Aug. 7, 1934. H. A. SCHRENK 1,968,912

PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK

Filed May 23, 1933 3 Sheets-Sheet 1

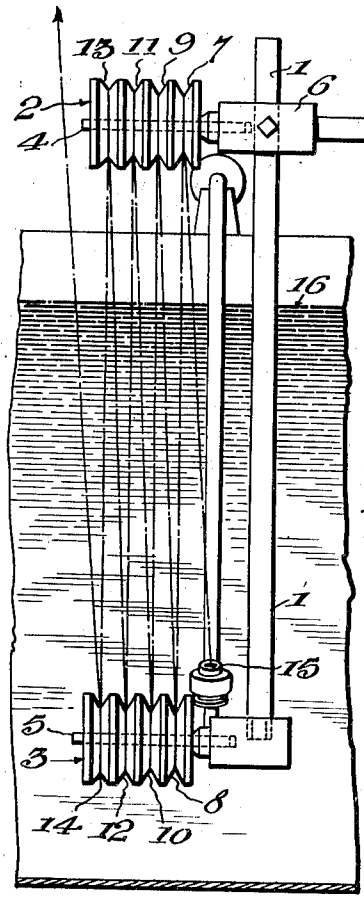


Fig. 1.

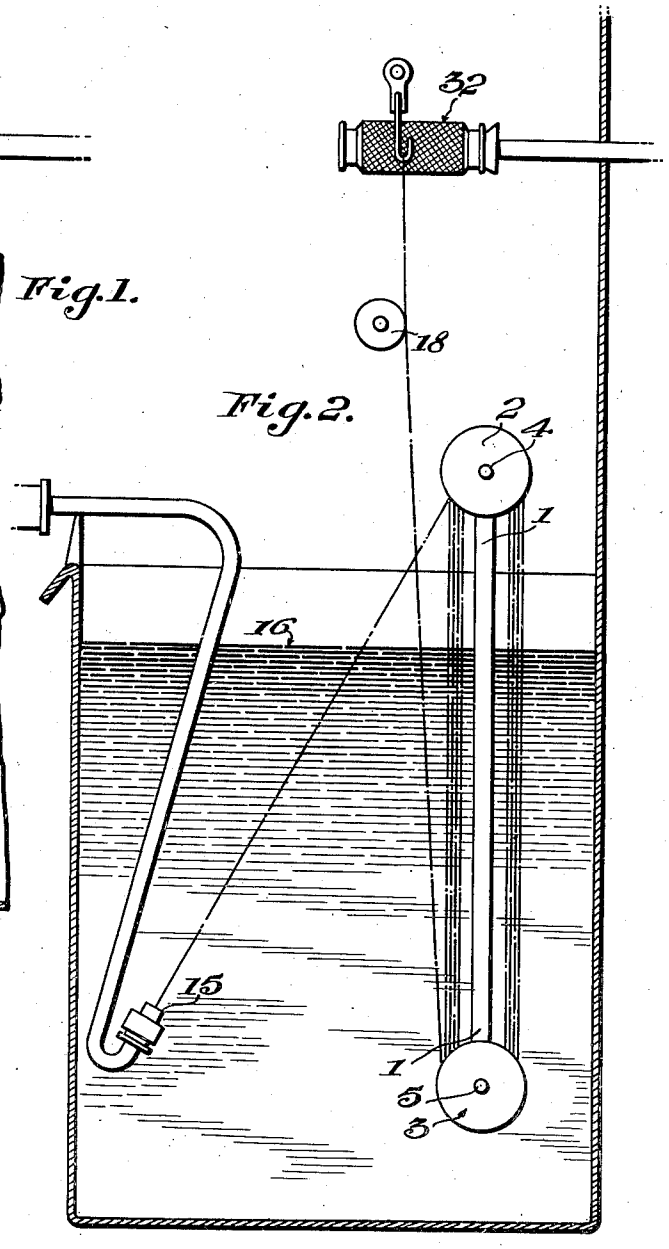


Fig. 2.

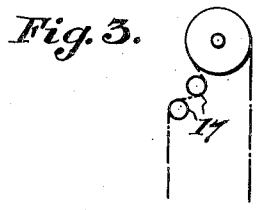


Fig. 3.

Inventor
Hans Alwin Schrenk.

By Thomas H. Byrne
Attorney

Aug. 7, 1934. H. A. SCHRENK 1,968,912

PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK

Filed May 23, 1933 3 Sheets-Sheet 2

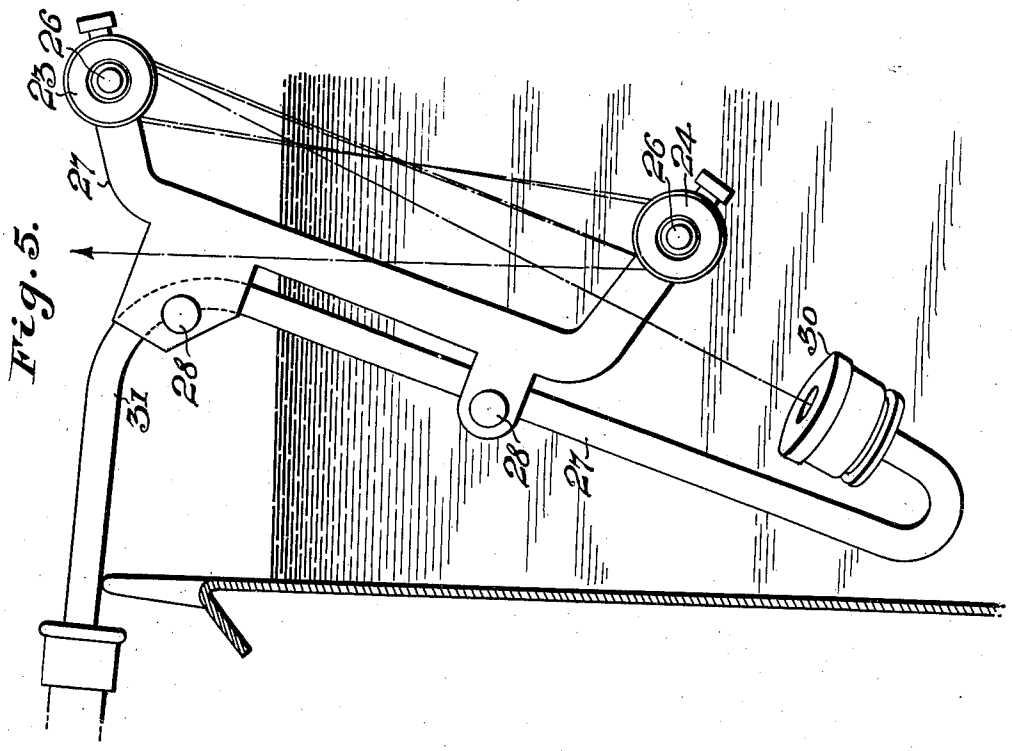


Fig. 5.

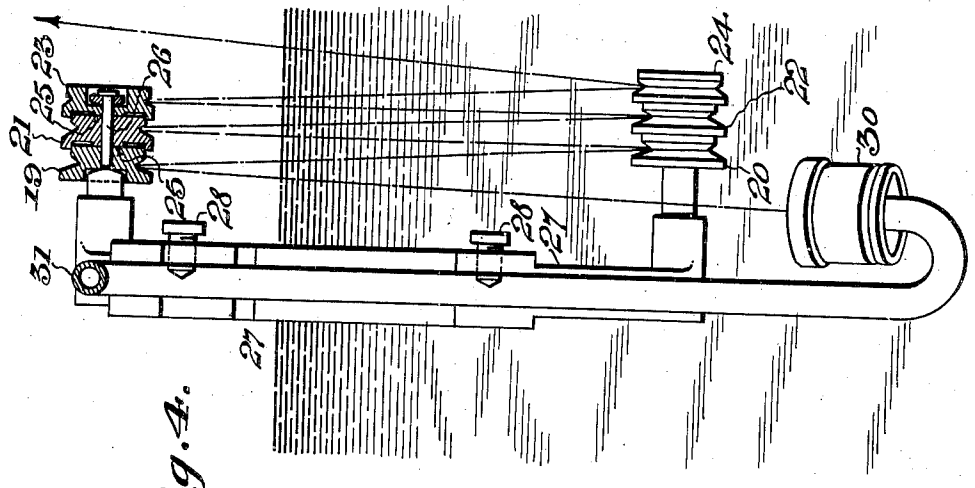


Fig. 4.

Inventor
Hans Alwin Shrenk.

By Thomas A. Byron.
Attorney

Aug. 7, 1934. H. A. SCHRENK 1,968,912

PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK

Filed May 23, 1933 3 Sheets-Sheet 3

Fig. 6.

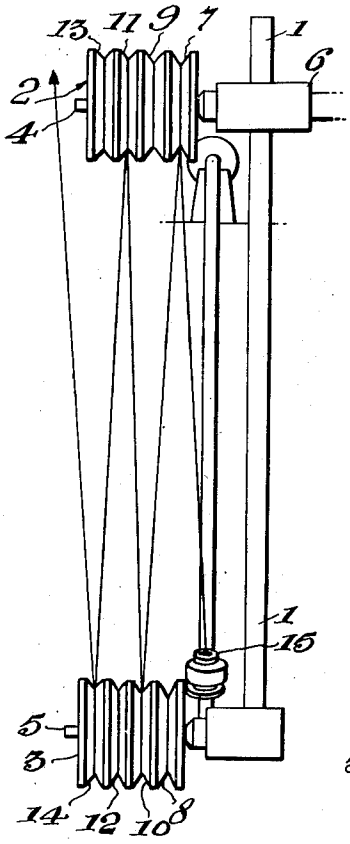


Fig. 7.

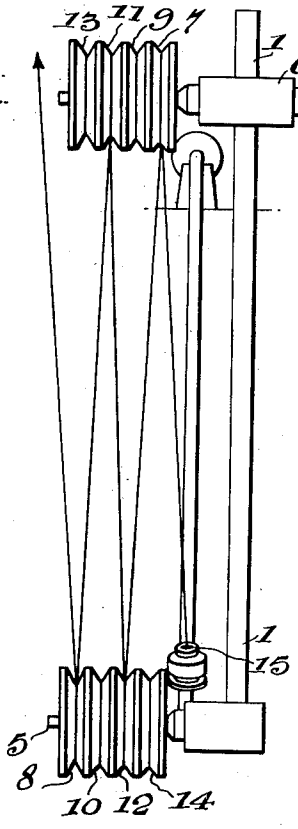
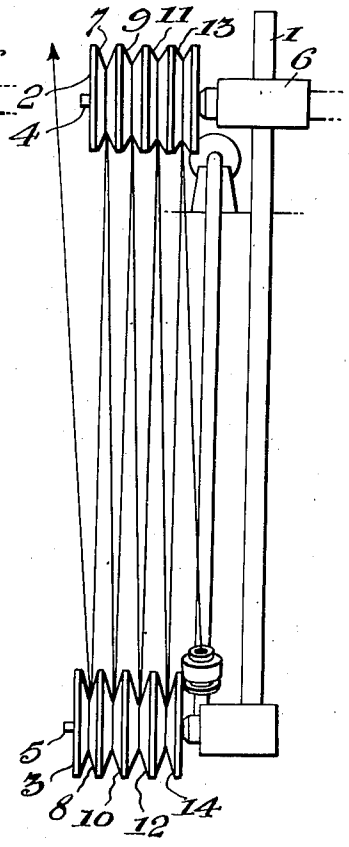


Fig. 8.



Inventor

Hans Alwin Shrenk

By Thomas H. Byron,

Attorney

Patented Aug. 7, 1934

1,968,912

UNITED STATES PATENT OFFICE

1,968,912

PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK

Hans Alwin Schrenk, Arnhem, Netherlands, assignor to American Enka Corporation, Enka, N. C., a corporation of Delaware

Application May 23, 1933, Serial No. 672,416
In Germany March 23, 1932

26 Claims. (Cl. 18—8)

The invention relates to a process and apparatus for changing the tension of a freshly spun artificial thread.

One object of the invention is to attain a gradually increasing tension and thus a stretching step by step of the thread.

Another object of the invention is to attain a gradual decrease of the tension and thus a shrinking step by step of the thread.

According to an other form of the invention several steps of tensioning and slackening of the thread can follow one another.

In the manufacture of artificial silk from cellulosic solutions, the spinning solution is extruded through a spinning nozzle into or through a coagulating or precipitating solution according to the particular process involved. The formed filaments, which are still in plastic condition, are then carried to a collecting means and wound into yarn bodies.

During the spinning operation it has been the usual practice to impart to the filaments a stretching action by collecting the filaments at a greater speed than the speed of extrusion from the spinning nozzle. This stretching action on the freshly made filaments not only gave a finer denier but also increased the tensile strength. With this method of imparting stretch it was found that control of the stretching action was difficult of achievement due to variations in the peripheral speed of the yarn body at different points of its circumference. In view of the aforementioned difficulty, various other means have been used which considerably improved the uniformity of the stretching action. The means mentioned included stationary guide rods and other guiding means which would act to retard the passage of the thread and thus create a stretching action. In practice, however, it has been found that these thread guides, though they imposed a tension and were an improvement over the first mentioned method, were still not satisfactory in that an irregular tension resulted. The use of power driven rollers running at different peripheral speeds, over which the threads passed, has been tried with varying degrees of success in the stretching of the threads. With these last mentioned means, uniformity of the stretching action was attained but not a uniform thread.

The purpose of the present invention is to overcome the difficulties mentioned above by imparting to the filaments changes in tension which are imparted by a method and means operated by the passage of the threads themselves during the spinning operation or at any stage where they are in a plastic condition. These means include surfaces, at least one of which has different diameter guiding surfaces, over which the threads are passed alternately from one surface to another a plurality of times and which are actuated solely by thread contact. By use of these filament driven surfaces, the stretching action is found to be uniform and the threads are allowed to compensate within themselves for any variations in the operating conditions.

The invention is also suited to imparting a stretch and contracting action during the passage of the thread over the rollers or it is possible to obtain an increasing contraction of the filaments. These latter arrangements are for producing threads having different tensile strengths and elongation characteristics. It is a well known principle that, within certain limits, the greater the stretch during the spinning of artificial filaments the less will be the elongation. It is therefore readily apparent that threads with the greatest strength may have the least elongation, and vice versa. For certain uses a thread of comparatively little strength and having high elongation may be desired in preference to one of greater strength with low elongation qualities; whereas threads having maximum thread strength in combination with maximum elongation are preferable in other respects. These qualities are given to the threads mainly through means for varying the tension during spinning. It is the purpose of applicant's invention, as hereinbefore pointed out, to achieve these different tension results in a novel manner and whereby the threads receive a less rigid stretching action than heretofore in the art.

It has also been found that, due to the use of applicant's stretching method and apparatus, filaments of improved and uniform dyeing characteristics have resulted. Dyeing difficulties are caused by varied spinning conditions which the invention overcomes by the use of thread driven means which allow the threads to become self-compensating during the varied stretching step.

According to the invention the freshly spun artificial thread is conducted over two or more rollers, each roller consisting of a plurality of guiding surfaces in the form of grooves having the same or different diameters. If the diameter of the thread guiding grooves following each other in the run of the thread is increased step by step, then a continuous stretching of the thread is attained. If, on the other hand, the diameter of these rollers is decreased, then a slackening of the thread and shrinking is at-

tained. The dimensions of the guiding grooves can, of course, also be selected in such a way that the thread is subject to stretching and also to slackenings. Furthermore it can be imagined that a stretching or a slackening of the thread can be produced by some of the grooves only and that the other grooves are only used for lengthening the path of the thread requisite for a finished thread formation.

The series of rollers—under certain circumstances there are more than two—can be situated both inside the spinning bath or partly inside and partly outside the spinning bath. They can also be so arranged that the thread only makes its path through the air. In using the apparatus according to the invention the formation of the thread is done rapidly and demands the smallest space. This is especially of importance in spinning according to the continue process.

In many cases it can be preferable to use instead of the rollers having several guiding grooves or in combination with such a roller or rollers one or more separate freely rotating rollers.

In the drawings two forms of execution of the apparatus according to the invention are represented.

Fig. 1 shows the front view, of the apparatus.

Fig. 2 shows the side-view of the apparatus.

Fig. 3 shows a detail.

Fig. 4 shows another form of execution in front view.

Fig. 5 shows the same in side view.

Fig. 6 is a diagrammatic view illustrating the path the threads are given over the rollers when each succeeding guiding surface in the path of the thread has a greater diameter resulting in imparting to the thread a successive stretch.

Fig. 7 is a view similar to Fig. 6 in which each succeeeding guiding surface in the path of the thread is of a lesser diameter, thereby imparting to the thread a successive lowering of its linear speed and allowing a successive contraction.

Fig. 8 is a view similar to Figs. 6 and 7 in which the threads have imparted thereto an alternate stretch and contraction by alternately passing the threads to surfaces of greater and lesser peripheral speeds.

The apparatus according to Figs. 1 and 2 consists of a holder 1 and the two rollers 2 and 3, which are mounted on bolts 4 and 5 respectively. The bolt 5 is attached to a slide 6, so that the distance between the rollers 2 and 3 and thus the length of the path of the thread is changeable.

Each roller is the combination of four thread guiding grooves 7, 9, 11 and 13 and 8, 10, 12 and 14 respectively. In this form of execution the diameter of these guiding grooves is chosen in such a manner that the thread leaving the jet 15 is subject to a stretching step by step. The diameter of the guiding groove 7 is thus the smallest and the diameter increases from guiding groove to guiding groove. The thread leaving the guiding groove 14 is either fed to a spool or roller, to a spinning pot or in using the continue process is passed to the several treating baths.

In the first form of execution the roller 2 lies outside the spinning bath and roller 3 inside the spinning bath, the level of which is shown at 16. When at least one roller is immersed in the spinning bath and at least one roller is positioned outside the spinning bath, the filaments pass into and out of the precipitating bath a plurality of times, so that in its passage through the air after each immersion, the filaments may, to a certain extent, compensate in themselves for any stress applied by the drawing means before being wound on the take-up device. The result is to effect a step by step coagulation with intermediate compensation for any stress on the threads taking place. The revolution of the rollers is actuated by the thread passing over it; they can, however, be driven positively.

According to Fig. 3 two guiderods 17 for the thread to be stretched are positioned in front of a roller in order to cause in a manner known in itself the stretching to take place at a certain section of the thread.

Should the braking resistance of the roller caused by the bath or bearing friction necessary for stretching the thread in the shown forms of execution be not sufficient, then a brake weight or turbulance brake or the like may be used. In leaving the guiding groove 14 a subsequent stretching or slackening can be given to the thread by the drawing-off member.

In machines, in which the thread is collected on a rigid base (spool or roller) it is advisable to interpose according to Fig. 2 a positively driven guiding or drawing off roller 18 between the apparatus according to the invention and the winding organ 32, around which the thread is entwined one or more times for the purposes of a good hold. It can have a slower, the same or a greater drawing off speed than that which corresponds to the speed of the thread running on to the spool or roller.

The apparatus according to Figs. 4 and 5 has only single rollers. The rollers 19, 21, 23 and the rollers 20, 22 and 24 are united into one group. The two last mentioned rollers of each group are excavated on one side in such a way that they somewhat overlap the rollers adjacent to this side. The rear side of the roller protruding into this cavity is kept at a corresponding diameter. In order that a small as possible friction surface between the rollers is supplied, the rollers 21—24 are each provided with a projection 25.

The rollers run loosely on bolts 26, which are carried by a holder 27. This holder is clamped by means of the screws 28, 29 to the pipe 31 ending in the spinning jet 30. In Fig. 6 is illustrated the manner in which a successive stretching action may be imparted to the thread by giving it a greater lineal speed at each spaced point. The thread is shown extruding from the spinneret 15 and passing it to the smallest groove 7 of the roller 2 and then carrying it to the larger groove 10 of the roller 3, back to groove 11 of roller 2 and then around groove 14 of roller 3, the grooves 7, 10, 11, and 14 being of successively increasing diameters and traveling at greater peripheral speeds.

In Fig. 7 the thread first passes around the largest groove 13 of roller 2, then to a groove 12 of smaller diameter, on roller 3 back to roller 2 and passing around groove 9, which is of smaller diameter than groove 12, and finally passes around groove 14 which is smallest of all. This arrangement allows a successive contraction of the thread because successive grooves in its path are traveling at successively slower speeds.

In Fig. 8 the thread is passed first to groove 13 and then to groove 14, which travels at a slower peripheral speed, then to groove 11 traveling at a higher speed, to groove 12 traveling at a lower, and so on to grooves 9, 10, 7, and finally around groove 8, whereby higher and lower speeds are alternately imparted to the thread.

What I claim is:—

1. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, at least one of said surfaces having different diameter portions, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner as to impart different linear speeds to the thread when it passes over the said surfaces.

2. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, each of said surfaces having different diameter portions, repeating the drawing of the thread at least once over different portions of the said surfaces in such a manner that each successive portion contacted by the thread will have a greater peripheral speed, thereby imparting a progressive stretch to the thread.

3. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, each of said surfaces having different diameter portions, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner as to impart different linear speeds to the thread when it passes over the said surfaces.

4. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, each of said surfaces having different diameter portions, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner that each successive portion contacted by the thread will have a lesser peripheral speed, thereby resulting in an increasing contraction of the thread.

5. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, stretching it and contracting it while in plastic condition by giving it different linear speeds at spaced points in its path of travel by drawing it over surfaces driven solely by said thread, at least one of said surfaces being immersed in a bath calculated to aid in the precipitation of the filaments, then passing it to a collecting device.

6. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, stretching it and contracting it while in plastic condition by giving it different linear speeds at spaced points in its path of travel by drawing it over surfaces driven solely by said thread.

7. A device of the class described comprising at least two shafts, freely rotating guiding rollers on the said shafts, a spinning pipe and means for movably connecting the said shafts with the said spinning pipe.

8. A device of the class described comprising at least two shafts, several freely rotating guiding rollers on each of the said shafts, a holder carrying the said shafts, a spinning pipe and clamping means for movably connecting the said holder with the said pipe.

9. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, imparting to it while in plastic condition different linear speeds at spaced points in its path of travel, comprising drawing it successively over surfaces driven by said thread, each of said surfaces having different diameter portions and at least one of said surfaces immersed in a bath calculated to aid in the precipitation of the filaments, repeating this drawing at least once over different portions of the said surfaces.

10. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, at least one of said surfaces having different diameter portions, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner as to impart different linear speeds to the thread when it passes over the said surfaces, and passing it to a collecting device under decreased tension.

11. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, imparting to it while in plastic condition different linear speeds at spaced points in its path of travel, comprising drawing it successively over surfaces driven by said thread, each of said surfaces having different diameter portions and at least one of said surfaces immersed in a bath calculated to aid in the precipitation of the filaments, repeating this drawing at least once over different portions of the said surfaces, and passing it to a collecting device under decreased tension.

12. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, at least one of said surfaces having different diameter portions, said surfaces mounted in part in and in part out of a bath calculated to aid in the precipitation of the thread, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner as to impart different linear speeds to the thread when it is drawn over the said surfaces.

13. In the manufacture of artificial silk from cellulosic solutions, the steps of extruding the thread, drawing it successively over surfaces driven by said thread, at least one of said surfaces having different diameter portions, said surfaces mounted in part in and in part out of a bath calculated to aid in the precipitation of the thread, repeating this drawing of the thread at least once over different portions of the said surfaces in such a manner as to impart different linear speeds to the thread when it is drawn over the said surfaces, and passing it to a collecting device under decreased tension.

14. Apparatus for use in the manufacture of artificial silk comprising freely rotatable rollers, at least one of which has thread engaging surfaces of different diameters to impart different linear speeds at spaced points in its path of travel to a thread drawn alternately from one of the said rollers to another a plurality of times, and means for drawing the thread thereover.

15. Apparatus for use in the manufacture of artificial silk comprising freely rotatable rollers having thread engaging surfaces of different diameters to impart different linear speeds at spaced points to a thread in its path of travel when said thread is drawn alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, and means for drawing the thread thereover.

16. Apparatus for manufacture of artificial silk comprising a spinning nozzle for extruding the thread, freely rotatable rollers in spaced relation and driven by the thread passing thereover, said

rollers having guiding surfaces of different diameters so arranged that, when the thread is passed alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, each successive guiding surface in the path of the thread has a greater diameter than the preceding one, and means for drawing the thread thereover.

17. Apparatus for manufacture of artificial silk comprising a spinning nozzle for extruding the thread, freely rotatable rollers in spaced relation and driven by the thread passing thereover, said rollers having guiding surfaces of different diameters so arranged that, when the thread is passed alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, each successive guiding surface in the path of the thread has a different diameter than the preceding one, and means for drawing the thread thereover.

18. Apparatus for manufacture of artificial silk comprising a spinning nozzle for extruding the thread, freely rotatable rollers in spaced relation and driven by the thread passing thereover, said rollers having guiding surfaces of different diameters so arranged that, when the thread is passed alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, each successive guiding surface in the path of the thread has a lesser diameter than the preceding one, and means for drawing the thread thereover.

19. Apparatus for use in the manufacture of artificial silk comprising freely rotatable rollers having thread engaging surfaces of different diameters to impart different linear speeds at spaced points to a thread in its path of travel when said thread is drawn alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, means for drawing the thread at a constant rate, and a take-up device for collecting the thread.

20. Apparatus for manufacture of artificial silk comprising a spinning nozzle for extruding the thread, freely rotatable rollers in spaced relation and driven by the thread passing thereover, said rollers having guiding surfaces of different diameters so arranged that, when the thread is passed alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, each successive guiding surface in the path of the thread has a different diameter than the preceding one, tension creating guide rods positioned in advance of the first freely rotatable roller for deflecting the course of the thread, and means for drawing the thread from said guide rollers at a constant rate.

21. Apparatus for use in the manufacture of artificial silk comprising freely rotatable rollers having thread engaging surfaces of different diameters to impart different linear speeds at spaced points to a thread in its path of travel when said thread is drawn alternately from the surfaces of one roller to the surfaces of another roller a plurality of times, means for drawing the thread at a constant rate, a rotatable receiver for collecting the threads, and means for driving said receiver at a lesser peripheral speed than said drawing device.

22. Apparatus for manufacture of artificial silk having a spinning nozzle for delivering thread forming material to a coagulating bath and a means for collecting the thread, in combination with a plurality of freely rotatable rollers having thread engaging surfaces of varying diameters disposed intermediate the spinning and the collecting means, at least one of said rollers contacting with the coagulating bath, said rollers adapted to be driven by the thread passing thereover and to impart different linear speeds when it is passed alternately from the guiding surfaces of one roller to the guiding surfaces of another a plurality of times.

23. An apparatus for the manufacture of artificial silk having a spinning nozzle for delivering thread forming material to a coagulating bath and a means for collecting the thread, in combination with a pair of spaced freely rotatable rollers disposed intermediate the spinning nozzle and the collecting means, said rollers having guiding grooves of different diameters and driven by the thread passing thereover, said guiding grooves being so arranged that, when the thread is passed alternately from the grooves of one roller to the grooves of another roller a plurality of times, each successive guiding groove in the path of the thread has a different diameter than the preceding one.

24. An apparatus for the manufacture of artificial silk having a spinning nozzle for delivering thread forming material to a coagulating bath and a means for collecting the thread, in combination with a pair of spaced freely rotatable rollers disposed intermediate the spinning nozzle and the collecting means, said rollers having guiding grooves of different diameters and driven by the thread passing thereover, said guiding grooves being so arranged that, when the thread is passed alternately from the grooves of one roller to the grooves of another roller a plurality of times, each successive guiding groove in the path of the thread has a lesser diameter than the preceding one.

25. An apparatus for the manufacture of artificial silk having a spinning nozzle for delivering thread forming material to a coagulating bath and a means for collecting the thread, in combination with a pair of spaced freely rotatable rollers disposed intermediate the spinning nozzle and the collecting means, said rollers having guiding grooves of different diameters and driven by the thread passing thereover, said guiding grooves being so arranged that, when the thread is passed alternately from the grooves of one roller to the grooves of another roller a plurality of times, each successive guiding groove in the path of the thread has a greater diameter than the preceding one.

26. Apparatus for the manufacture of artificial silk having a spinning nozzle for delivering thread forming material to a coagulating bath and means for collecting the thread, in combination with a plurality of freely rotatable rollers, each having a plurality of guiding grooves, and disposed intermediate the spinnerette and the collecting means, at least one of said rollers having guiding grooves of different diameters, said rollers adapted to be driven by the thread passing thereover and to impart different linear speeds when the thread is passing alternately from the grooves of one roller to the grooves of another roller a plurality of times.

HANS ALWIN SCHRENK.