May 20, 1941. A. S. BROWN 2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Filed March 11, 1938 5 Sheets-Sheet 1

Fig. 1

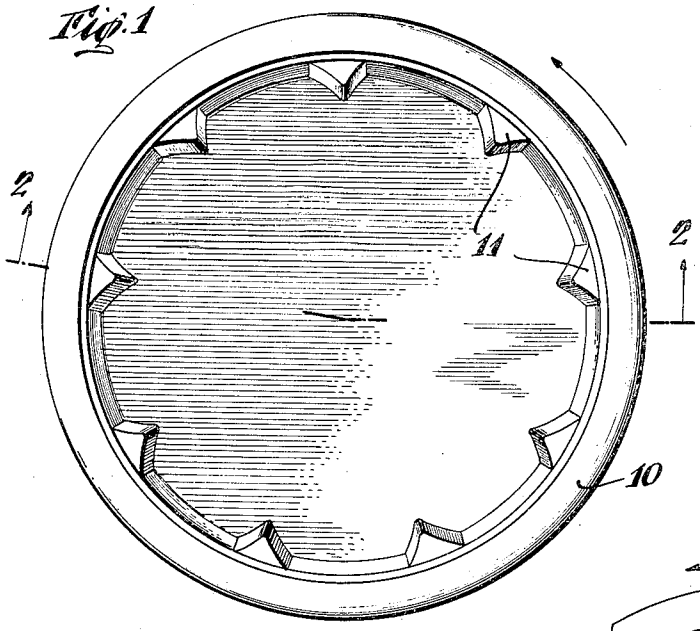


Fig. 3



Fig. 4

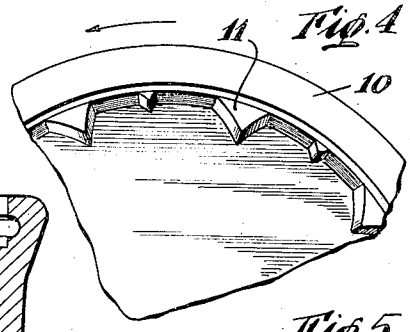


Fig. 2

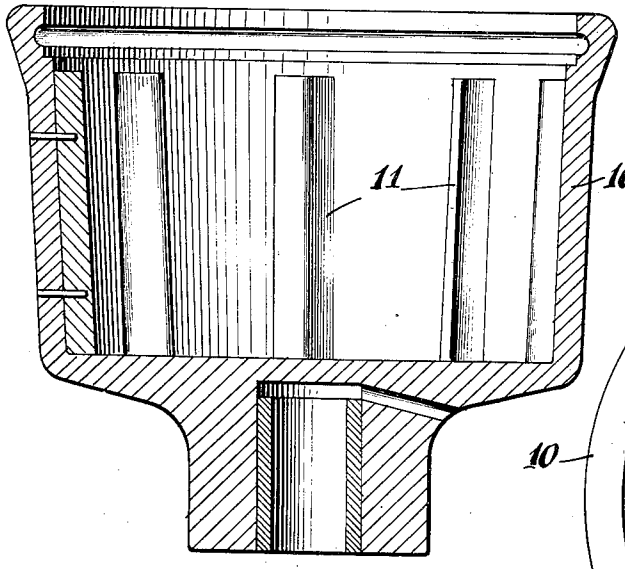
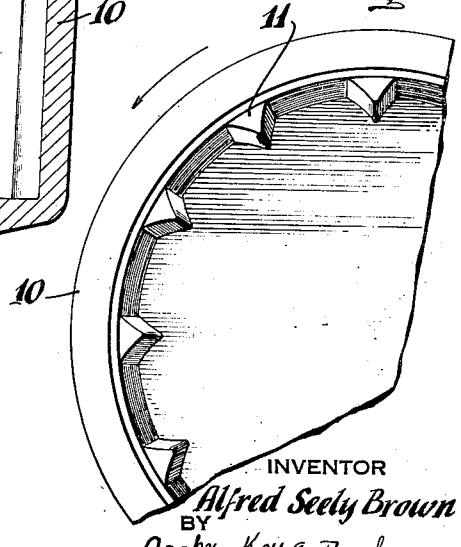


Fig. 5



INVENTOR
Alfred Seely Brown
BY
Cooper, Kerr & Dunham
His ATTORNEYS

May 20, 1941. A. S. BROWN 2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Filed March 11, 1938 5 Sheets-Sheet 2

Fig. 6

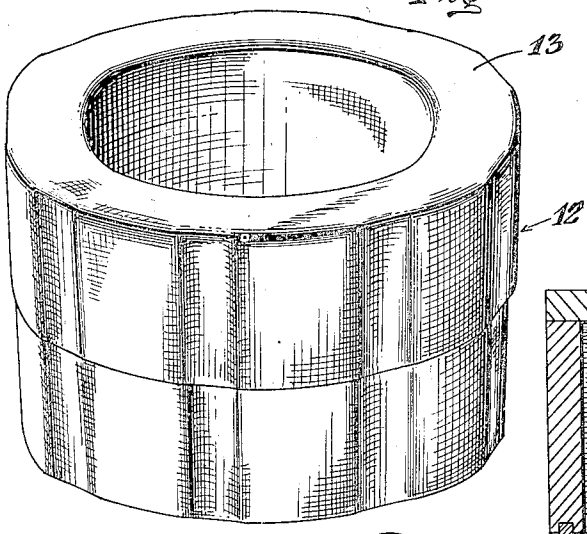


Fig. 14

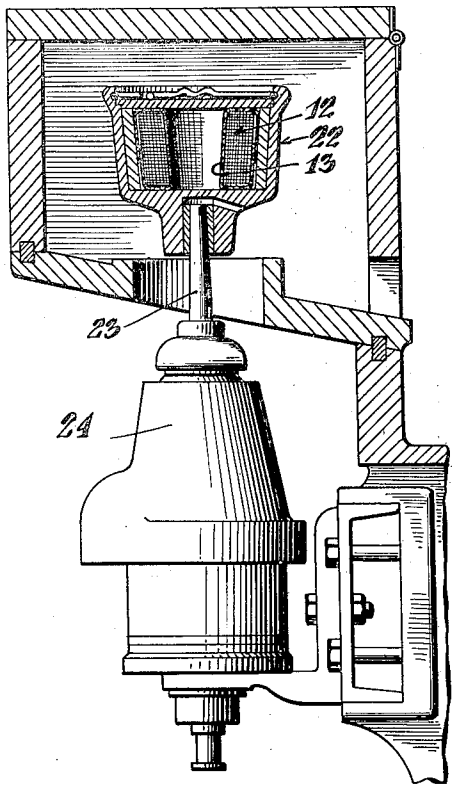
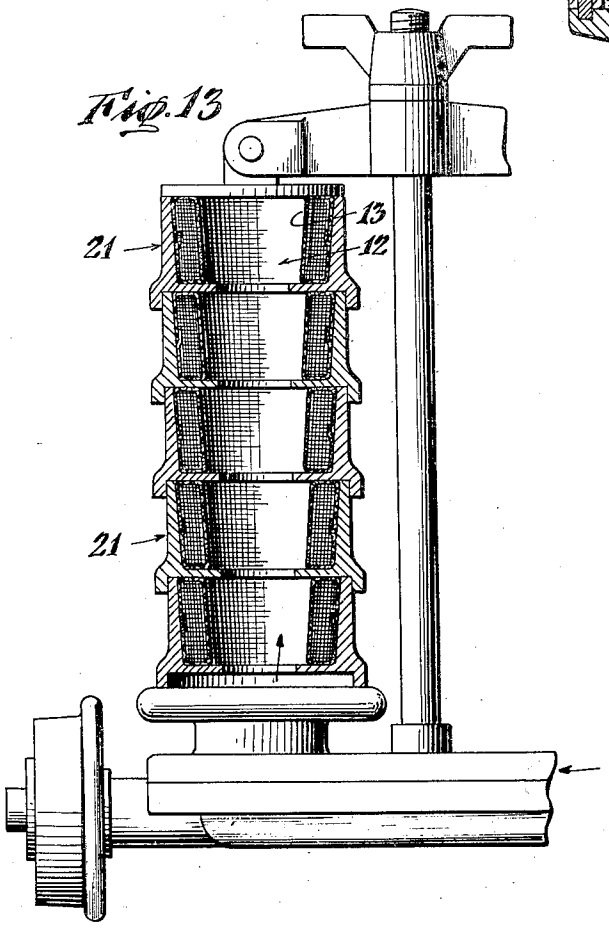


Fig. 13



INVENTOR
Alfred Seely Brown
BY
Cooper, Kerr & Dunham
His ATTORNEYS

May 20, 1941. A. S. BROWN 2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Filed March 11, 1938 5 Sheets-Sheet 3

Fig. 7

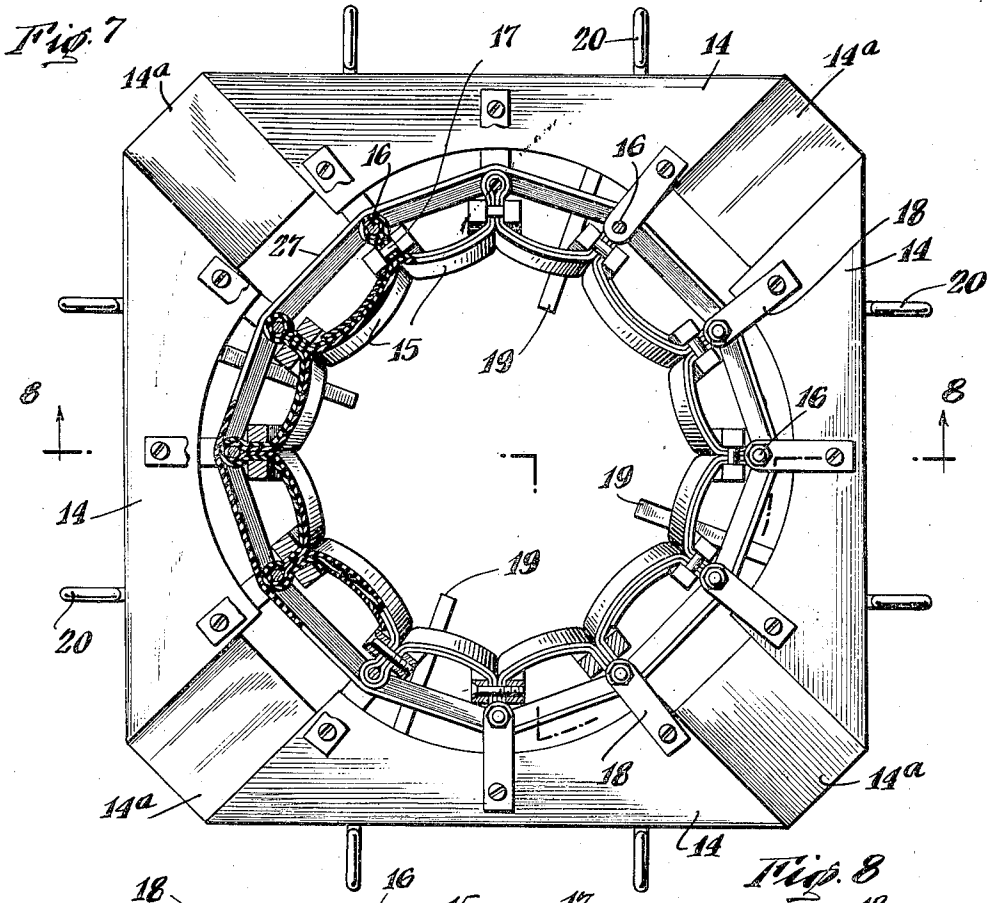
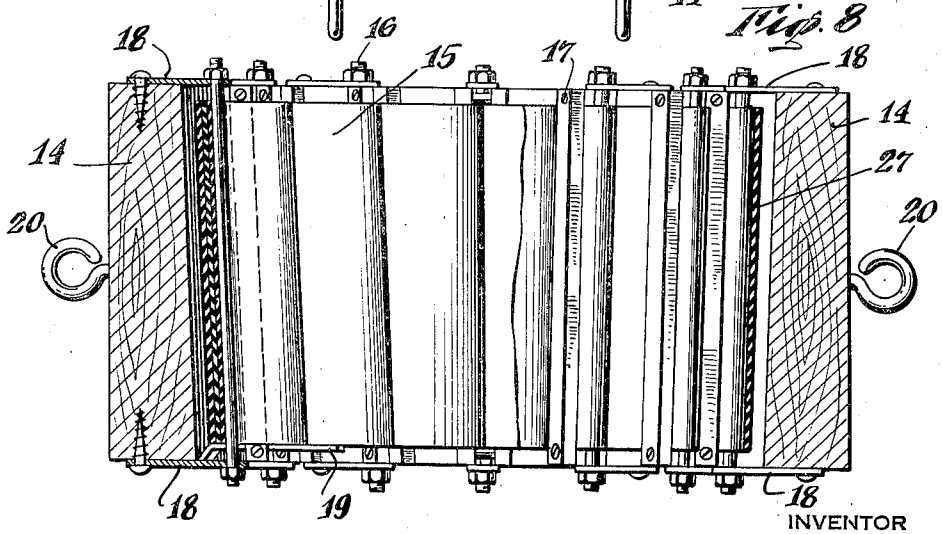


Fig. 8



INVENTOR

Alfred Seely Brown

BY

Cooper, Kerr & Dunham

His ATTORNEYS

May 20, 1941. A. S. BROWN 2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Filed March 11, 1938 5 Sheets-Sheet 4

Fig. 9

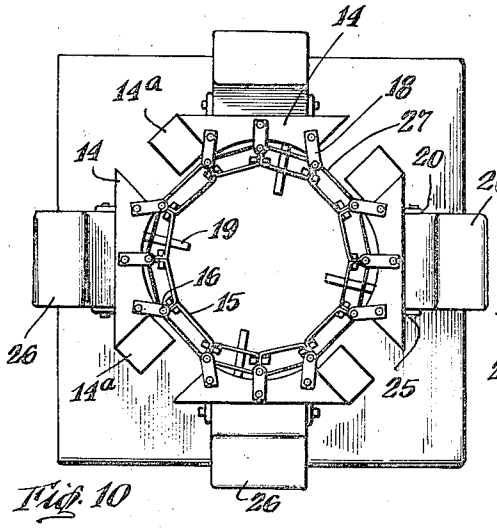


Fig. 11

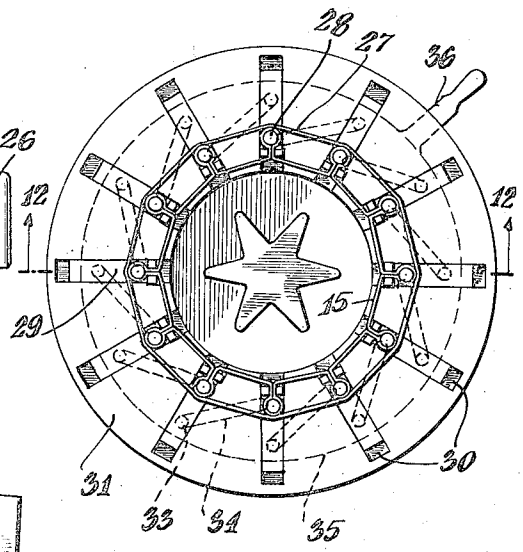


Fig. 10

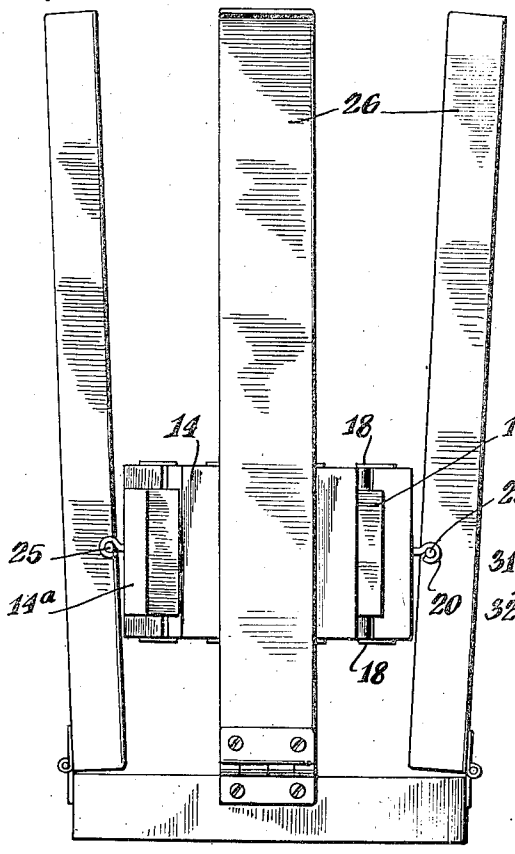
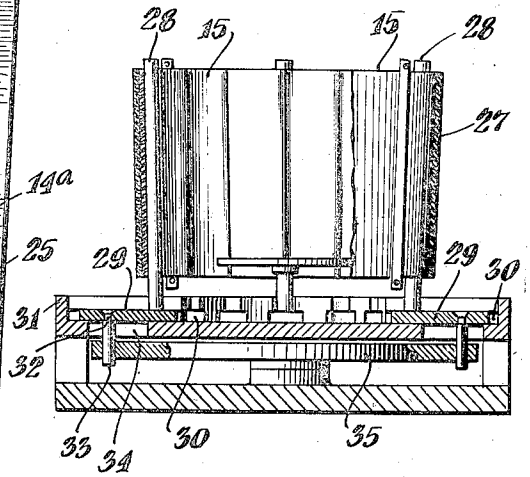


Fig. 12



INVENTOR
Alfred Seely Brown
BY
Cooper, Kerr & Dunham
His ATTORNEYS

May 20, 1941. A. S. BROWN 2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Filed March 11, 1938 5 Sheets-Sheet 5

Fig. 15

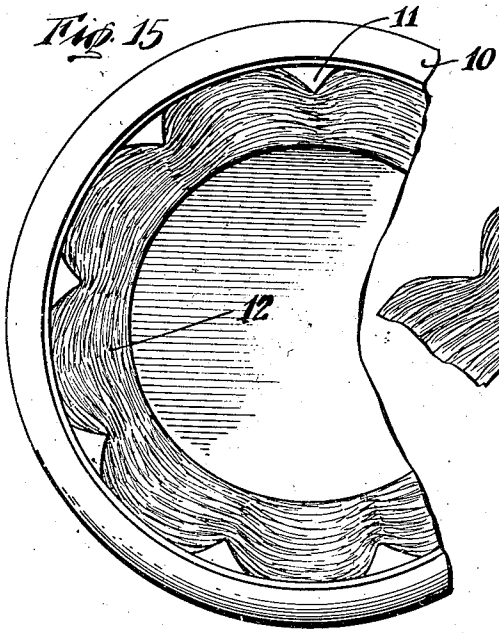


Fig. 16

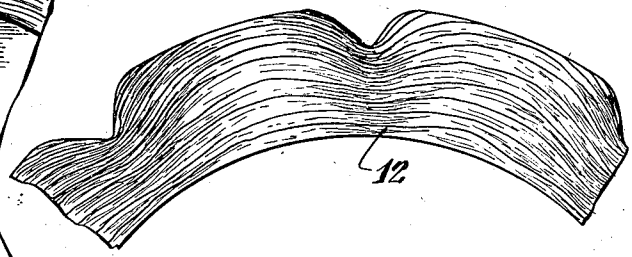


Fig. 17

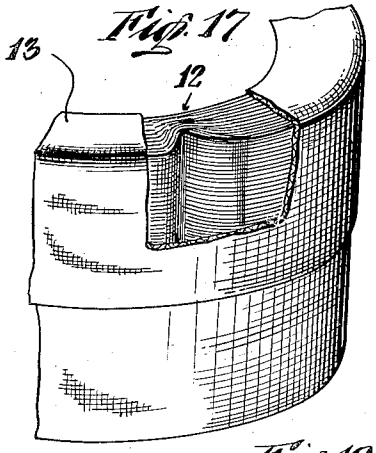


Fig. 18

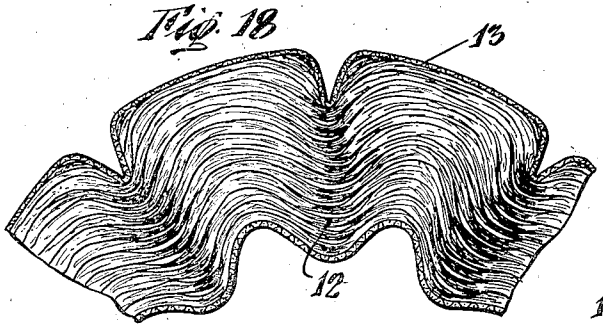


Fig. 19

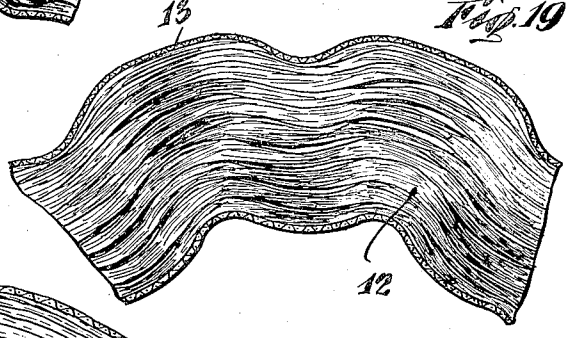
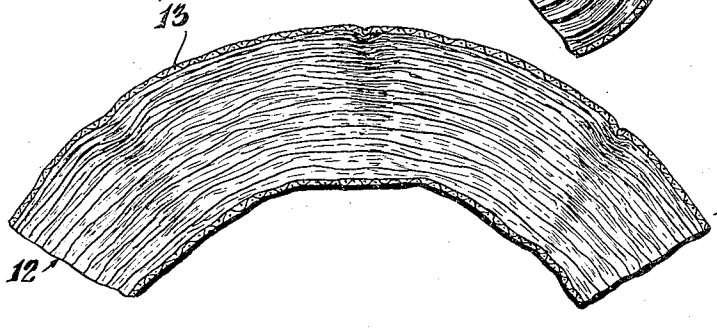


Fig. 20



INVENTOR
Alfred Seely Brown
BY
Cooper, Kerr & Dunham
His ATTORNEYS

Patented May 20, 1941 2,243,000

UNITED STATES PATENT OFFICE

2,243,000

METHOD AND APPARATUS FOR MANUFACTURE OF RAYON

Alfred Seely Brown, Hamilton, N. Y., assignor to Skenandoa Rayon Corporation, Utica, N. Y., a corporation of Delaware

Application March 11, 1938, Serial No. 195,364

6 Claims. (Cl. 18—8)

This invention relates to the manufacture of rayon, and, more particularly, to new and improved methods and apparatus for treating and processing rayon yarn, primarily in cake form.

Objects of the invention include the provision of new and improved methods and apparatus for treating and processing rayon yarn while in cake form, and, more particularly, for improving uniformity and quality of the yarn; reducing rigidity of the yarn cake before and during the processing of the yarn; producing a softer yarn cake; and producing a better and more uniform quality of the finished yarn.

Other objects of the invention include the following: to improve the bleaching of the yarn; to improve the uniformity of quality of the yarn in different parts of the cake; to reduce harshness which might otherwise occur in the yarn, especially on the outside of the cake; to reduce differences in denier which might otherwise exist between the yarn in different parts of the cake; and to improve the uniformity of textile properties of the yarn from different parts of the yarn cake.

Other objects of the invention will appear from the following description, and the claims.

In the accompanying drawings:

Figure 1 is a plan view of a spinning bucket which may be used in carrying out the invention;

Figure 2 is a sectional elevation of the same bucket;

Figure 3 is a detailed view of one of the vertical rib members, or "slats," which project inwardly from the inner face of the spinning bucket shown in Figure 1;

Figure 4 is a partial, detailed view of a different spinning bucket, and of the internal projections or ribs therein provided;

Figure 5 is a partial view of another spinning bucket with internal projections;

Figure 6 is a perspective view, diagrammatic in character, of a yarn cake spun in a bucket such as shown in Figures 1 and 2, and thereafter covered with an elastic fabric jacket or "stocking," as hereinafter described;

Figure 7 is a plan view of one form of apparatus which may be used in carrying out the invention, for softening a yarn cake, and reducing the diameter thereof, by application to the outer surface of the cake of substantially tangential force, or components thereof;

Figure 8 is a sectional elevation of the same apparatus;

Figure 9 is a plan view; and

Figure 10 is a side elevation, of one form of apparatus which may be employed for actuating and applying to the yarn cake the apparatus shown in Figures 7 and 8;

Figures 11 and 12 are, respectively, a plan view and a side elevation of another apparatus which may be used for applying substantially tangential force to the outer surface of a yarn cake;

Figure 13 is a partial side elevation, partly in section, of an apparatus which may be used for washing, bleaching and otherwise processing and treating yarn cakes as hereafter explained;

Figure 14 is a side elevation, partly in section, of a centrifugal extraction or "whizzing" apparatus which may be used in removing excess liquid from yarn cakes prior to drying, as hereafter explained;

Figure 15 is a partial plan view showing, in diagrammatic manner only, the arrangement of the yarn as spun in a spinning bucket like that shown in Figures 1 and 2; and

Figures 16, 17, 18, 19 and 20, are respectively, enlarged partial illustrative views, diagrammatic only, of one form and size of yarn cake as follows: as originally spun; as covered with fabric and ready for application of a cake softener and reducer; as softened and reduced to an extreme position by application of tangential force; as ready for washing, bleaching or other processing; and as finally dried.

Methods and apparatus have heretofore been proposed, both for deforming a yarn cake, and for reducing the diameter of the cake without substantial deformation. An example of the former is the Topham United States Patent No. 1,736,681, granted November 19, 1929, in which the cake is first spun in circular form, then washed, thereafter deformed so that it is no longer annular in shape, and dried after such deformation. Examples of the latter include the Mattinson United States Patent No. 2,068,031, granted January 19, 1937, in which there is disclosed a method and apparatus for reducing the diameter of a yarn cake, without substantial deformation, by subjecting the cake to radial compression at a plurality of spaced points about its periphery; and Patents No. 2,068,032, to Bryant, granted January 19, 1937, and No. 2,068,033, to Mattinson, granted January 19, 1937, in which there are disclosed methods and apparatus for reducing the diameter of yarn cakes by subjecting the cakes to simultaneous radial and axial compression.

I have discovered that both the quality and uniformity of the completed yarn may be substantially improved, and other desirable objects

attained and advantages secured, under certain conditions, by manufacturing the yarn, including initially spinning and subsequently working, processing and otherwise treating the yarn cake in the manner hereafter described.

Apparatus which I have found especially useful for such manufacture of rayon yarn and which embodies the best mode in which I have contemplated applying the principle of the invention, is hereafter described in detail together with the principle thereof.

The process may be carried out according to the following example: a rayon yarn cake is first spun in a centrifugal spinning pot, which, while it may be generally circular in cross-section, is preferably provided, upon its inner surface, with inwardly projecting ribs or what I sometimes call "slats", which may be vertical and may extend from top to bottom of the pot in such manner as to provide a particular desired contour of the inner periphery of the spinning pot, as will be hereafter more particularly illustrated and described. Shapes and proportions of spinning pots, and their ribs, which I have found especially advantageous for this purpose are described and claimed in my copending application filed concurrently herewith, Serial No. 195,363; although, under some conditions, a part of the present invention may include the hereafter-described treatment of a cake spun in an ordinary pot. The cake spun in such a ribbed pot has been found, when removed from the spinning pot, to have indentations in its outer periphery, corresponding substantially to the projections on the inside of the pot, as illustrated in the drawings—for example, Figures 16 and 17. The cake may be then next allowed to age for a suitable period, although aging is not always necessary, after which it may be encased in a suitable elastic fabric or other protective cover, in the form of a jacket or "stocking" (for example, as described in United States Patent No. 2,002,481 to Gordon and Michel, granted May 21, 1935). The cake may next be softened and, also, reduced in diameter. I have found that a desirable way to carry out that step is by the application to the outer surface of the cake of what is primarily a tangential force, or, at least, a force of which substantial components act primarily tangentially with respect to the outer surface of the cake. Other components of force may or may not be employed simultaneously, as, for example, radial or axial compression; but I have found that advantages reside in the use of primarily tangential force, or, at least, components thereof, for softening the cake and reducing the diameter thereof. The thus-softened and reduced-diameter yarn cake may then be washed, bleached and otherwise processed or treated, as may be required,—for example, in the manner described and claimed in United States Patent to Gordon, No. 1,973,953, granted September 18, 1934, after which the processed cake may be centrifugally extracted or "whizzed," to remove excess liquid, and dried. After drying the yarn from the cake may be rewound into a cone or other desired form of package for shipment or fabrication.

Referring now, in greater detail, to the accompanying drawings:

In Figure 1 there is shown, in plan view, a spinning pot 10 which may be used for initially spinning the yarn cake. It is provided, upon its inner surface, with inwardly extending projections 11. In the construction shown, these are substantially vertical, and extend throughout the height of the inside of the pot. Figure 2 is a sectional elevation of the same pot, and shows the projections or ribs 11, which I hereinafter sometimes refer to as "slats," extending from top to bottom of the spinning area. They may be slightly tapered from top to bottom so that the finished yarn cake may be readily withdrawn from the pot. One shape and form for the ribs or "slats" 11, which may be either integral with the pot, or inserted and secured therein, is shown in detail in Figure 3.

In Figures 4 and 5 are shown other numbers and arrangements of inward projections or ribs which may be used in the spinning pot. In Figure 4 the pot is indicated as having nine large and nine small ribs, of the form shown. Such an arrangement may be beneficial, under certain conditions, in spinning a soft yarn cake, especially amendable to uniform processing. In Figure 5 the spinning pot is indicated as having twelve ribs, all of the same height, instead of nine as shown in Figures 1 and 2. This may be advantageous in larger spinning pots, especially if operated at higher speeds.

In Figures 6 and 17 are shown two views, the latter partial and diagrammatic, of a spun yarn cake 12, in its "raw" or untreated form, as taken from the spinning pot, but covered with an elastic fabric or other "stocking" or jacket 13, as previously described. This assists in protecting the cake during subsequent treatment, but, for best results, the stocking should not be so tight as to prevent subsequent loosening of the cake. In Figure 6 the indentations in the outer part of the cake are diagrammatically indicated inside the stocking; but, in practice, the stocking should not too tightly restrict or compress the cake.

In Figures 7 and 8 there are shown, respectively, plan and sectional elevational views of an apparatus for softening and reducing the diameter of the spun yarn cake by application to the outer surface thereof of substantially or primarily tangential force, in addition to such components of radial force, or radial and axial force, as may also be present or employed, if desired. The apparatus comprises four radially-movable blocks or sectors 14, each provided with a spacing and stop member 14*a*, for limiting its inward motion to the desired extent. Within the members 14, 14*a* is an elastic wall 15, suitably made of rubber. It may be of double thickness, as illustrated, and is attached to the movable members 14 by means of vertical rods or pins 16 and the bolts 17, as shown. The rods 16 are supported at top and bottom by inwardly projecting strips 18 pivotally secured, at their outer ends, to the blocks 14, as by screws in the manner indicated, and free to assume the positions shown. At the bottom of the apparatus there are arranged fingers 19 which prevent the yarn cake from dropping out the bottom of the apparatus, and hold the cake in the desired position during and after its treatment by tangential force. On the outside of the movable members 14 there may be provided suitable rings or hooks, as at 20, by means of which the blocks 14 may be radially separated (as by attachment to the apparatus shown in Figures 9 and 10) to stretch the elastic wall 15 to the required diameter for reception of the yarn cake to be treated therein.

Substantially tangential force may be applied to the yarn cake by suitable operation of the apparatus of Figures 7 and 8, as follows:

The mechanism may be actuated by the apparatus shown in Figures 9 and 10 to stretch the

rubber sheet 15 prior to its application to the outside of the yarn cake, and to the extent necessary for reception of the cake as spun and covered. The direction in which the rubber wall 15 is stretched is substantially the same as the longitudinal axis of the threads on the outside of the cake. Thus, when subsequently allowed to contract, the stretched rubber applies what is substantially a longitudinal compression to the outer threads. The mutual adhesion between successive layers of thread tends to convey this longitudinal compression to inner layers of the cake. This longitudinal compression of the threads is in a plane substantially tangential to the outer periphery of the cake, and tends to shorten and swell the threads, hence to loosen or soften the cake and, by the same operation, to reduce its diameter. The existence of components of force directed substantially along the faces of the indentations in the outer periphery of the cake further tends to loosen the cake structure and reduce its diameter. Thus the cake indentations form what may be termed "foci" for the action of the tangential force in softening the cake and reducing the diameter thereof. Contraction of the stretched rubber, or other forces, may, also, produce some radial compression of the cake, but the friction of the rubber with the outer surface of the covered cake gives what I believe to be primarily a tangential force, or substantial components thereof, which contribute to the cake softening and reduction, with the results stated.

The spun yarn cake, preferably suitably covered with fabric as shown in Figures 6 and 17, is inserted within the elastic wall 15 while the latter is in its stretched and extended position, which it has assumed due to retraction of the members 14. The elastic 15 is then allowed to contract upon the cake, and thereby apply to the outer surface thereof substantial components of tangential force, in addition to whatever radial or other force may also be applied in the manner stated.

The resulting softened and reduced-diameter yarn cake, preferably still encased in its elastic covering 13, may be then transferred to an apparatus for washing and processing the cake. One suitable form of such an apparatus is shown in Figure 13. It consists of a series of processing pots 21, into which treating liquids are introduced under pressure by which means the cakes, one in each of the pots 21, are subjected to washing, bleaching, and such other processing as may be necessary or desirable. This may be done to advantage, in the manner described and claimed in the Gordon Patent No. 1,973,953, previously referred to; but the present invention is not limited to use of that apparatus, and the processing may, if desired, be carried out in other ways, as by drip or centrifugal washing, or otherwise.

After processing, excess liquid may be extracted from the cake in a centrifugal extracting or "whizzing" apparatus such, for example, as shown in Figure 14. In that apparatus, 22 is a centrifugal extractor or whizzing pot mounted upon a suitable spindle 23, and driven by an electric motor 24, as indicated.

Figures 9 and 10 show an apparatus for actuating the mechanism of Figures 7 and 8 to stretch the elastic wall 15 preparatory to inserting the cake. The rings or hooks 20 are applied to studs 25 carried by hinged levers 26. When the latter are moved outwardly, the blocks or sections 14 are retracted into the position shown in Figure 9, and the elastic wall 15 is sufficiently stretched or expanded so that the covered yarn cake may be inserted therein. The levers 26 are then permitted to return to their initial position by contraction of the rubber, and the blocks 14 move radially inward until their motion is stopped by the spacing members 14a, each of which comes into contact each with its adjacent member 14. In order to increase the elastic force, an additional elastic backing or reinforcing member, or strip, 27, suitably of rubber, may, if desired, be applied outside the rods 16, by which means additional force may be applied to the yarn cake.

In Figures 11 and 12 there is shown another apparatus for applying tangential forces to the outside of a yarn cake. It consists of a number of vertical arms or rods 28, twelve in the arrangement shown, although more may be used, mounted at their lower ends upon the radially-moving sliding plates 29. These are arranged to move in the radial slots or guideways 30 in the fixed plate 31. Beneath the radial slides 29 there depend pins 32 carrying rollers 33. These move in the slots 34 of a rotorily reciprocating cam-plate 35. A rotary motion may be imparted to this cam plate, to the extent permitted by the length of the slots 34, by the handle 36, or otherwise as desired. Rotation of the cam plate 34 serves to retract outwardly the vertical rods or pins 28, to which the rubber or other elastic wall 15 is attached by the nuts and bolts 17, in the manner indicated. In this way the elastic wall 15 may be powerfully stretched or distended; and, after a yarn cake is inserted therein, subsequent contraction of the wall applies a powerful and substantially tangential force to the outer surface of the cake, in the manner previously explained.

Figure 15 shows, in diagrammatic manner, the use and effect of a spinning pot such as those of Figures 1 to 3. The shape of the cake 12, as spun therein, is illustrated in conjunction with the immediately-following figures, which illustrate, also diagrammatically, successive stages of and changes in a yarn cake when first spun in a pot having the configuration shown in Figure 15, and thereafter subjected to other steps which may be included in the instant process, as will be hereafter described in greater detail.

In carrying out a preferred embodiment of the process in the foregoing apparatus, the principle and operation is as follows:

The rayon is first spun into a yarn cake, in a spinning pot provided with vertical ribs or inward projections, of which suitable forms are shown in Figures 1 to 5 and 15. The cake thus spun is then allowed to age for a suitable time, if desired, after which it is, preferably, covered, not too tightly, with an elastic covering or stocking, as shown in Figs. 6 and 17. The cake, so covered, is then softened and reduced in diameter by the application to the outer surface thereof of a substantially or primarily tangential force, or components thereof. This may be accomplished by the use of apparatus such as shown in Figures 7 to 12 inclusive. The cake is then washed, bleached and otherwise processed, which may be done in apparatus such as that shown in Figure 13, after which excess liquid is extracted, as by centrifugal whizzing of the cake, which may be done in an apparatus such as that of Figure 14, and the cake is then

finally dried. The yarn may then be wound into a cone or any other desired package, for sale or fabrication.

Taking up in sequence, in greater detail, the several steps which may be embodied in the process:

Spinning.—By properly proportioning the number, shape, size and relation of the vertical ribs or projections on the inner face of the spinning pot, and their circumferential spacing, I have found that it is possible to spin a cake having what I call "an excess length of yarn," particularly in its outer layers. That is, the length of the yarn laid down in the ribbed spinning pot, provided with inward projections as described, may be made so great that when the cake, during subsequent processing (e. g., aging, washing, bleaching, extracting, or drying), subsequently assumes a substantially circular shape, with the indentations diminished or eliminated, such shape involves a smaller length of thread in each turn, and the "excess" length of yarn initially spun into the outer layers of the cake tends to permit a free and natural shrinkage of the yarn to take place upon the outside as well as the inside of the cake.

Also by proper shape, arrangement, relation and proportioning of the ribs, it is possible to spin a relatively soft cake. Constructions such as those shown in Figures 4 and 5 have been found sometimes advantageous for this purpose, more particularly with pots of larger diameter, and at higher speeds; while pots such as those shown in Figures 1 to 3 are sometimes more advantageous for the purpose with smaller pots, or at somewhat lower speeds.

In addition, the use of ribs or projections in the pot tends to promote subsequent loosening of the cake, and to provide foci for such loosening action, as by the subsequent application of tangential force.

Particular forms of spinning pot, which I have found to be especially advantageous for the purposes just stated, are illustrated in the accompanying drawings and described above, and form the subject-matter of my concurrently pending application, Serial Number 195,363, previously referred to.

Aging.—It is often desirable to permit the spun cake to age between the spinning and subsequent processing steps. This may improve the results of processing, particularly the bleaching, if sufficient aging is used. A suitable aging time has been found to be between twenty-four and forty hours, although more or less may be used. In some cases, however, aging may be deferred until after softening and reduction of the diameter of the cake, or later.

Protective covering.—The use of such a covering tends to assist the cake in retaining its shape during subsequent processing, but, preferably, the elastic stocking should not be so tight or inelastic as to retard the desired loosening of the cake structure during subsequent treatment of the cake. By loosening the cake structure prior to processing, efficient washing, bleaching and other processing treatment has been found to be promoted.

Softening and reduction of diameter of the cake.—This may be performed before or after aging the cake, and the aging step may be omitted under some conditions. An important object of the reduction of the cake is to soften and loosen the cake structure to permit better processing and more general and uniform access of the processing liquids during the subsequent operations, often resulting in more rapid washing and other processing treatment, and also to permit more uniform shrinkage of the yarn in different parts of the cake, during subsequent stages of the process.

I am aware that it has previously been proposed to deform yarn cakes in various manners; and also to reduce the diameter of a yarn cake by the application of substantially radial force, as well as by the simultaneous application of radial and axial compression. I have found, however, that it is often advantageous to soften the cake, and also reduce its diameter, by the application to the outer surface thereof of primarily tangential force, or components thereof; preferably without substantial, or, at least, excessive radial compression; but, in any event, in addition to any radial or other compression which may be employed. According to my observation (although I do not desire to limit myself by any particular theory of operation), the application of such substantially tangential force acts in a direction tending to shorten each individual thread longitudinally, assisting the thread to attain its natural shrinkage. It also appears to avoid an initial tendency to pack the yarn cake and a tendency to formation of "hard spots" and local regions of high rigidity in the cake structure. Accordingly, I have found that by such application of substantially tangential force, improved uniformity of the cake structure, and, particularly, softness of the cake, is promoted, and subsequent processing is rendered easier and more uniform, and may be performed in a substantially shortened time. In addition, I have found that the degree of softening of the yarn cake may be controlled, so that the operation may be performed upon cakes of varying degrees of rigidity.

While reduction in diameter of the cake by application of substantially tangential force to the outer surface thereof may be applied to the cake even though the cake be spun in a circular spinning pot, without the use of internal ribs, I have found, nevertheless, that the use of such a ribbed or "slatted" spinning pot, as previously described, tends to facilitate the operation and produces a cake which is more readily loosened by the application of tangential force, and which lends itself to quicker and more uniform processing.

The softening and reduction in diameter of the cake, by application of substantially tangential force thereto, may be carried out either before or after the washing, bleaching, and other processing or purification of the yarn cake. I have found, however, that if the cake is first loosened by the application of tangential force, prior to the processing step, both the speed and effectiveness of the processing may be substantially increased, and the uniformity of shrinkage is also improved. I ordinarily prefer, therefore, to apply the cake softening and reduction, by tangential force, to the spun cake before it is processed. However, under some circumstances, the cake reduction step may be employed after bleaching and other processing of the cake, in which event, nevertheless, the uniformity of denier and shrinkage, and the quality and "feel" of the yarn, tends to be improved.

Processing.—During processing and bleaching, which may be carried out in the manner shown and described in Gordon Patent No. 1,973,953, I have found that the uniformity of the processing treatment is improved by previously loosening the cake by application of tangential force,

When the processing is conducted after reduction of the diameter of the cake, the diameter of the processing pot may correspond substantially to the diameter of the reduced cake, which has been found to contribute to uniform processing and shrinkage of the yarn.

Extraction.—It is desirable to remove excess liquid from the cakes before placing them in a drying oven, and for this process centrifugal extraction or whizzing has been found useful. The extraction pot may have a diameter somewhat larger than that of the processed cake, but the increase in size should not be so great as to prevent the cake from centering in the pot or to permit stretching or tensioning of the yarn. I have also found that the speed of the whizzing pot should preferably be substantially as low as will remove a sufficient amount of excess liquid, as too high speeds tend to pack the cake.

Drying.—A suitable method of drying is to place the cakes on trays and pass them through a tunnel drier, in which they are dried by means of heated air. Since each cake tends to dry progressively from its exposed outer and inner surfaces toward the interior of the cake, the drying is, preferably, slow, in order to minimize tension applied to the interior layers by shrinkage of the exposed ones. This effect is, however, greatly reduced by application of the present invention, so that, when my invention is employed, drying may be more rapid than might otherwise be possible without damage to the yarn, which is an additional advantage of the invention.

As an example of the size and proportion of the apparatus, I have found that, in the case of a 7-inch diameter cake, sufficient loosening of the cake structure, by application of tangential force, may be produced, in certain cases, by reducing the diameter of the cake from 7 inches to about 6.5 inches. The cake may then be washed, processed and otherwise bleached in buckets having an internal diameter of about 6.6 inches, and the subsequent extraction may be carried out in whizzing pots having an internal diameter of from about 6.6 to 7 inches.

I have found that when the process is carried out as described, and the foregoing precautions are observed, there is produced a yarn cake having a relatively loose structure, and having a substantially improved uniformity of denier of the yarn in all parts of the cake, an improved feel, and improved quality and uniformity of other physical and textile characteristics. The uniformity of bleaching and other processing may be substantially improved, possible tendency to harshness of the yarn, especially on the outside of the cake, is reduced, and there is also a substantial reduction in any differences, which might otherwise exist, between the denier and other textile properties of the yarn from the inside and outside of the cake. In addition, uniformity of shrinkage of the yarn, and uniformity of looseness of the cake, both before and after drying, is promoted.

In Figures 16 to 20, inclusive, there is illustrated, in diagrammatic manner only, the shape and form of a yarn cake, when spun in the manner illustrated in Figure 15, at various subsequent stages of the process. In Figure 16 there is shown a plan view of a raw cake, as spun in a pot having a series of ribs all of the same height, and having the shape and configuration shown in Figure 15. The arrangement of the threads is illustrated in purely diagrammatic manner. Spinning may, although it need not, be continued until the inner layer of threads is substantially circular in cross-section, as shown.

Figure 17 is a partially broken away perspective view of a cake thus spun, after being encased in an elastic covering and ready for treatment by tangential force.

Figure 18 shows a cake as reduced in diameter to its extreme position, indicating the loosening effect and longitudinal compression of the individual threads.

Figure 19 shows a cake after the tangential force has been released, and when the cake is ready for insertion in the processing pot for washing, bleaching, and other treatment, and

Figure 20 indicates diagrammatically the completed, dried cake, showing the loosened structure, and indicating the uniformity of contraction of the yarn on the inside and outside of the cake.

Approximate dimensions which I have observed upon cakes treated in the manner described are:

For the cake of Figure 16:

	Inches
Top external diameter	7
Indentation depth	3/8
Indentation base	3/4
Cake thickness at indentation	5/8
Cake thickness between indentation	1
Cake height	4

For the cake of Figure 18:

	Inches
Top external diameter	5 3/4
Indentation depth	7/16
Indentation base	3/8
Cake thickness at indentation	1 1/8
Cake thickness between indentation	1 3/16
Cake height	4 3/8

After the tangential force has been released, the cake has considerable springiness and tends to reassume its original shape, hence the dimensions are only approximate, for the cake of Figure 19:

	Inches
Top external diameter	6 3/8
Indentation depth	1/4
Indentation base	1
Cake height	4 1/16
Cake thickness, all over	1 1/4

The cake is preferably bleached in a pot just large enough to permit it to be slipped easily into place. The pot preferably supports substantially the entire exterior of the cake during the processing operation. The top internal diameter of the pot, for a cake of the foregoing dimensions, may be about 6.5 inches and its height 3 7/8 inches, the height of the pot being somewhat less than that of the cake so that the top and bottom of the cake are sealed against leakage, and the processing liquid is forced through the yarn.

The extraction operation may be performed in a pot large enough to permit the cake to be easily introduced and removed therefrom, suitably about 6.5 inches in diameter with a height of 3.8 inches.

For the cake of Figure 20, the approximate dimensions, the cake being dried, are roughly as follows:

	Inches
Top external diameter	6 1/4
Indentation depth	1/16
Cake thickness, all over	1 1/8
Cake height	3 5/8

The method and apparatus herein described are the best embodiments of my invention now known to me, but it is to be understood that the invention is not necessarily or specifically limited thereto, in all cases, but, under suitable conditions, may be carried out in other ways without departure from its spirit, and within the proper scope of the following claims.

I claim:

1. An apparatus for use in the manufacture of rayon by applying components of substantially tangential primarily compressive force simultaneously over substantially the entire outer surface of a spun rayon yarn cake, comprising an elastic wall member normally smaller in diameter than the outer surface of a rayon yarn cake to be treated therein, and means for stretching said elastic member to a diameter sufficient to receive the yarn cake and then releasing the stretched wall member to engage the outer surface of the cake and apply components of substantially tangential force thereto.

2. In an apparatus for use in the manufacture of rayon yarn, means for applying substantial components of primarily tangential compressive force simultaneously over substantially the entire outer peripheral surface of a spun yarn cake comprising, in combination: an elastic member adapted to engage the outer periphery of a spun cake to be treated, said member being, in its contracted condition, of less diameter than the periphery of the cake; supporting means associated with the outside of said elastic member; and means for actuating said supporting means to distend the elastic member to a diameter sufficient to receive a yarn cake to be treated therein and thereafter releasing said distended member and permitting it to contract and engage the outer periphery of a yarn cake placed therein and apply thereto substantial components of primarily tangential force, by contraction of said elastic member.

3. In a process of manufacturing rayon by the centrifugal bucket spinning system, including spinning a rayon yarn cake in a collecting bucket and thereafter liquid processing the yarn while still in cake form, the method of softening the spun rayon yarn cake, preparatory to such liquid processing treatment thereof, which comprises distending an annular elastic membrane having a normal diameter less than the outer diameter of the cake sufficiently to permit the cake to be inserted within the distended membrane, inserting the cake in said distended membrane, and then permitting the membrane to contract about the cake.

4. The method of softening a spun rayon yarn cake to prepare the same for liquid processing treatment of the softened cake, which comprises applying a distended, annular, elastic membrane to the outer peripheral surface of the yarn cake and then allowing the membrane to contract about such surface to soften the cake and reduce the diameter thereof.

5. In an apparatus for use in the treatment of spun rayon yarn cakes, means for softening and reducing the diameter of such a spun cake, preparatory to liquid processing treatment thereof, which comprises an expansible, annular, elastic membrane having, in its untensioned condition, a diameter substantially less than that of the outer peripheral surface of the yarn cake to be treated; means for distending said elastic membrane to permit introduction within the expanded membrane of the yarn cake to be treated; and means for subsequently releasing said distended membrane to permit the same to contract upon the outer peripheral surface of the yarn cake and soften the same and reduce the diameter thereof.

6. In a method of treating a spun rayon yarn cake to prepare the same for liquid processing, the steps which comprise inserting the cake within an annular membrane which has a diameter sufficiently great, at the time the cake is inserted, freely to receive the cake, said membrane being made of a material capable of contracting to a diameter less than that of the outer diameter of the cake, and causing the membrane to contract about the cake sufficiently to exert a substantial compressive force on the outer peripheral surface thereof.

ALFRED SEELY BROWN.

CERTIFICATE OF CORRECTION.

Patent No. 2,243,000. May 20, 1941.

ALFRED SEELY BROWN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 19, for "amendable" read --amenable--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of June, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.