

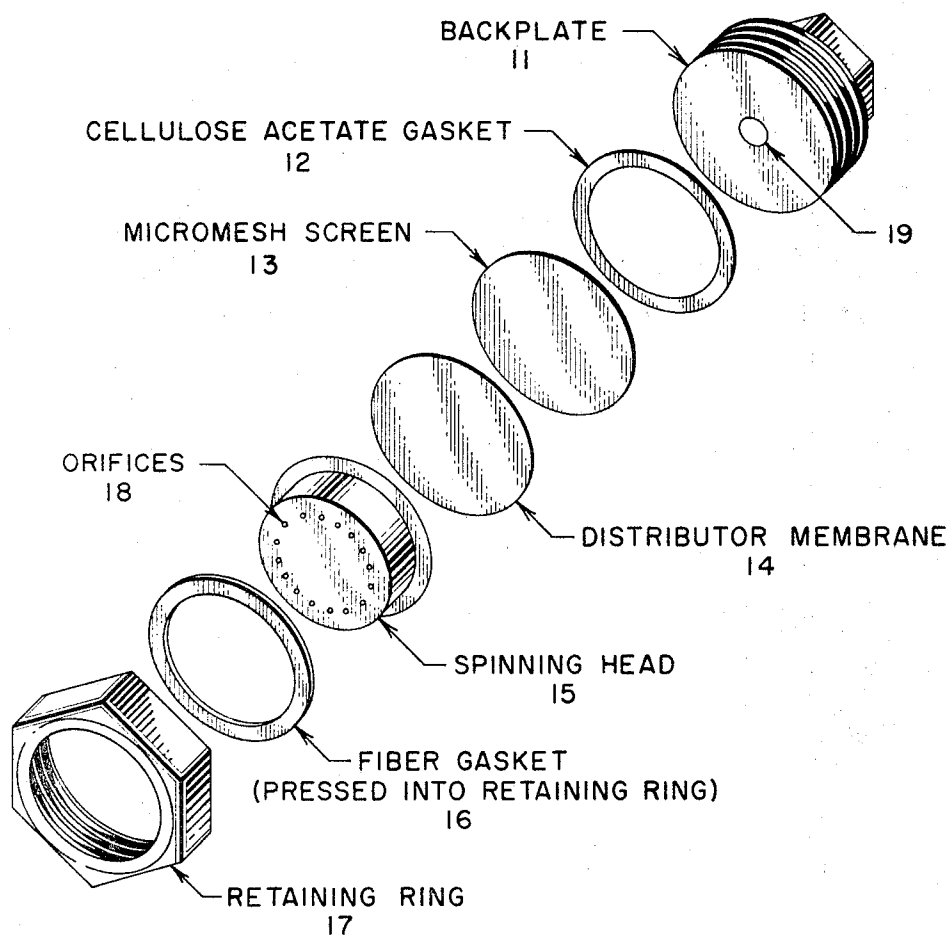
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CELLULOSE ESTER SEALING MEANS FOR DRY SPINNING SPINNERET

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CELLULOSE ESTER SEALING MEANS FOR DRY SPINNING SPINNERET

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ABSTRACT OF THE DISCLOSURE

An improved cellulose ester gasket for use in a spinneret assembly for dry spinning cellulose acetate.

This invention relates to sealing means. It especially relates to gaskets used in a spinnerette assembly. It particularly relates to the construction of gaskets used in a spinnerette assembly for dry spinning textile filaments.

The process of dry spinning for the production of filaments is generally well known. It has been said that dry spinning is in many respects analogous to the method used by the silkworm in producing a filament of silk. Basically, such a process comprises the extrusion under pressure of a filament-forming material, for example, cellulose acetate, dissolved in a suitable solvent, such as acetone, into an evaporative atmosphere. The evaporation of the solvent leaves a lustrous solid filament which is then conventionally wound on a suitable bobbin for further use and/or processing.

Typical methods and apparatus for dry spinning solutions of various synthetic fibers are discussed in U.S. Patent No. 2,000,047 and U.S. Patent No. 2,000,048 to H. G. Stone. These patents, in general, describe a process wherein a heated cellulose ester dissolved in a solvent is forced through a spinnerette having a plurality of orifices into a filament-forming or spinning chamber containing an evaporative atmosphere which is of a temperature sufficiently high to evaporate the solvent from the filaments.

While modern processing utilizing the above described processing techniques have been immensely successful in producing filaments of synthetic fibers there have been significant mechanical and manufacturing problems associated with the operation of this process. One of the more serious problems has been the leakage of the spinning solution through the connecting parts of the spinnerette assembly due primarily to the failure of the gasket material which is used for sealing the various integral parts of the spinnerette assembly. This leakage of the spinning solution around the outer periphery of the spinnerette assembly and/or into the spinning chamber or metier, seriously affects the quality of the filaments in the following ways: (1) leakage will cause large variations in the denier of the filaments being extruded; and (2) leakage will cause changes in the air flow in the metier thereby influencing uneven evaporation of the solvent from the newly formed filaments which in turn adversely affects the tensile strength and other properties of the filaments.

It is, therefore, an object of this invention to produce improved sealing means. It is also an object to produce an improved gasket which can be used in a spinnerette assembly for dry spinning textile filaments. It is a particular object of this invention to construct an improved gasket for use in a spinnerette assembly for dry spinning secondary cellulose acetate. It is a further object of this invention to teach an improved method for sealing spinnerette assemblies by the construction of an improved gasket.

In accordance with the present invention, an improved sealing means is constructed from gasket material which is swollen by the action thereon of the solvent used to carry the filament-forming material and is constructed of said filament-forming material. For example, this invention relates to improved gasket material which is composed of the same substance as the filament-forming material. That is, in a spinnerette assembly for dry spinning cellulose ester filaments from a solution of cellulose ester dissolved in a solvent; said spinnerette assembly comprising at least a spinning head attached to a solution supply by means having a gasket associated therewith; the present invention teaches an improvement which comprises a gasket formed from a material which is swollen by the action thereon of said solvent and is composed of said ester.

There are numerous means known to those skilled in the art for the construction of spinnerette assemblies. For example, U.S. Patent No. 858,648, to C. A. Ernst, teaches a spinnerette configuration that can withstand the pressure of the viscous fluid being extruded without being substantially distorted. Other illustrative spinnerette assemblies can be seen in U.S. Patents Nos. 2,440,761, 2,988,420, 2,891,278 and 3,049,397. Each of these prior art spinnerette assemblies are different in certain respects but each have the common problem discussed hereinabove, namely, each depend upon suitable gaskets to prevent leakage of the spinning solution into undesirable and unwanted places thereby causing the various problems of filament quality which were discussed hereinabove.

The figure is a schematic diagram of one typical spinnerette assembly.

With reference to the figure, the spinning head 15 which contains a circle of orifices 18, is held in place against backplate 11 by the integral association of the retaining ring 17 being screw-fitted onto backplate 11. A micromesh screen 13, e.g., 200 mesh per inch, is pressed into position along with distributor membrane 14 and gasket, e.g., composed of cellulose acetate, and serves as a spacer and filter between spinning head 15 and backplate 11. Backplate 11 contains at least one annular chamber 19 which is connected to suitable piping and filtration apparatus (not shown) to receive the spinning solution. Fiber gasket 16 may be pressed into the retaining ring for additional insurance against leakage but may be omitted.

It can be seen from this description that numerous modifications may be made in the spinnerette assembly but in each case this invention is particularly directed solely to those that rely upon gasket means in order to seal the spinnerette assembly tight against leakage. It can also be seen that leakage may occur for this kind of assembly at the point formed by the spinning head and the retaining ring, at the backplate of the assembly where the backplate threads into the retaining ring, and at the connection between the spinning solution supply line (not shown) and the backplate or spinnerette assembly itself.

The filament-forming materials which can be passed through spinnerette assemblies contemplated by this invention encompass all materials compatible to the dry spinning process. However, this invention is distinctly successful in spinnerette assemblies used for the dry spinning of cellulose ester filaments. Examples of suitable materials include the organic derivatives of cellulose, certain of the polymers and copolymers of acrylonitrile, superpolyesters and superpolyamides. Specific cellulosic ester materials include secondary cellulose acetate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose acetate formate, cellulose acetate propionate, cellulose acetate butyrate, and the like, ethyl cellulose, etc. The esters may be ripened and acetone-soluble, such as

conventional cellulose acetate hereinafter referred to as cellulose acetate or may be substantially fully esterified, that is, contain fewer than 0.29 free hydroxyl groups per anhydroglucose unit, e.g., cellulose triacetate, which is soluble in a solvent such as methylene chloride.

The filament-forming material which may be processed through spinnerettes in accordance with this invention may also comprise other thermoplastic or solvent-soluble polymeric materials such as superpolyamides, e.g., nylon; superpolyesters, e.g., polyethylene terephthalate; polyglycolic acid and copolymers thereof; polymers and copolymers of vinylidene compounds such as ethylene propylene, vinyl chloride, vinylidene chloride, acrylonitrile, vinylidene cyanide, and vinyl acetate:polyacrylonitrile, copolymers of acrylonitrile with other monomers such as vinyl acetate, vinyl chloride, methyl acrylate, vinyl pyridine, sodium styrene sulfonate, etc. In the practice of this invention using any of the above mentioned filament-forming materials it is necessary that the sealing means so constructed be swollen by the action of the solvent carrying the filament-forming material in question and also be constructed of such filament-forming material.

The choice of the gasket dimensions may be varied over a wide range depending upon the particular configuration of spinnerette assembly desired by those skilled in the art. Usually, the gasket is in sheet form which ranges in thickness from 0.005 inch to 0.01 inch depending upon the flange facing used, e.g., plain face, raised face, male and female, tongue-and-groove, etc., but may be of the ring-type of oval or octagonal cross-section; or of any other design desired. The gasket of this invention may be used alone or in conjunction with other gasket materials, such as, metal, plant-fiber, etc.

EXAMPLE I

A spinning solution comprising 24.6% by weight secondary cellulose acetate dissolved in acetone was spun into filaments through the spinnerette assembly and its general operation as described above in connection with the figure. The results from this operation indicated that on the average there was 2.6% leaks per 240 headers per 24 hours when the gasket material was composed of cellulose acetate gaskets which were cut from 7½ inches x 9¼ inches secondary cellulose acetate plastic sheets of 0.010 inch thickness. When conventional plant fiber gaskets were used in the same operation without any cellulose acetate gaskets, the leakage rate was 75% per 240 headers per 24 hours.

EXAMPLE II

A spinning solution comprising 26.5% by weight cellulose triacetate, 1.31% titanium dioxide based on the weight of cellulose triacetate, 1.5% water and the remainder solvent (90% methylene chloride, 10% methanol) was spun into filaments using the spinnerette assembly and its general operation as described above in connection with the figure. The results of this trial indicated

that the leakage rate when using gasket material composed of cellulose triacetate was 100% less than the leakage rate when normal gasketing materials such as a fiber gasket or Teflon (polymerized tetrafluoroethylene) gasket was used.

Having described my invention, what I desire to secure by Letters Patent is:

1. Method of sealing with gasket means a spinnerette assembly, used for dry spinning cellulose ester filaments from a solution of cellulose ester dissolved in a solvent, which comprises using as sealing means a gasket material which is swollen by the action thereon of said solvent and is composed of said ester.

2. Method according to claim 1 wherein said ester is secondary cellulose acetate; said solvent comprises acetone; and said gasket material is secondary cellulose acetate.

3. In a dry spinning process wherein a solution of a filament-forming material in a volatile solvent is extruded through a spinnerette assembly into an evaporative atmosphere, said spinnerette assembly comprising at least a spinning head attached to a solution supply by means having a gasket associated therewith; the improvement which comprises forming the gasket from a material which is swollen by the action thereon of said solvent and which comprises said filament-forming material.

4. Improvement according to claim 3 wherein said filament-forming material is secondary cellulose acetate; said solvent comprises acetone; and said gasket material consists of secondary cellulose acetate.

5. In a spinnerette assembly for dry spinning cellulose ester filaments from a solution of cellulose ester dissolved in a solvent; said spinnerette assembly comprising at least a spinning head attached to a solution supply by means having a gasket associated therewith; the improvement which comprises a gasket formed from a material which is swollen by the action thereon of said solvent and is composed of said ester.

6. Improvement according to claim 5 wherein said ester is secondary cellulose acetate; said solvent comprises acetone; and said gasket material consists of secondary cellulose acetate.

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