes one engagement. With six spinners incorporated in the winder as illustrated in Figure 2, each makes one engagement with the strand during a cycle of the winder in which the spinners follow at intervals 60° behind each other in the cycle. As the speed of the spinners increases, the number of engagements with the strand within a given unit of time is increased. Thus, the linear distance between points of contact along the length of the strand and correspondingly the size of loops for any given speed of movement of the strand becomes smaller as the spinner speeds are increased.

Figures 3 and 4 show how the spinners **27** are driven by the motor **25** and an associated connecting belt-drive mechanism. The motor is mounted on a bracket **38** laterally displaced from the annular loop-forming portion **24** a sufficient distance to permit independence of operation from the pulling wheels **14** and ready access for maintenance. The motor is mounted so that its axis of rotation is generally vertical and such that the drive end of its shaft extends upward to a position above the bracket 28 for convenient positioning of a drive sheave **28** mounted thereon. The sheave is connected by a primary-drive belt **29** to supply power to a spinner-drive pulley **30** directly and fixedly associated with one of the spinners in the annular portion **24**. The tension in the belt **29** may be adjusted as desired by lateral positioning of the motor and the sheave **28** by corresponding positioning and securement of the support bolts of bracket **38** within slots provided therefor.

Each of the spinners has a grooved rim **32** enclosed in the housing structure of the portion **24** within which the spinners are all connected together by a secondary drive belt **31**. Three idler pulleys **33** are located within the annular structure in the alternate spaces between adjacent pairs of the grooved rims **32**. Both the spinners and the idlers are rotatably mounted on the annular structure by providing threaded ends on their shafts of sufficient length to permit them to be fixedly mounted in the upper part of the housing by securing means such as nuts. The idlers are positionably mounted on the housing structure by providing radially extending slots **37** within which the idler shafts may be adjusted in radial location to permit establishment of a range of oriented relationships of each idler with the grooved spinner rims **32** with which it is associated.

The secondary drive belt **31** is looped about the circumferentially disposed rims **32** and adjusted for pressure engagement therewith by adjustably positioning the idlers **33** inwardly against the outer surface of the belt loop for the desired contact. The primary belt operates to drive the spinner to which the spinner drive pulley **30** is directly connected, which in turn drives the rest of the spinners in synchronism therewith through the secondary belt **31**. Although the spinners are herein illustrated as being driven by means of belts, it will be readily understood that other means such as a gear train or chains may also be arranged to effect the desired operating relationships.

During operation of the winding unit, the strand **15** is fed downwardly generally through the center of the annular structure **24** and is sequentially contacted by the laterally sweeping fingers **22**. Thus, a length of strand is displaced from its straight path and is moved laterally with each contact. By regulating the speed of the spinners so that the circumferential speed of the strand-contacting points of the fingers is less than the linear speed of the strand, a loop is formed between each pair of successive or adjacent fingers **22** as they sweep past the path of the strand.

Each loop portion overhanging a finger of a spinner is carried laterally and is then thrown off from the finger by centrifugal force. As indicated above, the ends of the fingers may be curved backwardly, or otherwise configurated with respect to their direction of movement, to facilitate such throwing off. The successive loops thus thrown from the winder align themselves to be deposited in circumferentially oriented relation when introduced into the container **18** located directly under the annular structure **24**. The container **18** is sufficiently large in diameter to accommodate the full diameter of the pile package **35** formed therein and, as such, is larger than the circle of disposition of the spinners by an amount determined by the dimension of the circle defined by the points where the loops are thrown from the fingers **22**.

The amplitude dimension of the loops collected in the package, and correspondingly, the difference between the outer and internal diameters of the package are determinable by the relative rate of movement of the strand with respect to the spinner speeds. The greater the strand speed with respect to a given speed of rotation of the spinners, the greater is the amplitude of the loops.

With each cycle of spinner operation, a circumferential layer of loops is formed in the package. The layers may be arranged so that the loops of each layer after the first overlap the gaps between loops in the layer immediately underneath by slowly rotating the package **35** as it is being formed.

This is accomplished in the present instance by placing the container **18** on the rotary platform **19** driven by the motor **20**. Thus, as each layer of strand is deposited, the slow rotation of the package assures that the loops of the subsequent layers are not deposited directly on

top of and in alignment with the loops immediately thereunder, but rather in overlapping or staggered out-of-phase relation as illustrated in Figure 5. The strand is thereby piled in layered relation rather than nested or tangled relation so that on withdrawal of the strand, snagging and pulling of clumps of the strand does not occur and withdrawal or disassembly of the strand can be accomplished smoothly and rapidly with a minimum of effort and attention. Although rotation of the package is illustrated herein as a method by which overlapping the loops in the pile can be assured, it has been found that under practical conditions of collection into the package, for some small sizes of loops, the loop orientation may be sufficiently different between successive layers that enough out-of-phase relation exists between layers to effect a desirable degree of overlap without need for rotation of the package.

Although the invention as herein illustrated shows a winder including six circumferentially disposed spinners, it will be readily understood in view of the foregoing description that the winder is not limited to this number of spinners only. Two or more spinners may be used, and under some circumstances it may be desirable to incorporate but one spinner in the winder.

It will be recognized, however, that with more spinners included in the winder, the greater is the possibility of imparting a smooth or more true circular configuration to the individual coils or loops being formed.

In view of the foregoing, it will be understood that while I have shown a certain particular form of my invention, I do not wish to be limited thereto since many modifications may be made within the concept of the invention, and I, therefore, contemplate by the appended claims to cover all such modifications which fall within the true spirit and scope of my invention.

I claim:

1. Apparatus for packaging a continuous flexible strand comprising in combination, means for projecting said strand longitudinally along a generally linear path, means comprising strand engaging members movable laterally with respect to the path of said strand in sequence to move successive adjacent portions laterally predetermined equal distances circumferentially about said path to form serially connected loops arranged in generally annular relationship substantially concentric with the path of said strand, and means in said path for receiving said annuluses in piled relation for formation of a package of said strand.

2. Apparatus for packaging a continuous flexible strand comprising in combination, means for projecting said strand longitudinally along a generally linear path, means comprising at least two spinners including strand-engaging peg members arranged about the path of said strand to sequentially reorient successive spaced portions of said strand as loops laterally equal distances about the line of said path to form annuluses of serially connected loops, and means for receiving said annuluses in piled relation to form a package.

3. Apparatus for packaging a continuous flexible strand comprising in combination, means for projecting said strand longitudinally along a generally linear path, a plurality of rotary spinners distributed in concentric alignment about the path of said strand, each of said spinners comprising an extended member arranged to be rotationally swept about one of its own ends and across said path during rotation, said spinners being oriented such that all the extended members extend laterally in the same direction from their axes of rotation at any given instant, means for driving said spinners rotationally in synchronism to cause said strand to be engaged sequentially by each of said spinner members, whereby said strand is looped over said extended members in connected series one after another and is serially thrown in the form of loops circumferentially distributed about said path, and means below said spinners for receipt of said circumferentially distributed loops as they are formed.

4. Apparatus for packaging a continuous flexible strand comprising in combination, means for projecting said strand longitudinally along a generally linear path, means for reorienting said strand comprising at least two rotational spinners disposed at equal distances in circumferential alignment about the path of said strand, each said spinner including a strand-engaging member and having its axis of rotation located and oriented so that the member engages said strand in transverse relationship on rotation of the spinner, said spinner members being so oriented with respect to each other that on rotation they engage said strand sequentially one after another and throw successive spaced portions thereof laterally substantially equal distances about an extension of the line of said path, thereby forming serially connected annuluses of said successive strand portions, means for driving said spinners rotationally in synchronism, and means spaced from said spinners in alignment with said path for receiving said annuluses of strand as they are formed.

5. Apparatus for packaging a continuous flexible strand comprising in combination, means for projecting said strand longitudinally along a generally linear path, a plurality of strand-engaging spinners disposed in positions equidistant from each other in circumferential alignment about the path of said strand, each said spinner including a longitudinal strand-engaging member extending laterally from an axis of rotation at one end about which it rotates, the axes of rotation of said spinners each being generally parallel to the path of said strand as well as parallel to each other, the axis of rotation of each said spinner being spaced from the path of said strand a distance less than the distance of lateral extension of its strand-engaging member, means for driving said spinners rotationally in synchronism, said spinner members being so oriented with respect to each other that on rotation they engage said strand sequentially one after another and throw successive spaced portions of the strand laterally substantially equal distances about an extension of the line of said path, thereby forming serially connected annuluses of said successive strand portions, and means for receiving said annuluses in piled relation as they are formed.

6. Apparatus for packaging a continuous flexible strand comprising in combination means for projecting said strand longitudinally along a generally linear path, means for reorienting said strand comprising a plurality of strand-engaging spinners disposed in positions equidistant from each other in circumferential alignment about the path of said strand, each said spinner including a single longitudinal strand-engaging member extending laterally from an axis of rotation at one end about which it rotates, the axes of rotation of said spinners each being generally parallel to the path of said strand as well as parallel to each other, said spinners being oriented so that all of said strand-engaging members extend laterally in the same direction from their axes of rotation, the axis of rotation of each spinner being spaced from the path of said strand a distance less than the distance of lateral extension of its strand-engaging member, means for driving said spinners rotationally in synchronism causing said spinner members to engage said strand sequentially one after another and form annuluses of engaged spaced portions in space about an extension of the line of said path, and means below said spinners for receiving said annuluses in piled relation as they are formed.

References Cited in the file of this patent

UNITED STATES PATENTS

334,453	Morgan	Jan. 19, 1886
408,842	Mitchell	Aug. 13, 1889
1,557,830	Gurley	Oct. 20, 1925

(Other references on following page)

7

UNITED STATES PATENTS

1,578,921	Roe et al.	Mar. 30, 1926
1,653,311	Rice et al.	Dec. 20, 1927
2,352,781	Fletcher et al.	July 4, 1944
2,364,569	Thomas	Dec. 5, 1944
2,377,771	Fletcher	June 5, 1945

8

2,415,075	Abbott	Feb. 4, 1947
2,604,687	Broden	July 29, 1952
2,634,923	Taylor	Apr. 14, 1953
2,721,371	Hodkinson et al.	Oct. 25, 1955

FOREIGN PATENTS

420,085	France	Nov. 14, 1910