

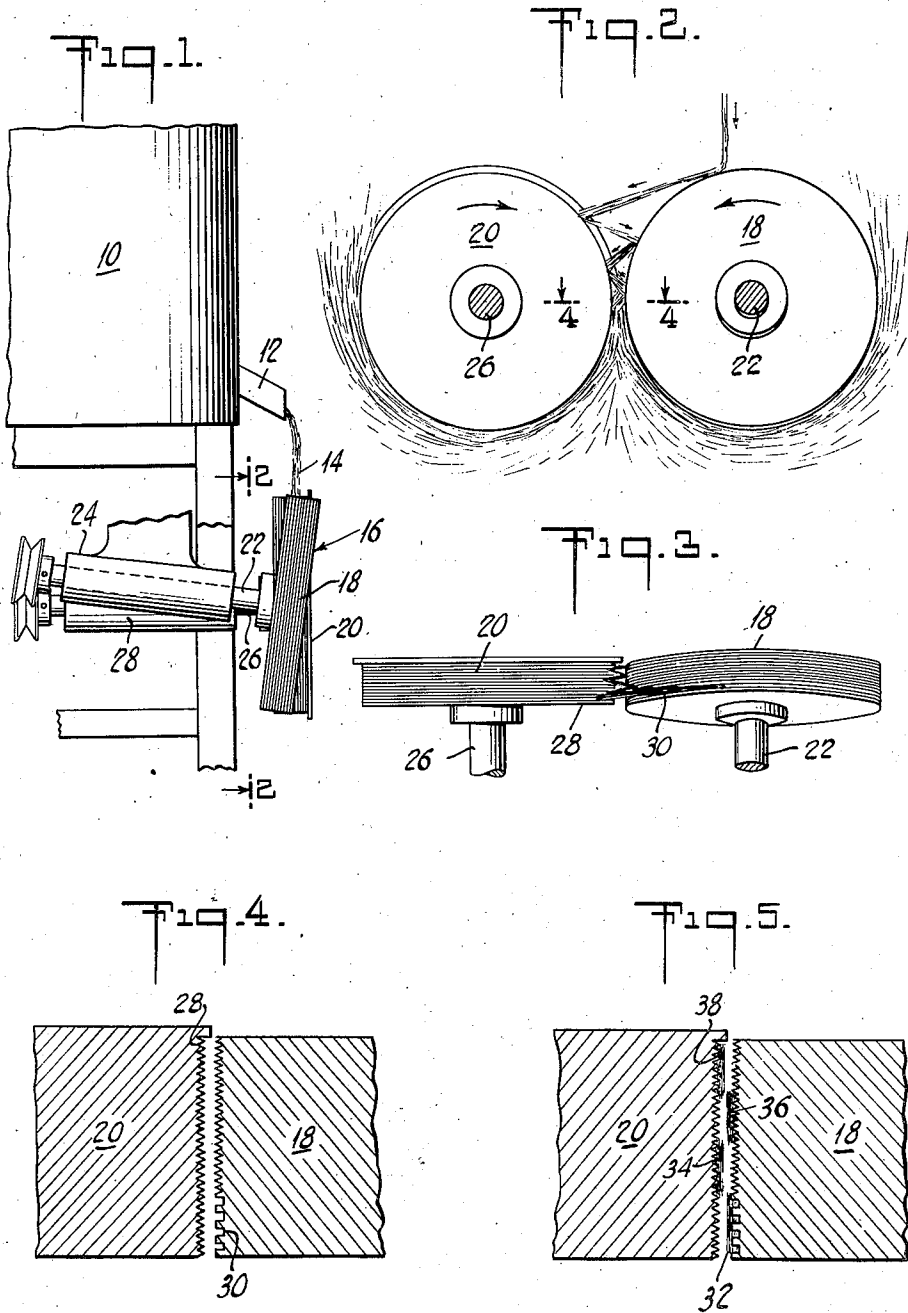
Oct. 14, 1947.

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2,428,810

METHOD AND APPARATUS FOR FIBERIZING MOLTEN MATERIAL

Filed April 29, 1943



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2,428,810

METHOD AND APPARATUS FOR FIBERIZING
MOLTEN MATERIAL

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Application April 29, 1943; Serial No. 485,009

10 Claims. (Cl. 18—2.6)

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The present invention relates to the manufacture of mineral wool and particularly to improved apparatus for converting molten raw material into fibers. The term "mineral wool" is employed herein in a generic sense to include wool or fibers formed from rock, slag, glass, mixtures thereof and like raw materials.

Heretofore mineral wool has been made in a number of ways including the conventional method of disintegrating molten material into a multiplicity of fibers by the action of a high pressure steam jet. More recently it has been proposed to fiberize the molten material by the use of a spinner or rotor rotated at high speed upon which the material impinges and by which it is broken up into drops or masses which are thrown from the spinner by centrifugal force to be drawn into fiber or thread form. The principal object of the instant invention is the provision of an improved apparatus and method of the latter type.

Another object of the invention is the provision of a rotor type fiberization apparatus of increased fiber yield, and which will produce a finer, more uniform fiber than obtained by prior practice.

Further objects of the invention are the provision of an apparatus including multiple rotors acting in succession on the molten material and of improved rotor constructions and arrangements.

My invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawings, in which:

Fig. 1 is a diagrammatic elevational view illustrating the arrangement of the material melting and fiberizing means;

Fig. 2 is a sectional view on an enlarged scale taken on a line 2—2 of Fig. 1;

Fig. 3 is a top plan view of the apparatus of Fig. 2;

Fig. 4 is a sectional view on an enlarged scale taken on a line 4—4 of Fig. 2; and

Fig. 5 is a sectional view similar to Fig. 4 illustrating the condition of the rotor surfaces during operation.

Referring now to the drawings there is shown an apparatus comprising a melting furnace 10. The furnace illustrated is of the cupola type but it will be understood that any other suitable melting furnace such as a tank furnace may be employed, if desired. The furnace includes a discharge trough 12 by which a stream of molten material 14 is drawn from the furnace and dis-

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charged in position for fiberization. The raw material melted in furnace 10 may comprise rock, slag, glass and mixtures thereof or other thermoplastic materials employed in the manufacture of mineral wool, glass wool and the like.

Below the end of trough 12 and positioned to receive the molten material is a fiberizing device indicated generally at 16 and, in accordance with the invention, comprising a plurality of rotors.

The rotors are indicated at 18 and 20 and are preferably of cylindrical shape though they may be slightly coned if desired. Rotor 18 is affixed to a shaft 22 for rotation therewith, the shaft being supported in suitable bearings 24, carried by any desired mounting. Rotor 18 is positioned to have its peripheral surface contacted by molten material stream 14. Rotor 18 is tilted with respect to rotor 20. The particular degree of tilt of rotor 18 is not critical within reasonable limits but, for the purposes of example, it may be stated that a tilt of 12 degrees from the vertical, where rotor 20 is supported on a horizontal axis, has been found satisfactory in service. Rotor 20 is carried by a shaft 26 for rotation therewith, the shaft being supported in bearings 28, also carried by any suitable mounting. Shafts 22 and 26 are driven by a motor or other suitable means (not shown) for rotation in opposite directions and so that points on the upper arcs of the peripheries of the rotors approach each other, as indicated by the arrows in Fig. 2. The mounting of the shafts is such that the spacing between the rotors, as well as the angle between the planes of their faces, may be varied as found necessary or desirable.

Referring now particularly to Fig. 4, the peripheral surfaces of the rotors are provided with a succession of annular grooves 28. The grooves of rotor 20 are suitably V-shaped in cross-section and of relatively small uniform size. Rotor 18 is provided with a few somewhat larger and deeper annular grooves 30, preferably rectangular in cross-section, on and adjacent that portion of the rotor surface impacted by the stream of molten slag or other material 14, with which the molten material forms a relatively permanent bond. The remainder of the peripheral surface of the rotor is grooved similarly as rotor 20. It has been found that where the rotors have a peripheral velocity of about 13,000 ft./minute (4500 R. P. M. for an 11-inch diameter rotor) the fine grooves 28 should run about 20 to 40/inch. The grooves serve to retain the molten slag or other material to build up incandescent rings on the peripheral surfaces of the rotors. It is pointed out

that the particular size and character of the grooves will depend upon the several operating characteristics, such as the peripheral speed of the rotor surfaces, the viscosity of the molten material and the like.

In the operation of the apparatus described above the position of rotor 18 is adjusted so that the molten material stream 14 impinges against its peripheral surface somewhat to the left of a vertical line drawn through the rotor axis, as viewed in Fig. 2. The adjustment also provides for the impingement of the molten material stream on that part of the rotor surface having the relatively deep grooves 30. Rotors 18 and 20 are adjusted to provide a bite or space therebetween of approximately the combined thickness of the molten material built up on the rotors, say, $\frac{1}{8}$ " to $\frac{3}{8}$ " and rotor 18 is tilted to lie in a plane at an angle to the plane of rotor 20. Rotors 18 and 20 are driven in opposite directions, as previously explained, and at suitable peripheral speeds, depending upon the particular operating conditions such as the fluidity of the molten material. For purposes of example, it may be stated that in employing a conventional mineral wool melt, successful operation was obtained by driving rotors, approximately 11" in diameter and grooved as previously described, at 4500 R. P. M.

The molten material impinging on rotor 18 is partially bonded to the rotor in grooves 30, the bonded material forming a relatively permanent non-stripping annular ring or rings 32 (see Fig. 5) revolving with the rotor. Most of the stream, however, is projected by the rotor almost tangentially to the surface thereof, at a greatly accelerated speed and in a slightly spread condition, onto the peripheral surface of the second rotor, as indicated in Fig. 2. The molten material bonds in the grooves of rotor 20 to provide an annular ring 34, the excess unbonded material being projected tangentially back to the first rotor. The bond of the material in the finer grooves 28 is of a relatively temporary nature and from time to time the material may strip from these grooves. However, after stripping, bonding of the material in the grooves will immediately be resumed. Due to the tilt of the first rotor relatively to the second, the material projected back strikes rotor 18 at a location laterally removed from the location of impact of the original stream to form a second annular bonded slag ring 36 on rotor 18 (see Fig. 5).

The projection of the unbonded molten material from one rotor to the other may continue to form a third bonded ring 38 on rotor 20, as indicated in Fig. 5, and likewise in some instances may again be projected back onto rotor 18. In each case the additional ring will be laterally removed from the previous rings due to the relative tilting of the rotors.

When the remaining unbonded molten material reaches the bite between the rotors it is leveled off and admixed instantaneously with the material which has been carried around each rotor. As the rotor surfaces separate considerable fiberization takes place by the pulling of the material from the surfaces of the opposite rotors, the fibers being momentarily attached to both. The molten incandescent material on the outer surface of rings 32, 34, 36 and 38 is thrown off by centrifugal force and drawn out into fibers due to the velocity of movement.

As has been referred to above, the peripheral speeds of the rotors, the fluidity of the melt and the grooving of the rotors, may be varied to meet

given conditions. It will be understood that there is, in effect, a relationship between these several factors which must be maintained within reasonable limits. Also the molten material must be at a sufficiently high temperature to maintain the bonded rings in an incandescent state to permit the fiberization to take place.

The fiber formed, as described above, may be collected in any suitable manner. Also, a binder may be introduced into the fiber, if desired, the particular construction and operation of binder addition and felting means not forming a part of the instant invention.

The construction, as explained above, has been found to deliver a greatly increased fiber yield over other rotor type fiberizing means as heretofore proposed. Also, a relatively fine and uniform fiber is obtained adapting the product for many different uses.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to, but that various changes and modifications will 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. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten stream positioned to receive said stream, means for rotating said rotor at high speed, a second, similar rotor adjacent said first rotor but spaced therefrom and positioned to receive molten material discharged from said first rotor, means to rotate said second rotor at high speed and in a direction opposite to the rotation of said first rotor, and means on said rotor surfaces to retain rings of the molten material thereon.

2. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten stream positioned to receive said stream on its peripheral surface, means for rotating said rotor in one direction at high speed, a second, similar rotor adjacent but spaced from said first rotor and positioned to receive on its peripheral surface molten material discharged by said first rotor, means to rotate said second rotor at high speed in a direction opposite to the rotation of said first rotor, and means on said rotor surfaces to retain rings of the molten material thereon.

3. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten stream positioned to receive said stream, a second rotor of similar character and tilted with respect to said first-mentioned rotor and positioned to receive material discharged by said first rotor, means for rotating said rotors at high speeds and in opposite directions and means on said rotors to retain rings of the molten material thereon.

4. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a cylindrical rotor having a forward face and including a peripheral surface of a character to withstand the heat of the molten stream positioned to receive said stream on its peripheral

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surface, means for rotating said rotor at high speed in one direction, a second cylindrical rotor of similar character adjacent but spaced from said first-mentioned rotor and having a forward face lying in a plane at an angle to the plane of the forward face of said first rotor, the line of intersection of said planes passing through the axes of said rotors, said second rotor being positioned to receive on its peripheral surface molten material discharged from said first rotor, means for rotating said second rotor at high speed in a direction opposite to the rotation of said first rotor, and means on said surfaces of the rotors to retain rings of the molten material thereon.

5. In a mineral wool apparatus including means to discharge a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten stream positioned to receive said stream on its peripheral surface, said surface including annular material-retaining grooves, means for rotating said rotor at high speed in one direction, a second rotor of similar character adjacent but spaced from said first rotor and positioned to receive on its peripheral surface molten material discharged by said first rotor, said surface of the second rotor having annular material-retaining grooves, and means for rotating said second rotor at high speed in a direction opposite to the rotation of said first rotor.

6. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a cylindrical rotor having a forward face and including a peripheral surface of a character to withstand the heat of the molten stream positioned to receive said stream on its peripheral surface, said surface having relatively large annular retaining grooves at the location of contact with said stream and relatively fine annular grooves on the remainder of said surface, means for rotating said first rotor at high speed, a second rotor of similar character adjacent but spaced from said first rotor and positioned to receive on its peripheral surface molten material discharged by said first rotor, said surface of the second rotor having annular relatively fine material-retaining grooves, means for rotating said second rotor at high speed in a direction opposite to the rotation of said first rotor, said second rotor having a forward face lying in a plane at a slight angle to the plane of the forward face of said first rotor.

7. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten material supported on an axis at an angle to the horizontal and positioned to receive said stream on its peripheral surface, means for rotating said rotor at high speed, a second rotor of similar character adjacent but spaced from said first rotor and supported on a substantially horizontal axis and positioned to receive on its peripheral surface molten material discharged by said first rotor, means to rotate said second rotor at high speed, and means on said rotor surfaces to retain rings of the molten material thereon.

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8. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten material, means supporting said rotor on an axis at an angle to the horizontal and in position to receive said stream on its peripheral surface, said surface including annular material-retaining grooves, means for rotating said rotor at high speed in one direction, a second rotor of similar character, means supporting said second rotor on a substantially horizontal axis lying in a vertical plane substantially parallel to the vertical plane of the axis of the first rotor and in position to receive on its peripheral surface material discharged by said first rotor, said surface of said second rotor including annular material-retaining grooves, and means for rotating said second rotor at high speed in a direction opposite to the rotation of said first rotor.

9. In a mineral wool apparatus including means for discharging a molten material stream many times larger than the fibers to be formed therefrom, a rotor of a character to withstand the heat of the molten material, means supporting said rotor on an axis at an angle to the horizontal and in position to receive said stream on its peripheral surface, means for rotating said rotor at high speed, a second rotor of similar character, means supporting said second rotor on a substantially horizontal axis lying in a vertical plane substantially parallel to the vertical plane of the axis of said first rotor and in position to receive on its peripheral surface molten material discharged by said first rotor, and means to rotate said second rotor at high speed in a direction opposite to the rotation of said first rotor.

10. A method of making mineral wool from a molten mineral material comprising discharging said material onto a peripheral surface of a rotor having means on said surface for retaining molten material thereon and rotating on an approximately horizontal axis, whereby a portion of the material is retained on said surface by said means in the form of an incandescent ring, and another portion is thrown off, intercepting said other portion on the peripheral surface of another rotor similar to said first rotor whereby an incandescent ring is formed on said second rotor, and rotating said rotors at sufficiently high speeds and in opposite directions to form fibers from said incandescent rings.

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