July 15, 1941. W. F. KNEBUSCH 2,249,710

APPARATUS FOR CONTINUOUSLY PROCESSING THREAD OR THE LIKE

Original Filed Feb. 18, 1935

FIG. 2

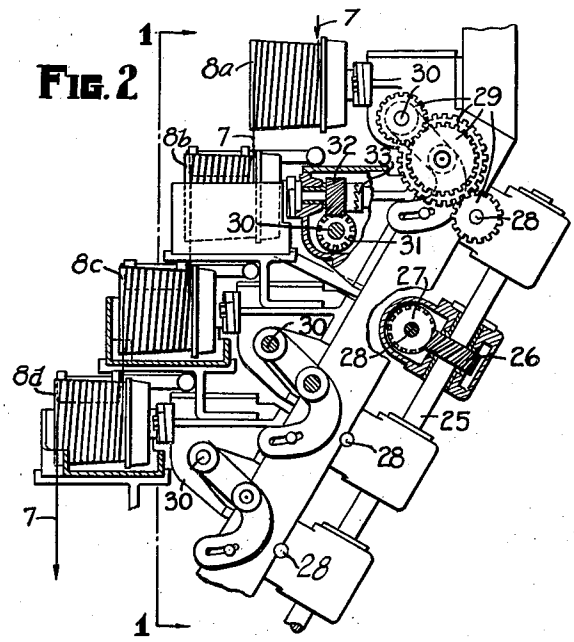


FIG. 1

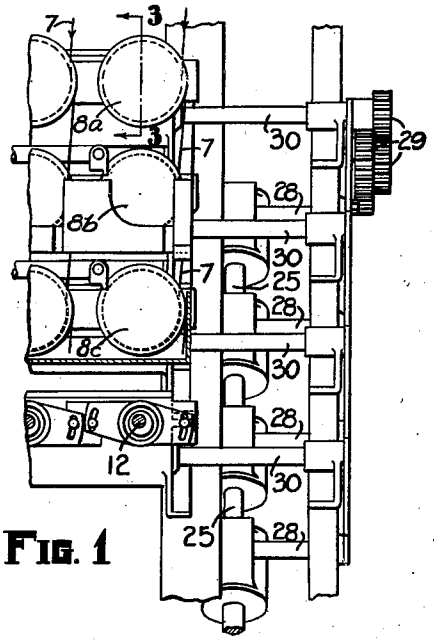


FIG. 3

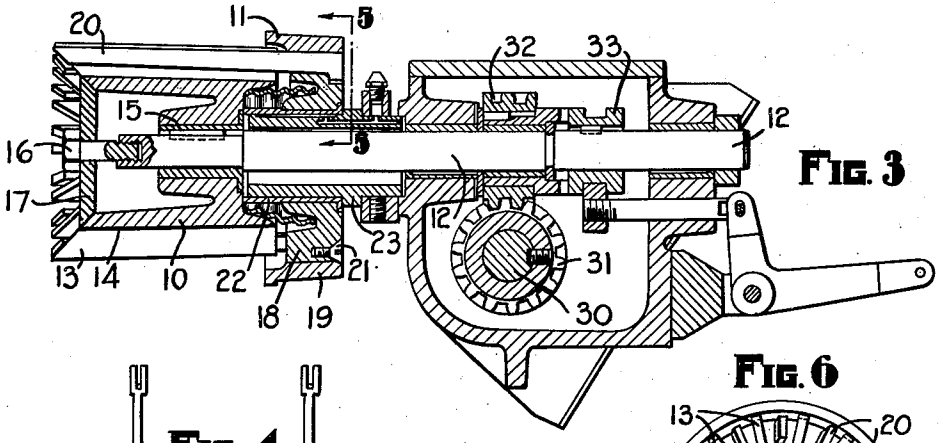


FIG. 4

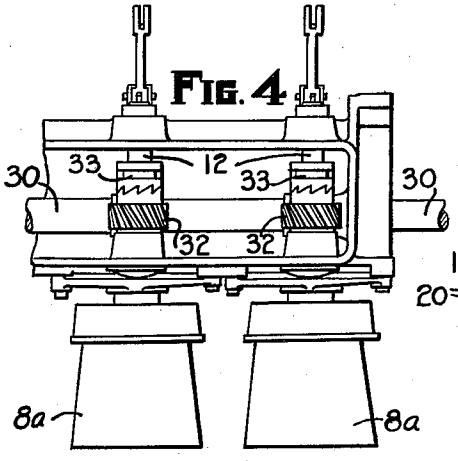


FIG. 5

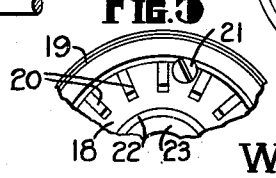
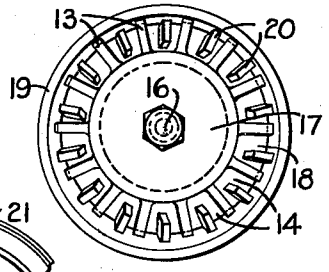


FIG. 6



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APPARATUS FOR CONTINUOUSLY PROCESSING THREAD OR THE LIKE

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Original application February 18, 1935, Serial No. 7,113. Divided and this application January 25, 1938, Serial No. 186,801

3 Claims. (Cl. 18—8)

This invention relates to methods of and apparatus for continuously processing thread or the like, especially artificial silk thread. More particularly, the invention relates to the progressive introduction into the thread of a predetermined amount of stretch, the stretching being accomplished by passing the thread successively over the surfaces of a series of flared thread-advancing reels. The use of a series of flared reels makes it possible to effect a gentle stretching of a very considerable length of thread, giving rise to a product having an enhanced tensile strength, an unusually low ductility, and a high degree of uniformity.

The subject matter of the present application is described but not claimed in application Serial No. 7,113, filed February 18, 1935, of which the instant application is a division.

While the invention is capable of particularly advantageous employment in the production of multiple filament artificial silk thread by any of the usual processes, such as the viscose, cuprammonium, nitrocellulose and cellulose acetate processes, the invention has been illustrated and will be described hereinafter as employed in the manufacture of viscose artificial silk thread. The invention resides not only in the novel method of stretching thread hereinafter described, but also in the apparatus employed for stretching it; however, in respect of neither the method nor the apparatus is the invention to be understood as restricted to the manufacture of artificial silk thread.

One form of apparatus which may be employed to advantage in the practice of the present invention is illustrated in the accompanying drawing, in which Figure 1 is a front elevation, partly in section, on the line 1—1 of Figure 2, certain parts being shown diagrammatically; Figure 2 is an end elevation from the right of Figure 1, with parts broken away and in section; Figure 3 is a sectional view on the line 3—3 of Figure 1; Figure 4 is a plan corresponding to Figure 3; Figure 5 is a detailed sectional elevation on the line 5—5 of Figure 3; and Figure 6 is an end view from the left in Figure 3. Corresponding parts are identified in all views by corresponding reference characters.

It will, of course, be readily understood that the apparatus forming part of the present invention may take various forms. Generally speaking, however, such apparatus will embody means for converting the spinning solution into a thread, such means takin g the form of a spinning nozzle; a plurality of flared thread-advancing reels of a number sufficient to enable the necessary process steps to be performed upon the thread; and a collecting device on or in which the thread is wound into convenient package form. As illustrated in the accompanying drawing, the apparatus embodies a number of parallel thread processing units each of which units is capable of producing a single multiple filament artificial silk thread which is caused to travel in sequence over the several reels of such unit.

Referring to Figure 3, each such reel may, as shown, consist of two members 10 and 11, both of which are rigid in the sense that all of their respective parts are fixed and immovable with respect to each other.

Member 10 may be termed the concentric member, because it is fixed to and rotates with the drive shaft 12. This reel member includes a body portion of generally cylindrical form with its periphery slotted to form a series of alternating bars 13 and recesses 14, the body portion being mounted upon a sleeve 15 keyed to the shaft 12 and held in place thereon by a cap screw 16 threaded into the shaft. The head of the cap screws 16 passes through and serves to clamp in place an imperforate disc 17, the beveled periphery of which seats against and forms a sealed joint with the correspondingly beveled end of the imperforate wall of the body portion of member 10.

The other member 11 of the reel may be called its eccentric member, because, while it is generally of cylindrical form, it is mounted with its axis both offset slightly from and inclined to the axis of the shaft 12. The member 11, as shown, comprises a head formed of inner ring 18 and outer ring 19, the former of which has peripheral slots to receive bars 20. Rings 18 and 19 are respectively externally and internally tapered, being held together in their home position by screws 21. The inner ring 18 is attached to a sleeve 22 journalled to rotate upon a supporting tubular member 23, which surrounds shaft 12 and is spaced therefrom with its axis slightly offset from and inclined with relation to the axis of said shaft.

In Figure 3, the reel is shown as regularly flared; i. e., progressively increasing in diameter from its thread-receiving to its thread-discharging end. The flared conformation, which is for the purpose of imparting the desired degree of stretch to the thread, may but need not necessarily take the form of a frusto-conical surface, as illustrated. Preferably, the reel is of canti-

lever form; i. e., supported and driven from one end only, as a result of which the operation, inspection and maintenance of the reel are greatly facilitated. If, as in Figure 3, the reel is of cantilever form, the direction of advance of the thread and hence of the increase in diameter of the reel is, of course, from the supported to the unsupported end of the reel.

The reel elements, or at least those which come into contact with corrosive reagents, are preferably made of such materials and in such manner as to be unaffected by the various processing media. In the form shown, concentric member **10** may be formed integrally of hard rubber, Bakelite or similar material molded around or in such manner as to include the central metal bearing sleeve **15**. In the case of eccentric member **11**, the several parts may all be molded of similar material, the ring **18** being molded around or to include the central metal bearing sleeve **22**. Screws, nuts, bars and other parts of the reel may be either made of or coated with some material unaffected by reagents or, if desired, they may be shielded from reagents by washers, packings, sleeves or the like.

It will be noted that, as shown in Figures 1, 2, and 4, the reels of each unit are not only arranged in parallel relation, but in vertically stepped arrangement. The driving and thread-receiving end of each reel is therefore directly beneath the thread-discharging end of the next preceding reel. With such an arrangement, the thread advances in the same direction over all the reels. The reels are presented endwise, their flared ends facing a common front; i. e., the face of the machine from which the reels are tended by the operator. Each reel is provided with suitable means for supplying and removing the treating medium to which the thread is subjected on such reel.

Each unit has a drive shaft **25** provided at intervals with spiral gears **26**, each of which drives a spiral gear **27** on a short shaft **28** connected by suitable change speed gears **29** to a shaft **30** extending lengthwise of the machine and arranged to drive corresponding reels in different units. At each unit, for example, the shaft **30** is provided with a spiral gear **31** driving a spiral gear **32** loosely rotatable on the reel shaft **12** and capable of being operatively connected to it by a clutch marked generally **33**. Shaft **12** is connected to, supports and drives the concentric member **10** of each reel which, in turn, drives the eccentric member **11** of such reel.

In practice, the thread **7** is received from the spinning nozzle, or from the preceding reel, as the case may be, on the receiving end of reel **8***a*, along which it is caused to progress automatically in the form of a large number; e. g., fifty to two hundred, of closely spaced, generally helical turns. Due to the stepped arrangement of the reels **8***a*, **8***b*, **8***c*, **8***d*, etc., it can be received in an entirely similar manner on the driving and receiving end of reel **8***b*, along which it progresses as before until it reaches the discharge end of reel **8***b*. It is then threaded up on the third reel, **8***c*, and so on until it has been subjected to the successive treating processes, in addition to being progressively stretched over all of the reels of the series, and finally reaches the cap twister or other collecting means (not shown).

The fact that artificial silk thread may, if desired, be stretched to reduce its potential elongation has been recognized for some time; but the general practice in both the remote and recent past has been to submit such thread to only a moderate degree of stretching, generally not over about 20 or 30%. In methods thus far employed, the stretching has been exerted in the early stages of regeneration of the cellulose content of the viscose, over comparatively short lengths of thread, at best only a few feet, and for a period not exceeding a second or two. By contrast, the present invention permits of the gradual stretching of the thread during and after the regeneration of the cellulose content of the viscose, over successive periods of time approaching and, if desired, exceeding half a minute each, and over thread lengths hundreds of times as great as those heretofore employed.

Extensive experiments have established that if, as in prior pot-and spool-spinning practice, viscose is extruded through a spinneret into a coagulating bath, the viscose on the surface of each filament is coagulated as and remains for some time in the form of a film surrounding a liquid core. Completion of the regeneration of the cellulose content of the viscose may not and often does not occur for a considerable period after the time of the extrusion of the viscose into the coagulating bath. If, in such circumstances the thread while still in the coagulation stage is stretched in a short space of time by even as little as 20 or 30%, lack of uniformity of the degree of coagulation of the thread from point to point along its length gives rise to quite different physical and physico-chemical properties in different parts of one and the same thread.

For these reasons it is advantageous to apply the stretch to the thread over a much greater period of time which, as desired, may or may not include the final stages of the period of regeneration of the cellulose content of the viscose. This may be done particularly conveniently by the practice of the present invention which to the end of permitting the stretching of the thread over a long period of time employs a plurality of flared reels on each of which the thread is progressively stretched. An exceptionally high degree of uniformity in the physical and physico-chemical characteristics of the thread is thereby made possible.

An advantageous feature of the invention is the elimination of the guides needed to direct the travel of the thread over the usual godet wheels. It is a well known fact that the guides employed with godet wheels create undue friction on the thread and contribute to lack of uniformity in the product, with consequent variations in strength, dyeing properties and other characteristics. In the present invention, the slippage of the thread which occurs so often on a single godet wheel or in stretching between two or more godet wheels operated at different peripheral speeds is not experienced. In addition, the overriding of thread turns with consequent breakage of filaments which sometimes occurs in the stretching of thread by means of godet wheels is not found.

These and other important advantages readily apparent to those skilled in the art emphasize the practical value of the present invention. As has been indicated, various changes and modifications may, within the scope of the claims, be made in the invention without in any way departing from the spirit thereof: among other things, other forms of thread store devices may be used in lieu of the thread-advancing reels herein described. 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 stretching thread or the like comprising a frame structure having power means associated therewith; a first thread-advancing reel of cantilever construction rotatably mounted on said frame structure and driven by said power means, said thread-advancing reel being progressively flared from a thread-receiving zone adjacent its supported end to a thread-discharge zone adjacent its unsupported end with a view to gradually stretching a considerable length of thread or the like over a relatively long period of time; a second thread-advancing reel of like character rotatably mounted on said frame structure, driven by said power means and arranged with its small end in juxtaposition to the large end of said first thread-advancing reel, whereby thread or the like discharged from said first thread-advancing reel may be subjected to a further stretching operation on said second thread-advancing reel; and take-up means to which the thread or the like proceeds from said second thread-advancing reel.

2. Apparatus as in claim 1 embodying means for applying liquid to the thread or the like in the course of one, at least, of the stretching operations.

3. Apparatus as in claim 1 embodying means for applying liquid to the thread or the like on each of said thread-advancing reels.

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