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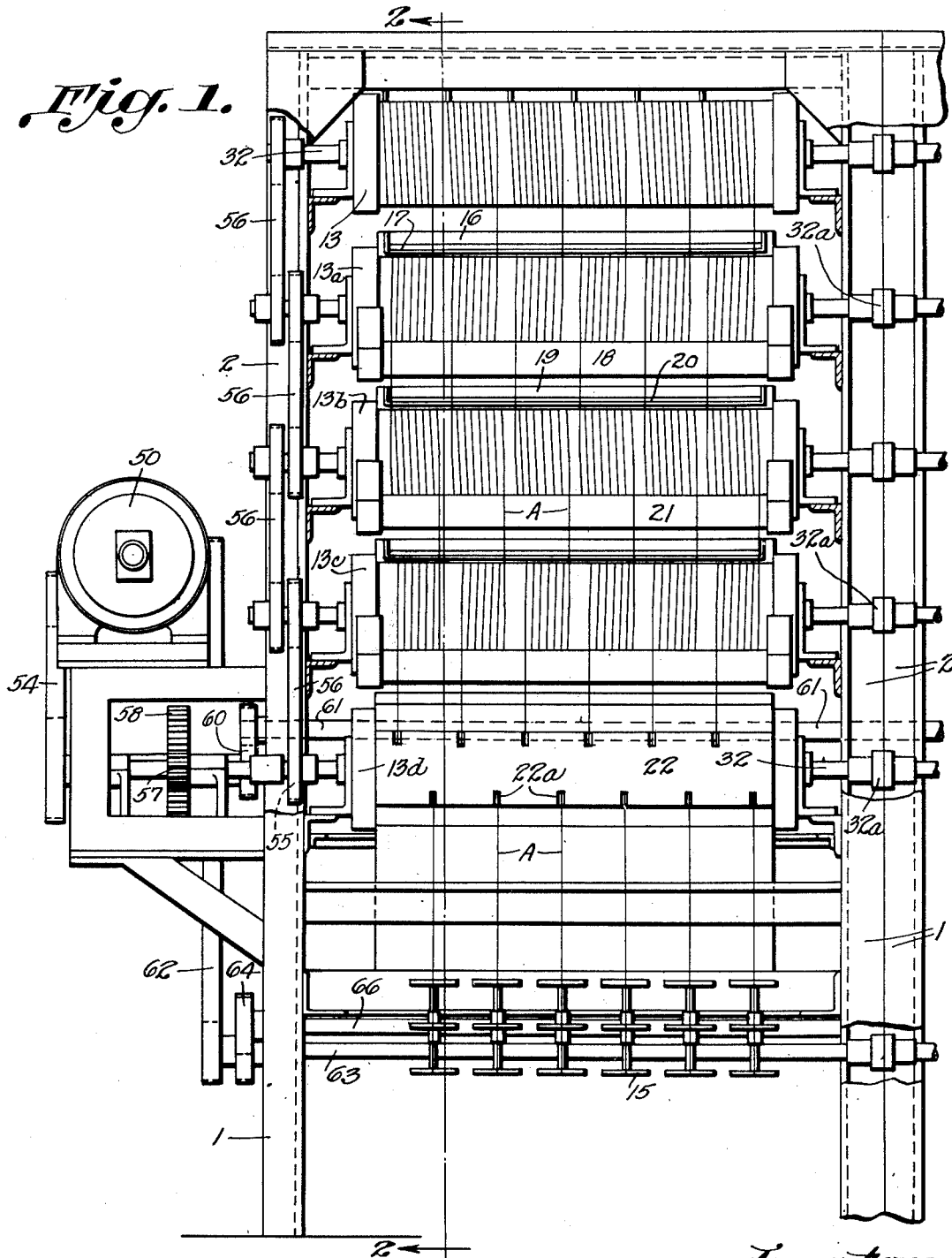
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MANUFACTURE OF THREAD OR THE LIKE

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Fig. 1.



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MANUFACTURE OF THREAD OR THE LIKE

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3 Claims. (Cl. 34—27)

This invention relates to the manufacture by a continuous method of thread or the like, particularly artificial silk thread. The invention aims, among other things, to make possible a closer degree of control in the manufacture of thread or the like, especially artificial silk thread, with the consequent advantage of greater uniformity of product. The invention aims further to provide means by which, in a single machine, the thread can be conveniently spun, treated, stretched, dried, and wound or otherwise gathered in finished or semi-finished package form ready for shipment, distribution, fabric manufacture, or the like. Further objects and advantages of the invention will in part be obvious and will in part appear more fully hereinafter.

This application is a division of prior application Serial No. 651,404, filed January 12, 1933, for "Continuous spinning machine".

In the drawings, which represent a machine of the kind to which the invention relates and in which like reference characters refer to like parts throughout, Figure 1 is a front elevation of a portion of the machine; Figure 2 is a sectional elevation on the line 2—2, Figure 1, looking in the direction of the arrows, parts being omitted for simplicity of illustration; Figure 3 is a detail cross section, on the line 3—3, Figure 5; Figure 4 is a detail end elevation of one of the controlling cams; Figure 5 is a detail sectional elevation on the line 5—5, Figure 2, through the end portion of one of the reels, all bars beyond the plane of section being omitted for clearness of illustration; and Figure 6 is a detail end view of one of the reel bars.

While the invention is capable of use in connection with the manufacture of any synthetic thread or thread-like article, regardless of kind, and, more particularly, in connection with any process of making artificial silk thread, such as the cuprammonium, cellulose nitrate, cellulose acetate, and viscose processes, for convenience but in no sense of limitation it has been illustrated and will be described herein in connection with the viscose process of manufacturing artificial silk thread. The purpose of the invention is, among other things, to provide means by which the thread or the like to be formed may be spun in any customary manner and then led successively to various devices for subjecting it to the necessary treatment by the particular process by which the thread or the like is being manufactured, the thread or the like finally emerging from the machine as a whole in finished or partly finished form, preferably dry, and wound or

otherwise collected in package form upon a collecting device.

In the viscose process, generally speaking, an alkaline solution of cellulose xanthate is spun into an acid coagulating bath and is collected either upon bobbins in a bobbin spinning machine or in the form of cakes in a centrifugal spinning machine, after which the thread, upon such bobbins or in such cakes, is subjected to various treatments, including washing, desulfurizing, bleaching, scouring, drying and the like, although some of these steps may be omitted or other or additional method steps may be performed upon it, as will be readily understood. Any or all of these various method steps may be performed upon the thread in one and the same organized machine, during continuous travel of the thread from the place of spinning to the device upon which it is finally collected. The drawings for convenience show only a few such steps, but they may be varied over a wide range, as will appear.

Referring first to Figures 1 and 2, the machine comprises a suitable frame including front and rear uprights 1, 2 connected by horizontal cross braces 3. The frame, and indeed the machine as a whole, is readily fabricated in the form of units of such a character that there may be attached to each other, in regular order, any number of such units; so as to multiply to any desired degree the number of threads which may be formed or produced in a given multiple machine. For example, as many as two hundred complete sets of thread forming devices may be readily included in a single machine and be operated in unison or by the same source of power. For simplicity of illustration, but a single multiple unit has been illustrated, which unit is shown as equipped to form six threads, although the number formed in each unit may be more or less than six.

At the back of the frame are mounted the necessary devices for spinning the thread, such including the usual supply pipe 5, pumps 4, spinnerets 7, etc. In placing the machine in operation, the mass tube 6 is swung about pivot 8 and immersed in the usual way beneath the surface of the acid coagulating bath 9 in trough 10. The thread A extruded from the spinneret 7 is conducted through the coagulating bath 9 over or through suitable guides 11, 12 to the first of a series of unitary thread-advancing reels, five being shown in the drawings, marked respectively 13, 13a, 13b, 13c, 13d. Except for differences in the baths used therewith, the process steps in which they are employed, their peripheral speeds, and the direction of thread travel thereon, these

devices are alike in construction and manner of operation; so that detailed description of one will suffice for all.

Generally speaking, the reels 13, 13a, etc., may take the form of any thread-advancing device upon which a thread may be wound continuously in generally helical form in a manner to expose to treatment all of the thread thereon and from which the thread may be continuously unwound. In other words, the reel is preferably so constructed and operated as to enable the thread to be simultaneously wound upon it, advanced by it, and unwound from it. At the same time it must have the capacity to hold an appreciable length of the thread and expose the entire length thereof to treatment of the thread by the appropriate process reagents. Also, successive turns of the thread should not contact with each other at any point and the thread should not be subjected to undue strain or rough handling while upon the reel. Various thread-advancing devices are available for the purpose.

In the arrangement shown in the drawings, each reel is of generally cylindrical form. Each includes two sets of bars, 14a, 14b, all of more or less rectangular cross section and parallel to each other, arranged to form the elements of a cylinder. Together, the two sets of bars form a hollow cage-like reel upon which the thread is wound in generally helical form. The reel is also provided with means for operating the bars, individually and as groups, so as to cause thread wound upon it to take substantially a helical form and to cause the thread turns to progress bodily along the length of the reel to a discharge point. The reels may be long enough to take care of a plurality of threads, six threads being shown in the drawings. The particular reel illustrated is thus divided into six zones arranged end to end, on each of which the reel carries a large number of substantially helical turns of a thread, as many as from fifty to several hundred turns of thread. For clearness of illustration, the turns are shown in the drawings as more widely spaced.

Any number of said reels may be mounted in vertically spaced relation, five being shown in the drawings. The mechanism of successive reels 13, 13a, 13b, etc., is so arranged as to produce travel of threads along the reels in one direction on the first reel, in the opposite direction on the next reel, and so on. As shown in Figure 1, the turns of thread progress bodily from left to right on reel 13, from right to left on reel 13a, from left to right on reel 13b, and so on. The thread is led from reel to reel in such manner that the transfer or carry over of the thread from reel to reel is at the front of the machine, as shown in Figure 2. This is the working face of the machine and consequently all threads are readily accessible to the operator.

In the machine shown in the drawings, the upper reel 13 is a holding or set-up reel upon which coagulation of the thread is allowed to proceed to substantial completion. The thread upon it is not subjected to any bath, although it may be, if desired, according to the requirements of a particular process. Guides 11 and 12 serve as wipers to turn back toward the trough 10 surplus bath liquor clinging to and carried up by the thread. The thread is wound upon the upper reel 13 in wet condition. The time necessary for the thread to progress along the reel to the place of discharge therefrom is utilized to promote substantially complete regeneration of the cellulose content of the viscose.

The drawings show the second state of the machine as utilized for a washing step, as, for example, washing with hot water to remove acid coming from the coagulating bath or with hot water containing a small amount of a reagent adapted to neutralize remaining traces of acid from the coagulating bath. The reel 13a is provided with suitable means for supplying wash liquor to the thread upon the reel, such as a supply trough 16 mounted in the frame and from which wash liquor is delivered to the thread upon the reel either by suitable spray nozzles above it, or, in the manner shown, by flowing over a horizontal weir notch 17 with its outlet above the reel axis. This weir notch extends the full length of the reel and supplies wash liquor for all the threads being wound upon it. The wash liquor of course showers down upon the thread subjecting every portion of the thread upon the reel to flowing wash liquor. The length of each thread, taking into consideration the speed of thread travel, is sufficient so that by the time the thread leaves the reel it is completely washed. The wash water drains from reel 13a into a collecting trough 18 beneath it, from which it may be discharged to the sewer or recirculated to the supply trough 16.

In like manner the thread on the third reel, 13b, may be subjected to a desulphurizing process, as by treating it with a solution of an alkali sulphide distributed from a trough 19 by a weir notch 20 and collected by a receiving trough 21.

Likewise, in the fourth state, at reel 13c, the thread may be subjected to another washing step, with clear water, which is either circulated over and over again or discharged to the sewer.

Other reels may be provided for additional steps, such as a bath of bleaching material, another wash bath, etc.; but the reels, collecting troughs, pumps, etc., for such steps have been omitted for simplicity of illustration.

Finally, the thread is led to the last reel, 13d, where it is subjected to a drying operation. Reel 13d is disposed in a drying chamber 24 in a hollow casing 22 of sheet metal or the like, only a small portion of the reel projecting beyond the casing proper. The projecting portion of the reel may be practically entirely covered by means of a sheet metal closure adapted to permit the several threads to pass to and from said reel through very narrow slots or openings 22a. In the passage 25 leading to chamber 24 are finned heating coils 23, heated by steam or the like, and an adjustable damper 29 for regulating the quantity of the air supply. The chamber 24 communicates by passage 25 with a chamber 26 supplied by a fan or the like with a supply of air pre-conditioned as to moisture content, as by passing it through a suitable air conditioning apparatus conventionally shown at 26a. The chamber 24 also communicates by passage 27 with an outlet passage 28.

In the air conditioning device 26a the air is subjected to the action of a simple dehumidifier so as to fix its moisture content at a known amount. As it passes the heating coils 23, its temperature is raised to a point where it will leave a predetermined amount of moisture in the thread. Temperature control alone is sufficient to maintain uniform drying conditions in chamber 24. As a result, a control bulb 30 is placed in the discharge air passage and said bulb is adjustably associated with and is utilized to control a valve 31 in the steam supply line for the coils 23. The drying mechanism will accordingly au-

tomatically maintain uniform drying conditions and deliver the thread to the collecting device with any desirable maximum moisture content.

Figures 3, 4, 5 and 6 illustrate details of the reel mechanisms. Each reel includes a central rotatable shaft 32 having keyed to it at each end of the reel a spider-like end head 33 having a series of radial notches 33a in which are mounted the rectangular bars 14a, 14b. Each of the end heads 33 rotates adjacent a stationary cam disc 34 rigidly mounted and supported upon one of the cross frame members 3. Each cam member 34 is provided with two cam grooves 35, 36, and with two end face cams 37, 38. Each bar is provided at each of its ends with an operating member 39 fastened to it by rivets 40 or the like and including an end arm 41 entering one of the grooves 35, 36 and a shoulder 42 abutting one of the end cams 37, 38. The arrangements at the two ends of the reel are alike in the sense that the end grooves 35, 36 in one cam member 34 are reversed duplicates of those in the other, while the end cams 37, 38 on the two cam members are oppositely acting or the reverse of each other. End arms 41 on the bars of one group, such as the bars 14a, are offset from said bars radially outwardly, while the end arms 41 on the bars of the other group are offset radially inwardly, as shown in Figure 5.

The end cams 37, 38 produce longitudinal reciprocation of the bars 14a, 14b, whereas the groove cams 35, 36 produce radial motion of said bars, or, in other words, motion of said bars toward and from the central axis. As the shaft 32 rotates, it carries with it the two end heads 33 and causes the bars to move around like those of a squirrel cage, and as said bars travel their arms 41 and shoulders 42 travel in the cam grooves and along the end cams and cause the bars to reciprocate back and forth endwise and also to move in and out radially. The motion of said bars is diagrammatically illustrated and greatly exaggerated in Figure 3.

Generally speaking, the two cam grooves 35, 36 are circles slightly eccentric to each other and to the central axis, say by one-sixteenth of an inch in a seven inch diameter reel. They are not true circles, however. Considering the full 360° of the cage, there are two diametrically opposite zones M, Figure 3, each of about 30° circumferential extent, where neighboring bars of the two grooves are simultaneously in contact with the thread turns, and beyond these 30° zones M there are two very short zones N where the two sets of bars quickly change their relative radial positions, one group of the reel bars 14a moving inwardly and the group of bars 14b moving outwardly in one zone N, with the reverse action occurring in zone N on the opposite side of the reel. During travel through these zones M, N, while both sets of bars are in contact with the thread, and while they are rapidly changing their relative radial positions, the shoulders 42 are moving along flat portions of the end cams 37, 38 so that both groups of bars have no longitudinal motion in either direction. When the bars have changed their relative radial positions, one group moving inwardly and the other outwardly, so that the turns of the threads are supported on one group of the bars alone, then the end cams 37, 38 begin to be curved and to produce longitudinal bar motion, that group of bars in contact with the thread turns moving forward to advance the thread and that group out of the contact with the thread turns moving backwardly

or retreating to be ready for the next advance movement, and so on. From the practical standpoint, in the arrangement shown, thread advance occurs through approximately 270° of full rotation.

The end cams 37, 38 may vary in different reels, so as to provide different rates of progression or travel of the thread turns along different reels.

The operating mechanism may be of any suitable form, as, for example, an electric motor 50. A chain belt, or the like, designated 54, drives shaft 32 of the lowermost reel 13d. Said shaft is provided with a pulley 55 from which a belt 56 passes to a similar pulley on the shaft 32 of the next higher reel, and the drive is then from reel to reel by successive belts 56 and proper pulleys, as shown in Figure 1. Motor 50 is also connected by a belt 62 with a horizontal main line shaft 63 which, by belt 64, drives a pulley 65 on the shaft 66 of the collecting device 15. It will be understood that the same motor 52 may be used for driving any number of units such as those shown in Figure 1.

The apparatus should preferably be arranged for convenience in threading up, for which purpose successive reels are offset horizontally relative to each other, as shown in Figure 2. In other words, while the axes of the reels are parallel to each other, each reel is just a little nearer to the front of the machine than its predecessor reel next above it. The thread is wound upon the reels so that the leading and following portions of the thread, where the thread passes from reel to reel, are tangent to the reels at the front of the machine, but are not truly vertical. As a consequence, when the machine is threaded up, the free end of the thread is applied to one of the bars on the upper reel while it is rotating. The thread is then wound by the reeling operation upon the first or uppermost reel, the helical turns progressing bodily toward the right, Figure 1, until the discharge point is reached. The leading end of the thread is then picked off and is led down to the next reel, with similar operations at each of the successive reels, and thence to the final collecting device.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. Apparatus for the drying of artificial silk thread comprising a self-threading thread-storage, thread-advancing reel; supply means disposed in proximity to said reel for delivering moist artificial silk thread thereto; take-up means disposed in proximity to said reel for receiving dry artificial silk thread therefrom; a housing confining said reel, said housing having an opening exposing all of the thread turns on one side of said reel extending in the direction of the axis of the reel; and a curviform closure for said opening conforming to the shape of said reel.

2. Apparatus for the drying of artificial silk thread comprising a self-threading thread-storage, thread-advancing reel and, enclosing said reel, a housing made up of a stationary portion and a closure separated by a line of cleavage so located that the thread in passing to and from said reel enters and leaves said housing through said closure, said closure having slots for the thread at the edge thereof contiguous to said stationary portion.

3. Apparatus for the drying of artificial silk thread comprising a self-threading, thread-stor-

5 age, thread-advancing reel; a housing practically completely enclosing said reel, said housing having an opening exposing both the portion of the reel with which the thread initially contacts and the portion of the reel with which the thread finally contacts; and a closure for said opening having slots therein registering, when the clo-

sure is shut, with the respective paths taken by the thread in traveling toward and away from said reel.

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