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G. J. ROY

METHOD OF AND APPARATUS FOR MANUFACTURING ARTIFICIAL FILAMENTS

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Fig. 1.

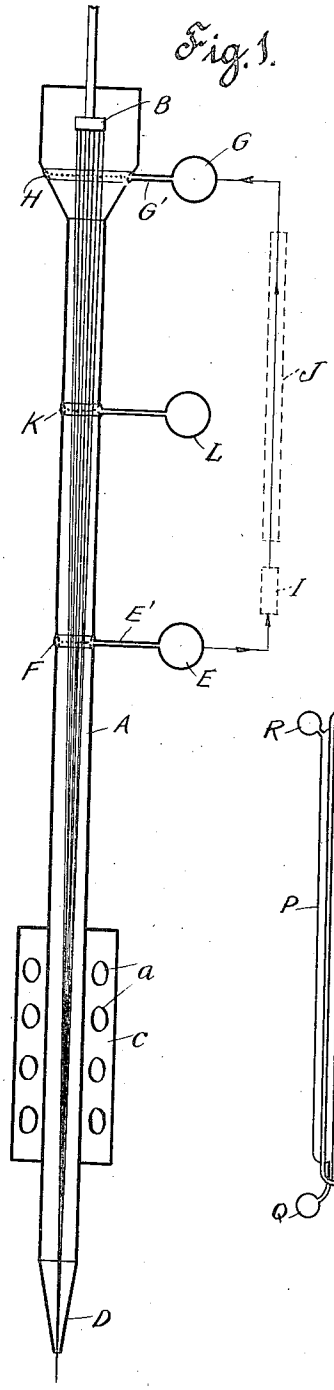


Fig. 3.

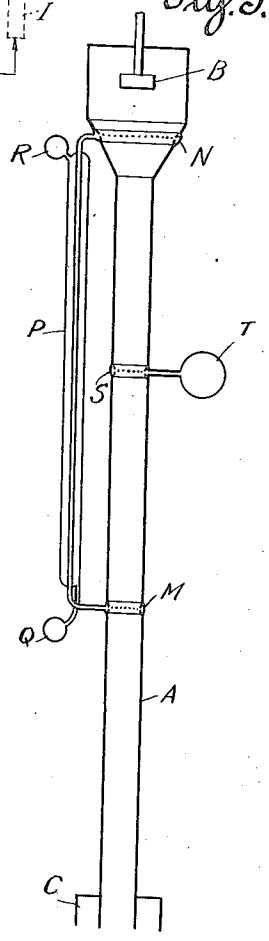
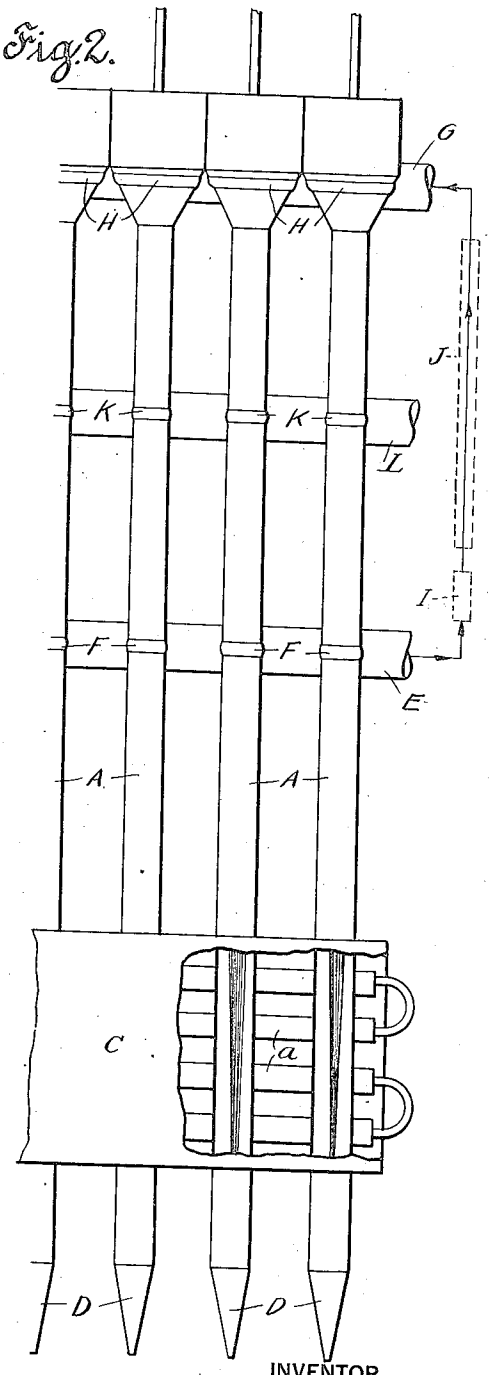


Fig. 2.



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UNITED STATES PATENT OFFICE.

GUSTAVE JEAN ROY, OF LYON, FRANCE, ASSIGNOR TO SOCIÉTÉ POUR LA FABRICATION DE LA SOIE RHODIASETA, OF PARIS, FRANCE, A CORPORATION OF FRANCE.

METHOD OF AND APPARATUS FOR MANUFACTURING ARTIFICIAL FILAMENTS.

Application filed January 9, 1926, Serial No. 80,383, and in Great Britain September 18, 1925.

In the manufacture of artificial threads by dry spinning of collodions the basis of which is esters, ethers or any cellulosic derivative, it is usual to obtain the evaporation of the solvents inside a closed or almost closed space, by subjecting the filaments issued from the spinning dies to the action of a gaseous current, preferably hot, which passes through this space, generally in the opposite direction to the motion of the filaments.

In the application of Prince, Serial No. 720,106, filed June 14, 1924, the importance of the regulation of the temperature in the region of the spinning dies, independently of that of the remaining portion of the cell, has been stated, and, as means for attaining this result, Prince has pointed out the exhaust of the evaporating atmosphere at an intermediate region of the cell, and the introduction, in the neighborhood of the spinning dies, of a certain proportion of evaporating atmosphere the temperature of which is regulated.

The possibility of controlling the shape of the section of the filaments, and avoiding the scintillating effect by a judicious selection of the temperature in the region of the spinning dies, according to the conditions selected for performing the spinning, has also been disclosed in an application of Girardet, Serial No. 33,497, filed May 28, 1925.

Finally, it has also been shown, in the application of Lahousse, Serial No. 739,972, filed September 26, 1924, in order to obtain filaments with a round section, to expose the filaments, for evaporating the solvents, to the action of an atmosphere heavily laden with the volatile solvents entering into the composition of the spun collodion. For this purpose, the evaporating atmosphere, instead of being admitted into the cell pure, or as free as possible from solvent vapors, is admitted thereto already heavily laden with such vapors. The Lahousse application also describes how any loss of gas richly laden with solvent vapors, through the orifice by which the spun filaments issue from the cell, may be avoided by creating in the cell a slight negative pressure, so as to cause thereby an extremely small inflow of fresh air, reduced to the possible minimum.

The present invention relates to a new method by means of which it is possible to obtain in an extremely simple manner, simultaneously, the independent regulation of the temperature at the spinning dies and the spinning in an atmosphere richly laden with solvent vapors, along any desired length of travel of the filaments, and this, contrary to the procedure described in the application of Lahousse above referred to, while a relatively considerable amount of fresh atmosphere is introduced into the cell for the purpose of the evaporation of the solvents, which atmosphere will work under specially favorable conditions.

The improved method consists in effecting the tapping or withdrawing of atmosphere from the cell, at an intermediate region thereof, and re-admitting this atmosphere into the cell in the vicinity of the region of the spinning dies, after having re-heated it to a suitable temperature if necessary.

For greater simplicity, I will hereinafter refer to the auxiliary movement so created as the "derived circuit", in contradistinction to the movement, which I shall call "principal circuit", of the fresh atmosphere introduced by the outlet orifice of the filaments, or in the vicinity of this orifice. In reality, there is naturally a mixing of the two circuits in the regions of common travel, but these designations remain nevertheless quite comprehensible. The output of the "derived circuit" will be that provided at the point of tapping or withdrawing of the atmosphere from the cell and consequently at the point of re-admittance into the cell at the region of the spinning dies. The rate of flow of the "principal circuit" will be that of the fresh atmosphere introduced into the cell, and, consequently, of the atmosphere finally exhausted for the recovery of solvents, with only the difference arising from the volume of solvents with which this atmosphere is laden.

As a first consequence of the adoption of this method, it will be seen that the derived circuit will participate in the evaporation of the solvents in the region of travel of the filaments where this evaporation is particularly intense. As the atmosphere of this derived circuit can be readmitted hot in the region of the spinning dies, its evaporating action will, in this case, thereby considerably increase. One result of this is that, for similar conditions of manufacture the quantity of fresh atmosphere introduced into the cell, in comparison with that which would be

necessary in the absence of this derived circuit, is considerably reduced. Another result is that it is possible to evaporate considerably larger quantities of solvents for a similar rate of flow of fresh atmosphere introduced into the cell, and consequently, to spin with a much greater speed.

This invention, therefore, provides a means of reducing the quantity of atmosphere used for the recovery of the vapor for a definite production, thereby increasing the concentration of the solvents to be recovered, which will constitute an important economy. As a matter of fact, it is known that, in most processes for the recovery of vapors, the dilution of the atmosphere influences not only the final efficiency of the operation, but also the co-efficient of utilization of the products used for the recovery.

Moreover, it will be immediately apparent that, owing to the present invention, a means is now obtained for causing the filament to perform the first portion of its travel in an atmosphere particularly rich in solvent vapors, since the atmosphere tapped from the cell and re-admitted in the neighborhood of the spinning dies contains a certain percentage of solvents which adds itself to the amount resulting from the evaporation in that region of travel of the filaments.

For a definite position of the point of tapping of the derived circuit the proportion of vapors in the atmosphere at the spinning dies will be varied by causing the rate of flow of the principal circuit and that of the derived circuit to vary with respect to each other. It will be particularly obvious from the spirit of the present invention that the derived circuit is given a large rate of flow, substantially greater than that of the principal circuit.

Similarly, if the rates of flow of the principal circuit and that of the derived circuit are kept constant, the proportion of solvent vapors in the tapped atmosphere, and thereby the proportion of solvent vapors in the region of the spinning dies can be varied by varying the height of the point of tapping of the derived circuit and with respect to the height of the point of final exhaust of the evaporating circuit.

Finally, the present invention provides a very simple means of adjusting to the required degree the temperature in the region of the spinning dies by the regulation of the temperature of the atmosphere so re-admitted in this region, the rate of flow of which atmosphere, moreover, besides, may be varied between wide limits.

It will suffice, for given conditions of spinning, and for a given rate of flow of the atmosphere in the derived circuit, to determine the temperature to which this atmosphere must be raised in order that its introduction in the region of the spinning dies may bring the temperature in that region to the desired degree. Of course, the heating so obtained in the region of the spinning dies by the introduction of this atmosphere may be combined with any other known arrangement also adapted to influence the temperature in the region of the spinning dies, such for instance as that described in the application of Girardet, Serial No. 33,497, hereinbefore referred to.

The details of means for carrying out the present invention can be of a widely varied nature. For instance, the individual tappings of each cell may be gathered together in a single collector for one or several groups of cells, creating the flow by a propelling device of any type, and, by means of another collector, re-admit this atmosphere in the individual cells, the equality of the flow in the individual cells being preferably insured by the methods of simultaneous regulation, described in the patent to Grillett, No. 1,571,474, dated February 2, 1926. The heating of the atmosphere of the derived circuit may be insured at any suitable portion of the circuit, and the piping for the hot atmosphere may be suitably insulated to avoid losses of heat.

It will be obvious that an individual derived circuit may be provided for each spinning cell, the movement in this circuit being caused either by an individual propelling device or by the sole action of the densities. In the latter case, the flow may be regulated, within limits depending on the temperatures maintained at diffrent positions of the circuit, by the arrangement and the dimensions of the piping system and the provision of identical dampers, constrictions, and like devices, identical for all cells where the same product is being manufactured.

In order to insure a symmetrical distribution of the gaseous current, it will be wise to effect the tapping and the re-admittance of the atmosphere by annular passages, as described in the application of Prince, Serial No. 720,106, hereinbefore referred to.

The method according to the present invention may be adapted to any type of cell, but in view of a perfectly rational utilization of the evaporating atmosphere, which is the purpose specially sought by the present invention, preference will be given to cells of cylindrical shape, each of which produces only the proper number of filaments intended to constitute one thread, with either the multiple spinning dies in current use in the artificial silk industry, or individual spinning dies mounted on circular collars. In this manner the "dead corners" of the rectangular cells in general use are avoided and a perfect symmetry of the position of the filaments with respect

to the gaseous currents is obtained. The diameter of the cells is preferably reduced to a minimum, always having in mind a better utilization of the atmosphere, and the cell is provided at its lower end with a funnel-shaped chamber, as described in the patent to Prince, No. 1,572,955, dated February 16, 1926, the orifice through which the filaments issue being coincident with the axis of the cell thus eliminating the use of guiding means such as are necessary when the filaments produced are leaving the cell non-axially.

The cells may be constructed slightly tapered or converging towards the thread outlet, and such taper may extend along the whole or only a part of the length of the cell, so as to correspond to the conical formation of the filaments as they extend from the spinning dies down to the outlet.

In the appended drawings, which illustrate diagrammatically, as an example only, the application of the method of the present invention to a group of cells of the cylindrical type.

Fig. 1 is a diagrammatic side elevation of an apparatus having a single cell;

Fig. 2 is a view similar to Fig. 1, but showing an apparatus having a plurality of cells; and

Fig. 3 is a diagrammatic side view of a modified form of apparatus.

Referring to the drawings, A designates the individual cells, the major portion of each of which is formed of a tube of thin metal and of small diameter, which is particularly economical. The cell is preferably provided at its upper end with a portion of larger diameter which will serve not only to afford easy access to the spinning dies B by means of a door (not shown) but also as a means for spacing the cells at a suitable distance apart so as to provide for sufficient space to accommodate the apparatus for winding, bobbining, etc., for the thread issuing from each cell.

At their lower portion, the cells A are heated by any known suitable means. In the drawings, the cells are shown inclosed for a portion of their length by a jacket C forming a chamber around the cells, through which chamber pass a plurality of tubes *a* through which any suitable heating fluid may be circulated by means of which perfect regularity of heating from one end to the other of a group of cells may be insured. The cells A may, if desired, be provided with large perforations in the portions enclosed by the jacket *c*, in order to enhance the exchange of temperature, but in that case it would be necessary to partition off the chamber between successive cells, in order to insure each cell an independent working.

The cells A may be continued some distance below the heating chamber, in order that the filaments may be cooled, if necessary, by the current of fresh atmosphere entering through the thread-outlet orifice, which has certain advantages for the winding, bobbining, and like operations. As shown in Figs. 1 and 2 each cell merges at its lower end into a funnel D which may be provided with a hinged opening device as described in the application of Prince, Serial No. 720,106.

The atmosphere is tapped from the cell by means of an annular tubular member F encircling the cell at the proper point in its length and which is in communication with the interior of the cell through a series of perforations as indicated in Fig. 1. The atmosphere thus drawn from successive cells is conducted through branch pipes E^1 into a collector E, and from thence the derived atmosphere, after passing through a suitable heating apparatus, is delivered to a distributor G from whence it passes through branch pipes G^1 and annular tubular members H similar to the members F into the successive cells at a point near the region of the spinning dies. For the sake of simplicity the heating apparatus J by means of which the tapped atmosphere may be raised to any desired temperature, as well as the fan I for causing the circulation of the air are illustrated herein only diagrammatically. The heater may be placed at any suitable point of the circuit either on the distributor G or on the individual branch pipes between the distributor and the member H of each cell. The atmosphere is exhausted from the cell through a third annular perforated member K, and is thence conducted to a collector L, for the purpose of recovery.

The equality of the flow of all the several "principal circuits" and the equality of the flow of all the "derived circuits" in each cell in which a similar product is being manufactured may be insured, for instance, by the use of special means such as described in the application of Grillet, Serial No. 697,029.

As a second example of the application of the present invention, Fig. 3 illustrates the upper portion of a cellular apparatus in which the derived circulation takes place independently for each cell, by the sole action of the differences of density caused by the heating of the "derived circuit". In the cell shown in this figure, the tapping takes place at M and the re-admission at N. In this modification P designates a heating jacket enclosing the pipe through which the derived atmosphere passes from M to N the heating fluid being supplied to the jacket for all of the cells by a distributor Q and being collected as it issues from the jacket by a collector R, both Q and R being carefully thermally insulated. The exhaust of the atmosphere to the recovery apparatus

takes place at S, and thence to the collector T.

Having thus described my invention, what I claim is:—

1. A process of manufacturing artificial filaments from collodions the basis of which is a cellulose derivative, which consists in spinning the collodion through dies disposed within a practically closed cell, supplying said cell with a gaseous medium intended to cause the evaporation of the solvent and to be evacuated for recuperating said solvent therefrom, and creating an auxiliary circulation of evaporating medium by tapping atmosphere from the cell at a point intermediate its ends, and reintroducing said atmosphere into the cell at a point in the region of the dies.

2. A process of manufacturing artificial filaments from collodions the basis of which is a cellulose derivative, which consists in spinning the collodion through dies disposed within a practically closed cell, supplying said cell with a gaseous medium intended to cause evaporation of the solvent and to be evacuated for recuperating said solvent therefrom, and creating an auxiliary circulation of evaporating medium by tapping atmosphere from the cell at a point intermediate its ends, passing said atmosphere through a heating apparatus, and reintroducing the heated atmosphere into the cell at a point in the region of the dies.

3. A process of manufacturing artificial filaments from collodions the basis of which is a cellulose derivative, which consists in spinning the collodion through dies disposed within a plurality of practically closed cells, supplying each of said cells with a gaseous medium intended to cause the evaporation of the solvent and to be evacuated for recuperating the solvent therefrom, and creating an auxiliary circulation of evaporating medium by tapping atmosphere from each of said cells at a point intermediate its ends, collecting the atmosphere drawn off from each of the cells in a single collector, heating the collected atmosphere and reintroducing the heated atmosphere into the individual cells at a point in the region of the dies.

4. Apparatus for manufacturing artificial filaments from collodions, comprising a practically closed cell, dies disposed within said cell, means for supplying said cell with gaseous medium intended to cause the evaporation of solvents and to be evacuated for recuperating said solvents therefrom, and means for creating an auxiliary circulation of evaporating medium by withdrawing atmosphere from said cell at a point intermediate its ends and reintroducing said atmosphere into the cell at a point in the region of the dies.

5. Apparatus for manufacturing artificial filaments from collodions, comprising a practically closed cell, dies disposed within said cell, means for supplying said cell with gaseous medium intended to cause the evaporation of solvents and to be evacuated for recuperating said solvents therefrom, means for creating an auxiliary circulation of evaporating medium by withdrawing atmosphere from said cell at a point intermediate its ends and reintroducing said atmosphere into the cell at a point in the region of the dies, and means for heating said atmosphere between its withdrawal from and its reintroduction into the cell.

6. Apparatus for manufacturing artificial filaments from collodions, comprising a practically closed cell, dies disposed within said cell, means for supplying said cell with gaseous medium intended to cause evaporation of solvents and to be evacuated for recuperating said solvents therefrom, means for creating an auxiliary circulation of evaporating medium by withdrawing atmosphere from said cell at a point intermediate its ends and reintroducing said atmosphere into the cell at a point in the region of the dies, means for heating said atmosphere between its withdrawal from and its reintroduction into the cell, and means for heating the gaseous evaporating medium during its passage through the cell.

7. Apparatus for manufacturing artificial filaments from collodions, comprising a practically closed cell, dies disposed at the upper part of said cell, means for supplying said cell with gaseous medium intended to cause the evaporation of the solvents and to be evacuated for recuperating said solvents therefrom, a piping connecting externally a point of the cell intermediate its ends with a point of said cell in the region of the dies and means for heating said piping between its connection with said cells.

8. Apparatus for manufacturing artificial filaments from collodions comprising a plurality of practically closed cells, dies disposed within each of said cells, means for supplying each of said cells with gaseous medium intended to cause the evaporation of the solvents and to be evacuated for recuperating said solvents therefrom, means for creating an auxiliary circulation of evaporating medium by withdrawing atmosphere from each of said cells at a point intermediate its ends, a collector for receiving the atmosphere drawn off from all of said cells, a distributor in communication with said collector, and with each of said cells at a point in the region of its dies, and means for heating the atmosphere before its reintroduction into the cells.

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

GUSTAVE JEAN ROY.