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KIYOHIKO HAGIWARA, OF OJI-MACHI, KAMIKYO-KU, KYOTO, JAPAN, ASSIGNOR TO TOSHIYA IWASAKI, OF TOKYO, JAPAN.

PROCESS FOR MANUFACTURING ARTIFICIAL SILK AND OTHER FILAMENTS BY APPLYING ELECTRIC CURRENT.

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This invention relates to a process for manufacturing artificial silk and other filaments, characterized by applying electricity to solution of the raw material while or before spinning them.

The object of the invention is to make the colloidal solution of the raw material migrate in one direction by passing an electric current through the solution which is divided into an anode and a cathode section by a capillary, such as a spinning nozzle. By utilizing this migration speed caused by the electrical endosmose or cataphoresis, together with the speed due to the pressure of compressed air and pump as in the case of ordinary practice, the speed of the solution is very much accelerated and increased, and at the same time the silent discharge may take place between the solution and the coagulation liquid, decomposing such a sort of gas as is often produced in coagulation. for instance, hydrogen sulphide liberated from viscose, into some soluble sulphur or oxygen compounds and thus there is no unhealthy gas of disagreeable odor and it serves to protect the health of operatives very easily and surely.

It is evident that the colloidal solutions are migrated under the influence of a fall in potential, and that the quantity of a given solution carried through a capillary in a definite time depends upon its viscosity and varies directly according to the current strength and is independent of the area of the capillary. As the discharge of the electric current of high frequency and high voltage like an induction current is usually intermittent according to its frequency and the nature of its electrodes is also definite, the same effect, as in the case of direct electric current of high voltage, will be obtained by applying an induction current of high frequency. And also, the higher the frequency is, the less dangerous it is to human body. Therefore, as the solution of artificial silk like viscose is a negative colloid which migrates toward the cathode, if an electrode be placed in solution of the material of artificial silk or other filaments and another electrode in the coagulation bath in the case of spinning, the solution migrates toward cathode through the spinning nozzle owing to electric cataphoresis. If high voltage of induction current be applied, the speed of migration will be considerably increased, which accelerates the flowing speed due to the pressure of compressed air and pump, and accordingly the spinning speed i. e. the production of artificial silk or other filaments will also be increased. Further, as the flow of particles suspended in the solution tends to make the configuration of particles in regular rows, the particles are coagulated in a regular and parallel order and the strength and other physical properties of the product will be much improved.

During the coagulation period the gases will evolve from the surface of the spun filaments in the case of viscose silk and the passage of electricity is separated by such evolved gases, in consequence of which the silent discharge of electric current will take place continuously until the spun filaments reaches the surface of coagulation liquid from the spinning orifice; by this silent discharge, ozone gas is produced and such a sort of gas as is often produced during the coagulation, for instance, hydrogen sulphide, is decomposed into soluble oxygen compound and dissolves in water. Thus, there being produced no unhealthy gas of disagreeable odor, the ventilating apparatuses, the masks, the ozonizer etc. hitherto used for the protection of health, can be entirely dispensed with.

When coagulation is effected in two stages as in spinning arrangement of so-called bobbin system, the same effect will be obtained by the anodes in solution of the raw material and on the surface of winding bobbin, and the cathodes in the first and second coagulation baths respectively.

In this invention an induction current of electricity is applied, although the same effect may be obtained by the use of direct electric current, because it is evident that the effect is somewhat inferior to the one obtained by the application of an induction current which is considerably different from that in potential difference.

The following example will illustrate how the invention may be carried out in practice, but the invention is not limited to this example.

Place an anode in a spinning nozzle of an artificial silk spinning frame and a cathode in coagulation bath. The induction current having a frequency of 4,800 cycles per minute is regulated to a spark or air gap of 5 to 10 millimeters. Make the initial pressure of

compressed air 1.2 kg. per sq. cm. to make it maintain about 0.8 kg. per sq. cm. near the spinning nozzle. First try to spin without discharging the electric current, then we will find that the spinning is very difficult without keeping the spinning speed within 15 to 20 meters per minute, owing to the breakage of thread or filaments. However, when the induction current is discharged, the spinning goes very easily and even at the speed of 45 to 50 meters per minute a thicker thread than that obtained in the previous case can be spun out. With spinning nozzle to spin single filaments of 6 to 7 deniers in common case, single filament of 25, 12 to 15, and 8 to 10 deniers can be obtained at the speed of 15 to 20, 30, and 45 meters per minute respectively. From these results we can easily consider that the spinning speed may be increased more. Further, under the ordinary spinning pressure, i. e. 2 to 3 kg. per sq. cm., the spinning speed may be increased to 70 to 100 meters per minute according to the condition of the colloidal solution of artificial silk and the production of spinning frame will be nearly doubled and at the same time the spinning pump with which we suffer always to repair very soon by its wear, serves only as a meter and does not need such a fine and precise workmanship as now we can find in practice. The pulsation of solution is mainly governed by the voltage and the number of frequency of current used, and if we apply high voltage and high frequency current, the effect of pulsation will be much finer than that of spinning pump and the size of filament will be more uniform. Furthermore, the particles of the colloidal grains in the solution are aggregated in regular and parallel order and the physical quality of the product will be very much improved.

In short, this invention has the special feature that the flowing movement of solution of artificial silk of great viscosity can be increased and accelerated in spinning process, thus increasing the efficiency of production and at the same time saving spinning pumps or making them simply serve as supplement, and all the devices for removing or ozonizing the poisonous gases can be entirely dispensed with. In this way we can economize the costs of machineries in spinning department as well as the maintenance expenditure and also can easily and surely protect the health of operatives.

I claim:—

Process for manufacturing artificial silk and other filaments, characterized by causing the raw material solution to migrate, which consists in placing an electrode in a solution of the raw material and another electrode in the coagulation liquid and then passing thereto an electric current, especially an induction current.

In testimony whereof I have affixed my signature.

KIYOHIKO HAGIWARA.