Jan. 30, 1951 F. B. BREAZEALE 2,539,943

DRYING RAYON

Filed Feb. 24, 1948

Fig. 1.

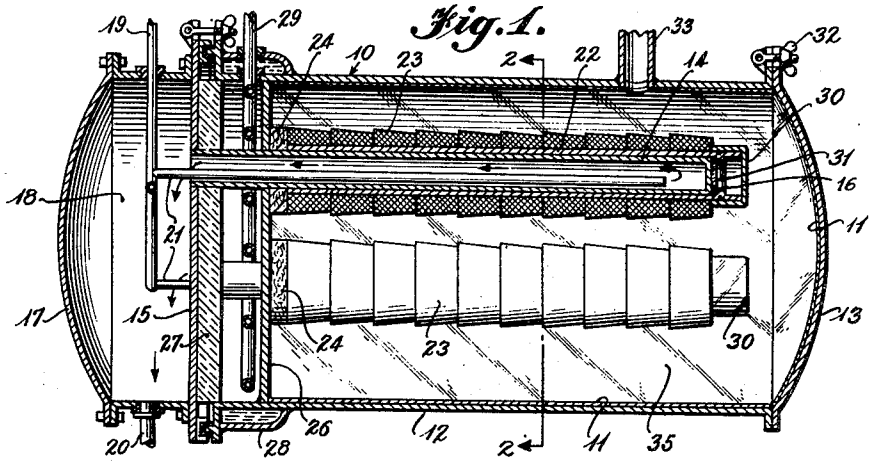



Fig. 2.

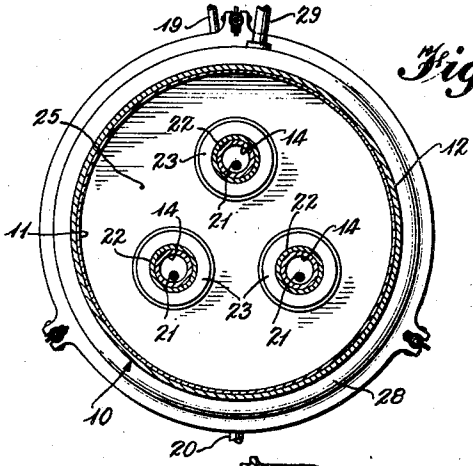
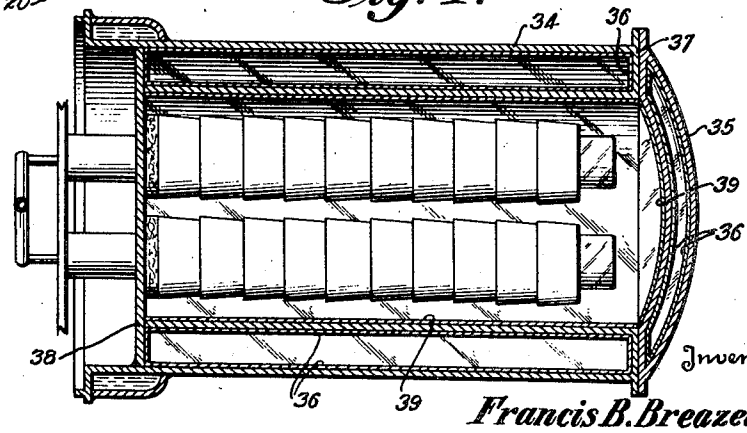



Fig. 3.


Fig. 4.

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# UNITED STATES PATENT OFFICE

2,539,943

## DRYING RAYON

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5 Claims. (Cl. 34—92)

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This invention relates to drying yarn in package form and more particularly to an apparatus for drying rayon packages having thread-free centers, such as cakes of rayon collected in centrifugal buckets or bobbin spun packages from which the rigid inner cores have been removed.

U. S. Patent No. 2,266,375 describes and claims a method of, and apparatus for, drying rayon packages under a controlled vacuum in a closed container to effect the drying of the rayon at lower temperatures than would otherwise be possible, the drying of the packages proceeding from the inside to the outside thereof. In this connection it is to be noted that the container is provided with a number of cantilever supported heating cylinders extending inwardly from one end wall thereof. The cylinders are each open at their supported ends to permit the circulation of a heating medium therethrough, the cylinders being closed at their unsupported ends to confine the heating medium to the interiors thereof. Rayon packages may be assembled on the cylinders in any convenient manner, e. g., as shown in the patent, they may be arranged in side-by-side relationship on loading tubes which are adapted to slide snugly over their respective cylinders. The diameter of each of the tubes with respect to the rayon packages is sufficiently small to permit complete contraction of the rayon in the packages during drying.

Despite the fact that the patentees intended that all heat be directly applied to the packages through the medium of the cylinders and that they disclosed the presence of an insulating material as a lining for the container, it has been determined that, in the use of such an apparatus, the drying does not proceed entirely as desired since some drying actually takes place prematurely in those segments of the outer portions of the packages which are adjacent or near the shell of the container. This premature drying in the outer portions of said packages is due to the radiation of heat from the shell of the container. The source of this heat is, of course, the atmosphere surrounding the container which is at a temperature of 21° to 35° C. depending upon the season of the year. These temperatures are above the boiling point of water at the pressures prevailing within the container so that, if the heat from the atmosphere is radiated to the outer surfaces of the cakes, before the heat provided from within the cakes reaches their surfaces, premature drying occurs. Although it is not fully understood why the insulating material such as cork does not effectively prevent premature drying by heat radiation from the shell of the drier, it has been determined that such is the fact, and the drying of rayon in those portions of the outsides of the packages before the respective interiors of the packages are completely dry create tension in the outer portion and causes shrinkage differences in the packages which in turn produces a barré effect in weaving and creates uneven dyeing characteristics in the threads.

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United States Patents Nos. 2,432,951 and 2,432,952 describe and claim a method and apparatus, respectively, that overcome, to a large extent, the premature drying difficulties discussed above in connection with the primary patent. However, both of these later patents are concerned with a system which requires the rotation of those packages of rayon which are located adjacent the shell of the drier. Naturally, the employment of any sort of scheme for rotating the packages involves increases in the initial and operating costs of the equipment. Accordingly, in commercial production involving the drying of thousands of packages of rayon per day, the use of the rotating package system is not economically feasible.

It is therefore an object of the present invention to overcome the premature drying effect of the system of Patent No. 2,266,375 by a novel arrangement which is completely devoid of moving parts.

It is another object of this invention to provide a drier for rayon cakes characterized by its simplicity and efficiency and which creates optimum drying conditions on the interior thereof.

A further object of the invention is the provision of a vacuum drier for rayon cakes which is constructed of materials that permit a maximum of heat of conduction and radiation at the interiors of the cakes and a minimum of heat of radiation from the shell of the drier.

Other objects and advantages of this invention will become apparent from the following detailed description when considered in conjunction with accompanying drawings wherein:

Figure 1 represents a longitudinal section of a vacuum drier constructed in accordance with this invention;

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

Figure 3 illustrates in detail an enlargement of one of the loading tubes; and

Figure 4 shows a modified form in partial section of the drier.

Referring to the drawings, the numeral 10 indicates the vacuum drier which in general lay-

out, is similar to that shown in the above mentioned Patent No. 2,266,375. However, this drier does not have an expensive insulating material, such as cork, lining the interior of the drier, since it was found that the cork liner was inefficient in that it did not prevent heat from radiating from the shell of the drier onto the cakes. The drier 10 has a metallic lining 11 of low thermal emissivity covering the interior of the shell 12 and hinged door 13. This lining 11 has a bright surface and may be constructed of aluminum, tin, stainless steel, etc.

The drier is provided with a plurality of heating cylinders 14, the open ends of which are integrally fixed to a plate 15 at the rear of the drier, and are closed at their other ends at 16. The plate 15 is spaced a short distance from the closed end 17 of the drier and forms a header chamber 18 therewith. This chamber serves as a space for introducing and exhausting the fluid heating medium through pipes 19 and 20 respectively. The heating medium, after it passes through the inlet pipe 19, is forced into the heating cylinders 14 by way of smaller pipes 21.

Referring more particularly to Figure 3, there is shown in detail a loading tube 22, which in its finished form has a very high thermal emissivity. This is effected by painting the outside of the loading tube black. Rayon packages 23, having thread-free centers, are arranged side by side in contact on this loading tube 22. The diameter of the tube is sufficiently less than that of the rayon packages to permit complete contraction on drying. Each of the loading tubes 22 is adapted to be slidably mounted on each of the heating cylinders 14 in such a manner that the open end remote from the door 13 abuts against insulating ring pads 24.

In order to prevent the introduction of any heat by conduction into the drying chamber 25, except through the heating cylinders 14, several insulating elements are employed. Plate 15 and copper plate 26 would normally become heated by conductance due to their contact with heating cylinders 14, and also because of the fact that they are in contact with the shell 12. To prevent this heating, an insulating backing 27 is applied to plate 15, and a cooling band 28 surrounds plate 26. Cold water is circulated through this band. In addition, cooling coils 29 are employed adjacent copper plate 26. As a further precautionary measure, the insulating ring pads 24 are inserted on the heating cylinders between the copper plate 26 and the cakes 23 that are on the extreme end of the loading tubes 22 remote from the door 13. In this way, the heating medium is confined exclusively to the heating cylinders, whereby drying takes place progressively from the inside to the outside of each package.

To avoid improper drying of the packages adjacent the door 13 and thereby improve the quality of the rayon in the packages at that end of the tubes, a bright or polished metal cap 30 is placed over the end of each loading tube 22 just far enough to be inserted under the front edge of the cake. To minimize heat of conduction between the cylinder end 16 and the cap 30, an insulating material 31 may be deposited within the cap. Radiant heat from the shell of the drier onto the cakes is reduced to a minimum by means of the bright or polished surface lining 11, and when the door 13 is closed and secured by lock nuts 32, a hermetically sealed, temperature- and pressure-proof chamber is formed. Air and moisture are evacuated from the chamber by means of pipe line 33 connected to a vacuum pump (not shown).

The vacuum drier disclosed in Figure 1, is for all practical purposes, fool-proof, and effects substantially optimum drying conditions. The relatively inexpensive bright, shiny lining on the interior of the shell of the drier reduces all heat of radiation from the shell onto the cakes to a minimum, and the utilization of black loading tubes effects a maximum amount of heat of conduction and radiation onto the interiors of the packages which substantially reduces the drying cycle. However, it has been determined that the more bright surfaces interposed between the cakes and the shell of the drier, the more complete will be the prevention of heat transfer from the outside of the drier to the interior thereof. The modification shown in partial section in Figure 4, is similar in most respects to the drier shown in Figure 1. However, in this modification, the shell 34 is double walled, forming an air gap between the inner and outer walls of approximately one inch, which acts very much the same as a thermos bottle. The door 35 is also double walled, although the space between the walls is less. The interior walls of the shell and the door are lined with a shiny metal at 36. This shiny metal extends around the ends 37 and 38 of the double wall of the shell 34. A similar bright metal lining 39 is applied to the inside surface of the inner wall of the shell and of the door which together constitute the inner shell of this modification.

Because of the fact the cakes must fit loosely enough to permit complete contraction on the loading tubes, the outside of the loading tubes must always be black to permit a maximum heat of radiation. However, since the loading tubes fit snugly over the heating cylinders, it is not necessary to paint the inside of the loading tubes black. In the event that it is not desired to have the loading tubes fit snugly over the heating cylinders, then the interior and exterior of the tubes should be painted black, and also the outside of the heating cylinder should be painted black.

Vacuum drying, as practiced according to the present invention, requires an absolute pressure within the drier of approximately 15 mm. mercury. Under these conditions the temperature at the outside of the cakes is in the neighborhood of 17° C. (the boiling point of water at this pressure). Inasmuch as the air on the outside of the vacuum drier varies from about 21° to 35° C. during the year, it is apparent that the vacuum drier shell, is at all times, at a higher temperature than the outside of the cakes, at least during the initial period of each drying cycle. Therefore, heat would normally be radiated from the shell of the drier onto the cakes, and particularly to those closest to the inner shell of the drier. By lining the inner shell of the drier with a bright metallic surface such as aluminum, the thermal emissivity of this surface is greatly reduced, and therefore the heat transfer from the shell to the cakes is minimized. This substantially prevents the barre effect which is caused by unsatisfactory or uneven shrinkage.

One of the most practical and satisfactory linings is aluminum foil, because it is readily available and retains its brightness over a long period of time. However, other metallic foils that have these same characteristics and have a low coefficient of thermal emissivity can be substituted for aluminum, e. g., tin or polished metal surfaces such as stainless steel. It is believed that metals which have and retain a coefficient of

thermal emissivity below .2 would be satisfactory as a liner for the shell of the drier, and any surface having a high coefficient of thermal emissivity, i. e., above .8 is preferable for application to the loading tubes.

While it is apparent that the bright metallic surface of the liner of the shell shown in Figures 1 and 2 will constitute an excellent heat-reflective surface, it should be borne in mind that the source of heat is from the cylinders 14, so that before heat could be reflected back from the shiny liner it would have first to pass through the cakes to dry them.

What is claimed is:

1. Apparatus for drying rayon cakes which comprises a container, means for hermetically sealing and evacuating the same, a metallic liner of lower thermal emissivity surrounding the interior shell of the container, a plurality of imperforate heating cylinders arranged within the space defined by said liner, means to support cakes over said heating cylinders in a position to prevent radiation from said cylinders to said liner, and means to prevent radiation from said cylinders to said liner from areas of the cylinders not covered by the cakes, said liner effectively minimizing radiation of heat from the shell of the container to the cakes so that the cylinders constitute the sole source of heat to the container and the heat is confined to the interiors of the cakes whereby the temperature at the outside of the cakes is lower than the temperature on the outside of the container at least during the initial drying period and drying of the cakes takes place progressively from the inside to the outside of the cakes without premature drying at the outsides thereof.

2. Apparatus for drying rayon cakes which comprises a container, means for hermetically sealing and evacuating the same, a metallic liner of low thermal emissivity surrounding the interior shell of the container, a plurality of imperforate heating cylinders arranged within the space defined by said liner, loading tubes of high thermal emissivity to support cakes over said heating cylinders in a position to prevent radiation from said cylinders to said liner, and means to prevent radiation from said cylinders to said liner from areas of the cylinders not covered by the cakes, said liner effectively minimizing radiation of heat from the shell of the container to the cakes so that the cylinders constitute the sole source of heat to the container and the heat is confined to the interiors of the cakes whereby the temperature at the outside of the cakes is lower than the temperature on the outside of the container at least during the initial drying period and drying of the cakes takes place progressively from the inside to the outside of the cakes without premature drying at the outsides thereof.

3. Apparatus for drying rayon cakes which comprises a container, means for hermetically sealing and evacuating the same, a metallic liner having a coefficient of thermal emissivity less than 0.2 surrounding the interior shell of the container, a plurality of imperforate heating cylinders arranged within the space defined by said liner, loading tubes having a coefficient of thermal emissivity greater than 0.8 to support cakes over said heating cylinders in a position to prevent radiation from said cylinders to said liner, and



means to prevent radiation from said cylinders to said liner from areas of the cylinders not covered by the cakes, said liner effectively minimizing radiation of heat from the shell of the container to the cakes so that the cylinders constitute the sole source of heat to the container and the heat is confined to the interiors of the cakes whereby the temperature at the outside of the cakes is lower than the temperature on the outside of the container at least during the initial drying period and drying of the cakes takes place progressively from the inside to the outside of the cakes without premature drying at the outsides thereof.

4. Apparatus for drying rayon cakes which comprises a container, means for hermetically sealing and evacuating the same, at least two metallic liners of low thermal emissivity surrounding the interior shell of the container, a plurality of imperforate heating cylinders arranged within the space defined by said liners, means to support cakes over said heating cylinders in a position to prevent radiation from said cylinders to said liners, and means to prevent radiation from said cylinders to said liners from areas of the cylinders not covered by the cakes, said liners effectively minimizing radiation of heat from the shell of the container to the cakes so that the cylinders constitute the sole source of heat to the container and the heat is confined to the interiors of the cakes whereby the temperature at the outside of the cakes is lower than the temperature on the outside of the container at least during the initial drying period and drying of the cakes takes place progressively from the inside to the outside of the cakes without premature drying at the outsides thereof.

5. Apparatus for drying rayon cakes which comprises a container, means for hermetically sealing and evacuating the same, a bright polished aluminum foil surrounding the interior shell of the container, a plurality of imperforate heating cylinders arranged within the space defined by said foil, black loading tubes to support cakes over said heating cylinders in a position to prevent radiation from said cylinders to said foil, and means to prevent radiation from said cylinders to said foil from areas of the cylinders not covered by the cakes, said foil effectively minimizing radiation of heat from the shell of the container to the cakes so that the cylinders constitute the sole source of heat to the container and the heat is confined to the interiors of the cakes whereby the temperature at the outside of the cakes is lower than the temperature on the outside of container at least during the initial drying period and drying of the cakes takes place progressively from the inside to the outside of the cakes without premature drying at the outsides thereof.

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## REFERENCES CITED

The following references are of record in the file of this patent:

### UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 2,156,845 | Gentele | May 2, 1939 |
| 2,266,375 | Mengeringhausen | Dec. 16, 1941 |
| 2,377,177 | Pfleumer | May 29, 1945 |