March 10, 1959 H. J. H. JANSSEN ET AL 2,876,494

PROCESS AND DEVICE FOR DRY SPINNING

Filed July 6, 1955

FIG. 1

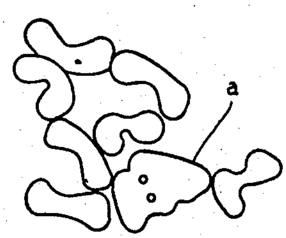
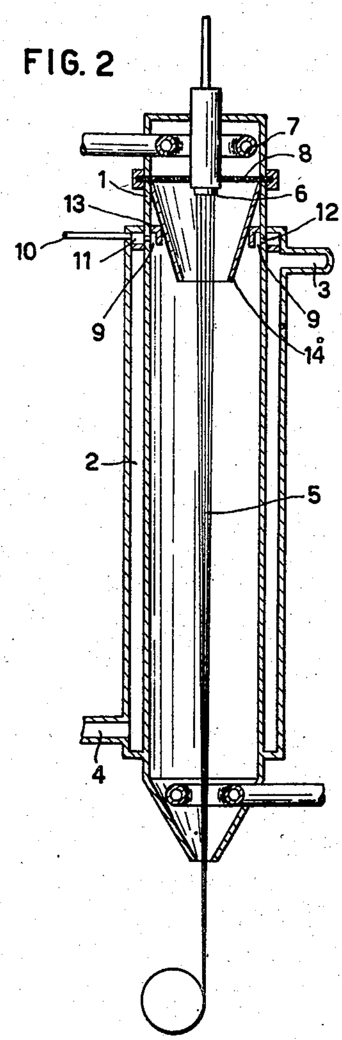


FIG. 2



INVENTOR.
Henricus J.H. JANSSEN,
BY Hendrik S. JONGEPIER,
Hendrik WANING
BY A. John Michel
ATTORNEY

2,876,494

PROCESS AND DEVICE FOR DRY SPINNING

Henricus J. H. Janssen, Hendrik S. Jongepier, and Hendrik Waning, Nimeguen, Netherlands, assignors to Kunstzijdespinnerij Nyma N. V., a Dutch company

Application July 6, 1955, Serial No. 520,329

Claims priority, application Netherlands July 31, 1954

3 Claims. (Cl. 18—8)

The invention relates to a process and apparatus for dry spinning, particularly for dry spinning of polyacrylonitrile filaments.

It is known, for instance, from the British Patent 614,959 that for the dry spinning of polyacrylonitrile the polymer is dissolved, for instance, in dimethyl formamide (solution of 15 to 25%) and the solution is extruded at a high temperature through a spinneret mounted in the upper part of a spinning shaft, whereupon the polyacrylonitrile thread in obtained by evaporation of the solvent. The evaporation of the solvent is effected by supplying to the spinning shaft a gas, for instance air, of about 200° C. The hot gas is either supplied at the bottom of the spinning shaft and discharged at the top or supplied at the top and discharged at the bottom.

Moreover, the spinning shaft is generally provided with a heating jacket through which superheated steam or a heating liquid is passed at a high temperature; this is necessary to maintain the required high temperature in the shaft.

It is the principal object of the present invention to provide a dry spinning process and apparatus in which the thread formed at the spinneret moves quietly through the shaft. Air whirls in the shaft make the thread flutter. The consequence is that some filaments come into contact with the shaft wall and stick there and/or adjacent filaments come into contact with each other, stick together and give filaments of double thickness.

In the accompanying drawing,

Fig. 1 is a top view of a bundle of filaments produced by conventional dry spinning methods; and

Fig. 2 is a vertical section of a spinning cell according to the present invention.

We found that the filaments quietly move through the shaft if the temperature at which the gas arrives at the shaft is 10 to 70° C. and preferably 20 to 40° C. higher than the temperature of the shaft wall in the vicinity of the spinneret. The following measures increase the favorable effect of the temperature difference between shaft wall and entering air:

(1) The hot gas is admitted at the top of the shaft through gauze or a plate or foil with holes. The gas is moreover preferably admitted into the space which is sepaarted by the said gauze or plate or foil from the spinning shaft, by means of an annular tube with holes.

(2) At some distance from the spinneret an additional hot gas stream is admitted through an annular slot.

(3) A truncated cone surrounds the spinneret at point adjacent the annular slot so that the additional hot gas stream enters the shaft between shaft wall and cone.

Referring to Figure 2, **1** is the spinning shaft, **2** the heating jacket around the shaft, **5** the filaments bundle and **6** the spinneret. The heating medium for the jacket of the spinning shaft enters the heating jacket at **3** and leaves it at **4**. The heating gas enters the top part of the

spinning shaft through an annular tube with holes **7** and reaches the remaining part of the shaft through gauze **8**, so-called electrolytic nickel gauze 40 mesh.

Moreover the heating gas is supplied to the shaft by means of the annular slot **9**, the gas being guided to this slot **9** through the supply tube **10**, the annular channel **11** and the openings **12**.

Conical guide member **14** is connected to channel member **13**.

The invention is elucidated by the following comparative examples.

Example I

(*a*) A 20% solution of polyacrylonitrile in dimethyl formamide was pressed through a spinneret with 40 holes into a spinning shaft according to Fig. 2, in which air of 200° C. was supplied only through the annular tube **7**, the wall of the spinning shaft being maintained at 200° C. The gauze **8** and the guide member **14** were absent. While proceeding in this manner regular spinning appeared to be entirely impossible. Owing to strong fluttering of the thread, thread ruptures occurred repeatedly.

(*b*) While proceeding according to the manner as indicated sub a, with this difference that the spinning shaft was maintained at 160° C., the spinning process proceeded regularly, although the movement of the thread in the spinning shaft was still somewhat unquiet. However, the spun thread appeared to possess still 3 to 5 double filaments, such as indicated at [a] in Fig. 1.

Figure II

When spinning as indicated sub Example 1*b*, where the gauze 8 and the guide member 14 were provided in the shaft and in which a similar quantity of hot air of 200° C. was supplied through the slot **9** as well as through the tube **7**, the spinning proceeded very regularly and no double filaments were encountered in the obtained yarn anymore.

What is claimed is:

1. A dry-spinning process for the conversion of a spinning solution into filaments by extruding the solution through a spinneret into a heated cell having a wall and passing a gaseous evaporative medium through the cell, comprising the steps of heating the cell wall, supplying the gaseous medium to the cell from above the spinneret and in an annular stream from the cell wall below the spinneret, the gaseous medium being supplied at a temperature 10 to 70° C. higher than the temperature of the cell wall in the vicinity of the spinneret, and deflecting the annular stream downwardly and away from the spinneret to merge therebelow with the gaseous medium supplied from above the spinneret.

2. The dry-spinning process of claim 1 wherein the spinning solution comprises polyacrylonitrile and dimethyl formamide.

3. A dry-spinning apparatus comprising a spinning cell having a wall, a heating jacket surrounding the wall, a spinneret mounted near one end of the cell, a conduit means for supplying a gaseous evaporative medium to the cell, said conduit means being mounted in the cell between the spinneret and said one end, a baffle member having the form of a truncated cone arranged in the cell between the spinneret and the cell wall, the baffle member and the cell wall defining an annular space therebetween, and second conduit means for supplying gaseous evaporative meduim to the cell, said latter means discharging into the annular space through an annular slot in the cell wall.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

1,592,006	Roy	July 13, 1926
2,404,714	Latham	July 26, 1946
2,615,198	Flannagan	Oct. 28, 1952
2,697,251	Bauer	Dec. 21, 1954
2,763,891	Moos	Sept. 25, 1956
2,763,892	Moos	Sept. 25, 1956

FOREIGN PATENTS

474,043	Germany	Mar. 25, 1929
731,478	Great Britain	June 8, 1955
71,410	Norway	Dec. 23, 1946