Dec. 16, 1941. H. B. KLINE 2,266,557

APPARATUS FOR HANDLING THREAD OR THE LIKE

Filed July 15, 1939 2 Sheets-Sheet 1

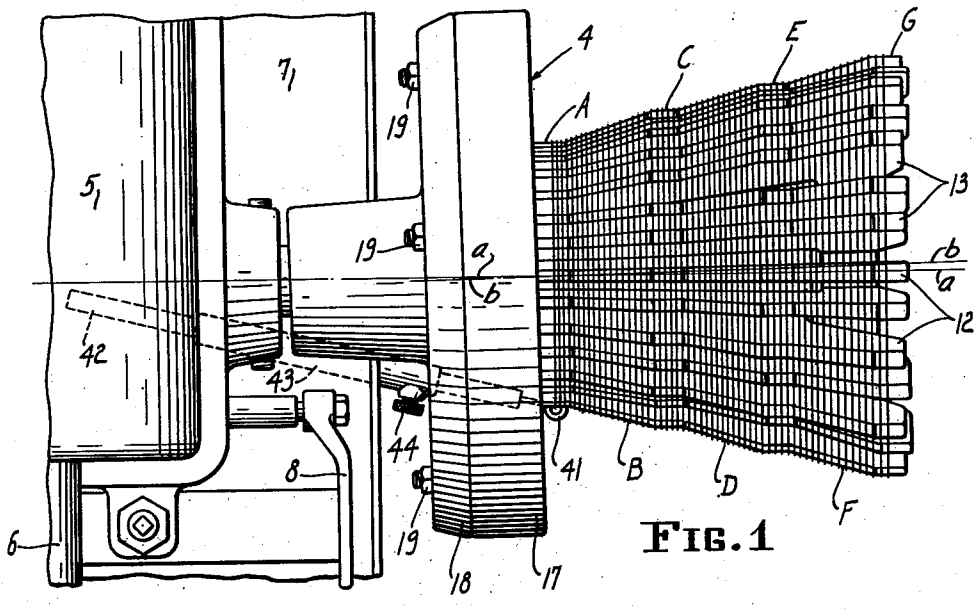


FIG. 1

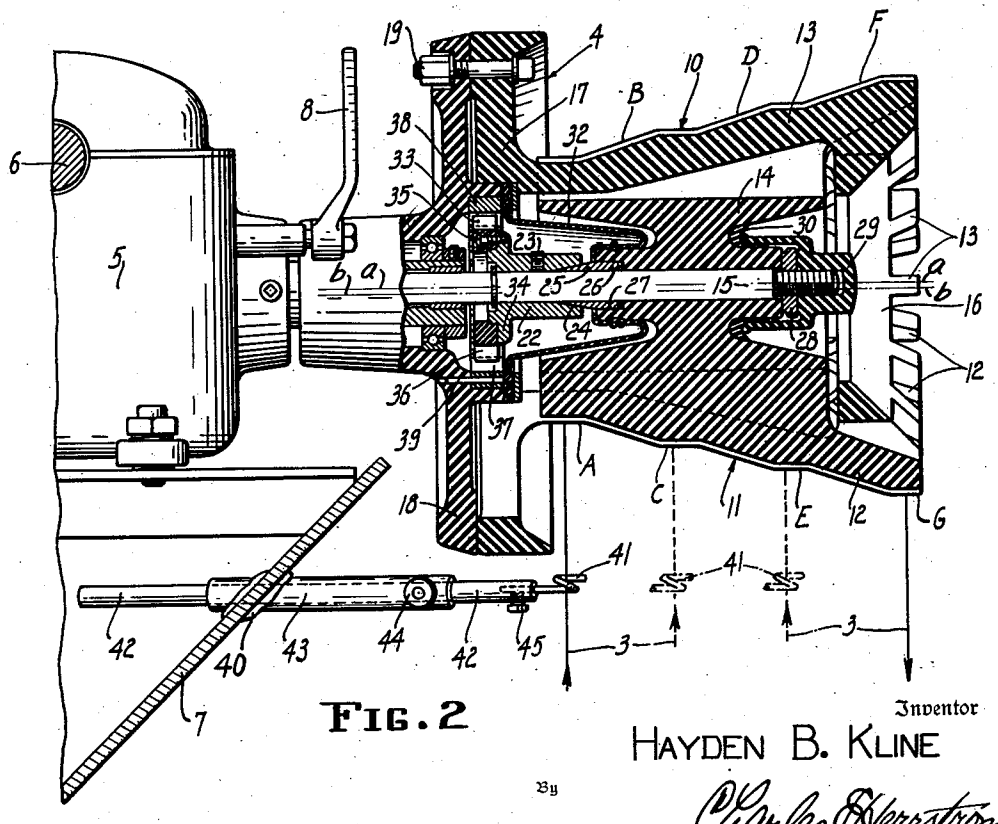


FIG. 2

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APPARATUS FOR HANDLING THREAD OR THE LIKE

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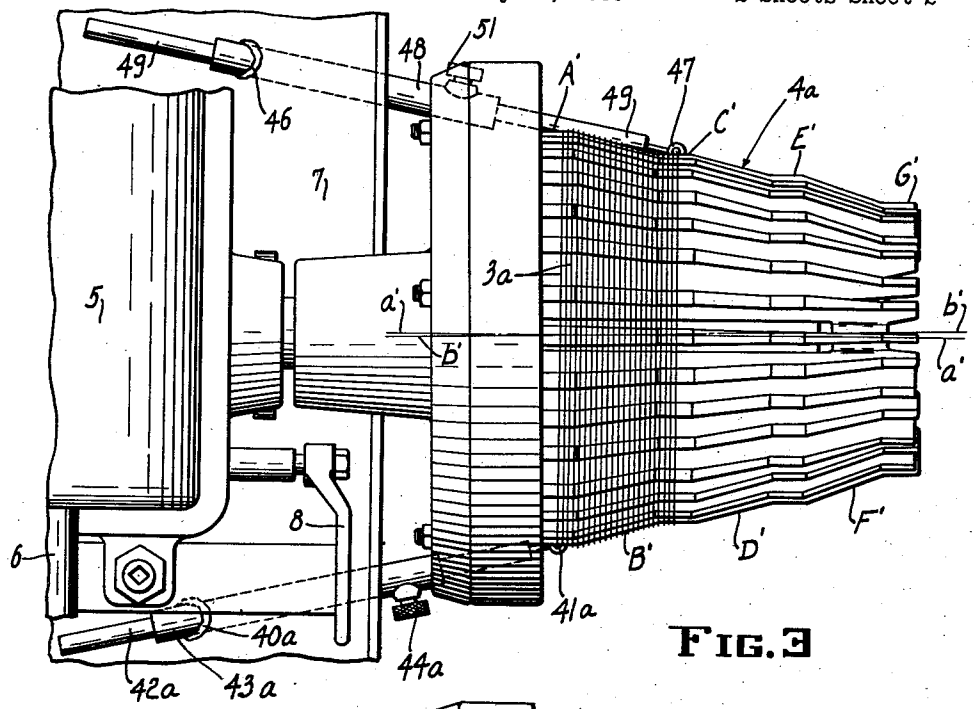


FIG. 3

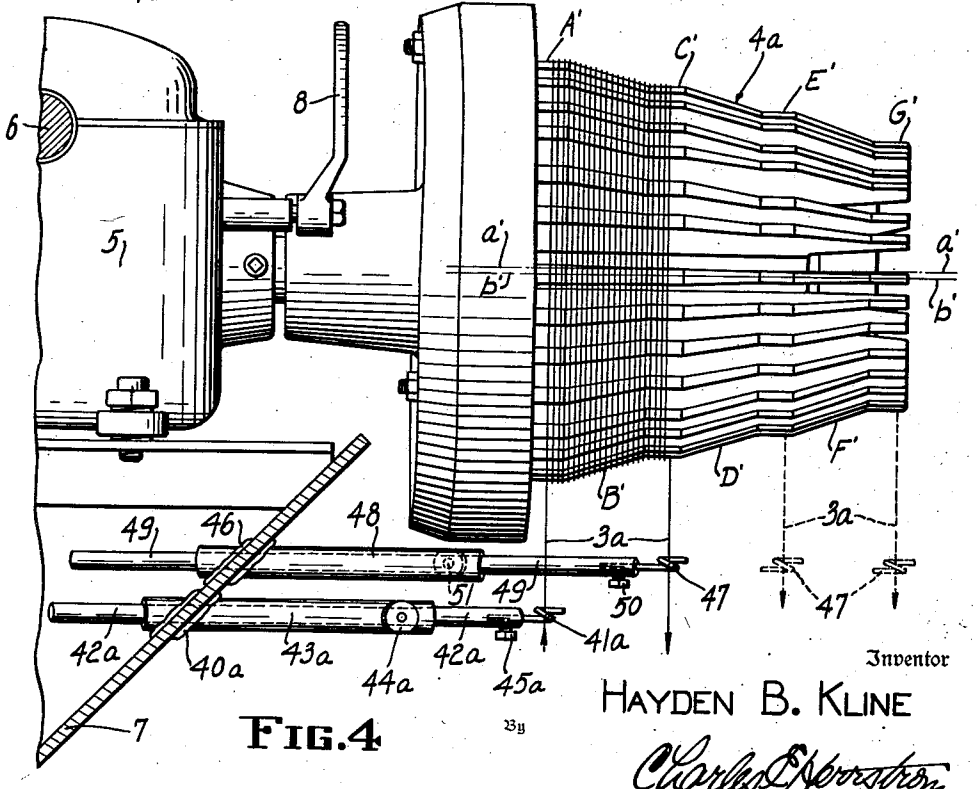


FIG. 4

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UNITED STATES PATENT OFFICE

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APPARATUS FOR HANDLING THREAD OR THE LIKE

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Application July 15, 1939, Serial No. 284,639

7 Claims. (Cl. 28—57)

This invention relates to improved means for selectively imparting to thread or the like a predetermined degree of stretch or relaxation. More particularly, the invention is concerned with means for introducing into the thread or the like upon one and the same thread-handling device any desired one of several different degrees of stretch or any desired one of several different degrees of relaxation. As hereinafter employed in the specification and in the appended claims, the term "thread" will be used in a generic sense, the intention being to include all forms of single or multiple filament threads, cords, ropes, tapes and the like.

Many difficulties have been experienced in the past in the operation of thread-handling apparatus employed under conditions involving a change in the tension of the thread. In an effort to overcome these difficulties, it has been proposed from time to time to use thread-advancing thread store devices; for example, thread-advancing reels, which are characterized by flared or tapered contours over which the thread may be advanced in turns of progressively varying diameter. In spite of obvious advantages provided by apparatus of this kind, complications arise out of the fact that such devices are adapted to operate only a comparatively limited range; in other words, they are as a rule not of general application.

Among other things, thread-advancing thread store devices which are flared or tapered from one end thereof to the other are disadvantageous for the reason that it is virtually impossible to subject the thread to conditions other than those for which the device was designed. To feed the thread onto the device at any point other than the intended lead-on point or to withdraw the thread at any point other than the intended take-off point involves operating difficulties. Furthermore, the feeding of the thread to and/or its withdrawal from the device at different points along its periphery leads to uncertainties as to the exact amount of stretch or relaxation which has been imparted to the thread.

The present invention contemplates, among other things, the employment in apparatus for the manufacture and/or processing of thread of a thread-advancing thread store device the periphery of which comprises alternately arranged cylindrical and frusto-conical portions, together with adjustable means for selectively defining the path of the thread. By means of such a device, the thread may readily be subjected to varying degrees of stretch or relaxation, depending upon the number of flared or tapered portions embodied in the periphery of the device. For example, by altering the path defined by the thread, it may be caused to traverse the entire length of the device, whereby over several succeeding flared portions the maximum possible stretch may be imparted to the thread, or only a single flared portion, whereby a minimum stretch may be imparted to the thread.

By virtue of the fact that a thread-advancing thread store device constructed in accordance with the teachings of the present invention is considerably more flexible in its operation than the devices of the prior art, the difficulties above mentioned are largely, if not entirely, eliminated. Among other things, a thread-advancing thread store device designed in accordance with the principles of the invention may be adapted with but a minimum of effort to a variety of widely differing conditions. Any one of several degrees of stretch or relaxation may be imparted to the thread at will, entirely avoiding the necessity for guess work upon the part of the operator Other advantages also characterize the invention, as will be apparent from the following explanation.

The accompanying drawings, in which like reference characters refer to like parts throughout, illustrate the application of the principles of the invention to two different types of thread-advancing reels.

Figure 1 is a plan of a thread-advancing reel, together with its asociated elements, embodying the principles of the invention, the reel being flared to permit the thread to be stretched. Figure 2 is a side elevation of the apparatus of Figure 1 with the thread-advancing reel shown in sectional elevation. Figure 3 is a plan of a similar thread-advancing reel designed to compensate for shrinkage in thread subjected to conditions tending to shrink it; e. g., drying conditions. Figure 4 is a corresponding side elevation.

The thread-advancing reels shown for purposes of illustration in Figures 1 to 4, inclusive, operate on the principle disclosed in Knebusch Patent 2,210,914, differing from the reel therein shown chiefly in that it has a generally frusto-conical periphery and is of cantilever construction.

The thread-advancing reel 4 shown in Figures 1 and 2 is carried by gear box 5, being driven by suitable gearing in gear box 5 actuated by longitudinally extending shaft 6. The gear box 5 is supported by a built-up beam 7 which may, if desired, be employed to support a large number of horizontally aligned gear boxes 5 each of which is capable of carrying one or more similar reels 4. Where a number of otherwise independent reels are so employed, it is desirable to provide clutch mechanism (not shown) operated by hand lever 8 to disengage each reel from driving relation with shaft 6. It will be understood that, although only a single reel is shown in Figures 1 and 2, there is no reason why, with suitable modifica-

tions as to the means for leading on and taking off the thread, several such reels may not be mounted in stepped relation to handle a single thread.

Referring to the section of the reel shown in Figure 2, it will be apparent that the device includes two cage members 10 and 11 each of which comprises a plurality of longitudinally extending bar members 12 and 13, respectively. When the reel is assembled, bar members 12 and 13 are alternately disposed with respect to each other, thereby forming the thread-bearing periphery of the reel. The latter, while generally circular in cross section, is for the purposes of the invention irregularly flared, preferably, as in Figures 1 and 2, from the supported to the unsupported end of the reel.

The reel member 10, which will be referred to hereinafter as the concentric member, embodies a generally cylindrical body portion 14 mounted concentrically upon drive shaft 15 which body portion 14 supports and imparts rigidity to the bar members 12. The reel member 11, hereinafter referred to as the eccentric member, is of rigid cagelike construction, being made up of a plurality of bar members 13 provided at their forward ends with an internal reinforcing ring 16 and at their rear ends with an external reinforcing rib 17. Eccentric member 11 is concentrically mounted by means of reinforcing rib 17 upon annular supporting member 18, to which it is secured by bolts 19. Annular supporting member 18 is rotatably mounted about shaft 15 with its axis in spaced and inclined relationship to the axis of concentric member 10.

Flanged collar 22 secured to shaft 15 by means of set screw 23 has formed at one end thereof a conically shaped recess 24 into which is fitted a correspondingly shaped wedge member 25. The generally cylindrical portion 26 of wedge member 25 is driven tightly into the corresponding recess 27 in the rear end of cylindrical body portion 14 of concentric member 10. Positive driving engagement between flanged collar 22 and concentric member 10 is accomplished by means of nut 28 threaded upon the forward end of shaft 15 and adapted to engage the forward end of body portion 14 of concentric member 10, thereby maintaining driving contact between wedge member 25 and flanged collar 22.

In order to prevent corrosive fluids from coming into contact with the exposed end of shaft 15 and nut 28, a hard rubber cap 29 is provided which screws on shaft 15. Cap 29 seats against a sponge rubber washer 30 in contact with body portion 14, thereby effectively sealing the forward end of the reel. To protect wedge member 25, shaft 15, flanged collar 22 and other metallic parts from corrosion, as well as to exclude processing fluids from the interior of the reel itself, a suitable flexible seal 32 preferably made from rubber or similar corrosion-resistant material is employed. Such seal may be generally of the type illustrated in Knebusch Patent No. 2,023,477, but adapted as in Figure 2 to the needs of a reel of cantilever construction.

For the purpose of maintaining a substantially uniform spacing between the respective bar members positive driving engagement is provided between concentric member 10 and eccentric member 11. To that end, a spur gear 33 is secured by means of screws 35 to the flanged portion 34 of flanged collar 22. Teeth 36 of spur gear 33 engage teeth 37 of an annular internal gear 38 secured by means of pins 39 to annular supporting member 18. Spur gear 33 and internal gear 38 are preferably of some suitable combination of materials obviating the necessity of lubrication and insuring quiet operation.

Rotation of shaft 15 serves to drive concentric member 10 through the elements shown in Figure 2, including flanged collar 22. Simultaneously, spur gear 33 mounted on flanged collar 22 drives internal gear 38, which in turn drives supporting member 18 upon which eccentric member 11 is mounted. In this manner reel members 10 and 11 are positively driven from shaft 15 while bar members 12 and 13 thereof, respectively, are maintained in spaced arrangement out of contact with each other. The latter feature is of considerable importance in a reel flared for the purpose of stretching the thread.

The offset relation between the axes *a*—*a* and *b*—*b* of concentric member 10 and eccentric member 11, respectively, which relation is shown in Figure 2, causes the thread in each turn to be transferred from the bar members of one reel member to those of the other reel member. The inclined relation indicated in Figure 1 between axes *a*—*a* and *b*—*b* of the two reel members causes the thread to advance along the reel periphery from one end thereof to the other. By acting upon reel members 10 and 11 in the manner hereinabove described, shaft 15 causes the thread to progress in the form of an advancing helix made up of a plurality of closely spaced turns the pitch of which depends upon the degree of inclination between the axes of the reel members.

As shown in the drawings, the contour of the reel is made up of alternately arranged cylindrical and flared portions increasing in diameter as they approach the unsupported end of the reel. As previously indicated, the invention contemplates the feeding of the thread to the reel at one of the several cylindrical lead-on portions. The thread is permitted to advance from the selected lead-on point along the subsequent flared and cylindrical portions until it reaches the take-off point, in this instance the cylindrical portion adjacent the unsupported end of the reel. The reel shown in Figure 2 is provided with four cylindrical lead-on portions A, C, E and G with which are associated three flared portions B, D and F.

To facilitate the feeding of the thread to the reel there is provided a guide eye 41 secured by means of set screw 45 to an adjustable arm 42. Arm 42 is longitudinally slidable within a tube 43 secured to supporting beam 7 by means of weld 40. Tube 43 is so positioned that, when extended, arm 42 is generally parallel to one of the elements of the flared portion of reel 4; that is to say, it is parallel to one of the two generally divergent lines developed by projecting the reel onto a horizontal plane. Thumb screw 44 is provided for the purpose of securing arm 42 in any desired position. If desired, a similar guide may be employed above the reel to facilitate withdrawal of the thread, but for simplicity the thread is shown as passing downward without the aid of a take-off guide.

If a maximum degree of stretch is to be imparted to the thread on the reel, guide eye 41 is moved lengthwise of tube 43 until it is positioned at a point opposite cylindrical lead-on portion A, in which position it is secured by means of thumb screw 44. Thread 3 is then allowed to feed onto the reel through guide eye 41. It advances as above described over portions B, C, D, E and F

of the reel until it reaches the cylindrical take-off portion G thereof. At a point on cylindrical take-off portion G the thread is withdrawn, either by causing it to pass in the manner above described through a second adjustable guide (not shown) located above the reel on the same side thereof or by allowing it to discharge downward as illustrated in Figure 2.

Any desired number of such cylindrical and flared portions may be employed at one time consistent with the total number of stretch increments for which the reel is designed. To illustrate, if it is desired to provide a maximum ultimate stretch of say 60% and occasionally it is desired to impart only a total of say 20% or 40% stretch in a given thread, it will be found most practicable to provide a reel of the type illustrated having three flared and four cylindrical portions each of which flared portions will impart a 20% stretch increment to the thread. Therefore, on a reel of the type illustrated, a thread may be subjected to 20%, 40% or 60% stretch, depending upon the position at which the thread is led onto the periphery of the reel. A lesser degree of stretch than the maximum may be imparted to the thread by positioning guide eye **41** opposite the cylindrical lead-on portions C or E, as the case may be, and thereafter advancing the thread over the intervening portions of the reel to cylindrical take-off portion G.

A greater or less number of flared portions may be provided for in the design of the reel; in fact, any reasonable degree of flare and any convenient number of flared portions may be employed. For instance, if a total stretch of 60% is desired but it is found that increments imparting a 15% stretch are desirable, the reel may readily be designed with four flared portions each of which will impart an increment of 15% stretch in the thread. Between each two flared portions will of course be an intermediate cylindrical portion, so that the reel will embody five such cylindrical portions in all. The thread may in such case be fed to the reel at any one of the cylindrical portions other than the fifth or withdrawn from the reel at any one of the cylindrical portions other than the first. The device of Figures 1 and 2 is thereby rendered highly flexible, so as to conform with almost any stretching requirements.

Referring now to the embodiment of the invention illustrated in Figures 3 and 4 of the drawings, it will be observed that reel **4***a*, together with its associated apparatus, is generally similar to that of Figures 1 and 2; in fact, many of the parts of the two reels are identified by the same reference characters. Reel **4***a* differs from reel **4** in the main only in that it has a generally tapered periphery by virtue of which it is especially adapted to accommodate a thread characterized by a tendency to shrink. It is possible by such means to permit substantially unrestrained shrinkage of thread to take place or, if desired, to control the amount of relaxation of the thread so as to permit of the retention in the thread of some potential capacity to shrink after the processing of the thread is otherwise complete.

The periphery of reel **4***a*, like that of reel **4**, is generally circular in cross section, but decreases in cross sectional diameter from the supported to the unsupported end thereof. Inasmuch as the periphery of the reel comprises a number of alternately arranged cylindrical and tapered portions, the thread may be fed to the reel at any one of the several cylindrical portions and permitted to advance along the subsequent tapered and cylindrical portions until it reaches a desired cylindrical take-off portion. For purposes of illustration, the reel of Figures 3 and 4 is shown as provided with four cylindrical portions A', C', E' and G' with which are associated three tapered portions B', D' and F'.

As in the case of the reel of Figure 2, an adjustable guide eye **41***a* is provided to facilitate the feeding of the thread to the reel. Tube **43***a* is secured to supporting beam **7** by means of weld **40***a* in such fashion that arm **42***a*, to which guide eye **41***a* is secured by means of set screw **45***a*, extends parallel to one of the two generally convergent lines developed by projecting the reel onto a horizontal plane; that is, arm **42***a*, although disposed at a lower level, parallels one of the two elements of the reel periphery which extend substantially horizontally. As shown, arm **42***a* may be secured in any desired position by means of thumb screw **44***a*.

In the embodiment of Figures 3 and 4, an adjustable guide eye **47** is provided for the purpose of directing the thread as it leaves the reel. Like guide eye **41***a*, guide eye **47** is slidable longitudinally of a suitable tube **48** secured by means of weld **46** to supporting beam **7**. It is shown as mounted on the opposite side of reel **4***a* from tube **42***a*, but would be mounted on the same side thereof if the thread, on leaving the reel, were to travel upward rather than downward. As shown, tube **48** is so positioned that arm **49**, to which guide eye **47** is secured by set screw **50**, extends parallel to the second of the two convergent lines developed by projecting the reel onto a horizontal plane. Thumb screw **51** serves to fix arm **49** in any desired position in tube **48**.

Either or both of the guide eyes **41***a* and **47** may be readily adjusted with respect to the reel or with respect to each other. Lead-on guide eye **41***a*, for example, may conveniently be positioned at a point opposite cylindrical lead-on portion A' of reel **4***a*, being secured in position by thumb screw **44***a*. Thread **3***a*, previously subjected on a prior reel to the action of a liquid processing medium, is fed through guide eye **41***a* to the reel **4***a*, on which it is to be dried. After leaving cylindrical portion A', it is permitted to shrink as it advances along tapered portion B' until it reaches cylindrical portion C', from which it is discharged through a guide eye **47** secured in position by thumb screw **51**.

The same degree of flexibility is provided in and by the embodiment of the invention shown in Figures 3 and 4 as characterizes the application of the invention to the flared reel previously described. If a greater degree of shrinkage of the thread than that above indicated is to be permitted, guide eye **47** may be positioned at a point opposite cylindrical portion E'. Likewise, maximum shrinkage of the thread will be permitted if, with guide eye **41***a* located as shown in Figure 4, guide eye **47** is disposed opposite cylindrical portion G'. In a similar manner, however, guide eye **41***a* may be positioned adjacent any of the cylindrical portions intermediate the length of the reel.

It is obvious that numerous modifications may be made in the illustrated apparatus without departing in any way from the spirit of the invention. It has already been pointed out that the periphery of the reel may be designed to comply with the demands of a wide variety of

conditions. Thus the embodiment of the invention shown in Figures 1 and 2 employs an adjustable lead-on guide while the discharge point is permitted to remain constant; however, as indicated in Figures 3 and 4, it is equally possible to have either or both of these guides selectively adjustable not only with respect to the reel but with respect to each other. In either of the illustrated embodiments of the invention the reel itself may be movable in an axial direction the lead-on and take-off guides which determine the path of the thread remaining fixed.

Furthermore, the particular type of thread-advancing thread store device employed may, as previously stated, take any convenient form. It is not necessary that the device be a thread-advancing reel of cantilever form, as shown, since the teachings of the invention may be applied to advantage in connection with any thread-advancing thread store device. There is no reason, for example, why, if desired, the principles of the invention may not be applied to a thread-advancing thread store device made up of two spaced cylinders mounted with their axes offset from and inclined with respect to each other; but in general a thread-advancing reel of the type illustrated will be found to be most practicable.

The invention may readily be employed in any suitable type of thread manufacturing apparatus such, for example, as a machine of the type ordinarily employed in the usual discontinuous processes of manufacturing artificial silk thread: in such case the thread will be withdrawn from some suitable source, subjected to a stretching action as it is advanced along a flared thread-advancing thread store device, and collected in package form. The invention is, however, equally adaptable for use at any desired point in any form of continuous processing apparatus, wherein a thread may, for example, be directed to a flared or tapered thread-advancing thread store device, stretched or relaxed thereon, and led to a subsequent thread-advancing thread store device or to a collecting device. A variety of other uses not related to the manufacture of artificial silk thread will suggest themselves to those skilled in the art.

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 introducing a predetermined change of length into thread or the like comprising a unitary thread-advancing thread store device which includes two cage members mounted in interdigitating relation to each other, each of said cage members having a plurality of longitudinally extending bar members which cooperate with the bar members of the other cage member to define a thread-bearing periphery the contour of which is characterized by a plurality of generally similar frusto-conical portions extending in the same direction separated from each other by one or more substantially cylindrical portions, and, in combination therewith, adjustable guide means for selectively defining the path of travel of the thread or the like upon the periphery of said thread-advancing thread store device, said guide means being mounted for adjustment in substantially parallel relation to one of two vergent lines representing the projection of said thread store device upon a reference plane.

2. Apparatus for imparting a predetermined amount of stretch to thread or the like comprising a unitary thread-advancing thread store device having a thread-bearing periphery characterized by alternately arranged cylindrical and frusto-conical portions of the latter of which there are at least two flared in the direction of advance of the thread or the like and, in combination therewith, adjustable guide means for defining the path of travel of the thread or the like mounted for adjustment in substantially parallel relation to one of two generally divergent lines representing the projection of said thread store device upon a reference plane.

3. Apparatus for imparting a predetermined amount of stretch to thread or the like comprising a thread-advancing thread-storing reel characterized by a substantially cylindrical lead-on portion, a substantially cylindrical take-off portion, and, connecting said lead-on and take-off portions, a generally flared portion which is interrupted by one or more substantially cylindrical portions disposed intermediate the ends thereof, and, in combination therewith, means for selectively defining the path of travel of the thread or the like upon the periphery of said reel.

4. Apparatus according to claim 3 in which said defining means comprise spaced guide means each of which is capable of being adjustably positioned along a line substantially paralleling one of the elements of the generally flared portion of said reel.

5. Apparatus for permitting a predetermined amount of shrinkage in thread or the like comprising a unitary thread-advancing thread store device having a thread-bearing periphery characterized by alternately arranged cylindrical and frusto-conical portions of the latter of which there are at least two tapered in the direction of advance of the thread or the like and, in combination therewith, adjustable guide means for defining the path of travel of the thread or the like mounted for adjustment in substantially parallel relation to one of two generally convergent lines representing the projection of said thread store device upon a reference plane.

6. Apparatus for permitting a predetermined amount of shrinkage in thread or the like comprising a thread-advancing thread-storing reel characterized by a substantially cylindrical lead-on portion, a substantially cylindrical take-off portion and, connecting said lead-on and take-off portions, a generally tapered portion which is interrupted by one or more substantially cylindrical portions disposed intermediate the ends thereof, and, in combination therewith, means for selectively defining the path of travel of the thread or the like upon the periphery of said reel.

7. Apparatus according to claim 6 in which said defining means comprise spaced guide means each of which is capable of being adjustably positioned along a line substantially paralleling one of the elements of the generally tapered portion of said reel.

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