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M. S. FIRNHABER

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APPARATUS FOR MANUFACTURING MINERAL WOOL AND THE LIKE

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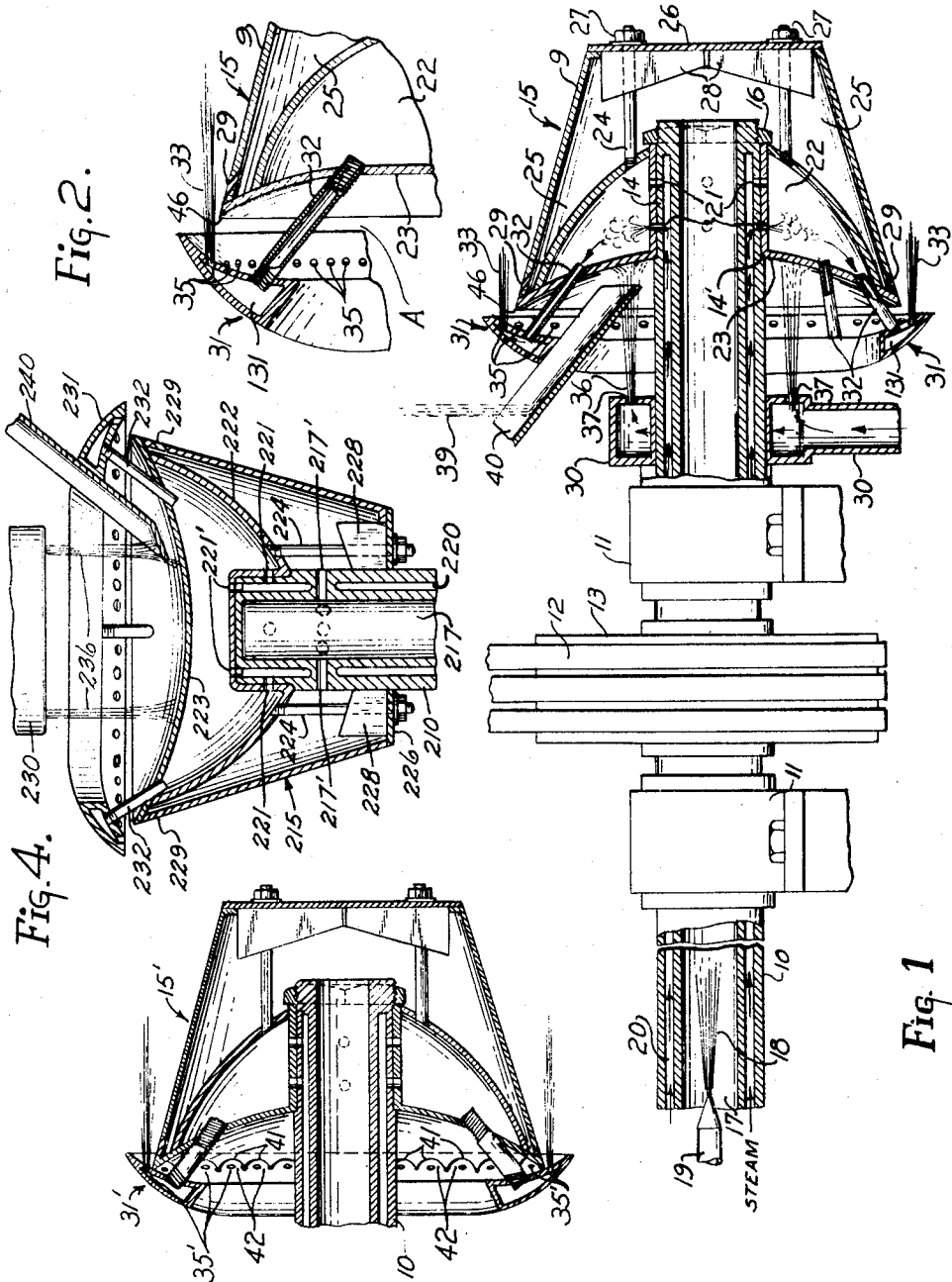


Fig. 3

Fig. 1

INVENTOR.
Miles S. Firnhaber
BY
Monsell M. Monsell

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APPARATUS FOR MANUFACTURING MINERAL WOOL AND THE LIKE

Miles S. Firnhaber, Pewaukee, Wis., assignor to Sealrite Insulation Mfg. Corp., Waukesha, Wis., a corporation of Wisconsin

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10 Claims. (Cl. 18—2.5)

This invention relates to improvements in apparatus for manufacturing mineral wool and the like.

The apparatus comprising the present invention is an improvement upon that disclosed in my copending application Serial No. 549,933, filed November 30, 1955 now Patent No. 2,855,626, dated October 14, 1958. The general object of both inventions is to provide an improved apparatus for manufacturing mineral wool wherein the molten mineral material being fiberized is maintained at a proper temperature and viscosity throughout the entire fiberizing process, and wherein the fibers produced are longer, finer, and of a quality superior to those formerly manufactured.

With the present invention the stationary steam ring employed in the apparatus of my prior application has been replaced with a novel steam ring attached to and rotatable with the rotor, and in addition, means have been provided in my new apparatus for discharging a heating agent directly onto the face of the rotor to thereby apply intense heat at high velocity directly onto said rotor face so as to raise the viscosity of the molten material and minimize the number of unfiberized particles. The use of a steam ring on the rotor makes it possible to have an annular space of controlled width through which the molten material is centrifugally thrown, said space serving as a meter to prevent large globules of glass getting through and into the final product as was formerly possible, any such globules being stopped so that they fall back toward the center of the rotor for further heating. In addition, the rotating steam ring creates a fan-like effect to suck air and gas into its central opening, and the discharging steam creates a syphon effect to pull heated air and gases through the annular space between the rotor periphery and steam ring, which air and gases serve to keep the molten material in molten condition until fiberized.

A further object of the invention is to provide as an alternative form of the device a rotor having a serrated edge abutting a connected steam ring, the spaces created by the serrations providing multiple outlets through which the molten material is discharged centrifugally. An advantage of this form of the invention is that the serrations tend to break up the molten material as it is thrown from the ring and tend to divide said material into longer and finer fibers.

With the above and other objects in view, the present invention consists of the improvements in apparatus for manufacturing mineral wool and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating three embodiments of the invention, in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a side elevational view of the principal form of the apparatus, parts being broken away and shown in vertical section;

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Fig. 2 is a fragmentary sectional view of a portion of the rotor and steam ring;

Fig. 3 is a vertical sectional view showing the rotor used in a modified form of the invention; and

Fig. 4 is a vertical sectional view showing a modification where the rotor is disposed to rotate in a horizontal plane on a vertical axis.

Referring more particularly to the drawings, the numeral 10 designates a tubular shaft suitably journaled for rotation in bearings 11, which bearings are suitably supported from a frame (not shown). The shaft may be rotated by the endless belts 12 which engage the grooves of a sheave 13.

The inner end of the shaft is of reduced diameter as at 14 to receive the rotor 15 which is locked in position against an annular shoulder 14' by a nut 16 to rotate with the shaft. The rotor has a peripheral wall 9. The shaft 10 is tubular to provide an interior duct 17 into which hot gases 18 at relatively high velocity, or other heating agent, may be directed from the nozzle 19 of a suitable burner. This may be an oil burner or a gas burner under pressure. The wall of the shaft 10 is of sufficient thickness to allow for a cylindrical passageway 20 therein. The passageway 20 is adapted to receive steam, or other cooling agent, which is discharged through openings 21 into an inner cooling chamber 22 in the rotor. The inner end of the rotor is closed by a dished end 23 forming a receiving face, which end also closes the chamber 22. The steam within the chamber 22 has a cooling effect on the rotor and prevents overheating of the dished end 23. Bolts 24 projecting rearwardly from the chamber 22 extend through the rear wall 26 of the rotor.

The hot gases 18 emerge from the open inner end of the tubular shaft 10 into the chamber 25 of the rotor, which chamber may be termed a hot gas chamber. The outer or rear end of the hot gas chamber 25, as well as the outer or rear end of the rotor, is closed by an end disc 26 which is held in position by nuts 27 threaded onto the projecting ends of the bolts 24. On the inner face of the end 26 fan blades 28 are mounted which rotate with the rotor. The hot gases 18 from the fuel burner are discharged under pressure from the tubular shaft 10 against the blades 28. The blades, in turn, rotating with the rotor, direct the hot gases in a reverse direction back through the chamber 25 toward the inner or forward end of the rotor and toward a circle of peripheral outlet openings 29.

The peripheral outlet openings 29 extend at an oblique angle so as to direct the hot gases at such an angle that they will impinge against molten mineral material which is centrifugally thrown from the rotor (as will be hereinafter described). The purpose of the hot gas discharge is to prevent premature cooling of the material as it leaves the rotor and to ensure proper formation of the fibers. This latter feature is not essential with the improved features of the invention, as adequate heat is provided by a supplementary burner 30 positioned adjacent the dished end 23 of the rotor, as will be more fully described below; however, by using the two features together the production of the more perfect fibers is insured.

It will be noted that, with the exception of the supplementary fuel burner 30, the structural elements so far recited are similar to those described in my aforementioned copending application. However, the present invention makes use of a novel rotatable steam ring 31 which constitutes an extremely important feature of my invention.

The steam ring 31 is hollow to provide an interior chamber 131 and is of a diameter somewhat greater than that of the adjacent dished end 23 of the rotor 15. It is

attached to said dished end by means of a plurality of tubes 32 which communicate with the steam chamber 22 and with the steam ring chamber 131. Each tube has its ends externally threaded as shown in Fig. 2 with the threading on one end reversed from the threading on the other, so that in initial installation, rotation of the tubes will adjust the width of the annular gap A to whatever is desired for specified requirements. The surface of the steam ring facing the rotor is spaced from said rotor, is concave in transverse section, and is provided with a multiplicity of steam discharge holes 35 arranged all around the ring 31. It has been found that an annular space of about 1/2 inch at A, between the ring and the rotor, is very effective, although this may vary according to requirements. The steam is admitted to the ring 31 from the chamber 22 through the tubes 32, the steam ring being fixed to the rotor by the tubes 32, the rotation of the rotor 15 necessarily also rotates said ring.

In practice, molten mineral material, such as molten glass 39 from a furnace, is directed by a suitable inclined trough 40 onto the dished end 23 of the rotor 15. The rotation of the rotor causes the molten material to be centrifugally thrown from the periphery 46 of the dished end of said rotor and toward the concave face of the ring 31. The steam 33 which is forcibly discharged through the holes 35 of the ring is directed against the mineral material and fiberizes the same in a manner similar to that described in my aforementioned copending application. Although the fiberizing agent is herein described as steam, it is to be understood that other suitable fluids may be utilized, and the invention is not to be confined to the use of steam for this purpose.

The advantage of the rotatable steam ring 31, as compared to the stationary type formerly employed, is that any large globules of glass are metered off by the rotating ring and thrown back on to the face 23 for remelting and are thus prevented from getting into the final product. This is due in part to the fact that where the ring is attached to the rotor the space between the ring and the dished end 23 of the rotor may be relatively narrow, thereby preventing large particles from escaping. Furthermore, the jolting action of the swiftly moving ring tends to intercept such large particles and make them fall back onto the rotor face. In addition, the improved arrangement has a tendency to elongate the molten material into finer and longer fibers as it leaves the periphery of the rotor. The possibility of a sealing action, which occurs with a stationary steam ring, is minimized with the present invention, thus producing a superior quality of product.

A further advantage of the rotatable steam ring, and one which forms a very important feature of the improved device, is that the rotation of the ring produces a fan-like action which tends to maintain the molten material at a high temperature until fiberized. It has been found that the rotation of the steam ring causes the hot air and gas emitted from the burner 30 to be sucked into the central ring opening. The steam being discharged from the holes 35 acts as a syphon upon said heating fluids and pulls them through the annular space A between the ring and rotor, where they contact the molten mineral material as the same is being thrown from the rotor. This contact of the hot air and gases with the mineral material tend to maintain the material in a desirable molten condition until fiberized.

The burner 30, a portion of which is shown in Fig. 1, may be either a conventional oil or gas burning type designed to forcibly direct heated gases 36 against the dished end 23 of the rotor to maintain the mineral material thereon and particularly the outer part thereof in molten condition and at proper viscosity before the material is thrown from the rotor periphery. Part of the burner 30 surrounds the tubular shaft 10, so as to be in close proximity to the rotor, and is suitably mounted on a frame (not shown). A plurality of discharge outlets

37 are positioned to direct the blast of hot gases through the central opening of the steam ring 31 onto the dished end 23 of said rotor. It has been found that the burner 30 supplies sufficient heat to adequately maintain the mineral material in a proper molten condition before fiberizing, but it is preferred to use this device in conjunction with the hot gas chamber 25 of the rotor and in conjunction with the peripheral rotor outlets 29, heretofore described, in order to obtain maximum quality.

In the modification illustrated in Fig. 3, the peripheral edge of the rotor 15', adjacent the steam ring 31', is serrated as at 41, said serrated edge preferably abutting the steam ring at a point within the circle of steam discharge holes 35'. The molten material thrown from the face of the rotor is forced through the relatively small spaces 42 created by the serrations, and large globules are thereby prevented from passing through the spaces 42 to get into the final product. The serrations 41 are advantageous in preventing globules from getting into the final product whether or not the steam ring is attached to the rotor to rotate therewith, but such serrations are particularly advantageous in the arrangement shown in Fig. 3.

In the modification illustrated in Fig. 4, substantially the same arrangement is employed except that the shaft is disposed vertically and the rotor rotates in a horizontal plane. In Fig. 4, all of the parts which correspond to like parts in Fig. 1 are designated by the same last numerals preceded by the digit 2. In this form of the invention, however, the shaft 210 comes up from below, because of the vertical disposition, and its upper end is spaced below the dished wall 223. In addition, the cooling jacket 220 extends to the upper end of the shaft 210 so that cooling fluid may be directed from the additional ports 221' directly against the central portion of the dished face 223 of the rotor. Also in this form of the invention the supplemental burner 230 does not surround the shaft 210 as in the principal form of the invention because of the changed position of said shaft. In addition the hot gases from the interior 217 of the shaft are discharged into the chamber 225 through holes 217'. In all other respects the construction and operation of this form of the invention is the same as that of Fig. 1.

In all forms of the invention the rotor, or parts thereof, such as the receiving face 23 or 223, may be made of suitable ceramic material to withstand the high temperatures encountered, such as silicon carbide or such rotor or parts may be made of metal.

Summary of operation

In use of the present invention the mode of operation is generally similar to that disclosed in my previously mentioned copending application Serial No. 549,933, filed November 30, 1955.

The rotor 15 is started, hot gases 18 are continuously directed into the tubular shaft 10, steam into the chamber 20, and molten glass 39 against the dished receiving face 23 of the rotor. As the rotor spins, the molten material 39 is centrifugally thrown tangentially from the peripheral rim portion 46 of the rotor (which rim portion may be serrated as in the form of the invention illustrated in Fig. 2) toward the concave face of a steam ring 31, which ring is also rotating with the rotor. The molten material is then acted upon by the blasts of steam 33, or other suitable fiberizing agent, which are discharged from the rotating steam ring 31. Due to the discharge of hot gases from the burner 30 against the dished receiving face 23 of the rotor, the molten mineral material is maintained at a high temperature before it is thrown from the rim 46 of the rotor. In addition, hot gases 18 are discharged from the holes 29 in the rotor, which holes are positioned closely adjacent said rim 46, to further prevent the premature cooling of said molten material. While the rotor is in operation, the steam in the chamber 22 acts as a cooling agent to keep the rotor from getting excessively

hot. As a result of the above described novel features of the present invention, the fibers are drawn out longer and finer than was formerly possible and a minimum of globules adhere to the fibers or otherwise get into the finished product.

In the form of the invention of Fig. 4, substantially the same method of operation as that just described is carried out. In this form of the invention some of the steam from the jacket 220 is directed from the end ports 221' directly against the inner side of the center of the receiving face 223 to effectively maintain the receiving face at a proper temperature.

When operating the apparatus of the present invention, less glass must be directed by the trough 40 onto the face of the rotor than in standard practice. This is because of the relatively narrow annular space A between the rim and the rotor. If too great a quantity of molten glass is directed onto the rotor the peripheral gap A is overloaded. Therefore, with the present invention, it is preferred to use two or more units alongside one another, each taking a part of the steam of molten glass from a furnace.

While only three forms of the invention have been shown and described herein, it is obvious that various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In an apparatus for manufacturing mineral wool having a rotor with an external end receiving face and having means for feeding molten material onto said end receiving face, said rotor having an internal receiver for a fiberizing agent, means for feeding a fiberizing agent into said receiver while the rotor is rotating, a hollow ring supported adjacent the periphery of said end receiving face for rotation with the rotor and having a central opening, and means for conducting the fiberizing agent from the internal receiver of the rotor into said hollow ring, said ring having a plurality of outlets for said fiberizing agent positioned so that molten material thrown centrifugally from the periphery of said end receiving face will be fiberized by said fiberizing agent.

2. In an apparatus for manufacturing mineral wool having a rotor rotatable on a horizontal axis with said rotor having an upright external end receiving face and having means for feeding molten material onto said end receiving face, said rotor having an internal receiver for a fiberizing agent, means for feeding a fiberizing agent into said receiver while the rotor is rotating, a hollow ring supported adjacent the periphery of said end receiving face for rotation with the rotor and having a central opening, there being a relatively narrow annular space between said ring and periphery, and means for conducting the fiberizing agent from the internal receiver of the rotor to said hollow ring, said ring having a plurality of outlets for said fiberizing agent positioned so that molten material thrown centrifugally from the periphery of said end receiving face through said annular space will be fiberized by said fiberizing agent.

3. Apparatus for manufacturing mineral wool as recited in claim 1, wherein there is means for directing hot gases through the central opening of said ring against said end receiving face.

4. Apparatus for manufacturing mineral wool as recited in claim 1, wherein there is means for directing an annulus of hot gases through the central opening of said ring against said end receiving face.

5. Apparatus for manufacturing mineral wool as recited in claim 1 wherein the periphery of said end receiving face is scalloped to provide an annulus of openings through which the molten material which is thrown centrifugally must pass.

6. Apparatus for manufacturing mineral wool as recited in claim 5, wherein said scalloped periphery is in contact with said hollow ring.

7. In an apparatus for manufacturing mineral wool having a rotor with an external end receiving face and having means for feeding molten material onto said end receiving face, said rotor having an internal receiver for a fiberizing agent, means for feeding a fiberizing agent into said receiver while the rotor is rotating, a hollow ring adjacent the periphery of said end receiving face, and a plurality of tubes connecting said rotor and hollow ring so that the latter rotates with the rotor, said tubes each having one end in communication with said fiberizing agent receiver of the rotor, and having their other ends in communication with the hollow interior of said ring to supply fiberizing agent thereto, said ring having a plurality of outlets for said fiberizing agent positioned so that molten material thrown centrifugally from the periphery of said end receiving face will be fiberized by said fiberizing agent.

8. In an apparatus for manufacturing mineral wool having a rotor with an external end receiving face and having means for feeding molten material onto said end receiving face, said rotor having an internal chamber behind said receiving face for a fiberizing and cooling agent, means for feeding a fiberizing agent into said chamber while the rotor is rotating, a hollow ring adjacent the periphery of said end receiving face, and a plurality of tubes connecting said rotor and hollow ring so that the latter rotates with the rotor, said tubes each having one end in communication with said fiberizing and cooling agent chamber of the rotor, and having their other ends in communication with the hollow interior of said ring to supply fiberizing agent thereto, said ring having a plurality of outlets for said fiberizing agent positioned so that molten material thrown centrifugally from the periphery of said end receiving face will be fiberized by said fiberizing agent.

9. Apparatus for manufactured mineral wool as recited in claim 7, wherein said tubes adjustably connect the hollow ring to said rotor whereby the width of the annular space between said ring and rotor may be adjusted.

10. Apparatus for manufacturing mineral wool as recited in claim 1, wherein the hollow ring is adjustably connected to said rotor whereby the width of the annular space between said ring and rotor may be varied.

References Cited in the file of this patent

UNITED STATES PATENTS

2,192,944	Thomas	Mar. 12, 1940
2,587,710	Downey	Mar. 4, 1952
2,609,566	Slayter et al.	Sept. 9, 1952
2,729,849	Downey	Jan. 10, 1956