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PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK

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Fig. 1.

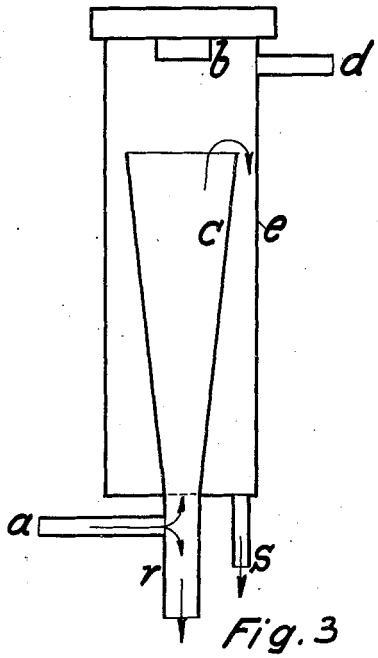


Fig. 2

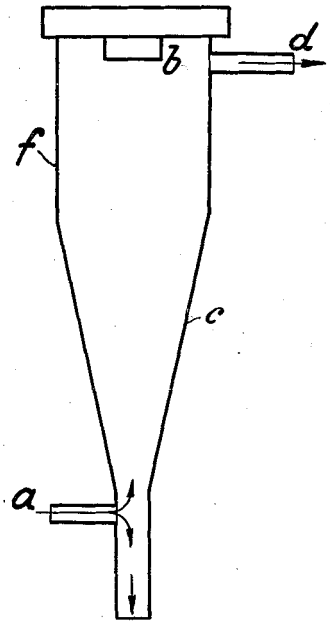
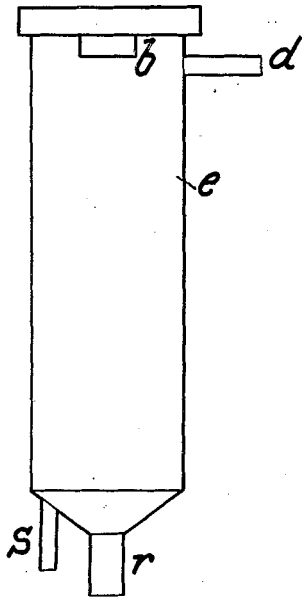


Fig. 3



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PROCESS AND APPARATUS FOR SPINNING ARTIFICIAL SILK.

Application filed October 9, 1924, Serial No. 742,699, and in Germany November 5, 1923.

In German patent specification No. 220,051 a process and apparatus is described for the spinning of artificial silk, in which the fibres, after leaving the spinning nozzle, are surrounded at first by a slowly flowing precipitating liquid, and not until after they are partly drawn out therein and are also partly hardened and have thus become more resistant, are they seized by a strong current of liquid and carried farther. For this purpose apparatus is indicated which consists of a conical funnel, which is inserted in a cylinder. In the latter the precipitating liquid is introduced from below and rises upwards therein, then flows over the edge of the conical funnel into the latter and again assumes a downwardly directed motion, to pass out finally at the lower aperture of the funnel. As the conical funnel does not extend right into the cylinder but ends about 5 to 8 centimeters below its upper edge, the fibres first traverse a rather long layer of very slowly moving precipitating liquid, which serves for the careful drawing out of the fibres.

It has now been found that it is also possible to spin if the precipitating liquid is allowed to flow in the opposite direction in the conical funnel, that is to say, upwards. This is attained by connecting at or a short distance below the lower end of the cone, where the same merges into the cylindrical tube *r* (Figure 1), a side tube, and introducing the precipitating liquid through this. In this case the current of liquid divides, so that part of it flows upwards through the cone in the opposite direction to the fibre, while another part flows downwards through the pipe *r*, that is, in the same direction as the fibre.

Processes are already known in which the flowing of the precipitating liquid is likewise in the direction opposite to that of the fibres. In such cases however there is only one direction of flow in the spinning processes, whereas in the case of the present process both a counter-current and also a flow in the same direction take place in one and the same piece of spinning apparatus.

The importance of this flow in the same direction in the lower part should not be underestimated as it is just here that the most rapid flowing of the precipitating liquid occurs. Thus the fibre finds there no excessive friction, on the contrary it is drawn by the strong current flowing in the same direction, and the pull of the winding apparatus is thereby assisted, so that in this way the fibre is wound up on to the latter with a tension which is not too great.

In the drawing three pieces of apparatus for carrying out the new process are illustrated.

Figure 1 shows spinning apparatus with a cylindrical jacket and an internal spinning cone,

Figure 2 a conically shaped piece of apparatus without a jacket, and

Figure 3 a cylindrical piece of apparatus with a short conical addition at the bottom.

For the carrying out of the process, water is admitted through the pipe *a*, which is connected to the cone *c* in the neighborhood of the union of the pipe *r*, the outlets of the pipes *r* and *s* being closed. When the whole apparatus is filled with water the closure cover with the spinning nozzle plate *b* is put on, and the pipe *r* is then opened. Then the cock is opened which lets the spinning solution pass through the nozzle plate. No flow of the water takes place at first through the funnel, that is, towards or against the descending fibres. The fibres can accordingly descend without meeting with any resistance. When the fibres come to the junction point of the tube *a* they find there only the motion of the water toward the outlet of *r*, so from this point onwards they are drawn along with it. They are then passed on to the winding mechanism, and a beginning can now be made with the counter-current by opening the closure of *s* also. The admission of water is then regulated by *a* in such a way that so much water flows out of *s* as is found by experience to be necessary for good spinning.

The cylindrical upper part of the spinning apparatus is made so long that the drawing out of the fibres proceeds mainly therein. Now the precipitating liquid in this part takes up much ammonia from the fibre passing through it. It would soon become unusable for the precipitating or stiffening of the fibres if it were not constantly being renewed from the precipitating liquid admitted from below, by means

of which a condition of equilibrium suitable for good spinning is produced.

Instead of letting the precipitating liquid flow away through the pipe *s* is may be allowed to flow away through a pipe union *d* at the upper end of the spinning apparatus, for the movement of the precipitating liquid in the upper cylindrical part of the apparatus is so small that it opposes no resistance at all to the passages of the fibre. In this case of course the renewal of the precipitating liquid in the cylindrical part is somewhat quicker, which however causes no sort of harm. At most the hardening of the fibres takes place somewhat more quickly. Here again, however, as in the first part, there are two different flows present, one very slow and uniform in the cylindrical part, and one continuously varying with the cross-sectional area of the conical funnel in the latter.

Now if the discharge takes place from the pipe *d*, the apparatus can assume the simpler form according to Figure 2. Here the funnel *c* is connected directly to the cylindrical piece *f* and is in one piece therewith.

It was found that it is possible to work without the conical funnel in the interior of the cylinder and without giving the spinning vessel the form of the said funnel, so that in this way the apparatus, as Figure 3 shows, consists only of a cylinder *e*, which is closed in a fluidtight manner at the top by means of a cover. The cover *b* carries the nozzle plate, while the lower end is closed by a cap, which carries in the middle a short tubulure *r* to which the discharge pipe is secured by means of rubber tubing. Furthermore a second short tubulure *s* is applied to the bottom of the cap, through which the precipitating liquid enters.

In order that at the beginning of the spinning the descending fibres may not remain lying on the bottom of the cap but may pass out through the pipe *r* it is preferable to make the bottom somewhat conical.

Thus the flow of the precipitating liquid is not in this case slow at the beginning and becoming slower later on, but a flow always remaining unformly slow in its passage through the cylinder. Instead of introducing the precipitating liquid through the pipe *s*, it would be possible, as in the case of Figures 1 and 2 to attach to the pipe *r* a side pipe, and to let the precipitating liquid enter there.

What we claim is:—

1. In the process of spinning artificial silk by the stretch spinning process, the step of so directing the flow of the precipitating liquid that it is countercurrent to the motion of the fibre until it is partially hardened and cocurrent to the motion of the fibre after the fibre has been partially hardened.

2. In the process of spinning artificial silk by the stretch spinning process, the step of so directing the flow of the precipitating liquid that it is slowly countercurrent to the motion of the fibre until it is partially hardened and rapidly cocurrent to the motion of the fibre after the fibre has been partially hardened.

3. In apparatus for spinning artificial silk by the stretch spinning method, a spinning rose for admission of the material to be spun situated near the top of a treating vessel, means for the admission of the precipitating liquid, means for discharging precipitating liquid and for removing the fibre being spun from the treating vessel located below the inlet for the precipitating liquid, and other means for simultaneously discharging precipitating liquid located above the inlet for the precipitating liquid.

4. In apparatus for spinning artificial silk by the stretch spinning method, a spinning rose located near the top of a funnel shaped treating vessel, an inlet for precipitating liquid located at a cross section of the funnel of relatively small area, an outlet for the fibres being spun below the inlet for the precipitating liquid, and outlets for simultaneously discharging precipitating liquid near the bottom and top of the treating vessel.

5. In apparatus for spinning artificial silk, a treating vessel provided with a spinning rose for the admission of the material to be spun located near its top, said treating vessel comprising an upper portion of relatively large cross-section, a tapered intervening portion and a lower portion of relatively small cross-section, an inlet for precipitating liquid located near the upper part of said portion of smaller cross-section, an outlet for precipitating liquid located below the said inlet and in the portion of smaller cross-section, and another outlet for the simultaneous discharge of precipitating liquid located above said inlet and in the portion of larger cross section.

In testimony whereof, we have signed our names to this specification.

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