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SHOWER HEAD TYPE SPINNING NOZZLE FOR THE CUPRAMMONIUM PROCESS

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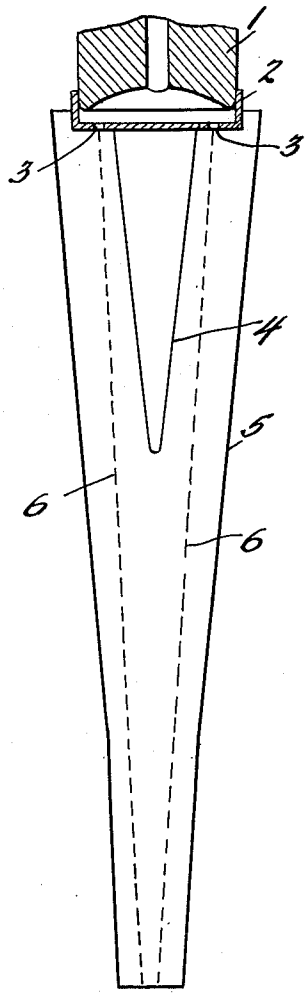

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SHOWER HEAD TYPE SPINNING NOZZLE FOR THE CUPRAMMONIUM PROCESS

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5 Claims. (Cl. 18—8)

This invention relates to the cuprammonium spinning process, and more particularly to an improved shower head type spinning nozzle for use in this process.

In the spinning of cuprammonium solutions by the funnel spinning method it is usual for the bunch of capillary filaments to fill the conical portion of the funnel rather uniformly. In consequence of this, the individual capillary filaments in this conical portion undergo widely different strains and are stretched and coagulated in an entirely uneven manner.

With given spinning conditions such as composition of the spinning solution, composition of the precipitating liquid, temperature and drawing-off velocity, the coagulation and stretching process is determined by the rate of diffusion of the solvent from the mass of the filament, and the pull or tension on the filaments which depends upon the difference in the velocities of filaments and spinning water, respectively. It is manifest, as any test will demonstrate, that these two conditions, to wit: rate of diffusion, and amount of tension, vary very greatly for the individual filaments of a bunch of filaments filling very nearly the entire conical portion of the funnel section. One of the reasons for this great variation is that the water flows, particularly in the upper funnel portion where the flow has a laminar character, at equal distance from the nozzle, with a speed increasing from the periphery of the funnel toward the funnel axis, with the result that the relative velocity of the filaments drawn by the winding member with respect to that of the water, is much lower for filaments moving near the funnel axis than for those close to the periphery of the funnel. Moreover, the bunch of filaments proper hinders the ready exchange of ammonia diffusing therefrom, in consequence of which the concentration of ammonia in the water is found to be much higher near the axis of the funnel than in the vicinity of the wall of the funnel. These two phenomena both act in the same direction, namely to cause the filaments moving near the funnel periphery to be more firmly coagulated and to be stretched earlier than filaments moving close to the funnel axis. This unevenness in the coagulation and stretching characteristics results in material differences in the ultimate micelle structure of the capillary filaments which in turn, materially impair the textile characteristics of the thread or yarn. Another very important drawback arises from the fact that in the region in the funnel where the filaments are drawn out to substantially their ultimate section, the laminar flow of water in the funnel changes into an eddy current, or turbulent flow. This causes an exchange of the ammonia content between axial and peripheral layers in the funnel. This exchange or eddy zone, however, has no stable location but fluctuates up and down and even causes lateral displacements of the entire bundle of filaments which, in the finished thread or yarn, lead to material variations of the titer or denier, a defect apt to greatly impair the quality and appearance of the finished product. In hosiery, for example, these titer variations are a most disagreeable blemish.

It is an object of this invention to eliminate the numerous severe drawbacks delineated above, and to provide a means for spinning cuprammonium solutions by the funnel spinning method whereby filaments of uniform micelle structure are obtained and any variations in titer due to conditions in the funnel are eliminated.

Other objects, and the manner in which the same are obtained, will become apparent as this specification proceeds.

The invention contemplates eliminating the disadvantages outlined hereinabove, and to insure a uniform micelle structure for all capillary filaments, and a uniform titer and the same textile properties for the finished threads or yarns, by providing a shower head type spinning nozzle mounting, in its center and coaxially with it, a cone which extends far into the funnel and the mantle of which extends substantially in parallel to the wall of the funnel.

The orifices of the shower head type spinning nozzle according to the invention are arranged in one or two circles surrounding the base of the cone; the distance between adjacent orifices must not substantially exceed 3 mm., and preferably, is below 3 mm. With this arrangement, the capillary filaments emerging from the orifices of the shower head type spinning nozzle, travel along paths extending between two concentric walls, with the result that each capillary filament, during its passage through the conical portion of the funnel, is subject to the same uniform flow and diffusion processes. Consequently, the pull or tension is rendered equal for all these capillary filaments. Inasmuch as with the arrangement according to the invention, no exchange between different ammonia concentrations can occur, it follows that coagulation also proceeds with all capillary filaments in the same uniform manner. Consequently, the micelle structure is rendered uniform for all capillary filaments so that they all display the same textile characteristics. The thread or yarn obtained from the capillary filaments, therefore, also is distinguished by uniform textile properties and thus is materially superior to a thread composed of unevenly coagulated and stretched, capillary filaments. This means, of course, that objectionable variations of the titer or denier, as far as they could be caused by conditions in the funnel, are eliminated and a uniform and materially improved finished product is obtained.

In the drawing attached to this specification and forming part thereof, one embodiment of the invention is illustrated diagrammatically by way of example.

The sole figure of the drawing is a diagrammatic section through a shower head type spinning nozzle and funnel assembly according to the invention.

Referring now to the drawing, **1** denotes a spinning nozzle body and **2** the shower head type nozzle head mounted on this body. Orifices **3** are arranged in a circle in the shower head type nozzle head, it being understood that the orifices may be arranged along two concentric circles instead of the single circle shown in the drawing for sake of clarity. The distance between adjacent orifices, as noted above, is not to exceed substantially 3 mm. and preferably, is even below 3 mm.

The shower head type nozzle head mounts in its center and inside the circle or circles defined by the orifices, and concentric therewith, the cone **4** according to the invention which, as shown in the drawing, extends into the funnel **5** to about the middle of the conical portion of the funnel, its wall extending substantially in parallel to the wall of the funnel. The capillary filaments **6**, indicated in dashes, are seen to emerge from the orifices **3** and to travel along paths extending between the wall of the cone **4** and the wall of the funnel **5**. Provided adjacent orifices are spaced from one another by a distance

not substantially exceeding 3 mm., and preferably even less than 3 mm., the capillary filaments emerging from these orifices form, together with the boundary layers of water formed around these capillary filaments, a cone the shape of configuration of which remains completely stable.

According to the invention, it has been ascertained that the cone extending into the conical funnel portion is of vital importance in securing the beneficial effects obtained by the invention. Accordingly, the mere use of shower head type spinning nozzles which have no orifices arranged in their center portion, does not attain the objectives of the invention, nor do shower head type spinning nozzles having tapering or stepped perforated portions as none of these devices is capable of insuring the uniformity of flow and diffusion conditions which is essential in the elimination of the drawbacks inherent in the spinning methods heretofore employed.

While I have disclosed certain embodiments of my invention and several modes of carrying it into effect, it will be readily apparent to those skilled in the art that the invention as illustrated in the foregoing specification and in the attached drawing, is susceptible to numerous variations without departure from the spirit of the invention or sacrifice of the advantages thereof. Accordingly, the scope of the invention is to be understood as limited solely by the appended claims.

I claim:

1. Shower head type spinning nozzle particularly for use in the cuprammonium funnel spinning process, comprising a cone mounted in the center of said nozzle and adapted to extend into the conical portion of the funnel, said cone being substantially coaxial with said funnel and its wall is spaced from and extending substantially in parallel to the funnel wall so as to convert the conical passage into a cylindrical passage.

2. Shower head type spinning nozzle particularly for use in the cuprammonium funnel spinning process, comprising a cone mounted in the center of said nozzle and adapted to extend into the conical portion of the funnel, to about the middle of said portion, said cone being substantially coaxial with said funnel and an outer surface extending substantially in parallel to and spaced from the funnel wall, thereby delimiting in the conical portion a cylindrical passage of substantially uniform width.

3. Shower head type spinning nozzle particularly for use in the cuprammonium funnel spinning process, comprising a cone extending into the conical portion of the funnel with its surface extending substantially in parallel to the inner wall of said cone and orifices spaced from one another by a distance not substantially exceeding 3 mm. arranged in the nozzle on at least one circle which is concentric with and has a larger diameter than the base of said cone.

4. Shower head type spinning nozzle particularly for use in the cuprammonium funnel spinning process, comprising a cone extending into the conical portion of the funnel with its surface extending substantially in parallel to the inner wall of said cone and orifices spaced from one another by a distance of less than 3 mm. arranged in the nozzle on at least one circle which is concentric with and has a larger diameter than the base of said cone.

5. Shower head type spinning nozzle particularly for use in the cuprammonium funnel spinning process, comprising a cone extending into the conical portion of the funnel with its surface extending substantially in parallel to the inner wall of said cone and orifices arranged in the nozzle on two circles which are concentric with and have larger diameters than the base of said cone.

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