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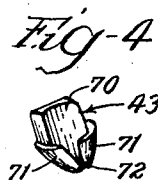
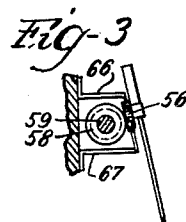
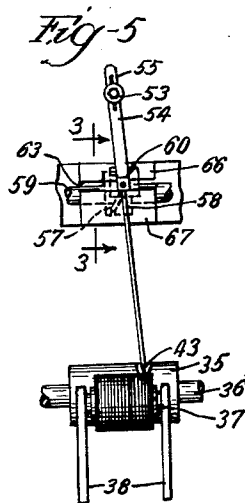
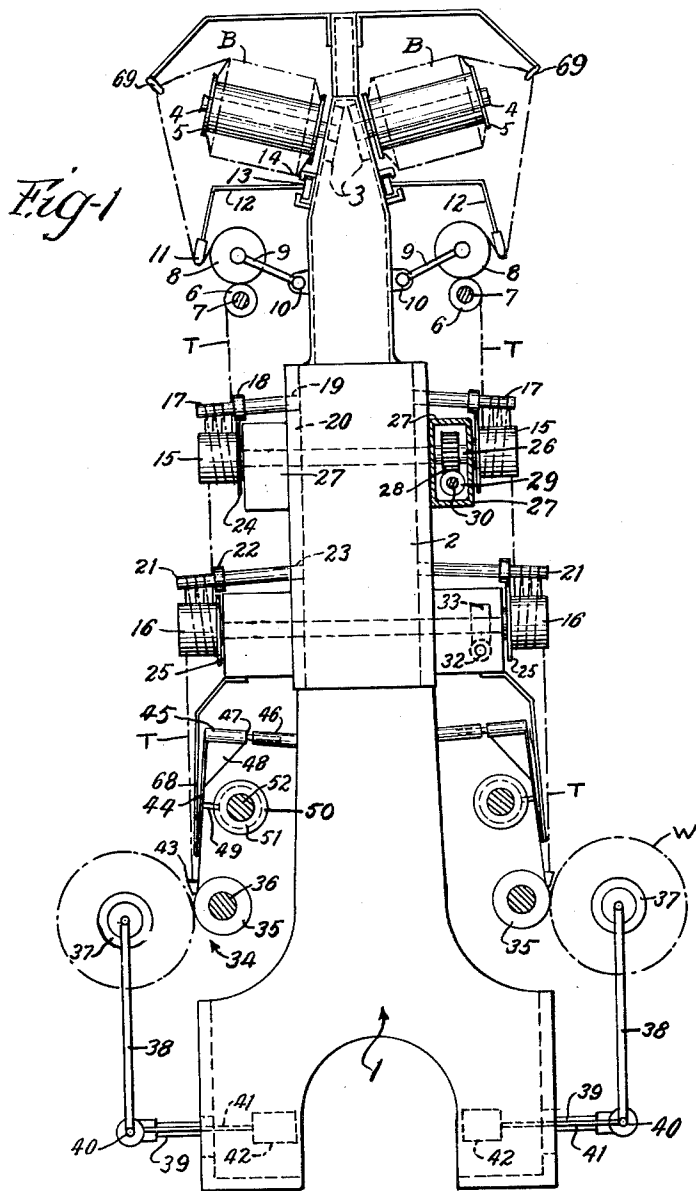
H. SCHIPPERS

3,069,745

STRETCH-SPOOLING MACHINES

Filed March 9, 1959

2 Sheets-Sheet 1



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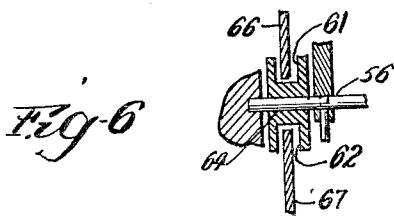
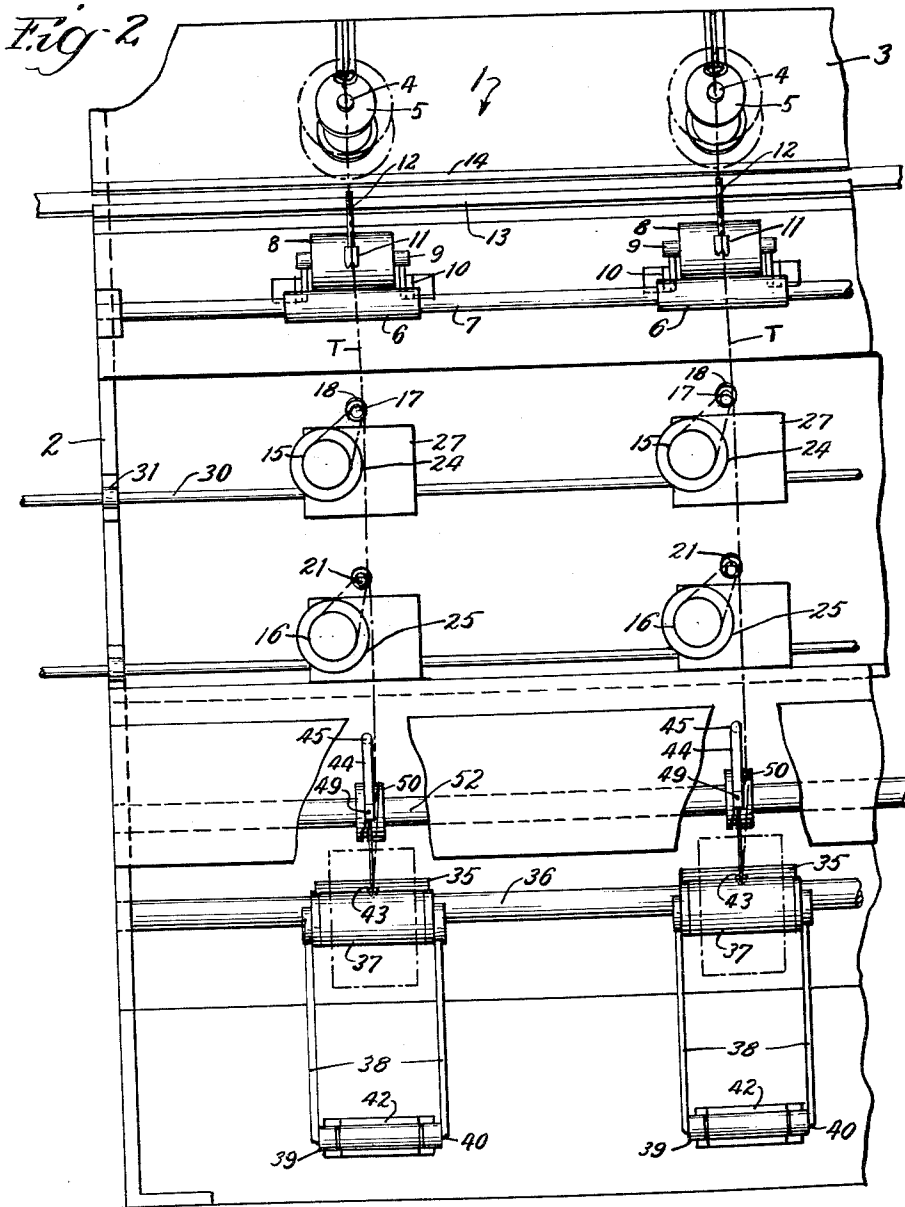
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STRETCH-SPOOLING MACHINES

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6 Claims. (Cl. 28—71.3)

This invention, in general, relates to stretch-spooling processes and machines in which synthetic threads such as threads composed of unbroken filaments may be first stretched to a multiple of their original length and then wound in untwisted state.

Hitherto, the stretching of threads composed entirely of synthetic filaments was generally accompanied with a twisting of the filaments about each other. For this purpose a twisting device was employed as a part of the stretch-winding mechanism. In particular, the well known ring twist device was positioned at the outlet side of the stretching mechanism to twist the stretched threads as well as wind them. It has, however, also been suggested that such synthetic filament threads, after the stretching, be simply wound and that a twisting, if need be, be carried out later in a separate operation. In comparison to stretch-twisting, a simplification and acceleration of the individual operations and a greater choice of types of the further processing of the threads results from a non-twist winding.

In stretch-spooling, which will be understood to mean a stretching of the thread followed by a winding or spooling thereof without imparting a twist to the thread between the stretching and spooling operations, directly driven bobbin heads have been used, to which bobbin heads the thread was conducted by way of a feeler lever located at a thread hoard. The feeler lever in this arrangement acted on an adjustable speed gear in the drive of the bobbin head or on the adjustable speed drive motor itself in such a manner that the winding rate of revolution of the bobbin head was always adjusted to the amount of thread delivered from the stretching rollers.

In the case of threads with a relatively great tendency to shrinkage after stretching, however, disadvantages appeared with these machines. These disadvantages were caused by the fact that the thread just stretched, not yet fully oriented as to its molecular structure, was subjected to intolerable strains on its molecular structure by the sharp deflections in the thread hoard. Also, the control of the winding speed could not always take into account the degree of shrinkage, so that excessively hard, tight windings resulted, which in further processing yielded a qualitatively inferior thread.

The present invention is predicated upon improving upon these disadvantages occurring in the known stretch spooling machines. The machine of my invention can be used in the stretching of threads composed of unbroken, synthetic polymer filaments by either a single or double stretching operation of the threads, according to the cold or hot-stretching process, in which the threads are stretched to a number of times their original length and then wound in untwisted state.

According to my invention, the drive for the winding spool or bobbin is a drive roller in frictional drive with the thread winding. The drive roller is driven at the same peripheral velocity or at a peripheral velocity lower than the peripheral velocity of the last stretching roller to compensate wholly or at least in part for the shrinkage of the thread in the thread path between the last stretching roller and the winding bobbin or spool. The drive roller and spool or bobbin are mounted directly beneath the last stretching roller. A traverse-motion thread

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guide for distributing the thread in even layers on the spool or bobbin is positioned immediately ahead of the contact point of the running thread with the winding. In this manner, the freshly stretched thread is not subjected to any undesirable sharp deflections. Furthermore, the thread runs to the winding spool in loose state and without tension, so that it can shrink on its way to the winding. It can be taken up on the spool at constant linear speed, usually somewhat reduced, however, in comparison to the linear speed of discharge from the last stretching roller, almost without tension. A small residual shrinkage of the thread may occur after winding without detrimental effect—in fact, this shrinkage may improve the tightness and compactness of the winding.

An especially simple and effective arrangement in my new winding mechanism for stretch-spooling machines is the use of a transverse-motion thread guide designed as a rocking lever, which engages, through a follower pin, an endless curved groove of a rotating cylinder. Each rocking lever may be driven individually or several may be ganged by a connecting bar so as to be driven from one follower pin and grooved cylinder. Here, the position of the pin and of the rotating cylinder can be made such that the reciprocal stroke across the rotating cylinder is considerably smaller, for example, less than 50%, than the reciprocal distribution stroke of the thread guide at the winding spool. Furthermore, the rocking lever can be mounted to slide on its pivot in the longitudinal direction. In this arrangement, the follower pin riding in the curved groove of the rotating cylinder has a slide member oscillatable in guides extending in the general direction of oscillation of the rocking lever. Such arrangements make it possible for the arc which the thread conducting guide at the free end of the rocker arm describes in the oscillating swinging movement of the thread guide to be flatter, so that any possible tendency to the formation of thread accumulations at sharp angles in the thread path can be reduced. For example, for this purpose, the rocking lever may have at one end a slot guide through which extends a shaft or bolt serving as the pivot axis. The slide member of the follower pin may be a slide ring, a roller or the like guided in members forming a slot, which may be straight or an arc curved oppositely to the arc of normal swinging movement of the rocker lever.

Furthermore, other devices can be provided which bring about a periodic thread distributor stroke change or displacement and serve to form more gentle winding edges or provide special winding forms. This can be achieved by suitable axial displacement of the rotating cylinder, or by oscillating motion imparted of the rocking lever bearing. Likewise, the speed with which the thread guide is moved back and forth can be controlled in a desired pattern by variable speed outputs in the drive for rocking the arm. Finally, the thread distribution devices with the transverse-motion thread guide can be driven in each case individually or in groups or all in common, and with these drive arrangements they can be shielded with a protective wall to such an extent that only the outermost end of the rocker arm and thread guide remain exposed.

In this manner it is possible in the winding even of finest and most delicate fully synthetic threads immediately after the stretching to assure an especially delicate handling of the thread and also to obtain a good winding structure.

Embodiments of my invention are illustrated in the drawings wherein:

FIG. 1 is a side elevation of a stretch-spooling machine, with portions thereof in cross-section to better illustrate individual parts thereof;

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FIG. 2 is a partial, front elevation of the embodiment of FIG. 1 showing two units mounted along the length of the machine;

FIG. 3 is a cross-sectional view taken on section 3-3 of FIG. 5;

FIG. 4 is a perspective view of the thread guide of the rocker arm;

FIG. 5 is a partial view of the machine showing a modification in the thread-laying mechanism; and

FIG. 6 is an enlarged cross-sectional view of the guide for the thread-laying mechanism of FIG. 5.

The embodiment of a stretch-spooling machine of the present invention comprises a long machine frame 1, shown only in part, having a vertical support 2 at each end thereof and as many intermediate vertical supports (not shown) as is necessary to provide the required rigidity. The top of the frame 1 has a pair of parallel horizontal bars 3 on which are mounted, at an upward angle to the horizontal, journal shafts 4 for supporting thread supply spools 5 having a wound body B of threads of synthetic polymer filaments.

Each of the thread supply spools 5 compose the upper unit of individual stretch-spooling mechanisms described hereinafter. The thread T is drawn off the spool for frictional contact with a drive roller 6 mounted on a rotatably driven shaft 7 running the length of the machine frame 1. The thread T is held in frictional contact with the drive roller 6 by a pressure roller 8 after the thread T has passed about the major portion of the circumference of the pressure roller 8. The pressure roller 8 is urged by gravity against the drive roller 6 and is rotatably mounted on a pair of pivot arms 9 pivotably mounted at 10 on the machine frame 1.

If desired, a reciprocal thread guide 11 may be interposed between the spool 5 and the rollers 6, 8 to reciprocate the thread path back and front on the surfaces of the rollers 6 and 8 and thereby prevent uneven wear on the rollers which would otherwise arise through continued passage of the thread over one path on the rollers. Each of the thread guides 11 on one side of the machine frame are reciprocated in unison by means of mounting arms 12 for each thread guide 11, each arm 12 being attached to a reciprocable bar 13 mounted for reciprocal movement in bearing members 14.

The rollers 6, 8 draw the thread T off the spool 5 at a constant linear thread velocity. The thread T then travels downwardly to an upper stretching roller mechanism and thereafter passes in a downward direction to a lower stretching roller mechanism. The upper stretching roller mechanism is composed of a rotatably driven roller 15 driven at a constant angular velocity providing approximately the same linear speed to the thread as the linear speed imparted by the rollers 6, 8 or a greater velocity if stretching is to be imparted to the thread between the rollers 6, 8 and the roller 15. To secure adequate frictional contact between the roller 15 and the thread T the thread passes around a small roller 17 which is canted with respect to the roller 15. The canted relationship between the rollers 15 and 17 causes the thread paths around the two rollers to move progressively outwardly and thus avoid entanglement of the thread in its plural paths about the two rollers. The guide roller 17 has mounted thereon a ring 18 which prevents accidental displacement of the thread path inwardly of its desired path of travel. The guide roller 17 is journaled for free rotation at 19 in a side plate 20 of the machine frame 1.

The lower stretching roller mechanism is of similar construction to the upper roller stretching mechanism and is composed of a driven roller 16 and canted guide roller 21 having a ring 22 and journaled in the plate 20 at 23. The linear velocity imparted to the thread by the lower stretching roller 16 is usually greater than the velocity imparted by the roller 15—thereby providing a stretch to the thread running between the two

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roller mechanisms. In machines utilizing a hot-stretch process, suitable heated bars, heated electrically or by means of steam, Dowtherm vapors or the like, may be mounted on the frame 1 in positions where the heating devices contact the running thread between the upper and lower stretching roller mechanisms. Further, the rollers 15 and 16 may be provided with rings 24 and 25, respectively, at the inner ends thereof to prevent accidental displacement of the running thread off the rollers 15 and 16.

One means for driving the rollers 15 and 16 in pairs on opposite sides of the frame is shown with the upper right hand roller of FIG. 1. A drive shaft 26 is rotatably journaled in the frame 1 and housings 27. A gear 28 is driven by worm gear 29. The worm gear drive 29 for each pair of opposed rollers in the upper horizontal rows is driven by a common drive shaft 30 rotatably mounted in bearings 31 on the machine frame. The drive shaft 30 is driven at a constant speed by a power source (not shown). The right hand lower row of rollers is driven by a similar gear mechanism activated by drive shaft 32, which rotatably drives the gears 33. The left hand roller mechanisms in FIG. 1 are driven by shafts connecting in pairs the left hand rollers with the right hand roller, but they may be driven by worm gear drives similar to those previously described, which worm gear drives extend along the left hand side of the frame in a manner similar to that shown for the worm gear drive on the right hand side of the frame.

After the thread leaves the lower roller mechanism, it is wound by a winding mechanism which operates at a constant linear take-up velocity. The linear take-up velocity of the winding mechanism may operate at a speed which is equal to the linear velocity of the thread leaving the lower stretching roller or at a take-up velocity which is less than the linear velocity of the thread leaving the lower stretching roller. In many cases, the thread running between the lower stretching roller and the winding mechanism undergoes a shrinkage. If this shrinkage is to be permitted, the take-up velocity of the winding mechanism must be lower than the linear velocity of the thread leaving the lower stretching roller by an amount equal to the amount of shrinkage occurring between the lower stretching roller and the winding mechanism. In other instances, it may be considered desirable to prevent the shrinkage, in which case the take-up velocity of the winding mechanism is equal to the linear rate of discharge from the lower stretching roller. In still other instances, it may be considered desirable to permit only partial shrinkage in which case the take-up velocity of the winding mechanism will lie between the two extremes—the linear velocity of the thread leaving the stretching roller 16 and the last-mentioned linear velocity less the amount of shrinkage which would occur in the stretch of thread running without tension between the stretching roller 16 and the winding mechanism.

In order to attain maximum control of the amount of shrinkage occurring between the lower stretching roller 16 and the winding mechanism, the winding mechanism, designated generally at 34, is constructed to operate at a constant linear take-up velocity. This is achieved by using a drive roller 35 which is in frictional contact with the thread, the drive roller 35 being driven at a constant angular velocity by drive shaft 36 connected with a power source (not shown). A spool or bobbin carrier 37, mounted on swinging arms 38, contacts the drive roller 35 with the tangent between the two being substantially in line with the thread path approaching the winding mechanism 34 so as to avoid any sharp corners in the path of thread travel. The swinging arms 38 are pivotally mounted at 40 on fixed arms 39. The spool or bobbin is urged into frictional contact with the drive roller 35 by providing an arm 41 having a weight 42, which arm 41 is rigidly connected with swinging arms

38 in a manner to urge the spool or bobbin toward the drive roller 35.

As the diameter of the winding W on the spool or bobbin carrier 37 increases, the axis of the winding and carrier is pivoted away from the roller 35—this action being permitted by the pivotal mounting 40 of the swinging arms 38. By providing the drive roller 35, which operates at a constant angular velocity, the linear take-up velocity of the thread by winding mechanism 34 is independent of the diameter of the winding W and remains substantially constant throughout the entire winding on a given spool or bobbin.

The thread on the winding W is wound in even, superposed layers by the provision of a reciprocable thread layer 43 mounted at the end of a swinging arm 44. This arm oscillates back and forth during the winding operation to distribute the thread in even superposed layers in the winding W. The thread layer 43 is positioned immediately ahead of the point of contact between the drive roller 35 and the winding W and its guiding contact with the running thread is positioned so that there is no sharp angle as the thread passes through the thread layer 43 to the winding mechanism 34.

In the embodiment shown in FIG. 1, the reciprocal thread layer 43 follows an arcuate path during the oscillation of the swinging arm 44 by virtue of the pivotal mounting of the swinging arm 44 on axis arm 45, which, in turn, is pivotably mounted in a fixed bearing arm 46 by means of a shaft 47 rotatably mounted in bearing arm 46. A triangular reinforcing plate 48, connecting swinging arm 44 and axis arm 45, provides additional rigidity.

The swinging arm 44 is oscillated by means of a follower pin 49 extending outwardly therefrom at a point intermediate the ends of the arm 44. The follower pin 49 rides in an endless, curved, camming groove 50 in the cylindrical surface of a roller 51. The roller 51 is driven rotatably by a rotatably mounted drive shaft 52 rotatably driven by a power source (not shown). The camming groove 50 is an endless groove which arcuately bends in one direction over 180° of the roller circumference and arcuately bends in a similar manner in the opposite direction over the other 180° of the roller surface.

FIGS. 3 and 5 show a modification for the mounting of the swinging arm whereby the arc normally taken by the oscillation of the thread guide 43 may be either completely or partially flattened out. Referring to FIG. 5, on the shaft of a fixed bolt 53 is mounted a pendulous or swinging arm 54. The arm 54 is mounted for pivotal movement on the bolt 53 and also may move axially on said bolt by the provision of an axial slot 55 through which the shaft of the bolt 53 extends. The pendulous or swinging movement is imparted to the arm 54 by a follower pin 56 extending outwardly from the arm 54 at a point intermediate the ends thereof. The follower pin 56 rides in a curved, endless, camming groove 57 provided in the cylindrical surface of a rotatable drum 58, which, in turn, is rotatably driven by the drive shaft 59. The drive shaft 59 is rotatably driven at a constant speed by a power source (not shown).

The path of oscillating movement taken by the swinging arm 54 is controlled by a slide head designated generally at 60. Referring to FIG. 6 along with FIG. 5, the slide head 60 is a rectangular plate having upper and lower guiding grooves 61 and 62, respectively. The slide head 60 rides in the slot 63 formed by the opposing front plates or brackets 66 and 67. The follower pin 56 extends through an aperture 64 in the slide head 60 and is loosely positioned therein so as to be rotatable with respect to the slide head 60. The guiding motion of the slide head 60 is imparted through the follower pin 56 and, coupled with the mounting of the swinging arm 54 by the slotted connection 55, the pendulous motion of the swinging arm 54 is changed to a straight line motion rather than an arcuate motion. In this manner, the

path of the thread guide 43 at the end of the swinging arm 54 can be made to follow a more linear reciprocal path rather than an arcuate path. If desired, other paths of reciprocal motion may be attained by making the slot 63 curved rather than linear.

In order to prevent entanglement of the running thread with the swinging arm 44 (FIGS. 1 and 2) or 54 (FIG. 5) there may be provided a protective wall 68 mounted at a suitable point on the machine frame. This wall extends downwardly over a major portion of the swinging arm and its associated actuating mechanism. The drawing off of the thread from the spools 5 may be improved by providing a pigtail guide 69, or a roller if desired, which is positioned at the outer end of the spool 5. This guide point facilitates the drawing off of the thread T over the outer end of the spool 5.

One type of thread guide which may be used at the end of the swinging arms 44 or 54 is shown in FIG. 4 wherein the thread guide has a slipper-like shape. The thread guide has an arcuately grooved face 70 and terminates in a raised portion 71. The thread guiding function is provided by a tapered slot 72 formed between the raised portion 71 on each side of the thread guiding member.

Thus, my invention provides a machine for stretch-spooling of synthetic polymer threads or filaments with close control of stretching and winding conditions whereby the stretched and wound thread is of substantially uniform quality. The individual stretch-spooling units are compact and are positioned on the frame to make servicing thereof simple. The individual components are of a general design permitting their ready adaptation to the needs of a particular stretch-spooling process.

The invention is hereby claimed as follows:

1. In a stretch-spooling machine, a first roller mechanism, a second roller mechanism positioned below said first mechanism and operable to impart a thread linear velocity greater than the thread linear velocity on said first roller mechanism to stretch the thread running therebetween, means including a rotatably driven roller above said first mechanism for supplying thread at a predetermined linear velocity, winding means below said second mechanism for winding at a constant linear velocity the thread leaving said second mechanism, said winding means including a friction drive roller operable on thread wound by said winding means, and reciprocal means including a thread guide for laying the thread in layers on a spool on said winding mechanism with the thread guide being positioned between said friction drive roller and said thread wound by said winding means.

2. In a stretch-spooling machine, a first roller mechanism, a second roller mechanism positioned below said first mechanism and operable to impart a thread linear velocity greater than the thread linear velocity on said first roller mechanism to stretch the thread running therebetween, means above said first mechanism for supplying thread at a predetermined linear velocity, winding means below said second mechanism for winding at a constant linear velocity the thread leaving said second mechanisms, and a pivotally-mounted, pendulous lever having thread guide means on an end thereof located adjacent said winding means, said pendulous lever being actuated by a follower mechanically connected with said pendulous lever, which follower rides in a curved, endless groove in the surface of a rotatable drum.

3. In a stretch-spooling machine, a first roller mechanism, a second roller mechanism positioned below said first mechanism and operable to impart a thread linear velocity greater than the thread linear velocity on said first roller mechanism to stretch the thread running therebetween, means above said first mechanism for supplying thread at a predetermined linear velocity, winding means below said second mechanism for winding at a constant linear velocity the thread leaving said second mechanism, said winding means including a friction drive roller oper-

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able on thread wound by said winding means, a pendulous lever having a thread guide on an end thereof located adjacent said winding means, said pendulous lever being slidably and pivotally mounted on an axis positioned at a point above said winding means, said pendulous lever being actuated by a follower mechanically connected with said pendulous lever, which follower rides in a curved, endless groove in the surface of a rotatable drum, and guide means operatively connected with said pendulous lever for translating the path of motion of said pendulous lever to a predetermined path of travel during pendulous motion thereof.

4. The combination of claim 3 wherein the predetermined path is a substantially straight line.

5. In a stretch-spooling machine, a first roller mechanism, a second roller mechanism positioned below said first mechanism and operable to impart a thread linear velocity greater than the thread linear velocity on said first roller mechanism to stretch the thread running therebetween, means including a rotatably driven roller above said first mechanism for supplying thread at a predetermined linear velocity, winding means below said second mechanism for winding at a constant linear velocity the thread leaving said second mechanism, said constant linear velocity lying between (a) the linear velocity of the thread leaving the second roller mechanism and (b) the last-mentioned linear velocity less the amount of shrinkage occurring in the running thread between said second roller mechanism and said winding means, said winding means including a friction drive roller operable on the thread wound by said winding means, and reciprocal means including a thread guide for laying the thread in layers on a rotating spool on said winding means with the thread guide being positioned between said friction drive roller and said thread wound by said winding means.

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6. In a stretch-spooling machine, a first roller mechanism, a second roller mechanism positioned below said first mechanism and operable to impart a thread linear velocity greater than the thread linear velocity on said first roller mechanism to stretch the thread running therebetween, means above said first mechanism for supplying thread at a predetermined linear velocity, winding means below said second mechanism for winding at a constant linear velocity the thread leaving said second mechanism, said constant linear velocity lying between (a) the linear velocity of the thread leaving said second mechanism and (b) the last-mentioned linear velocity less the amount of shrinkage occurring in the running thread between said second mechanism and said winding means, and a pivotally-mounted, pendulous lever having thread guide means on an end thereof located adjacent said winding means, said pendulous lever being actuated by a follower mechanically connected with said pendulous lever, which follower rides in a curved, endless groove in the surface of a rotatable drum.

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