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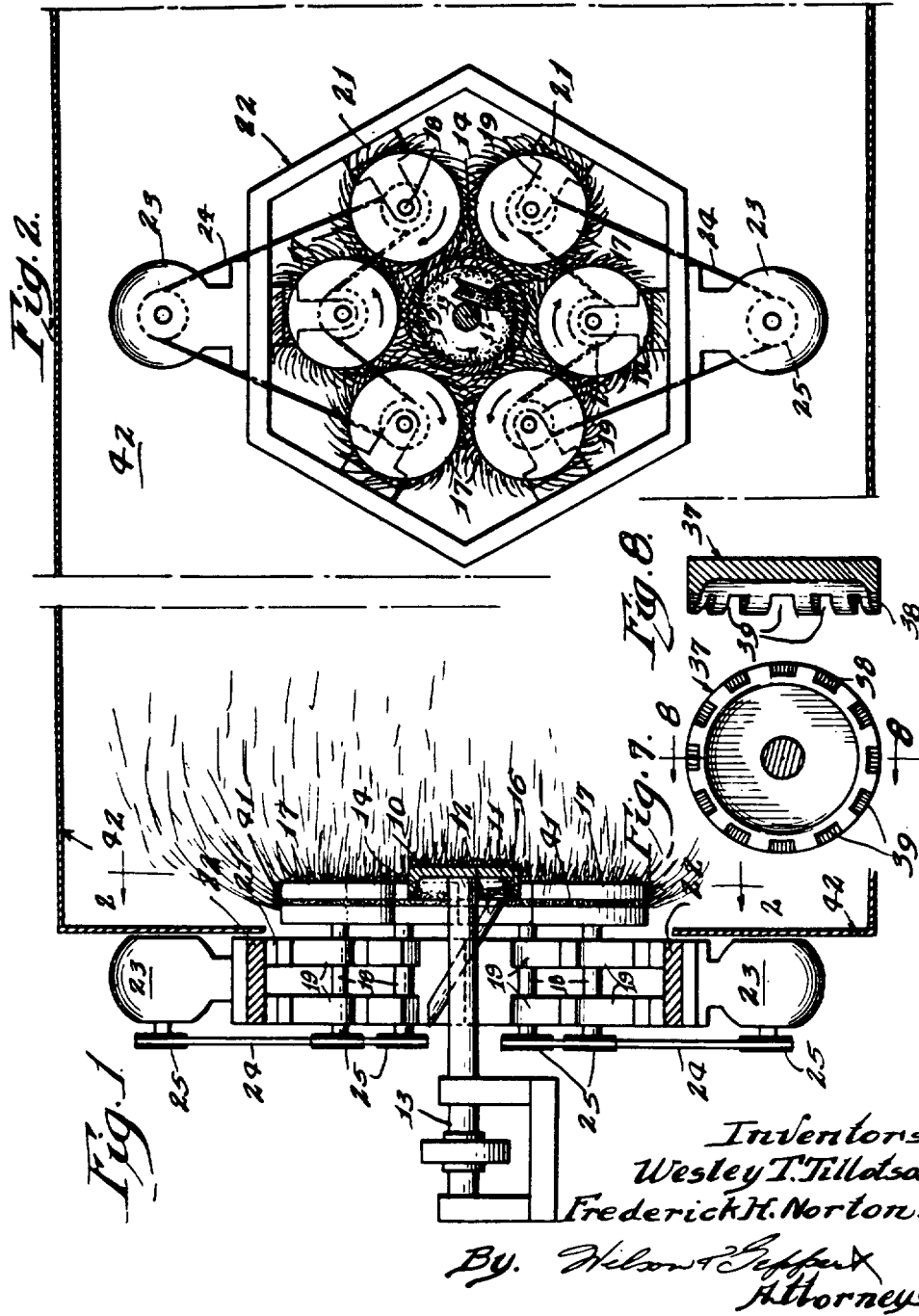
W. T. TILLOTSON ET AL

2,678,466

APPARATUS AND METHOD OF FIBERIZATION OF MINERAL WOOL

Filed Jan. 16, 1953

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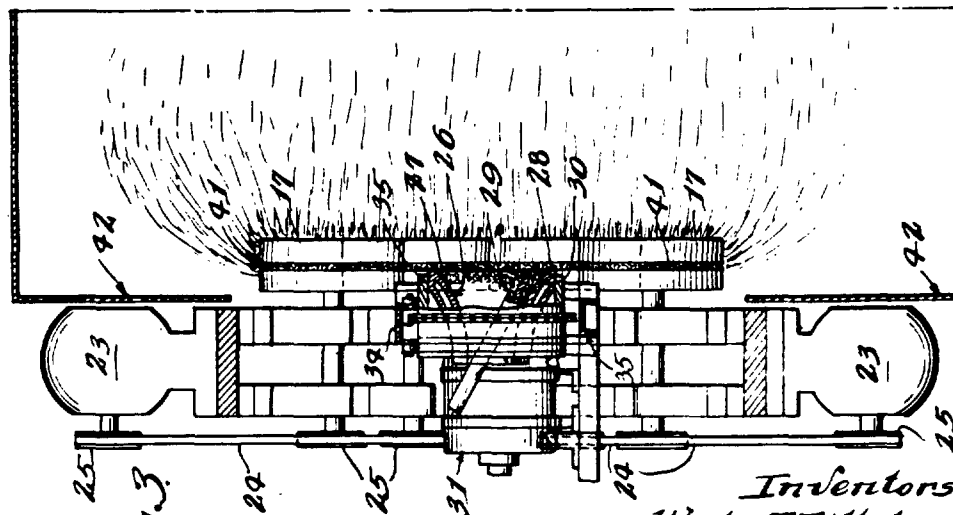
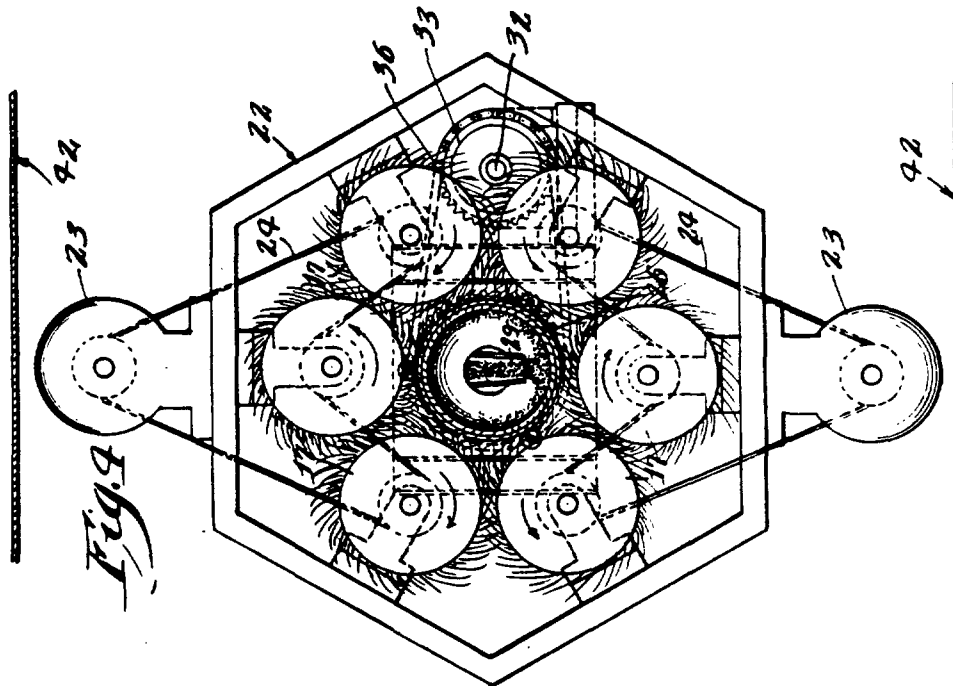
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APPARATUS AND METHOD OF FIBERIZATION OF MINERAL WOOL

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The present invention relates to a novel means and manner of fiberizing molten fiber-forming material including blast furnace slag, wool rock, vitreous materials, etc. to produce fibers herein-after designated generally as mineral wool.

In the present novel embodiment there is provided a rapidly rotating distributor in the form of a cup-shaped or hollow rotor receiving molten slag or fiber-forming material, and a plurality of encompassing wheels so positioned and arranged about the rotor or distributor that the molten material ejected by said centrally disposed rotor or distributor is forcibly projected thereagainst by centrifugal force.

The plurality of spinning wheels in this novel arrangement are disposed about but spaced from the peripheral edge or circumference of the centrally arranged cup distributor or rotor in such manner that as the molten material is centrifugally ejected over the discharge edge of the distributor or rotor, its surface tension is broken and its dispersed mass is distributed as rapidly moving particles that are violently thrown and impinged against and collected on the circumference of these encompassing spinning wheels and rotated therewith as a fire band until ejected as fibers from the circumference of these wheels by centrifugal force.

It is, therefore, an important object of the present invention to provide a distributor in the form of a cup-shaped rotor operable at high speed and adapted to receive on its interior a molten stream of fiber-forming material such as blast furnace slag, fusible rock, vitreous materials, etc., dispersing the mass of molten material over the inner annular surface of the distributor in the form of a thin sheet, and centrifugally projecting said molten material from this inner annular surface and over its adjacent peripheral edge onto a plurality of encompassing spinning wheels.

By the present novel construction and method of fiberization, the molten slag or fiber-forming material is distributed by the rapid rotation of a cup-shaped rotor, ejected from its peripheral edge and impinged against the circumference of a plurality of closely spaced and encompassing spinning wheels.

Although the use of several wheels in the spinning of fibers has been proposed, such wheels have been arranged in offset or staggered relation and in such manner that the entire stream or mass of molten fiber-forming material issuing from the guide spout impinges upon the circumference of one rotating wheel and such mass

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is projected therefrom onto an adjacent wheel, or such mass may be caused to cascade or be deflected or thrown from the circumference of one wheel onto the circumference of another wheel and back and forth, in an effort to increase the yield of mineral wool fibers.

Unlike such proposed apparatus and manner of operation, in the present novel method and apparatus the cup-shaped rotor receiving the molten material from the cupola functions to most effectively distribute and disperse the molten material from its peripheral edge and along its entire periphery of 360°, and impinge this molten material at high velocity onto the circumference of a plurality of encompassing spinning wheels with each wheel intercepting or receiving a proportionate share of the distributed molten material, and each of these encompassing wheels subjecting its proportionate share to a spinning action to cause optimum fiberization.

By this novel arrangement and assembly of encompassing spinning wheels, each wheel in receiving its proportionate amount of the dispersed fiber-forming material centrifugally ejected from the distributor, spins into fibers the material that collects thereon in the form of a fire band and the resulting spun fibers from each fire band are collected by suction in a collecting chamber.

The encompassing spinning wheels may rotate in the same or in a direction opposite to that of the centrally disposed cup-shaped distributor and adjacent wheels may rotate in the same or in opposite directions. As the rapidly travelling particles of material are centrifugally ejected from the distributor throughout its entire 360° circumference, and assuming there are six spinning wheels encompassing the rotor or distributor, approximately one-sixth of the total of ejected streams from the distributor are forcibly driven onto the circumference of each wheel to thereat form a fire band of the fiber-forming material, and as these wheels rotate rapidly this material is spun into fibres of mineral wool. To facilitate removal of the spun fibers as formed from adjacent the wheels, a suction is applied and draws the loose and relatively light fibers into a collecting chamber or wool room for accumulation as a sheet or batt of suitable thickness.

Further objects are to provide a construction of maximum simplicity, efficiency, economy and ease of assembly and operation, and such further objects, advantages and capabilities as will later more fully appear and are inherently possessed thereby.

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In the drawings:

Figure 1 is a view, part in vertical cross section and part in side or end elevation, showing the novel apparatus and manner of fiberization.

Fig. 2 is a view, part in front elevation and part in vertical cross section, of the present novel mechanism or apparatus for the production of spun fibers, the view being taken on the line 2—2 of Fig. 1 and viewed in the direction of the arrows.

Fig. 3 is a view similar to Fig. 1 but showing a modified form of distributor in the novel assembly.

Fig. 4 is a view in front elevation of the novel assembly of Fig. 3.

Fig. 5 is a fragmentary view, part in side elevation and part in vertical cross section, showing the manner in which the encompassing spinning wheels and their drive shafts of Figs. 1 and 2 may be turned or disposed at a desired angle whereby to widen the fire band by causing the slag ejected by the distributing rotor to strike or impinge against a desired width of the circumference of the spinning wheels, such width depending upon the amount of angle.

Fig. 6 is a view similar to Fig. 2, but devoid of the drive mechanism and encompassing frame and with the axis of the spinning wheel shafts turned through a desired angle.

Fig. 7 is a view in elevation of the open end of a distributor of the type shown in Figs. 1 and 2 but with its discharge edge serrated or notched to show one method of spreading or widening the fire band.

Fig. 8 is a view in vertical cross section taken in a plane represented by the line 8—8 of Fig. 7.

Fig. 9 is a view similar to Fig. 7 but showing another embodiment of distributing rotor in which the discharge edge is given a wavy or undulated contour.

Fig. 10 is a view in vertical cross section taken in a plane represented by the line 10—10 of Fig. 9 and viewed in the direction of the arrows.

Referring more particularly to the disclosure in the drawings and to the novel illustrative embodiments therein shown, Figs. 1 and 2 disclose a cup-shaped rotor or distributor 10 for receiving the molten slag or other fiber-forming material 11 issuing from a cupola or furnace and directing this stream onto the interior of the rotor or distributor by a guide spout or suitable directing plate 12. This rotor or distributor 10 is given by means of a horizontally arranged drive shaft 13 from a motor or other suitable power source (not shown) for rotating the rotor or distributor at high speed whereby the molten material collecting in the form of a thin sheet or layer on the interior surface or annulus 14 is ejected centrifugally as rapidly travelling material 15 issuing over the peripheral edge 16.

Arranged in uniformly and rather closely spaced relation about the circumference of the rotor or distributor 10, are a plurality of encompassing spinning wheels 17 each suitably mounted upon and driven by a horizontally disposed drive shaft 18. Each shaft 18 is rotatably mounted in spaced bearing supports or brackets 19 and to permit adjustment of the wheels 17 with respect to the centrally disposed rotor or distributor 10, the base of each bearing support or bracket is mounted on shims 21 located between it and an encompassing frame 22. Several of these spinning wheels may be driven from a single motor 23 by means of a belt drive 24 and pulleys or sheaves 25, in the manner shown in Fig. 1, although any suitable drive mechanism may be

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provided to drive these spinning wheels individually or in multiple.

These wheels 17 may all be rotated in the same, or adjacent wheels in opposite directions, but, regardless of their direction of rotation, each wheel receives its proportionate share of the rapidly moving particles ejected from the rotor or distributor 10 as these molten particles are impinged against the encompassing wheels and these wheels fiberizing the intercepted material.

In Figs. 3 and 4 is disclosed an alternate form of rotor or distributor 26 functioning in a manner similar to that of the cup-shaped rotor 10 in that the molten slag of fiber-forming material is directed onto the interior surface or annulus 27 of the rotor or distributor 26 adjacent its discharge edge 28 by means of a guide spout or directing plate 29. This form of rotor or distributor 26, as well as the rotor or distributor 10, may be hollow as at 30 to permit the passage there-through of water or other liquid or gaseous coolant, steam, etc., or it may be cooled by ambient air.

The rotor or distributor 26 may be driven in any suitable manner, such as by means of a motor 31 having a drive shaft 32 to which is attached a sprocket wheel 33 driving a sprocket wheel 34 mounted on an encompassing housing 35 carrying the rotor or distributor 26, for rapidly rotating the latter through a chain drive 36. The encompassing spinning wheels being similar to and similarly arranged with respect to the rotor or distributor 26 as in the assembly of Figs. 1 and 2, similar reference characters have been applied thereto.

In Figs. 5 and 6 is disclosed another embodiment or arrangement of the rotor or distributor 10 and the encompassing spinning wheels 17, but in which the axis of the spinning wheel shafts 18 are turned or disposed at an angle whereby to widen the fire band 41 by causing the slag ejected from the peripheral edge 16 of the rotor or distributor to strike or impinge against the spinning wheels 17 at a desired angle. The angle of the shafts 18 may be varied through a substantial amount or angle depending upon the width of fire band desired in the encompassing wheels. Fig. 5 shows somewhat diagrammatically how such spinning wheels 17 may be located at a desired angle and how the angle determines the width of the fire band 41.

Figs. 1, 3 and 5 disclose the fire band 41 formed by the molten fiber-forming material distributed by the rotor or distributor 10 or 26 and forcibly ejected from these distributing rotors and impinged against the spinning wheels 17. Figs. 5 and 6 show one manner of widening the fire band by the angular arrangement of the spinning wheel shafts 18, and the embodiments of Figs. 7 and 8 and Figs. 9 and 10 show how such width may be increased by contouring the peripheral discharge edge of these distributing rotors to provide a serrated or undulated surface.

To withdraw the fibers as formed from adjacent the spinning wheels 17 by suction, these wheels are partially enclosed within a wool room or collecting chamber 42, the bottom of which may be closed by a conveyor (not shown) upon which the collected fibers may accumulate as a mat, all in a manner well known in the industry.

Figs. 7 and 8 disclose an alternate embodiment of a distributing rotor 37 similar to the rotor 10 of Figs. 1 and 2, except that its discharge edge 38 is serrated or notched at 39 whereby the mol-

ten slag or fiber-forming material is discharged over the interrupted edge 38 as well as through the notches or recesses 38 whereby the fire band is substantially widened.

In Figs. 9 and 10 the distributing rotor 37 is shown as having its discharge edge 40 of a wavy or undulated contour whereby the discharge from this edge in striking the encompassing spinning wheels 17 produces a substantially widened fire band.

As but illustrative of the disclosed embodiment and not to be taken as limiting the present invention, the temperature of the molten slag or fiber-forming material fed to either form of the distributor or rotor 10, 26 or 37, may be approximately 2200° F. to 2800° F., with the quantity of slag or material fed thereto being at the rate of approximately 4000 pounds per hour, although this may be varied through a relatively wide range of between approximately 1000 to 6000 pounds per hour, depending upon the size and speed of rotation of the rotor or distributor. The diameter of this rotor is preferably approximately ten (10) inches, with a depth of approximately two (2) inches and operating at a speed of approximately 800 R. P. M. However, the effective diameter of the rotor or distributor may vary between approximately six (6) and twelve (12) inches, its depth may vary between approximately one and one-half (1½) and four (4) inches and its speed of rotation from approximately 200 to 1200 R. P. M.

As further illustrative, the encompassing spinning wheels 17 preferably have an outer diameter of approximately twelve (12) inches and are rotated at a speed of approximately 4000 R. P. M. However, the diameter of these spinning wheels may vary between approximately eight (8) and sixteen (16) inches and their speed of rotation between approximately 2000 and 8000 R. P. M. These wheels are shown as preferably six in number, but this number may vary between four and eight, with the number of wheels being determined so that each wheel receives its proportionate share of the ejected particles from the distributor or rotor 10, 26 or 37, and each may be cooled or heated, as desired.

From the above disclosure it will be apparent that the present invention comprehends the provision of a novel means and method of mechanical fiberization whereby the molten slag or fiber-forming material is initially received on the interior of a rotating distributor, and from its peripheral edge the material is projected by centrifugal force and forcibly impinged against the circumference of a plurality of encompassing spinning wheels whereby the material is dispersed and each spinning wheel receives its proportionate share of the total amount distributed by the rotor or distributor 10, 26 or 37. For example, if there are six wheels spaced about the distributing rotor, each wheel is adapted and so positioned as to receive approximately one-sixth of the material distributed by the rotor.

Having thus disclosed the invention, we claim:

1. Mechanism for fiberizing molten fiber-forming material comprising a hollow distributing means for receiving said molten fiber-forming material, means for rapidly rotating said distributing means for forcibly ejecting therefrom by centrifugal force the molten fiber-forming material in the form of rapidly travelling particles, a plurality of spinning wheels mounted about the periphery of said distributing means and so constructed and arranged as to receive

and have forcibly impinged on their circumference the particles of molten fiber-forming material from the distributing means, and means for rapidly rotating said wheels for forming said molten fiber-forming material into mineral wool fibers.

2. Apparatus for forming mineral wool fibers from molten fiber-forming material, comprising a hollow distributing rotor, means for feeding a stream of the molten fiber-forming material to said rotor, means for rapidly rotating said rotor for forcibly ejecting the molten fiber-forming material therefrom as rapidly travelling particles, multiple spinning wheels mounted for rotation about the circumference of said rotor and each so constructed and arranged as to receive and have forcibly impinged on its circumference said particles of the molten fiber-forming material ejected by centrifugal force from the distributing rotor, and means for rapidly rotating said spinning wheels to fiberize the molten material collected on their circumference.

3. Apparatus for forming mineral wool fibers from molten fiber-forming material, comprising a hollow distributing rotor for receiving the molten fiber-forming material, means for rapidly rotating said distributing rotor and ejecting therefrom the molten fiber-forming material by centrifugal force, a plurality of spinning wheels disposed about the circumference of said rotor with said rotor centrally arranged and each spinning wheel so constructed and arranged as to receive on its circumference its proportionate share of the molten fiber-forming material as this molten material is ejected by centrifugal force from the rotor and distributed to and driven against the circumference of the spinning wheels, and means for rapidly rotating said wheels for fiberizing the molten material received thereby.

4. Apparatus for forming mineral wool fibers from molten fiber-forming material, comprising a hollow distributing rotor receiving the molten fiber-forming material, means for rapidly rotating said rotor about a horizontal axis to discharge the molten fiber-forming material therefrom by centrifugal force as rapidly moving particles, multiple spinning wheels disposed in encompassing relation about the centrally arranged rotor but spaced therefrom and from each other and so constructed and arranged that each wheel has forcibly impinged on its circumference a portion of the material ejected by centrifugal force from said distributing rotor, and means for rapidly rotating said wheels about their substantially horizontal axes for fiberization of the distributed molten material collected on their circumference.

5. An apparatus for forming mineral wool fibers from fiber-forming material, comprising a hollow distributing rotor, means for supplying molten fiber-forming material to the interior of said rotor, means for rapidly rotating said rotor about a horizontal axis to cause the dispersion and ejection by centrifugal force of said molten material in a plane substantially perpendicular to the axis of rotation of said rotor, a plurality of spinning wheels arranged in spaced relation about the circumference of said rotor and each so constructed and arranged as to receive on its circumference a portion of the dispersed molten material ejected from the rotor by centrifugal force, and means for rapidly rotating said wheels for fiberizing the molten material collected on the circumference of each wheel.

6. Apparatus for forming mineral wool fibers from molten fiber-forming material, comprising

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a hollow distributing rotor rotatable about a horizontal axis and receiving the molten fiber-forming material, means for rapidly rotating said rotor about its horizontal axis to eject the molten material therefrom by centrifugal force, multiple spinning wheels disposed in encompassing relation about the centrally arranged rotor but spaced therefrom and from each other and so constructed and arranged that each wheel receives and has forcibly impinged upon its circumference a portion of the molten material ejected by centrifugal force from said rotor, means for rotatably mounting said wheels about an axis disposed at an angle to the axis of rotation of the rotor, and means for rapidly rotating said wheels for fiberizing the fiber-forming molten material collected on the circumference of said wheels.

7. The method of forming mineral wool fibers comprising the steps of feeding a stream of molten fiber-forming material, ejecting this molten material by centrifugal force in an annular pattern and in the form of rapidly travelling particles to project said particles and forcibly impinging these particles onto the circumference of a plurality of encompassing and rapidly rotating spinning surfaces for fiberization of the molten material collected on said spinning surfaces.

8. The method of forming mineral wool fibers from molten fiber-forming material comprising the steps of feeding a stream of said molten material, distributing the molten material in an annular pattern formed of rapidly moving particles and forcibly ejecting said particles by centrifugal force and impinging these particles of ejected molten material upon the circumference of a plurality of rapidly rotating spinning surfaces disposed in spaced relation thereabout, and rapidly rotating said spinning surfaces for fiberization of the molten material collected on said spinning surfaces.

9. The method of forming mineral wool fibers

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from molten fiber-forming material comprising the steps of feeding a stream of said molten fiber-forming material, discharging this molten material in the form of an annular pattern of rapidly travelling particles with sufficient force to impinge these ejected particles onto the circumference of a plurality of rotating spinning surfaces disposed about the ejected molten material, and rapidly rotating said spinning surfaces for fiberization of the molten material collected thereon.

10. The method of forming mineral wool fibers from molten fiber-forming material, which comprises the steps of converting a stream of said molten material into a multiplicity of rapidly travelling diverging particles projecting said particles at high velocity from a common axial center throughout a circular area against spinning surfaces substantially surrounding said axial center and imparting to said spinning surfaces a movement transverse to said paths of travel at such speed as to effectively fiberize said material.

11. The method of forming mineral wool fibers from molten fiber-forming material, comprising the steps of feeding a stream of said material, converting said stream into a thin sheet of fiber-forming material, centrifugally ejecting the material of said sheet at high velocity from a common axial center throughout the area of a circle against spinning surfaces substantially surrounding said center and causing said spinning surfaces to travel transversely of the paths of said centrifugally ejected material at a high speed, whereby said projected material is effectively fiberized.

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