

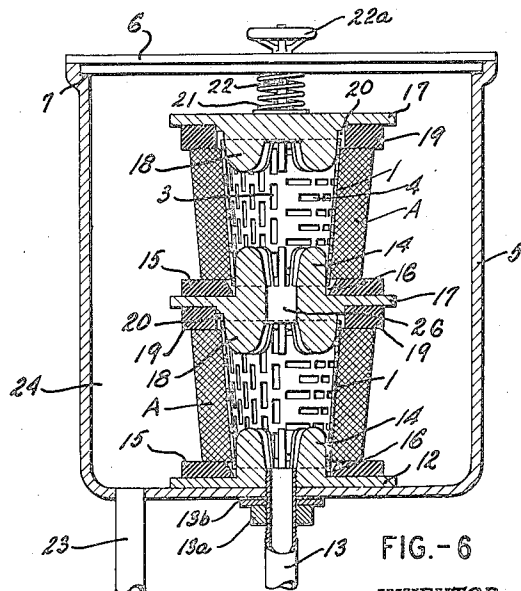
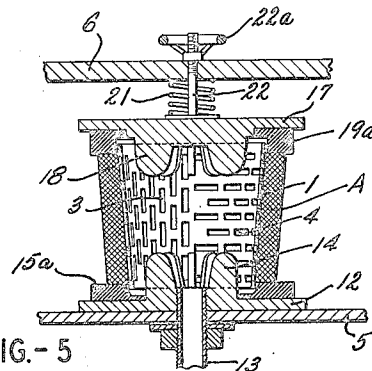
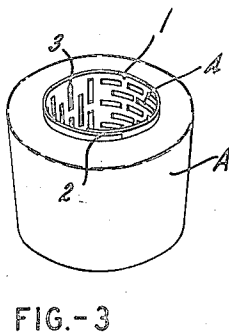
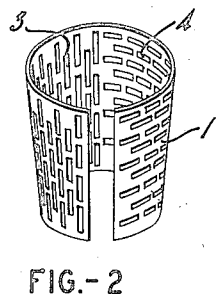
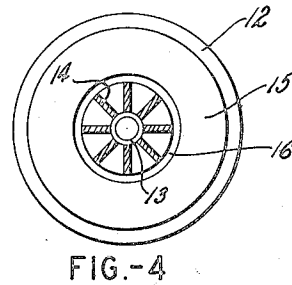
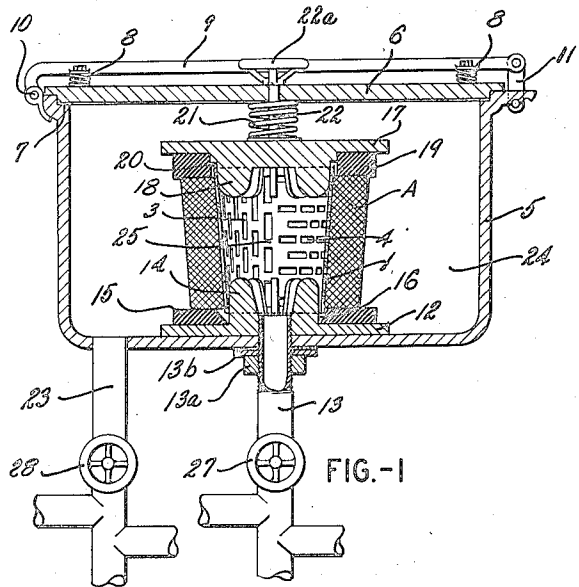
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2,038,036

METHOD AND APPARATUS FOR TREATING RAYON

Filed Jan. 11, 1934



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METHOD AND APPARATUS FOR TREATING
RAYON

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7 Claims. (Cl. 18—8)

This invention relates to the manufacture of artificial silk, and more particularly to the pot spinning process for the production of artificial silk from viscose. In said process the multiple filament thread, after coagulation, is led to and wound or formed as a hollow generally cylindrical cake in the spinning pot, following which the thread is washed, desulfurized, bleached, and otherwise treated, culminating in the usual drying operation with the thread ready for dyeing, knitting, or weaving operations.

My invention is designed to provide improved method and apparatus by which the thread wound in and removed from the centrifugal pots may be subjected to any or all of the usual treatments in the most efficient and satisfactory manner, not only by convenient and rapid operations which reduce the amount of handling to which the material is subjected and therefore avoid breakage and injury to the fiber or thread, but also by practices which insure a uniform effect upon all parts of the thread, giving it desirable characteristics as regards dyeing properties, strength, luster and the like.

One object of the invention is to provide apparatus including a holder or support for the cake which enables air or treating liquids or baths to be moved through the hollow cake in either or both of the two possible directions, to wit, either from the outside inwardly or from the inside outwardly, and in a manner to always insure application of the air or treating liquids to all parts of the cake, to avoid by-passing or flow of the liquids or air around and not through the cake, and to insure uniform treatments of all parts of the cake with uniform and even shrinkage upon drying.

A further object of the invention is to provide an improved inner liner, of cuff form, upon which the cake is sleeved and supported during treatment, said liner being self-accommodating to any variations in inner diameter of the cake not only to take account of minor variations in diameter but also to receive unusually short doffs, and which also is provided with perforations or openings so arranged that regardless of the inner diameter of the cake uniform and free flow of material is provided to all parts of the cake.

A further object is to provide holding or supporting means for rayon cakes of this type which is self-accommodating to the length of the cake along its axis from end to end, with the ability to accommodate itself to either shrinkage or expansion lengthwise during any of the treating operations or during drying, and in a man-

ner to seal the cake at both ends against the production of short cut paths by which the liquor or air may pass around the cake without application to its fibers, and further, such an apparatus which is automatic in operation and requires no special attention from the operator.

A further object of the invention is to provide an improved method of treating rayon cakes of this kind in a simple and expeditious manner and so as to insure uniform characteristics of the thread by causing the treating liquid or air to flow alternately inwardly and outwardly through the cake walls so that all parts of the cake receive like treatment and the thread has uniform characteristics from end to end, all in the manner to accomplish any or all treatments to which the thread is to be subjected from the time of its initial setting up or coagulation clear through to and including the drying operation.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawing, which represents one suitable embodiment of the invention, Fig. 1 is a sectional elevation, partly diagrammatic, showing a cake in position for treatment; Fig. 2 is a perspective view of the liner; Fig. 3 is a similar view of the assembled cake and liner; Fig. 4 is a sectional plan view on the line 4—4, Fig. 1; Fig. 5 is a sectional view corresponding to Fig. 1, and illustrating the manner of handling short doffs; and Fig. 6 is a similar view illustrating a modification for handling a plurality of cakes.

Referring to Fig. 1, A represents the rayon or artificial silk cake as produced by the spinning operation in the pot or bucket process. The thread is produced from viscose with the use of usual reagents and the cake is produced in a rotating pot along the axis of which the thread is delivered from a feeding device, the rotating motion causing the thread to fly outwardly and pile up inwardly against the wall of the pot until the spinning operation is concluded. The cake itself, generally speaking, is of hollow cylindrical form, although it is usually somewhat tapered from end to end to enable it more readily to be removed from the pot. The outer diameter and form is controlled by the shape of the pot itself and particularly by the form of the inner surface of the pot wall. The length of the cake depends upon the length of travel of the traverse mechanism and its thickness upon the length of the thread spun into cake form. This thread length in normal operations is more or less uniform, the cake being half an inch to an inch and a half

in thickness and from four to six inches long depending upon conditions established in the plant, but if the thread breaks during the spinning operation or if the doff, for any reason, is terminated earlier than usual, the cake may be considerably thinner than usual and is known as a short doff.

Upon conclusion of the spinning operation the cake, in wet form, is removed from the pot and is applied to a supporting liner which, in the present instance, is of substantially cylindrical cuff-like form, but tapered to correspond to the taper of the cake, as will be readily understood. Such a cuff-like liner or support is illustrated at 1, Fig. 2. It is made of suitable non-corrodible material, such as aluminum, rubber, etc., in relatively thin sheet form and with sufficient yield, inherent strength and resiliency to yieldingly resist inward collapse as the result of pressure upon it by shrinkage of the cake or otherwise. Circumferential dimension of the liner is such that when it is within a cake, as in Fig. 3, the longitudinally extending edge portions have a material overlap upon each other, as indicated at 2, the overlap being sufficient so that the cuff may be either contracted to fit a normal cake or expanded to accommodate itself to a short doff with a larger internal diameter, and the edges themselves of course are smoothed or rounded out so as not to injure the fibers.

This cuff, while it supports the cake, must nevertheless be of a form to enable treating liquids or air to travel through the cake in the radial direction, for which purpose it is perforated, but the perforations consist of two series of slots or elongated openings 3, 4, one set extending in the circumferential direction around the cuff and the other at a suitable angle thereto, such as longitudinally along it. Therefore, where the adjacent longitudinally extending edge portions of the cuff overlap the two sets of circumferential and longitudinal slots overlap each other, insuring the presence of through openings in this overlapping zone regardless of the size to which the cuff is expanded or contracted, and avoiding any possibility of blocking penetration of liquor or air through the overlapping portions in particular adjustments of its size, as is the case when the openings are simple round holes.

The cuff itself is made longer than the particular size of cake with which it is to be used, the excess length being desirable for subsequent connection of the dry cake mounted on the cuff to a coning, reeling, or other textile machine.

Upon removal of the cake from the spinning pot and its application to a cuff or liner in the manner described, the cake and cuff together are mounted in supporting apparatus where subsequent process steps are performed upon the yarn. Such supporting apparatus is more or less conventionally shown in Fig. 1. It comprises a suitably supported casing or shell 5, shown as of box-like form to serve as a receptacle for liquid, and closed by a cover 6, which may be sealed to the casing in any manner to produce a tight joint, such as is necessary when pressure or vacuum are employed. In the arrangement shown, the cover is sealed to the casing by gaskets 7 against which it is yieldably clamped by springs 8 beneath a clamping bar 9 hinged at 10 and releasably locked in place by the hasp 11, although any other clamping arrangement may be employed. By releasing hasp 11 the clamping bar may be raised and the cover removed.

Within the casing 5 is a base or platform 12

having an opening in its center to which a conduit 13 is connected, the joint being sealed by a nut 13a and sealing gasket or washer 13b. Surrounding the opening the platform is provided with a pilot and liner supporting member including wing-like portions 14 and with a sealing gasket or seat member 15, made of rubber or other suitable material, and which at its center is cut away or otherwise formed to produce a recess 16 to receive the projecting end of the cuff or liner 1. The cuff or liner with the cake upon it is laid in place in the manner shown in Fig. 1, with the cake resting directly upon gasket 15 and the cuff entering recess 16. The cover 6 is provided on its under surface with a head or upper clamping member 17, which in form is generally similar to the base 12, having pilot wing portions 18 at its center designed to enter and support the other end of the cuff 1, while outside of the pilot portions the head member 17 is provided with a sealing gasket 19 which again may be of rubber or like yielding material. In this case the wings 18 are so formed that there is a gap or space 20 between the inner edge of the gasket 19 and the wings 18 to receive and support the projecting end of the cuff 1, and the parts are so proportioned, with relation to the length of the cake A, that both ends of the cuff 1 stop short of seating at any time against any rigid portion of the base 12 or head 17. Head 17 is connected to the cover by a suitable yielding compression means, such as the spring 21 surrounding a rod 22 extending through the cover and provided outside of the cover with means for adjusting the spring pressure, such as the nut 22a.

The drawing shows the cake applied to its seat in the casing 5 with its small end down, but this is not essential as the parts may be arranged to receive the cake with its small end up, as will be readily understood.

Outside of the base 12 the casing 5 is also provided with connections to a second conduit 23 and of course it will be understood that the casing 5 may be made large enough to contain a plurality, even a large number of supports for individual cakes and cuffs of the kind illustrated in Fig. 1. In other words, the chamber 24 may receive and contain a plurality of cakes, with a separate supply pipe 13 to the cavity 25 within each cake and with one or more pipes 23 connected to the chamber 24.

Moreover, a plurality of cakes may be piled one upon the other or arranged in axial alinement, in the general manner illustrated in Paley Patent 1,779,103, October 21, 1930, in which case, as illustrated in Fig. 6, each head 17 not only carries a pilot 18 for the upper end of the cake beneath it, but also serves as the base 12 for the cake next above it, carrying a pilot 14 to enter its lower end, and the intermediate separating members between cakes in this case are perforated or provided each with a through opening 26 so that each pipe 13 communicates openly with the chamber within each of the endwise alined cakes connected with it. Such an arrangement, however, is usually not so satisfactory as that shown in Fig. 1, due to increasing weight and pressure upon the lower cakes as cake is piled upon cake, as will be readily understood.

In operation, the spring 21 is adjusted to such a compression that when one or more cakes, each mounted upon a cuff, are laid in position as shown in Figs. 1 or 6, and the cover 6 is sealed upon the casing 5, each cake is supported between two gaskets 15, 19 which contact with and therefore

seal its opposite ends, although the gaskets are applied with a light pressure which has no tendency to harm or injure the fiber. Moreover, the gaskets are clamped to the opposite ends of the cake by a light pressure which is adjustable and also self-accommodating to any endwise expansion or contraction of the cake or cakes as a whole. Experience shows that in some plants practicing the pot spinning process the cakes actually expand during some of the treatments, whereas in other plants the same treatments cause the cakes to contract. Indeed, expansion and contraction may occur during the same process but in different stages, expansion occurring in the first steps and contraction following as the purification proceeds, the contraction becoming quite pronounced during drying. Whatever be the conditions and whatever be the process step performed, the spring 21 always exerts a light pressure endwise upon the cake, sealing the gaskets to it with a self-accommodating adjustment or movement of each head 17 back and forth to take account of either expansion or contraction, and all without conscious attention on the part of the operator.

The result of constant and uniform application of the sealing gaskets to the cake ends is always to avoid the formation or occurrence of gaps or openings around the cake from the cavity within it to the cavity outside of it, through which either air or treating liquids might pass, and consequently compelling both air and treating liquids to travel through the material of the cake itself and not elsewhere. That is true of travel in both directions inwardly and outwardly.

Having seated the parts in the position shown in Fig. 1 or 6, the cake is now subjected to the necessary treating operations, such as washing to remove excess acid, desulfurizing, bleaching, dyeing or the like, with intervening washings where necessary. The treating material, whether it be air or wash water, desulfurizing bath, bleaching bath, or any other liquor, is passed through the cake by use of the pipes 13, 23, which are connected by valves 27, 28 to supplies of such liquids or baths and to a pump system (not shown) for repeatedly circulating the same, if desired. Suitable valves (not shown) may be provided for reversing the direction of flow, and in the usual treatment the bath liquor may be caused to flow in one direction for a short period, say a few minutes, and then in the opposite direction for a like period, and so on until the operation is completed. By this method uniformity of effect upon all parts of the thread in the cake is assured, as distinguished from those arrangements in which the flow of liquor through the cake is always in one direction. For example, in the bleaching operation, when the bleaching bath always flows from the inside outwardly, the degree of bleaching effect is always greater along the inside of the cake than it is along the outside of the cake, because the inside of the cake always encounters a bath of full strength and the outside of the cake always encounters a bath of reduced strength. When the direction of flow is reversed, the gradation in effect in one direction is balanced against the gradation in effect in the other direction, resulting in an average effect which is uniform throughout the package.

The cake of course is applied to its cuff and is placed in the treating apparatus as shown in Fig. 1 in wet form, and all treatments with water or bath liquors are performed in succession while the cake is still wet and without permitting it

to dry, and further, without any necessity for transferring it from place to place. Consequently, breakage or injury to the thread by unnecessary handling is avoided.

When all treatments with water or liquor baths have been completed, the cake is now dried by passing dry or heated air through it. Preferably the air is caused to travel from the outside of the cake toward its center. The air may be supplied by way of pipe 23 and may be exhausted by way of pipe 13. When it travels in this direction, uniform shrinkage conditions upon drying are insured, because the outer layers of the cake dry first and drying continues toward the center of the package. As shown in the drawing, the outer edges of the pilots 18, where they engage the ends of the cuff, are very slightly tapered, in addition to which the cuff itself is tapered. When the apparatus is first assembled with a cuff in place upon the pilots, preparatory to cake treatment, the cuff may engage the pilots rather loosely. However, as the treatment proceeds, particularly during drying, the cake as a whole shrinks endwise and the spring 21 expands to advance the end heads toward each other, forcing the pilots more and more into the ends of the cuff, with an increasing tendency to positively resist contraction thereof. Therefore, referring particularly to the drying operation, when air is passed through the cake radially inwardly, at first each of the outer layers of thread dries against the tension of a relatively non-yieldable wet cake with some slight shrinkage of the cake both radially and endwise. The pilots are pushed into more intimate and more firmly supporting engagement with the cuff and the last layers of thread dry against a similarly non-yielding body, to-wit, the cuff or insert. This operation is fundamentally quite different from that which occurs in the usual practice where the air current is caused to travel from the inside of the cake outwardly. Here the first layers to dry do so against a relatively non-yielding body—the cuff or insert—and as drying proceeds to the outer layers these layers have more and more room to shrink because the previous layers have already shrunk in drying. Thus, in the preferred method, the entire length of yarn dries and shrinks under the same tension conditions, while in the usual method the yarn dries and shrinks under varying tension conditions with a consequent production of varying yarn characteristics as regards dyeing properties, luster, strength, etc. If the cake is dried in the usual conventional manner, that is, when placed on a truck and dried in a chamber, all of the exposed surfaces of the cake dry first; the outer layers and the yarn on both ends dry against the wet cake and therefore shrink very little, but the inner layers dry against an unsupported cuff or insert and shrink more while the layers in the center of the cake thickness which are last to dry shrink most. Thus the yarn acquires serious variations in its properties which manifest themselves as "barre", "railroad tracks", "shiners", etc.

When the doff is short or when, in other words, the cake is not of full thickness, as shown in Fig. 5, it may nevertheless be treated in the present apparatus. Of course, with such short doff and therefore thinner cake, the cuff must be expanded to a larger diameter at both ends than with a full thickness cake, as in Fig. 1. Therefore, the projecting ends of the cuff would abut endwise against the sealing washers 15, 19. Ac-

cordingly, to receive and accommodate thin cakes produced from short doffs, special washers 15a, 19a are employed, such washers having the same external but having increased internal diameter except at the base flange. Otherwise the operation with a thin cake is the same as before, the benefits derived from the preferred method of drying not being fully achieved, however. Nevertheless, such short doffs may be well dried by passing the air current from the inside of the cake toward its outside, when again fairly uniform conditions are insured, the reason being that the liner is now not internally supported by the pilots and is therefore yieldable, so that each layer dries with yieldable material beneath it.

While the drawing illustrates the cakes mounted in the treating apparatus with their axes lying vertically, it will nevertheless be understood that such an arrangement is not essential, as the parts may be so arranged as to support the cakes in the horizontal or any other position.

What I claim is:

1. Apparatus for treating wet, freshly spun, hollow, generally cylindrical rayon cakes, comprising cooperating end heads provided with seats to receive the ends of the cake, means for yieldingly pressing said end heads toward each other to permit self-accommodation of the end heads to either endwise expansion or endwise contraction of the cakes, and a resilient expansible perforated liner of generally tubular form within the cake and projecting from each end thereof, the end heads having cavities of sufficient depth to receive the projecting ends of said liner without abutment of the end heads against the liner ends upon maximum endwise cake shrinkage, and means for causing the flow of treating fluid radially through the cake.

2. Apparatus for treating wet, freshly spun, hollow, generally cylindrical rayon cakes, comprising cooperating end heads provided with seats to receive the ends of the cake, means for yieldingly pressing said end heads toward each other to permit self-accommodation of the end heads to either endwise expansion or endwise contraction of the cakes, and a resilient expansible perforated liner of generally tubular form within the cake and projecting from each end thereof, the end heads having cavities of sufficient depth to receive the projecting ends of said liner without abutment of the end heads against the liner ends upon maximum endwise cake shrinkage, and means for causing the flow of treating fluid radially through the cake, each end head having a pilot entering one end of the liner and adapted to engage and resist contraction thereof as the treatment proceeds.

3. Apparatus for treating wet, freshly spun, hollow, generally cylindrical rayon cakes, comprising a hollow casing provided with opposed

end heads each provided at its center with a pilot, one of which pilots has a through opening for the flow of fluid therethrough, a resilient yielding perforated liner of generally tubular form having its end portions sleeved over the opposed pilots, a seat member surrounding each pilot and at its inner edge spaced therefrom to form a cavity to receive an end of said liner, said seat members being adapted to be applied to the ends of a rayon cake supported by the liner and the cavities being of sufficient depth to prevent abutment of the liner ends with the end heads upon maximum endwise cake shrinkage, and means for yieldingly moving the end heads toward each other to maintain uniform sealing pressure of the seat members upon the cake ends throughout the treatment.

4. A liner for insertion into wet, freshly spun, hollow, generally cylindrical rayon cakes, comprising a thin sheet-like member having overlapping end portions and provided with perforations distributed over its entire area, the perforations in the overlapping end portions being of elongated form and the perforations in one end portion extending at an angle to the perforations in the other end portion.

5. A liner for insertion into wet, freshly spun, hollow, generally cylindrical rayon cakes, comprising a thin sheet-like member having overlapping end portions and provided with perforations distributed over its entire area, the perforations in one end portion extending circumferentially of the liner and the perforations in the other end portion extending longitudinally of the liner.

6. The method of drying wet, freshly spun, hollow, generally cylindrical cakes of rayon, consisting in passing drying air radially through the cakes while subjected at both ends to a sealing pressure which is maintained uniform throughout the drying operation and thereby seals the cake ends against any direct exposure to the air current, producing yielding resistance to contraction over substantially the entire inner surface of the cake, and as the drying effect approaches the cake interior gradually increasing said resistance, whereby the thread layers, in order from the outside to the inside, shrink under substantially uniform conditions.

7. Apparatus for treating wet, freshly spun, hollow generally cylindrical rayon cakes, comprising cake supporting means including means for applying and maintaining uniform sealing pressure to both ends of the cake during the entire treating operation, means for applying to substantially the entire inner surface of the cake yielding resistance to cake contraction, means for gradually increasing said resistance as the treating operation proceeds, and means for causing the flow of treating fluid radially through the cake.

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