

April 26, 1938.

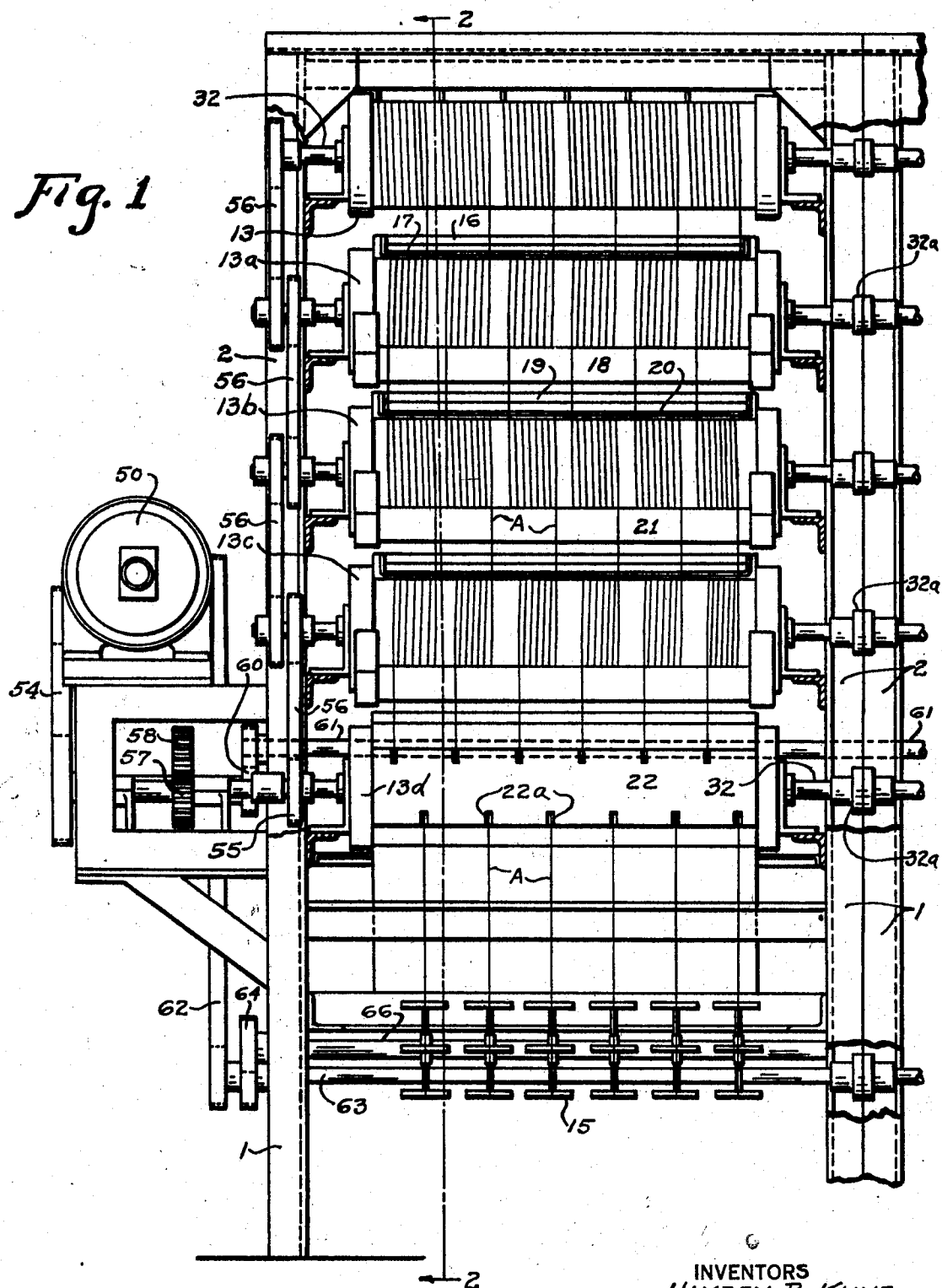
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2,115,025

MANUFACTURE OF THREAD OR THE LIKE

Original Filed Jan. 12, 1933 2 Sheets-Sheet 1

Fig. 1



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2 Sheets-Sheet 2

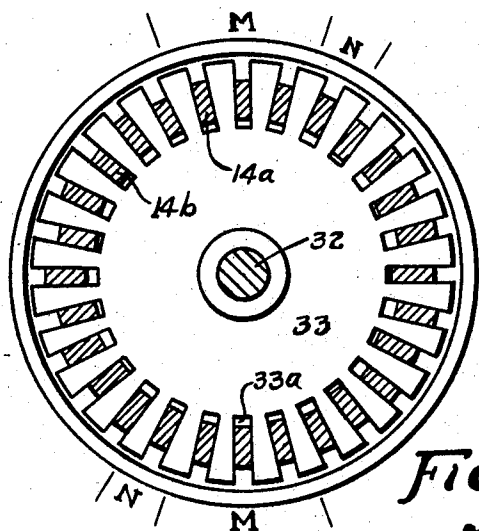


Fig. 3

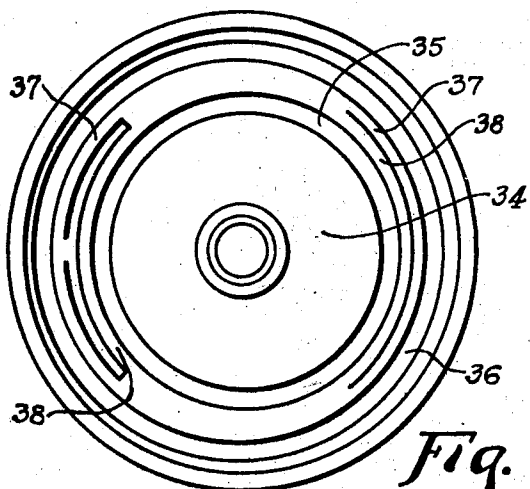


Fig. 4

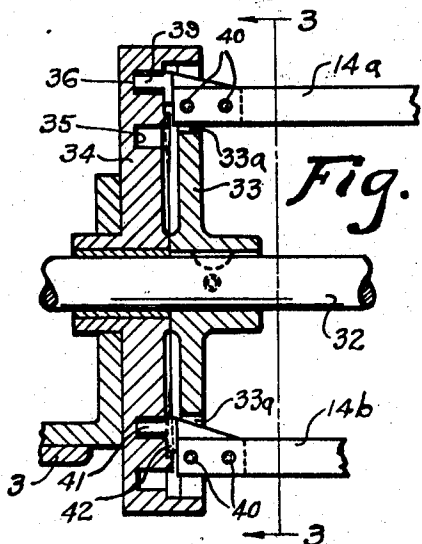


Fig. 5

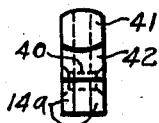
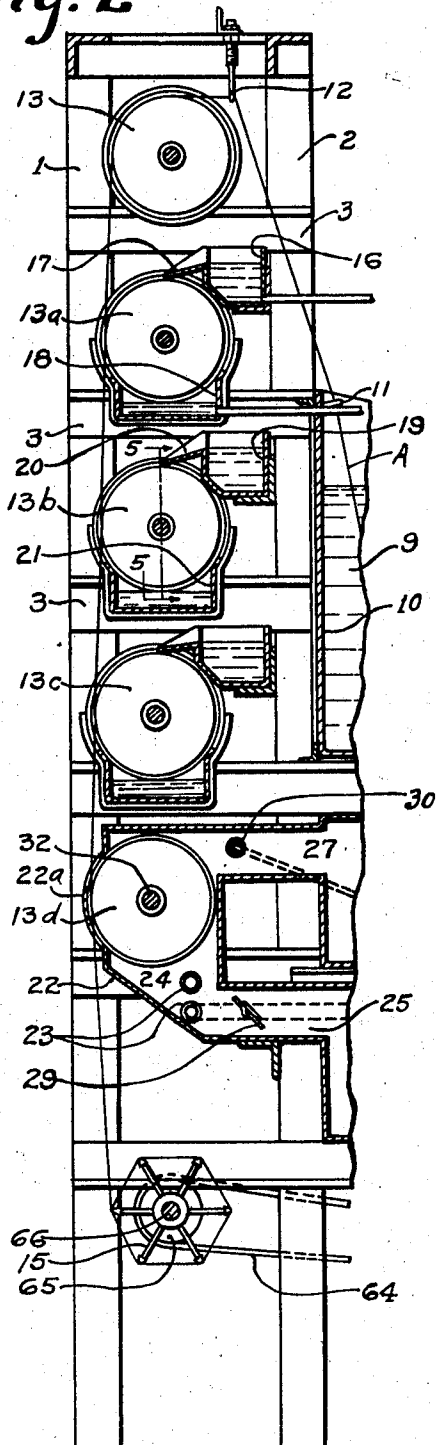


Fig. 6

Fig. 2



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MANUFACTURE OF THREAD OR THE LIKE

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Original application January 12, 1933, Serial No. 651,404. Divided and this application November 5, 1935, Serial No. 48,356.

3 Claims. (Cl. 18—54)

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 provide a manipulative process by or as a result of 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. The invention further aims to provide a process making possible a closer degree of control in the manufacture of thread or the like, particularly artificial silk thread, with the consequent advantage of greater uniformity of product. 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 of part of the machine on the line 2—2, Fig. 1, looking in the direction of the arrows, other 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 familiar viscose process of manufacturing artificial silk thread. The purpose of the invention is, among other things, to provide a method 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 upon a collecting device into suitable package form convenient for handling or shipment.

In the viscose process, generally speaking, an alkaline solution of cellulose 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 cake form, is subjected to various treatments, including washing, desulfurizing, bleaching, souring, 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 one or 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 pipes, pumps, spinnerets, etc. (not shown). In placing the machine in operation, the spinnerets are immersed in the usual way beneath the surface of the acid coagulating bath 9 in trough 10. The thread A extruded from each spinneret 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 lead 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 known 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 one thread or a plurality of threads, six threads being shown in the drawings. The particular reel illustrated is 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, although, for clearness of illustration, the turns are shown 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 and the thread upon it 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 or moist condition and the time necessary for the thread to pass to the feeding on point and progress along reel 13 to the place of discharge therefrom is utilized to per-

mit complete regeneration of the cellulose content of the viscose.

The drawings show the second stage 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 and subjects every portion of the thread upon the reel to flowing wash liquor. The length of each thread upon the reel, 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 stage, 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 enclosed within a drying chamber 24 in a hollow casing 22 of sheet metal or the like, the several threads passing to and from said reel through very narrow slots or openings 22a. In the casing 22 are finned heating coils 23, heated by steam or the like. The drying chamber 24 of said casing communicates by a passage 25 with a supply of air pre-conditioned as to moisture content. The chamber 24 also communicates by passage 27 with an outlet passage. As the air passes the heating coils 23, the temperature of the air is raised to a point at which it will leave a predetermined amount of moisture in the thread.

Figures 3, 4 and 5 illustrate in detail one 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.

Of course, the several reels of a given unit, or, in other words, those reels traversed in order by a single thread from the coagulating bath to the collecting devices, should be so proportioned to each other as to operate in harmony without detrimental effect upon the thread. In other words, there must be an organized timed relation between the reels of a single unit and the same timed relation should persist throughout all the units of a single machine. In addition, the reels of a given unit should bear proper relation to each other, particularly as to their relative circumferential dimensions. If it is assumed that there is no longitudinal stretch or shrinkage in the thread as it progresses through the unit, the effective circumferential dimensions of all of the reels of the given unit should be identical, and, in any event, care should be taken to see that no reel has an effective circumferential dimension less than that of its predecessor; otherwise, slack in the thread would be produced between the two reels.

Preferably, each reel has an effective circumference very slightly greater, if anything, than the circumference of its predecessor, so as to insure absence of slack in the carry-over portion of the thread from reel to reel; but, if preferred, any desired definite amount of stretch may be put into the thread between successive reels by making the following reel greater in circumference than its predecessor. The differences in circumference, however, usually should be very slight unless, as in the latter case, it is desired to impart considerable stretch to the thread, when any desirable differences in diameter may be resorted to. A similar effect may be accomplished by so arranging the driving mechanism as to drive different reels at different speeds. An increase in the angular speed of a following reel obviously requires stretch of the thread.

The apparatus should also 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. Preferably, however, the reels are provided with means to cause the leading free end of the thread to automatically pass from reel to reel, to thereby automatically thread up the entire machine.

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. In the manufacture of thread or the like by a process pursuant to which the thread or the like is subjected to processing treatment on one or more of a plurality of vertically spaced thread-advancing reels, the method of threading up comprising applying the thread or the like to an upper reel of said plurality of thread-advancing reels; causing the thread or the like to progress in generally helical form along the surface of said upper reel; manually disengaging the leading end of the thread or the like from said upper reel; causing the leading end of the thread or the like, aided by gravity, to be brought into proximity to a lower reel of said plurality of thread-advancing reels; applying the leading end of the thread or the like to said lower reel; and causing the thread or the like to progress in generally helical form along the surface of said lower reel.
2. In the manufacture of thread or the like by a process pursuant to which the thread or the like is subjected to processing treatment on one or more of a plurality of vertically spaced thread-advancing reels, the method of threading up comprising causing the thread or the like to progress in generally helical form along the surface of an upper reel of said plurality of thread-advancing reels; manually transferring the leading end of the thread or the like, aided by gravity, from the

surface of said upper reel to the surface of a lower reel of said plurality of thread-advancing reels; and causing the thread or the like to progress in generally helical form along the surface of said lower reel.

3. In the manufacture of thread or the like by a process pursuant to which the thread or the like is subjected to processing treatment on one or more of a plurality of vertically spaced thread-advancing reels corresponding portions of which face toward a common front, the method of threading up comprising applying the thread or the like to an upper reel of said plurality of thread-advancing reels, causing the thread or the like to progress in generally helical turns along the surface of said upper reel, manually disengaging the leading end of the thread or the like from the portion of the reel facing said common front, causing the leading end of the thread or the like, aided by gravity, to be brought into proximity to a lower reel of said plurality of thread-advancing reels, applying the leading end of the thread or the like to said lower reel, and causing the thread or the like to progress in generally helical turns along the surface of said lower reel.

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