March 13, 1934. F. H. GRIFFIN 1,950,922

MANUFACTURE OF ARTIFICIAL SILK

Filed April 26, 1927 3 Sheets-Sheet 1

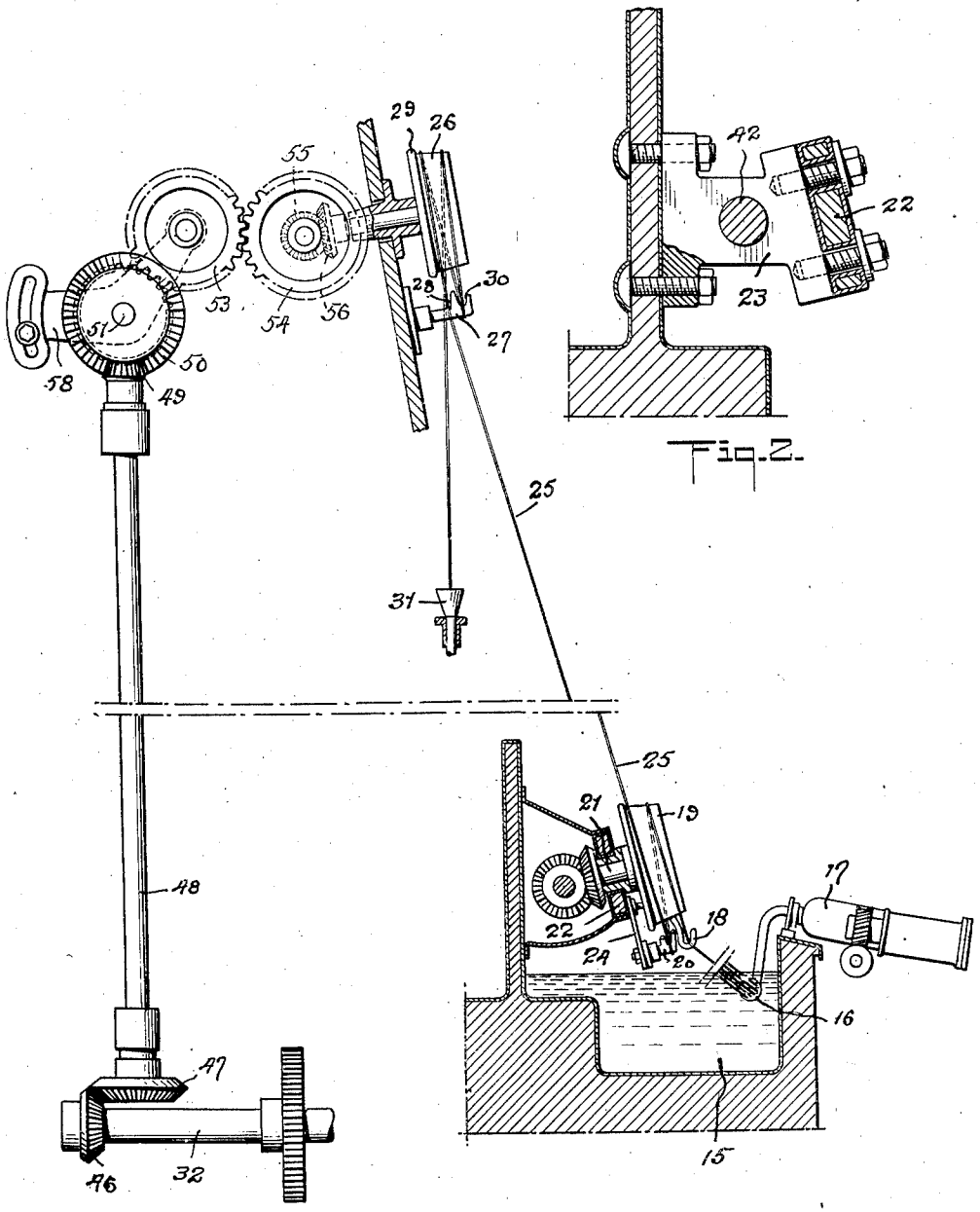

Fig. 1.

Fig. 2.

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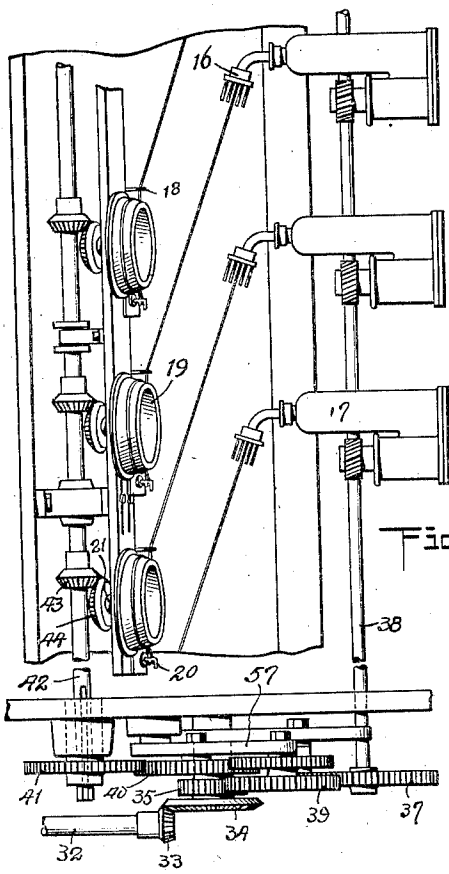


Fig. 3.

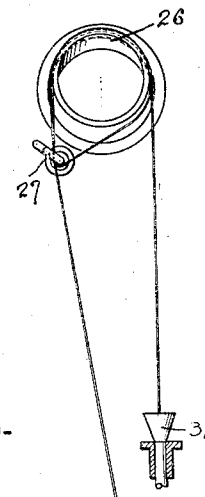
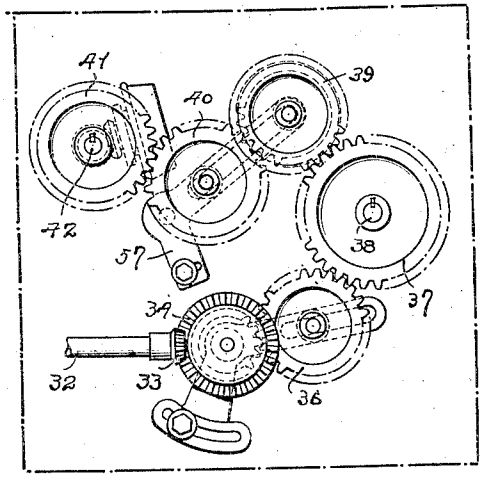
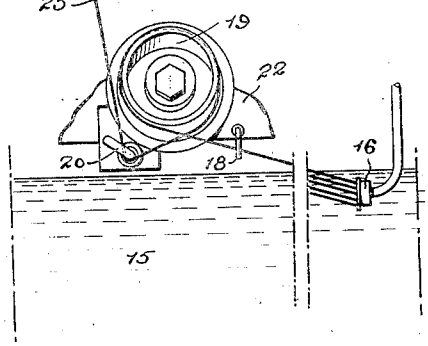


Fig. 5.

Fig. 4.





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MANUFACTURE OF ARTIFICIAL SILK

Filed April 26, 1927 3 Sheets-Sheet 3

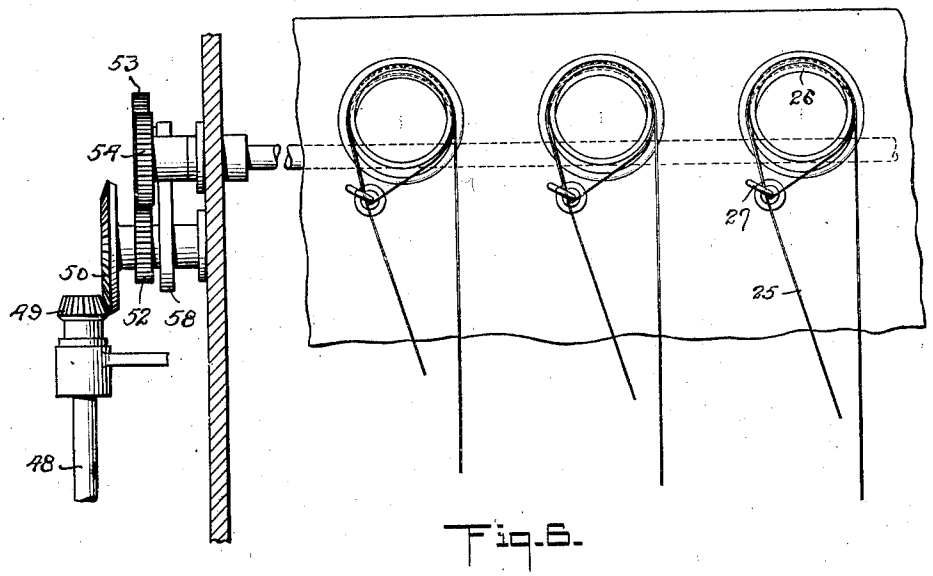

Fig. 6.

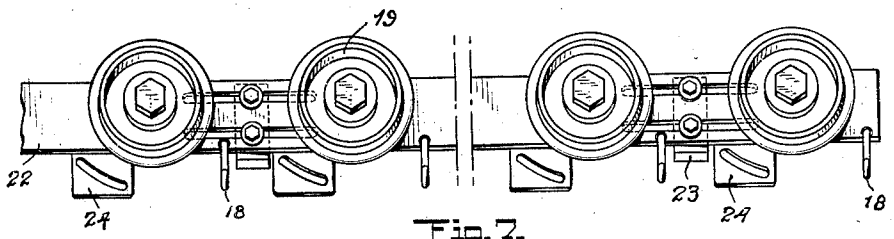

Fig. 7.

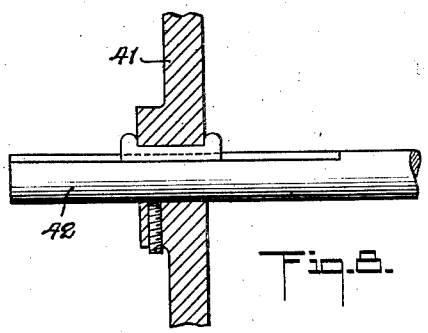

Fig. 8.

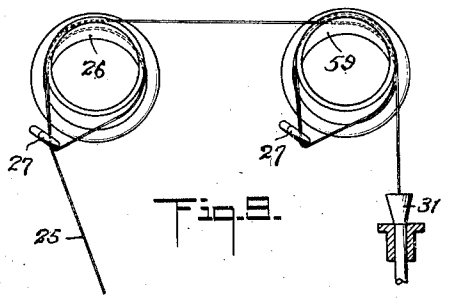

Fig. 9.

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1,950,922

UNITED STATES PATENT OFFICE

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MANUFACTURE OF ARTIFICIAL SILK

Frank H. Griffin, Wawa, Pa., assignor to The Viscose Company, Marcus Hook, Pa., a corporation of Pennsylvania

Application April 26, 1927, Serial No. 186,728

17 Claims. (Cl. 18—8)

My invention relates to the manufacture of artificial silk, and particularly to an improvement in method and apparatus by which the product is improved from the standpoint of tensile strength, uniformity in strength and size, and dyeing properties. While my invention may be applicable to dry spinning as well as wet spinning, and also to silk spun from various cellulosic solutions, I have practiced it particularly in the manufacture of artificial silk from viscose, and accordingly have illustrated viscose silk spinning apparatus in the accompanying more or less diagrammatic drawings, in which

Fig. 1 is a side elevation, partially in section, of a viscose spinning unit adapted for the practice of my invention;

Fig. 2 is an enlarged section illustrating the adjustable carrier bar in which a battery of lower godets and their associated guides are mounted;

Fig. 3 is a broken plan view of portion of a battery of spinning units, only the pumps and lower godets and their drive connections being shown;

Fig. 4 is an end elevation of the drive gear for the lower godets and pumps;

Fig. 5 is a front elevation of the spinning unit shown in Fig. 1;

Fig. 6 is a broken front elevation of a battery of upper godets and their drive gear;

Fig. 7 is a front elevation of an adjustable carrier bar for the lower godets and their associated guides;

Fig. 8 is a section of a detail of the lower godet drive; and

Fig. 9 is a front elevation of a modified layout in which a plurality of upper godets is used.

It is known that in the spinning of artificial silk increased tensile strength of the finished product is attained if the thread, while still in plastic condition, is placed under tension. To accomplish this it has been suggested that the thread be interlaced with a series of glass rods submerged in or located adjacent the setting bath, the interlacing of the thread with the rods resulting in a drag on the thread which places the latter under tension between the rods and the bobbin upon which the thread is wound. The suggestion has not proved practical, however, since the drag of the thread on the rods is not constant. In actual practice there is a variation in the frictional engagement of the thread on the rods which results in nonuniform tensile strength, inequality of denier, and uneven dyeing properties.

It has also been suggested that the thread be led from a stationary guide, submerged in the setting bath, to a positively driven cylinder and thence to a winding bobbin, the peripheral speed of the bobbin exceeding that of the positively driven cylinder. Practical experience has established, however, that there is not only slippage of the thread at the cylinder which prevents uniformity of tension between the latter and the winding bobbin, but also that the deflection of the thread at a sharp angle from the submerged guide to the cylinder is in itself objectionable, since it prevents uniformity of tension between guide and cylinder and between guide and spinning nozzle. The frictional engagement of the thread at a guide increases rapidly with the angle of deflection, and when the angle of deflection is marked the engagement of the thread with the guide is non-uniform. It must be borne in mind that uniformity of tension is essential to uniformity of strength, denier and dyeing qualities in the finished product, and that a product which lacks these characteristics is not acceptable to the trade.

So far as I am aware, no method has heretofore been suggested by which uniformity of tension on the thread during the spinning operation has been attained. My invention provides a simple and workable method and apparatus for accomplishing this result by means which are adaptable to standard apparatus without undue expense in view of the greatly improved character of the product which results from the practice of my invention.

My invention contemplates the engagement of the thread (that is to say the group of filaments which eventually constitutes the thread) between spaced rotors positively driven at different peripheral speeds, the engagement of the thread with each of the rotors being so effected that no appreciable slippage occurs at either. A uniform tension is thus placed on the thread between these rotors, and also between the spinning nozzle and the rotor which draws the thread from the spinning bath.

The condition which must be created to do away with appreciable slippage is that of substantial identity between the speed of the rotor and the speed of the portion of the thread in engagement with the rotor. It is within the scope of the invention to use other movable elements than rotors to engage the thread.

As will appear from the description following of the preferred embodiment, it is an underlying thought of this invention that, in drawing the thread from the setting bath, as the thread passes certain spaced points or positions in its path of

travel, the portions of it which, for the instant, are at these spaced points are given respectively different speeds and that the difference of thread speed between these points is maintained constant as succeeding portions of thread pass. The result is that all portions of the thread are put under the same tension.

Various expedients are available to effect this result. For example, the thread may be passed between pairs of cooperating rolls which positively engage the thread at the nip of each roll pair. This practice, however, is objectionable from several standpoints. I prefer an arrangement such as indicated in the accompanying drawings, in which the engagement of the thread with each rotor is effected by lapping the thread thereon to an extent sufficient to insure a frictional grip of the thread on the rotor which prevents appreciable slippage at that point.

Referring to the drawings, I have illustrated in Fig. 1, more or less diagrammatically, a layout which comprises a setting bath 15, into which the group of filaments which composes the thread is discharged through a submerged nozzle 16 connected to the pump 17. From the spinning nozzle 16 the thread passes to a guide 18 so arranged with respect to a positively driven lower godet 19 that the thread is delivered without substantial deflection by the guide 18 to the periphery of the godet. On the latter the thread is lapped sufficiently to insure a non-slip draughting engagement therewith, and is taken from the godet over a second guide 20 located to prevent interference between the "on" and "off" courses of the thread on the godet. Both guides 18 and 20, as well as the godet spindle 21, are carried by a bar 22 longitudinally adjustable on its supporting brackets 23 to vary the length of the thread submersion in the bath 15. The guide 20 is also preferably mounted on an adjustable bracket 24 so that its position with respect to the godet may be varied.

The thread 25 passes from guide 20 to the upper godet 26, with which is associated the guide 27. The notch 28 of the guide 27 receives the thread and delivers it to the godet 26 adjacent the rim flange 29 of the latter. Lapping the godet 26 the thread is engaged in notch 30 of the guide from which it again laps the godet 26, thus similarly insuring a non-slip draughting engagement between the godet and thread. Passing from the godet 26 the thread descends through the guide funnel 31 to a coiling device such as a spinning box (not shown).

Any suitable means may be provided for driving the godets 21 and 26 at different peripheral speeds. In the layout shown the godets are of the same diameter and the gearing is so arranged as to impart to the godet 19 a slower speed of rotation than that imparted to the upper godet 26. Both take their drive from the main shaft 32. The drive for the lower godet 19 is indicated in Fig. 4 through bevel gears 33, 34, sprocket 35 on the shaft of bevel gear 34 meshing with idler pinion 36 which in turn meshes with gear 37 on the driving shaft 38 for the pump 17. Gear 37 drives idlers 39 and 40, the latter meshing with pinion 41 slidably keyed on shaft 42, which is provided at intervals along its length with bevel gears 43, each meshing with a bevel gear 44 on the spindle 21 of a godet 19. The upper godet 26 is driven from shaft 32 through bevel pinion 46, meshing with a bevel sprocket 47 on shaft 48, a second bevel sprocket 49 at the opposite end of the shaft meshing with bevel gear 50 on shaft 51 of sprocket 52 through which motion is transmitted by idler 53 to the sprocket 54 on the shaft of the bevel pinion 55 which drives the bevel gear 56 on the shaft of godet 26. By replacing either or both of the gears 41 and 54 by gears of different sizes, the relative peripheral speeds of the two godets 21 and 26 may be varied to increase or decrease the tension exerted upon the thread as it passes therebetween and between the lower godet and the spinning nozzle. Gear 37 may be replaced by a gear of different size if it is desired to change proportionally the speeds of pump 17 and godets 19. The adjustable mounting of the idlers 39, 40 and 53 permits these substitutions.

The number of laps necessary to insure a sufficient frictional grip of the thread upon the godets may vary with the diameter of the latter, with their speed of rotation, the denier of the thread and other factors. It may be desirable under certain conditions to vary the number of laps on either or both godets, and my invention contemplates appropriate guide constructions to prevent interference between the courses or tracks of the laps on the respective godets. Guide 27, as well as guide 20, is preferably adjustable upon its support. The guides may be glass or porcelain rods. They may be substituted if desired by metallic spindles, upon which small pulleys of glass, or other inert material, may be journaled to prevent possible injury to the thread by frictional engagement. Guide pins of known type may be used if desired.

When the godets are lapped by the thread in this fashion there is no appreciable slippage of the thread on the godets. Consequently a uniform tension, determined by their relative peripheral speeds, is imparted to the thread between the godets and between the lower godet and the spinning nozzle. The tension thus applied may be so increased without danger of slippage that the tensile strength of the product, both wet and dry, is greatly increased over that heretofore attained in the manufacture of artificial silk of like denier, and the product is greatly improved from the standpoint of uniformity of strength, size and dyeing properties.

Instead of leading the thread 25 directly from the upper godet 26 to the spinning box, it may be led to and lapped around another godet 59 (Fig. 9) which is driven at still higher peripheral speed, thus adding still further to the tension placed upon the thread and further increasing its strength, while maintaining the desired uniformity of strength, denier and dyeing properties.

Of course godet 26 or 59 may be replaced by a bobbin, when bobbin winding is desired, suitable means being provided to maintain constant the tension upon the thread between the bobbin and the preceding godet as the diameter of the bobbin increase.

With the understanding that the apparatus shown is but a single illustrative embodiment of apparatus appropriate for carrying out my invention according to the wet spinning process, and that it may be varied in many ways to accomplish a like result, in either wet or dry spinning processes, without departing from the thoughts which underlie what I claim as my invention.

I claim—

1. In the manufacture of artificial silk from a cellulosic solution, the steps of drawing the thread from the spinning nozzle by a driven rotor, leading the thread from said rotor to a second rotor positively driven at higher peripheral speed, causing the thread to travel at substantially the

same linear speed, while in association with each rotor, as the portion of the said rotor with which the thread is associated to effect a uniform stretching effort upon the thread between the rotors and delivering the thread continuously from said second rotor.

2. In the manufacture of artificial silk from a cellulosic solution, the steps of stretching the thread while in plastic condition by lapping it upon spaced rotors having different peripheral speeds, the lappage being sufficient to cause the thread to have, at each rotor, substantially the same linear speed as the periphery of the rotor and delivering the thread continuously from the last of said rotors.

3. In the manufacture of artificial silk from a cellulosic solution, the steps of stretching the thread while in plastic condition, by lapping it upon spaced rotors having different peripheral speeds, the lappage being sufficient to cause the thread, at each rotor, to have substantially the same linear speed as the periphery of the rotor and guiding the thread on each rotor to prevent the thread from tracking on itself.

4. In the manufacture of artificial silk from a cellulosic solution, the method of stretching the thread which comprises feeding the thread from the spinning nozzle into engagement with a series of rotors while causing the thread engaging portion of each rotor to have a higher linear speed than the corresponding portion of the preceding rotor in the series and while causing the thread to have, at each rotor, substantially the same linear speed as the portion of the rotor it engages, and delivering the thread continuously from the last of said rotors.

5. In the manufacture of artificial silk from cellulosic solution, the method of giving the thread uniform tension while drawing it from the setting bath which consists in giving the thread a different linear speed at predetermined spaced points in its path of travel and maintaining this difference of speed constant for succeeding portions of the thread passing these points.

6. In the manufacture of artificial silk from a cellulosic solution, the method of passing the thread from the spinning nozzle to a coiling device, which comprises drawing the thread from the spinning nozzle by a driven godet, delivering the thread from said godet to a second godet driven at a higher peripheral speed, causing the thread while in engagement with each godet to have substantially the same linear speed as the portion of the godet that it engages, and delivering the thread continuously from said godets to a coiling device.

7. In the manufacture of artificial silk from a cellulosic solution, the method of passing the thread from the spinning nozzle to a coiling device which comprises drawing the thread from the spinning nozzle by a driven rotor, delivering the thread from said rotor to a second rotor driven at higher peripheral speed, causing the thread while in engagement with each rotor to have the same linear speed as the portion of the rotor which it engages, and delivering the thread continuously from said second rotor to a coiling device.

8. In the manufacture of artificial cellulosic silk, the method of delivering the thread from the spinning nozzle to a coiling means which comprises giving the thread a different speed at spaced points in its path of travel the speed at each point being higher than at the preceding point, and maintaining the respective speeds constant for successive portions of the thread passing said points.

9. Apparatus for the manufacture of artificial silk comprising a pair of spaced rotors positively driven at different peripheral speeds, and means associated with each rotor for thereon engaging against slippage and trackage a thread drawn by the rotor of higher peripheral speed from the rotor of lower peripheral speed.

10. Apparatus for the manufacture of artificial silk comprising a spinning bath, a positively driven rotor in proximity to the bath, and means associated with the rotor for thereon engaging against slippage a thread drawn by the rotor from the bath, in combination with a similar rotor of higher peripheral speed, and means for thereon engaging against slippage the thread drawn thereby under tension from the first rotor.

11. Apparatus for the manufacture of artificial silk comprising a pair of spaced godets, means for positively driving said godets at different peripheral speeds, and guide means associated with each godet for preventing trackage interference thereon of a thread extending between said godets and lapped on each to prevent slippage of the thread on said godets due to the tension exerted on the thread by the draft of the godet having higher peripheral speed.

12. An artificial silk producing apparatus having a spinning nozzle for delivering thread-forming material to a setting bath and a means for coiling the thread, in combination with two or more godets between the nozzle and the coiling means, said godets having means for guiding the thread therearound with an arc of contact of the yarn on the godets sufficient to prevent slippage, and means for driving the godets each at a uniform peripheral speed higher than that of the preceding godet, for the purpose set forth.

13. Apparatus for stretching freshly spun filaments of artificial silk, comprising a spinning nozzle, two or more rollers spaced apart, each roller revolving at a peripheral speed greater than the peripheral speed of the preceding roller, in combination with means associated with each roller for guiding the thread onto the same, and a second thread guiding means for preventing tracking of the thread inserted in the thread course at each roller positioned to move the thread from one position on the roller to another as the thread passes one or more times around the respective rollers.

14. Apparatus for the manufacture of artificial silk thread, comprising a spinning nozzle, a pair of spaced godets around which the thread is lapped to prevent slippage, and means for driving said godets positively at different peripheral speeds, in combination with guide means associated with a godet adapted to contact with thread as it passes around said lapped godets to prevent trackage thereon.

15. Apparatus for the manufacture of artificial silk thread, comprising a pair of spaced godets driven at different peripheral speeds, each adapted to have arcs of contact with the thread sufficient to ensure against slippage of the thread on the godets, in combination with a guide means at each godet guiding the thread onto same, and a second guide means positioned to remove the thread from the godet after the thread has contacted with the godet and to guide it back onto the godet in a manner to prevent tracking.

16. Apparatus for the manufacture of artifi-

cial silk, comprising a pair of spaced godets, means for positively driving said godets at different peripheral speeds and guide means associated with each godet having a plurality of guiding surfaces, one such surface being located and adapted to guide the thread onto the godet in the first instance, and the other guiding surfaces being adapted to remove the thread from the godet and place it back on the godet so as to prevent tracking by placing it at a different position from that given by each of the other guiding surfaces.

17. In the manufacture of artificial silk from a cellulosic solution, the steps of stretching the thread while in plastic condition by lapping it upon spaced rotors having different peripheral speeds, removing the thread from each spaced rotor after partial lapping, replacing same on the rotor at another position to prevent the thread from tracking on itself, and further lapping said threads thereby giving it substantially the same linear speed as the periphery of each rotor, and delivering the thread continuously from the last of said rotors.

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