April 25, 1933. H. L. BARTHELEMY 1,906,042

SPINNING CELL FOR THE MANUFACTURE OF ARTIFICIAL FILAMENTS WITH AUTO RECOVERY OF THE VOLATILE SOLVENTS

Filed Sept. 14, 1929

Fig. 1.

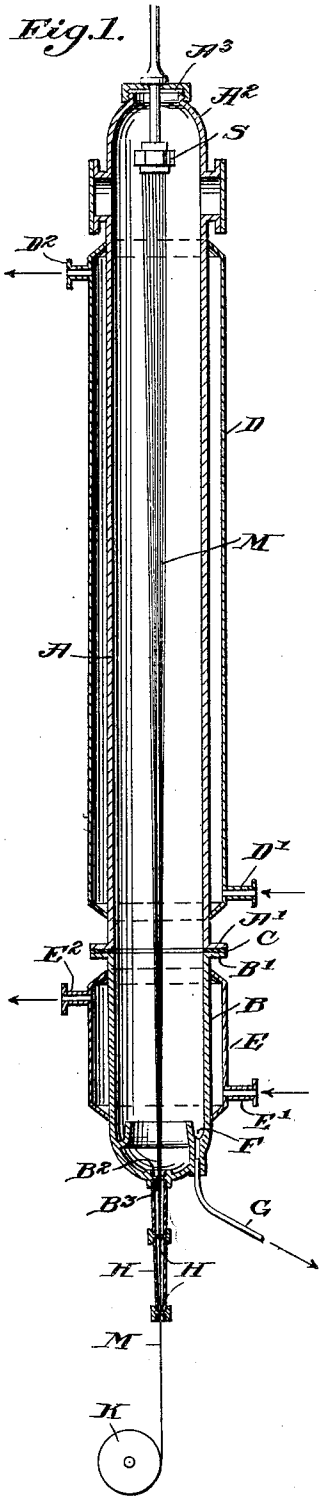


Fig. 2.

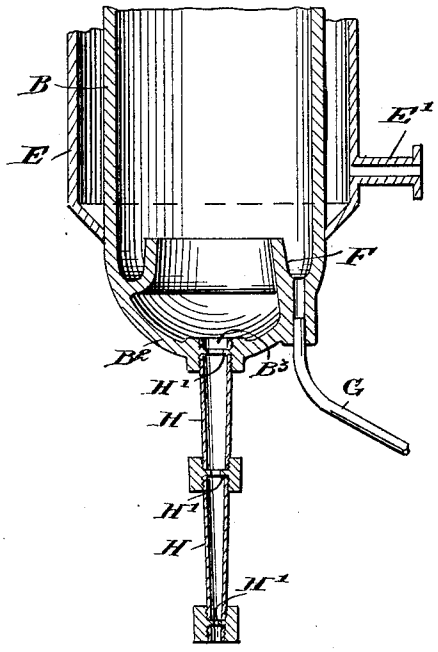
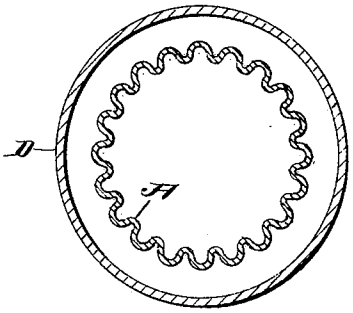


Fig. 3.



Inventor:

Henri Louis Barthelemy

By Alexander & Dowell

Att'ys.

Patented Apr. 25, 1933 1,906,042

UNITED STATES PATENT OFFICE

HENRI LOUIS BARTHELEMY, OF ROME, GEORGIA

SPINNING CELL FOR THE MANUFACTURE OF ARTIFICIAL FILAMENTS WITH AUTO-RECOVERY OF THE VOLATILE SOLVENTS

Application filed September 14, 1929. Serial No. 392,612.

This invention is a novel improvement in spinning cells for the manufacture of artificial filaments, and the principal object thereof is to provide a spinning cell involving the feature of auto-recovery of the volatile solvents and in which there are no gas pipes, no gas collector, no gas connections with any recovery systems and with any heating systems, and wherein no means are required to control the velocity and quantity of gaseous medium circulating through the cell. All this is replaced by the control of the temperature of the heating and the cooling fluids which is easy to do, and is accurate. This insures a perfect stability and equality of spinning and assures a perfect regularity in the cross section of the threads, and in the luster.

It is well-known that the cellulose esters or cellulose ethers dissolved in suitable organic volatile solvents can be converted into filaments by evaporation of the said solvents. Heretofore this has been done in a hollow cell containing the spinneret, and connected through one or more openings with an external condenser in such a way that all or part of the air and solvents can be removed from the cell.

My invention provides a new spinning cell unique in its simplicity for the manufacture of rayon or artificial filaments with means for auto-recovery of the volatile solvents used for the collodion preparation and characterized by the following advantages:

(1) All openings leading outside of the cell for air circulation and vapor condensation are suppressed so as to avoid the employment of diaphragm, elbows, angles, and air return pipes, etc.

(2) The air of the cell is maintained in an apparent static form by means of a special outlet for the spun filaments having a series of annular constrictions to prevent any gas or vapor circulating or passing in or out of the cell with or beside the filament.

(3) Auto-recovery of the volatile solvents inside the spinning cell, while obviating the possibility of irregularity inherent to ordinary gas circulations through pipes, elbows, gaskets, or along other pipes in narrow vessels inasmuch as these occasions are entirely omitted in my new spinning cell and the inside of such cell is entirely free from internal organs, and therefore the circulation of the threads is never constrained, making the starting of spinning easier. In fact each cell constitutes a closed distillation apparatus with its heater and its condenser.

I will explain the invention with reference to the accompanying drawing to enable others to adopt and use the same; and will summarize in the claims the novel features and novel combinations for which protection is desired.

In said drawing:

Fig. 1 is a vertical sectional view through the entire cell.

Fig. 2 is an enlarged vertical section through the lower end of the cell.

Fig. 3 is a transverse section, showing a corrugated cell.

As shown in the drawing, my cell preferably comprises two superposed cylindrical bodies or chambers, preferably pieces of pipe, A and B, connected together by means of end flanges A′ and B′ respectively.

Between the flanges A′, B′ is secured a gas tight gasket C which, at the same time, provides thermal or heat insulation between the two cylindrical bodies A and B.

The upper end of body or chamber A is preferably contracted as at A^2 and provided with a removable cap A^3, through which passes a downwardly directed spinning nozzle S for the filaments M disposed on the axis of the cell. Similarly the lower end of body B is preferably contracted as at B^2 in the center of which is the outlet B^3 for the filaments, also disposed on the axis of the cell.

The cylindrical part of body A is surrounded by a jacket D the interior of which is maintained at the desired high temperature by the circulation of a hot fluid through the said jacket, the fluid entering at D′ and discharging at D^2.

The cylindrical part of body or chamber B is surrounded by a similar jacket E which is maintained at the desired low temperature by the circulation of any suitable cold fluid

entering the jacket at E′ and discharging at E^2. The sides of chambers A and B may be corrugated (Fig. 3) so as to increase the internal thermo-radiating surface.

The lower portion of the cooled body B adjacent the outlet B^3 is provided with an internal annular channel F which acts as a retainer and collector of the solvent condensate, which deposits upon the wall of the cold body B, the solvent being thus automatically recovered in body B and can be drained from channel F through the small drain tube G.

To the outlet B^3 for the filaments, is connected a pipe H containing a series of internal annular constrictions H′ having apertures only sufficient for the passage of the filaments M.

Said constrictions H′ prevent any escape of internal air from the cell or entry of external air thereinto and, therefore, of avoiding any loss and external dispersion of the solvent.

The filaments M issuing from the outlet pipe H are collected by any known means, for example, by means of a horizontally rotating bobbin K, or by means of a vertically rotating bobbin or a twisting machine.

The operation of my novel cell is easy to understand. As the hot cylinder A concentrates the heat along the vertical axis of the cell, the coagulation of the filaments is immediate and the solvent disperses itself in the atmosphere of the cell. In accordance with the well-known principle of Watt, the solvent pressure in cooled chamber B cannot rise above the maximum vapor tension corresponding to the temperature of the coldest wall of the cell.

In heated chamber A the filaments continuously give out vapor of the solvent having a tension limit regulated by the chamber temperature. Consequently, an equilibrium is not possible, and the solvent is automatically condensed along the cold inner wall of chamber B. The condensate passes by gravity down into the annular channel F and is drained out of the cell by means of the pipe G. In fact, the recovery of solvent efficiently and easily reaches 97% with this special cell. The construction of my novel cell insures a perfect uniformity in spinning; the physical characteristics of the threads instead of depending upon the velocity of the gaseous medium, upon its temperature, upon its concentration in volatile solvents, and upon its quantity in circulation by unit of time, are dependent only upon the temperature of the hot water jacket and upon the temperature of the cold water jacket, which are easily controllable. This results in great simplification, especially when it is desired to construct a spinning machine with a large number of cells, each of which must operate exactly like the others in order to produce exactly the same grade of yarn; that is to say yarn having the same tenacity, same elongation, same cross section and same luster.

By juxtaposition of many cells like the above described, it is easy to constitute a uniquely simple industrial spinning machine without external condensors, absorbers, air pipes, and without any other internal cooling or heating pipes.

My invention of course is not limited to the embodiment shown in the drawing. It is not limited to the obligation to locate the cold cylinder beneath the warm cylinder. One easily conceives that, by inversion of the order of the chambers A and B, one will have a cell still working according to the Watt principle, but with a lower thermal efficiency caused by the unavoidable air convexion currents.

I claim:—

1. Apparatus for dry spinning filaments of cellulose esters or ethers dissolved in organic volatile solvents and the like, comprising a closed spinning cell containing a confined body of air or gases and having two superposed portions, an inlet for admitting solution to the nozzle in the upper portion and an outlet for the filament in the lower portion, a spinning nozzle in the upper portion of the cell, means for heating the major portion of the cell exterior to the cell, means for cooling the cell adjacent the outlet, means exterior to the cell for preventing passage of air or gases into or out of the cell thermal insulating means between the heated portion and the cooled portion through the filament outlet passage, and means for withdrawing the solvent condensate from the cooled portion of the cell.

2. In apparatus as set forth in claim 1, the means for preventing passage of air or gases through the filament outlet, comprising a tubular member connected with the outlet for the passage of the filament, having a series of internal integral rigid constrictions whereby ingress or egress of air or gases to or from the cell through the filament outlet is prevented.

3. In apparatus as set forth in claim 1, an annular channel in the cell adjacent the outlet for collecting the condensed solvent.

4. In apparatus as set forth in claim 1, corrugations in the inner wall of the cell adjacent the bottom forming vertical grooves in said wall and an annular cooling channel communicating with the lower ends of said grooves to receive condensate therefrom.

5. Apparatus for use in spinning artificial filaments; comprising a spinning cell having upper and lower thermally insulated sections and a filament outlet in the lower section; a spinning nozzle in the upper section; means for heating the upper section; means for cooling the lower section; means adjacent

the outlet for collecting the condensed solvent; a tubular member exterior to the cell and connected with the outlet thereof, and a series of spaced annular internal constrictions in said member permitting the passage of the filament therethrough but preventing ingress or egress of air or gases to or from the cell.

6. Apparatus for use in spinning artificial filaments; comprising a spinning cell having upper and lower thermally insulated sections and a filament outlet in the lower section; a spinning nozzle in the upper section; means for heating the upper section; means for cooling the lower section; an annular channel adjacent the outlet for collecting the condensed solvent; a drain for said channel; a tubular member exterior to the cell and connected with the outlet thereof, and a series of spaced annular internal constrictions in said member permitting the passage of the filament therethrough but preventing ingress or egress of air or gases to or from the cell.

HENRI LOUIS BARTHELEMY.

CERTIFICATE OF CORRECTION.

Patent No. 1,906,042. April 25, 1933.

HENRI LOUIS BARTHELEMY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 99, for "low" read "cold"; page 2, line 97, claim 1, strike out the words "exterior to the cell" and insert the same after "means" in line 96; and lines 101 and 102, strike out the words "thermal insulating means between the heated portion and the cooled portion" and insert the same after "outlet" in line 98; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of August, A. D. 1933.

M. J. Moore.

(Seal) Acting Commissioner of Patents.