

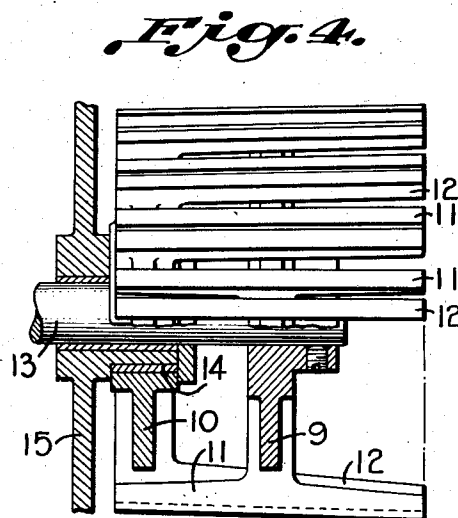
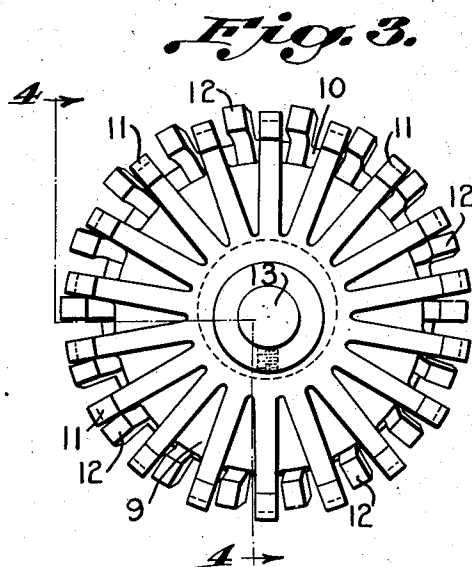
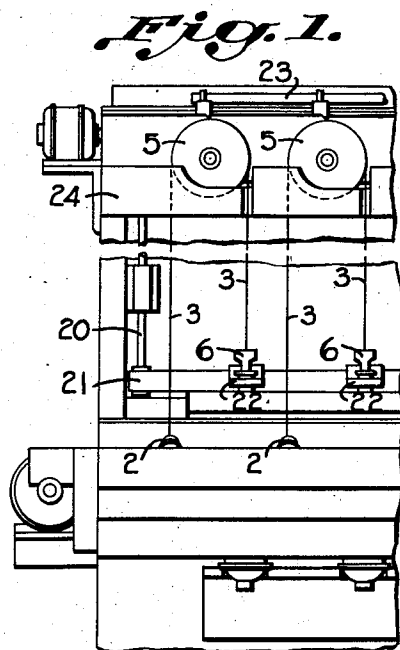
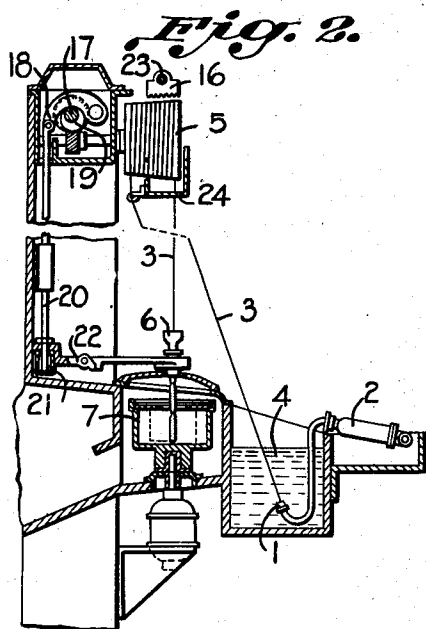
Feb. 11, 1941.

H. B. KLINE ET AL

2,231,851

MANUFACTURE OF ARTIFICIAL SILK THREAD

Filed Jan. 25, 1938



*Inventors:*

HAYDEN B. KLINE AND

LOUIS S. FRYER

by *Charles E. Christman*  
Attorney

## UNITED STATES PATENT OFFICE

2,231,851

MANUFACTURE OF ARTIFICIAL SILK  
THREAD

Hayden B. Kline and Louis S. Fryer, Lakewood,  
Ohio, assignors to Industrial Rayon Corpora-  
tion, Cleveland, Ohio, a corporation of Dela-  
ware

Application January 25, 1938, Serial No. 186,800

3 Claims. (Cl. 18—54)

This invention relates to methods of and means for producing thread or the like of synthetic origin, particularly artificial silk thread.

Among other things contemplated by the invention is the operation of imparting to thread or the like of synthetic origin a predetermined, progressively increasing stretch, the introduction of the latter being begun before the thread or the like has become completely coagulated. A preferred embodiment of the invention involves the stretching of the thread or the like by means of a generally flared thread store device; for example, a frusto-conical thread-advancing reel. In consequence of the use of such a device it is possible to effect a gentle, progressively increasing stretching of the thread or the like over a considerable period of time during which the thread or the like gradually approaches complete coagulation, thereby providing a higher tensile strength, a considerably reduced capacity for further elongation, and a much more uniform product.

This subject matter is described but not claimed in application Serial No. 7,115 filed February 18, 1935, of which the present application is in part a continuation.

Although mention has been made of the fact that the invention may, if desired, be applied to the manufacture of viscose artificial silk thread, it is not to be understood as limited to this field. The invention is capable of employment in the manufacture of any thread-like article of synthetic origin, including artificial straw, staple fiber and multiple filament artificial silk thread produced by any of the usual processes; e. g., the viscose, nitrocellulose, cuprammonium and cellulose acetate processes. For convenience, the invention has been illustrated and will be hereinafter described as employed in connection with the pot-spinning system of manufacturing multiple filament viscose artificial silk thread.

Apparatus of a kind adapted to employment in the practice of the present invention is illustrated in the accompanying drawing. In such drawing, Figure 1 represents a front elevation of the apparatus, certain parts being shown more or less diagrammatically. Figure 2 is a corresponding sectional elevation. Figure 3 is an end elevation of the reel diagrammatically indicated in Figures 1 and 2. Figure 4 is a detailed longitudinal elevation partly in section on the line 4—4 of Figure 3. In all figures, corresponding parts are identified by corresponding reference characters.

In the apparatus of Figures 1 and 2, viscose is

forced by a pump (not shown) through a candle filter 2 to suitable means for converting the viscose into thread, the same taking the form of spinneret 1 through which the viscose is extruded into spinning bath 4 to form the multiple filament thread 3. The thread 3 is withdrawn from the spinning bath 4 by a flared reel 5. The reel 5 is so constructed that it continuously accepts the thread directed to it, forms it into and positively advances it in the form of a large number of closely spaced generally helical turns, and discharges it from the end thereof to a suitable collecting device which, as in the illustrated arrangement, may conveniently be a spinning pot.

The collecting device illustrated in the drawing is shown conventionally as including, besides the spinning pot 7, the usual funnel 6, which has a reciprocatory motion with respect to the spinning pot 7 along the axis of rotation of the spinning pot itself. The purpose of such motion is to lay the thread in a regular pattern, layer upon layer, as the cake builds up in the pot. The traverse mechanism for moving several funnels in a multiple unit machine is illustrated as including a cam 19 mounted upon a shaft 17, said cam operating a lever 18 connected to a slide rod 20 which in turn operates a bar 21 having arms 22 extending out to support and operate the respective funnels.

Brief description of the reel 5, which may be taken to exemplify a thread store device of the kind to which the invention relates, will suffice for the purposes of the present application.

The reel illustrated in the drawing of the present application is of a type similar to that disclosed in British Patent No. 413,414, except that the illustrated reel is of cantilever construction; e. g., supported and driven only from its thread-receiving end. It comprises two reel members 9 and 10 provided respectively with sets of longitudinally extending bars 11 and 12, the two sets of bars being disposed in alternate relation with respect to each other. Each of the reel members is rigid in the sense that all of its parts are immovable with respect to each other and with relation to the shaft on which the reel as a whole is mounted. The reel is generally frusto-conical in shape, being flared from its thread-receiving to its thread-discharge end, but may, of course, have some other conformation.

Member 9, referred to as the concentric member of the reel, is disposed concentrically of, fixed to, and rotates with the driving shaft 13. Member 10 is driven by bar-to-bar contact with member 9 and is mounted upon a bearing 14 carried

by the stationary frame 15, the central axis of said bearing being both slightly offset from and inclined to the axis of rotation of the shaft 13. Consequently, since the member 10 is mounted

5 symmetrically about the bearing 14 on which it rotates, its axis also is slightly offset from and inclined with reference to the axis of shaft 13, wherefore it is referred to as the eccentric member.

10 In general, depending upon the angle of inclination between the reel members, there are from 50 to more than 100 thread turns upon the reel, all of which are caused to advance along the periphery thereof by reason of the offset and

15 inclined relation of the bar members. Because the diameter of the reel as a whole increases toward the discharge end, each turn of thread is progressively stretched as it advances along the reel, the same stretching effect being produced on

20 each succeeding turn of thread. The large number of turns of thread upon the reel eliminates any possible thread slip, as a result of which succeeding portions of the same thread are withdrawn from the coagulating bath without variations having their origin in this source. The reel

25 itself may be and preferably is long enough to permit regeneration of the cellulose content of the viscose to proceed substantially to completion before the thread reaches the discharge end of the reel.

The coagulation of the thread 3, which, given time, will occur in and of itself, may be furthered by the application of an appropriate reagent from a suitable means such as a reagent distributor 16, preferably so positioned as to shower

35 said reagent upon the successive turns as they approach the discharge end of the reel 5. The reagent may be supplied to the distributors 16 by a supply pipe 23. It may be removed by a

40 suitable drain trough 24 from which it is conducted by suitable conduits either to the sewer or to a make-up reservoir from which it may be recirculated in the event that the reagent is of a character making its re-use desirable.

45 Prior to the present invention, such stretching of the thread as it has been considered desirable to effect has been accomplished by the use of a plurality of godet wheels operating at different peripheral speeds. Older methods have

50 involved the drawing of thread through a series of guides, over glass rods, or on a combination of driven rollers and guides disposed between the spinneret and the collecting means. In more recent practice, however, the desired degree of

55 stretch has been imparted to the thread by means of a series of godet wheels operated at successively greater peripheral speeds. At least two and, where there have been only two, both of such godet wheels have been positively driven at

60 angular speeds such as to produce the desired speed differential.

The difficulties encountered in such arrangements are well known to those familiar with the art. The employment of guides or glass rods

65 introduces a very high degree of friction resulting in broken filaments, nonuniformity of tensile strength, and inequality of denier. Godet wheels give rise to unsatisfactory results for the reason that the thread often tends to underwind, dam-

70 aging or snarling the filaments thereof; in addition, considerable slippage of the thread occurs, adversely affecting uniformity of denier, tensile strength and dyeing qualities. In either event, if, as is frequently the case, variations occur in

75 the degree of coagulation of the thread at the

time of actual stretching, the drastic pull to which the thread is subjected during stretching tends to intensify the effect of the original irregularity.

The use of a generally flared thread store device, preferably the frusto-conical thread-advancing reel of the present invention, over-

5 comes these difficulties.

From the principle of operation of such a device it is apparent that the friction exerted upon

10 the thread is negligible. The underwinding and thread slippage characteristic of operation with godet wheels are virtually impossible. By increasing the diameter or the length of the reel, any given length of thread from a very few feet

15 up to several hundred feet can be advanced at one time upon the periphery of one and the same reel; so that the same progressively increasing tension can be gradually applied to every succeeding increment of the thread. The result is

20 a degree of uniformity in the physical and physico-chemical characteristics of the stretched thread heretofore quite unattainable.

Extensive experiments have established that on a reel of the kind shown the coagulation of

25 the filaments approaches completion only after the lapse of a considerable time interval not usually less than twenty or thirty seconds, depending in part on the nature of the coagulating bath. It has also been found that a progressively in-

30 creasing tension exerted upon thread during most, if not all, of the time while coagulation of the filaments is still incomplete tends to enhance the desirable qualities which it is sought to develop in the thread. This is by way of contrast

35 with the conventional spinning methods heretofore employed in which the stretching action, exerted over short lengths of thread not generally in excess of a few feet and for a duration of only one or two seconds, is invariably performed

40 in the course of the early stages of the process of coagulation.

Whereas in ordinary practice the stretching does not in general exceed 20 to 30%, it is possible, depending upon the diameter and length of

45 the reel used, to handle by the present invention lengths of thread well in excess of 100 feet. By the application of the principles of the present invention the resultant stretch may easily be made double that employed in the older methods.

50 At the same time, a product of much greater uniformity of denier, tensile strength and dyeing properties is made possible, this for the reason that no drastic pull is applied to a relatively short length of thread, but instead a gradually

55 increasing tension continuing over substantially the entire period of coagulation.

As previously indicated, it is intended that the invention shall be understood as applying to the production of thread-like articles of synthetic

60 origin, not merely to multiple filament viscose artificial silk thread. The apparatus and method herein described represent but one embodiment of many possible embodiments of the invention. Various modifications within the scope of the

65 appended claims may be made without in any way departing from the spirit of the invention.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside

70 in the invention.

What is claimed is:

1. In the viscose process of manufacturing thread or the like, the method of stretching comprising the steps of forming the thread or the

75

like by extruding viscose through a spinning nozzle into a coagulating bath; withdrawing the thread or the like from said coagulating bath before the thread or the like has had an opportunity to attain a state approaching complete coagulation; gradually increasing the tension on the thread or the like while it is still in a state of incomplete coagulation by impressing upon it the form of a traveling helix characterized by a large number of closely spaced generally helical turns of progressively increasing diameter, to that end causing the thread or the like to traverse a thread-advancing thread store device which is flared from a point near its receiving zone to a point near its discharge zone; and, after

coagulation of the thread or the like has had an opportunity to proceed more nearly to completion, passing the thread or the like to take-up means located in juxtaposition to said thread-advancing thread store device.

2. The method of claim 1 in which, in the course of the stretching operation, a liquid is applied to the thread or the like.

3. The method of claim 1 in which, in the course of the stretching operation, a reagent for furthering coagulation is applied to the thread or the like.

HAYDEN B. KLINE.

LOUIS S. FRYER.