

2,175,205

DRYING REEL

Filed Oct. 4, 1937

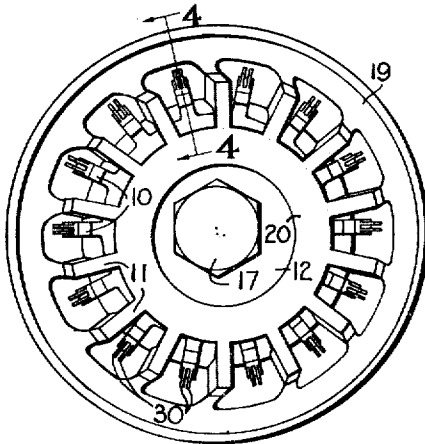


FIG. 2

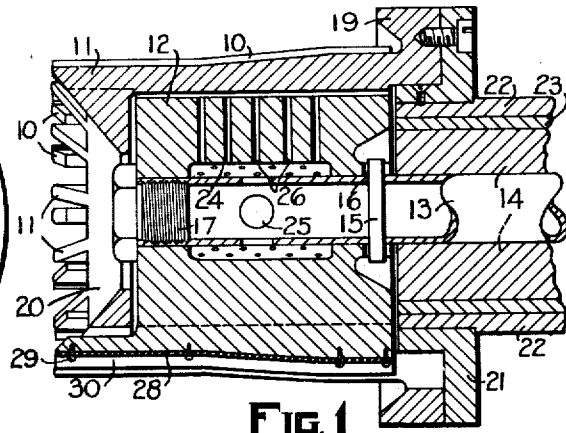


FIG. 1

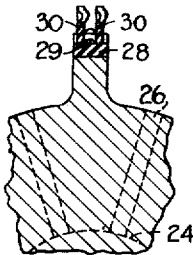
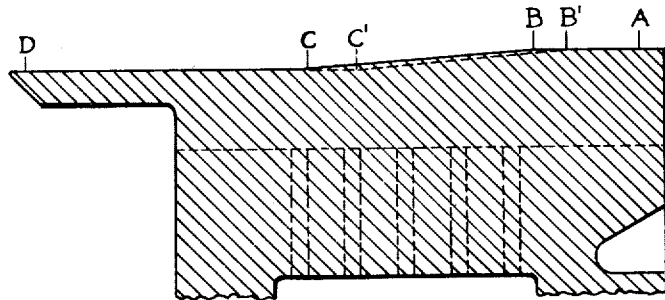
**FIG. 7**

FIG. 3

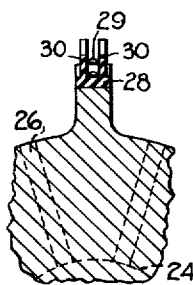


FIG. 5

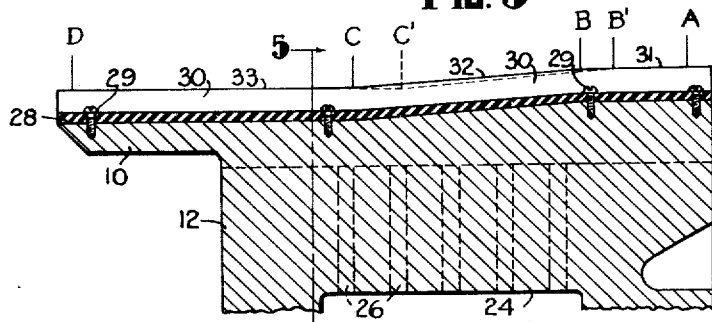


FIG. 4

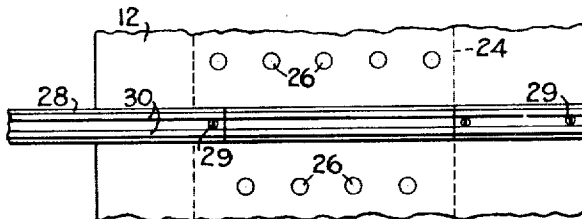


FIG. 6

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2,175,205

DRYING REEL

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7 Claims. (Cl. 242—53)

This invention relates to a thread-storage, thread-advancing device permitting changes in thread length to occur freely.

In the processing of some threads, particularly artificial silk threads, marked changes tend to occur in their lengths. If the thread is to be of high standard, it is usually necessary that little, if any, resistance be offered to changes in length. In processes utilizing thread-storage, thread-advancing devices, difficulty is experienced, because of the virtual impossibility of maintaining strictly uniform processing conditions, in providing a device of this character that will freely accommodate changes in the length of the thread. As a material which presents this problem and which may be advantageously handled by the device of the present invention, viscose artificial silk thread may be mentioned by way of example.

In the course of the drying of viscose artificial silk thread, considerable shrinkage occurs the rate of which depends upon the rate of removal of moisture from the thread. In actual practice it has been found impossible to maintain absolutely uniform drying conditions, with the result that the thread being dried may shrink at varying rates. By providing a thread-storage, thread-advancing device embodying the principles of the present invention, these varying rates of shrinkage will be accommodated and the thread allowed to shrink without substantial restraint.

While for purposes of illustration the invention is here disclosed as employed in the drying of viscose artificial silk thread, the invention may be practiced not only in connection with the drying operation but with any other treatment in which it is desired to employ it. The thread may be either of natural or artificial origin; if the latter, it may be manufactured from casein, from cuprammonium cellulose solution, from cellulose acetate or the like. Moreover, the invention may be employed in connection with any thread-like material, such as filaments, tubes, tapes, bands and ribbons, all of which are intended to be comprehended by the term "thread" as herein used.

In the accompanying drawing illustrating a preferred embodiment of the invention, Figure 1 is a vertical section through a thread-storage, thread-advancing reel embodying the invention. Figure 2 is an elevation of the front end of the reel of Figure 1. Figure 3 is a diagrammatic representation of the variations in its contour necessary to enable a reel to conform to different shrinkage conditions in a thread. Figure 4 is a

section on the line 4—4 of Figure 2 on an enlarged scale. Figure 5 is a section on line 5—5 of Figure 4. Figure 6 is a plan corresponding to Figure 4. Figure 7 is a section corresponding to that of Figure 5, showing an exaggeration of the deformation occurring under the action of thread.

Referring first to Figures 1 and 2, the thread-storage, thread-advancing reel there illustrated comprises two sets of interdigitating bar members 10 and 11. The bar members 10 are carried upon the periphery and extend longitudinally of a cylindrical body 12 which is concentrically fixed to a hollow shaft 13 rotatably mounted in a bearing 14. To establish driving engagement between shaft 13 and body 12, a pin 15 carried by the shaft is disposed within slots 16 in body 12. To retain cylindrical body 12 upon shaft 13, a bolt 17 may be screw-threaded into the forward end of the shaft. Bolt 17, in addition to retaining cylindrical body 12 upon the shaft, serves as a closure member for the front end of the hollow shaft 13.

Bar members 11 are carried by an annular base member 19 at the rear ends of the bar members and an annular reinforcing member 20 at their forward ends. Annular member 19 is fixed to a ring 21 having secured within its central opening a bushing 22. Bushing 22 is rotatable upon a sleeve 23 which is carried upon the exterior of the supporting bearing 14 through which shaft 13 passes. The contact which exists between the two sets of bar members due to their interdigitating relation causes the bar members 11 to be driven from bar members 10.

The exterior of bearing 14 is eccentric with respect to the bore therethrough and due to this eccentricity the axis of rotation of the bar members 11 is offset laterally from the axis of rotation of the bar members 10. The axes of the inner and outer surfaces of sleeve 23 are at an angle with respect to each other and consequently the axis of rotation of the bar members 11 likewise is askew with respect to the axis of rotation of the bar members 10. The bar members 10 and supporting body 12 make up and may be termed the concentric reel member. The bar members 11 and supporting members 19 and 20 and affixed ring 21 may be termed the eccentric reel member. Due to this relation existing between the concentric and eccentric reel members, thread carried upon their exteriors will, upon rotation of the reel, be advanced longitudinally thereof in a plurality of generally helical turns.

The reel may be said to be of cantilever form inasmuch as it is supported at one end only,

bearing 14 at corresponding ends of both reel members providing the sole support for the reel. The end of the reel opposite bearing 14, being independent of any support, is freely accessible to an operator. The reel should be rotated in such a direction that the thread will be advanced thereover from the supported to the unsupported end, in which case the thread may easily be removed from the unsupported end due to the absence of obstructions. Since the bar members of the two sets 10 and 11 lie in interdigitating relation and the axis of the one set lies within the periphery of the other set, the reel as a whole may be said to be unitary.

To dry the thread being advanced along the reel a heating medium such as hot air from any suitable source may be supplied through hollow shaft 13 to the interior of the reel. A chamber 24, formed centrally of the body 12, receives the heated air from shaft 13 through openings 25 in the shaft and distributes it through radially extending ports 26 to the periphery of the reel. Bar members 11 are heated to approximately the same temperature as bar members 10. The thread is dried not only by contact with the exterior of the heated reel, but by the heated air issuing from ports 26.

The thread to be dried on the reel may be supplied from any source. For example, the thread may come from a package into which it was collected while wet. Such a package may be that formed on the usual collecting spool or in the ordinary centrifugal spinning pot. However, the wet thread may, if desired, come from apparatus which is continuously processing the thread, in which event the drying reel here shown may follow the liquid processing stages of the apparatus. After being dried, the thread may be collected by any suitable winding device or it may be twisted and then collected.

For the reasons and in the respects hereinafter explained, the reel of the invention is formed to allow substantially free shrinkage of the thread being dried thereon.

At the completion of the liquid processing steps, viscose artificial silk thread contains as much as 300% moisture by weight. Approximately half of this moisture is upon the exterior of the thread and must be removed before the remaining half of the moisture, which apparently is internal moisture, may be removed. The external moisture may be removed rapidly and during its removal the thread probably will undergo less than one-half of one percent shrinkage. Removal of the internal moisture, however, requires a relatively long length of time, since this moisture must be removed largely by diffusion.

In the course of the removal of the internal moisture, the thread, if allowed to shrink without restraint, may shrink as much as 6% of the initial length of the thread. For various reasons, it is desirable that substantially free shrinkage be permitted to take place during removal of the internal moisture. Thread so dried commands a higher price, having a wide acceptance in the weaving and knitting industries. It gives rise to no difficulties arising out of excessive shrinkage on the tentering frames. It dyes uniformly, color variations from unit to unit along the thread being minimized.

It is desirable, however, that complete shrinkage of the thread be prevented by arresting shrinkage of the thread when nearly complete shrinkage has occurred. By preventing complete shrinkage of the thread, it retains a slight residu-

al capacity to shrink. In accordance with the invention, substantially unrestrained shrinkage of the thread is permitted during removal of nearly all of its internal moisture, but is arrested before complete shrinkage has occurred.

In the drying of thread upon a reel, moisture may be removed from different portions of the thread at different rates due to variations occurring from time to time in the temperature of the same portion of the reel. Also, the rates of removal of external and internal moisture may vary either together or independently of each other; i. e., the internal and external moisture may be slowly removed, rapidly removed, or removed more rapidly in the case of one than in the case of the other. These different drying conditions require different formations of the thread-bearing surface of the reel if the thread is to be allowed to shrink without substantial restraint.

Figure 3 illustrates the different formations which a bar member should have along its length if it is to conform to variations imposed by the drying operation.

Thread delivered to the reel may make contact with the bar member at a point A adjacent the supported end of the reel. In advancing toward the unsupported end of the reel, the thread will, if external moisture is removed at the lowest rate to be expected, reach the point B on the bar member by the time all external moisture has been removed. The portion A—B over which the thread passes may be parallel with the axis about which the bar members turn, since the shrinkage which the thread undergoes in passing over this portion is only very slight. In travel of the thread beyond point B, internal moisture being assumed to be removed from the thread at the lowest rate to be expected, by the time the thread reaches the point C only the desired residual capacity to shrink remains in the thread. As shown, portion B—C is tapered to permit substantially unrestrained shrinkage of the thread to take place. From point C the thread is advanced without provision for shrinkage to a point D on the bar member from which point the thread is led off.

If, on the other hand, external moisture of the thread is removed at the most rapid rate to be expected, this may be fully accomplished by the time the thread has reached a corresponding point B', from which point the bar member should have a tapered configuration. If, starting at the point B', the internal moisture also is removed at the most rapid rate to be expected and if shrinkage of the thread is to be permitted until only the desired residual capacity to shrink remains in the thread, the point C' will have been reached somewhat sooner than point C in the example given in the preceding paragraph. The portion C'—D must in such case be a continuation of the portion C—D; i. e., having an approximately cylindrical surface. The net effect, therefore, of drying under the conditions stated is to require a change in the location of the tapered portion B—C, so that it assumes the dotted line position B'—C'.

In either case, the diameter of the portion C—D or C'—D preferably bears such relation to the diameter of portion A—B or A—B' that the desired residual capacity to shrink is left in the thread.

The portion of the bar member upon which external moisture is removed from the thread may be of relatively short extent inasmuch as the ex-

ternal moisture may be rapidly removed from the thread. The portion of the bar member upon which internal moisture is removed from the thread will necessarily be of relatively long extent since considerably more time is required for removal of this moisture. The terminal portion of the bar member upon which the thread is set with the desired residual capacity to shrink may likewise be of relatively long extent to assure complete dryness or equilibrium moisture conditions in the thread.

If, therefore, both the external moisture and the internal moisture are removed slowly, the bar members of a reel which will correspond to this drying condition should have a contour corresponding to the solid line A—B—C—D appearing in Figure 3. If the external and internal moisture are both rapidly removed, bar members determined by the line A—B'—C'—D will be required. Variations in the relative rates of removal of external and internal moisture will call for a formation of the bar members falling between the limits of the solid line and the dotted line between points B' and C. In accordance with the present invention means are provided to permit alterations to occur in the contour of the bar member in response to variations in the rate of removal of both the external moisture and the internal moisture.

To accomplish this object the exterior of each bar member is provided with a longitudinally extending strip 28 secured to the bar members by screws 29. Projecting substantially vertically from this strip is a pair of parallel ribs 30—30. In order better to support the thread it is desirable that the pair of ribs shown be provided although a single rib upon each strip 28 may be found to be sufficient. The strip 28 and the ribs 30 should preferably be made of one piece and should be of some resilient material, as rubber. Best results are obtained if both sets of bar members are provided with such supporting means, although if desired only one of the sets of bar members need be provided with resilient ribs, as is shown.

In order that the reel may support thread from which both the external moisture and the internal moisture are being removed at a low rate, the contour of ribs 30 on bar members 10 corresponds closely to the solid line appearing in Figure 3. This will be the maximum required of the reel under the slowest drying conditions to be expected. The initial portion 31 of the reel is preferably cylindrical, since it is determined by the portion A—B' in Figure 3. The terminal portion 33 of the reel is likewise preferably cylindrical, since it corresponds to the portion C'—D appearing in Figure 3. The central portion 32 of the reel is of frusto-conical formation, corresponding to portion B'—C' in Figure 3.

During actual drying of thread upon the reel, the ribs 30 remain in their normal upright position so long as both the internal moisture and the external moisture are removed slowly. However, if the external moisture is removed rapidly or if the internal moisture is removed rapidly, the resulting rapid shrinkage of the thread causes the ribs 30 to bend. Due to the ease with which ribs 30 bend sideways, very slight resistance is offered to shrinkage of the thread. This lateral deformation of ribs 30 under the influence of the thread is shown in an exaggerated condition in Figure 7.

Thus, while the bar members normally have the conformation of line A—B—C—D in Figure 3,

they may yield to the conformation of line A—B'—C'—D in Figure 3 to allow for thread shrinkage resulting from rapid drying. For any intermediate rate of removal of the external or internal moistures, the ribs 30 will yield to a formation between the two limits B—C and B'—C'. As a result, regardless of whether the total thread moisture is slowly or rapidly removed, substantially unrestrained shrinkage of the thread is permitted. A very wide variation in drying conditions may thus be permitted without affecting the uniformity of the thread being dried.

In passing over the terminal portion 33 of the reel it is desirable that the thread be set with the residual capacity to shrink which it is intended that it shall have. In order to obtain this result, the portions of ribs 30 forming portion 33 of the reel surface should be relatively firm. If the ribs are made of rubber, this firmness may be obtained by stiffening the portions of ribs 30 from the free end of the reel inwardly to point C. Inserts may be utilized to make portion 33 more firm than portion 32.

Thus, although the central portions of the lengths of ribs 30 may deflect laterally to varying extents due to different rates of drying of the thread, the total shrinkage permitted at all points throughout the length of the thread will be limited to the same amount due to the relatively firm terminal end portions of ribs 30. As a consequence, the residual capacity to shrink remaining in the thread upon reaching portion 33 of the reel will be uniform throughout the thread irrespective of whether the internal and external moistures have been slowly or rapidly removed. Passage over portion 33 of the reel will set this residual capacity to shrink in the thread and either allow the thread to fully dry or come to equilibrium moisture conditions.

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. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the like lengthwise thereof in a plurality of generally helical turns, at least one of said members having on its periphery a plurality of thread-bearing elements deformable laterally thereof to provide thread-bearing surfaces yieldable substantially radially of said rotatable member.

2. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the like lengthwise thereof in a plurality of generally helical turns, at least one of said members having extending longitudinally of its periphery a plurality of thread-bearing elements deformable laterally thereof to provide thread-bearing surfaces yieldable substantially radially of said rotatable member.

3. Apparatus of the character described in claim 2 in which the terminal portion of said elements is of reduced deformability at at least one end of said rotatable member.

4. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the like lengthwise thereof in a plurality of generally helical turns, at least one of said members

having on its periphery a plurality of longitudinally extending thread-bearing elements which are deformable laterally thereof to permit changes in the lengths of the turns of thread or the like.

5. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the like lengthwise thereof in a plurality of generally helical turns, at least one of said members having projecting generally perpendicularly from its periphery a plurality of longitudinally extending strip-like thread-bearing elements which are deformable laterally thereof to provide thread-bearing surfaces yieldable substantially radially of said rotatable member.

6. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the

like lengthwise thereof in a plurality of generally helical turns at least one of said members having projecting generally radially from its periphery a plurality of longitudinally extending strip-like thread-bearing elements which are deformable laterally thereof to permit changes in the lengths of the turns of thread or the like.

7. A thread-storage, thread-advancing reel comprising two rotatable, alternately disposed sets of bar members, each substantially circular in cross section and, associated therewith, means for causing said sets of bar members to cooperate during rotation of said sets to advance thread or the like lengthwise thereof in a plurality of generally helical turns, the bar members of at least one of said sets having extending lengthwise thread-bearing surfaces deformable substantially thereof strip-like thread-bearing elements which are deformable laterally thereof to provide radially of the reel.

LOUIS E. LOVETT.

CERTIFICATE OF CORRECTION.

Patent No. 2,175,205.

October 10, 1939.

LOUIS E. LOVETT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 17, claim 7, strike out the words "thread-bearing surfaces deformable substantially" and insert the same after "provide" in line 19, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of November, A. D. 1939.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

having on its periphery a plurality of longitudinally extending thread-bearing elements which are deformable laterally thereof to permit changes in the lengths of the turns of thread or the like.

5. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the like lengthwise thereof in a plurality of generally helical turns, at least one of said members having projecting generally perpendicularly from its periphery a plurality of longitudinally extending strip-like thread-bearing elements which are deformable laterally thereof to provide thread-bearing surfaces yieldable substantially radially of said rotatable member.

6. A thread-storage, thread-advancing device comprising two rotatable members each substantially circular in cross section which, during rotation thereof, cooperate to advance thread or the

like lengthwise thereof in a plurality of generally helical turns at least one of said members having projecting generally radially from its periphery a plurality of longitudinally extending strip-like thread-bearing elements which are deformable laterally thereof to permit changes in the lengths of the turns of thread or the like.

7. A thread-storage, thread-advancing reel comprising two rotatable, alternately disposed sets of bar members, each substantially circular in cross section and, associated therewith, means for causing said sets of bar members to cooperate during rotation of said sets to advance thread or the like lengthwise thereof in a plurality of generally helical turns, the bar members of at least one of said sets having extending lengthwise thread-bearing surfaces deformable substantially thereof strip-like thread-bearing elements which are deformable laterally thereof to provide radially of the reel.

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