April 16, 1935. H. HOFMANN 1,997,930

PROCESS OF AND APPARATUS FOR THE SPINNING OF CUPRAMMONIUM FILAMENTS

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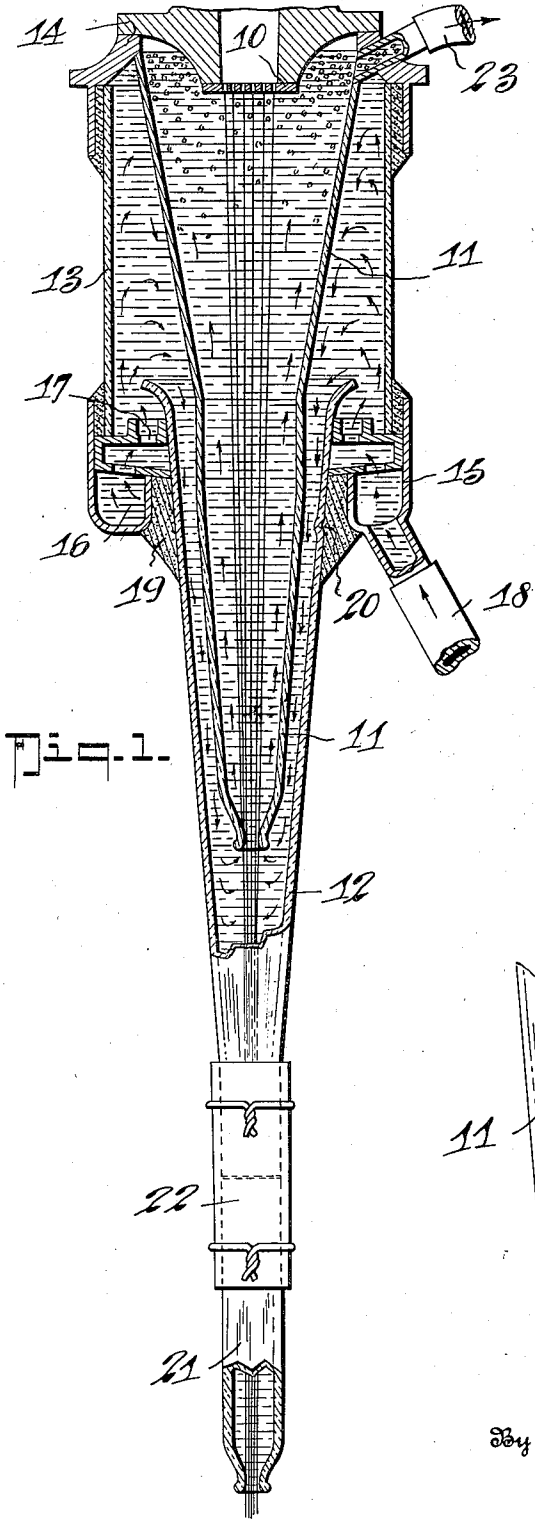


Fig. 1.

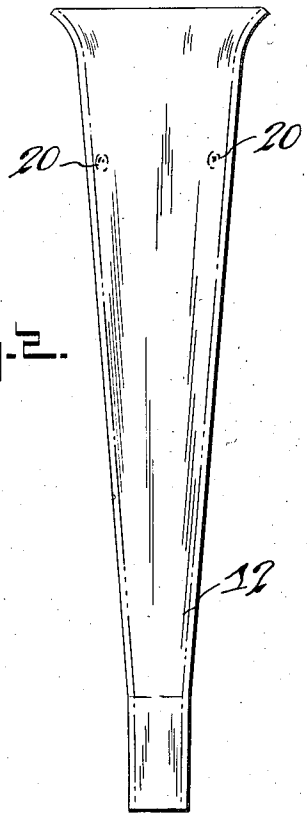


Fig. 2.

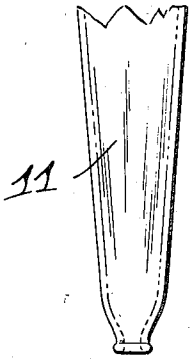


Fig. 3.

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PROCESS OF AND APPARATUS FOR THE SPINNING OF CUPRAMMONIUM FILAMENTS

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8 Claims. (Cl. 18—8)

My present invention has to do with a new and improved method of an apparatus for the production of artificial threads, filaments and the like which may be produced by the cuprammonium process.

One object of my invention is to provide a method of coagulating or hardening artificial threads and the like whereby the recovery of the ammonia and copper in the coagulating or hardening liquid is made economically possible.

Another object of my invention is to provide a new method for the treatment of cuprammonium thread which will result in a finished product of more even texture and fineness than that produced by existing methods and mechanisms.

A further object of my invention is to provide a new method of treating threads and filaments of cuprammonium silk whereby the strength thereof both in the wet and in the dry state will be materially improved.

A still further object of my invention is to so treat the threads and filaments of cuprammonium silk produced by the stretch spinning process that disadvantages arising from the formation of eddy-currents will be obviated.

A still further object of my present invention is to so treat the threads or filaments that the disadvantages arising from the setting up of currents of water used in the coagulating or hardening of said threads or filaments, which would exert harmful and deleterious injuries to the more freshly extruded threads or filaments, will be avoided.

These and other objects of my invention will become more apparent from a study of the following description, and of the drawing, in which:

Figure 1 is a partial sectional view of the spinning mechanism;

Figure 2 is a detailed view of a portion of the funnel; and

Figure 3 is a detailed view of the outlet end of the funnel of the spinning mechanism.

Referring now more particularly to Figure 1, I have shown a spinnerette 10 fed with any suitable cellulosic solution, such as a cuprammonium solution, by means of the usual feed line (not shown). A double funnel arrangement may be used and, as shown the lower portion of the upper funnel 11, is within the wall of the lower funnel 12. The upper funnel is enclosed in a casing 13 which has cemented or otherwise secured thereto a flanged ring 14 upon which the spinnerette 10 rests and is suitably secured. A ring 15 is secured to the lower end of said casing which is provided with a chamber 16, the upper wall of which has a series of openings 17 through which the hardening or coagulating liquid passes from the inlet 18.

The funnel 12 is secured in the ring 15 by means of any suitable cementitious material 19. To prevent any possible rotation or movement of said funnel, I have provided the same with spaced indentions 20. At the lower end of the funnel I have provided an outlet member 21 which is secured to the lower end of the funnel by a rubber hose or tube 22. As will be noted the upper funnel is provided with an opening 23 by means of which the treating liquid at the upper part of the spinning funnel and surrounding the spinnerette may be readily removed.

In the usual operation, the filaments are extruded into a suitable coagulating solution in the device at the rate of approximately 600 cc. of the solution per minute. This rate of flow has been found necessary in order to keep the funnel filled with the treating liquid and so prevent the formation of eddy currents which will tend to damage the freshly spun filaments. The solution, after passing through the funnel, was discarded since only about .8 grams of ammonia was present in each 600 cc. of solution. This low concentration made it economically impossible to recover the ammonia used. By my new method, however, a siphon action is set up by withdrawing about 120 cc. of the treating liquid through the outlet 23 provided in the funnel. The path of movement of the treating liquid throughout the spinning chamber has been clearly indicated by arrows (Figure 1).

The liquid which is thus removed contains most of the ammonia which is to be recovered, since it is known that the greater part of the ammonia of the cuprammonium solution goes into solution in the coagulating liquid within the area adjacent to and surrounding the spinnerette. By this means the treating liquid which is removed through the above described siphon arrangement will contain a high concentration of ammonia sufficient to render the recovery thereof economically feasible. Whereas the amount of ammonia in each 600 cc. of liquid normally does not exceed .8 grams, each 120 cc. of liquid siphoned up by my new method will contain as high as from 3 to 4 grams. This increases the percentage concentration of ammonia greatly.

Moreover the use of my new method possesses other advantages. As the ammonia solution rises in the upper funnel, those filaments farthest away from the spinnerette are treated with a liquid containing comparatively little ammonia. As the

ammonia content increases the liquid is rising toward the spinnerette, and those filaments just emerging therefrom are treated with a liquid which is rich in ammonia and other salts. As these filaments are very soft and only partially coagulated the action of this liquid is very beneficial since a more steady and gradual coagulation action of the filaments takes place. Thus it will be appreciated that by the use of my new method a very gradual and steady hardening of the filaments will be obtained with the result that the filaments possess better qualities than those ordinarily produced. I have been able also by the use of this method to obtain a 20% greater wet strength and a 15% greater dry strength of finished yarn than has been heretofore possible to produce by the cuprammonium stretch spinning process.

The ordinary filament possesses a wet strength of 120 grams per 100 denier, and a dry strength of approximately 180 grams per 100 denier. I have been able, by my new method and apparatus, to secure a strength up to 144 grams per 100 denier and a dry strength of 207 grams per 100 denier.

It will be readily appreciated that I have devised a new method of and apparatus for the production of artificial filaments by which, in the cuprammonium process, the economical recovery of ammonia is made possible and the resulting product possesses a much greater strength both in the wet and dry state.

It is to be understood that numerous details of my new method and apparatus may be varied through a wide range without departing from the terms or spirit of my invention, and I do not desire limiting the patent granted here or otherwise than as necessitated by the prior art.

I claim:

1. In the production of cuprammonium filaments, the steps of first subjecting the filaments to a setting solution containing a high ammonia content of approximately 15 grams of ammonia per 600 cc. of solution, and then to a solution with a progressively lower ammonia content.

2. In the production of cuprammonium filaments, the steps of first treating the filaments with a setting solution containing between .8 and 20 grams of ammonia per 600 cc., and then subjecting the filaments to a setting bath containing a gradually decreasing ammonia content.

3. In a device for use in the production of filaments by the cuprammonium process, in combination, a spinnerette, a case surrounding the same, a funnel rigidly fixed in said case and surrounding the spinnerette, and means arranged so that liquid may flow only upwardly through the funnel to aid in the precipitation of the filaments and a second funnel embracing the lower end of said first named funnel.

4. In a device for use in the production of filaments by the cuprammonium process, in combination, a spinnerette, a case surrounding the same, a funnel rigidly fixed in said case and surrounding the spinnerette, and means arranged so that liquid may flow only upwardly through the funnel to aid in the precipitation of the filaments, and a second funnel embracing the lower end of said first named funnel, the upper end of said second named funnel being itself contained by said case.

5. In a device for use in the production of filaments by the cuprammonium process, in combination, a spinnerette, a case surrounding the same, a funnel rigidly fixed in said case and surrounding the spinnerette, and means arranged so that liquid may flow only upwardly through the funnel to aid in the precipitation of the filaments, and a second funnel embracing the lower end of said first named funnel, the upper end of said second named funnel being itself contained by said case, said case being provided with inlet means whereby the setting solution may enter.

6. In a device for use in the production of filaments by the cuprammonium process, in combination, a spinnerette, a case surrounding the same, a funnel rigidly fixed in said case and surrounding the spinnerette, and means arranged so that liquid may flow only upwardly through the funnel to aid in the precipitation of the filaments, and a second funnel embracing the lower end of said first named funnel, the upper end of said second named funnel being itself contained by said case, said case being provided with inlet means whereby the setting solution may enter, said setting solution passing downwardly in said second named funnel and upwardly through said first named funnel.

7. In a device for use in the spinning of cuprammonium filaments, two funnels arranged above one another so that the upper mouth of the lower funnel embraces the lower opening of the upper funnel, and means whereby liquid may be circulated only downwardly through the lower funnel and upwardly through the upper funnel.

8. In the production of cuprammonium filaments, the steps of preparing a cuprammonium solution and extruding it into a precipitating bath containing between 15 and 20 grams of ammonia per 600 cc. of solution.

HUGO HOFMANN.