Dec. 16, 1941. E. MENGERINGHAUSEN ET AL 2,266,375

PROCESS AND APPARATUS FOR DRYING PACKAGES OF ARTIFICIAL SILK

Filed Feb. 5, 1938

Fig. 1.

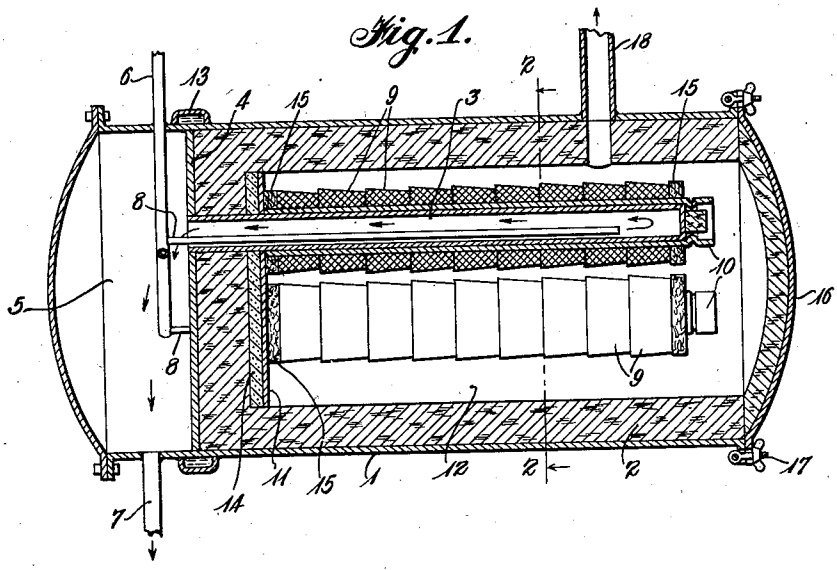


Fig. 2.

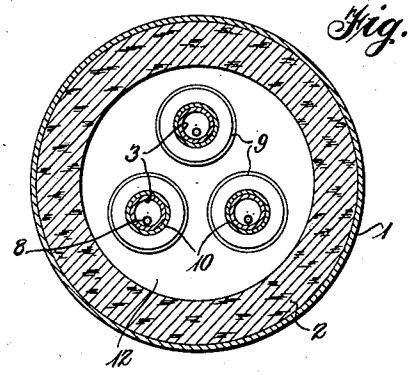
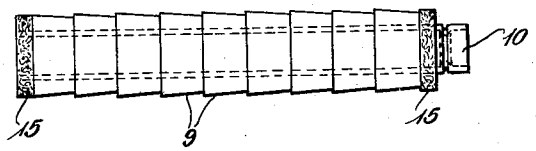


Fig. 3.



Inventors
Ernst Mengeringhausen
and Ludwig Silberberg

By Albin F. Knight Attorney

Patented Dec. 16, 1941 2,266,375

UNITED STATES PATENT OFFICE

2,266,375

PROCESS AND APPARATUS FOR DRYING PACKAGES OF ARTIFICIAL SILK

Ernst Mengeringhausen, Oberbruch, Bezirk Aachen, Germany, and Ludwig Silberberg, Arnhem, Netherlands, assignors to American Enka Corporation, Enka, N. C., a corporation of Delaware

Application February 5, 1938, Serial No. 189,000
In Germany August 31, 1933

10 Claims. (Cl. 34—15)

This application is a continuation in part of our copending application Serial No. 740,018 filed August 15, 1934.

The present invention relates to a process of and apparatus for drying rayon or artificial silk in package form, and more particularly to a system in which unsupported wound packages are caused to be uniformly contracted during drying. In referring to the "unsupported wound packages" we mean cakes of rayon produced by the centrifugal bucket spinning method or bobbin spun packages from which the rigid inner support has been removed.

Several different methods exist for drying unsupported packages of artificial silk in which various systems are employed to effect a drying substantially from the inside to the outside of the package. It is known that several advantages may be realized when conducting the drying in such a manner; one of the most important is that unequal shrinkage from the inside to the outside of the package is substantially overcome. Prior to the advent into the industry of the so-called inside outside drying, packages of artificial silk had to be either wound into skeins in order that a uniform shrinkage could be had, or the packages were placed in large oven driers and the drying took place substantially from all directions throughout the body of the package. The former method offered the disadvantage of necessitating an extra, expensive operation with the resultant increase in the amount of handling of the filaments thereby weakening, tangling or breaking the same. The latter method produced unequal shrinkage throughout the package owing to the fact that the outer layers of yarn could not shrink to the same extent as the inner layers because of the resistance offered by the inner layers while the inner layers themselves were unsupported.

Accordingly, various forms of apparatus were devised for conducting methods whereby drying passages were formed throughout the thread-free interior of unsupported packages of artificial silk wherein a drying medium could be passed through the same and the drying would take place substantially from the inside progressively to the outside of the package. Such a process was found to be comparatively successful due to the fact that the inner layers of thread tended to dry first and thereby leave space for the outer layers to contract. One of the objections to this method was that the higher drying temperatures still caused inequalities in the finished thread. However, owing to the more equalized tension and therefore more uniform contraction, it was apparent that the so-called inside-outside drying method was an improvement over the old practice of rewinding into skeins and drying the same. In other words, although the current methods for carrying out this inside-outside drying produced small shrinkage differences in the thread, the trend in the industry was to adopt this simplified process, provided a practical system could be worked out.

This invention, therefore, has for an object the provision of a method for improving and facilitating the inside-outside drying of artificial silk packages.

It is further contemplated to conduct the drying operation in vacuo so that the drying operation can be effected at very much lower temperatures than would otherwise be possible.

Another object of the invention is the provision of an improved apparatus for carrying out the present process.

Other objects and advantages will be apparent from the following detailed description and when considered in connection with the accompanying drawing wherein:

Figure I represents a longitudinal section of a vacuum drier formed in accordance with the invention which is particularly constructed to permit the practice of this process, packages of artificial silk being shown in proper position for drying;

Figure II is a transverse section taken on lines 2—2 of Figure I;

Figure III illustrates in detail one of the loading tubes with several freshly spun and washed artificial silk packages thereon in readiness to be slipped over a heating cylinder within the drying chamber.

Referring to the drawings, the numeral 1 indicates a metallic container suitably lined with an insulating material 2 such as cork which very effectively prevents any temperature changes within the container from external causes. The container is provided with a number of heating cylinders 3, the open ends of which are integrally fixed to a plate 4 and the closed ends have insulating caps attached thereto. The plate 4 is spaced a short distance from the closed end of the container and forms a header chamber 5 therewith. This chamber serves as a space for introducing and exhausting the heating medium, namely through pipes 6 and 7, respectively. The heating medium such as hot water, steam or oil after it is passed through inlet pipe 6 is forced

into the heating cylinder 3 by way of smaller pipes 8 located within the said cylinders.

With reference to Figure III, the artificial silk packages 9 are arranged side by side in contact on a loading tube 10. The diameter of tube 10 is sufficiently less than that of the packages to permit complete contraction on drying. Each of the loading tubes is adapted to be slidably mounted on one of the heating cylinders 3 (Figure I) in such a manner that the open end of the loading tube is in contact with an aluminum plate 11. In order to prevent the introduction of any heat by conduction into the drying chamber proper designated at 12, except through the heating tubes, several insulating elements are employed in addition to the lining 2. In this connection between the aluminum plate 11 and the supporting plate 4 for the heating cylinder, there is as stated, the cork lining 2 which is used for maintaining a constant low temperature in the drying chamber. However, the heating cylinders themselves would normally raise the temperature of the plates 4 and 11 by conduction. To prevent this, cold water is circulated through a shell 13 surrounding plate 4. A pipe system (not shown) for circulating cold water is welded to the back of the aluminum plate 11. A layer of magnesia 14 is preferably superimposed over the insulation behind the aluminum plate to further prevent the heating of the plate. Such precautionary measures confine the heating medium entirely to the heating cylinders whereby drying takes place exclusively from the inside of each package to the outside. In order to avoid improper drying of those ends of the packages on the extremities of the respective heating cylinders that would normally be exposed, a suitable material such as portions of artificial silk packages or asbestos pads 15 may be utilized as insulating coverings therefor.

At its front end the container is provided with a hinged cover member 16 which is lined with an insulating material so that when the cover is closed and secured by lock nuts 17, a hermetically sealed, temperature- and pressure-proof chamber is formed. Air and moisture are evacuated from the chamber by means of pipeline 18 connected to a vacuum pump (not shown).

Various modifications and changes can be made in the details of the aforedescribed apparatus without departing from the spirit and scope of my invention. However, the general arrangement offers a distinct improvement over the prior practice. In proceeding in accordance with the present invention a plurality of rayon packages are preferably placed upon loading tubes and the tubes are mounted on heating cylinders. The cover member is then closed and tightly secured by means of lock nuts 17 and air from the chamber is evacuated to the greatest degree possible with commercially feasible mechanism. In practice a vacuum of from 5 to 15 mm. of mercury (absolute pressure) is attained during the initial drying period. At this pressure the moisture boils off at approximate temperatures from 4° C. to 20° C. As the moisture boils off, it absorbs the heat from the heating tube and thereby acts to prevent the temperature from rising in the chamber.

The water or other heating medium circulating through the heating cylinders is maintained at a temperature of about 70° C. Due to the aforedescribed construction of the apparatus, the only heat that can enter the drying chamber in appreciable quantity is transmitted by way of the heating cylinders per se. As this heat first contacts the inner portions of the packages, the drying proceeds exclusively from the insides to the outsides thereof. The extremely high vacuum permits the drying to take place at a much lower temperature than would otherwise be possible. Moreover, the drying in vacuo greatly improves the process and imparts extremely uniform qualities to the finished thread.

What we claim is:

1. A method of drying tubular wound packages of freshly spun artificial silk which have thread-free centers, which comprises positioning a plurality of such artificial silk packages in a drying chamber, evacuating the drying chamber sufficiently to maintain a high vacuum about the outer surfaces of the packages and applying heat solely by a confined heating medium circulated within the thread-free centers of the packages without directly contacting the inner threads with the heating medium to effect progressive drying and resultant progressive contraction of the thread in each package from the interior toward the exterior thereof.

2. A method of drying tubular wound packages of freshly spun artificial silk which have thread-free centers, which comprises positioning a plurality of such artificial silk packages in a drying chamber, evacuating the chamber sufficiently to subject the packages to a vacuum of from 5 to 15 mm. of mercury (absolute pressure), at which pressure the moisture boils off at a temperature of about 4° C. to 20° C., applying heat to the packages solely by a confined heating medium circulated within the thread-free centers thereof while protecting the ends of the packages sufficiently to substantially prevent their premature drying to thereby effect progressive drying and resultant progressive contraction of the thread in each package from the interior toward the exterior thereof, continuously withdrawing the vapor formed in the chamber due to the drying of the packages, continuously supplying the heating medium to the cores of the packages and withdrawing it therefrom without directly contacting the inner threads of the packages with the heating medium.

3. A process for drying tubular rayon packages which comprises assembling a plurality of freshly spun wound packages on an imperforate loading tube, positioning the tube within a drying chamber, maintaining a vacuum about the outer surfaces of the packages and heating the packages solely by supplying a heating medium within said imperforate loading tube whereby the drying of each package is effected progressively from the inside to the outside.

4. A process for drying tubular rayon packages which comprises assembling a plurality of freshly spun wound tubular packages on an imperforate loading tube, positioning the tube within a drying chamber, maintaining a vacuum about the outer surfaces of the packages and heating the packages solely by a heating medium within said imperforate loading tube and withdrawing the same therefrom without directly contacting the inner threads of the packages while maintaining a high vacuum thereon such that a boil-off of the moisture is effected at a temperature below 20° C. whereby drying of the packages takes place progressively from the inside to the outside.

5. A method of drying tubular wound packages of freshly spun artificial silk which comprises the steps of forming thread-free drying passages by arranging a plurality of such packages with their adjacent ends abutted, applying heat solely by a confined heating medium within the said pas-

sages without directly contacting the inner threads of the packages while protecting the ends thereof sufficiently to substantially prevent premature drying to effect drying of the packages substantially, exclusively from the inside to the outside, and during the drying period maintaining a high vacuum on the packages thereby effecting evaporation of the moisture at a lower temperature than would otherwise be possible.

6. A method of drying tubular wound packages of freshly spun artificial silk which comprises the steps of forming thread-free drying passages by arranging a plurality of such packages with their adjacent ends abutted, maintaining the packages with their ends protected to prevent premature drying, heating the packages solely by supplying a confined heating medium to the said passages without contacting the inner threads of the packages to effect drying of the packages from the inside to the outside, and during the drying period maintaining a vacuum on the outer surfaces of the packages of from 5 to 15 mm. of mercury (absolute pressure), at which pressure the moisture boils off at a temperature of about 4° C. to 20° C.

7. An apparatus for drying rayon packages which comprises a container capable of being hermetically sealed to form an air-tight drying chamber, imperforate tubular members, each supported at one end for receiving thereover a plurality of tubular rayon packages in each of a plurality of rows within said container with the packages in each row having their thread-free centers in alignment, means for supplying a heating medium solely within the imperforate tubular members and withdrawing the same therefrom without contacting the inner threads of the package, said means being so positioned with respect to the said members that the heat supplied within the same, is transmitted initially only to the inner surfaces of the packages thereby avoiding the subjection of the outer portion of the packages to the direct application of heat, and means for evacuating the drying chamber whereby the packages may be dried at a very low temperature progressively from the inside to the outside of each thereof.

8. An apparatus for drying rayon packages which comprises a container having a closure capable of being hermetically sealed to form an air-tight drying chamber, imperforate tubular projections extending into the container from one wall thereof, said tubular projections being closed at their inner ends to thereby avoid communication between their respective interiors and the drying space in the container, loading tubes for removably fitting over and closely engaging respective tubular projections, each of the loading tubes being formed to be passed through the thread-free centers of a plurality of tubular rayon packages with their ends abutted, means constituting substantially the sole heating source for the area within the chamber arranged in each of the tubular projections for directing a circulation of a heating fluid therethrough thereby to effect the application of heat to the interior of each package suspended upon a loading tube engaged thereover while avoiding the subjection of the outer portion of each package to the direct application of heat, means for evacuating the drying chamber to permit the respective packages to be dried at a very low temperature progressively from the inside to the outside thereof, whereby a plurality of rayon packages may be suspended upon each of the loading tubes and placed in the drying position within the container upon the engagement of the loading tubes with the respective tubular projections and the drying may be effected by sealing the closure, evacuating the chamber and circulating the heating fluid within the projections.

9. A method of drying tubular wound packages of freshly spun artificial silk which have thread-free centers, which comprises positioning a plurality of such artificial silk packages in a drying chamber, evacuating the chamber sufficiently to maintain a high vacuum on the packages, heating the packages solely through the medium of imperforate heat emitting means confined within the thread-free centers thereof, the drying of the packages being effected substantially entirely solely by the passage of heat from the heat emitting means and the action of the vacuum, whereby drying and the resultant contraction of the thread in each package is progressive from the interior toward the exterior.

10. A method of drying tubular wound packages of freshly spun artificial silk which have thread-free centers, which comprises positioning a plurality of such artificial silk packages in a drying chamber, evacuating the chamber sufficiently to maintain a high vacuum on the packages, heating the packages solely through the medium of imperforate heat emitting means confined within the thread-free centers of the packages, the heating of the packages being effected solely by the passage of radiant heat and heat of conduction from the heat emitting means, whereby drying and the resultant contraction of the thread in each package is progressive from the interior toward the exterior.

ERNST MENGERINGHAUSEN.
LUDWIG SILBERBERG.