

June 8, 1943.

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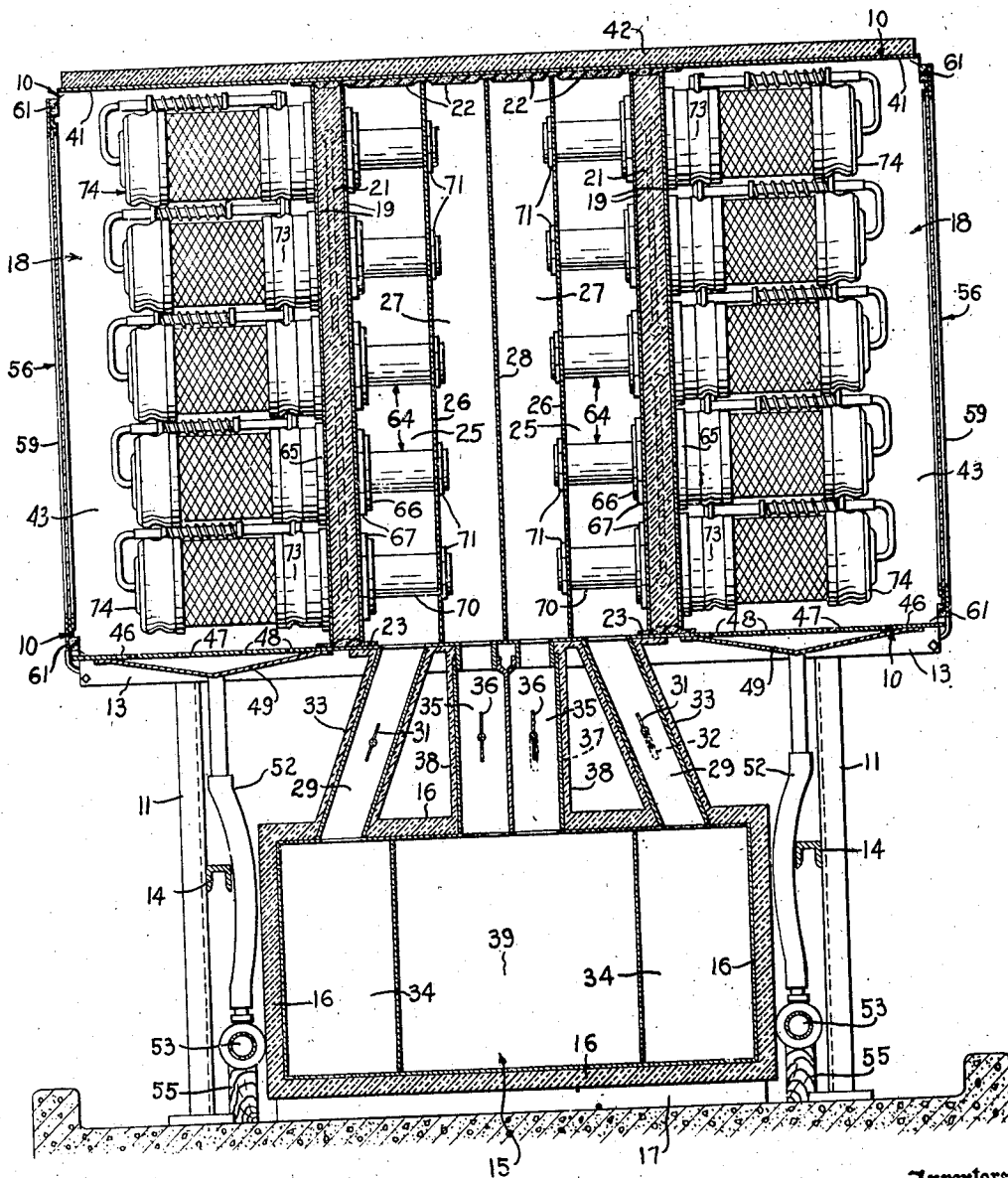
2,321,541

APPARATUS FOR PROCESSING THREAD

Filed June 10, 1940

3 Sheets-Sheet 1

FIG. 1



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3 Sheets-Sheet 2

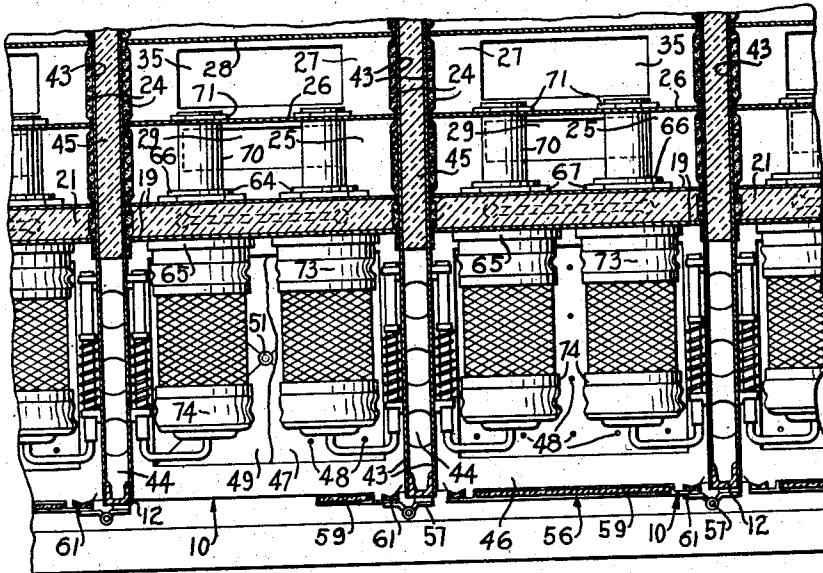


FIG. 3

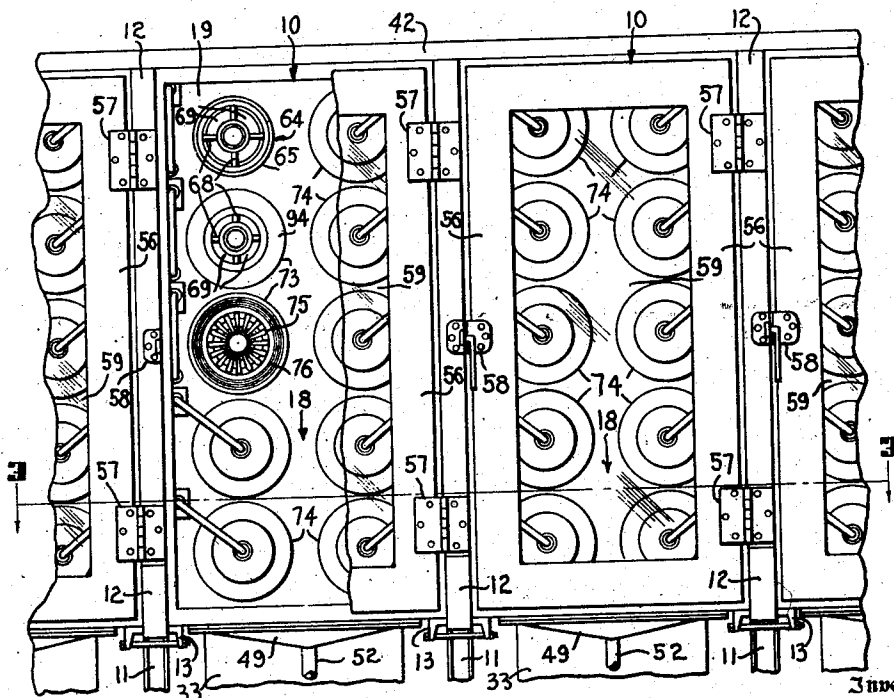


FIG. 2

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3 Sheets-Sheet 3

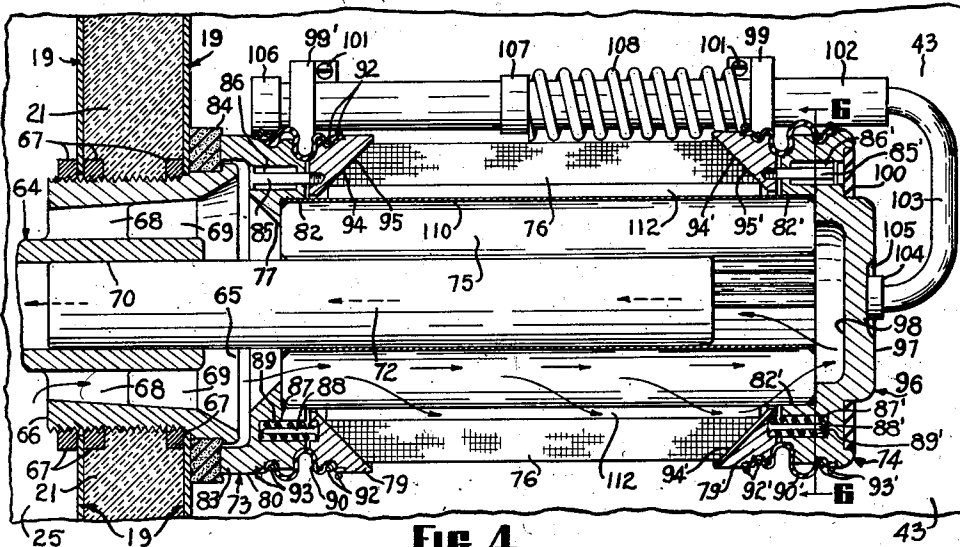


FIG. 4

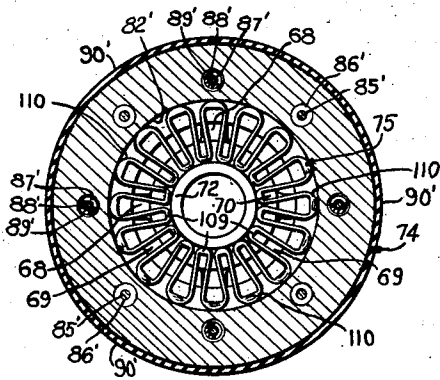


FIG. 6

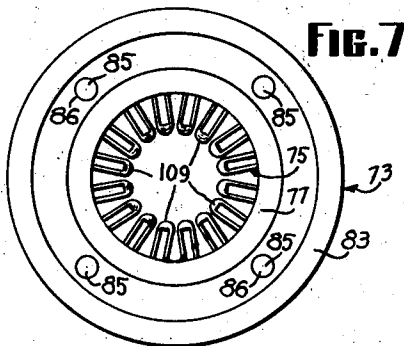


FIG. 7

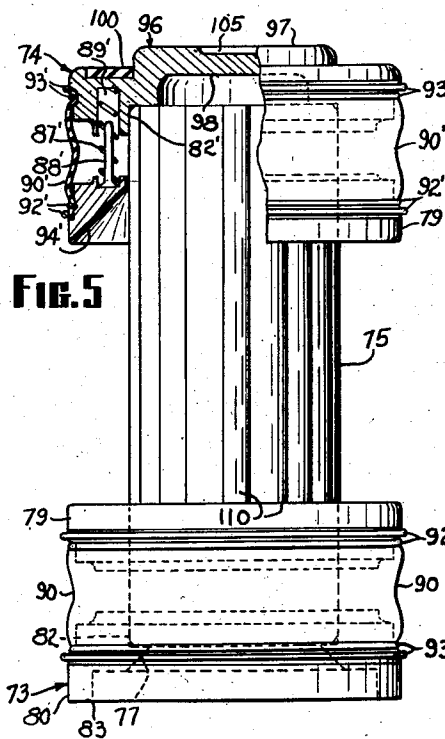


FIG. 5

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2,321,541

APPARATUS FOR PROCESSING THREAD

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7 Claims. (Cl. 34—104)

The present invention relates to apparatus for supporting thread packages or thread bodies made up of a plurality of layers of thread during processing treatment. More particularly, it relates to means for supporting the package or thread body during drying. As hereinafter employed, the term "thread" is used in the generic sense: it is intended to embrace materials, whether of natural or synthetic origin, such as tapes, bands, single- or multiple-filament threads, cords and the like but notably those intended for weaving purposes. For convenience, however, the invention will be described as employed in the manufacture of multiple filament viscose artificial silk thread.

In the production of multiple filament viscose artificial silk thread, the desideratum is to make a product which will have universal adaptability. Many conventional practices presently employed in manufacturing multiple filament viscose artificial silk thread produce a material which, due to non-uniformity of physical and physico-chemical characteristics, is not suitable for weaving purposes. Much of this non-uniformity, particularly in the so-called spool-spinning process, is traceable to the practices employed in the drying operation.

In the spool-spinning process, thread in package form is customarily exposed to the action of a drying medium applied simultaneously to the innermost and outermost layers of the package. Such practices give rise to uneven shrinkages due to the fact that portions of the length of thread comprising the package are subjected to unequal tension induced by different rates of drying, depending upon the proximity of the thread layers to the source of the drying medium. Various methods have been devised to correct for these factors.

One process which has been found to produce thread of more nearly uniform character is unidirectional drying, according to which the drying medium is introduced exclusively from one side of the package; for instance, from within the inner core of said package, wherefore drying must proceed layer by layer from the interior to the exterior layers thereof. In such operations, it is extremely difficult, due to the fact that the package shrinks both axially and radially, to seal the ends of the package sufficiently to prevent leakage of the drying medium from the interior of the package. Obviously, unless such leakage can be prevented, the outer layers will dry simultaneously with the inner layers.

The instant invention contemplates apparatus which, when assembled with the thread package, effectively maintains a sealing action upon the ends thereof, thus preventing leakage of the drying medium. The preferred embodiment of the invention is illustrated as adapted to the drying of thread wound in package form upon a suitable flexible winding surface. The apparatus is, however, readily capable of modification to handle other types of thread packages than that shown.

In the accompanying drawings, Figure 1 is a sectional elevation of a thread-drying apparatus employing the supporting device of the present invention. Figure 2 represents a partial front elevation of the apparatus of Figure 1. Figure 3 is a sectional plan as seen from line 3—3 of Figure 2. Figure 4 is a section on an enlarged scale, with parts in elevation, of one of the supporting devices employed in the apparatus of Figure 1. Figure 5 indicates the relationship of the parts of the device of the invention as employed in connection with one form of flexible winding spool. Figure 6 is a section from line 6—6 of Figure 4. Figure 7 represents an end elevation of the assembly of Figure 5.

The drying apparatus illustrated in Figures 1, 2 and 3, which is of the type shown and described in Fryer et al. Patent 2,288,618, employs the supporting devices of the instant invention. It comprises a plurality of cabinets 10 which are preferably arranged in a double row back to back, extending longitudinally of and at some distance above a supply duct 15. Vertical frame members 11 arranged at spaced intervals along longitudinally extending horizontal frame members 14 carry spacer members 12 and lateral members 13 upon which cabinets 10 are supported in operative relation to supply duct 15 supported above the floor by blocks 17.

Each cabinet 10 is preferably made up of a spool compartment 18, an intake chamber 25, and an exhaust chamber 27. Rear panel 19, containing insulating material 21, serves to separate spool compartment 18 from intake chamber 25. Sponge rubber gaskets 22, 23 and 24 form a leak-proof seal about the top, bottom and sides respectively of rear panel 19 to prevent the leakage of drying medium from intake chamber 25 into spool compartment 18. Division wall 26 separates intake chamber 25 and exhaust chamber 27, while wall 28 serves as a common division between the corresponding exhaust chambers 27 of adjacent units of the drying apparatus.

Supply duct 15 is divided longitudinally into a central return duct 39 flanked on either side by inlet ducts 34. By this arrangement, fresh drying medium is introduced from inlet ducts 34 into the several intake chambers 25 and moisture-laden drying medium is removed by means of return duct 39 from exhaust chambers 27 of cabinets 10 extending therealong. Supply duct 15 is preferably enclosed by a suitable insulation jacket 16 which is provided primarily for the purpose of preventing dissipation of heat from the heated drying medium conveyed by inlet ducts 34 and return duct 39.

Inlet branch ducts 29, each of which is jacketed with insulating material 33, connect with and serve to direct drying medium from each inlet duct 34 to the adjoining intake chamber 25 of each cabinet 10 on the same side of the apparatus. Each inlet branch duct 29 is provided with an individual control damper 31 which is manually adjustable by means of lever 32. Such means are needed in order to control the rate of flow of the drying medium entering the intake chamber and to permit equalization of the supply of said drying medium to each of the units comprising the apparatus.

Connecting the several exhaust chambers 27 with the central return duct 39 are exhaust branch ducts 35 for the removal of the moisture-laden drying medium. Control dampers 36 equipped with levers 37 for manual adjustment are provided in exhaust branch ducts 35 as in the case of inlet branch ducts 29 to control the efflux of the drying medium from exhaust chambers 27. Each exhaust branch duct 35 is jacketed with insulating material 33.

Each pair of cabinets 10 arranged back to back and extending transversely of the longitudinal axis of the apparatus has a common top 41 and floor 46. Surmounting top 41 is a layer of insulating material 42. Sidewalls 43, which are secured to spacer members 12, extend laterally of the apparatus and serve to separate each pair of cabinets from the adjacent pairs, as indicated in Figure 3. Insulating panel 45 is provided between sidewalls 43 with the exception of that portion of said sidewalls adjacent spool compartments 18, which is left uninsulated. Thus is formed air space 44 which aids in the dissipation of any heat which may be imparted during the operation to the interior of each spool compartment 18.

Inserted in a substantially square opening in floor 46 of each spool compartment 18 is a base plate 47 in which are drilled a number of drain holes 48. Secured to the opening in floor 46 below base plate 47 is a generally funnel-shaped pan 49 in the apex of which is a drain outlet 51 communicating by means of drain pipe 52 with drain conduit 53 extending longitudinally of the apparatus. When a thread package is first placed in the dryer, a certain amount of the processing medium in the thread package drips therefrom, is collected in pan 49, and removed by means of an inclined conduit 53 mounted upon a series of supports 55.

Access to the interior of each spool compartment 18 for the insertion of spools mounting wet thread packages and the removal of such spools after the drying operation has been performed is provided by means of a tight fitting door 56 hung from spacer members 12 of the apparatus, as by means of hinges 57. The entire outer edge of door 56 is sealed by means of sponge rubber insulating material 61 so as to insure a substan-

tially air-tight closure when door 56 is locked in place by means of latch 58. In order to facilitate inspection of the thread packages during the drying operation, each door 56 is equipped with a transparent window 59 of glass or other similar material adapted to withstand heat.

As hereinabove indicated, it is desirable that the drying medium be passed into and withdrawn from the interior of the package in order that the package may be dried layer by layer from the innermost toward the outermost layers. Optimum operating conditions involve maintaining the atmosphere within spool compartment 18 as nearly static as possible so that the outer layers of the package will not dry simultaneously with the inner layers. Thus it is desirable to prevent the influx of air to spool compartment 18 which might produce a circulation of the air therein so as to cause premature drying of the exterior of the thread package.

Within each spool compartment 18 and mounted on the rear panel 19 thereof are a plurality of spool mounting bases 64 each of which is generally of the form of a hollow cylinder. Each base 64 comprises a face 65 which projects into spool compartment 18 and a butt portion 66 which extends through panel 19 into intake chamber 25. The exterior of butt portion 66 is threaded to accommodate nuts 67 which serve to secure base 64 in rear panel 19.

Extending axially of and supported within base 64 by means of webs 68 separated by openings 69 is a generally tubular shank portion 70 which extends through intake chamber 25 and communicates with exhaust chamber 27. Nut 71 threaded upon the end of shank portion 70 effectively seals the opening in division wall 26 through which said shank portion passes. Exhaust tube 72 inserted in the end of shank portion 70 adjacent face 65 and projecting therefrom serves not only to assist in the recirculation of the drying medium but also to locate the thread package.

As hereinbefore indicated, the invention contemplates, among other things, apparatus for supporting the thread package while it is disposed in spool compartment 18. Such apparatus preferably takes the form of base collar 73 and cap 74 which serve not only to support the thread package but, as will be hereinafter explained, to provide means for recirculating the drying medium within the interior of the package. These parts also serve to maintain a fluid-tight seal with the ends of the package to prevent leakage of the drying medium.

A flexible corrugated spool 75 of the type shown in Figures 5 and 6 upon which is wound package 76 is especially adapted to employment with the apparatus of the instant invention. Spool 75 is characterized by a plurality of longitudinally extending grooves 109 and ridges 110. This spool construction, which is shown and described in the copending application of Louis S. Fryer and Wayne J. Jokilehto Serial No. 339,666, filed June 10, 1940, gives rise to a relatively high degree of radial flexibility and freedom from fatigue. It is not intended, however, that the instant invention shall be restricted to a flexible core of the class above described.

Base collar 73 of the invention comprises a floating ring 79 and a compression ring 80. Upon assembling the apparatus for insertion in the dryer, compression ring 80 into which one end of spool 75 is inserted operates by virtue of shoulder 82, which is of slightly smaller diameter than

the normal diameter of spool 75, to compress away from the interior of package 76 at least a portion of said spool. This operation causes the inner diameter of spool 75 to conform substantially to the outside diameter of exhaust tube 72. Conically shaped opening 77 in compression ring 80 serves to direct the drying medium passing from intake chamber 25 through openings 69 to the interior of package 76. An annular flanged portion 83 extending about opening 77 fits over face 65 of spool mounting base 64 and is sealed by contact with a sponge rubber gasket 84 encircling said face 65.

Floating ring 79 of base collar 73, which is adapted to slip freely over the end of compressed spool 75, is supported from compression ring 80 by means of a plurality of guide pins 85. Said guide pins 85, which are threaded into the flat face of floating ring 79 adjacent compression ring 80, are adapted to slide longitudinally within cylindrical sockets 86 formed in said compression ring. An equal number of springs 87 disposed about fingers 88 formed upon floating ring 79 and alternately spaced with respect to guide pins 85 cooperate with spring sockets 89 to force floating ring 79 and compression ring 80 apart. Flexible tubing 90 held in place by wire clamps 92 and 93 serves to provide a flexible connection between floating ring 79 and compression ring 80 while preventing escape of the drying medium therebetween.

The face of floating ring 79 opposite that adjacent to compression ring 80 is tapered as indicated by reference character 94 to conform to the shape of shoulder 95 formed on package 76 upon spool 75. Depending upon the method of winding package 76, tapered portion 94 may be altered to correspond generally with the shoulders 95 and 95' on the ends of the package, regardless of whether they be square, hyperbolic or stepped. It is especially desirable to have the contour of tapered portion 94 of floating ring 79 and package shoulder 95 conform, for otherwise leakage or channelling of the drying medium may result.

The structure of cap 74 corresponds generally to that of base collar 73. The principal difference in cap 74 is that its compression ring 96 has a blank outer face 97 and a substantially cup-shaped inner deflecting surface 98. Shoulder 82' corresponding to shoulder 82 of base collar 73 cooperates with the latter to compress the other end of spool 75 uniformly away from package 76 leaving the package itself supported entirely by tapered portions 94 and 94' of floating rings 79 and 79' of base collar 73 and cap 74, respectively.

Guide pins 85', sockets 86', springs 87', fingers 88' and spring sockets 89' of cap 74 correspond both in arrangement and function with their corresponding parts in base collar 73.

To facilitate assembly and to insure against possibility of leakage of drying medium around guide pins 85', sockets 86' are formed by drilling the holes therefore through the outer face 97 of cap 74. After inserting guide pins 85', ring 100 is cemented in place to seal the openings of said sockets in outer face 97. This precaution is unnecessary in the case of sockets 86 in base collar 73. Flexible tubing 90' held in place by wire clamps 92' and 93' is provided on cap 74 and corresponds generally with that of base collar 73.

In the operation of the apparatus of Figure 1, it is the practice to fit spool 75, together with its

package 76, base collar 73 and cap 74 together as a unit in the manner suggested by Figure 5 before positioning the assembly upon one of the several spool mounting bases 64 in spool compartment 18. Assembling each drying unit in this manner permits the operator to adjust floating rings 79 and 79' of base collar 73 and cap 74 respectively so that they will fit snugly against the ends of package 76, maintaining constant contact with shoulders 95 and 95' thereof.

By virtue of this method of mounting floating rings 79 and 79' upon compression rings 80 and 96 of base collar 73 and cap 74 respectively, such rings are capable of movement under the influence of springs 87 and 87' within the limits imposed by guide pins 85 and 85' and sockets 86 and 86' in which they slide. Floating rings 79 and 79' therefore continually follow thread package 76 as it shrinks during the drying operation. Package 76 is, of course, supported by tapered portions 94 and 94' of floating rings 79 and 79' out of contact with spool 75, for spool 75 is compressed by shoulders 82 and 82' of base collar 73 and cap 74.

After spool 75 is assembled in this fashion with its respective base collar 73 and cap 74, the unit is slipped over the extended end of exhaust tube 72 until annular flanged portion 83 of base collar 73 contacts sponge rubber gasket 84 surrounding face 65 of spool mounting base 64. Suitable means are provided for holding each unit in this position, such, for example, as clamping device 102. One such clamping device is provided for each position and is mounted upon the sidewall 43 of spool compartment 18 adjacent each spool mounting base 64, being secured thereto by means of brackets 99 and 99' and bolts 101.

Clamping device 102 is adapted to pivot about its longitudinal dimension and to slide in a direction parallel to the longitudinal axis of spool 75 when the latter is positioned in spool compartment 18. On the forward end of clamping device 102, handle 103 is provided having a butt portion 104 which registers with depression 105 in outer face 97 of cap 74. Collar 106 is fitted on the end of clamping device 102 opposite to handle 103 to serve as a stop to prevent its being drawn through bracket 99' when in extended position. A second collar 107 on clamping device 102 serves to urge spring 108 against bracket 99, thereby causing butt portion 104 to exert a force of compression against cap 74 sufficient to hold the entire assembly in place on spool mounting base 64.

With spools 75 mounted in place in spool compartment 18 in the manner just described, clamping devices 102 are applied to caps 74, after which door 56 is closed and locked by means of latch 58. Drying medium circulated through ducts 34 by means of a suitable impelling device (not shown) is directed into each intake chamber 25 by means of inlet branch ducts 29. From intake chamber 25, the drying medium passes through openings 69 in spool mounting bases 64, through conically shaped opening 77 in base collar 73, and thence along the outer periphery of spool 75 into a generally cylindrical space 112 which is left between said spool and thread package 76.

The manner in which the drying medium moves along the interior of each package 76 is indicated by the arrows in Figure 4. Having absorbed some of the moisture from the thread, the drying medium strikes deflecting surface 98 of cap 74 and is directed toward exhaust tube

72 about which spool 75 is disposed. Exhaust tube 72, shank portion 64, and exhaust chamber 27 cooperate to remove the moisture-laden drying medium which is directed therefrom by means of exhaust branch ducts 35 into central return duct 39 and thence to the suction side of the aforementioned impelling means.

Upon completion of the drying operation, the spools and thread packages may be removed by releasing clamping means 102 and removing as a unit spool 75, bearing dried thread package 76, base collar 73 and cap 74. After the removal of the spool and thread package from base collar 73 and cap 74, the equipment is ready for the next batch of spools. The thread on the spool may be packaged in any suitable way by unwinding it from said spool onto a twister, a coning machine, skeining device or the like, or it may be otherwise handled as desired before packaging.

As will appear to those skilled in the art, various modifications may be made in the apparatus hereinbefore described without in any way departing from the spirit of the invention. Base collar 73 may, for instance, be formed integrally with spool mounting base 64. Other equally satisfactory means may, if desired, be devised not only for supporting floating rings 79 and 79' from base collar 73 and cap 74 respectively but also for urging tapered portions 94 and 94' thereof into contact with the shoulders of the thread package.

While the instant embodiment of the invention is adapted for use in the drying of thread formed into precision wound packages, it is readily applicable to a wide variety of other analogous uses. It may, for example, be found useful with little or no alteration for the application of other treatment processes involving the use of either liquid or gaseous processing media. The apparatus is likewise adapted to the treatment of thread collected in the form of pot-spun cakes or other types of thread packages, whether or not wound upon a core or insert.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. Apparatus for processing a thread body of hollow, generally cylindrical form made up of a plurality of layers comprising demountable means disposed at each end of the thread body; means for maintaining said demountable means in substantially fixed relation to each other; supporting means cooperating with said demountable means for supporting said thread body; means associated with one of said demountable means for introducing a processing medium into the interior of the thread body; means associated with the other of said demountable means for directing the processing medium from the interior of the thread body to the exterior thereof, said directing means cooperating with the means for introducing the processing medium to create a flow of processing medium in a substantially axial direction within the interior of the thread body in contact with the innermost layers thereof; and flexible sealing means joining said supporting means and said demountable means for preventing escape of the processing medium from the interior of the thread body in the course of the processing operation.

2. Apparatus for processing a thread body made up of a plurality of layers wound upon a member having a flexible winding surface of generally tubular form, said apparatus comprising demountable means in fixed relation to each other at each end of said flexible winding surface for uniformly compressing the same so that the thread body is wholly out of contact with said winding surface; means associated with one of said demountable means for introducing a processing medium into the interior of the thread body; deflecting means associated with the other of said demountable means for directing the processing medium from the interior of the thread body to the exterior thereof, said directing means cooperating with the means for introducing the processing medium to create a flow of processing medium substantially axially of the interior of the thread body in contact with the innermost layers thereof; and, resiliently mounted upon each of said demountable means, means for supporting the thread body and simultaneously sealing it by maintaining constant contact with the ends thereof so as to prevent escape of the processing medium from the interior of the thread body in the course of the processing operation.

3. Apparatus of the character described in claim 2 in which said demountable means comprise an annular ring and a cover having an annular rim on one face thereof.

4. Apparatus of the character described in claim 2 in which said demountable means comprise an annular ring and a cover having an annular rim on one face thereof, the inner diameters of said annular ring and said annular rim being less than the normal outer diameter of said flexible winding surface.

5. Apparatus of the character described in claim 2 in which said resiliently mounted means comprise annular rings provided with means for forming fluid-tight contact with the ends of the thread body.

6. Apparatus of the character described in claim 2 in which said demountable means comprise an annular ring through the center of which a processing medium can be introduced into the interior of the thread body and a cover provided with a cup-shaped depression in one face thereof which directs the processing medium from the interior of the thread body.

7. Apparatus for processing a thread body of hollow, generally cylindrical form made up of a plurality of layers comprising demountable means disposed at each end of the thread body; means for maintaining said demountable means in substantially fixed relation to each other; means associated with one of said demountable means for introducing a processing medium into the interior of the thread body; means associated with the other of said demountable means for directing the processing medium from the interior of the thread body to the exterior thereof; supporting means resiliently mounted upon each of said demountable means for supporting the thread body; and sealing means cooperating with said supporting means and said demountable means to prevent the escape of processing medium from the interior of the thread body in the course of the processing operation.

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