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FILAMENT SPINNING APPARATUS

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FIG. 1

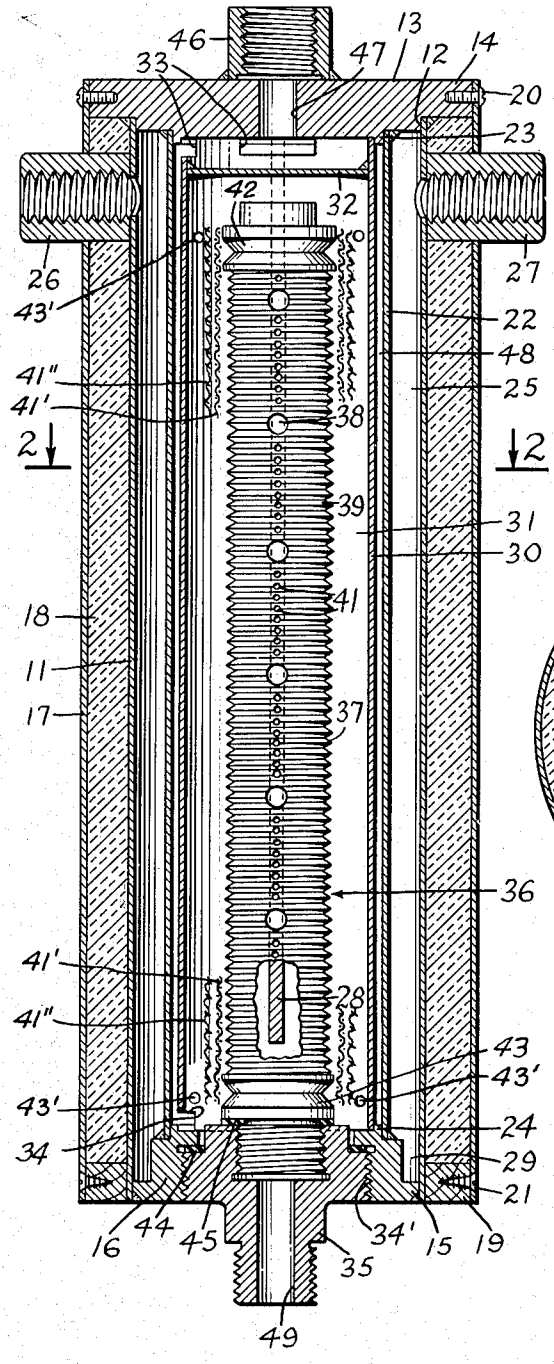
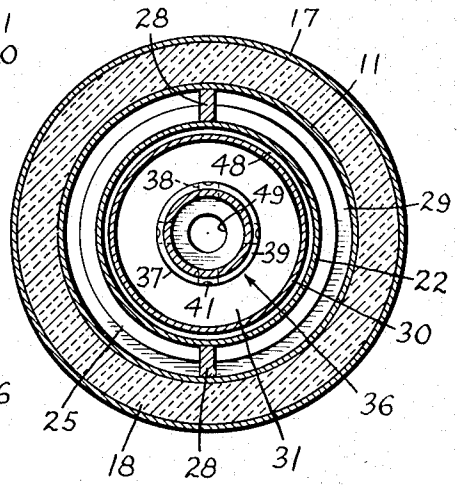



FIG. 2.




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# FILAMENT SPINNING APPARATUS

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6 Claims. (Cl. 210—150.5)

This invention relates to filament spinning apparatus and relates more particularly to a novel candle filter adapted for use with filament spinning apparatus.

In the production of artificial filamentary materials by the so-called dry-spinning process, a solution or dope of filament-forming material in a volatile solvent at an elevated temperature is pumped or otherwise forced through a spinning jet, having one or more spinning orifices therein, into a spinning cabinet or metier. As the filamentary materials pass through the spinning cabinet, the bulk of the solvent is evaporated therefrom, by means of a suitable evaporative medium such as air. The filamentary materials are then drawn from the spinning cabinet and may be lubricated and have a twist imparted thereto before they are packaged or otherwise treated for further use.

The diameter of the spinning orifices through which the spinning dope is forced will vary depending upon the desired size of the filamentary material, but may, in certain cases, be as low as 0.1 to 0.05 millimeter, or even less. If there are any solid impurities in the spinning dope, they will tend to lodge in and clog one or more of the spinning orifices thereby interrupting the continuity of spinning. It is customary to filter the spinning solution several times to remove solid impurities therefrom, and to effect a final filtration of the spinning solution by means of a candle filter mounted in the line leading from the spinning pump to the spinning jet.

To raise the temperature of the spinning solution to the proper value for satisfactory spinning, the candle filter may be provided with a jacket through which a heating medium is passed. It is essential that the temperature of the spinning solution leaving the candle filter be uniform, since any variation in temperature will produce corresponding variations in the physical properties of the filamentary materials. At high spinning speeds when the spinning dope passes through the candle filter, at an increased rate of flow, the spinning solution is subjected to a reduced period of heating. As a result, the spinning dope may not be brought uniformly to the desired spinning temperature. The non-uniform temperature of the spinning dope renders the spinning conditions unstable, producing filamentary materials that are irregular with respect to their physical properties. Even if the spinning dope is brought uniformly to the desired temperature for spinning during its passage through the candle filter, any cooling of the dope which occurs in its passage from the heating surfaces of the candle filter to the spinning jet will introduce undesirable non-uniformities in the temperature of the spinning dope. The amount and effects of such cooling are particularly pronounced at low spinning speeds when the rate of flow of the spinning dope to the spinning jet is at a relatively low level.

It is an important object of this invention to provide a candle filter which will be free from the foregoing and other difficulties and which will be especially simple in construction and efficient in use.

A further object of this invention is to provide a novel candle filter of compact design which will filter and heat



uniformly to the desired temperature the spinning solution passing therethrough even at high rates of flow.

Another object of this invention is to provide a novel candle filter in which the distance through which the spinning dope flows in its passage from the heating surfaces of the candle filter to the spinning jet is reduced to a minimum so that little or no cooling of the spinning dope will take place during such flow.

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

In accordance with this invention, there is provided a candle filter comprising a cylindrical casing which is jacketed with a layer of heat insulating material. Positioned concentrically within the casing is a cylindrical tube which forms with said casing an annular jacket through which a heating medium, such as steam, hot water or the like, may be passed. At the upper end of the candle filter there is provided a plug to which the casing and tube are fastened, as by welding or the like and which acts to seal one end of the annular jacket. At the lower end of the candle filter there is provided an annular plug of smaller diameter than the casing, which annular plug has a rim extending from the lower periphery thereof into contact with said casing. The casing and the tube are fastened, as by welding or the like, to the rim and the annular plug, respectively, to seal the other end of the annular jacket. The annular plug and the casing define an annular passageway communicating directly with the annular jacket so that the heating medium supplied to said jacket will flow through said space and raise the temperature of said annular plug.

Positioned concentrically within the cylindrical tube is a tubular shell which butts against and is held in place by a ridge projecting from the inner surfaces of the plugs that are provided at the upper and lower ends of the candle filter. The tubular shell and the cylindrical tube together define an annular passageway into which the spinning dope is introduced and through which it flows, in the form of a thin film, in heat exchange relation with the heating medium. The heated spinning dope then flows into the chamber defined by the tubular shell, through a filtering element, positioned in said chamber and supported by a fitting engaged in said annular plug, and then to a spinning jet secured directly to said fitting. Owing to the provision for passing the heat exchange medium over the periphery of the annular plug, the fitting mounted therein will be raised to an elevated temperature and the cooling of the spinning dope during its passage to the spinning jet will be substantially prevented. In addition, because of the efficient heating of the spinning dope during its passage through the candle filter, the said spinning dope will be raised uniformly to the proper spinning temperature. As a result, the spinning dope entering the spinning jet will be free from undesirable non-uniformities in temperature both at high spinning speeds and at low spinning speeds.

A preferred embodiment of the invention is shown in the accompanying drawing, wherein

Fig. 1 is a substantially vertical sectional view, partly in section, of the candle filter, and

Fig. 2 is a cross-sectional view taken along the line 2—2 in Fig. 1 in the direction of the arrows.

Referring now to the drawing, the reference numeral 11 designates the outer casing of the candle filter proper, which casing is welded at its upper end to shoulder 12 of a plug 13 whose outer rim 14 extends beyond the circumference of said casing. At its lower end, the casing 11 is welded to the periphery of a rim 15 extending outwardly from the lower edge of an annular plug 16 of smaller diameter than the said casing. The casing 11 is positioned concentrically within a shell 17 and a heat in-

sulating material 18 fills the space between said casing and said shell. The heat insulating material 18 is held in place by means of the rim 14 and an annular plastic fiber plug 19 located between the bottom of casing 11 and shell 17. Screws 20 in threaded engagement with the rim 14 hold the shell 17 securely in place, and the annular plug 19 is held in place by means of screws 21 that extend through the shell 17.

A cylindrical tube 22 is positioned concentrically within the casing 11 and is welded at its upper end to the plug 13 and is positioned against the outer periphery of a circular ridge 23 projecting from the inner surface of the plug 13. At its lower end the tube 22 is welded to the plug 16 and is positioned against the outer periphery of a circular ridge 24 projecting from the inner surface of the plug 16. The casing 11 and the tube 22 define an annular jacket 25 into which a heating medium may be introduced through a fitting 26 and from which it may be discharged through a fitting 27. To prevent the heating medium from flowing directly from the fitting 26 to the fitting 27, the jacket 25 has longitudinal partitions 28 positioned therein, which partitions extend downwardly from the top of said jacket for a major portion of its length. The heating medium entering the jacket 25 through the fitting 26 flows downwardly through one half of said jacket, past the lower ends of the partitions 28, upwardly through the other half of said jacket, and leaves said jacket through the fitting 27. As shown in the drawing, the jacket 25 communicates directly with annular space 29 between the plug 16 and the casing 11 so that the heating medium will flow through said space and raise the temperature of the plug 16.

Mounted concentrically within the tube 22 is a tubular shell 30 defining a chamber 31. The upper end of the shell 30 bears against and is held in place by the inner periphery of the ridge 23 and the lower end of said shell bears against and is held in place by the inner periphery of ridge 24. At a point spaced from its upper end, the shell 30 has positioned therein a plate 32 which divides the same into two liquid-tight portions. The upper end of the shell 30 is provided with a plurality of openings 33 and the lower end of the shell 30 is provided with a plurality of openings 34, the function of which will be described hereinafter.

The annular plug 16 is provided with an internally threaded bore 34' in which is mounted a fitting 35 that carries a filter support of conventional design, indicated generally by reference numeral 36, positioned in the chamber 31. The filter support 36 comprises a hollow tubular member 37 which has a plurality of apertures 38 extending therethrough and which has a spiral thread 39 periodically interrupted by depressions 41 extending over its outer surface. The thread 39 and depressions 41 provide a passageway for the flow of spinning solution to the apertures 38. During operation, the filter support 36 is covered with a screen 41' and a filtering material 41'' which is held in position by fastening its upper and lower ends in grooves 42 and 43, respectively, with cords 43'. A liquid-tight seal is produced between the disc 16 and the fitting 35 by means of a gasket 44 positioned therebetween, and liquid-tight seal is produced between the fitting 35 and the filter support 36 by means of a gasket 45 positioned therebetween.

Spinning dope is introduced into the candle filter of this invention through a fitting 46 fastened to the plug 13 and flows from said fitting into a passageway 47 extending through said plug. The spinning dope then flows through the openings 33 into annular passageway 48 defined by the tube 22 and the shell 30. As it flows, in a relatively thin film, through the annular passageway 48, the spinning dope is raised uniformly to the proper spinning temperature by means of the heat transferred through the walls of the tube 22. The spinning dope then passes through the apertures 34, into the chamber 31, flows



through the filtering material on the surface of the filter support 36 and then through the apertures 38 into the interior of the filter support. The heated and filtered spinning dope then leaves the candle filter through a passageway 49 extending through the fitting 35 and flows directly into a spinning jet (not shown) which fastens to said fitting.

In the candle filter of this invention the spinning dope is brought uniformly to the proper spinning temperature, even at high spinning speeds, when the spinning dope passes through the candle filter at increased rates of flow. In addition, because of the particular design employed and the provision of the annular space 29 to bring the heating medium into contact with the periphery of the annular disc 16 whereby the said disc and the fitting 35 mounted therein are also heated, the cooling of the spinning dope in its passage from the last heating surface of the candle filter to the spinning jet is substantially prevented. As a result, the spinning dope delivered by the candle filter of this invention will be free from undesirable non-uniformities in temperature both at high spinning speeds and at low spinning speeds.

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. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindrical tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket an annular plug of smaller diameter than the inner diameter of said casing positioned at the lower end of said candle filter and having a rim projecting from the lower portion of the periphery thereof into contact with the inner surface of said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, means for leading a spinning dope into and out of the space within said cylindrical tube and through said plug, and a filtering unit positioned within said cylindrical tube to filter the spinning dope.

2. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindrical tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket, an annular plug of smaller diameter than said casing positioned at the lower end of said candle filter and having a rim projecting from the lower portion of the periphery thereof into contact with said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, means for leading a spinning dope into and out of the space within said cylindrical tube and through said plug, a tubular shell positioned concentrically within said cylindrical tube and forming with said tube an annular passageway through which the spinning dope flows in a thin film in heat exchange relation with the heating medium, and a filtering unit positioned within said tubular shell to filter the spinning dope.

3. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindri-

cal tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket, a plug positioned at the upper end of said candle filter, an annular plug of smaller diameter than said casing positioned at the lower end of said candle filter and having a rim projecting from the lower portion of the periphery thereof into contact with said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, means for leading a spinning dope into and out of the space within said cylindrical tube and through said plug, a tubular shell positioned concentrically within said cylindrical tube and forming with said tube an annular passageway through which the spinning dope flows in a thin film in heat exchange relation with the heating medium, said plug and said annular plug having ridges projecting from the internal surfaces thereof for engaging the ends of said cylindrical tube and said tubular shell, and a filtering unit positioned within said tubular shell to filter the spinning dope .

4. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindrical tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket, a plug positioned at the upper end of said candle filter, an annular plug of smaller diameter than said casing positioned at the lower end of said candle filter and having a rim projecting from the lower portion of the periphery thereof into contact with said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, means for leading a spinning dope into and out of the space within said cylindrical tube and through said plug, a tubular shell positioned concentrically within said cylindrical tube and forming with said tube an annular passageway through which the spinning dope flows in a thin film in heat exchange relation with the heating medium, a plate fastened internally of said tubular shell and dividing the same into two liquid-tight compartments, said tubular shell having openings therein through which the spinning dope enters the annular passageway and is discharged therefrom, said plug and said annular plug having ridges projecting from the internal surfaces thereof for engaging the ends of said cylindrical tube and said tubular shell, and a filtering unit positioned within said tubular shell to filter the spinning dope.

5. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindrical tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket, a plug positioned at the upper end of said candle filter, an annular plug of smaller diameter than said casing positioned at the lower end of said candle filter and having a rim projecting from the lower portion of the periphery thereof into contact with said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, a tubular shell positioned concentrically within said cylindrical tube and forming with said tube an annular passageway through which the spinning dope flows in a thin film in heat exchange relation with the heating medium, a plate fastened internally of said tubular shell and dividing the same into two liquid-tight compartments, means for leading a spinning dope into said tubular shell above said plate, said tubular shell having openings in the upper edge thereof through which the spinning dope flows into the annular passageway, said tubular shell having openings in the lower edge thereof through which the spinning dope flows from the annular passageway into the interior of the tubular shell, said plug and said annular plug having ridges projecting from the internal surfaces thereof for engaging the ends of said cylindrical tube and said tubular shell, a filtering unit extending into said tubular shell to filter the heated spinning dope, and a fitting mounted in said annular plug and carrying said filtering unit, said fitting being adapted to discharge the filtered, heated spinning dope from said filtering unit directly to a spinning jet.



6. A candle filter wherein a spinning dope is heated and filtered before being passed to a spinning jet, said candle filter comprising a cylindrical casing, a cylindrical tube positioned concentrically within said cylindrical casing and forming with said casing an annular jacket through which a heating medium is passed, means for leading a fluid heating medium into and out of said jacket, partitions extending longitudinally of said annular jacket for guiding the flow of heating medium, a layer of heat insulating material surrounding said casing, a plug positioned at the upper end of said candle filter, an annular plug of smaller diameter than said casing positioned at the lower end of said candle filter and having a rim projecting from the lower periphery thereof into contact with said casing, said annular plug forming with said casing an annular space communicating directly with said annular jacket whereby the heating medium will come into contact with the periphery of said annular plug to heat the same, a tubular shell positioned concentrically within said cylindrical tube and forming with said tube an annular passageway through which the spinning dope flows in a thin film in heat exchange relation with the heating medium, a plate fastened internally of said tubular shell and dividing the same into two liquid tight compartments, means for leading a spinning dope into said tubular shell above said plate, said tubular shell having openings in the upper edge thereof through which the spinning dope flows from the annular passageway into the interior of the tubular shell, said plug and said annular plug having ridges projecting from the internal surfaces thereof for engaging the ends of said cylindrical tube and said tubular shell, a filtering unit extending into said tubular shell to filter the heated spinning dope, and a fitting mounted in said annular plug and carrying said filtering unit, said fitting being adapted to discharge the filtered, heated spinning dope from said filtering unit directly to a spinning jet.

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