

May 13, 1958

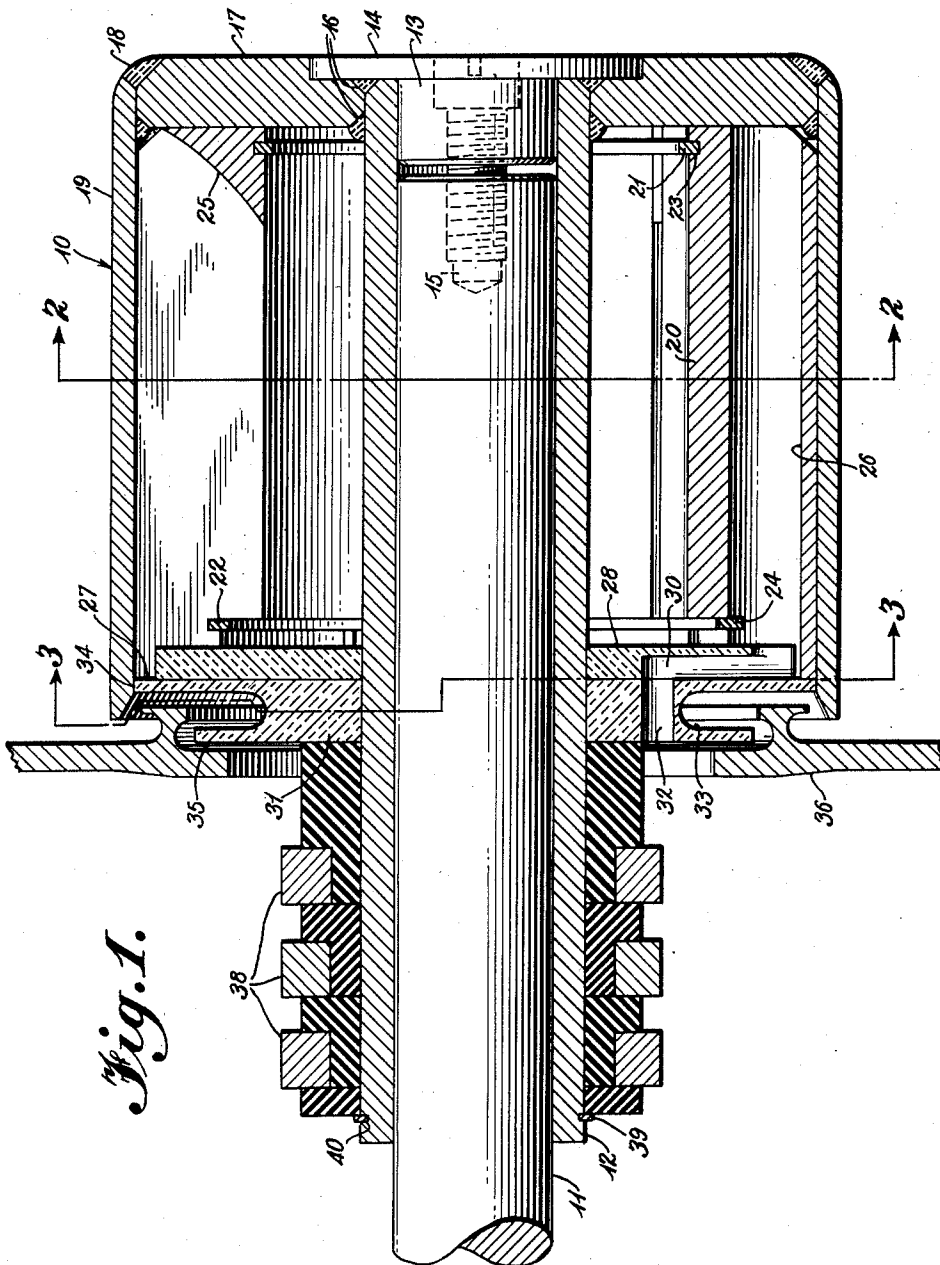
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2,834,860

APPARATUS FOR CONTINUOUS DRYING OF YARN, ETC

Filed March 18, 1955

4 Sheets-Sheet 1



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Fig. 2.

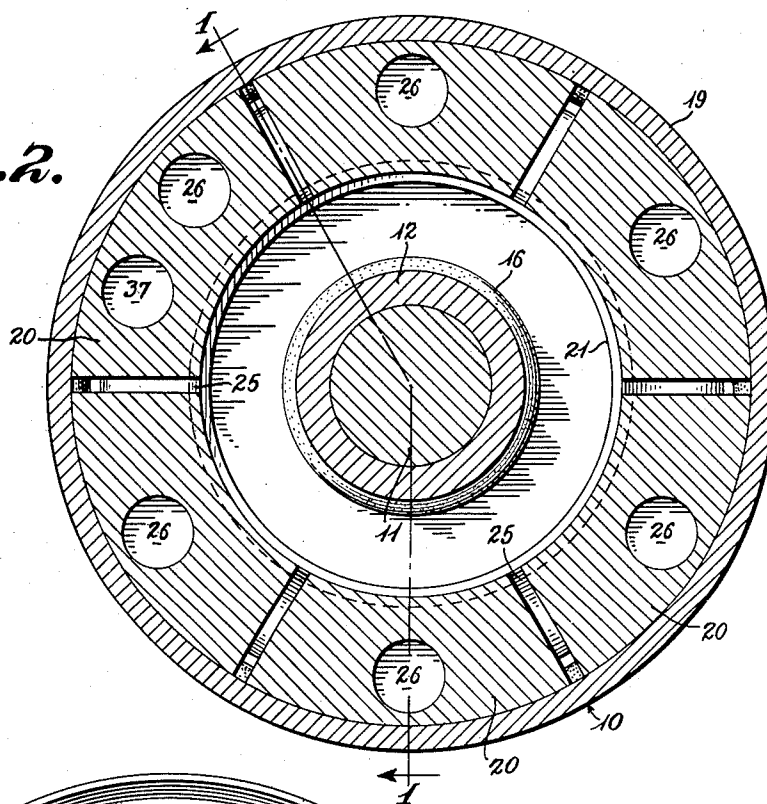
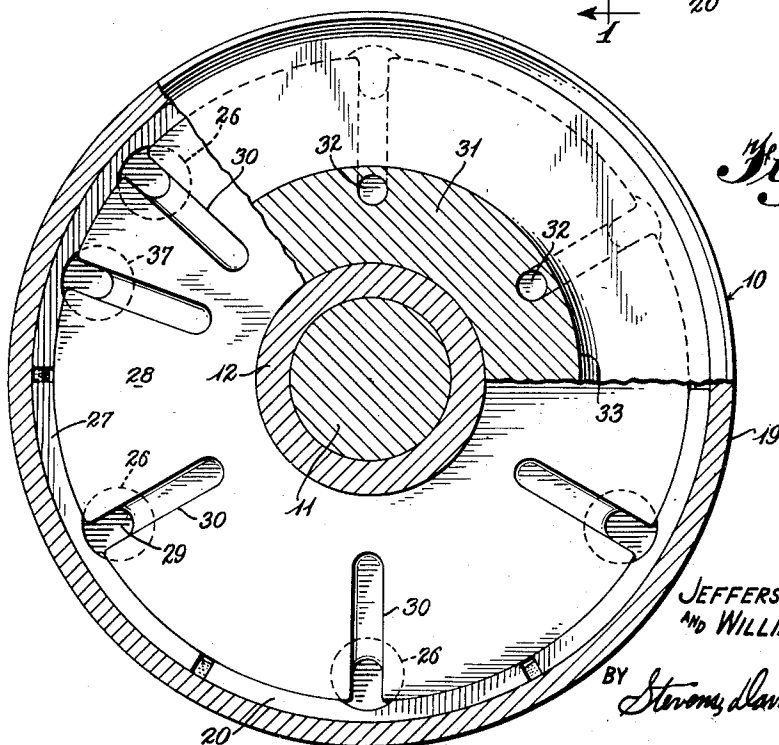


Fig. 3.



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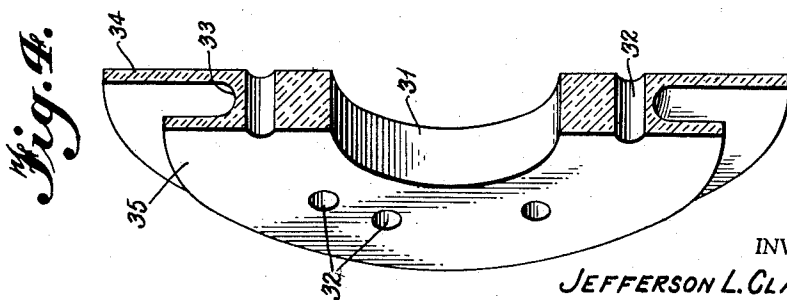
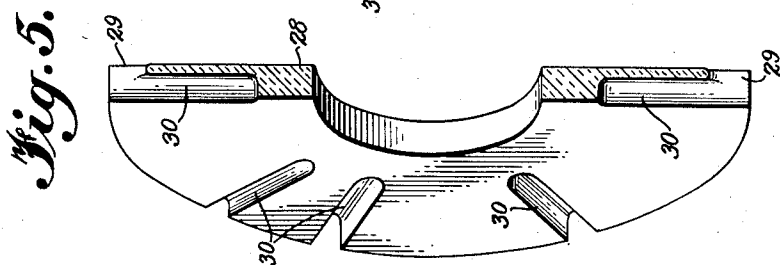
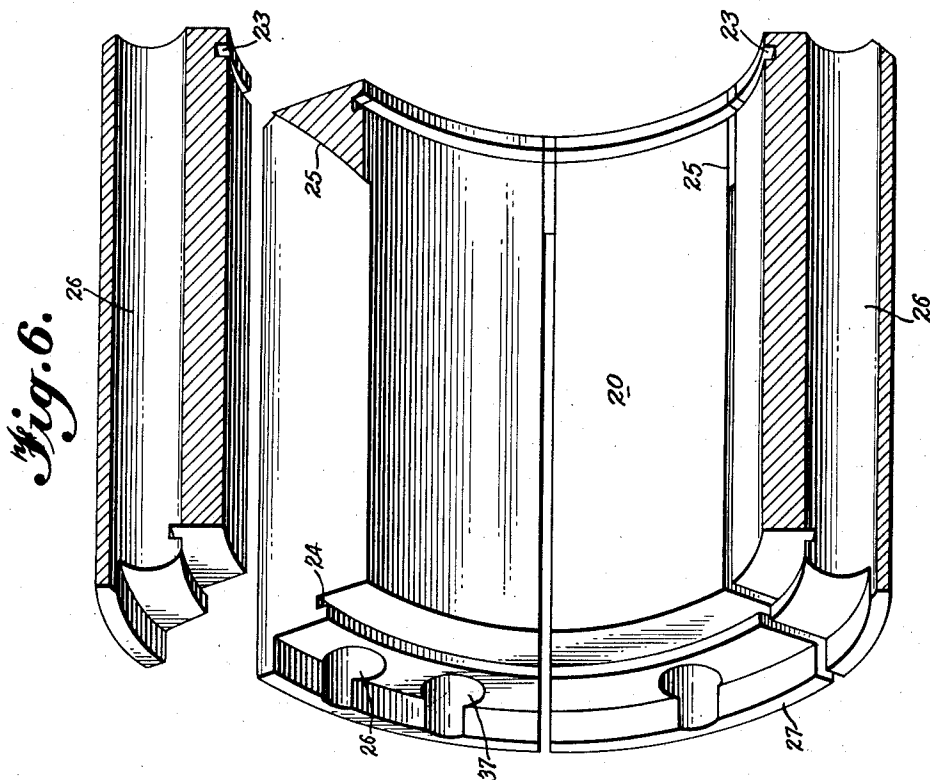
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4 Sheets-Sheet 3



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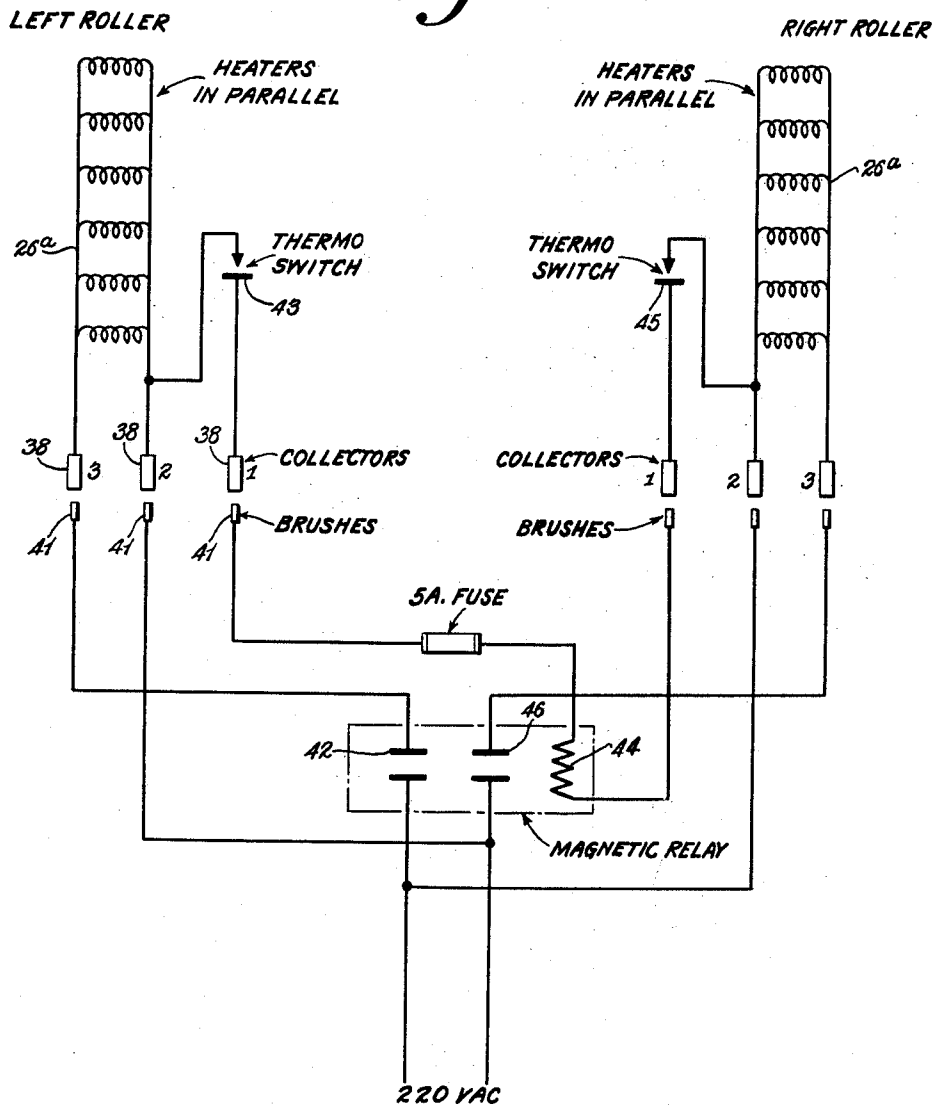
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Fig. 7.



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APPARATUS FOR CONTINUOUS DRYING OF YARN, ETC.

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Application March 18, 1955, Serial No. 495,242

4 Claims. (Cl. 219—19)

This invention relates to apparatus for the drying of yarns, threads or filaments and more particularly, to a drying roller set for the continuous drying of a single yarn, thread or filament as it is being continuously advanced.

In the usual apparatus for drying yarn, thread or filaments the drying roll has been centrally heated by means of a stationary heating element spirally wound around the roll shaft. With this type of dryer the heat is radiated through an annular air gap to the interior of a hollow cylinder, the outer surface of which supports the yarn being dried. Because much heat is lost incident to transmission across the air gap to the cylinder, the temperature of the heating coils is maintained much higher than the desired temperature of the outer surface of the cylinder. This, of course, is inefficient and liable to result in non-uniform heating of the cylinder with resulting yarn damage.

Another difficulty with dryers of the type in which heat is radiated from a stationary central source to the surrounding shell becomes evident when such a dryer is stopped as in doffing. Under these circumstances the heat is, of course, shut off but the residual heat in the core radiates to the now stationary cylinder and often overheats it with resulting damage to the coils of yarn wound thereon.

The usual apparatus also fails to provide a heat control means in close proximity with the roll shell. These control means are usually stationarily placed centrally within the roll or even on the outside of the roll, which results in inaccurate heat control and thus a non-uniformly dried product.

It is therefore an object of this invention to provide drying apparatus characterized by a uniform, reliable and efficient conductivity path between the heat source and the surface of a drying cylinder whereby to maintain a desired temperature at the surface of the cylinder irrespective of whether the cylinder is moving or not and without a large temperature differential between the heat source and the shell.

It is also an object of the present invention to provide a drying roll which will afford uniform drying throughout the entire length of the yarn, thread or filament in contact therewith.

Another object of this invention is to provide an expansible heater block which allows for a space to compensate for the lack of accuracy in expansion of the roll due to heat.

A further object of the present invention is to provide a heating roll which will provide a metal conductivity path between the heater block and the roll which will remain positive under all conditions.

Another object of this invention is to provide a drying roll in which the expansible heater block takes advantage of the centrifugal force while rotating and insures even more positive contact between the heater block and roll.

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A still further object of the present invention is to provide a heat control means in close proximity with the roll and heater block to give an accuracy of temperature control which corresponds well with changes in surface temperature.

A still further object of the present invention is to provide a drying roll with a heater block which will allow for easy replacement of heating units.

Other objects of the invention will appear from the following description when considered in conjunction with the accompanying drawings.

Figure 1 is a sectional view of a drying cylinder or roller contemplated by the invention when taken along line 1—1 of Figure 2;

Figure 2 is a sectional view taken on line 2—2 of Figure 1;

Figure 3 is a sectional view taken on line 3—3 of Figure 1;

Figure 4 is a perspective view partly in section of an insulating ring positioned at one end of the roller;

Figure 5 is a perspective view also partly in section of a second insulating ring positioned adjacent to the ring of Figure 4;

Figure 6 is a cut-away sectional perspective view of the heating block segments and spacers, and

Figure 7 is a circuit diagram illustrating the electric circuits used in heating a two-unit dryer according to the present invention.

Referring now to the drawings, and more particularly to Figure 1, there is shown a rotatable roller 10 which may be used as a drying unit with another roller either plain or of the same design to form a thread-storage, thread advancing device. Since if two rollers are used they will be alike only one is shown. This roller 10 is supported on a rotatable shaft 11 which is supported and driven by sources not shown. Surrounding a portion of the shaft 11 is a sleeve 12 which constitutes the general support of the cylinder. The sleeve 12 extends somewhat beyond the right end of the shaft 11 as it is viewed in Figure 1. A plug 13 is received in the right end of the sleeve 12 and is held there by a screw 15 which enters a threaded aperture in the end of the shaft 11. The plug carries a flange 14 thereon and this flange is the holding piece to keep the sleeve 12 and the elements of the dryer mounted thereon in position on shaft 11.

Welded at right angles to the sleeve 12 at 16 is an annular end plate 17 of steel having an annular depression therein for seating flange 14. Welded coaxially to the end plate 17 at 18 is a hollow, cylindrical stainless steel shell 19 about the outer surface of which the yarn, thread or filament to be dried is helically wound. Fitting immediately within the roller shell 19 is an aluminum heater block 20 (see Figures 1, 2 and 6) which is held tightly against the innerface of the cylindrical shell 19 by means of expansion rings 21 and 22. Expansion rings 21 and 22 when in place engage respectively arcuate grooves 23 and 24 on the interior of the heater block 20. The heater block has six equally spaced radial slots therein which except for interconnecting portions 25 at one end only (see Figure 1) divide the block into substantially six segments. The block thereby acts in much the same manner as an expanding mandrel. Running longitudinally of the heating block segments are cylindrical holes 26 within which standard heating elements or cartridges may be inserted. As an example of the cartridge heaters which may be employed are Westinghouse cartridge heaters. These are described in catalog 28-020 of February 1952, entitled "Industrial Electric Heating Units and Controls." In the present invention

type C-48, style 854840 is used. This appears on page 14 of the catalog. Since the cartridges do not themselves form a part of this invention they are shown only schematically in Figure 7 wherein they bear reference numeral 26a. They make a metal to metal fit in the holes 26 for excellent heat conductivity.

Looking now at Figures 1 and 6, it can be seen that groove 24 is of such depth that when ring 22 is engaged therein it passes into the cylindrical space constituting hole 26 to thereby retain the heating element against axial displacement. Thus, it can be seen that when the roller is in operation the heating block 20 through centrifugal force and the expansion rings 21 and 22 will maintain a tight fit or contact with the outer shell 19 and allow for good conductance of heat from the heating block segments through the outer shell to the yarn, thread or filament which is being dried.

Seated within arcuate flanges 27 (see Figures 1, 3 and 6) on the heater block and covering a portion of the end of cylindrical cartridge heater spaces 26 is an insulating disc 28. Passing transversely through a portion of disc 28 and in alignment with the cartridge heater spaces 26 are slots 29. Disc 28 also has in communication with slots 29 radial slots 30. Contacting the insulating disc 28 is an additional insulating disc 31 independent thereof (see Figures 1 and 4) which contacts the inner end of the roller 19 and aids in preventing longitudinal movement of heating block 20. Passing transversely through the insulating disc 31 are cylindrical holes 32 communicating with the radial slots 30 of disc 28. The conduits defined by cylindrical holes 32 and slots 29 and 30 carry wires to the cartridge heaters. The insulating disc 31 also has a circumferential groove 33 therein with the inner rim 34 of the groove of the disc when assembled being of greater radius than the outer rim 35. The outer rim 35, in combination with a brush and collector housing 36, only a portion of which is shown, prevents any liquid carried by the yarn, thread or filament from coming in contact with the system for supplying current to the cartridge heaters. Referring again to the heating block as shown in Figure 2, there is shown one section containing two cylindrical holes. In one of these holes the usual cartridge heater is inserted while in hole 37 a thermal switch is inserted which controls the amount of heat generated by the cartridge heaters. See switches 43 and 45 in Figure 7. Also surrounding sleeve 12 are three brush rings 38. These three brush rings 38 contact brushes (not shown) surrounding the shaft and form a part of an A. C. system which supplies current to the cartridge heaters. Holding the brush rings 38 and discs 28 and 31 in place is a split ring 39 which encompasses the sleeve 12 and seats in a circumferential groove 40 on the sleeve 12.

In Figure 7 there is shown a wiring diagram illustrating the preferred connections to the heater cartridges of a two-unit thread storage, thread advancing device used in drying threads or yarns. It will be noted that the heaters 26a of each roller are connected in parallel. Dealing first with the left-hand roller, the parallel group is in series with two brushes 41 coacting with brush rings 38 and a main cut-off switch 42. The thermal switch 43 is connected in parallel with one of the brush-brush ring units leading to the heaters 26a for the left-hand roller and is connected through the other brush-brush ring of the group of three which service the left roller to a control element 44 which actuates the switch 42. The circuit from the actuator 44 passes through another thermal switch 45, associated with the right roller of the group. From the switch 45 the circuit taps into one of the lines to the heaters 26a for the right roller and from there the circuit is complete across the source. Otherwise, the right and left-hand rollers are heated in the same way. The main switch 46 services the right-hand roller in the same way the switch 42 serves the left-hand one and both switches are operated together by the actuator 44.

If it is desired to heat only one roller, as might be de-

sirable with the drying of light weight yarn, one or the other of switches 42 or 46 can be cut out manually and the thermal switch for the cut-out group closed manually so that only a single cylinder will heat. This will avoid off and on cycling which is an undesirable consequence of using both heating units under light loads.

In the arrangement shown in Figure 7, the two thermostats 43 and 45 are connected in series to render the apparatus extra safe against over heating. One of the thermostats is set a little higher than the other so that, if the one set lower fails to function for some reason or other, the higher one will take over at a heat level which is still too low to cause thread damage. It will be appreciated that the thermostats 43 and 45 are located in cavities such as the cavity 37 shown in Figure 2, one in each roller. One of each heating unit 26a is disposed in each cavity 26. As far as the mechanical manipulation of the thread is concerned, i. e., the drying and disposition of the cylindrical surface, the unit is disposed with the two cylinders side by side with askew axes to cause advance of the yarn in a generally helical path as is shown in Patent 2,688,863.

While the invention has been described in specific embodiments, it is nevertheless to be understood that various changes and modifications obvious to one skilled in the art can be made without departing from the true spirit and scope of the present invention.

What is claimed is:

1. Drying apparatus comprising a pair of rotatable hollow cylinders the surfaces of which are adapted to support thread or yarn for drying, a segmented and expandable metal body in contact with most of the interior of each cylinder and rotatable therewith, each body having a plurality of axially extending circumferentially spaced cavities therein, a thermostat in one cavity of each body, a heater in each other cavity of both bodies, means to control the circuit to the heaters of each body and means to actuate said control means, said actuating means being connected in series with both said thermostats.

2. Drying apparatus comprising a rotatable hollow cylindrical roller having an outer cylindrical surface for the drying of thread or yarn thereon and having an inner cylindrical surface defining with said outer cylindrical surface a relatively thin cylindrical shell, a hollow cylindrical and rotatable heater body having an outer diameter substantially equal to the diameter of said inner cylindrical surface of said roller, said heater body having a plurality of axially extending and circumferentially spaced slits for subdividing said body into a plurality of individual segments, whereby said body can expand outwardly to provide contact between the outer cylindrical surface of said body and the inner cylindrical surface of said roller, each segment having a longitudinally extending cavity therein, and a heater unit received within each cavity.

3. The improvement as set forth in claim 2 wherein one of said segments has an additional cavity for receiving a thermostat therein.

4. Drying apparatus comprising a rotatable hollow cylindrical roller having an outer cylindrical surface for the drying of thread or yarn thereon and having an inner cylindrical surface defining with said outer cylindrical surface a relatively thin cylindrical shell, a hollow cylindrical and rotatable heater body having an outer diameter substantially equal to the diameter of said inner cylindrical surface of said roller, said heater body having a plurality of axially extending and circumferentially spaced slits for subdividing said body into a plurality of individual segments, whereby said body can expand outwardly to provide contact between the outer cylindrical surface of said body and the inner cylindrical surface of said roller, each segment having a longitudinally extending cavity therein, a rotatable shaft extending through the center of said heater body for rotating said body and

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said roller, an end plate attached to one side end of said roller for closing said one side end, a sealing plate for covering the other side end of said roller and for enclosing said heater body within said roller, said sealing plate having a plurality of holes extending through said sealing plate and into communication with said cavities, and a reduced flange portion on said sealing plate extending outwardly away from said roller, said flange portion having a circumferential groove therein positioned adjacent to said other end of said roller.

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