March 16, 1937. P. E. HARRISON ET AL 2,073,839

MANUFACTURE OF THREAD

Filed July 14, 1932 2 Sheets-Sheet 1

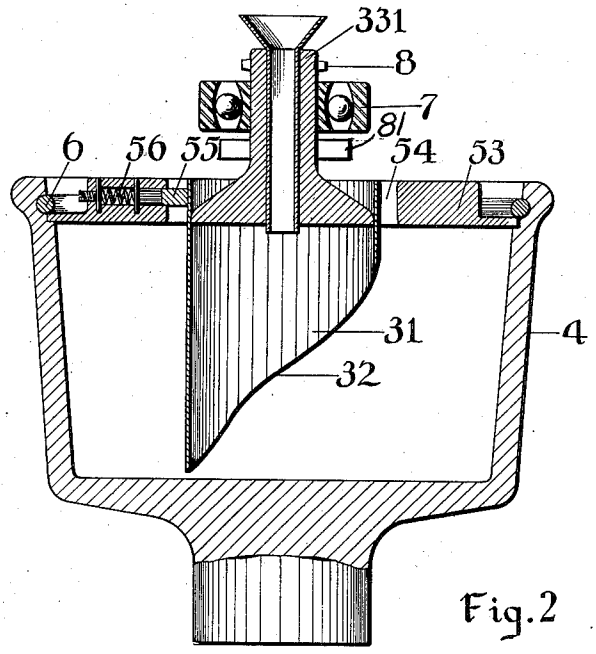


Fig. 2

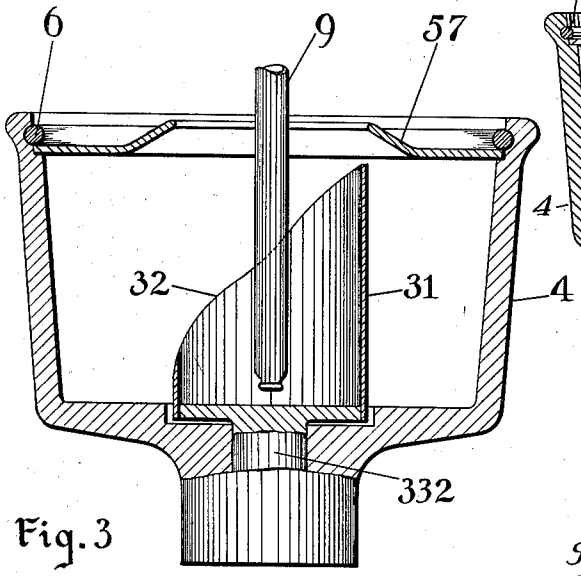


Fig. 3

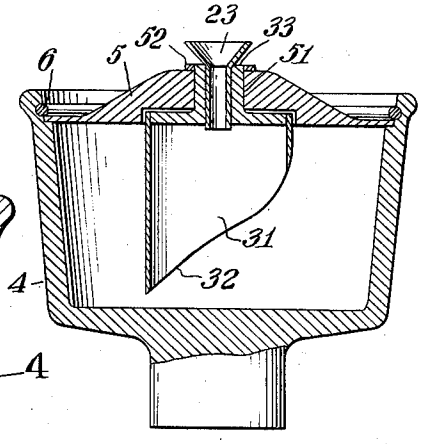


Fig. 1

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Filed July 14, 1932 2 Sheets-Sheet 2

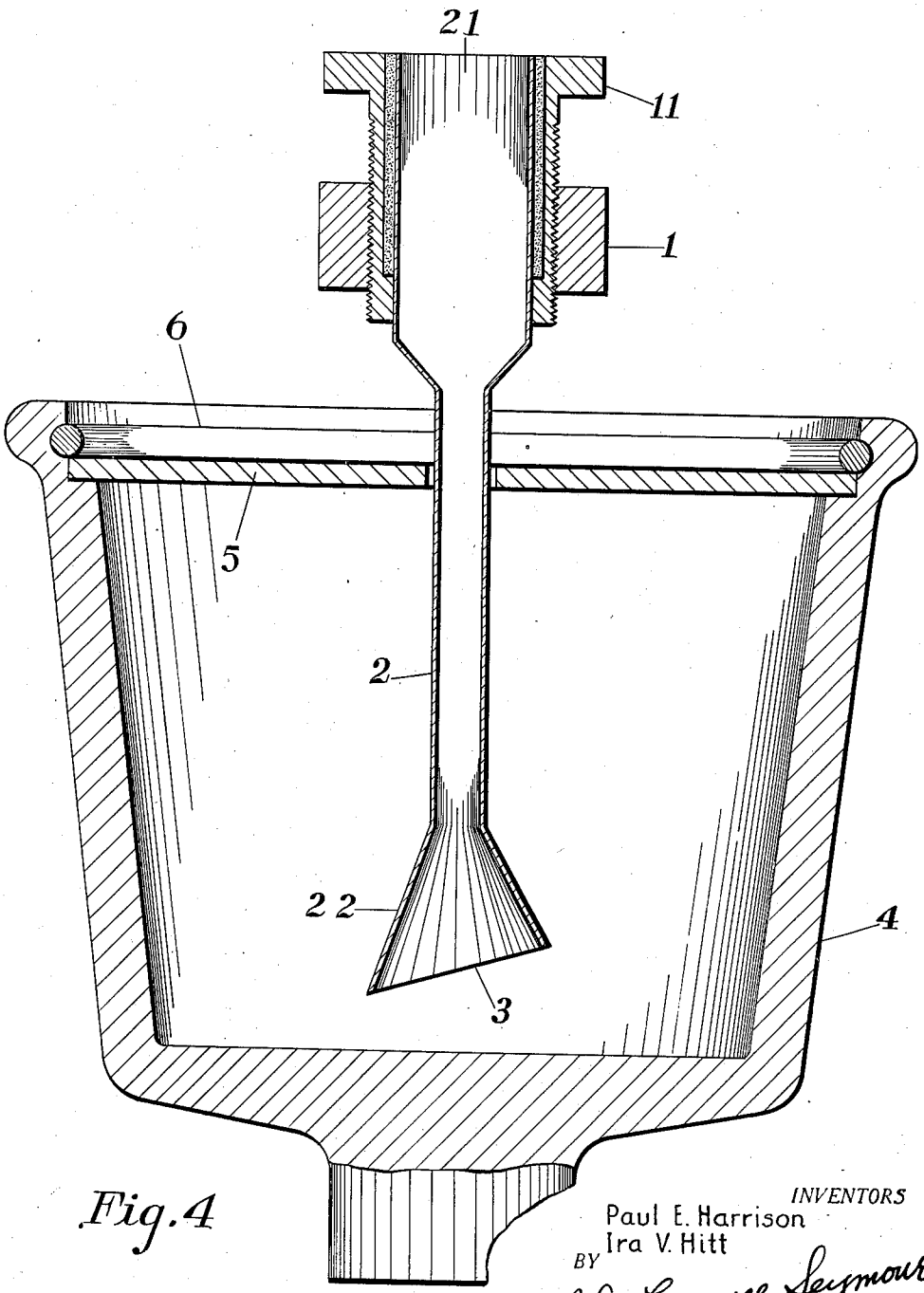


Fig. 4

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MANUFACTURE OF THREAD

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Application July 14, 1932, Serial No. 622,390

23 Claims. (Cl. 117—27.5)

This invention relates to the manufacture of thread. More particularly the invention relates to the manufacture of continuous filament thread such as the products prepared from viscose, cuprammonium cellulose, cellulose acetate, and other cellulosic materials. Still more particularly the invention relates to the bucket spinning method of preparing rayon from viscose, and to traversing mechanisms whereby the thread is laid in cake form in the bucket. The invention will be described in its application to the manufacture of rayon from viscose, but this description is not limitative of the invention, which is useful in winding any kind of thread.

In one of the common methods of preparing rayon, viscose is spun into a setting bath to form a thread which is drawn from the bath at a constant speed by a godet wheel and is then passed downwardly through a funnel shaped guide into the interior of a bucket rotating at high speed. The centrifugal force created by the high speed of the bucket draws the thread through the funnel and throws it against the wall of the bucket or against the layers of thread previously laid down. The funnel guide is reciprocated between the top and bottom of the bucket so that the thread as it is laid against the wall of the bucket forms a helix. As the funnel guide changes in direction, the helix formed by the thread is similarly reversed until, as time goes on, a cake is formed comprising a large number of layers of yarn, or helixes of yarn, superimposed on each other. In this specification the point at which the thread leaves the traversing mechanism is called the point of incidence of the thread. In the form of traversing mechanism wherein a reciprocating funnel guide is used the point of incidence of the thread is at that end of the funnel guide from which the thread issues to be laid onto the cake.

The process above described, in which a reciprocating traversing funnel is used, is unsatisfactory because it requires careful attention to control the heighth and depth of the cake; since a difference of even two hundredths of an inch in the vertical mounting of the funnel will result in the formation of loops of thread at the top or at the bottom of the cake; because the thread frequently whips around itself to create "points" which increase the difficulty of unwinding and produce an inferior yarn; and because if the number of courses of thread laid down per unit of time synchronizes at certain definite intervals with the funnel traverse, the thread piles up in bands or layers, making a cake difficult to process and causing considerable waste.

The mechanism is particularly unsatisfactory with high bucket speeds. If a cake permeable to liquids and easy to purify is to be built up the helixes of yarn must have a relatively sharp pitch. In order to secure a thread having a given, satisfactory twist, and a satisfactory pitch in the cake, the reciprocations per minute of the funnel must bear at least a certain ratio to the speed of the thread. If the reciprocations per minute of the funnel fall below that ratio, the crossings of the yarn are too nearly parallel and a hard compact cake is formed. As high and higher thread speeds are used and thick and thicker cakes are built up, washing and purification become increasingly difficult. It becomes necessary, consequently, in order to secure a satisfactory cake to reciprocate the funnel 80 to 100 or even more times per minute. It has been found impracticable to secure such high speeds of reciprocation because of mechanical difficulties and funnel breakage. Sixty (60) reciprocations per minute may be considered roughly an upper limit for winding with this type of traversing mechanism. It is apparent, consequently, that, where a reciprocating funnel guide is used, spinning can only be carried out below certain thread speeds. It is the desire of the rayon industry, because of economy and improvement in the product, to progress to high and higher speeds of spinning and to the building up of thick and thicker cakes.

It is an object of this invention to provide a new traversing mechanism for use in the spinning bucket process of winding thread into cakes. Another object of the invention is to improve the traversing mechanism which uses the traversing funnel. Another object of the invention is to wind looser, more permeable cakes of thread of improved quality at higher speeds. Another object of the invention is to eliminate the formation of points. Other objects of the invention will be apparent from a consideration of the following description.

The objects of this invention are accomplished, generally speaking, by imposing upon the point of incidence of the thread a reciprocating motion by the novel reciprocating mechanisms, inventions, and constructions herein described.

In the drawings Figure 1 is a vertical section of a new traversing mechanism applied to the cover of a bucket. Figure 2 is a vertical section through a bucket showing another mounting of the new traversing mechanism of our invention. Figure 3

is a vertical section through a bucket showing a form of our invention mounted in the bucket itself. Figure 4 is a vertical section through our improved traversing funnel.

In Figure 1, **4** is a bucket; **5** is a bucket cover; **6** is a spring clip for keeping the bucket cover in place; **23** is a guide for directing thread into the bucket; **31** is a cylinder; **32** is an annular lower face on the cylinder which may be considered made by cutting obliquely through the cylinder at an angle so flat that the thread will not wrap itself around the cylinder end but so steep that it will give the thread a complete traverse; **33** is a trunnion; **51** is a bearing in cover **5** in which trunnion **33** is rotatably mounted; **52** is any suitable mechanism for maintaining the trunnion in place.

The vertical dimensions of the cake are regulated by the highest and lowest points on the annular face of the traversing mechanism. The trunnion is so mounted in the bearing that the traversing mechanism is capable of motion about the axis of the bucket. The traversing mechanism must be mounted in the bucket freely enough to allow relative rotation without separate driving of the traversing mechanism. If the mounting is too tight, it will cause the traversing mechanism to rotate as one with the bucket and will pile the thread up in a narrow band. In a most advantageous form of our invention the face **32** of the traversing mechanism is not truly plane but is cut in a sinuous manner.

The invention functions as follows:

As the bucket rotates the traversing mechanism revolves with it but with a definite loss of motion which causes it to travel at a lower speed than the speed of the bucket. The traversing mechanism revolves with a constant average speed, but its speed actually fluctuates irregularly above and below that average speed. The loss of motion between the traversing mechanism and the bucket causes the traversing mechanism to rotate with respect to the bucket and to traverse the thread regularly in the form of a helix having a sharp pitch; at the same time the fluctuation in the speed of the traversing mechanism causes the speed of the traversing mechanism with relation to the speed of the bucket to be constantly inconstant and causes the thread to be laid in a more or less sinuous path which contributes to the building of a soft and permeable cake.

The pitch of the helix can be regulated by regulating the speed of the traversing mechanism relative to the bucket. This regulation of the relative speeds of bucket and traversing mechanism can be accomplished by braking or by separately driving the traversing mechanism.

Since the rotation of the traversing mechanism with respect to the bucket is not constant but fluctuates, a particular advantage is secured by the laying of thread in an irregular manner which prevents the formation of bands and insures an easily purifiable cake. By cutting the face of the traversing mechanism sinuously an additional, sinuous motion can be imposed upon the reciprocating motion of the point of origin which will lay the thread in a sinuous manner and will contribute to the building of an easily purifiable cake.

In Figure 2, **4** is a bucket; **53** is a bucket cover; **54** is an opening in the center of the bucket cover; **31** is the traversing cylinder; **32** is the annular edge of the traversing cylinder hereinbefore described; **331** is a trunnion which carries the traversing mechanism; **7** is a ball bearing carrying the trunnion **331**; **8** represents a gear by which the traverse mechanism may be driven; **81** are wind vanes by which the rotation of the traversing mechanism may be retarded; **55** is a brake pressing against the outside of the traversing mechanism **31**; **56** is an adjustable spring which presses brake **55** against the traversing mechanism to insure its tendency to rotate.

In the ordinary operation of the mechanism described in Figure 2 the traversing mechanism will not be driven, the bucket itself furnishing through brake **55** enough friction to accomplish the purpose of the mechanism. By adjusting the pressure of the brake against the traversing mechanism the slippage of traversing mechanism **31** with regard to the bucket can be regulated to the point where the traversing mechanism travels at a speed just sufficiently below that of the bucket to produce the best result. The wind vanes **81** may be adjusted in size or shape to produce a desirable retarding action.

In case it is desired to drive the traversing mechanism at a lower or higher speed than that of the bucket the gear **8** may be put in connection with suitable driving mechanism, the brake **55** withdrawn from contact with the traversing mechanism, and the traversing mechanism rotated at the desired speed.

In Figure 3 is shown a modified form of our invention in which the traversing mechanism is mounted in the bucket; **4** is a bucket; **57** is a bucket cover; **9** is a thread guide which may or may not be traversed; **31** is our traversing mechanism; **32** is the annular edge of the traversing mechanism; **332** is a trunnion whereby the traversing mechanism is mounted in the base of the bucket. The mechanism functions in this instance as in the other forms of the invention and may be driven or not as the engineer decides. However, when it is desired to drive the traversing mechanism, the form of invention shown in Figure 2 is to be preferred because of mechanical simplicity.

With the types of traversing mechanism shown, the speeds of rotation are preferably only slightly less than the bucket speed, or slightly more than the bucket speed, although they may vary greatly and still function satisfactorily. It is to be understood, however, that it is not necessary, in order to secure a loose cake, that the traversing mechanism exceed the speed of the bucket.

In practice it will be found that the slippage which takes place between the traversing mechanism and the bucket is inconstant, which is advantageous because it tends to prevent the formation of synchronized windings. Our invention will work excellently with a truly plane face, but in order to insure sinuous winding the face of the traversing mechanism should be cut diagonally on a line other than straight.

Our traversing guides may be made of bakelite, of a plastic composition, of non-corrodible metal which should be preferably carefully polished, or it may be of ceramic material. Of course any material having sufficient bursting strength and sufficient resistance to the chemical action of the process liquids may be used.

It will be found advantageous to bring the rotating part of the mechanism into dynamic balance. This can be attained for example by designing the traversing guides symmetrically to give in effect two, three, or more strokes per revolution of the thread around the contour.

In Figure 4 is shown an improved form of traversing funnel. In this figure **1** is a traversing

bar which is reciprocated axially of the bucket by mechanisms not shown; 11 is a funnel holder mounted for adjustment by screw threads in the bar 1; 21 is a funnel guide through which the rayon thread is carried into the interior of the bucket; 4 is a bucket; 5 is a cover for the bucket; 6 is a spring ring which holds the cover in place; 2 is a stem of the guide; 22 is a flared end on the guide; 3 is a diagonal face on the end of the guide. In this form of the invention the primary reciprocating motion is imparted to the point of incidence by the reciprocating motion of the traversing bar and the sinuous motion is imparted to the point of incidence by the diagonal face on the lower end of the funnel. It is our discovery that the formation of points is due to the alinement of the funnel orifice outside the axis of the bucket and that, where the bucket axis is within the funnel orifice, points are substantially eliminated. Our improved funnel, consequently, not only imparts a desirable sinuous secondary motion to the point of incidence of the thread but substantially eliminates the formation of points by making it practically impossible for the operator to aline the orifice outside the axis of the bucket. The form of the invention disclosed in this figure is not adapted to the high speeds of spinning which can be attained by the preferred forms of the invention.

Generally speaking, when a 150 denier thread or smaller is fed into a spinning bucket 7" in diameter and 4" deep so as to impart to the finished thread a twist of 3 turns per inch and when the usual traversing funnel is reciprocated 60 strokes per minute, the bucket must not revolve more than 6000 R. P. M. If higher bucket speeds are used, the cake formed will be so compact that it can be washed and purified only with great difficulty. With larger diameter buckets, under the same set of conditions otherwise, a proportionally lower bucket speed must be used, but since the buckets customarily used in the industry are approximately 7" in diameter, larger diameter buckets need not be further discussed. A thread prepared with less twist than above mentioned is not commercially useful and, therefore, at 6000 R. P. M. bucket speed the thread speed must be kept below 2500" per minute. (After shrinkage has taken place during purification and drying, this will amount to about 2000" per minute as finished thread.) In many cases, especially with fine filament yarn, it is desirous to have even a higher twist in the thread, for instance 4 or 5 turns per inch, in which case the thread speed must necessarily be decreased, since we cannot spin at a higher bucket speed with the traversing funnel reciprocated at not more than 60 strokes per minute and secure a cake that can be purified economically.

With our invention, however, we can reciprocate the thread to 80, 100, or even more strokes per minute and by so doing we open the interlacing structure of the cake by making the crossings of the thread steeper and thus enable a more permeable cake to be formed. By traversing a 150 denier thread through 80 strokes per minute as it is collected into a bucket 7" in diameter and 4" deep, revolving at 7500 R. P. M. a commercially washable cake is prepared. If but 3 turns per inch in the finished thread is required, we are thus able to spin at about 3000" per minute. By increasing the number of reciprocations of the thread per minute as it is led into the bucket, still higher bucket speeds can be used and therefore higher thread speeds with greater economy of production.

Among the advantages of our invention are elimination of points, loops, and ribbon wind, the production of a much better and softer cake which is susceptible to more uniform processing and the production of a higher grade of thread. An additional advantage of the new traversing mechanism lies in the simplification of the spinning machine by eliminating traversing bars, their attendant mechanism, and the cost of their upkeep and operation. A most important advantage of the invention lies in the ability to traverse a thread more than about sixty reciprocations per minute, and, as a result, to use bucket speeds and spinning speeds much higher than those which have previously been used. The speed of spinning by previous bucket methods was limited by the machinery, but the speed of spinning with the preferred forms of our invention is limited, substantially speaking, only by the bursting point of the buckets and the speed at which a thread can be made. Other advantages of the invention will be apparent.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. In a spinning mechanism a rotatable bucket, a thread guide for imparting a reciprocating motion to the thread, and means forming part of the guide for imparting a sinuous motion to the thread.

2. In a spinning mechanism a revolvable bucket, a thread guide reciprocable axially thereof, at the end of the guide from which the thread emerges an enlarged end and a diagonal face on said end.

3. In a machine for manufacturing thread rotatable means for collecting thread and means mounted thereon and rotatable with respect thereto for guiding thread against the said collector.

4. In a machine for manufacturing thread rotatable means for collecting thread, and means mounted therein for rotation thereby and with respect thereto for directing thread helically against the said collector.

5. In a machine for manufacturing thread a revolvable bucket, means for guiding thread into the bucket, and annular means disposed in said bucket and diagonally arranged about the bucket axis for directing thread against the wall of the bucket.

6. In a machine for manufacturing thread a revolvable bucket, and annular means disposed in said bucket and angularly arranged with respect to the bucket axis for directing thread against the wall of the bucket.

7. In a machine for manufacturing thread a revolvable bucket, and annular, sinuous means disposed in said bucket and angularly arranged with respect to the bucket axis for directing thread sinuously against the wall of the bucket.

8. In a machine for manufacturing thread a revolvable bucket, and a thread guide having a ring-shaped face alined diagonally of the bucket axis for rotational movement with respect to the bucket.

9. In a machine for manufacturing thread a revolvable bucket, and a guide having a ring-shaped face for traversing the thread alined

diagonally of the bucket for rotational movement with respect to the bucket, the angle of alinement and diameter of the said face being sufficient to traverse the thread from the top to the bottom of the bucket.

10. In a machine for manufacturing thread a bucket, a thread guide comprising a ring alined diagonally of the bucket, means for rotating the bucket, and means for rotating the guide with respect to the bucket, the rotation of the guide being derived from the motion of the bucket.

11. In a machine for manufacturing thread a bucket, means for directing thread into the bucket, and a ring-shaped guide having a sinuous face mounted in and alined diagonally of the bucket, for rotation at a speed different from the speed of the bucket.

12. In a machine for manufacturing thread a bucket, a guide for directing thread into the bucket, a second guide mounted in the bucket for rotation at a speed different from the speed of the bucket, and a ring-shaped portion having a sinuous face oblique to the axis of the bucket on said second guide.

13. In a machine for manufacturing thread a bucket, a guide for directing thread into the bucket, a second guide mounted in the bucket for rotation at a speed different from the speed of the bucket, and a ring-shaped portion having a face oblique to the axis of the bucket on said second guide.

14. In a spinning machine a revolvable bucket, and a ring-shaped guide having a face oblique to the bucket axis mounted therein for rotation by, but at a less speed than the bucket.

15. In a spinning machine a revolvable bucket, a cylindrical guide mounted in the bucket for rotation by, but at a less speed than the bucket, and a diagonal face on said guide.

16. In a spinning machine a revolvable bucket, a cover on the bucket, a cylindrical guide mounted in the cover for rotation by, but at a less speed than the bucket, and a diagonal face on said guide.

17. In a spinning machine a revolvable bucket, a cover on the bucket, a cylindrical guide mounted in the cover for rotation by, but at a less speed than the bucket, and a diagonal, sinuous face on said guide.

18. In a spinning machine a revolvable bucket, a cover on the bucket, a bearing in the cover, a cylindrical guide mounted in the bearing for rotation by, but at a less speed than the bucket, and a diagonal, sinuous face on said guide.

19. A mechanical motion including a driving member comprising a rotatable plate, means to rotate the plate, a bearing located axially in the plate, a driven member, a bearing thereon seated in the axial bearing of the rotatable plate, the fit of the bearings permitting the driving of the driven member from, but at less speed than, the driving member, and wind vanes on the driven member whereby to affect the rate of its motion with respect to the driving member.

20. A mechanical motion including a driving member comprising a circular rotatable member, means to rotate the said member, a bearing member axially therein, a driven member, a bearing member thereon fitted to the said axial bearing, the fit of the bearings permitting the driving of the driven member with the lost motion, and an air brake on the driven member whereby to affect the rate of its motion with respect to the driving member.

21. A mechanical motion including a driving member, means to rotate the driving member, a driven member axially and rotatably mounted, by a bearing permitting lost motion, in the driving member, and means to affect the rate of motion of the driven member with respect to the driving member.

22. The method of winding a cake of thread in a revolving bucket which comprises introducing the thread to the bucket and imposing upon the point of incidence thereof inconstant motion in a closed path which lies about, and oblique to, the bucket axis at an angle such that the thread is completely traversed in one revolution of the point of incidence.

23. The method of winding a cake of thread in a revolving bucket which comprises introducing the thread to the bucket and imposing upon the point of incidence thereof motion in a closed path which lies about, and oblique to, the bucket axis at an angle such that the thread is completely traversed in one revolution of the point of incidence.

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CERTIFICATE OF CORRECTION.

Patent No. 2,073,839. March 16, 1937.

PAUL E. HARRISON, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, lines 55 and 70 and page 4, first column, lines 1, 8 and 15, claims 5, 8, 9, 10 and 11 respectively, for the word "diagonally" read obliquely; page 3, second column, lines 60 and 65, claims 6 and 7 respectively, for "angularly" read obliquely; page 4, first column, lines 39, 43 and 48 and second column, line 4, claims 15 to 18 inclusive for "a diagonal" read an oblique; and that the said Letters Patent shoul be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of May, A. D. 1937.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.