Sept. 25, 1956 G. E. MOOS ET AL 2,763,891

SPINNING APPARATUS

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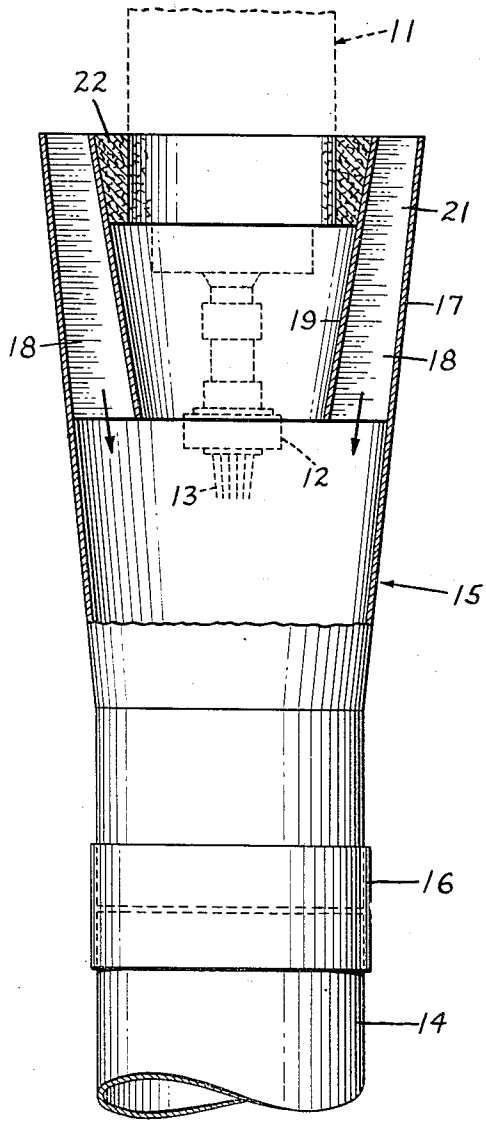
FIG. 1.



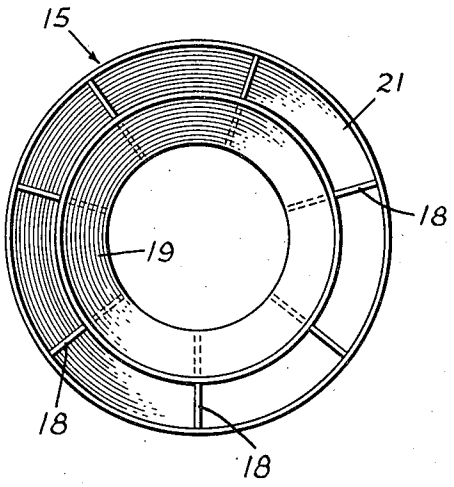


FIG. 2.

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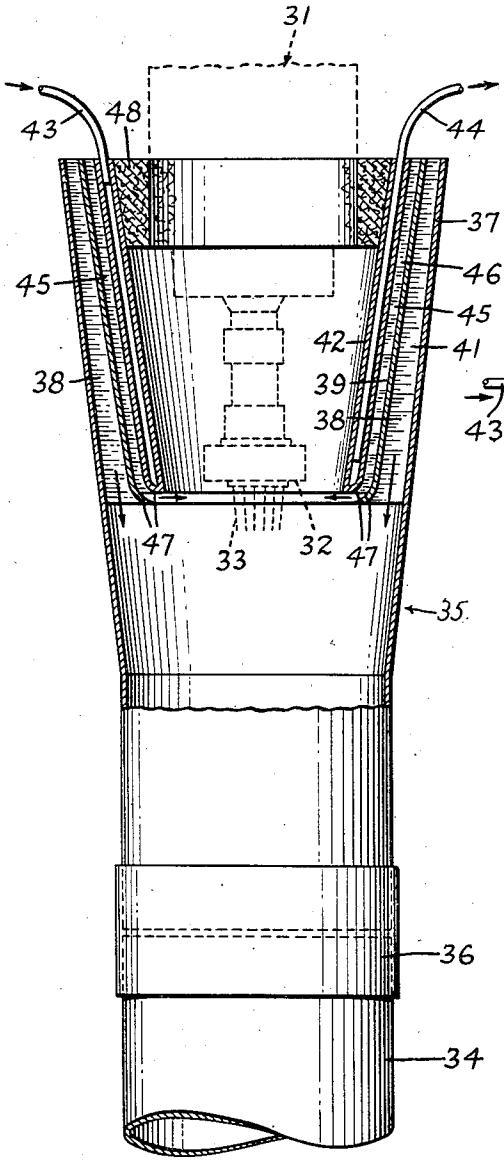
FIG.3.



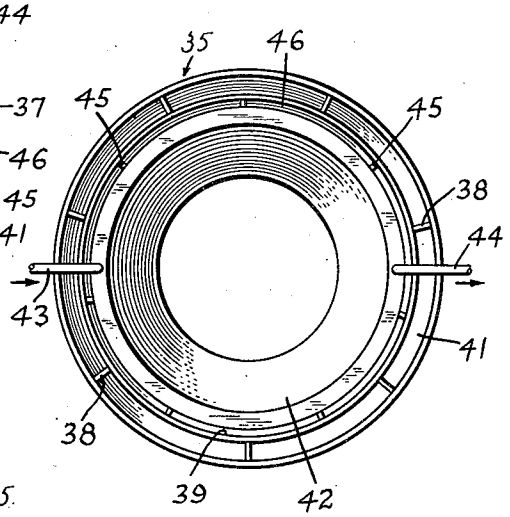


FIG.4.

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SPINNING APPARATUS

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10 Claims. (Cl. 18—8)

This invention relates to the spinning of artificial filamentary materials and relates more particularly to a novel apparatus for the spinning of artificial filamentary materials wherein a stream of gaseous coagulating medium flows through the spinning cabinet.

An important object of this invention is to provide a novel apparatus for the spinning of artificial filamentary materials having uniform properties and free from irregularities along their length.

A further object of this invention is to provide a novel apparatus for the spinning of artificial filamentary materials wherein means are provided for introducing a stream of gaseous coagulating medium substantially free from turbulence into a spinning cabinet.

Other objects of this invention, together with certain details of construction and combinations of parts, will be apparent from the following detailed description and claims.

According to one type of process that is widely employed for the production of artificial filamentary materials, a filament-forming composition is pumped or otherwise forced through a spinnerette, containing at least one spinning orifice, into a spinning cabinet wherein it is caused to set by the action of a gaseous coagulating medium. The setting of the filamentary materials by the gaseous coagulating medium may be effected through the evaporation of a volatile solvent from the filament-forming composition or simply by the cooling of said composition below its melting point. The gaseous coagulating medium may flow through the spinning cabinet either in the same direction as the filamentary materials or in a direction opposite thereto. When the gaseous coagulating medium flows through the spinning cabinet in the same direction as the filamentary materials, it normally enters the spinning cabinet at a point adjacent to the spinnerette and comes into contact with the filamentary materials immediately upon their emergence from the said spinnerette. Since the filamentary materials at this point are still in a relatively plastic state, any turbulence in the gaseous coagulating medium may introduce irregularities into the filamentary materials. In addition, if the gaseous coagulating medium comprises air which is drawn into the spinning cabinet by applying suction at a point in the spinning cabinet removed from the vicinity of the spinnerette, as is frequently the case, the spinning cabinet must be open to the atmosphere in the vicinity of the spinnerette to permit the air to enter the same. With a construction of this type, the spinnerette and the filamentary materials emerging therefrom are liable to be subjected to changing atmospheric conditions which may cause irregularities to develop in the said filamentary materials.

It has now been found that by providing a streamlining unit to control the flow of gaseous coagulating medium into the spinning cabinet, it is possible substantially to eliminate any irregularities in the filamentary materials resulting either from turbulence of the gaseous coagulating medium or from changing atmospheric conditions. A

form of streamlining device that has been found satisfactory for this purpose comprises a pair of members, spaced from one another and positioned coaxially of the spinnerette, which members define an annular passageway through which the gaseous coagulating medium will flow into the spinning cabinet without turbulence and which will protect the spinning cabinet from changing atmospheric conditions. To reduce to a minimum any tendency for turbulence to develop in the gaseous coagulating medium, the streamlining unit may be so designed that the cross-sectional area of the annular passageway remains constant throughout its length and is equal to the cross-sectional area of the body of the spinning cabinet. With this design, there will be no change in velocity or pressure as the gaseous coagulating medium flows through the annular passageway so that the flow of said medium will be substantially straight-line.

In certain cases, it has been found that the properties of the artificial filamentary materials are improved if a small portion of the gaseous coagulating medium is caused to impinge radially upon the said materials. The streamlining unit of this invention lends itself readily to providing for such radial impingement. For example, a third member may be positioned coaxially of the two members defining the annular passageway, and spaced therefrom, to form a second annular passageway which is shaped to cause a stream of the gaseous coagulating medium to impinge radially upon the filamentary materials. If it is desired to change the temperature of the gaseous coagulating medium, or a portion thereof, one or more of the members defining the annular passageways may, for example, be made of hollow wall construction and a heat transfer medium at the desired temperature may be caused to flow therethrough.

Preferred embodiments of this invention are shown in the accompanying drawings wherein

Fig. 1 is a front elevational view, partly in cross-section, of one form of streamlining unit,

Fig. 2 is a top plan view of the streamlining unit shown in Fig. 1,

Fig. 3 is a front elevational view, partly in cross-section of another form of streamlining unit, and

Fig. 4 is a top plan view of the streamlining unit shown in Fig. 3.

Referring now to Figs. 1 and 2 of the drawings, the reference numeral **11** designates a spinning head to the lower end of which is secured a spinnerette **12** for producing artificial filamentary materials **13**. Positioned beneath the spinning head **11** is a spinning cabinet **14** through which the artificial filamentary materials **13** pass and through which a stream of air is caused to flow in the same direction as the artificial filamentary materials in any suitable manner. For example, air may be exhausted from the spinning cabinet **14** at a point removed from the spinning head **11**, producing a sub-atmospheric pressure within the said cabinet and tending to cause a stream of air to enter into the top of said cabinet and flow downwardly therethrough.

The flow of the stream of air entering into the spinning cabinet **14** is controlled by means of a streamlining unit, indicated generally by reference numeral **15**, the lower end of which is of the same diameter as the upper end of the spinning cabinet **14** and which is butted against the said spinning cabinet and is connected thereto by means of a sleeve **16**. The upper end **17** of the streamlining unit **15** is flared outwardly and encircles the spinning head **11** and the spinnerette **12** and is coaxial therewith. The streamlining unit **15** includes, supported internally and coaxially of its upper end **17** by means of a plurality of fins **18**, a frusto-conical sleeve **19**, which extends approximately to the level of the spinnerette

12 and which forms with said upper end 17 an annular passageway 21 leading to the interior of the spinning cabinet 14. The wall of the frusto-conical sleeve 19 is inclined at a somewhat steeper angle than the wall of the upper portion 17 of the streamlining unit 15 so that the cross-sectional area of the annular passageway 21 remains substantially constant although its diameter decreases. As a result, there is no change in the velocity of the air flowing through the passageway 21 and no tendency for turbulence to develop therein. Advantageously, the cross-sectional area of the annular passageway 21 is substantially equal to the cross-sectional area of the body of spinning cabinet 14 further to reduce the development of turbulence in the stream of air. The fins 15 not only act to support the frusto-conical sleeve 19, but also act to cause a straight line flow of air through the annular passageway thereby reducing turbulence even further. To insure that all the air will enter the spinning cabinet 14 through the annular passageway 21, the space between the spinning head 11 and the frusto-conical sleeve 19 is sealed against the flow of air by means of a packing 22 of any suitable material.

A modified form of construction is shown in Figs. 3 and 4 of the drawings, wherein the reference numeral 31 designates a spinning head to the lower end of which is secured a spinnerette 32 for producing artificial filamentary materials 33. Positioned beneath the spinning head 31 is a spinning cabinet 34 through which the filamentary materials pass and through which a stream of air is caused to flow in the same direction as the filamentary materials by the same means as those employed in connection with spinning cabinet 14.

The flow of the stream of air entering into the spinning cabinet 34 is controlled by means of a streamlining unit, indicated generally by reference numeral 35, the lower end of which is of the same diameter as the upper end of the spinning cabinet 34 and which is butted against the said spinning cabinet and is connected thereto by means of a sleeve 36. The upper end 37 of the streamlining unit 35 is flared outwardly and encircles the spinning head 31 and the spinnerette 32 and is coaxial therewith. Supported internally and coaxially of the upper end 37 of the streamlining unit 35 by means of a plurality of fins 38 is a frusto-conical sleeve 39, which extends approximately to the level of the spinnerette 32 and which forms with said upper end an annular passageway 41 leading to the interior of the streamlining unit 35. A hollow-walled frusto-conical jacket 42 into which a heat exchange medium may be introduced through conduit 43 and from which it may be discharged through conduit 44 is supported internally and coaxially of the frusto-conical sleeve 39 by means of a plurality of fins 45, and forms with said sleeve an annular passageway 46 through which an additional quantity of air whose temperature is controlled by the heat transfer medium may flow to the spinning cabinet 34. The lower portions of the frusto-conical sleeve 39 and the frusto-conical jacket 42 are curved as at 47 in such a manner that the stream of air flowing through the annular passageway 46 will be directed radially toward the filamentary material 33, which, in certain cases, has been found to improve the properties of the said materials. To insure that all the air will enter the spinning cabinet 34 through the annular passageways 41 and 46, the space between the spinning head 31 and the frusto-conical jacket 42 is sealed against the flow of air by means of a packing 48 of any suitable material.

If desired, the streamlining unit 35 may, like the streamlining unit 15, be so designed that the cross-sectional area of the annular passageways 41 and 46 remains constant and equal to the cross-sectional area of the spinning cabinet 34.

While the spinning cabinets 14 and 34 have been shown as having a circular cross-section, they may obviously have a square, rectangular or any other desired cross-section.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and a spinning head carrying a spinnerette, of a streamlining unit operatively connected to said spinning cabinet and having a tapered outer wall positioned all around said spinning head coaxially of the spinnerette and a sleeve positioned internally and coaxially of said tapered outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet, said sleeve and said outer wall being so tapered that the cross-sectional area of said passageway, perpendicular to the direction of flow of said medium, is substantially uniform throughout the length of said passageway whereby there will be substantially no change in the velocity of the gaseous coagulating medium flowing therethrough said sleeve being tapered at a greater angle than said outer wall.

2. Apparatus as set forth in claim 1 in which said outer wall and said sleeve are tapered inwardly in the direction of movement of said stream.

3. Apparatus as set forth in claim 2 in which said streamlining unit is spaced from said spinning head and packing means are disposed between said spinning head and said streamlining unit for sealing the space between said head and said unit against the flow of air through said space.

4. Apparatus as set forth in claim 1 and including means positioned in thermal contact with the stream of gaseous coagulating medium in the annular passageway for changing the temperature of said medium as it flows through said passageway.

5. Apparatus as set forth in claim 1 and including means for deflecting a portion of the stream of gaseous coagulating medium to impinge radially upon the artificial filamentary materials emerging from the spinnerette.

6. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and the spinning head carrying a spinnerette, of a streamlining unit operatively connected to said spinning cabinet and having a tapered outer wall positioned all around said spinning head coaxially of the spinnerette and a tapered sleeve positioned internally and coaxially of said tapered outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet, a tapered jacket positioned internally and coaxially of said sleeve and spaced therefrom to form a second annular passageway for introducing a second stream of gaseous coagulating medium into said spinning cabinet, said second annular passageway being shaped to direct the gaseous coagulating medium flowing therethrough to impinge radially upon the artificial filamentary materials emerging from the spinnerette, and means for passing a heat transfer medium through said jacket to change the temperature of the gaseous coagulating medium flowing through said second annular passageway, said outer wall, said sleeve and said jacket being tapered inwardly in the direction of movement of said first mentioned stream.

7. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and a spinning head carrying a spinnerette, of a streamlining unit, operatively connected to said spinning cabinet, having an outer wall, the upper end of which is flared outwardly and positioned around said spinning head and coaxially of the spinnerette and a frusto-conical

sleeve positioned internally and coaxially of the upper end of said outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet, said annular passageway having a substantially uniform cross-sectional area throughout its length whereby there will be substantially no change in the velocity of the gaseous coagulating medium flowing therethrough.

8. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and a spinning head carrying a spinnerette, of a streamlining unit, operatively connected to said spinning cabinet, having an outer wall, the upper end of which is flared outwardly and positioned around said spinning head and coaxially of the spinnerette, a frusto-conical sleeve positioned internally and coaxially of the upper end of said outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet, said annular passageway having a substantially uniform cross-sectional area throughout its length whereby there will be substantially no change in the velocity of the gaseous coagulating medium flowing therethrough, and fins extending longitudinally of said passageway further to reduce the tendency toward the development of turbulence in the gaseous coagulating medium.

9. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and a spinning head carrying a spinnerette, of a streamlining unit, operatively connected to said spinning cabinet, having an outer wall, the upper end of which is flared outwardly and positioned around said spinning head and coaxially of the spinnerette, a frusto-conical sleeve positioned internally and coaxially of the upper end of said outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet said annular passageway having a substantially uniform cross-sectional area throughout its length whereby there will be substantially no change in the velocity of the gaseous coagulating medium flowing therethrough, and a frusto-conical

jacket positioned internally and coaxially of said sleeve and spaced therefrom to form a second annular passageway for introducing a second stream of gaseous coagulating medium into said spinning cabinet, said second annular passageway being shaped to direct the gaseous coagulating medium flowing therethrough to impinge radially upon the artificial filamentary materials emerging from the spinnerette.

10. In an apparatus for the spinning of artificial filamentary materials, the combination with a spinning cabinet and a spinning head carrying a spinnerette, of a streamlining unit, operatively connected to said spinning cabinet, having an outer wall, the upper end of which is flared outwardly and positioned around said spinning head and coaxially of the spinnerette, a frusto-conical sleeve positioned internally and coaxially of the upper end of said outer wall and spaced therefrom to form an annular passageway for introducing a stream of gaseous coagulating medium substantially free from turbulence into said spinning cabinet, a frusto-conical jacket positioned internally and coaxially of said sleeve and spaced therefrom to form a second annular passageway for introducing a second stream of gaseous coagulating medium into said spinning cabinet, said second annular passageway being shaped to direct the gaseous coagulating medium flowing therethrough to impinge radially upon the artificial filamentary materials emerging from the spinnerette, and means for passing a heat transfer medium through said jacket to change the temperature of the gaseous coagulating medium flowing through said second annular passageway.

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