Dec. 8, 1942. J. J. FRANKLIN 2,304,685

FILAMENT DRIER

Filed Nov. 25, 1940 4 Sheets-Sheet 1

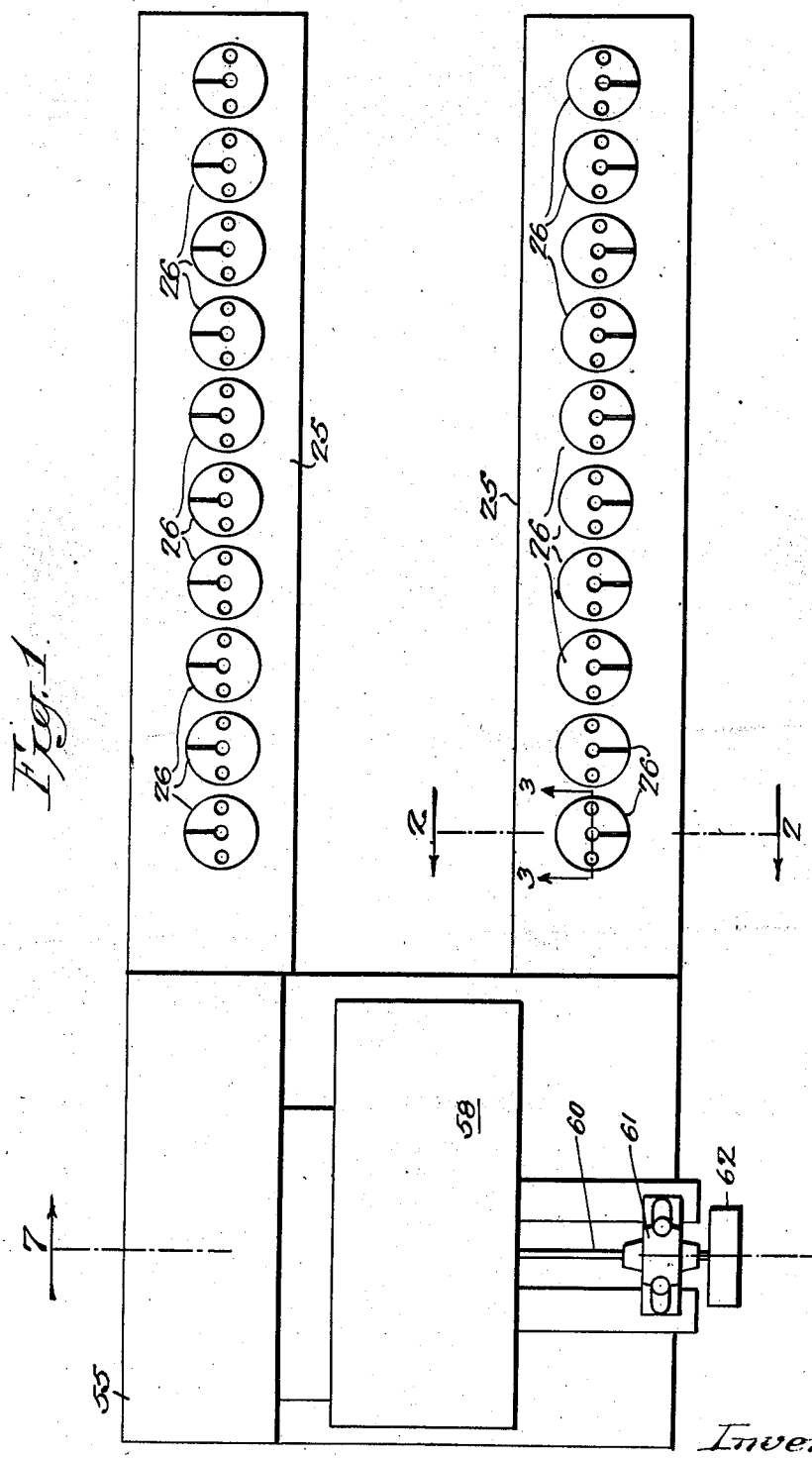


Fig. 1

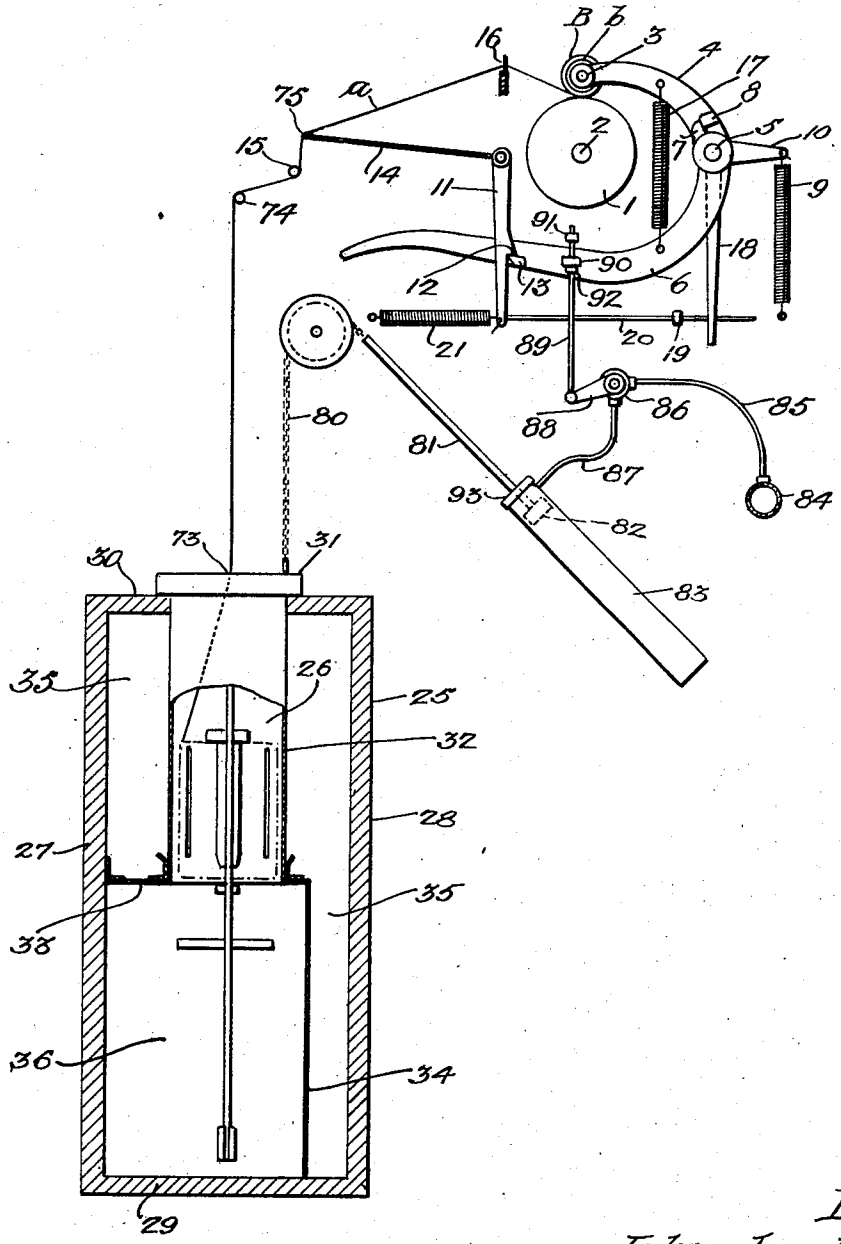
Inventor
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Fig. 2.



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Fig. 6.

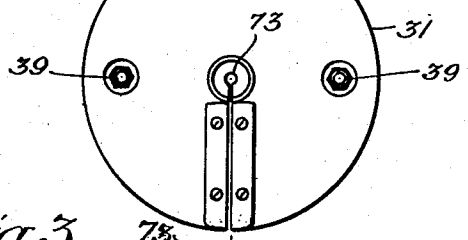


Fig. 3

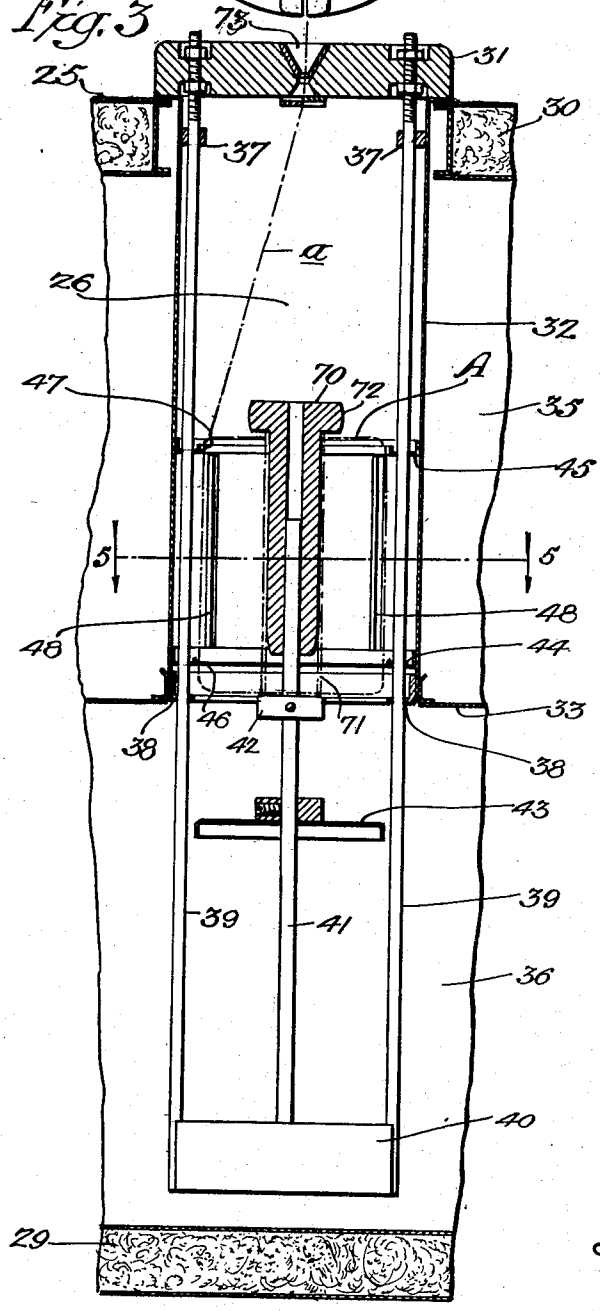


Fig. 4.

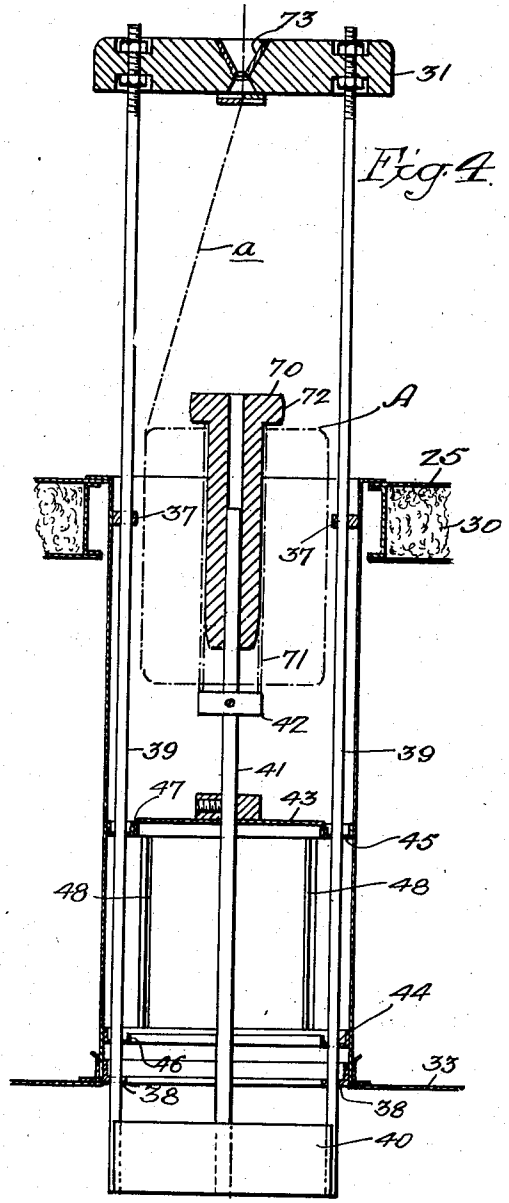
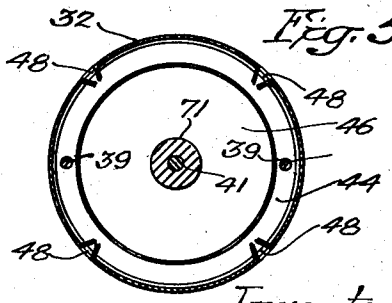


Fig. 5.



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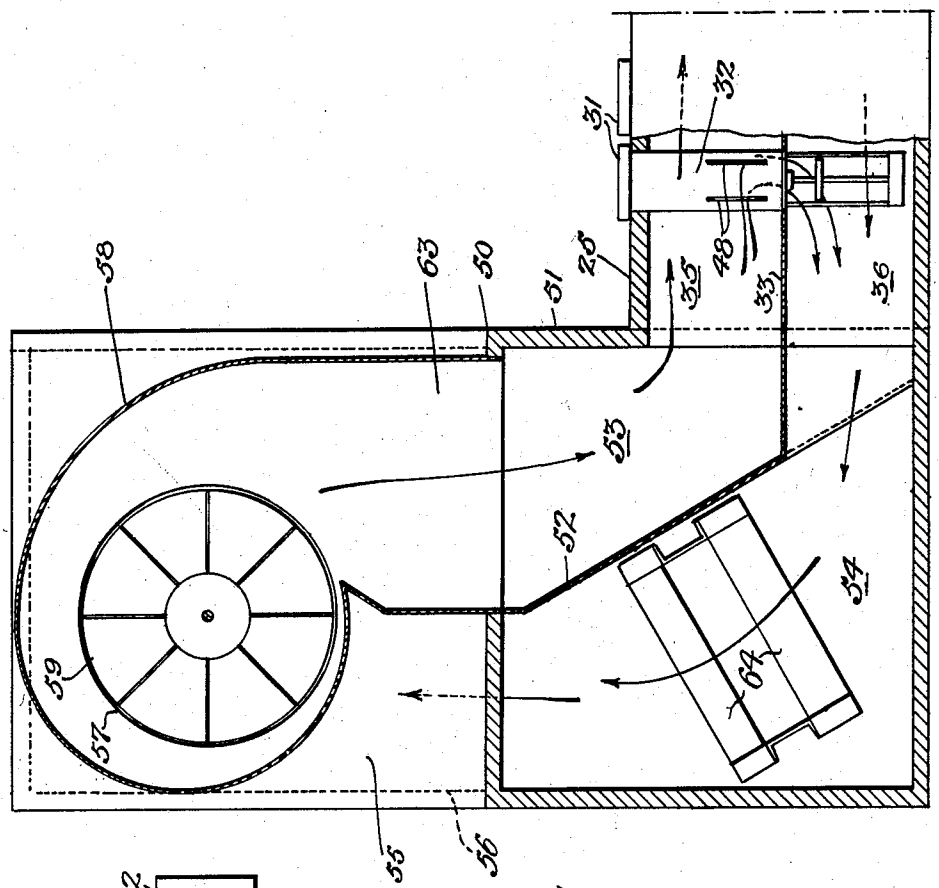


Fig. 8.

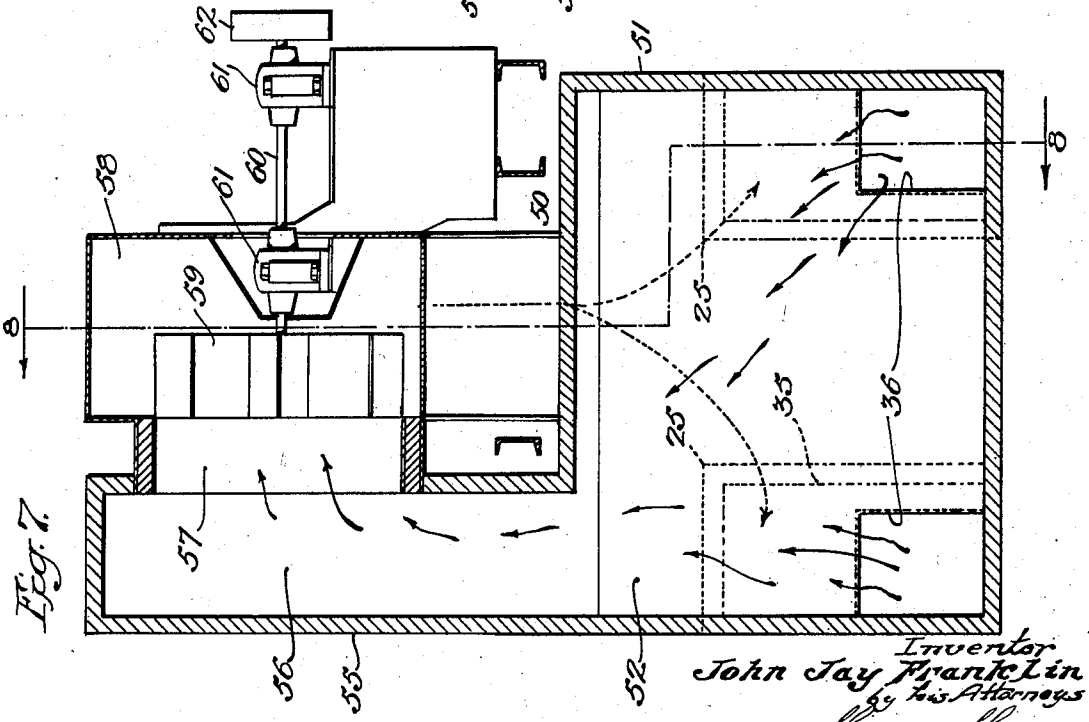


Fig. 7.

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UNITED STATES PATENT OFFICE

2,304,685

FILAMENT DRIER

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Application November 25, 1940, Serial No. 367,131

15 Claims. (Cl. 34—21)

This invention relates to the drying of "wet-package" filaments, i. e., filaments which have been respectively wound into packages, with each package composed of successive circular superposed layers, and with each layer consisting of a series of convolutions or turns of the filament. In this form the filament is subjected to dyeing, bleaching, washing or other processing from which the package emerges with the filament in a wet or moist condition throughout the whole of the bulk of the package.

The present invention embodies basic principles for drying "wet-package" filaments as disclosed in the common assignees' copending application of Alpheus O. Hurxthal, Harold G. Black and Phillips K. Schwartz, Serial No. 322,022, filed March 2, 1940, which issued as Patent No. 2,264,207.

It has been common practice to place a large number of the wet filament packages in a heated chamber at one time for simultaneously drying the packages; and to rewind or "backwind" the filaments from the respective packages, after the packages have been dried, onto the bobbins, spools, cones, etc., for future use. This method requires two separate handlings of each package, i. e., one to install each package on and another to remove the package from the rack, etc., on which the packages are supported in the drier. This method also requires the installation and maintenance of a large expensive drier which occupies considerable floor space. Furthermore, the bulk drying method requires twelve to twenty hours in the drier and is not particularly inductive to uniform drying throughout the whole of the bulk of filament contained in a package. The packages frequently vary from bone dry exteriors to 15% to 20% moisture content in the interior portions of the respective packages.

The primary object of the present invention is to backwind the filaments directly from the wet packages onto the bobbins, spools or cones, etc., on which the filaments are normally wound after bulk drying, as above described; and to dry each filament uniformly as it is being withdrawn from the wet package and passes to the traverse of the dry winding machine, thereby eliminating the necessity for providing large expensive space-consuming driers and the necessity for handling each package several times between the wet processing and the dry backwinding operations.

Another object of the invention is to arrest the drying operation during any interruption of the backwinding operation arising from breakage of the filament, or which may be required in order to replace a full dry package by an empty core element on the spindle of the dry winder.

Another object of the invention is to concentrate impingement of a suitable gaseous drying medium directly against the convolutions of the filament forming the exposed surface of the wet package, whereby drying of the filament is completed in and as it leaves the convolutions of the layer exposed to the influence of the drying medium, and whereby evaporation of moisture from the filament forming the underlying layers begins before the respective layers become successively exposed to the direct impingements of the drying medium, such initial evaporation occurring as a result of the influence of the drying medium progressively penetrating to the interior of the package as the exposed layers are successively removed from the package.

The invention is adaptable to a dry winder having a plurality of winding heads which, while normally operating simultaneously, may be independently stopped without interfering with the normal operation of other winding units of the machine. Another object of the invention, therefore, is to maintain a constant flow of drying medium to the impingement nozzles respectively operating against a plurality of packages simultaneously; and to withdraw any one of the wet packages from the zone of influence of the impingement nozzles, without interrupting the flow through the nozzles adapted to direct the drying medium against the withdrawn package, if and when interruption of the withdrawal of the filament from that particular package occurs under circumstances noted above, whereby the temperature, volume, and/or humidity of the drying medium being circulated through the apparatus will remain constant at all times.

It will be understood that the size, character, and density of the filament yarn or thread being dried and backwound, under the principles of the present invention, will determine the rate at which the filament is withdrawn from the wet package and wound on the dry package, and also the temperature of the drying medium employed, as heavy, hard, twisted filaments composed of animal or vegetable fibres will require greater drying time and higher temperatures than light weight and/or soft, twisted yarns, while filaments of a synthetic nature, of large and small diameters respectively, may require still different speed and temperature regulations. For these reasons, any dry winder to which the apparatus of the present invention is to be applied

should be equipped with a suitable conventional speed controlling means for varying the winding speed of the machine; and the apparatus employed for creating and circulating the currents of drying medium to the impingement nozzles should be provided with a suitable conventional means for controlling the temperature and humidity of the drying medium in circulation.

The present invention particularly concerns an apparatus adapted to be associated with a conventional backwinding machine, for drying the filaments of a plurality of wet packages simultaneously, as the filaments are being respectively withdrawn from the wet packages and individually wound, in a dry condition, on bobbins, spools, cones or other core elements mounted on the respective spindles of the winding machine; and to apparatus associated with and operated by the stop motion of each winding head of the winding machine for removing the wet package from the zone of influence of the drying medium at any one of the plurality of winding heads of the machine at which the winding operation is interrupted.

In the accompanying drawings:

Fig. 1 is a plan view of a drying apparatus adapted for association with a conventional double-bank winding machine;

Fig. 2 is a transverse section of one side of the drying apparatus as associated, diagrammatically, with one of the winding heads of the winding machine the section being taken on the line 2—2, Fig. 1;

Fig. 3 is an enlarged longitudinal sectional elevation taken on the line 3—3, Fig. 1, with the wet package in normal drying position;

Fig. 4 is a view similar to Fig. 3 with the wet package removed from the zone of influence of the drying medium;

Fig. 5 is a sectional plan view taken on the line 5—5, Fig. 3;

Fig. 6 is a plan view of the unit shown in Fig. 3;

Fig. 7 is a transverse sectional elevation drawn to an enlarged scale and taken on the line 7—7, Fig. 1; and

Fig. 8 is a longitudinal sectional elevation taken on the line 8—8, Fig. 7.

In Fig. 2, there is sufficient of one of the winding heads of a conventional double-bank winding machine shown to illustrate the principles of the present invention as applied to such machines. The shaft supporting and rotating all of the driving drums 1, along one side of the double-bank winding machine, is shown at 2. The spindle for supporting a core *b* of a dry package B is shown at 3.

The spindle 3 is carried by an arm 4 which is pivoted at 5 to any rigid part of the frame of the machine. Also pivoted at 5 is a knock-out lever 6 which has a lug 7 adapted to engage a lug 8 on the arm 4 to rock the arm 4 and lift the package B off the driving drum 1, when the filament *a* breaks or when the package B contains a predetermined amount of the filament *a*.

A spring 9 having one end secured to a rigid part of the machine and its opposite end secured to an arm 10 of the lever 6, tends to rock the lever 6 to lift the package B. The lever 6 is held in a normal position to resist the action of the spring 9 by a latch 11 having a shoulder 12 engaging a shoulder 13 on the lever 6.

The latch 11 has an arm 14 attached thereto which is engaged at its outer end by the filament *a*, intermediate a fixed guide 15 and the traverse 16 by which the filament *a* is laid back and forth on the outside surface of the package B as the package is rotated by contact with the peripheral surface of the drum 1.

A spring 17, stretched between the arm 4 and lever 6, holds the package B in firm driving contact with the drum 1 as the package increases in diameter and carries the lug 8 of the arm 4 away from the lug 7 of the lever 6.

When the package B attains a predetermined diameter, an arm 18 forming part of the arm 4, engages a collar 19 on a trip rod 20 and rocks the latch 11 to release the lever 6, whereupon the spring 9 rocks the lever 6 until its lug 7 engages the lug 8 on the arm 4, after which the lever 6 rocks the arm 4 until the package B is raised clear of the drum 1, thereby stopping rotation of the package.

The tension of the filament *a* between the guide 15 and traverse 16 normally holds the stop motion lever in a normal position against the action of a spring 21 which has one of its ends secured to the latch 11 and its opposite end secured to a fixed part of the machine. If the filament *a* breaks, or the wet package A becomes exhausted, the stop lever 14 is released and the latch 11 is rocked by the spring 21 to release the lever 6, whereupon the lever 6 acts to stop the rotation of the package B, in the manner above noted.

The operation of the mechanism above described is typical, in general principle, to the actions of any of the well known winding or backwinding machines in general use. The description and diagrammatic illustration of the winding machine thereof is provided merely for the purpose of illustration of that type of device and is not to be considered as imposing any limitations on the drying apparatus forming the subject of the present invention as hereinafter described.

As shown in Figs. 1 to 4 inclusive, the apparatus of the present invention includes an air box 25 for each side of the double-bank winding machine. Each air box 25 includes a wet-package well 26 for each winding head on the side of the winding machine with which the air box 25 is associated.

Each air box 25 is formed with insulated front, back and bottom closure walls 27, 28, 29 and top 30. In the insulated top 30 there is an opening for each wet-package well 26, covered by a removable insulated lid 31.

Each well 26 is formed of a cylinder 32 extending from the top 30 of the air box 25 to a transverse horizontal partition 33 disposed approximately midway between the top 30 and bottom 29 of the air box. The transverse partition 33 extends from end to end of the air box 25 and from the front wall 27 to a vertical longitudinal partition 34 spaced from the back wall 28 of the air box to form the interior of the air box into two longitudinally extending air conduits 35 and 36.

At opposite sides respectively of each well casing 32, adjacent the top 30 there is located a pair of bearings 37, 37 and in vertical alignment therewith, adjacent the partition 33 is a similar pair of bearings 38, 38. Slidably mounted in the bearings 37—38 is a pair of slide or elevator rods 39, 39, the upper ends of which are secured in the well lid 31 (Figs. 3 and 4) while the lower ends are secured to a transverse bar or yoke 40.

Secured to the center of the yoke 40, and projecting vertically therefrom, intermediate and parallel to the rods 39, 39, is a package support-

ing rod 41, on which is a package stop collar 42 and a horizontal disc 43, with the latter disposed below the former.

Within the well 26 is a pair of rings 44 and 45, through which the rods 39, 39 extend, leaving free central circular openings 46 and 47 in the rings 44 and 45 respectively.

The ring 44 is secured to the inners surface of the well tube 32 adjacent the partition 33; and the ring 45 is likewise secured to the inner surface of the well tube 32 intermediate the partition 33 and top 30 of the air box 25.

Vertical nozzles 48, 48 are formed in and through the circular wall of the well tube 32 (Fig. 5) as slots extending from the horizontal partition ring 44 to the horizontal partition ring 45 (Figs. 3 and 4), with the opposite side walls of the slots converging inwardly toward the center of the well.

The partition 33 is provided with an opening of the same diameter as the interior of the well tube 32, in axial alignment therewith to afford communication between the interior of the well and the conduit 36 for air or other gaseous drying medium entering the interior of the well from the conduit 35 through the nozzle slots 48, 48.

As shown in Figs. 1, 7 and 8, the air boxes 25, 25 are attached to an air circulator and conditioner 50, which includes a lower box-like structure 51 provided with an angular partition 52 dividing the interior thereof into compartments 53 and 54 respectively.

The conduits 35, 35 of the air boxes 25, 25 respectively communicate with the compartment 53, while the conduits 36, 36 of the air boxes 25, 25 communicate with the compartment 54.

Above the lower box-like structure 51 the circulator 50 is provided with an extension 55 in which is formed an air space 56 communicating with the compartment 54 of the lower box 51. The air space 56 also communicates with the inlet 57 of an air impeller casing 58 in which is rotatably mounted any suitable form of impeller 59, which may be of the radial fin type blower or disc type fan impeller. The impeller, in either case is mounted on the inner end of a shaft 60 which is rotatably mounted in bearings 61, 61 and provided with a pulley 62 by which the impeller may be rotated from any suitable source of power.

The outlet conduit 63 of the impeller casing 58 communicates with the compartment 53 of the circulator 50 and drives air into said compartment, under pressure. The air passes from the compartment 53 into the conduits 35, 35 of the air boxes 25, 25 respectively and passes through the nozzles 48, 48 into the interiors of the well casings 32, 32, from which the air passes downwardly into the conduits 36, 36. The air entering the conduits 36, 36 returns to the compartment 54 of the circulator 51, in which are mounted suitable coils or other heaters 64, such for example, as the "Trane" type heater, through which the air passes and is heated in transit. The air passing through the heaters 64 is drawn, by the suction of the impeller 59, from the compartment 54, through the conduit 56 and inlet 57 into the impeller casing 58 for repeat of the circuit.

As shown in Fig. 4, a centering plug 70 is first forced into one end of the perforated core tube 71 of a wet package A, after which the plug 70 is placed on the central spindle 41 in the well 26 until the exposed end of the core tube 71 of the package A rests on the collar 42. The collar 42 supports the package A in proper position for drying with respect to the nozzles 48, 48 in the wall of the well casing 32.

The loose end of the filament of package A is threaded through a guide eye 73 in the lid 31 of the well 26 and is passed over a guide 74 (Fig. 2) then under the guide 15, over the laterally extended end 75 of the stop motion wire 14, through the eye of the traverse 16 and around the core *b* for the package B, between said core *b* and the driving drum 1. An annular flange 72 on the plug 70 assists in guiding the filament *a* from the package A to the eye 73, especially when the package A is materially reduced in diameter.

The lever 6 is pressed down and caught by the latch 11 and the elevator, including the lid 31, rods 39, 39, yoke 40, spindle 41, package A and disc 43, is pressed down into the well 26. These operations start the core *b* rotating to wind the filament *a* thereon.

When the elevator is lowered, as noted above, the wet package A (Fig. 3) is disposed within the centers of the rings 44 and 45, with the top end of the package slightly above the upper ring 45 and the lower end of the package slightly below the lower ring 44, while the main portion of the package lies between said rings adjacent the nozzle slots 48, 48.

The heated air being forced through the conduit 35 by the air impeller 59, rushes through the nozzle slots 48, 48 and impinges upon the outer surface of the package A.

The conduit 36, being under suction of the impeller 59, causes the impinging air to pass downwardly between the inner edge of the ring 44 and the outer surface of the package A.

The ring 44 restricts the flow of air between its inner surface and the outer surface of the package A, which retards the drying and promotes uniformity of moisture content in the dried filament *a*, especially when the package A is still large.

The whole of the outside surface of the package A comes within the zone of influence of the drying air and said air effects drying of those portions of the filament *a* which constitute the outer layer of the package A.

The packages A are usually, though not necessarily, of the cross-wound type, which produces interstices into which the drying air can and does penetrate below the extreme outermost layer of the filament. Thus, with the outer layer completely exposed to the influences of the drying air, it becomes thoroughly dry and is progressively removed, convolution after convolution, by the filament *a* being wound, in a dry state, on the package B.

As the convolutions of the outer layer of the filament *a* are successively removed from the package A, the next underlying layer becomes completely exposed to the influences of the drying air and the drying air penetrates deeper and deeper into the heart of the package as layer after layer is removed from the outside of the package. The air penetrating the package through the interstices thereof effects initial evaporation of moisture from the package for a distance of a few layers successively underlying the outermost layer. Consequently, when a layer becomes completely exposed, its finishing drying is effected almost instantly, due to the pre-evaporation of moisture therefrom while occupying the position of an underlying layer.

If, during the winding of a dry package B, the filament *a* should break, the wire 14 will be released and the spring 21 will operate the latch 11 to release the lever 6, whereupon the spring 9 will swing the lever 6 upwardly and carry the partially wound package away from the driving drum 1. At the same time, the wet package A will be moved out of the zone of influence of the drying air passing into the well 26 through the nozzle slots 48, 48, as shown in Fig. 4, to prevent drying of the package while there are no convolutions of the filament *a* being withdrawn therefrom, thus eliminating excessive drying of the filament.

As shown in Fig. 4, when the package A is moved out of the zone of influence of the drying medium, the disc 43 assumes a position in the plane of the upper ring 45 in the well 26, thereby closing the upper portion of the well in which the package A is then located from the lower portion of said well, which latter remains in communication with the return or suction conduit 35 in the air box 25. Thus the circulation of the drying air remains constant and retains its proper predetermined temperature.

The raising of the wet package A from its drying position (Fig. 3) to its non-drying position (Fig. 4) is effected automatically when the stop motion latch 11 is operated, either by the wire 14, when the filament *a* breaks, or by the trip rod 20, when a package B assumes a predetermined diameter.

The carrier for the package A is elevated by a chain or equivalent flexible connector 80 having one end connected to the lid 31 and its opposite end connected to a piston rod 81 of a piston 82 operating in a cylinder 83 by compressed air, steam, etc., from a live pressure line 84 through a branch line 85, three-way valve 86, and a pipe 87 connecting the three-way valve to one end of the cylinder 83.

The three-way valve 86 has an operating lever 88 to the outer end of which is connected an operating rod 89. A pair of relatively spaced collars 91 and 92 are secured to the rod 89 at opposite sides respectively of a lug 90 which is carried by the lever 6.

When the stop motion latch 11 is released and permits the spring 9 to raise the lever 6, the lug 90 engages the collar 91 which raises the rod 89 and operates the valve 86 to permit pressure to flow from the line 84 into the cylinder 83 between the head 93 at one end thereof and the piston 82.

The piston moves in the cylinder 83 and through the piston rod 81 and chain 80 lifts the lid 31 and the other elements connected thereto which constitute the elevator for the wet package A. The elevator elements and the package A are raised from their respective positions in Fig. 3 to their positions shown in Fig. 4 and remain in this latter position throughout the duration of the period of interruption of winding the filament *a* on a dry package B.

When the cause of the interruption has been corrected and the lever 6 is depressed by the operator to set the winding unit into operation again, the lug 90 on the lever 6 engages the collar 92 on the valve operating rod 89 and operates the three-way valve 86 to cut off the flow of operating fluid from the piston cylinder 83 and to exhaust the fluid from the cylinder between the head 93 and piston 82, whereupon the elevator for the package A will descend by gravity, assisted, if desired, by additional weight or spring influence, to return the package A from its idle non-drying position (Fig. 4) to its active drying position (Fig. 3), whereupon the well sealing disc 43 is removed from the plane of the upper ring 45 to an idle position in the return conduit 36.

Obviously, the fluid operated cylinder 83 and valve 86, etc., may be replaced by any suitable electrically operated prime mover such as a motor, and the valve 86 may obviously be replaced by a suitable switch or rheostat for controlling the motor, without departing from the spirit of the invention, as it will be understood that the illustration in the drawings is merely for the purpose of showing a workable connection between the package winding unit and the drying unit cooperating therewith to dry the filament as it is drawn from the wet package and wound on the dry package.

As shown in Fig. 5, there are four nozzle slots 48, 48 employed in the wall of each well casing 32, although three slots may be used and in some instances at least the smaller number is preferable. The filament *a* is withdrawn from the package A at a uniform rate of speed. When the package A is large, there is a greater number of yards in each layer of the filament *a* than when the package A is small in diameter. By using a small number of nozzle slots, the air from each slot impinges upon but a relatively small percentage of the external surface of the package A. As the diameter of the package decreases, the range of each nozzle covers a relatively larger percentage of the outside area of the package. When the package is larger, it takes a greater amount of time to remove the outer layer of the filament *a* from the package than when the package is of smaller diameter. Consequently, with a small number of nozzles respectively impinging upon small percentages of the exterior surface of a large package, the drying is slower. This slower drying takes place at the time when it requires a greater amount of time to remove the outer layer from the package. As the package gets smaller, and the time the outer layer is exposed to the air emitted from the nozzles decreases proportionately, the percentage of the area of the outer layer falling within the range of each nozzle becomes greater, thus the drying of the outer layers of smaller diameters is quickened. This results in uniform drying of the layers of large, small and intermediate diameters as the filament *a* is unwound from the package A at a uniform linear speed.

I claim:

1. The process which consists in exposing a surface of a package of wet filament to a drying medium to dry the filament on said exposed surface, withdrawing the filament progressively from said surface, and withdrawing said package from the influence of said medium upon interruption of the withdrawal of said filament from said package.

2. The process which consists in directing a series of jets of drying medium against the outer surface of a cylindrical package of wet filament from positions relatively spaced about the axis of the package, withdrawing the filament progressively from said outer surface, and bodily withdrawing the package axially beyond the influence of said jets upon interruption of the withdrawal of the filament from the package.

3. The process which consists in directing a series of jets of drying medium against the outer surface of a cylindrical package of wet filament from positions relatively spaced about the axis

of the package, confining the medium impinged upon the outer surface of the package within a predetermined area surrounding the package, exhausting the medium axially of the package from one end of said area, withdrawing the filament progressively from said outer surface of the package, and bodily withdrawing the package axially in a direction opposite to the direction of exhausting said medium to a position beyond the influence of said jets upon interruption of the withdrawal of the filament from the outer surface of the package.

4. The process which consists in directing a series of jets of drying medium against the outer surface of a cylindrical package of wet filament from positions relatively spaced about the axis of the package, confining the medium impinged upon the outer surface of the package within a predetermined area surrounding the package, exhausting the medium axially of the package from one end of said area, withdrawing the filament progressively from said outer surface of the package, bodily withdrawing the package axially in a direction opposite to the direction of exhausting said medium to a position beyond the influence of said jets upon interruption of the withdrawal of the filament from the outer surface of the package, and sealing off the area normally occupied by the package during said withdrawal of said filament from the area occupied by the package after said bodily axial movement thereof.

5. The process which consists in maintaining a body of drying medium in constant circulation in a predetermined circuit, placing a package of wet filament in a predetermined position in said circuit to expose the outer surface of the package to the influence of said circulating drying medium, withdrawing the filament progressively from the exposed surface of the package, and bodily withdrawing the package from said circuit and the influence of said drying medium therein upon interruption of the withdrawal of the filament from the exposed surface of the package.

6. The process which consists in drying a filament on an exposed surface of a wet package of said filament in the presence of a constantly circulating drying medium, winding said filament into the form of a dry package directly from said exposed surface of said wet package, and withdrawing said wet package bodily from the influence of said circulating medium, without disrupting said circulation, simultaneously with any interruption in said winding.

7. The combination of mechanically actuated means for drying a filament on an exposed surface of a wet package formed of said filament, means for winding said filament into the form of a dry package directly from said exposed surface of said wet package, means for interrupting said winding, and means operable by said winding means interrupting means for rendering said drying means ineffective.

8. The combination of mechanically actuated means for drying a filament on an exposed surface of a wet package formed of said filament, means for winding said filament into the form of a dry package directly from said exposed surface of said wet package, and means controlled by the portion of said filament in transit between said wet and dry packages for interrupting said winding means and for rendering said drying means ineffective simultaneously.

9. The combination of mechanically actuated means for drying a filament on an exposed surface of a wet package formed of said filament, means for winding said filament into the form of a dry package directly from said exposed surface of said wet package, a stop motion mechanism comprising an element controlled by the portion of said filament in transit between said wet and dry packages for interrupting said winding means, and means operable by said stop motion mechanism for rendering said drying means ineffective.

10. The combination of mechanically actuated means for drying a filament on an exposed surface of a wet package formed of said filament, means for winding said filament into the form of a dry package directly from said exposed surface of said wet package, a stop motion mechanism for interrupting said winding means, and means operable by said stop motion mechanism for rendering said drying means ineffective.

11. The combination of mechanically actuated means for drying a filament on an exposed surface of a wet package formed of said filament, means for simultaneously withdrawing said filament from said surface, and means controlled by the portion of said filament in transit between said wet package and said withdrawing means for rendering said drying means ineffective when said controlled means operates as a result of interruption of said withdrawing.

12. The combination of means for circulating a drying medium in a predetermined circuit, means defining the course of the drying medium circulating in said circuit means supporting a wet package of filament in said circuit to dry the outer surface of said package, means for simultaneously withdrawing the filament from said outer surface of said package, and means for moving said package bodily beyond the confines of said predetermined circuit upon interruption of withdrawal of the filament from the package.

13. The combination of an air box provided with an adjacent pair of air circulating conduits, a well casing in one of said conduits with one of its ends communicating with the second of said conduits and its second end communicating with the exterior of the air box, air nozzles in the wall of said well for directing air from said one conduit into and through said well to said second conduit, means for circulating air through said conduits, said well and said nozzles, and an elevator operable axially of and within said well casing for supporting a filament package thereon and for moving said package into and out of the zone of influence of the air entering said well casing through said nozzles.

14. The combination of an air box provided with an adjacent pair of air circulating conduits, a well casing in one of said conduits with one of its ends communicating with the second of said conduits and its second end communicating with the exterior of the air box, air nozzles in the wall of said well for directing air from said one conduit into and through said well to said second conduit, means for circulating air through said conduits, said well and said nozzles, an elevator operable axially of and within said well casing for supporting a filament package thereon and for moving said package into and out of the zone of influence of the air entering said well casing through said nozzles, and a lid carried by said elevator and normally closing the second said end of said well casing while the package is in said zone.

15. The combination of an air box provided

with an adjacent pair of air circulating conduits, a well casing in one of said conduits with one of its ends communicating with the second of said conduits and its second end communicating with the exterior of the air box, air nozzles in the wall of said well for directing air from said one conduit into and through said well to said second conduit, means for circulating air through said conduits, said well and said nozzles, an elevator operable axially of and within said well casing for supporting a filament package thereon and for moving said package into and out of the zone of influence of the air entering said well casing through said nozzles, a lid carried by said elevator above said yarn package and normally closing the second said end of said well casing while the package is in said zone, and means carried by said elevator below said package for sealing the well casing between said nozzles and the second said end of said casing when the package is removed from said zone.

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