

Nov. 24, 1942.

H. B. KLINE ET AL

2,303,052

MANUFACTURE OF ARTIFICIAL SILK THREAD OR THE LIKE

Filed Oct. 6, 1938

3 Sheets-Sheet 1

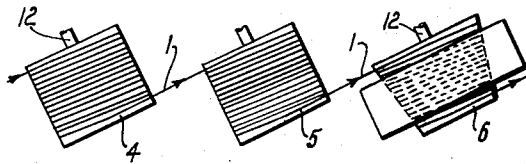
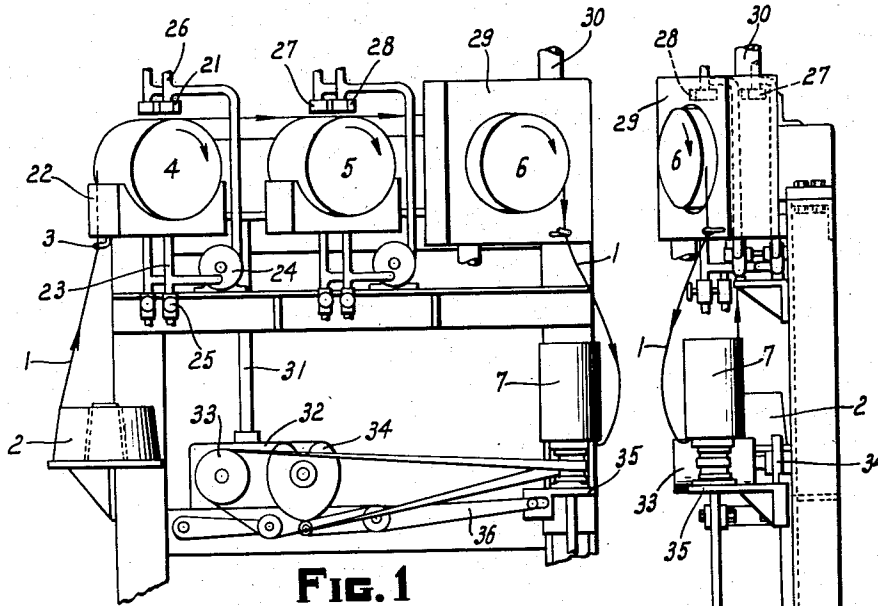


FIG. 3

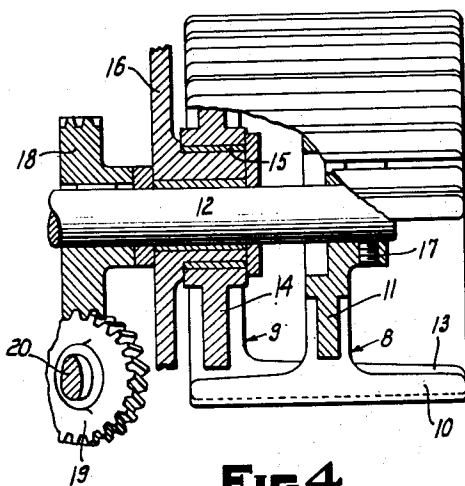


FIG. 4

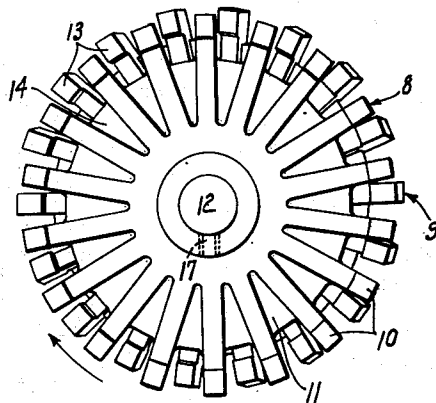


FIG. 5

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3 Sheets-Sheet 2

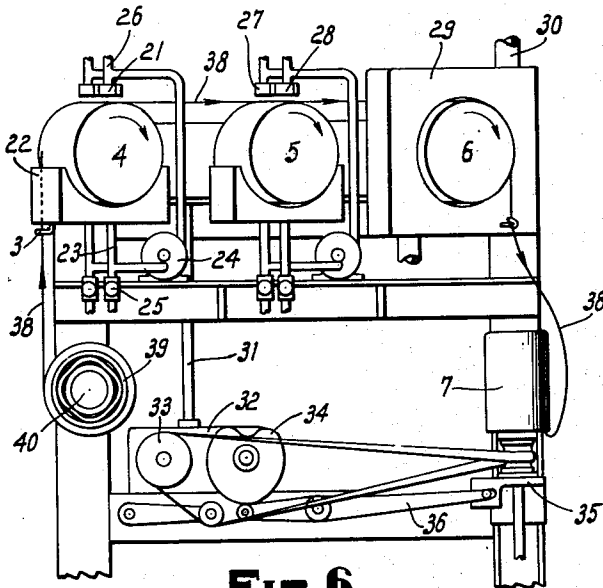


FIG. 6

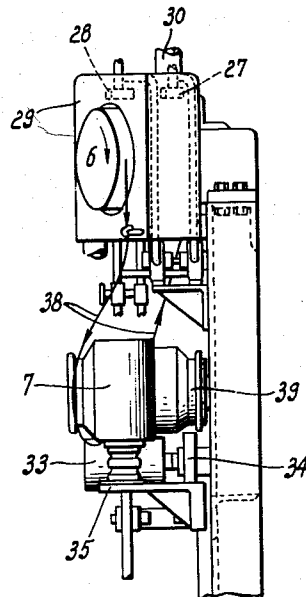


FIG. 7

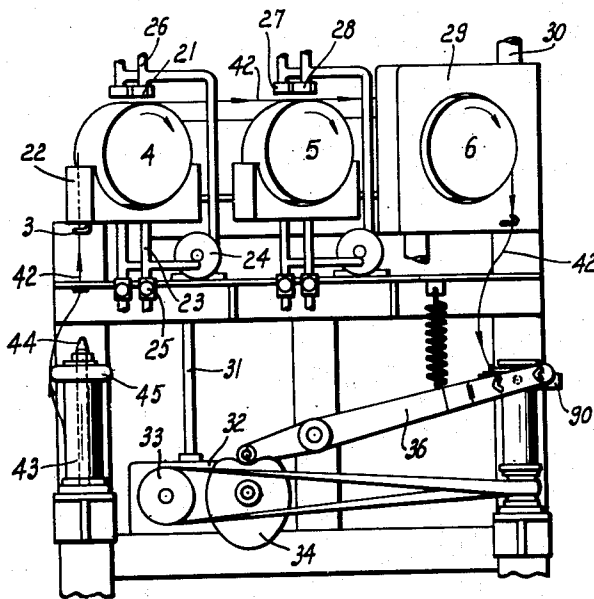


FIG. 8

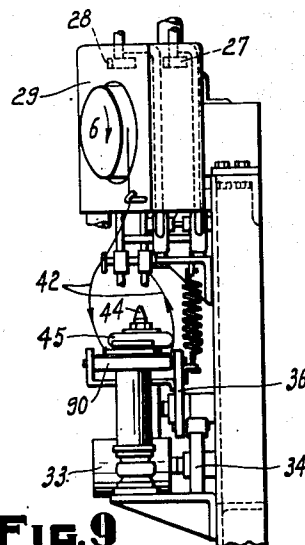


FIG. 9

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MANUFACTURE OF ARTIFICIAL SILK THREAD OR THE LIKE

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3 Sheets-Sheet 3

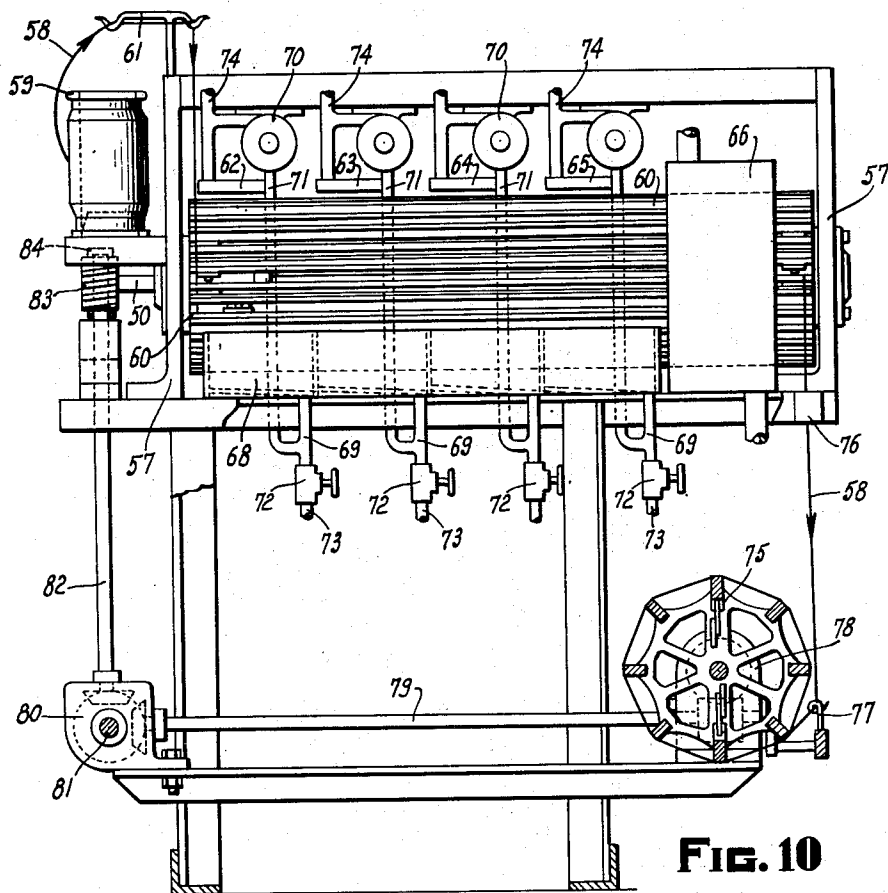


FIG. 10

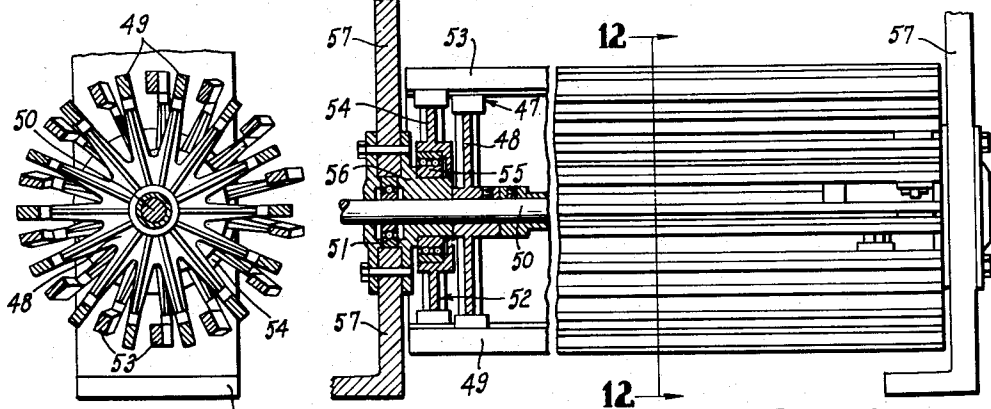
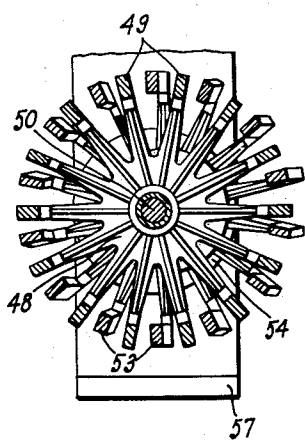


FIG. 11

FIG. 12



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UNITED STATES PATENT OFFICE

2,303,052

MANUFACTURE OF ARTIFICIAL SILK
THREAD OR THE LIKE

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ware

Application October 6, 1938, Serial No. 233,600

22 Claims. (Cl. 18—54)

This invention relates to methods of after-treating thread-like articles of synthetic origin; e. g., filaments, thread, ribbons, etc., produced by various processes, but particularly by the pot-spinning, spool-spinning and continuous processing systems. Among other things, the invention is applicable to the after-treatment of thread-like articles manufactured from casein, viscose, cellulose acetate solutions, cuprammonium cellulose solutions, etc., but for convenience it will be described hereinafter as applied to the production of multiple filament viscose artificial silk thread. The instant application is a continuation in part of application Serial No. 41,425 ("Method and apparatus for processing artificial filaments") and of application Serial No. 41,426 ("Method of processing rayon"), filed September 20, 1935.

In the conventional pot- and spool-spinning systems, the thread is extruded from a spinneret, coagulated by the usual methods, and either collected in a rotating pot in the pot-spinning system or wound with the aid of a reciprocating guide upon a spool in the spool-spinning system. According to usual practice, the pot-spun cake or spool package is subjected to further processing treatment, either in the original package or in skeins into which the thread is wound on skein reeling machines. In either case, many disadvantages reside in the sequence of operations incident to the processing of the thread, among which is the necessity of repeatedly handling the wet thread, with consequent likelihood of damage, at a time when its tensile strength is particularly low.

In the manufacture of continuously processed thread, most of the processing steps; i. e., desulphuring, bleaching, etc., are performed in sequence immediately following the coagulation of the thread. However, it is ordinarily impossible, because of limitations of space, to include in the sequence certain treatments which it may be desired to perform upon such thread; for example, oiling, dyeing, sizing, etc. The method of the present invention, in addition to being adapted to the after-treatment of pot- or spool-spun thread, is adapted to the further processing of continuously processed thread such, for example, as that produced by the process and apparatus of application Serial No. 7,114, filed February 18, 1935, by Walter F. Knebusch and Alden H. Burkholder (Patent 2,225,642).

Among other things, the present invention contemplates the carrying out of the processing of the thread in an improved manner in and by

which the thread is unwound from the thread package and advanced in helical form upon the periphery of at least one thread-advancing thread store device which may conveniently take the form of a thread-advancing reel on which it is subjected to any desired processing treatment or treatments. One of the objects of the invention is to provide a processing method which is simple in operation, which dispenses with certain of the steps heretofore necessary, and which makes for an extremely high degree of uniformity in the quality of the thread. Still another object of the invention is to provide a thread which is uniform in its luster, shrinkage and other physical properties, which is free from such defects as "dye barré," "shiners," "railroad tracks," etc., and which is equally adapted to the manufacture of both knitted and woven fabrics. Further objects of the invention will appear more in detail hereinafter.

In the accompanying drawings, in which corresponding parts bear corresponding reference characters, Figure 1 represents a front elevation of apparatus for the processing of moist thread collected in the form of a pot-spun cake, such apparatus comprising a plurality of thread-advancing thread store devices with which is associated a collecting device taking the form of a cap twister. Figure 2 is an end elevation of the arrangement of Figure 1. Figure 3 is a diagrammatic plan of the thread-advancing thread store devices of Figure 1. Figure 4 is an enlarged side elevation, partly in section, of one form of thread-advancing thread store device applicable to the practice of the invention. Figure 5 is an end elevation of the device of Figure 4.

Figure 6 represents a front elevation of generally similar apparatus for the processing of moist thread from a spool-spun package, the same comprising a plurality of thread-advancing thread store devices with which is associated a cap twister serving as the collecting device. Figure 7 is an end elevation of the arrangement of Figure 6. Figure 8 represents a front elevation of apparatus for the withdrawal from a cap twister bobbin and the subsequent processing of dry thread produced by the continuous processing system comprising a series of thread-advancing thread store devices with which series is associated a ring twister functioning as the collecting device. Figure 9 is an end elevation of the arrangement of Figure 8.

Figure 10 is an elevation of another type of apparatus adapted to the processing of moist thread from a spool-spun package comprising a

single thread-advancing thread store device having associated therewith a different type of thread-collecting device. Figure 11 is a longitudinal elevation, partly in section, of a thread-advancing thread store device which may be used to advantage in the arrangement of Figure 10. Figure 12 is a sectional elevation along the line 12—12 of Figure 11.

In the arrangement of Figures 1 and 2, the thread 1, after unwinding from the pot-spun cake 2, passes through guide means 3 to the first of a plurality of thread-advancing thread store devices 4, 5 and 6. As the thread travels around the surfaces of the devices 4, 5 and 6, it is subjected to the desired processing treatments, after which it is collected by some suitable device as a cap twister 7. The mass of thread contained in the cake is preferably moist, having been stored, if at all, under conditions of high humidity operating to prevent drying out of the cakes and consequent crystallization of the salts therein contained, which, if permitted, would result in cutting or deterioration of the thread as it is later unwound from the cake.

The thread-advancing thread store device may be of any type to which a thread may be continuously led, on which a considerable length of the thread may be continuously stored for a suitable interval of time while being subjected to processing treatment, and from which the thread may be continuously discharged. In general, some suitable form of reel may be used on which, by operation of the elements thereof, the thread is formed into a large number of closely spaced generally helical turns and successively advanced along the reel from one end thereof to the other. Thus a reel of the type shown in Figures 4 and 5 may be employed, such reel being generally similar in construction and mode of operation to that shown and described in British Patent No. 413,414, but differing therefrom in that it is of cantilever form.

As shown, the reel consists of two members 8 and 9 disposed to occupy substantially the same space. Member 8 is of a generally cylindrical form, its outer periphery being composed of bars 10, equally spaced around the circumference and supported by the spider 11. Member 8 may be termed the "concentric" member since it is mounted with its axis concentric with that of the drive shaft 12. Member 9 is also of generally cylindrical form, with similar bars 13, equally spaced circumferentially and supported by the spider 14. The periphery of member 9 contains the same number of bars as that of member 8.

Member 9, which may be termed the "eccentric" member, is mounted on the bushing 15 supported by the frame member 16, with its axis in a plane slightly offset from and parallel to the axis of the concentric member 8, and consequently to that of the drive shaft 12. The axis of member 9, in addition to being offset from that of member 8, is also inclined to that of member 8 for reasons more fully explained in British Patent No. 413,414. Member 8 is rigidly fastened, as by set screw 17, to drive shaft 12, which is caused to rotate by some means as the spiral gear 18 meshing with the gear 19 mounted on a shaft 20 from which the other reels may also be driven.

Rotation of the shaft 12 causes the concentric member to rotate and contact between the bars 10 of this member and the alternately disposed bars 13 of member 9 causes this latter member to rotate. The rotation of the reel members in the

proper direction, together with the limited relative movement of the members 8 and 9 with respect to each other caused by the off-set and inclined relationship of the axes of these members, causes the thread to progress in substantially helical form along the reel from its supported to its unsupported end; i. e., from left to right in Figure 4, in a manner more fully set forth in the previously mentioned French patent.

The horizontally offset relationship of each of reels 4, 5 and 6 with respect to adjacent reels as illustrated in Figure 3 is particularly advantageous if reels of this type are used. Since they are reels of the cantilever type; i. e., they are supported only at one end and consequently the other end is free from a projecting shaft, it is a relatively simple matter with this arrangement to "thread up" or start the thread in each reel. As a study of Figure 3 will show, the thread first comes into contact with reel 4 at its supported end and progresses toward the unsupported end thereof, where it leaves the reel. It comes into contact with the next reel 5 at the rear thereof, repeating the cycle on this reel and on all subsequent reels. It is obvious that various other dispositions of the reels with respect to each other, including vertical and horizontal arrangements, may be employed if desired, together with a larger or smaller number of reels than here shown, all without departing from the spirit of the invention.

On each reel one or more processing treatments may be applied to the thread; for example, on the first reel 4 in Figure 1, provision is made for two treatments, which may be desulphurizing and washing. The treating apparatus in each case consists of a reagent distributor 21 through which the treating liquid is caused to shower down on the thread under it. The liquid is caught in the trough 22, which it leaves by pipe 23. The trough 22, of course, is divided by a partition to keep the liquids used in the different treatments separate. On the next reel 5, similar provision is made for administering two more treatments, which may be bleaching, accomplished by means of a reagent supplied from distributor 27, and washing, accomplished by liquid from distributor 28.

In the case of any reagents that it may be desired to recirculate, a suitably driven pump 24 is provided which draws the liquid back up to the distributor 21. If it is desired to remove spent reagent, it may be drained by means of the valve 25 in the line which leads to the sewer or recovery apparatus. Fresh reagent may be supplied through the pipe 26. It is obvious, of course, that if the reagent is to be used only once, the pump is not necessary and the reagent may be drained directly from the trough 22 to the sewer or the like. In the illustrated embodiment of the invention there are two complete circulation systems for each of reels 4 and 5, since two treatments are administered on each.

With the last reel 6 are employed means for drying the thread, which in the embodiment of the invention under discussion consists of a chamber 29 enclosing at least a portion of the reel 6 to which chamber a fluid drying medium, such as hot air, is supplied through pipe 30. Obviously, various other suitable methods of drying the thread may be employed such, for instance, as advancing the thread along a reel through the interior of which a heated liquid is circulated. The thread may, if desired, be dried off the reel without departing from the spirit

of the invention. If desired, stretch drying, which results in increased luster of the thread, may be provided by constructing the drying reel so that its diameter increases slightly from the supported to the unsupported end thereof; similarly, by tapering the reel as illustrated in Figure 3, shrinkage of the thread may be permitted to take place.

Any suitable thread-collecting means, such as cap-spinning apparatus, may be provided to collect the thread as it discharges from the last reel. Although pot-spun thread is given a low degree of twist as it is collected in the pot, an additional or more pronounced twist is often desirable. To this end the cap-twister 7 may be employed although it is obvious that any one of various other kinds of collecting devices could be provided instead; for example, a ring-twister, a coping device, a bobbin-winding device, a skeining reel, etc. If, as shown, the reels are driven by gears 18 meshing with gears 19 mounted on the common drive shaft 20, the latter may conveniently be driven by a shaft 31 at right angles to it connected to the gear box 32 by means of which are also rotated the drum 33 for driving the whirl belt of the cap-twister 7, as well as the cam 34 which serves through lever 36 to actuate the lifting rail 35 of the cap-twister. Power may be supplied to gear box 32 by some means (not shown) as a motor or belt.

In the apparatus of Figures 6 and 7, the component parts and the arrangement thereof are for the most part duplicates of those of the machine of Figures 1 and 2, exceptions being occasioned by reason of the fact that the thread 38 to be processed thereon is an untwisted thread produced according to the conventional spool-spinning process. Thread 38 is collected on conventional apparatus upon the spin spool 39, removed with the spool from the spinning machine at the completion of the formation of the package, and placed on the machine of Figures 6 and 7 for further processing, which is done by merely slipping the spool 39 upon an ordinary rotatable spool mounting 40. The apparatus may then be threaded up and the thread 38 may be subjected to the desired processing treatment in the same manner as the pot-spun thread 1 in the machine of Figures 1 and 2.

In the embodiment of the invention illustrated in Figures 8 and 9, apparatus similar to that of Figures 1 and 2 may be employed to subject to additional processing treatment a dried, twisted thread 42 produced according to the continuous processing system. The thread 42 may, if desired, have been but partially purified on the continuous processing machine; but in general it is preferable to purify the thread completely on the continuous processing machine, dry it, and twist and collect it on a cap-twister bobbin 43, which may then be placed in the apparatus of Figures 8 and 9 upon a vertical spindle 44 surmounted by a cap 45. It is then threaded upon the series of thread-advancing thread store devices 4, 5 and 6 of the apparatus in the same manner as before and subjected to one or more additional processing treatments such, for example, as oiling, dyeing, sizing, etc., after which it may be dried and collected in suitable package form. Although the thread 42 may already have a certain degree of twist, in many instances it is desirable to collect the thread 42 upon ring twister 90 as illustrated in order to impart additional twist thereto.

Still another form of apparatus embodying the

principles of the present invention is illustrated in Figure 10. It consists of a single relatively long thread-advancing thread store device on which the thread may be subjected to a plurality of processing treatments. As has been previously mentioned, thread-advancing thread store devices which may be used in this embodiment of the invention may take the general form of reels on or along which the thread is advanced in a large number of closely spaced, generally helical turns. The reel itself, shown in detail in Figures 11 and 12, operates in the same manner as the similar reel disclosed in the aforementioned French patent.

In this reel, the concentric or driving member 47 may be provided with two spiders 48, one at each end of the reel, to support the bars 49. Drive shaft 50, to which the driving member 47 is fixed for rotation, is rotatably mounted in bearings 51. The eccentric or driven reel member 52 is comprised of bars 53 supported on the spiders 54, one at each end of the reel. This reel member 52 is mounted with its axis offset and inclined to that of member 47 by means of spiders 54 mounted on bearings 51 which are in turn supported on the boss members 55 bolted to the frames 56 of the machine. The driven or eccentric member 52 is caused to rotate by contact of its bars 53 with the alternately disposed bars 49 of driving member 47 which is rigidly fastened to the drive shaft 50. In a manner more fully explained in the aforementioned British patent, the combination of the rotation of the reel and the eccentric and inclined mounting of the reel member 52 causes the thread wound upon the reel to progress in spaced, substantially helical turns from one end of the reel to the other.

Referring to Figure 10, the thread 58 unwound from the spool 59, which typifies any suitable form of thread package, is led to the reel 60 by means of thread guide 61. The thread progresses in a series of closely spaced, generally helical turns from the left-hand end of the reel to the right-hand end, being meanwhile subjected to any desired processing treatments. Thus, in the case of the thread produced by the spool-spinning system it may be desirable to subject the thread in succession to desulphurizing liquid showered down by reagent distributor 62, to washing liquid from distributor 63, to bleaching liquid from distributor 64, to washing liquid from distributor 65, and to a drying medium in chamber 66.

It may in such case also be desirable to use certain of the reagents more than once. To that end, some form of reagent circulating system may be used such as that shown in Figure 10 as auxiliary to each reagent distributor. Each system comprises a trough 68 partitioned off as shown in dotted lines to separate the liquids used in the various treatments, a drain pipe 69, and a suitable driven recirculating pump 70 connected thereto. The reagent, after leaving the distributor, showers down upon the thread and is collected in trough 68. It is drawn through pipe 69 and pipe 71 into pump 70, from which it is discharged into reagent distributor 62. By means of the valve 72, spent reagent may be discharged to a sewer or to a make-up reservoir through the pipe 73. Fresh reagent may be supplied as needed through the pipe 74.

The drying means may take the form of any suitable device such as a chamber 66 enclosing at least a portion of the periphery of the reel 60,

to which a fluid drying medium, such, for example, as heated air, may be supplied. It is obvious that any other means of drying the thread while stored on the reel 60 could be used as, for instance, means for subjecting the thread to a gaseous drying medium supplied from the inside of said reel. Stretch drying of the thread may be effected by modifying the reel so that its diameter enlarges slightly as the thread passes through the drying means; similarly, by tapering the reel as illustrated in Figure 3 the thread may be permitted to shrink.

Any suitable collecting means may be provided for collecting or packaging the thread as it leaves the reel 60. Since the thread 58 is not twisted, a twisting apparatus may be introduced if desired; but if for certain uses the thread is to remain untwisted, some other suitable form of collecting apparatus such as the skeining reel 75 may be provided. The thread after drying leaves the reel 60 and passes through a suitable tension equalizing means 76 to a transverse guide 77 by means of which the thread is given the proper lay on the skeining reel. The skeining reel 75 may be equipped with means for collapsing it so that the skeins of thread may be more easily removed therefrom.

The skeining reel 75 is rotated from the gear box 78 connected to the shaft 79 which is caused to rotate by suitable gearing arrangement in gear box 80 to which power is supplied through the shaft 81 by some means (not shown) such as a motor. The reel 60 is also driven from gear box 80 by means of a shaft 82 on which is mounted a worm gear 83 meshing with the worm wheel 84 mounted on the drive shaft 50 of the reel. If several machines of this type are employed, it is possible to use a single long skeining reel 75 provided the machines are positioned alongside and parallel to each other. Machines of this type may be used either individually or in group arrangements, in which case suitable group drives may be employed.

The various methods of processing thread are simple and inexpensive and are especially advantageous in the treatment of thread produced according to the pot- and spool-spinning systems as hereinbefore outlined. The processes at present in use involve a much greater amount of handling, requiring considerably more labor and hence involving increased cost of manufacture. In addition, the amount and extent of equipment is considerably reduced. As noted, the adaptability of the invention extends to the further processing of thread produced according to the continuous processing system.

Among the treatments which may be employed in the processing of pot- or spool-spun thread is the use for bleaching of a rapid, wholly volatile bleaching agent such as hydrogen peroxide which is driven off the thread by the heat supplied in the drying means. Thus the step of washing and bleaching could be eliminated if desired and drying accomplished immediately after bleaching. The step of bleaching with a volatile bleaching agent could, of course, be one of a plurality of treating steps accomplished on a single reel or the application of the bleaching agent could be accomplished on one reel and the drying on another. Still another type of bleaching operation which may be employed, if desired, in conjunction with the methods of this invention comprises the use of sodium hypochlorite as the bleaching agent.

Other types of thread-advancing thread store

devices may be used than the reels hereinabove described. Any number of reels may be provided and various arrangements of said reels with regard to each other may be employed. Likewise, any number of any processing steps may be carried out on one or more thread-advancing thread store devices by suitably modifying the auxiliary apparatus. Drying may be accomplished either on or off the reel by any suitable means such as those described or, for instance, as by internally heated reels or by heat given off by steam coils, all without 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 in the invention.

What is claimed is:

1. In the manufacture by a wet spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool-winding the thread or the like; unwinding the thread or the like while moist from the spool on which it is collected during the spool-winding operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like while in such helical form to a plurality of different liquid processing treatments; drying the moist thread or the like, meanwhile effecting a change in the length thereof; and collecting the dried thread or the like in package form.

2. In the manufacture by a wet spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool-winding the thread or the like; unwinding the thread or the like while moist from the spool on which it is collected during the spool-winding operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like while in such helical form to a plurality of different liquid processing treatments; drying the moist thread or the like; and collecting the dried thread or the like in package form.

3. In the manufacture by a wet spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool-winding the thread or the like; unwinding the thread or the like while moist from the spool on which it is collected during the spool-winding operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like to the action of one or more treating liquids by which the liquid processing of the thread or the like is completed while the thread or the like is still in helical form; and thereafter collecting the processed thread or the like in package form.

4. In the manufacture by a wet-spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool-winding the thread or the like; unwinding the thread or the like from the spool on which it is collected during the spool-winding operation; taking up the thread or the like on helix-forming means immediately after unwinding it from said spool; continuously positively advancing the thread or the like on said helix-forming means in the form of one or more helices characterized by

a large number of closely spaced turns; subjecting the thread or the like to the action of one or more treating liquids, at least one of said treating liquids being a purifying liquid, by which the liquid processing of the thread or the like is completed while the thread or the like is still in helical form; drying the thread or the like, meanwhile permitting the thread or the like to shrink; and collecting the dried thread or the like in package form.

5. In the manufacture by a wet spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool winding the thread or the like; unwinding the thread or the like while moist from the spool on which it is collected during the spool-winding operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like while in such helical form to liquid processing treatment; drying the moist thread or the like; and collecting the dried thread or the like in package form.

6. In the manufacture by a wet spinning process of spool-spun artificial silk thread or the like, the steps of extruding, coagulating and spool-winding the thread or the like; unwinding the thread or the like while moist from the spool on which it is collected during the spool-winding operation; continuously positively advancing a long length of the moist thread or the like in the form of a traveling helix characterized by a large number of closely spaced turns; drying the moist thread or the like while in such helical form, meanwhile permitting the thread or the like to shrink; and simultaneously twisting and collecting the dried thread or the like.

7. In the manufacture by a wet spinning process of artificial silk thread or the like, the steps of extruding, coagulating and packaging the thread or the like; unwinding the thread or the like while moist from the package in which it is collected during the spinning operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like while in such helical form to a plurality of different liquid processing treatments; drying the moist thread or the like, meanwhile effecting a change in the length thereof; and collecting the dried thread or the like in package form.

8. In the manufacture by a wet spinning process of artificial silk thread or the like, the steps of extruding, coagulating and packaging the thread or the like; unwinding the thread or the like while moist from the package in which it is collected during the spinning operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like while in such helical form to a plurality of different liquid processing treatments; drying the moist thread or the like; and collecting the dried thread or the like in package form.

9. In the manufacture by a wet spinning process of artificial silk thread or the like, the steps of extruding, coagulating and packaging the thread or the like while moist; unwinding the thread or the like from the package in which it is collected during the spinning operation; continuously positively advancing the moist thread or the like in the form of one or more helices characterized

by a large number of closely spaced turns; subjecting the moist thread or the like to the action of one or more treating liquids by which the liquid processing of the thread or the like is completed while the thread or the like is still in helical form; and thereafter collecting the processed thread or the like in package form.

10. In the manufacture by a wet spinning process of artificial silk thread or the like, the steps of extruding, coagulating and packaging the thread or the like while moist; unwinding the thread or the like while moist from the package in which it is collected during the spinning operation; continuously positively advancing the moist thread or the like while in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread or the like in such helical form to liquid processing treatment; drying the moist thread or the like; and collecting the dried thread or the like in package form.

11. In the manufacture by a wet spinning process of artificial silk thread or the like, the steps of extruding, coagulating and packaging the thread or the like; unwinding the thread or the like while moist from the package in which it is collected during the spinning operation; continuously positively advancing a long length of the moist thread or the like in the form of a traveling helix characterized by a large number of closely spaced turns; drying the moist thread or the like while in such helical form, meanwhile permitting the thread or the like to shrink; and simultaneously twisting and collecting the dried thread or the like.

12. In the manufacture by a wet spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread while moist from the package in which it is collected during the pot-winding operation; continuously positively advancing the moist thread in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread to the action of one or more treating liquids by which the liquid processing of the thread is completed while the thread is still in helical form; and thereafter collecting the processed thread in package form.

13. In the manufacture by a wet-spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread from the package in which it is collected during the pot-winding operation, the step of unwinding the thread being performed without eliminating its twist; taking up the thread on helix-forming means immediately after unwinding it from said package; continuously positively advancing the thread on said helix-forming means in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the thread to the action of one or more treating liquids, at least one of said treating liquids being a purifying liquid, by which the liquid processing of the thread is completed while the thread is still in helical form; and thereafter collecting the processed thread.

14. In the manufacture by a wet spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread while moist from the package in which

it is collected during the pot-winding operation; continuously positively advancing the moist thread in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread while in such helical form to liquid processing treatment; drying the moist thread; and collecting the dried thread in package form.

15. In the manufacture by a wet spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread while moist from the package in which it is collected during the pot-winding operation; continuously positively advancing a long length of the moist thread in the form of a traveling helix characterized by a large number of closely spaced turns; drying the moist thread while in such helical form, meanwhile permitting the thread to shrink; and collecting the dried thread in package form.

16. In the manufacture by a wet spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread while moist from the package in which it is collected during the pot-winding operation; continuously positively advancing the moist thread in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread while in such helical form to a plurality of different liquid processing treatments; drying the moist thread; and collecting the dried thread in package form.

17. In the manufacture by a wet spinning process of pot-spun multiple filament artificial silk thread, the steps of extruding, coagulating and pot-winding the thread; unwinding the thread while moist from the package in which it is collected during the pot-winding operation; continuously positively advancing the moist thread in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the moist thread while in such helical form to a plurality of different liquid processing treatments; drying the moist thread; meanwhile effecting a change in the length thereof; and collecting the dried thread in package form.

18. In the manufacture of completely processed multiple filament viscose artificial silk thread, the steps of extruding, coagulating, partially processing and twisting the thread, meanwhile winding the thread into a collection package; unwinding the thread from said collection package, the unwinding step being performed without eliminating the twist previously introduced into the thread; taking up the thread on helix-forming means immediately after unwinding it from said collection package; continuously positively advancing the thread on said helix-forming means in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the thread while in such helical form to additional processing, such processing involving the application of a treating liquid to the thread; drying the processed thread, meanwhile permitting the thread to shrink; and collecting the dried thread in package form.

19. In the manufacture of completely processed multiple filament viscose artificial silk thread, the steps of extruding, coagulating, partially processing and twisting the thread, meanwhile winding the thread into a collection pack-

age; unwinding the twisted thread from said collection package, the unwinding step being performed without eliminating the twist previously introduced into the thread; taking up the thread on helix-forming means immediately after unwinding it from said collection package; continuously positively advancing the thread on said helix-forming means in the form of a helix characterized by a large number of closely spaced turns; subjecting the thread while in such helical form to additional processing, meanwhile permitting the thread to shrink; and collecting the processed thread in package form.

20. In the manufacture of completely processed multiple filament viscose artificial silk thread, the steps of extruding, coagulating, partially processing and twisting the thread, meanwhile winding the thread into a collection package; unwinding the thread from said collection package, the unwinding step being performed without eliminating the twist previously introduced into the thread; taking up the thread on helix-forming means immediately after unwinding it from said collection package; continuously positively advancing the thread in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the thread to the action of one or more treating liquids by which the liquid processing of the thread is completed while the thread is still in helical form; and thereafter collecting the processed thread.

21. In the manufacture of completely processed multiple filament viscose artificial silk thread, the steps of extruding, coagulating, partially processing and twisting the thread, meanwhile winding the thread into a collection package; unwinding the thread from said collection package, the unwinding step being performed without eliminating the twist previously introduced into the thread; taking up the thread on helix-forming means immediately after unwinding it from said collection package; continuously positively advancing the thread on said helix-forming means in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the thread while in such helical form to additional processing, such processing involving the application of a plurality of different treating liquids to the thread; drying the processed thread; and collecting the dried thread in package form.

22. In the manufacture of completely processed multiple filament viscose artificial silk thread, the steps of extruding, coagulating, partially processing and twisting the thread, meanwhile winding the thread into a collection package; unwinding the thread from said collection package, the unwinding step being performed without eliminating the twist previously introduced into the thread; taking up the thread on helix-forming means immediately after unwinding it from said collection package; continuously positively advancing the thread on said helix-forming means in the form of one or more helices characterized by a large number of closely spaced turns; subjecting the thread while in such helical form to additional processing, such processing involving the application of a plurality of different treating liquids to the thread; drying the processed thread, meanwhile effecting a change in the length thereof; and collecting the dried thread in package form.

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