

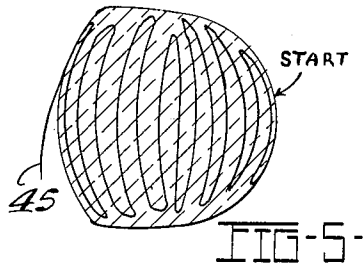
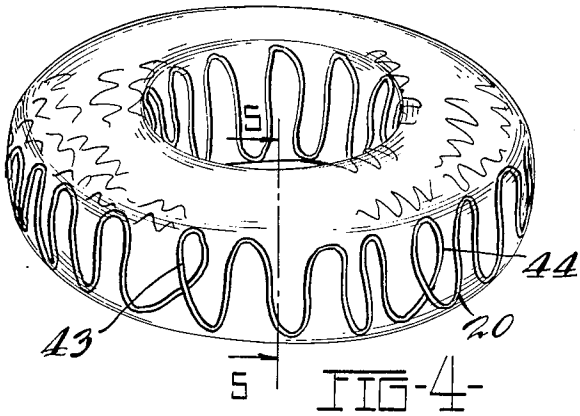
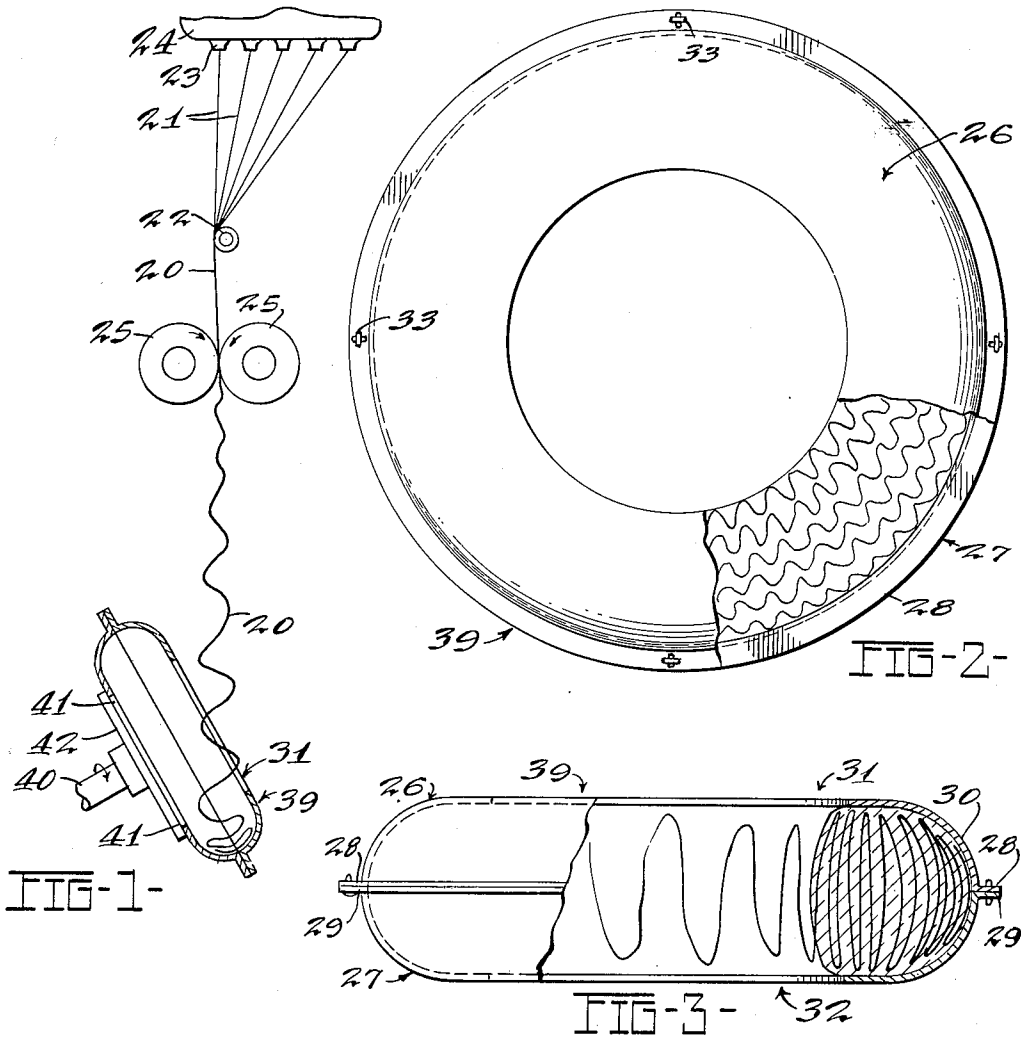
Feb. 28, 1956

W. W. DRUMMOND ET AL
PACKAGE FOR CONTINUOUS STRANDS

2,736,512

Filed April 16, 1952

2 Sheets-Sheet 1



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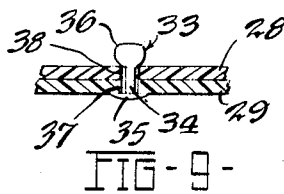
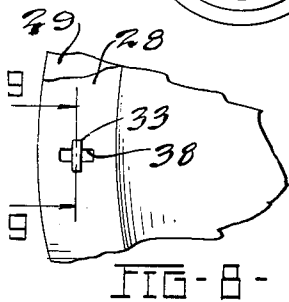
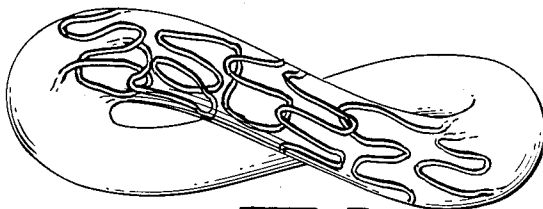
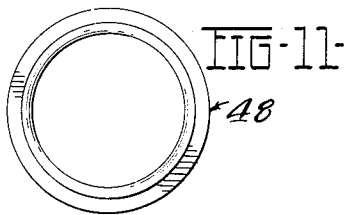
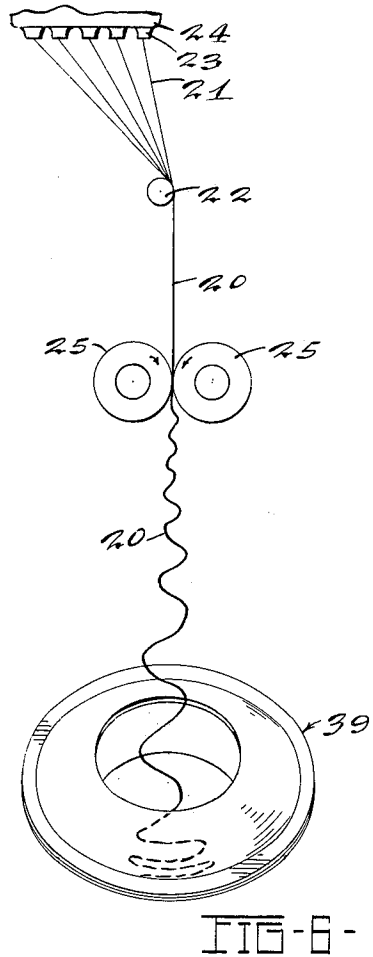
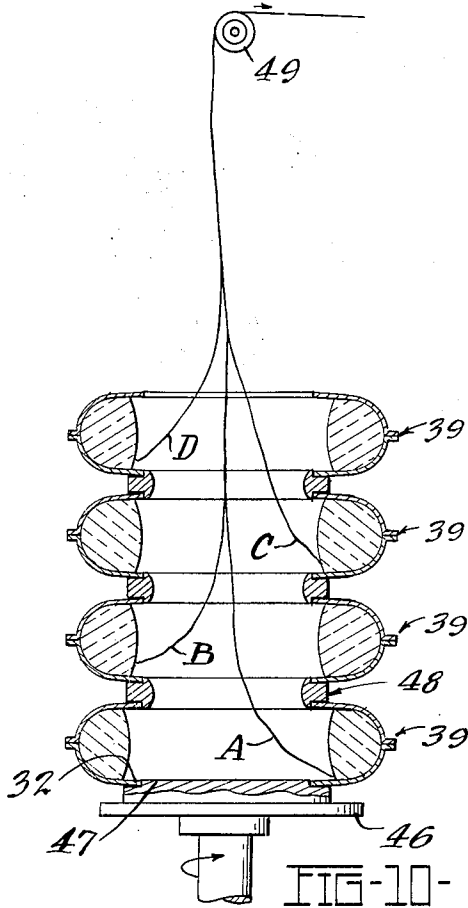
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2 Sheets-Sheet 2



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2,736,512

PACKAGE FOR CONTINUOUS STRANDS

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4 Claims. (Cl. 242—159)

This invention relates to the packaging of continuous strands and, more particularly, to the packaging of a strand that is continuously produced at a high linear speed and which is to be subsequently employed in further fabricating operations, as, for example, in the weaving of textiles, etc.

Continuously produced strands such as textile strands of rayon, nylon, various threads, glass fiber strands and others, for the most part have been packaged by winding upon high speed rotary spools or bobbins. Particularly in cases where the strand being packaged is produced at a high linear speed or with considerable tension created by pulling the strand, the accumulating layers or turns of strand on a spool which is increasing in diameter as the strand accumulates thereon progressively increase the inwardly acting compressive force of the mass of strands.

This increasing compressive force has several disadvantageous results. Among them are the difficulty of supporting the tube or center portion of the spool to prevent its collapse as the tension of superposed loops of strand builds up, and the necessity for high speed oscillation of the package to build it up in even layers and, frequently, to direct contacting loops of strand at considerable angles to each other to prevent adhesion therebetween which would snag the strand during unwinding.

Even if the spool is made sturdy enough to withstand the increasing compressive force of the winding, successive turns of strand are forced inwardly between prior turns, resulting in snags and tangles during unwinding. No matter how carefully the strand is originally wound, the problem of snags and snarls or licking during subsequent unwinding of the strand remains severe.

Another disadvantage inherent in spool type or wound packages results from the fact that the mass of strand is accumulated on the exterior of the package and therefore is unprotected and is likely to be damaged during handling.

Where the strand being packaged is comprised of a multiplicity of fine parallel fibers, for example, a glass fiber strand which may have upwards of 200 or so individual filaments, it has heretofore been impossible to package the strand as produced in any form that will permit shipment without a preliminary step.

A glass fiber strand is generated at a speed of, say, 10,000 feet per minute. A winding tube or spool of sufficient size to be rotated to provide a peripheral speed of 10,000 feet per minute is too big to permit a very great quantity of strand to be accumulated without becoming too large to handle. If any commercially usable length of strand is to be accumulated, the strand must be wound many, many layers deep.

Where the filaments in the strand are as fine as in this case, any disturbance of the strand on the spool results in confusion between the filaments of adjacent turns of the strand. The increasing tension mixes the filaments of different turns. Finding a complete "end" on such a package is almost impossible. Any substantial amount of

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handling hopelessly mixes the strand turns because some of the loops fall off the spool, etc.

For these many reasons, commercial practice includes a rewinding and twisting step. The wound spools are placed in a twister immediately after they are wound and the strand is twisted (to give strand integrity) and re-wound on second tubes or spools. The rewinding and twisting produces a package which is not subject to many of the ills enumerated above, but it is an expensive and time consuming solution to the problems.

Not only does the twisting step increase cost, but the "package," i. e., the spool, still must be relatively heavy and large in proportion to the strand wound on its exterior which increases the cost of shipping the strand as well as making the spool expensive enough to require its return to the strand producer. Since the spools must be of the same size in order to permit efficient operation, they cannot be nested and the cost of return of the spools also is high.

A further disadvantage inherent in a spool type package is the fact that the linear speed of the spool surface must be at least equal to the linear production rate of the strand.

It is the principal object of this invention to provide a strand package in which all of the problems enumerated above are substantially eliminated and in which there is practically no tendency of the strand to snarl during subsequent removal of the package.

It is another object of this invention to provide a package for a continuous strand in which the package is rotated so that its surface travels at a linear rate less than that of the linear feed of the strand and, in practice, as slow as one half the linear speed of the strand.

It is another object of this invention to provide a package for accumulating a substantial mass of linearly produced strand in which the last to enter portion of the strand at every point lies on top of any previously entered portion of the strand and thus no likelihood of kinks or snarls is prevalent during subsequent unwinding or strand removing operations.

It is a further object of this invention to provide a strand package in which relatively constant compacting force acts on each layer of strand and there is no accumulating tension on the strand acting to bind the strand or entangle its layers or loops.

It is another object of this invention to provide a strand package in which a strand made of assembled glass fibers produced at a rate of, say, 10,000 feet per minute, can be directly packaged without the necessity for careful strand handling, to accumulate a highly dense mass of strand in a compact form which then can be further compacted for ease in handling.

It is another object of this invention to provide a strand package in which the accumulated mass of strand is protected from external abrasion or damage by the package itself.

A still further object of this invention is to provide a packed mass of strand which has substantial integrity and thus may be removed from its package for shipping without serious danger of damage or entanglement.

Yet another object of this invention is to provide a package for a continuous strand which is light in proportion to the mass of strand accumulated therein and thus is relatively inexpensive to ship both as a container for the strand and when empty for return to the strand producer.

Still another object of this invention is to provide a package for a quantity of strand greater than that contained in conventional strand packages and which further facilitates handling by being separable for stacking during shipment and storage after the strand is removed.

These and more specific objects and advantages will

be better understood from the specification which follows and from the drawings appended hereto, in which:

Fig. 1 is a somewhat diagrammatic view in vertical section of the accumulation of a continuous strand in a package embodying the invention.

Fig. 2 is a greatly enlarged view in elevation of a package embodying the invention with a portion broken away to show details of its construction and the accumulation of a strand therein.

Fig. 3 is a side view of the package shown in Fig. 2 likewise partially broken away to show the strand accumulation therein.

Fig. 4 is a view in perspective of a mass of strands as accumulated in the package shown in Figs. 1 through 3.

Fig. 5 is a vertical sectional view taken substantially along the line 5—5 of Fig. 4.

Fig. 6 is a view similar to Fig. 1 but showing how a package embodying the invention can be filled with strand when arranged in a different manner with respect to the strand producing mechanism.

Fig. 7 is a view in perspective illustrating how the mass of strands shown in Fig. 4 can be decreased in overall size to facilitate shipping and handling.

Fig. 8 is a fragmentary view in elevation illustrating locking means as employed for assembling sections of a package embodying the invention.

Fig. 9 is a fragmentary cross sectional view taken substantially on the line 9—9 of Fig. 8.

Fig. 10 is a partially schematic view in section illustrating how several packages embodying the invention may be assembled for subsequent removal of strands packaged therein.

Fig. 11 is a plan view of a device adapted to facilitate the assembly of a plurality of packages embodying the invention to permit subsequent treatment of the strands packaged therein.

In explaining the packaging of a strand in a package embodying the invention, the strand to be packaged therein will be exemplified by a continuously produced glass fiber strand 20 (Fig. 1) which is accumulated from a mass of individual glass fibers 21 by a gathering roll 22. The glass fibers 21 are formed from streams of glass pouring through orifices 23 at the bottom of a glass melting or supply tank 24. The fibers 21 are gathered by the gathering roll 22 to form the strand 20 and pulled at an extremely high rate of speed, say, 10,000 feet per minute, by a pair of coating pulling rollers 25. As the rollers 25 pull on the strand 20 the rapid longitudinal movement of the fibers 21 attenuates the streams of glass pouring through the orifices 23 to form the fine individual fibers 21. There may be as many as 200 or more fine fibers gathered together in the strand 20.

As the strand 20 leaves the pulling rollers 25 it is projected (preferably downwardly) across an open air space where the resistance of the air to its passage causes it to be slowed down and to gradually be deformed into a generally wavelike pattern of increasing amplitude and decreasing wave length. As the strand is deflected, forming the wavelike pattern, its net linear speed of progression through the air correspondingly decreases and the strand 20 piles up upon itself as its momentum is overcome by the resistance of the air to its passage.

A package embodying the invention may consist of a pair of bezel-like rings 26 and 27. The rings 26 and 27 have flat perimetrical flanges 28 and 29 respectively which extend radially outwardly from the edge of the rings 26 or 27. The flanges 28 and 29 on the two rings are of the same inner and outer diameters and the surface of each lies in a plane so that the two rings 26 and 27 can be assembled by mating the two flanges 28 and 29. When thus assembled the two rings 26 and 27 form a hollow torus-like unit having an annular inner surface 30 and axial openings 31 and 32 of substantial diameter. The two rings 26 and 27 are held in assembled condition by the engagement of locking members 33 with their flanges

28 and 29. Each of the locking members 33 consists of a pin 34 having a flattened enlarged head 35 and a wing-like flattened end 36. The pin 34 extends through a circular hole 37 in the flange 29 and its flattened end 36 can be pushed through a slightly larger slot 38 in the flange 28. Thus, by rotating the locking member 33 on its axis its flattened end 36 can be aligned with the slot 38 to permit separation of the flanges 28 and 29 or rotated 90° to the position shown in Figs. 8 and 9 for retaining the flanges 28 and 29 and thus the rings 26 and 27 in assembled position. Similar means of various types may be employed for this purpose.

The rings 26 and 27 when assembled form a package generally indicated by the reference character 39 in the drawings. In the arrangement shown in Fig. 1 the package 39 is mounted upon a rotating spindle 40 having an inclined axis lying in a vertical plane perpendicular to the parallel vertical planes of the axes of the pulling rollers 25.

The package 39 may also be mounted with the axis 40 similarly inclined but lying in a vertical plane parallel to the parallel vertical planes of the axes of the pulling rollers as shown in Fig. 6. The employment of the package in either of these two positions, or any intermediate position, is within the scope of the instant invention and the mass of strands produced by its operation in either of these two positions, or any intermediate position, embodies the instant invention.

In either case (i. e., Fig. 1 or Fig. 6) the axis 40 is inclined only to a degree sufficient to permit the strand 30 to enter one of its axial openings, for example the opening 31, from above. The other one of the openings, for example 32, fits around a retaining element 41 carried by a plate 42 mounted on the spindle 40 to hold the package on the spindle during accumulation of a mass of strand therein.

In accumulating a mass of strand in a package embodying the invention when mounted with respect to the strand as shown in Fig. 1, the rotation of the package 39 beneath the falling waves of strand results in the wave form portions of the strand being laid on the inner surface 30 in such a manner that they extend circumferentially around the package. As can be seen by reference to Fig. 4, the first layer of strand (which is shown in detail and with a greatly exaggerated diameter) extends laterally substantially all the way across the surface 30 with the line of generation of the waves running circumferentially of the package. While Fig. 4 shows the wave of the strand 20 in relatively even form, it is to be understood that the strand falls not only in wave-form but also may form loops or swirls, for example, the loop indicated by the reference number 43 or the loop indicated by the reference character 44. Shapes similar to these loops 43 and 44 and different arrangements of the strand are all embraced within the scope of the term "generally wave-form."

As the package 39 rotates on the spindle 40 each 360° rotation of the package spreads a generally wave-form layer either on its surface 30 or superposed upon a previously laid wave-form layer. Each of the layers of strand remains discrete from previously laid layers insofar as entanglement therewith is concerned but, of course, due to the random deposition of the wave-forms in place, the actual lengths of strand may be forced circumferentially outward by the centrifugal force so that strand sections in later layers may contact strand sections in layers laid considerably previously. For example, it can easily be seen that a number of layers of strand have to be deposited before the surface 30 of the package is completely covered and before subsequent layers of strand do not contact that surface through spaces between the sections of strand in previously laid layers. The outward compacting force created by the rotation of the package 39, i. e., the centrifugal force acting upon the layers of strand is intended so to spread the wave-form layers in order that

the strand is tightly compacted and the accumulated mass of strands is dense.

Were it not for the application of strand layer compacting force a loop or swirl such as those numbered 43 and 44 might bridge or arch, establishing an open space and thus substantially reducing the total length of strand which could be packed in a container of a certain size. The action of centrifugal force in collapsing any such bridge or arched loops densifies the entire finished package so that a great length of strand can be accumulated in a single mass.

In accumulating the strand according to the arrangement shown in Fig. 6, the waves and loops of strand as deposited in the package 39 are even more random than is the case in the package shown in Fig. 4. The entire mass of strands as accumulated in Fig. 6 would have the same general appearance of the mass of strands shown in Fig. 4, i. e., it would be a torus having an exterior contour determined by the contour of the surface 30 formed by the two rings 26 and 27 and an interior contour determined by the building up of the strands within the package 39. Fig. 5 illustrates an approximate cross section through the torus. It will be observed that a free end 45 of the strand 20 is located at the inner or left side of the cross section shown in Fig. 5 and that the cross section of strand mass shown in Fig. 5 has its greatest dimension radially through its center portion. In the cross section of Fig. 5 the first layer commences at the point indicated by the word "start" and, were it possible to illustrate the actual strands lying in the package shown in Fig. 5, it would be seen that they would lie in tightly compacted spiralling layers each layer having approximately the general wave-form pattern of the exterior layer as shown in Fig. 4.

If the mass of strands involved had been laid according to Fig. 6, since the movement of the surface 30 by rotation of the package 39 in that figure extends along a line parallel to the amplitude of the wave forms and strand rather than parallel to the line of generation thereof, the individual layer of strands extends approximately in the manner shown in Fig. 7 of the drawings where it can be seen that the strand lies still in generally wave-form layers and the lines of propagation of the wave-forms extend not circumferentially of the mass but transversely thereof. If projected onto a flat surface, the general pattern would run for several waves, then a shift of phase and additional waves laid down in semi-overlapping relationship upon the previous waves, the peaks of the waves being spaced from the peaks of the previous waves in a direction corresponding to circumferential spacing in the package 39.

However, in either type of package, previously laid strand always remains exteriorly of the subsequently laid strand so that the last to be packaged is located at the innermost side of the finished torus shaped mass and the first to be packaged lies at the exterior of the mass.

After the entire mass of strands has accumulated in the interior of the package 39 it may be transported in that package to a location for subsequent use or the package may be disassembled by rotating the locking member 33 and separating the two rings 26 and 27 to leave the mass of strands as shown in Fig. 4. When the two rings 26 and 27 are removed the mass of strands is so tightly compacted by centrifugal force constantly applied during its accumulation that it maintains its integrity in the general shape of Fig. 4 and in fact can be further collapsed so as to occupy even less space, for example, during shipment. If it is desired to further reduce the size of the mass of strands this may be accomplished either by placing the mass on edge and simply flattening the ring, i. e., crushing its opposed sides together or, it may be accomplished by grasping diametrically opposed sides of the torus-like mass of strand and twisting the sides in opposite directions to form it generally in the

shape of a figure "8," as is illustrated in Fig. 7. Upon restoring collapsed or twisted mass of strands to its original torus shape, it is found that none of the strands have become entangled and the entire length of strand can be fed out of the package starting either at the interior or at the exterior or from both the interior and exterior at once.

In many cases it may be advantageous to ship the strand from the fabricating location to a subsequent use point in the package 39. The user may then place a selected number of packages 39 in position from which the strands can be fed directly into the weaving, roving or other machinery without the necessity for extra handling operations.

A package embodying the invention has a substantial advantage over spool type packages which results from its shape, method of packaging and size. Because the strand is packed in the interior of the package it is protected during handling and a larger mass can be accumulated with respect to the size of the package. Because the package is outside the strand and the compressive force of wound packages is avoided, the material from which the package is made need not be as sturdy nor as heavy, as a spool. Thus the dead weight of the package is less in relation to the weight of strand packaged which reduces the cost of shipment of a given number of yards or pounds of strand.

In practice where spools carrying ½ to 1 pound of fine filament strand (say, 15,000 yds. to the pound) have heretofore been used, a package embodying the invention may contain several times as much strand for a package of the same weight.

After the strand is removed from the package 39 either before shipment or after it is "used up" in a subsequent fabricating operation, the empty rings 26 and 27 can be nested and a considerable number stored or shipped in relatively small space.

An illustrative arrangement for simultaneously removing continuous strands from a plurality of packages embodying the invention is shown in Fig. 10. The arrangement of Fig. 10 consists of a rotary plate 46 having a spacer 47 which fits one of the openings 31 or 32 in a package 39 which is mounted thereon. Through the use of a smooth stacking ring 48 (see also Fig. 1) a second package 39 may be erected on top of the first package. Additional packages can be assembled through the use of additional stacking rings 48 between successive packages until a sufficient number for the purpose desired have been erected. In an assembly of this type the inner ends of the strands 20 (indicated by the reference letters A, B, C, and D in Fig. 10) are led upwardly and together over a roller 49, for example, and from there to appropriate handling mechanism such as weaving, winding or twisting mechanism. In the arrangement of Fig. 10, the rotation of the plate 46 coupled with the longitudinal movement of the strands as they are pulled over the roller 49 results in twisting the four strands A, B, C, and D together. The number of turns per linear dimension depends upon the ratio between the rotation of the plate 46 and the speed with which the strands are pulled from the packages 39 as erected thereon.

A package embodying the invention provides the mass of strands in generally wave-form, superposed layers with the strand continuous from spiral layer to spiral layer and with the strand layers compacted tightly together to densify the mass and permit the accumulation of a great length of strand in a single package. The random deposition of the strand in a single layer, the fact that subsequently laid waves and loops overlie only previously laid waves and loops and the absence of any progressive compression between layers such as that encountered in an increasing diameter spool upon which a strand might be wound, all cooperate to prevent entanglement between the strand portions in successive layers. In a package of the instant invention because the compaction of a layer

of the strand results from the action of centrifugal force on its mass, successive layers do not tend to be more tightly compressed nor to compress previous layers. Because superposed portions of the strand are not likely to lie parallel, there is no tendency for any section of strand to be squeezed between previously laid portions of strand and to be tangled thereby as frequently occurs with respect to strand portions in successive layers of spirally wound packages such as spools.

The particular cross sectional or elevational configuration of the elements from which the package 39 is made, i. e., the two rings 26 and 27 are not in any way critical to the accumulation of the strands into a package embodying the invention. In some instances the package elements might form a simple U in cross section and if, for example, it is intended that the mass of strands should be further processed at the same location where they are fabricated by feeding the strand directly from the package 39 in which it was originally accumulated to further machinery, there is no need for the package to be separable or to be made of two parts.

As mentioned, in many cases in order to reduce weight during shipment and to obviate the necessity for and cost of returning the empty strand packages 39, it may be desirable to make the package openable as shown so that the accumulated mass of strands as shown in Fig. 4 can be removed therefrom and shipped either in that form or in a crushed form (for example as shown in Fig. 7) to a mill or other establishment where the strand is to be subsequently handled.

The drawings and description above show and describe a preferred embodiment of the invention which is set forth in the claims appended hereto.

We claim:

1. A package of strand material consisting of the combination of a continuous length of multifilament strand built up progressively in superposed spiral layers of random waves and swirls and with each layer interiorly located relative to each preceding layer, the mass being torus shaped, with a torus-like container and accumulator therefor having an open semi-circular cross section with closed peripheral walls extending adjacent the outer surfaces of said mass of strand.

2. A package of continuous multifilament strand consisting in the combination of a rim-like container and accumulator having a circular periphery with axially spaced curved return walls forming a semi-circular cross section and having at least one centrally open side with

a continuous strand laid upon said peripheral wall in a wave form layer extending circumferentially around said wall and continuing in spirally arranged inwardly superposed wave form layers to form a torus shaped mass of strand with a free end on its exterior peripheral surface and a free end at its inner annular surface.

3. An annular mass of continuous strand consisting of a plurality of discrete superposed layers each of which extends spirally around the axis of the annular mass with each superposed layer lying radially inside each previous layer and in each of which layers the strand lies in random, high-frequency wave form patterns, the pattern and the strand being continuous from the generally cylindrical exterior layer through the mass, the amplitude of the waves extending from side to side of the mass and the frequency of the waves being such that a plurality of waves lies in each of said layers.

4. A package of continuous multifilament strand according to claim 2 in which said rim-like container consists of two mating halves separable on the median plane of said container, each of said halves having an axial opening and a quarter turn, saucer-like rim terminating in a perimetrical, planar flange and cooperating means on said flanges for separably attaching said mating halves together.

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