Oct. 14, 1930. F. W. SCHUBERT 1,778,301

MANUFACTURE OF ARTIFICIAL SILK

Filed May 19, 1928

Fig. 1.

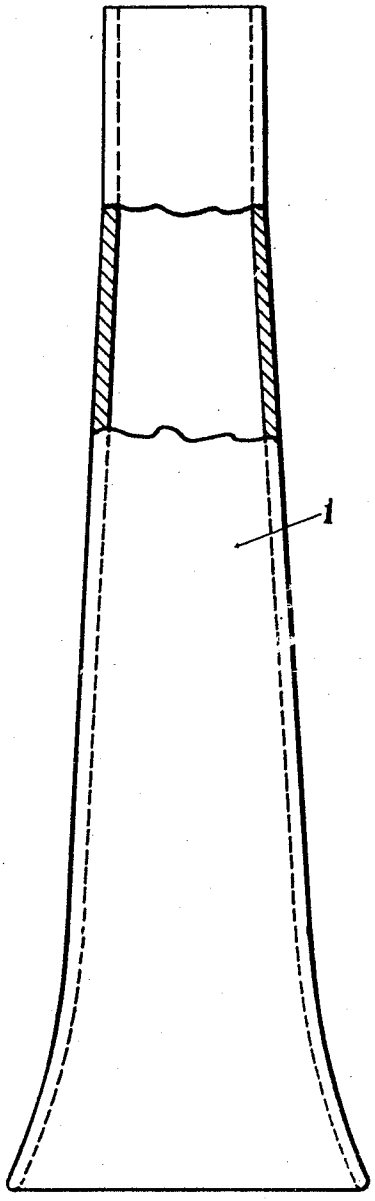
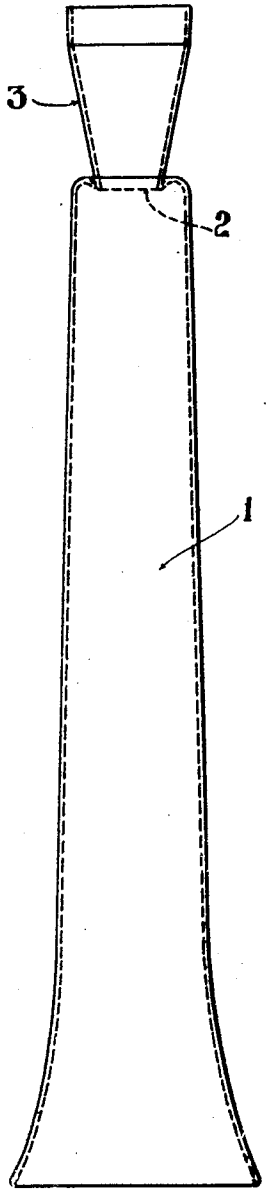


Fig. 2.



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UNITED STATES PATENT OFFICE

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MANUFACTURE OF ARTIFICIAL SILK

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In the stretch spinning process as employed in manufacturing artificial silk from cellulose dissolved in copper oxide ammonia, difficulties are encountered in producing a uniform thread. These difficulties are mainly due to the setting up of currents and eddies by the surface friction of the thread on the suspended column of coagulating liquor or superposed coagulating liquors in the spinning vessel during the passage of the thread therethrough. As the thread becomes more and more coagulated, the surface friction on the liquor becomes greater, with the result that comparatively strong currents and eddies are set up towards and at the outlet or mouth of the spinning vessel. These strong currents have a detrimental effect on the uniformity of the thread, particularly in the production of a comparatively coarse thread, say of 200 denier or over, where the currents or eddies created are, as a result of the increased surface friction, greater.

Various devices have been proposed for restricting or retarding the currents or eddies in the coagulating liquor, but it has been found that restriction of the flow of coagulating liquor can be and is adverse to coagulation when the volume of solution required to give a coarser count is too great for the amount of coagulating liquor required at any point, this being particularly evident in a restricted passage where a rapid upward current having an advarse effect on the regularity of the thread is created.

According to the invention we employ a spinning vessel wider at the bottom than at the top so as to allow ample room at the bottom for the strong currents and eddies to disperse without upsetting local conditions in or near the thread.

In order that the invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to and by the aid of the accompanying drawing; wherein Figure 1 illustrates in side elevation one embodiment of the invention, and Figure 2 shows in side elevation a modification.

Referring to the drawings, the spinning vessel 1 is flared or bell-bottomed so as to cause the change of direction of the current of coagulating liquor from the trough into the spinning vessel 1 to be very gentle.

It should be realized that the fibres commence pulling liquor with them from the drawing out zone in a downward direction, and that the actual quantity of liquor is progressively greater as the coagulation is completed, so the induced downward current gets stronger and more turbulent by the mere friction of the now solid fibres passing through the liquor. Therefore, the maximum rate of flow is at the bottom end of the funnel so that this quantity must be replaced by the upward current, which of necessity must also be at its maximum at the bottom of the funnel.

Should the area at the bottom be the same as at the top, then the velocity will not be equal to the speed of the yarn being spun. By increasing the diameter of the area at the bottom, a uniform velocity is given which reduces the turbulence to a minimum. Thus a much wider area than heretofore is provided for the entrance of the liquor into the spinning vessel 1 to replace the used liquor which is brought down the centre of the spinning vessel by the pumping action of the filaments or thread during coagulation as a result of surface friction, and thus the downward current with the thread is steady and further removed from any disturbance or eddy currents which would cause irregularities or unevenness in the more or less coagulated filaments or thread. The flared or bell-bottomed spinning vessel is tapered upwardly as shown so as to ensure that the slow dispersing action of the entering liquor is distributed throughout the length of the spinning vessel 1, i. e. a very steady upward current of replenishing liquor is ensured.

By providing a wide entrance for the replenishing liquor and ensuring its steady upward flow as above described, the pressure on the thread is greatly relieved and the thread only attracts and steadily pulls down the volume of liquor required.

The modification of the bell-bottomed funnel shown at Figure 2 is what we term the "crinoline" or reversal type. This is specially applicable to two liquor spinning

where a certain amount of turbulence is created at the position where the two liquors meet owing to the sudden reversal of the upward flowing liquor of a higher specific gravity. The form of funnel is such that the upward flow is arrested and the direction change is made more gentle by the lip 2 formed between the truncated cone 3, and the cylindrical portions of the funnel as shown. Moreover, the cone shaped upper portion 3 facilitates creation of a slight ejector action on the downward current of the exhausted weaker liquor out of the drawing out zone, caused by the passage of the thread into the stronger coagulate, thus greatly facilitating the smooth intermixing.

In this modification, the lower portion of the spinning vessel is so shaped as to still further increase the cross-sectional area for the dispersal of the strong currents or eddies. The particular shape illustrated ensures a slow change from upward to downward current in the zone where drawing out finishes and final coagulation begins.

The length of the coagulation field afforded by the spinning vessel is of the utmost importance, and, in practice, it is found to be preferable to employ long spinning vessels for the manufacture of threads of coarse counts and short spinning vessels for finer counts.

It will be seen that the present invention provides spinning vessels of simple construction and which have great advantages over the older types of spinning vessels having inner inverted conical funnels, and further that the spinning vessels according to the invention offer no obstructions or restrictions to the downward passage of the thread and are therefore easy to start up.

I claim:—

1. A spinning vessel for use in the manufacture of artificial silk thread by the stretch spinning process, in which the circulation of coagulating liquid is induced by frictional contact between such liquid and the filaments passing therethrough, said vessel being of vertically elongated form, having a height several times greater than its maximum transverse diameter, and of greater width at its lower, liquid inlet, end than at its upper end, so that an increased area is provided for dispersion of eddies of liquid in the neighborhood of points where the frictional contact between the filaments and liquid is at its maximum.

2. A spinning vessel for use in the manufacture of artificial silk thread by the stretch spinning process, in which the circulation of coagulating liquid is induced by frictional contact between such liquid and the filaments passing therethrough, said vessel being of vertically elongated form and of greater width at its lower, liquid inlet, end than at its upper end, the inner face of the side wall of said vessel being slightly tapered upward from its lower end and having a longitudinally curved portion adjacent said wider, lower, end.

3. A spinning vessel for use in the manufacture of artificial silk thread by the stretch spinning process comprising a tapering body having its greatest width at the bottom and an inwardly extending annular lip at its upper end, and a downwardly tapering section constituting an upward extension of the body, the lower end of said extension extending into the space surrounded by said annular lip, substantially as and for the purpose described.

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