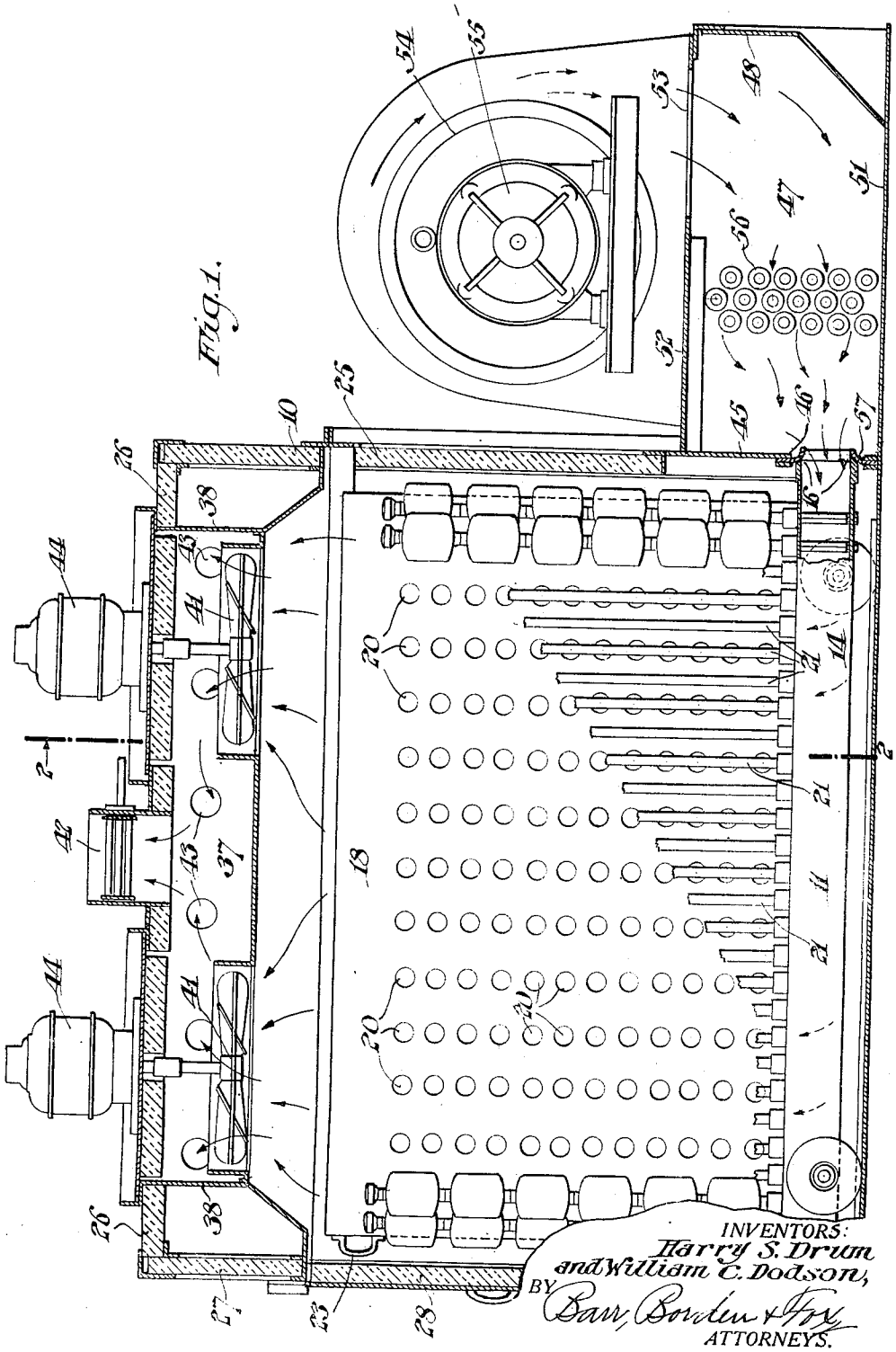
Aug. 29, 1944. H. S. DRUM ET AL 2,356,834

YARN DRYING APPARATUS

Filed July 3, 1942 3 Sheets-Sheet 1

Fig. 1.



INVENTORS:
Harry S. Drum
and William C. Dodson,
BY
Dann, Borden & Fox
ATTORNEYS.

Aug. 29, 1944. H. S. DRUM ET AL 2,356,834

YARN DRYING APPARATUS

Filed July 3, 1942 3 Sheets-Sheet 2

Fig. 2.

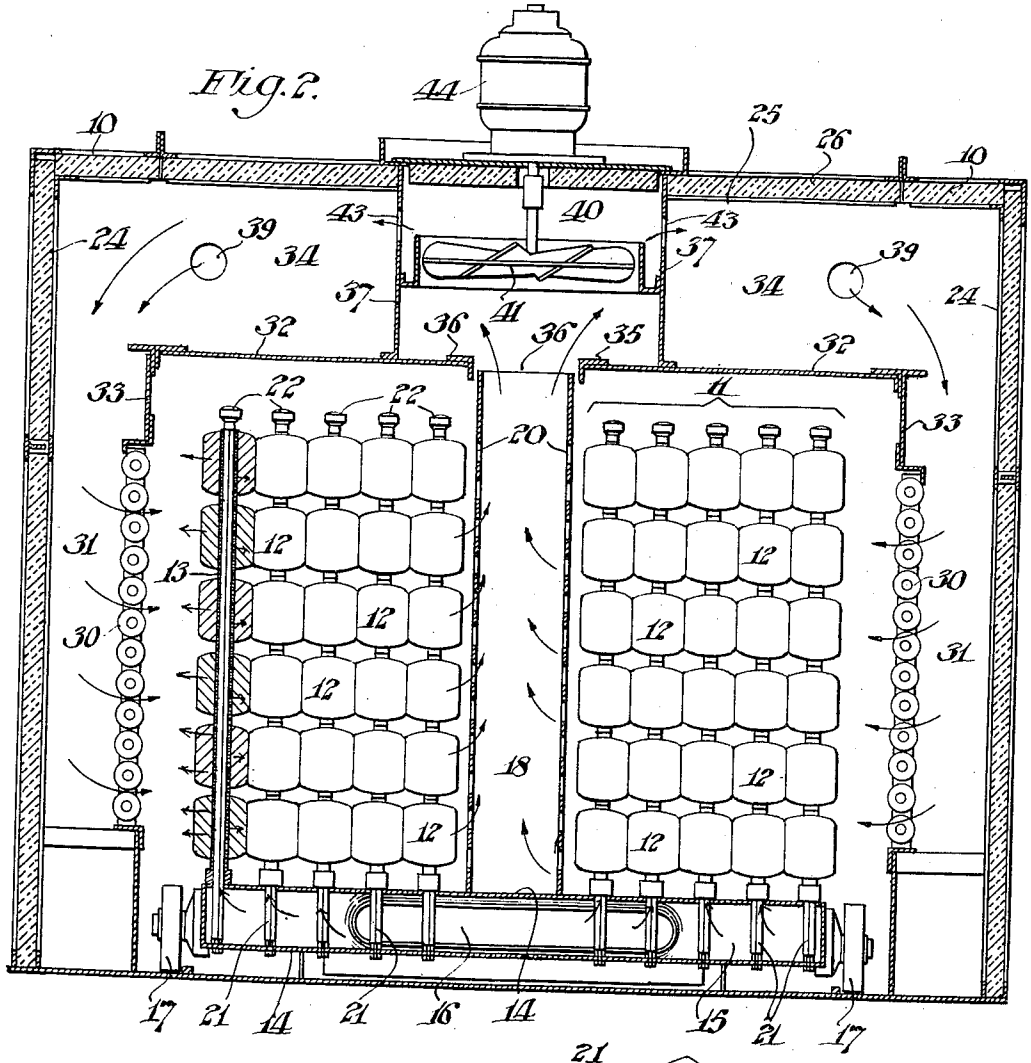
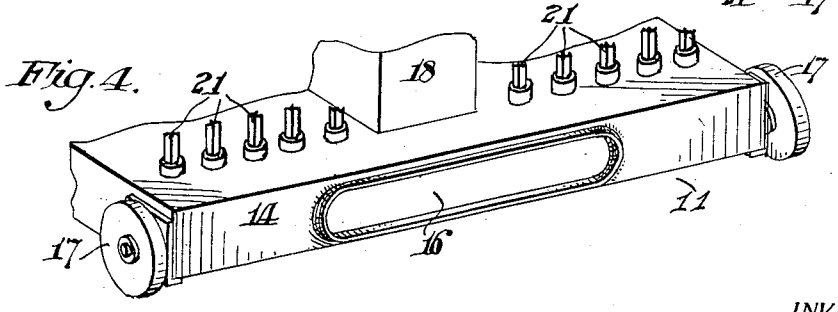


Fig. 4.



INVENTORS:
Harry S. Drum
and William C. Dodson,
BY
Bair, Borden & Fox
ATTORNEYS.

Aug. 29, 1944. H. S. DRUM ET AL 2,356,834

YARN DRYING APPARATUS

Filed July 3, 1942 3 Sheets-Sheet 3

Fig. 3.

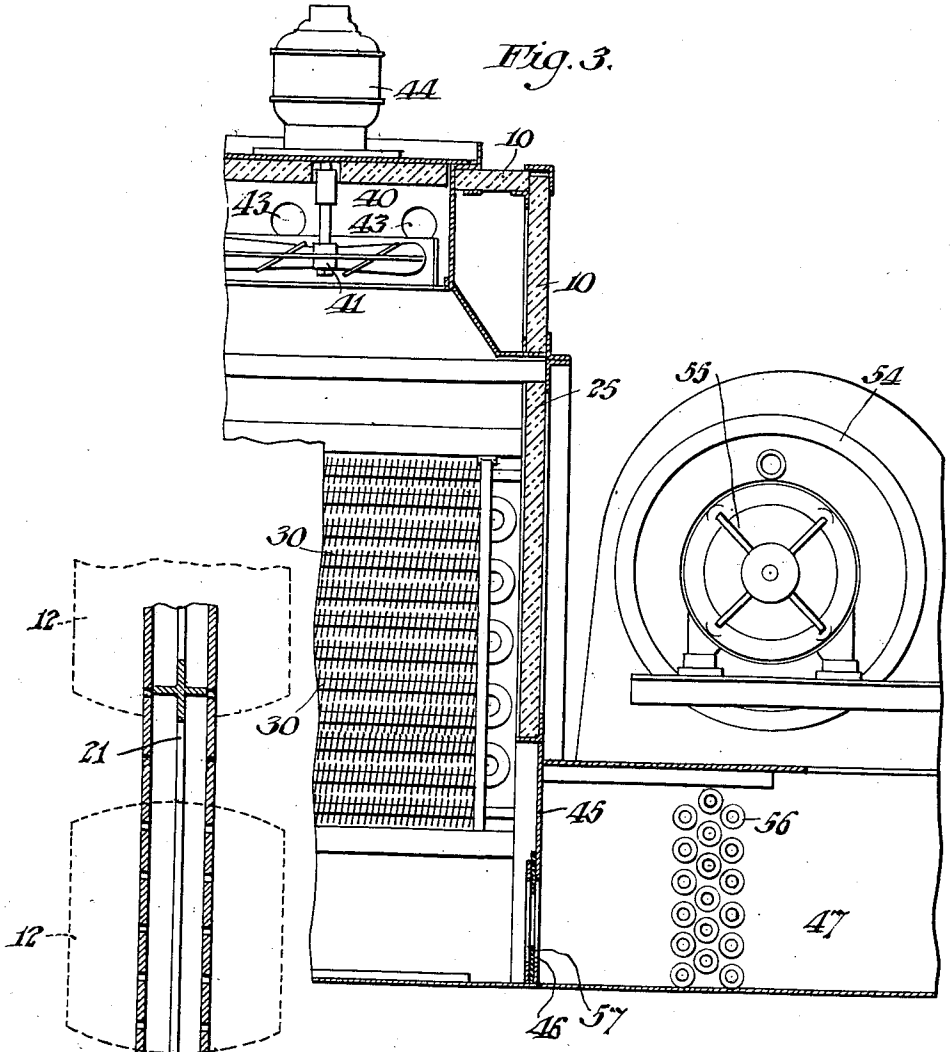


Fig. 5.

INVENTORS:
Harry S. Drum
and William C. Dodson,
BY
Barr, Borden & Fox
ATTORNEYS.

Patented Aug. 29, 1944

2,356,834

UNITED STATES PATENT OFFICE

2,356,834

YARN DRYING APPARATUS

Harry S. Drum and William C. Dodson, Abington, Pa., assignors to Smith, Drum and Company, Philadelphia, Pa., a corporation of Pennsylvania

Application July 3, 1942, Serial No. 449,642

15 Claims. (Cl. 34—105)

The present invention relates to the drying of material after a treating, washing or other wet process, and relates more particularly to the drying of yarn in package form.

In the drying of wet material, especially that in package form it has heretofore been proposed to subject the package to a current of air which is internally applied under pressure with the intent to force the liquid under suspension to travel outwardly to the surface of the package where it was hoped it would be evaporated by a secondary stream of air. This pressure method gave poor results because of the increase in saturation during the travel of the air through the package, and each circumferential layer of yarn was differently conditioned from all the others. As a corrective it has been proposed to heat the secondary stream of air but then it was found that all packages were not dried alike, many being quickly dried and damaged as the heated air continued to flow over them to dry the remainder. Loss of time and added cost of production were incident to prior attempts to safely and uniformly dry simultaneously a number of yarn packages.

Some of the objects of the present invention are to provide a drying apparatus in which the foregoing disadvantages are eliminated; to provide a drying apparatus which is so arranged and constructed as to ensure the uniform drying of yarn packages; to provide means for so controlling the drying of material that the efficiency of high drying temperatures can be obtained without damage to the material; to provide an apparatus for the hot air drying of yarn wound on a perforated cylinder wherein provision is made for step by step evaporation of suspended moisture; to provide an apparatus for the hot air drying of yarn on a perforated cylinder wherein provision is made for a circulation of air through the yarn and supplemented by an external substantially uniform circulation of air which takes place over the outside of the yarn; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Fig. 1 represents a sectional longitudinal elevation of a drying apparatus embodying one form of the present invention, part thereof being broken away for better illustration; Fig. 2 represents a section on line 2—2 of Fig. 1; Fig. 3 represents a fragmentary sectional elevation of the cabinet with the yarn carrier removed; Fig. 4 represents a fragmentary perspective of the yarn package carrier showing the inner end thereof with its air inlet; and Fig. 5 represents a sectional detail of a yarn spindle in association with the base manifold.

Referring to the drawings, one form of the present invention consists of a cabinet 10 and a carrier 11 for packages 12 of yarn which latter are to be dried when the carrier 11 is in the cabinet 10. The yarn packages 12 are of the type in which the yarn is wound on a perforated core or sleeve 13 so that air or treating liquid can enter the axis of the package to traverse radially outward through the package to the outside thereof. The direction of flow may be reversed according to requirements.

In the preferred form the carrier 11 consists of a base 14, here shown as rectangular, of generally enclosed box construction to form a manifold having a distributing chamber 15 for heated air which enters through an inlet 16 in one end of the base 14. Wheels 17 provide supports for the base and allow it to be moved from place to place. Extending medially and longitudinal of the base 14 is a vertically disposed, tubular duct 18 which is open at its top and closed at the bottom by the base 14, but provided in its two opposite sides with a plurality of ports 20 respectively to allow air to circulate therethrough as will later be described. Along opposite sides of this duct 18, the top plate of the base 14 is apertured to respectively receive vertically mounted spindles 21 which are fluted or otherwise made to permit air to travel longitudinally thereof and thereby obtain admittance to the yarn package sleeve 13. As shown each spindle 21 passes through the box top plate, then across the chamber 15 to enter the bottom plate of the base 14 where each is rigidly bolted or otherwise made fast. Each spindle 21 is of a length to mount a plurality of packages one above another and supported by the meeting ends of juxtaposed sleeves 13. The upper end of each spindle 21 is arranged to receive a weighted cap 22, so that gravity serves as a medium for maintaining the packages properly superposed in alined relation.

From the foregoing it will be seen that the carrier 11 has the general shape of an inverted T, the head of which is a manifold, and the leg of which is a duct 18 having no communication with the manifold. Rising vertically from the base 14 at opposite sides of the duct 18 are the rows of spindles upon which the packages are mounted for drying. Preferably the height or length of the spindles 21 is less than the height of the duct 18, so that the latter can readily cooperate with a part of the cabinet as will later appear. Thus the carrier with its manifold, duct, and

spindles forms a unitary wheeled structure readily movable as required. A grasping handle 23 is secured to the duct 18 at a convenient location for pulling or pushing the carried about.

In the preferred form the cabinet 10 is of rectangular box form, the side walls 24, rear wall 25, top 26, and front frame 27 for the doors being of insulated construction to prevent heat losses by radiation. Insulated doors 28 serve to close the cabinet after the carrier 11 has entered. As shown, the width of cabinet 10 is enough greater than the width of the carrier 11 to permit two spaced apart vertical partitions, in the form of heating coils 30, to be located in spaced relation respectively from the cabinet side walls 24 to form two passages which are open at the upper ends and closed at the lower ends. These heating coils 30 rise parallel to the outer rows respectively of the carrier spindles 21 and terminate in close proximity to the upper and lower ends of the said spindles.

In order to confine the heated air to a path directly transverse to the packaged spindles so that it enters the duct 18, overhead partitions 32 in the form of plates extend inwardly towards each other in the same horizontal plane and are supported respectively from angle irons 33, which also serve as supports for the two coil assemblies. These partitions 32 are spaced from the cabinet top 26 to provide two laterally arranged conduits 34 leading respectively to and communicating with the passages 31. The inner ends of the partitions 32 terminate in spaced relation and edged respectively with supporting angles 35 which project downwardly into the carrier receiving chamber, to form a longitudinally disposed slot 36. This spacing is such that the upper end of the duct 18 can enter there-between and discharge the air into a suction compartment formed by longitudinally disposed parallel wall strips 37 and transverse end strips 48. Due to the spacing of the plates from the top 26, the aforesaid strips 37 and 38 form a chamber 40 housing two exhaust fans 41 so mounted and arranged as to withdraw air from the carrier compartment and discharge it through an exhaust outlet 42 in the top of the cabinet 10. Also the wall strips 37 are provided with outlets 43 so that some of the air can be recirculated downwardly in the passages 31 and through the heating coils 30. Inlet ports 39 are suitably located in the rear wall of the cabinet so that the tempered air leaving the openings 43 will mix with fresh outside air drawn in by way of these ports 39, and then circulated downwardly in the passages 31, and be heated as it passes through the heating coils 30. Motors 44 suitably mounted on the cabinet 10 serve to operate the respective fans 41.

In order to supply heated air to the base 14 of the carrier, the lower portion of the rear wall 25 is formed as a panel 45 having a horizontal elongated opening 46 communicating with a compartment 47 formed by the panel 45, three sides 48, a closed bottom 51, and a top 52, which latter is provided with air inlets 53, respectively supplied with air from a blower unit 54 driven by a motor 55. Transversely mounted across the compartment 47 and between the inlets 53 and the opening 46, is a heating unit 56 of coil fin construction, through which steam circulates from a suitable source of steam. It will be understood that the heating unit 56 has pipe connections to the exterior of the compartment 47 for the steam supply and return. The opening 46 for the discharge of heated air is of the same size and shape as the inlet 16 to the chamber 15 of the carrier, and is furthermore located in direct alinement therewith. Encircling the opening 46 is a sealing gasket 57 arranged to be clamped between the carrier base 14 and the panel 45 when the carrier enters the cabinet and assumes its operative position. It is preferable to provide suitable interlocking means between the carrier 11 and the cabinet 10 whereby the former is held clamped in position to maintain the gasket protected joint sealed with no leakage possible. Thus, when the carrier 11 is wheeled into the cabinet 10, the inlet 16 is alined with the opening 46 and when the parts abut the sealing gasket 57 is compressed therebetween so that the circulated heated air passes into the base manifold chamber 15 for distribution into the yarn spindles 21.

In connection with the heating coils 30 it should be noted that the respective pipes thereof are spaced apart with relatively narrow equal spaces so that the circulated air passes through the coils with equal velocity at all points and a uniform temperature is thereby maintained for contact with all of the yarn packages. This is one fundamental advance in the art since heretofore streams of heated air have been directed to flow transversely of yarn packages and hence those packages which are first swept by the air are subjected to a higher temperature than those last met by the air. This type of heating militates against proper uniform drying treatment of a batch of yarn. The drier of the present invention operates to dry the material by evaporating the retained moisture from the inside as well as from the outside simultaneously whereby the drying time is materially reduced as compared to those driers in which the inside air under pressure forces the retained water to the outer surface of the packages where no provision is made to prevent precipitation. In contrast to prior driers wherein heated air is forced outwardly through the packages under a pressure of five pounds or more, the present invention utilizes a pressure materially lower than five pounds, and it has been found that air under one-half pound pressure gives unexpected and materially better results than heretofore attained in the art of yarn drying. Thus, where heated air under, not less than, five pounds pressure passes outwardly through a yarn body in the absence of any exterior heating, the outer convolutions of yarn are coldest and saturated with condensation. In applicant's construction the outwardly moving stream of heated air under approximately one-half pound pressure, and operating in conjunction with the exterior stream of heated air, results in the outer yarn convolutions being hot so that precipitation on the surface of the yarn body is prevented. By the method of the present invention utilizing a low pressure stream of heated air the time cycle has been reduced approximately one half as compared to other drying methods.

In operation the carrier 11 is loaded with the yarn packages 12 while outside of the cabinet 10, and is then wheeled into the cabinet 10, where it is locked in position with the inlet 16 to the base 14 in alinement with the opening 46, and sealed by pressure against the gasket 57. The doors 28 are now closed and the blowers 54 and fans 41 started to respectively initiate the circulation of the two streams of air over the heater coils 30 and the coil unit 56. The heated air stream from the two partition coils 30 passes substantially horizontally through the vertical arranged rows of packages and discharges through

its ports 20 into the duct 18. At the same time the heated air stream from the heating unit 56 enters the base 14 of the carrier where it is divided into streams to respectively traverse the spindles 21 and discharge radially of the respective packages. Emerging from the packages these streams enter the duct 18 by way of the ports 20, thus joining the first mentioned stream to be drawn upwardly by the fans 41 into the chamber 40, where a portion leaves by the exhaust 42, and the remainder traverses the inlets 43 to be redirected to the two passages 31. On the way to the passages 31, the combined streams are revived by fresh air drawn in through the ports 29, and then pass through the respective coils 30. Thus, each package is subjected to a low pressure stream of heated air moving from the inside to the outside of the package while a second stream is sweeping over the outer convolutions of the package at a temperature sufficient to prevent precipitation in the outer layers of the yarn package. The result is an even drying of each package at a uniform rate and temperature.

While in the foregoing reference has been made to a yarn "package," or "packages," this is only by way of example and is to be considered in the broad sense of any body of yarn, such as a yarn beam, so wound and mounted as to be capable of being dried in accordance with the teachings of the present invention. Also, while the invention will more generally be used to treat a plurality of wound yarn bodies simultaneously, there may be occasions where a single yarn body such as a yarn beam is to be dried by the method of the present invention.

Having thus described our invention, we claim:

1. A drying apparatus consisting of a cabinet, a carrier to be enclosed in said cabinet, said carrier comprising a base manifold and an apertured tubular member supported by said manifold but partitioned therefrom, a plurality of yarn package spindles exterior of said member and supported vertically by said manifold and forming air passages from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means to circulate heated air through said manifold and packages to discharge into said member, and means including a source of heat to circulate heated air transversely to said spindles about the outside of said packages to also discharge into said member.

2. A drying apparatus consisting of a cabinet, a carrier to be enclosed in said cabinet, said carrier comprising a base manifold and an apertured tubular member supported by said manifold but partitioned therefrom, a plurality of yarn package spindles exterior of said member and supported vertically by said manifold and forming air passages from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means to circulate heated air through said manifold and packages to discharge into said member, means including a source of heat to circulate heated air transversely to said spindles about the outside of said packages to also discharge into said member, and means to circulate the combined streams of air over said source of heat to recirculate about said packages.

3. A drying apparatus consisting of a cabinet, a carrier to be enclosed in said cabinet, said carrier comprising a base manifold and an apertured tubular member supported by said manifold but partitioned therefrom, a plurality of yarn package spindles exterior of said member and supported vertically by said manifold and forming air passages from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means to circulate heated air through said manifold and packages to discharge into said member, means including a source of heat to circulate heated air transversely to said spindles about the outside of said packages to also discharge into said member, means to circulate the combined streams of air over said source of heat to recirculate about said packages, and means to introduce fresh air into said combined streams.

4. A drying apparatus consisting of a cabinet having an air supply opening, a wheeled carrier to be enclosed in said cabinet, a manifold forming a part of said carrier having an air inlet located to assume an abutting alined position with respect to said supply opening when said carrier is operatively positioned in said cabinet, a plurality of yarn package spindles supported vertically by said manifold and having passages for air from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means forming a compartment communicating with said cabinet opening, a heating unit in said compartment, means to circulate air over said unit and into said manifold to dry said packages from the inside out, a heating coil mounted adjacent said spindles and spaced from the cabinet to form a passage for air, and means to circulate air through said passage to discharge through said coil and against the outside of said packages.

5. A drying apparatus consisting of a cabinet having an air supply opening, a wheeled carrier to be enclosed in said cabinet, a manifold forming a part of said carrier having an air inlet located to assume an abutting alined position with respect to said supply opening when said carrier is operatively positioned in said cabinet, a plurality of yarn package spindles supported vertically by said manifold and having passages for air from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means forming a compartment communicating with said cabinet opening, a heating unit in said compartment, means to circulate air over said unit and into said manifold to dry said packages from the inside out, two heating coils spaced by said spindles and respectively spaced from the cabinet to form two passages for air, and means to circulate air through said passages to discharge through said coils and against the outside of said packages.

6. A drying apparatus consisting of a cabinet having an air supply opening, a wheeled carrier to be enclosed in said cabinet, a manifold forming a part of said carrier having an air inlet located to assume an abutting alined position with respect to said supply opening when said carrier is operatively positioned in said cabinet, a plurality of yarn package spindles supported vertically by said manifold and having passages for air from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means forming a compartment communicating with said cabinet opening, a heating unit in said compartment, means to circulate air over said unit and into said manifold to dry said packages from the inside out, two heating coils spaced by said spindles and respectively spaced from the cabinet to form

two passages for air, means to circulate air through said passages to discharge through said coils and against the outside of said packages, and means to direct the discharged air into said last mentioned circulating means for recirculation through said coils.

7. A drying apparatus consisting of a cabinet having an air supply opening, a wheeled carrier to be enclosed in said cabinet, a manifold forming a part of said carrier having an air inlet located to assume an abutting alined position with respect to said supply opening when said carrier is operatively positioned in said cabinet, a plurality of yarn package spindles supported vertically by said manifold and having passages for air from said manifold to the interior of said packages, means respectively closing the passage ends opposite to the inlet ends, means forming a compartment communicating with said cabinet opening, a heating unit in said compartment, means to circulate air over said unit and into said manifold to dry said packages from the inside out, two heating coils spaced by said spindles and respectively spaced from the cabinet to form two passages for air, means to circulate air through said passages to discharge through said coils and against the outside of such packages, means to direct the discharged air into said last mentioned circulating means for recirculation through said coils, and means to introduce fresh air into said recirculation.

8. A drying apparatus consisting of a cabinet and a carrier enclosed therein, said carrier comprising a manifold, a vertically disposed duct having ports, a plurality of vertically mounted spindles for yarn packages on said manifold arranged about said duct, said spindles having passages respectively for air discharged from said manifold, means for circulating heated air across the outside of said packages and into said duct by way of said ports, means for circulating heated air into said manifold and spindles to discharge through said packages and into said duct by way of said ports, and means to cause the air discharged into said duct to be delivered to said first circulating means to traverse the outside of said packages.

9. A drying apparatus consisting of a cabinet and a carrier enclosed therein, said carrier comprising a manifold, a vertically disposed duct having ports, a plurality of vertically mounted spindles for yarn packages on said manifold arranged about said duct, said spindles having passages respectively for air discharged from said manifold, means for circulating heated air across the outside of said packages and into said duct by way of said ports, means for circulating heated air into said manifold and spindles to discharge through said packages and into said duct by way of said ports, means to cause the air discharged into said duct to be delivered to said first circulating means to traverse the outside of said packages, and means to introduce fresh air into the air recirculated from said duct.

10. A drying apparatus comprising a chamber formed by a closed top, two opposite closed end walls and two open side walls, a perforated plate closing one side wall, heating coils closing the other side wall, and a movable manifold arranged to enter said chamber to form the bottom of the chamber, a plurality of vertically mounted spindles for yarn packages on said manifold arranged between said perforated plate and said coils, said spindles having passages respectively for air discharged from said manifold, each spindle being arranged to support a plurality of yarn packages in superposed relation, means to close the upper ends of said spindles, means for circulating air through said coils to traverse the outside of said packages and discharge through said perforated plate, and means for circulating heated air into said manifold, said spindles and through said packages to discharge through said perforated plate.

11. A drying apparatus comprising a chamber formed by a closed top, two opposite closed end walls and two open side walls, a perforated plate closing one side wall, heating coils closing the other side wall, and a movable manifold arranged to enter said chamber to form the bottom of the chamber, a plurality of vertically mounted spindles for yarn packages on said manifold arranged between said perforated plate and said coils, said spindles having passages respectively for air discharged from said manifold, each spindle being arranged to support a plurality of yarn packages in superposed relation, means to close the upper ends of said spindles, means for circulating air through said coils to traverse the outside of said packages and discharge through said perforated plate, means for circulating heated air into said manifold, said spindles and through said packages to discharge through said perforated plate, and mean to recirculate the combined streams of heated air.

12. A drying apparatus of the type in which a cabinet forms a chamber having an inlet for heated air and a door controlled opening, a yarn carrier to pass through said opening into said chamber, said carrier comprising a manifold having an opening located to register with the air inlet when in the chamber, wheels on said manifold, a tubular member mounted upon said manifold having a plurality of ports, said member being closed at its manifold end and open at its other end to discharge into said chamber, and yarn mounting spindles carried by said manifold to assume an operative position juxtaposed to said ports, each spindle having a passage communicating with said manifold.

13. A drying apparatus of the type in which a cabinet forms a chamber having an inlet for heated air and a door controlled opening, a yarn carrier to pass through said opening into said chamber, said carrier comprising a manifold having an opening located to register with the air inlet when in the chamber, wheels on said manifold, a tubular member mounted upon said manifold having a plurality of ports, said member being closed at its manifold end and open at its other end to discharge into said chamber, and yarn mounting spindles carried by said manifold to assume an operative position in substantially parallel relation to said member and juxtaposed to all of said ports, each spindle having a passage communicating with said manifold.

14. A drying apparatus of the type in which a cabinet forms a chamber having an inlet for heated air and a door controlled opening, a yarn carrier to pass through said opening into said chamber, said carrier comprising a horizontal disposed wheel mounted manifold, a tubular member vertically mounted on said manifold having ports in the side thereof and open at its upper end to discharge into said chamber, means to admit air to said manifold, and yarn mounting spindles carried by said manifold and arranged about said member when said carrier is in said chamber, each spindle having a passage communicating with said manifold.

15. A drying apparatus comprising the combi-

nation of a casing forming a drying chamber, means in said casing forming fixed portions of two supplemental chambers, and a yarn carrier mounted to travel into and out of said casing, said carrier having the shape of an inverted T of which an elongated flat manifold forms the base and a perforated tube forms the leg, said tube being closed at the bottom and having a discharge opening into said casing, said manifold and tube forming movable portions to complete said supplemental chambers, spindles for mounting yarn packages rising from said manifold into said supplemental chambers substantially parallel to said tube, means for circulating heated air through said manifold, spindles and packages into said supplemental chambers, and means for circulating heated air transversely of said supplemental chambers to mix with the spindle circulation, said mixed circulation passing through said perforated tube.

HARRY S. DRUM.
WILLIAM C. DODSON.