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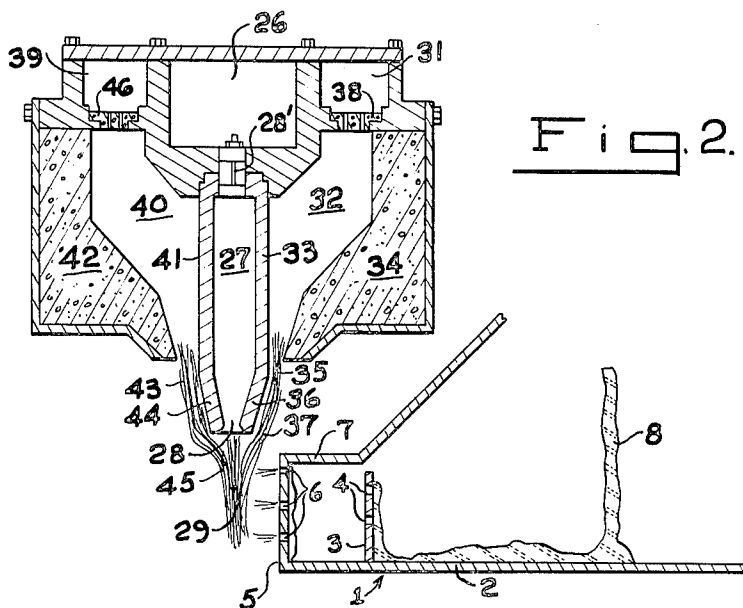
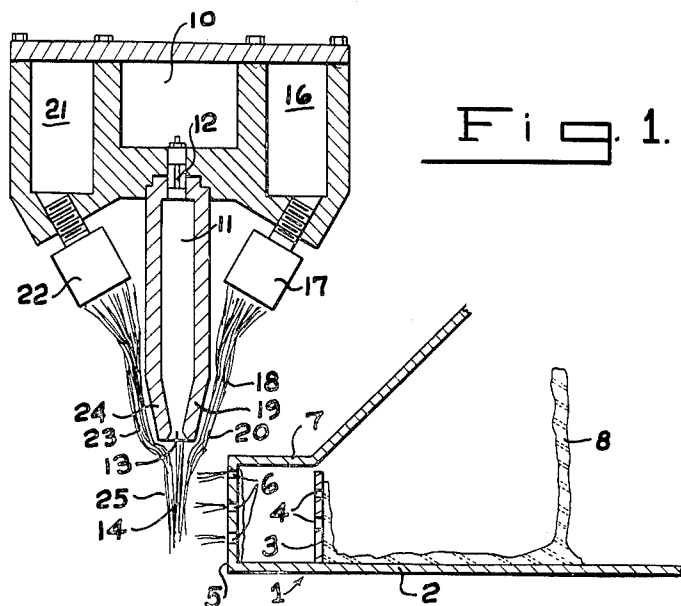
C. D. SIMMERS

3,238,028

APPARATUS FOR FORMING FIBER

Filed June 27, 1962

2 Sheets-Sheet 1



INVENTOR.
CHARLES D. SIMMERS

BY

John L. McKinney
ATTORNEY

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C. D. SIMMERS

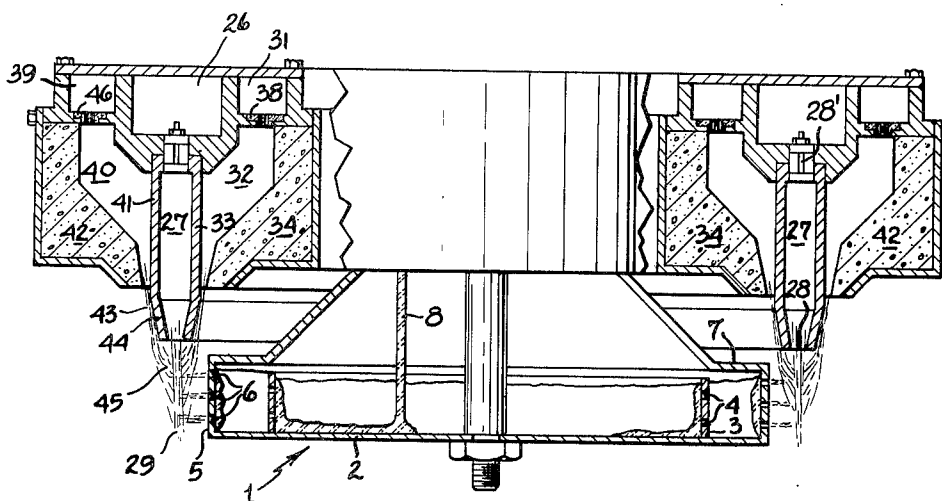
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Fig. 3.



INVENTOR.

CHARLES D. SIMMERS

BY

John A. McKinney

ATTORNEY

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APPARATUS FOR FORMING FIBER

Charles D. Simmers, Neshauc, N.J., assignor to Johns-Manville Corporation, New York, N.Y., a corporation of New York

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3 Claims. (Cl. 65—14)

This invention relates generally to the production of fibers and more particularly to the forming of glass fibers by the attenuation of centrifugally initiated filaments of molten glass. More specifically, the instant invention relates to apparatus for applying an attenuating force to centrifugally initiated filaments of molten material so as to attenuate these filaments into long, fine fibers.

In the so-called rotary or centrifugal process for forming glass fibers, a molten stream of glass is deposited on a rapidly rotating rotor provided at its periphery with a rim having a plurality of openings formed therein through which the molten glass issues in the form of filaments. As the filaments issue from the openings in the rim periphery of the rotor, they have the temperature and viscosity characteristics which will enable them to be attenuated into long, fine fibers when subjected to the proper attenuating forces. However, one difficulty in providing an economical attenuating force to the filaments is the fact that the temperature and viscosity characteristics of the filaments cannot be severely altered if the filaments are to be attenuated into fine fibers having average diameters less than 6 microns.

It is an object of the instant invention to provide apparatus for attenuating filaments of molten material into fine fibers.

The foregoing object is accomplished in accordance with the instant invention by a protected steam jet for applying the attenuating forces to filaments of molten material and particularly to centrifugally initiated filaments of molten glass. In the embodiment of the invention directed to attenuating centrifugally initiated filaments of molten glass, an annular steam jet surrounds the centrifuge and is protected by having a hot gaseous blast, such as a gas flame issuing from a burner, impinging on the inner peripheral surface of the nozzle from which the steam jet issues. This hot blast is inspired by the steam jet so as to move with the steam jet and provide a heated atmosphere adjacent the periphery of the steam jet. In this manner, the tendency of the movement of the surrounding air to produce a chilling effect on the filaments prior to being attenuated into long, fine fibers is eliminated and the filaments may readily be attenuated.

The invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the following detailed description of the preferred embodiments of the invention and the accompanying drawings in which:

FIG. 1 is a view in cross section of apparatus made in accordance with the instant invention;

FIG. 2 is a view in cross section of a modification of the apparatus of FIG. 1; and

FIG. 3 is a view with parts in cross-section of the apparatus illustrated partially in FIG. 2.

Referring to the drawing, there is disclosed in FIG. 1 a portion of a system for centrifugally initiating filaments of molten material, such as glass, comprising a centrifuge 1 having a base 2, a first annular wall 3 having a plurality of openings 4 therein, and a second annular wall 5 having a plurality of openings 6 therein. A splatter shield 7 is secured to the top portion of the wall 5. A supply of molten glass 8 is deposited on the rotating base 2 of the centrifuge 1 and is urged outwardly by centrifugal force to the wall 3 and then through the open-

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ings 4 to the wall 5. The molten glass then issues through the openings 6 as filaments of heat softened glass ready to be attenuated into long, fine fibers. The centrifuge 1 for initiating the filaments of heat softened material is a portion of conventional apparatus and is not part of the instant invention except for illustrating one method and apparatus for providing filaments of heat softened glass which filaments are ready to be attenuated into long, fine fibers.

An annular gaseous blower 10 having an annular nozzle 11 attached thereto by a plurality of webs 12 surrounds the centrifuge 1. A gaseous medium, such as steam, is fed into the blower 10 and issues from an opening 13 in the nozzle 11 as a downwardly moving attenuating jet 14 having high kinetic energy. Concentric with the blower 10 is an inner chamber 16 for supplying a combustible mixture of air and gas to a plurality of burners 17 connected thereto. Each of these burners 17 is directed so as to issue a hot gaseous blast 18 onto the nozzle 11 adjacent the lower inner wall portion 19 thereof. This hot gaseous blast 18 is inspired by the steam jet 14 to move therewith as a heated atmosphere 20 adjacent the periphery thereof. Also, concentric with the blower 10 is an outer chamber 21 for supplying a combustible mixture of air and gas to a plurality of burners 22 connected thereto. Each of the burners 22 is directed so as to issue a hot gaseous blast 23 onto nozzle 11 adjacent the lower outer wall portion 24. This hot gaseous blast 23 is inspired by the steam jet 14 to move therewith as a heated atmosphere 25 adjacent the periphery thereof.

In FIG. 2, there is disclosed a centrifuge 1 similar to that of FIG. 1. An annular gaseous blower 26 having an annular nozzle 27 attached thereto by a plurality of webs 28 surrounds the centrifuge 1. A gaseous medium, such as steam, is fed into the blower 26 and issues from an opening 28' in the nozzle 27 in the form of a downwardly moving attenuating jet 29 having high kinetic energy. Concentric with the blower 26 is an inner chamber 31 for supplying a combustible mixture of air and gas to an inner burner 32 concentric with the nozzle 27 and connected to the chamber 31. As illustrated in FIG. 2, the inner wall 33 of the nozzle 27 forms one peripheral wall of the burner 32 and the inner wall 34 of the burner 32 may be formed of a suitable refractory material. The hot gaseous blast 35 issuing from the burner 32 is directed to impinge on the lower inner wall portion 36 of the nozzle 27. This hot gaseous blast 35 is inspired by the steam jet 29 to move therewith as a heated atmosphere 37 adjacent the periphery thereof. A grid 38 prevents the flame from moving into the air and gas supply chamber 31. Also, concentric with the blower 26 is an outer chamber 39 for supplying a combustible mixture of air and gas to an annular outer burner 40 concentric with the nozzle 27 and connected to the supply chamber 39. As illustrated in FIG. 2, the outer wall 41 of the nozzle 27 forms one peripheral wall of the burner 40 and the outer wall 42 of the burner 40 may be formed of a suitable refractory material. The hot gaseous blast 43 issuing from the burner 40 is directed to impinge on the lower outer wall portion 44 of the nozzle 27. This hot gaseous blast 43 is inspired by the steam jet 29 to move therewith as a heated atmosphere 45 adjacent the periphery thereof. A grid 46 prevents the flame from moving into the air and gas supply chamber 39.

As is evident from the foregoing description, the instant invention utilizes a steam jet for attenuating filaments of molten material, such as glass, into fibers. However, to accomplish this desired mode of operation, it is necessary to protect the steam jet so that the characteristics of the filaments of molten material will not be

seriously altered. This is accomplished in accordance with the instant invention by hot gaseous blasts from suitable burners wherein the hot gaseous blasts are directed to impinge on and surround the lower portion of the steam nozzle. These hot gaseous blasts heat the orifice portion of the steam nozzle to maintain the super heat of the steam. Also, the steam jet inspirates the hot gaseous blasts from the burners to provide heated atmospheres adjacent the periphery of the steam jet. In this manner, the chilling effect normally accompanying the adiabatic expansion of the steam jet is alleviated.

In operation, molten material, such as glass, is deposited on the base 2 of the centrifuge 1 and is urged outwardly by centrifugal force through the openings 4 in the wall 3 to the wall 5. The molten glass issues through the openings 6 in the wall 5 as filaments of heat softened glass ready to be attenuated into long, fine fibers. If desired, burners may be provided for directing hot gaseous blasts onto the molten glass within the wall 3. The steam nozzle 11 or 27 is positioned closely adjacent the periphery of the centrifuge 1. The steam is introduced into the blower 10 under suitable pressures so as to issue from the nozzle 11 or 27 as a downwardly moving blast having high kinetic energy. The burners 17 and 22 or 32 and 40 are provided with proper air and gas mixtures and are ignited so as to direct hot gaseous blasts onto the lower portions of the nozzle 11 or 27. The temperature of these blasts greatly exceeds the temperature of the steam. The filaments of molten material issuing from the centrifuge 1 enter into the blast issuing from the steam jet issuing from the nozzle 11 and are attenuated into long, fine fibers. The heated atmospheres adjacent the peripheries of the steam jet function to maintain the filaments in proper condition so that they may be readily attenuated into long, fine fibers having average diameters less than 6 microns.

While the invention has been described in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. Apparatus for making fibers from heat softened material comprising:

- (a) a rotary centrifuge having a base and an annular peripheral wall having a plurality of openings therein,
- (b) steam jet means comprising an annular steam nozzle for producing an annular steam jet of high kinetic energy issuing from a discharge opening adjacent one axial extremity of said nozzle and moving in a predetermined direction,
- (c) said steam nozzle having an inner peripheral surface having an inside diameter greater than the outside diameter of said peripheral wall,
- (d) said steam jet means mounted concentrically with and adjacent said peripheral wall,
- (e) supplemental gaseous means for directing an annular, hot gaseous blast into contact with the inner peripheral surface of said nozzle adjacent said discharge opening,
- (f) said supplemental gaseous blast being at a temperature substantially greater than the temperature of said steam jet and moving generally in the same direction as the direction of movement of said steam jet,
- (g) means for supplying heat softened material to said rotary centrifuge to be urged outwardly by centrifugal force through said peripheral wall openings as a plurality of filaments of heat softened material centrifugally moving in a direction transverse to the direction of movement of said combined steam jet and supplemental hot gaseous blast, and

(h) said filaments moving into said combined steam jet and supplemental hot gaseous blast to be attenuated into fine fibers.

2. Apparatus for making fibers from heat softened material comprising:

- (a) a rotary centrifuge having a base and an annular peripheral wall having a plurality of openings therein,
- (b) steam jet means comprising an annular steam nozzle for producing an annular steam jet of high kinetic energy issuing from a discharge opening adjacent one axial extremity of said nozzle and moving in a predetermined direction,
- (c) said steam nozzle having an inner and an outer peripheral surface with said inner peripheral surface having an inside diameter greater than the outside diameter of said peripheral wall,
- (d) said steam jet means mounted concentrically with and adjacent said peripheral wall,
- (e) a first supplemental gaseous means for directing an annular hot gaseous blast into contact with the inner peripheral surface of said annular steam nozzle adjacent said discharge opening,
- (f) a second supplemental gaseous means for directing an annular hot gaseous blast into contact with the outer peripheral surface of said annular steam nozzle adjacent said discharge opening,
- (g) each of said first and second supplemental gaseous blasts being at a temperature substantially greater than the temperature of said steam jet and moving generally in the same direction as the direction of movement of said steam jet,
- (h) means for supplying heat softened material to said rotary centrifuge to be urged outwardly by centrifugal force through said peripheral wall openings as a plurality of filaments of heat softened material centrifugally moving in a direction transverse to the direction of movement of said combined steam jet and first and second supplemental hot gaseous blasts,
- (i) said filaments moving into said combined steam jet and first and second supplemental hot gaseous blasts to be attenuated into fine fibers.

3. Apparatus for making fibers from heat softened material comprising:

- (a) a rotary centrifuge having a base and an annular peripheral wall having a plurality of openings therein,
- (b) steam jet means comprising an annular steam nozzle for producing an annular steam jet of high kinetic energy issuing from a discharge opening adjacent one axial extremity of said nozzle and moving in a predetermined direction,
- (c) said steam nozzle having an inner and an outer peripheral surface with said inner peripheral surface having an inside diameter greater than the outside diameter of said peripheral wall,
- (d) said steam jet means mounted concentrically with and adjacent said peripheral wall,
- (e) a first annular burner having a diameter smaller than the diameter of said inner peripheral surface of said annular steam nozzle and mounted concentrically therewith,
- (f) a second annular burner having a diameter greater than the diameter of said outer peripheral surface of said annular steam nozzle and mounted concentrically therewith,
- (g) said first annular burner directing an annular, supplemental, hot gaseous blast into contact with the inner peripheral surface of said steam nozzle and said second annular burner directing an annular, supplemental, hot gaseous blast into contact with the outer peripheral surface of said annular steam nozzle adjacent said discharge opening,

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- (h) each of said first and second supplemental gaseous blasts being at a temperature substantially greater than the temperature of said steam jet and moving generally in the same direction as the direction of movement of said steam jet,
- (i) means for supplying heat softened material to said rotary centrifuge to be urged outwardly by centrifugal force through said peripheral wall openings as a plurality of filaments of heat softened material centrifugally moving in a direction transverse to the direction of movement of said combined steam jet and first and second supplemental hot gaseous blasts,
- (j) said filaments moving into said combined steam jet and first and second supplemental hot gaseous blasts to be attenuated into fine fibers.

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DONALL H. SYLVESTER, *Primary Examiner.*