METHOD AND APPARATUS FOR PRODUCTION OF FIBERS FROM THERMOPLASTIC MATERIALS, PARTICULARLY GLASS FIBERS

17 Claims, 1 Drawing Fig.

ABSTRACT: The production of fine fibers from a hardenable thermoplastic material in a viscous state particularly glass fibers from molten vitreous material, by dropping one or more streamlets or threads of the material onto a horizontally disposed disc-shaped body rotating rapidly around a vertical axis, at an inner radial portion thereof, whereby is provided an annular trough for the supply of material which flows outwardly from the top of the trough onto the upper surface of the body and is projected thereover in sheet form by centrifugal force over the peripheral portion of the body which is perforated with a plurality of substantially vertical orifices. An annular burner below the disc-shaped body serves as a source of hot gas under pressure which is blown upwardly through the orifices to produce the material into filaments, which are thereafter drawn out into fine fibers by an annular gaseous blast directed radially and substantially horizontally above the peripheral portion of the body to turn down the substantially vertical filaments while attenuating them, which is followed by the withdrawal thereof.
The present invention relates to the production of fibers from mineral or organic materials in the viscous state, and in particular glass fibers.

The process in accordance with the invention consists in bringing the material to be transformed into fibers onto the upper part of a body of generally discoidal shape rotating about a vertical axis, and with orifices on a peripheral zone thereof, over which passes a sheet produced by the supply of said material under the action of centrifugal force, and whereat jets of gas escaping from said orifices act on this sheet of material to project it in the form of filaments from the upper part of the rotating body, which are then drawn out into fibers.

According to another characteristic of the invention, the attenuation or drawing out of the filaments into fibers is obtained by subjecting said filaments to the action of hot gas or vapor jets. These jets of hot gas or steam are preferably directed perpendicularly to the direction of the filaments when they leave the orifices.

According to another characteristic of the invention, the filaments projected vertically from the orifices of the rotating body are turned down substantially horizontally by the jet of hot gas which effects their attenuation, and then the fibers derived from the filaments are directed downwardly by a jet of air or steam which effects their evaporation or withdrawal.

It is also the object of the invention to provide devices for executing the process described above.

The apparatus in accordance with the invention comprises:

a disc rotating about its vertical axis, this disc having an annular groove or gutter at one part thereof into which the viscous material drops in the form of one or several threads, and orifices at another part thereof, namely, in the peripheral zone; an annular burner coaxial with the axis of the disc and below the latter, wherefrom the hot gases produced by the burner discharge through said orifices; an annular burner above said disc arranged coaxially therewith for producing a gaseous blast acting on the fibers to turn them down substantially horizontally, and a blower ring beyond said disc and arranged coaxially therewith for withdrawing the produced fibers.

It is another feature of the invention to impart to the disc a generally concave shape, the concavity being directed upwardly so as to favor the adherence of the sheet of material to the upper surface of the disc. According to one embodiment, the peripheral portion of the disc containing the orifices rises upwardly towards the top and forms a truncated conical part whose angle at the apex is directed downwardly to the bottom.

It is another characteristic of the invention to provide a disc with orifices in its peripheral zone, which forms the upper part of a rotating body whose interior is put under pressure. The fluid under pressure may be advantageously produced by an annular burner which is integral with the rotating body.

Other characteristics and advantages of the invention will appear from the description which follows of an exemplary embodiment thereof which is illustrated in the accompanying drawing showing a vertical sectional view thereof.

The apparatus shown in the drawing comprises a disc 1 integral with a hollow vertical shaft 2, which is rotated by a motor, (not shown), through the intermediary of belts 3 and a pulley 4. Shaft 2 rotates in bearings 5 mounted on the fixed frame or part 6. Disc 1 is provided with an annular channel, trough or gutter 7 into which falls one or more streams 8 of the viscous material to be transformed into fibers. Disc 1 is also provided with orifices 10 in its peripheral zone 9 of truncated conical shape, the axes of which are directed substantially vertically.

Under disc 1 is disposed an annular burner 11 integral with a cylindrical casing 12, arranged coaxially with shaft 2, and the bottom 13 of which is fastened to a shaft 14 which itself is integral with the fixed part or frame 6. The burner is supplied through space 15 which is left open between fixed shaft 14 and rotary shaft 2. Zigzag joints 16 and 17 are provided on the lower surface of disc 1 in order to improve the tightness against leakage of the combustion gases of burner 11.

Arranged coaxially with the disc and from above it, are arranged an annular burner or blower 18 on one side, and a blower ring 19 on the other side, i.e., the former is within the area of the orifices 10 of the peripheral zone and the latter is beyond said orifices.

The viscous material which fills the annular channel 7 is thrown therefrom by the effect of centrifugal force and forms a sheet which reaches the peripheral zone of the disc and passes over orifices 10 whence it is projected in the form of filaments 20 by the gas issuing from burner 11. These filaments are then subjected to the action of the annular jet discharging from blower 18, which turns them substantially horizontally while drawing them out into fibers. The latter are then subjected to the action of the jet discharging from blower ring 19 which effect their withdrawal in a downward direction.

It is advantageous to arrange the orifices 10 in the peripheral zone of the disc in a quintincular pattern, so that the entire sheet of material is intercepted by the gaseous jets issuing from the burner 11.

1. The method of producing fibers from a hardenable thermoplastic material in a viscous state which comprises:
a. dropping at least one stream of said material onto the inner radial portion of the upper surface of a discoidal-shaped body, rotating rapidly about a vertical axis, wherefrom the material is thrown outwardly in sheet form by centrifugal force towards the outer perforated peripheral portion of said upper surface,
b. blowing upwards directed gaseous jets through the orifices of the peripheral portion of said surface to form filaments of viscous material from the sheet projected across said portion, and

c. attenuating the formed filaments into fibers by blowing a transverse radial hot gaseous blast outwardly across the filaments projected upwardly from said sheet of centrifugally flowing viscous material.

2. The method set forth in claim 1, wherein the viscous thermoplastic material is a molten vitreous composition for producing glass fibers therefrom.

3. The method set forth in claim 1, wherein the sheet of material thrown outwardly on the upper surface of the body emanates from an annular pool of material which is formed at said inner radial portion by said dropping stream of viscous material.

4. The method set forth in claim 1, wherein the blowing transverse radial blast turns the filaments in substantially horizontal planes while effecting the attenuation thereof.

5. The method set forth in claim 4, including the step of blowing the attenuated fibers, travelling in horizontal planes beyond the rotating body, in a downward direction to effect the evaporation thereof.

6. An apparatus for producing fine fibers from a hardenable thermoplastic material in a viscous state comprising:
a. a disc-shaped body with means to rotate it rapidly around a vertical axis, and having an inner portion and an outer peripheral portion,
b. means for supplying the viscous material to the upper surface of the body at said inner portion, wherefrom it spreads into a central source of supply, and wherefrom it is projected in sheet form by centrifugal force over said outer portion,
c. said outer portion being perforated with a plurality of orifices therein,
d. means below said perforated peripheral portion for directing upwardly gaseous fluid under pressure through said orifices to project the viscous material passing thereover into a plurality of filaments, and

e. means for attenuating said filaments into fine fibers comprising blowing means for directing transversely a hot gaseous blast outwardly in radial directions across the
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filaments projected upwardly from said sheet of centrifugally flowing viscous material.

7. An apparatus as set forth in claim 6, wherein said means below said perforated peripheral portion of said disc-shaped body comprises an annular burner, which together with said body, constitutes an annular chamber maintained under pressure.

8. An apparatus as set forth in claim 6, wherein said last-mentioned blowing means is of annular outline arranged coaxially with said rotating body at a sufficiently high level to direct the filaments above the peripheral portion of said body.

9. An apparatus as set forth in claim 6, wherein said disc-shaped body comprises an annular trough at said inner portion of the upper face of said body for receiving at least one stream of the viscous material.

10. An apparatus as set forth in claim 6, wherein said inner portion of the upper surface of the rotating body is provided with an annular channel for receiving at least one stream of the viscous material.

11. An apparatus as set forth in claim 6, wherein said upper surface of the rotating body is of concave configuration in an upward direction.

12. An apparatus as set forth in claim 11, wherein the outer perforated peripheral portion is a surface of revolution of truncated conical configuration.

13. An apparatus as set forth in claim 7, wherein an underlying portion of said chamber is fixed and is of cylindrical outline, including sealing joints of zigzag contours between the juxtaposed fixed and moving parts.

14. An apparatus as set forth in claim 13, wherein said sealing joints of zigzag cross section are disposed at radially displaced areas on the bottom surface of said rotating body.

15. An apparatus as set forth in claim 7, wherein said annular burner is integral with said rotary disc-shaped body.

16. An apparatus as set forth in claim 8, including a blower ring surrounding said rotating body beyond the peripheral portion thereof and provided with circumferential downwardly directed spaced openings above said annular blowing means for evacuating the attenuated fibers.

17. An apparatus as set forth in claim 8, wherein the orifices in the peripheral portion of said rotating body are directed substantially vertically and the gaseous blast openings of the annular blowing means are directed in a substantially horizontal plane.

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