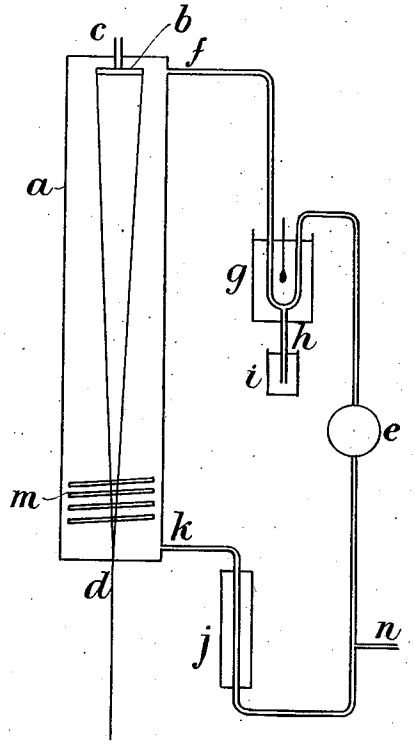
May 4, 1926. 1,583,475

J. E. G. LAHOUSSE

PROCESS OF MANUFACTURE OF ARTIFICIAL SILK AND OF ARTIFICIAL THREADS OR FILAMENTS

Filed Sept. 26, 1924



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Patented May 4, 1926. 1,583,475

UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURE OF ARTIFICIAL SILK AND OF ARTIFICIAL THREADS OR FILAMENTS.

Application filed September 26, 1924. Serial No. 739,972.

To all whom it may concern:

Be it known that I, JOSEPH EDOUARD GUSTAVE LAHOUSSE, residing at Ternay, France, a citizen of the Republic of France, have invented certain new and useful Improvements in Processes of Manufacture of Artificial Silk and of Artificial Threads or Filaments, of which the following is a specification.

The present invention is relative to the manufacture of artificial silk, and, generally, of any artificial threads, filaments or fibres by the process called "dry spinning." It is particularly applicable to the spinning of a solution of cellulose acetate and, generally, of any ester, ether or cellulose derivative or of a mixture of these products with or without addition of other compounds in a solvent or solvent mixture which evaporates while producing the manufactured artificial filaments.

Usually, the atmosphere introduced into, the cell, by or near the outlet of the filaments or elsewhere, in order to evaporate the solvents of the travelling filaments, is pure or has been freed from solvents as completely as possible, so that the vapors of solvents taken away from the filaments contribute alone, or practically alone, to the loading of the medium with vapor of solvents.

When the evaporation of the solvent or solvents takes place in an atmosphere which does not contain any, or only a little of the vapour of the solvent, a skin which is almost dry is produced on the surface of the filament as soon as it issues from the die. This film, which is much less plastic than the core of the filament, must subsequently flatten or crack to adapt itself to the diminution of volume suffered by the filament owing to the drying of its core, and also to the stretching to which it is generally subjected, this being detrimental to the appearance of the thread and to its mechanical properties. Moreover, the presence of this film constitutes an obstacle to the diffusion of the solvents of the core towards the surface, and therefore to the rapidity of the drying.

Applicant has discovered that considerable advantages are obtained by causing the evaporation of the solvent or solvents, not as hitherto in a medium containing only a small proportion of vapours of the solvent or solvents, but, on the contrary, in a medium previously richly laden but not saturated with such vapours.

By this means, the formation, at the surface of the filaments, of the almost dry film, the drawbacks of which have been mentioned above, is avoided. The diffusion of the solvents takes place in a regular manner, and the filament preserves an almost circular section with faint concavities.

The size of these concavities depends on the connection between the speed of the superficial evaporation and the speed of diffusion of the solvent of the core towards the surface. It is possible to cause it to vary by varying the degree of saturation of the medium in which evaporation takes place, the temperature of this medium and that of the material issuing from the dies. The latter is brought to the required temperature and the most economical concentration consistent with the permissible pressure in the apparatus is chosen.

By varying the above indicated factors, one can vary considerably the shape of the cross-section of the filaments and obtain sections of any shape, from sections extremely twisted, recalling the appearance of letters of the alphabet, to almost circular shapes.

According to the shape of its cross-section, the silk is more or less bright, and is more or less smooth to the touch. A new manner of varying these properties and of satisfying the exigencies of fashion, without changing the manufacturing device is thereby obtained.

Independently of the above advantages arising out of the control of form of the cross-section of the artificial filament, the process which is the object of the present invention permits besides, owing to the greater permeability of the surface of the filament, the obtainment of a more rapid drying and consequently the increasing or the production of the spinning plant. Moreover, it permits the operation of the recovery of the solvent or solvents by direct condensation.

The atmosphere which penetrates into the cell of the spinning apparatus is, according to this invention, a gaseous medium saturated with vapours of the solvents at a

suitable temperature t, lower than that inside the cell. In the cell it becomes richer owing to the vapours from the filaments which are drying, and becomes capable of depositing by direct condensation, at the temperature t, the solvent taken from the filaments in this manner. For this, it is caused to pass through the coil of a condenser or any other heat exchanging apparatus cooled to the temperature t. It issues saturated at that temperature and thence, to begin the cycle over again, it is sent back to the spinning cell, becoming again apt to cause the evaporation of the solvents of the filaments simply by being reheated either before or after entering the cell.

The circuits followed by the evaporating medium must of course be as free from leakage as possible, that is, it must constitute a closed system exchanges with the external atmosphere being only possible by the small orifice provided as an outlet for the filaments. These exchanges can be reduced to a very small amount, if the orifice is small, and any leakage of solvent through this orifice can be avoided in any case by creating there a very slight aspiration which causes a stream of air, which may be extremely small, directed from the exterior to the interior and opposing any leakage of the evaporating medium. A corresponding quantity of gas will of course be abstracted from that belonging to the cycle at another point of the circuit, and, however negligible its amount, it can be subjected to any suitable treatment for the purpose of recovering the solvents it contains.

As the density of the evaporating medium varies according to its temperature and according to the more or less great quantity of the solvent it carries, the various elements of the circuit (spinning cell, condenser of the solvents to be recovered, reheating system for the gases) may be arranged so that its circulation in this circuit automatically takes place by the sole effect of the differences of densities. This circulation may also be caused by any suitable propelling apparatus, ventilator, fan, pump or the like, this permitting the arrangement that the evaporating medium enters the spinning cell and issues from it at any points as may be considered advantageous.

A single ventilator may be used for one or more series of cells, the latter case being particularly advantageous as it permits the performance of a single condensation and a single reheating of the gases for one or several series of cells. This ventilator can, of course, act directly by suction and by forcing under pressure in the cells, or by the draught induced in the individual circuit of each cell. In order to equalize the gaseous flow in each cell, the arrangement described in the co-pending application of Grillet, Serial No. 697,029, filed March 5, 1924 will be adopted for all the piping systems.

The circulating medium may be the air of the shed, laden with the vapours of the solvents, but, in view of the danger of explosion due to the vapours of inflammable solvents carried by the medium, a gas, or gaseous mixture, not containing oxygen, may be caused to circulate in the system and to act as carrier for the vapours of the solvents. Evidently, a little air will always enter in the cells by the orifice of issue of the filaments, but the proportion of oxygen in the circulating gases can always be kept constant and very small by introducing regularly into the cycle a certain quantity of an inert gas at another point of the circuit.

Referring to the appended drawing, which illustrates diagrammatically, as an example, an apparatus constructed according to the principles described above:—

a is the spinning cage and b is the spinning die. The solution to be spun enters by a jacketed pipe c allowing it to be heated by steam or hot water or air. The filament issues from the cell by the orifice d to proceed to any other desired apparatus for further treatment or bobbining. The gases aspirated by the air fan or pump e leave the cell at f and pass into the condenser g, where they are cooled to the temperature t and freed from the solvents given out from the filaments, which solvents are collected by means of the tube h which dips into the vessel i filled with solvent and constituting a liquid seal preventing all communication between the evaporating medium and the external atmosphere. From the condenser the gases pass through the air pump e, through the heater j, and re-enter the cell at k. If desired, the cell may be heated by means of the heating coil m, situated at the bottom of the cell. A small quantity of gas, corresponding to the quantity of air which has entered the cell by the orifice d, is abstracted by the tube n, and is led to a suitable apparatus not shown, for the recovery of the solvents.

What I claim and desire to secure by Letters Patent is:—

1. A method of controlling the section of artificial silk and other threads, filaments and fibres obtained by dry spinning in a closed cell of a solution of a cellulose derivative in a volatile solvent, which consists in introducing into the cell a gaseous evaporating medium previously richly laden with a determined proportion of vapors of the solvent, but not saturated, at the temperature prevailing in the cell.

2. A method of controlling the section of artificial silk and other threads, filaments

and fibres obtained by dry spinning in a closed cell of a solution of a cellulose derivative in a volatile solvent, which consists in causing a gaseous evaporating medium to circulate through a piping circuit coupling a spinning cell, in a cycle in the course of which it enters into the cell richly laden with vapors of the solvents, but not saturated, at the temperature prevailing in the cell and loads itself further with the vapors of the solvent taken away from the filaments, issues from the cell and is partly freed from the vapors of the solvent by cooling and direct condensation, said evaporating medium being then reheated and returned to the cell to go through the cycle again, being richly laden with vapors of the solvent in a proportion which is determined by the temperature at which said condensation takes place.

3. An apparatus of the character described, which comprises a closed cell, a spinning die within said closed cell through which a solution of a cellulose derivative is led under the pressure by suitable means, an outlet for the spun filaments, an inlet and an outlet for the evaporating medium, a piping circuit connecting said inlet and outlet outside the cell, means connected to the said circuit for condensing the vapors of the solvent in the evaporating medium, means for heating the evaporating medium, means for causing a circulation of the said evaporating medium in the circuit, and means for abstracting a small quantity of the evaporating medium from the circuit thereby causing a slight aspiration in the cell to prevent leakage of the solvent by the outlet for the spun filaments.

4. Artificial silk and other threads, filaments and fibres of varied cross section, obtained by a method of dry spinning of a solution of cellulose derivative in a suitable solvent by introducing into the cell a gaseous evaporating medium richly laden with a determined quantity of the vapors of the solvent, but not saturated, at the temperature prevailing in the cell.

In testimony whereof I have signed my name to this specification.

JOSEPH EDOUARD GUSTAVE LAHOUSSE.