

Sept. 20, 1938.

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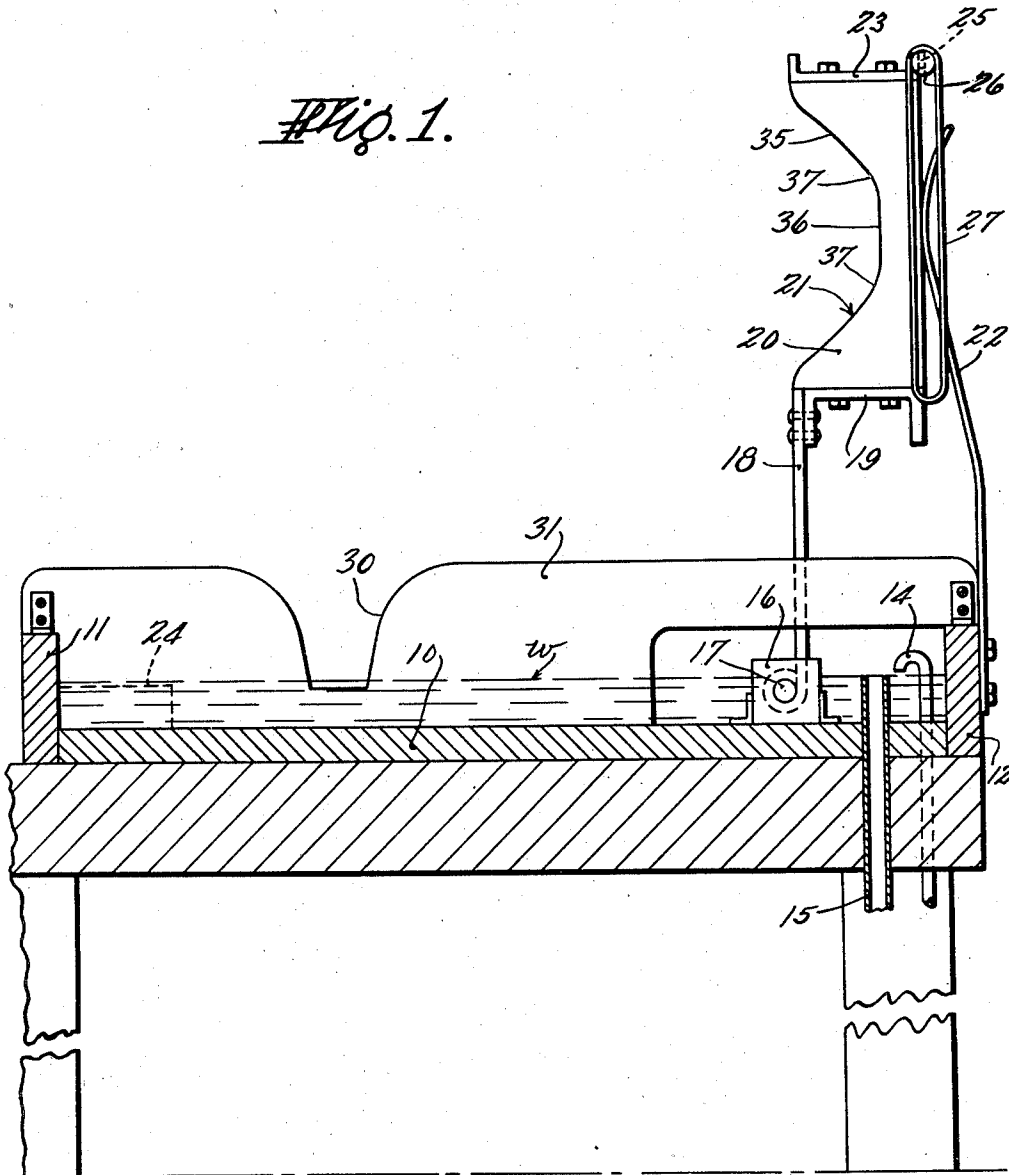
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METHOD AND APPARATUS FOR TREATING RAYON CAKES

Filed Aug. 26, 1936

3 Sheets-Sheet 1

Fig. 1.



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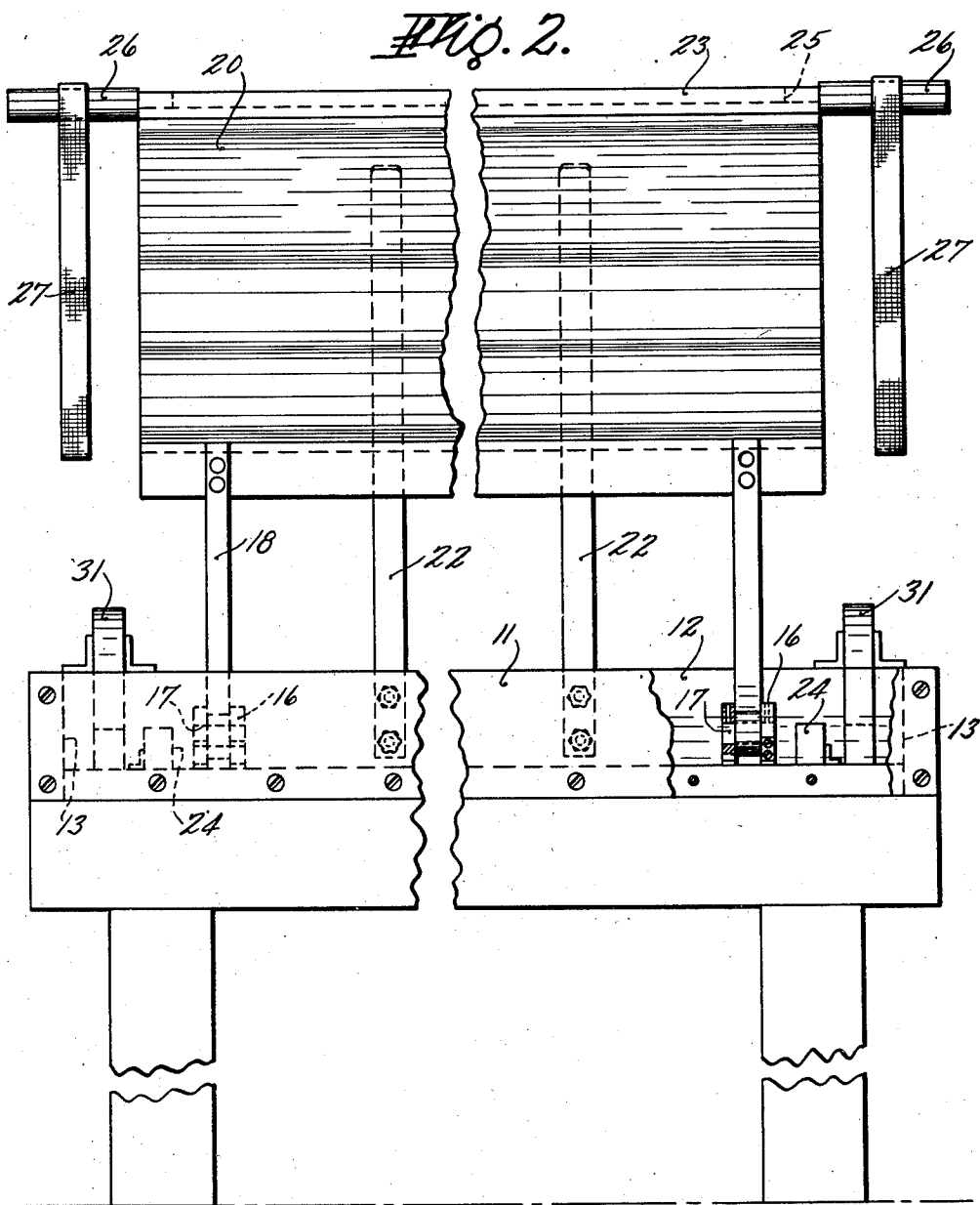
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Fig. 3.

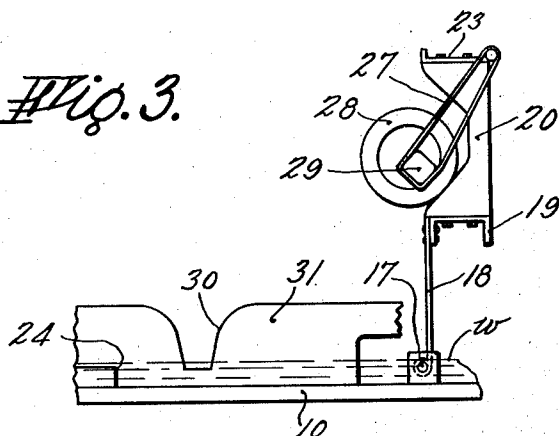


Fig. 4.

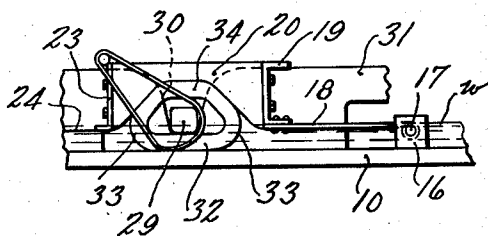


Fig. 5.

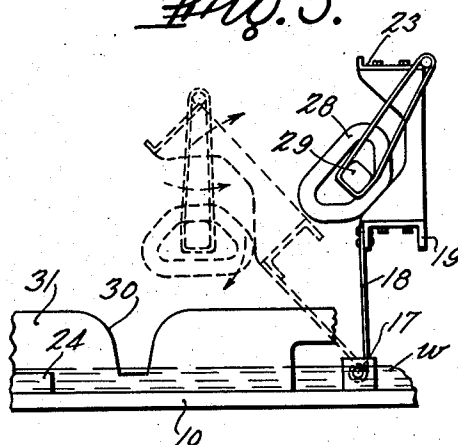


Fig. 6.

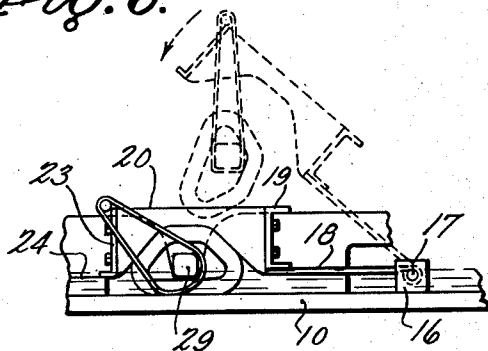
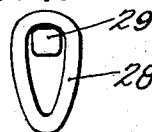


Fig. 7.



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2,130,791

METHOD AND APPARATUS FOR TREATING
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Application August 26, 1936, Serial No. 98,079

12 Claims. (Cl. 18—8)

In the preparation of rayon by the pot spinning method the freshly formed yarn is wound into annular form by being thrown by centrifugal force against the inner surface of a rapidly revolving pot or bucket, a longitudinal traverse of the yarn guide being combined with the rotation of the bucket to produce a cross wound package. The annular body thus formed is commonly known as a cake, and as a preparation for further treating steps, particularly where the further processing is to be done with the yarn still in cake form, it is necessary to loosen the texture of the cake to such an extent as will prevent any adherence of the successive windings and will permit the permeation of the cake structure by the washing and treating fluids. It has hitherto been proposed to accomplish this loosening by mechanical treatment, as by bending the annular cake manually or by passing it between a roller and a supporting surface such as a second roll or a platen. It has been found in practice that the first method does not secure sufficient loosening of the cake structure to permit thorough and uniform permeation of the cake by treating fluids, the cakes varying as to their permeability in general so that they will not be completely washed in equal times, and varying as to their local permeability, so that they will not wash evenly. It has also been found that the second method has a tendency to create waves or irregularities in the yarn which are a source of weakness when the yarn is finally unwound. Both prior methods are liable to produce cakes subject to "channelling," by which is meant passage of washing or treating fluids more easily through some parts of a cake than through other parts. The result of channelling is to leave the less permeable parts of the cake untreated by the washing or treating liquid, at least unless the rest of the cake is treated for an abnormally long time.

It is the object of the present invention to improve the prior methods of loosening the cake structure in such a manner that thorough permeation of the cake is possible and so that no irregularities will be introduced into the yarn which can cause trouble at a later stage of processing or which will weaken the yarn itself. A further object is to provide a method of loosening the cake structure which will not require prior aging of the cakes. A further object is to treat the cakes in such a manner that they will be completely limp, so as to receive the washing and treating fluids in the best manner. A further object is to treat the cakes so that they will not be subject to channelling. A further object is to

provide a simple apparatus which can be used for the simultaneous treatment of a number of cakes by this improved method. Additional objects will appear from the following description and claims.

Referring to the drawings,

Fig. 1 is a side elevation of an apparatus for carrying out the improved method, certain parts being shown in section;

Fig. 2 is a front elevation of said apparatus, partly broken away; and

Figs. 3 to 7 are detail views illustrating the practice of the method and the operation of the apparatus.

Before describing the construction of the apparatus the steps which constitute the improved method will be considered. As stated above, the cake which is formed in the spinning pot is an annular body, generally having an outside diameter of six or seven inches, a wall thickness of about an inch, and a length in its axial direction of about four inches. Due to the plastic character of the freshly formed rayon yarn and to the pressure exerted upon it by the centrifugal force of spinning, this cake structure is originally very compact. When it is finally loosened so that the individual yarns are free one from another there is danger of the yarn becoming displaced so that snarls result, and to prevent this the cake is generally enclosed in a cover of pervious fabric immediately upon its removal from the pot.

The fabric covered cake is, in accordance with my invention, bent while at least partially immersed in water so that the radius of curvature of some portions of the cake is increased and the radius of curvature of other portions is decreased with respect to the radius of the cake in its normal circular form, this treatment being repeated or continued so that all portions of the cake are worked upon and uniformly loosened. One convenient way of accomplishing this is to bend the cake so that one side is flat and the opposite side is of arch shape. If desired the arch may be made with alternating straight and curved sections to give to the arched portion of the cake a minor degree of working and to thus assist in the yarn loosening process. The immersion in water during the flattening operation greatly assists in the loosening of the yarn and in increasing the permeability of the cake for later processing operations.

The first bending operation is shown in Fig. 4. The cake is then shifted in its position and again bent so that the more sharply curved portions come at a different place in the cake body than

was the case in the first operation. Successive bending operations are continued until the entire cake body has been sufficiently loosened, at least the lower portion of the cake being kept under water each time the cake is bent. It has proved to be desirable to keep the height of the water in which the cake is treated greater than the thickness of the cake wall, as better permeation results when the lower portion of the cake is subjected to water from all sides. In practice three successive bending operations, with intermediate shifting of the cake so that the deformation of the cake progresses around its circumference, have proved in general to be enough. The thorough permeation of the cake structure by water in this manner not only loosens the cake but arrests to a substantial extent the aging process which results from prolonged contact with the yarn of the residual acid remaining from the coagulating process. Excessive aging results in deterioration of the yarn strength, and the process herein described, particularly if carried on with no prior aging step, reduces the critical nature of the time interval between spinning and washing.

For several reasons it is desirable to perform the operations described above by mechanical means rather than manually. Manual handling of the cakes, particularly in a water bath, is likely to be injurious to the workman on account of the high acid content of the cakes. In the apparatus about to be described all danger from this source is removed, as no manual handling of the wet cakes is necessary. Furthermore, if the cakes are treated by hand there is an unavoidable irregularity in the amount and location of the pressure applied to individual cakes and in the degree and shape to which successive cakes are bent. This also can be avoided by the use of mechanical means which treats all cakes alike. Still further, the provision of a mechanical treating device of the type to be described makes possible the handling of a large number of cakes at one time, so that the treatment of a batch of cakes is greatly speeded up.

In the form of the apparatus chosen for illustration there is a water-containing tank formed of a bottom member 10, a front wall 11, a back wall 12, and end walls 13 suitably secured together. Water is maintained at a constant level within this tank by any suitable means, such as an inlet pipe 14 and an over-flow pipe 15 (Fig. 1); a constant circulation of water within the tank being preferably maintained in order to prevent too great accumulation of acidity in the bath. Secured in blocks 16 mounted within the tank are shafts 17, upon which are pivoted members 18 joined to a channel member 19 which carries a pressure member 20 extending longitudinally of the tank. This pressure member may be made of wood or other material unaffected by the liquid in the bath, and has a pressing surface 21 of substantially the concave form shown in Fig. 1. The pressure member may be swung manually about the pivots 17 from the upper position shown in Figs. 1 and 3, where it rests against supports 22, to the lowered position shown in Fig. 4 where a second channel member 23 on the pressure member strikes against stop blocks 24 in the tank.

From each end of the channel member 23 a bar 25 extends longitudinally, the bar being preferably covered by a piece of rubber tube to form a handle by which the pressure member may be swung up or down. The handles also

serve as supports from which are suspended the cakes to be treated, a strap or belt 27, preferably of canvas, being hung on each handle for this purpose. A series of cakes 28 are strung on a long pole 29 so that by grasping the ends of the pole the whole series of cakes can be put into or removed from the apparatus as may be desired. In practice a large number of poles, each pole containing a series of cakes, are brought to the treating apparatus in a rack, and after treatment the cakes, still on the same poles, are placed in drip baths in which they are washed, desulphurized, and bleached. The present apparatus therefore has the advantage of treating the cakes to loosen them on the same poles on which they are to be supported in the drip baths. The poles are secured in the apparatus by placing each end within one of the loops 27.

When the poles are thus mounted and the pressure member is in its upper position the series of cakes rest against the heel of the curved pressure surface of the member 20 as shown in Fig. 3. The handles 25 are then swung downwardly to bring the pressure member into the position of Fig. 4. During this movement the ends of the poles 29 are received and guided in converging grooves 30 formed in end pieces 31 suitably secured within the tank. In the position of Fig. 4 the cakes are shown as having been bent, with their upper sides in arch shape and their lower sides substantially straight, for the reasons set forth above. The curve of the pressure member is such that in this position the bending is insufficient to cause pressure of the cakes against the pole, the latter floating freely within the aligned holes in the cakes. The straps 27 are also free so that the pole is not pulled to one side. The bottom 32 of each cake is, with the apparatus shown, flattened from its original curve into substantially straight form; the portions 33 are bent into a curve of sharper radius than the original curvature of the cake; and the upper portion 34 is bent into arch shape. As a means of securing a further working of the cake structure, less in magnitude than that described but for this very reason cooperating to secure a uniform loosening of the yarn throughout the cake structure, the pressure member 20 can have its pressing surface modified from regular arch form. Thus, as shown in Fig. 1, the sides 35 and the top 36 of the arch may be comparatively straight, being joined by regions 37 of sharper curvature. The additional working of the upper portion of the cake thus given may in some instances be beneficial and require a lesser number of bending operations. All portions of the cake are successively worked upon, while the portions 32 and 33 at each bending are under water so as to enhance the yarn loosening effect. The water could be deeper if desired, so that all of the cake is under water, but this raises some disadvantages and in practice has proved to be unnecessary. As pointed out above, however, the water level should preferably be high enough to cover completely the bottom portion 32 of the cake.

The handles 25 are then raised to bring the pressure member into its upper position against the stops 22. This is preferably done smartly, so that the series of cakes on the pole are caused to swing against the heel of the pressure member and strike it with a substantial blow. The contact of the cakes with the heel in itself produces some working and loosening of the yarn, and the cakes are turned as shown in full lines in Fig. 5 so that when the pressure member is again

lowered as in Fig. 6 a different portion of the cakes will be brought into flattening position. The alternate lowering and raising of the pressure member is repeated as often as necessary, three pressing operations being in general sufficient. When the cake has been completely treated throughout its periphery the last striking of the cake against the heel of the pressure member causes the then limp cake to drape downwardly from the pole in substantially the oval form shown in Fig. 7. This is substantially the form assumed by a wet skein held on a pole or tube, and is the best possible form for complete permeation by liquid supplied to it from the top.

The method of treatment described above produces a much limper and softer cake structure than has been possible with prior loosening methods. As one example of this, with the best known prior methods of loosening the cake structure the cake would assume the oval form of Fig. 7 only after a prolonged period of washing; and even then the cakes were not uniform as to their permeability. The cakes treated in accordance with this invention can readily be made so limp that they will hang normally and uniformly (as in Fig. 7) no matter from what point of their inner circumference they are suspended; thereby differing from the relatively stiff cakes produced by prior loosening methods. It has also been found possible by the present method to loosen the cake structure and to transfer it to the washing bath directly from the spinning pot, without the preliminary aging step which has formerly been required.

The form of apparatus shown is illustrative only, and it is apparent that many other forms of apparatus can be used to carry out the method described.

I claim:

1. A process of loosening the yarn structure of a rayon cake which comprises repeatedly bending successive portions of the cake into a form in which the cake has one substantially flat and one arched side while maintaining at least the flattened portion of the cake immersed in water during the bending operation.

2. A process of loosening the yarn structure of a rayon cake which comprises bending a portion of the cake wall while maintaining at least a portion of the bent cake wall immersed in water, and bending additional portions of the cake wall until the entire cake structure has been loosened.

3. A process of loosening the yarn structure of a rayon cake which comprises changing the curvature of successive portions of the cake wall throughout its circumference, and while said wall is at least partially immersed in an aqueous bath, into alternating portions of respectively greater and lesser curvature than that of the cake in its original circular form.

4. A process of loosening the yarn structure of a rayon cake which comprises bending the cake into a form in which the cake has one substantially flat and one arched side connected by portions having a smaller radius of curvature than the normal radius of curvature of the cake, again bending the cake so that the curved portions so formed are straightened and the flattened portions are curved and the cake is given again a form in which it has one substantially flat and one arched side connected by portions having a smaller radius of curvature than the normal radius of curvature of the cake, and repeating the bending operation upon additional

portions of the cake until the yarn structure has been substantially uniformly loosened throughout the body of the cake, at least the substantially flat portions of the cake being immersed in water at each bending operation.

5. An apparatus for loosening the yarn structure of rayon cakes comprising a tank, a pair of pressure members having coacting pressure surfaces shaped to impart to a cake a form changed from its normal circular contour so that a portion of the cake is flattened with respect to such contour and another portion is given a radius of curvature smaller than the radius of curvature of said normal contour, and a mounting for said pressure members whereby they may be caused to approach and recede from each other, one of said members being located within the tank below the water level thereof.

6. An apparatus for loosening the yarn structure of rayon cakes comprising pressure members having coacting pressure surfaces operable to change the radius of curvature of the cake wall, and means for subjecting at least a portion of the cake wall to a water bath during said change in curvature.

7. An apparatus for loosening the yarn structure of rayon cakes comprising a water-containing tank, a pressure member pivoted to the tank and having an arched pressure surface, means for suspending a rod strung with rayon cakes on the pivoted pressure member, and guide means for directing the rod into position within the tank so that the cakes thereon will be in position to be engaged by the arched pressure surface of the pivoted pressure member as the latter is swung downwardly.

8. An apparatus for loosening the yarn structure of a rayon cake comprising a water containing tank, a pressure member pivoted to the tank and having an arched pressure surface, means for suspending a rod strung with rayon cakes on the pivoted pressure member for free swinging movement, guide means for directing the rod into position within the tank so that the cakes thereon will be in position to be engaged by the arched pressure surface of the pivoted pressure member as the latter is swung downwardly, and means for arresting the upward movement of the pivoted pressure member positioned so that the cakes suspended from it will swing against said member, said pressure member being so shaped that the cakes will have the curvature of their walls shaped by the impact against said member when the member is arrested in its movement.

9. An apparatus for loosening the yarn structure of rayon cakes comprising a water-containing tank, a pressure member pivoted to the tank and having an arched pressure surface, means for suspending a rod strung with rayon cakes on the pivoted pressure member, guide means for directing the rod into position within the tank so that the cakes thereon will be in position to be engaged by the arched pressure surface of the pivoted pressure member as the latter is swung downwardly, and stop means limiting the downward motion of the pressure member so that the cake will not be flattened sufficiently to cause its inner surface to bear upon the supporting rod.

10. An apparatus for loosening the yarn structure of rayon cakes comprising a water-containing tank, a pressure member pivoted to the tank and having an arched pressure surface, handles projecting longitudinally beyond the pressure

member by which it may be swung upwardly or downwardly, straps suspended on said handles to receive a rod strung with rayon cakes, guide means for directing the rod into position within the tank so that the cakes thereon will be located in position to be engaged by the arched pressure surface of the pivoted pressure member as the latter is swung downwardly, and stop means limiting the downward motion of the pressure member so that the cakes will not be flattened sufficiently to cause their inner surfaces to bear upon the supporting rod.

11. An apparatus for loosening the yarn structure of rayon cakes comprising a water-containing tank, a pressure member pivoted to the tank and having an arched pressure surface, means for suspending a rod strung with rayon cakes on the pivoted pressure member, guide means for directing the rod into position within the tank so

that the cakes thereon will be in position to be engaged by the arched pressure surface of the pivoted pressure member as the latter is swung downwardly, and means for maintaining the water within the tank at a substantially constant level.

12. An apparatus for loosening the yarn structure of rayon cakes comprising opposed platen pressure members having coating cake engaging surfaces so constructed and arranged that when a cake is engaged between them it will be distorted into a form having unidirectional curvature with a portion of the cake flattened with respect to the contour of the cake and another portion convexly curved on a radius smaller than the radius of curvature of said normal contour.

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