This invention relates to improvements in apparatus for manufacturing mineral wool. It has heretofore been proposed to manufacture mineral wool by use of a rotor which centrifugally throws the molten material from the rim of the rotor, there being a blast of steam or other fluid which impinges against the molten material after it leaves the rotor to cause the formation of fibers. Heretofore problems have been encountered in connection with the premature cooling of the mineral material as it is being thrown off of the periphery of the rotor. When the material cools too quickly, globules form on the ends of the fibers, some of which drop to the floor of the bin so as not to enter into the final product, and others of which stay on the ends of the fibers to spoil the matting qualities. Where the mineral material cools too quickly, the length and quality of the fibers is detrimentally affected.

It is a general object of the present invention to provide improved apparatus for manufacturing mineral wool wherein the mineral material is kept in molten condition just enough longer than in practice heretofore employed as to cause the fibers to be drawn out to a greater degree of length and fineness and to minimize the formation of globules.

A more specific object of the invention is to provide apparatus for manufacturing mineral wool wherein hot gases of combustion including flame are discharged into the rotor and discharged from the periphery in an annulus which is adjacent to and directed into the molten mineral material as it is leaving the rotor. Thus the hot gases including flame intermingle with the molten material as it leaves the rotor to prevent premature cooling and the hot gases also keep the rim of the rotor at a sufficiently high temperature to prevent the rim portion from prematurely cooling the mineral material.

A further object of the invention is to provide apparatus as above described wherein there is novel means for preventing overheating of the rotor.

With the above and other objects in view, the 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 two 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 one form of apparatus for carrying out the invention, parts being broken away and shown in vertical section;

Fig. 2 is a fragmentary view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary sectional view of a portion of the rotor showing the arrangement of the apertures for discharging the hot gases;

Fig. 5 is a fragmentary plan view looking down on Fig. 4; and

Fig. 6 is a vertical sectional view showing the rotor as used in a modified form of the invention.

Referring more particularly to the drawings, the numeral 10 designates a tubular shaft suitably journalled 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 a 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 including flame from the nozzle 19 of a suitable burner may be directed. This may be an oil burner or a gas burner under lower 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 a cooling fluid such as water or steam, preferably the latter, which is discharged through openings 21, preferably six in number, into an inner cooling chamber 22 in the rotor. The end of the rotor is closed by a dished end 23 forming a receiving face, which end also closes the chamber 22. The cooling fluid within the chamber 22 therefore prevents overheating of the dished end 23. Outlet tubes 24 direct the cooling fluid to the exterior.

The hot gases of combustion including flame 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 end of the chamber 25, as well as the outer end of the rotor, is closed by an end disc 26 which is held in position by nuts 27 threaded on the projecting ends of the cooling fluid outlets 24. On the inner face of the end 26 fan blades 28 are mounted which rotate with the rotor (see also Fig. 3). The hot gases 18 including flame 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 including flame in a reverse direction back through the chamber 25 toward the front end of the rotor, and toward the circular opening of peripheral outlet openings 29 for the hot gases including flame.

Referring more particularly to Fig. 4, it is to be noted that these openings 29 extend at an oblique angle so as to direct the hot gases including flame at such an angle that they will impinge against the mineral material which is being thrown from the rim 46 of the rotor. The outer ends of the openings 29 open into an external annular groove 30 having a long sweeping side wall 31 so as not to interfere with the angular discharge of the gases. The inner ends of the holes 29 communicate with an internal annular groove 32.

The holes 29 are preferably as close as is practical to the end of the rotor and it is preferred to have the outside groove about one-eighth of an inch deep. The groove is preferably five-eighths of an inch from the end of the rotor. It is also preferable to have one of the holes 29 every quarter of an inch.

Suitable means is provided to direct an annular blast of fiberizing fluid such as steam 33 against the mineral material which is being thrown from the periphery of the rotor. This may be accomplished by an annular steam ring 34 having a multiplicity of holes 35. The steam is preferably admitted to the ring 34 from an outer manifold 36 through four radial ducts 37 spaced 90° apart. The steam is admitted to the outer manifold 36 through a steam inlet 38. Molten mineral material, such as molten glass 39 from a furnace, is directed by a suitable
Inclined trough 40 into the dished end 23 of the rotor 15. In the modification illustrated in Fig. 6, the hot gases of combustion including flame are directed into the chamber 22 of the hollow shaft 19' instead of into the center of the hollow shaft. These hot gases including flame then pass out of a circle of holes 40, each of which communicates with a generally radial duct 41 having an outlet opening 42 at the periphery of the rotor near the end thereof so that the hot gases are discharged from radial ducts 42 of the radial ducts 41 all the way around the rotor 15' in substantially the same way that they are discharged from the holes 29 of the principal form of the invention. In the modification there is an extra tube 43 within the main tubular shaft 19', which may be either fixed or rotate with the shaft and rotor, which is used to conduct a cooling fluid such as water to the interior of the rotor where it is discharged from openings 44, the water serving to cool the rotor, and there being a cylindrical outlet 45 for the water or other cooling fluid surrounding the inlet tube 43'. In this form of the invention the use of the further holes 28 is unnecessary. In all other respects the rotor 15 is used in the same manner as the rotor 15 of Fig. 1, and the rotor 15' and shaft 10' of Fig. 6 may be substituted for the rotor 15 and shaft 10 of Fig. 1 to accomplish a similar purpose.

Operation

In use the invention the rotor is started, hot gases of combustion 18 including flame are continuously directed into the tubular shaft 10, cooling fluid into the chamber 20, and molten glass 39 against the dished receiving face 30 of the rotor 15. As the rotor spins, this material 39 is centrifugally thrown tangentially from the peripheral portion 46 of the rotor and is acted upon by the fiberizing fluid such as steam 33 which is discharged in an annulus from the steam ring 34. Due to the discharge of hot gases of combustion including flame from the holes 29 in the form of the invention of Fig. 1 and from the holes 42 in the form of the invention of Fig. 6, at locations closely adjacent the rim 46 of the rotor, this rim is kept at a sufficiently high temperature so that the molten material is not prematurely cooled. In the form of invention of Fig. 1 a ribbon of hot gases including flame is maintained in the groove 30. The hot gases which are discharged from the holes 29, or from the holes 42 of the form of the invention of Fig. 6, impinge against the mineral material just after it leaves the rotor to keep it from becoming prematurely cool. As a result of this action the fibers are drawn out longer and finer, resulting in a superfine product, and there are a minimum of globules attached to the fibers or falling into the bin. At the same time the cooling fluid in the chamber 22 of the form of the invention of Fig. 1, and in the interior of the rotor in the form of the invention of Fig. 6, keeps the rotor from getting excessively hot as a result of the hot gases and the heat of the molten material.

It is to be noted that the angle of the holes 29 and the angle of the ducts 41 causes discharge of the hot gases in a direction which is at least partly opposed to the direction of the fiberizing blasts 33. This results in a very efficient fiberizing action.

While only two forms of the invention have been shown and described, 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. An apparatus for manufacturing mineral wool having a rotor with a peripheral wall and with an end wall having a receiving face closing one end of said peripheral wall, and said apparatus having means for fiberizing molten material, means for feeding molten material onto said end wall receiving face while the rotor is rotating, said rotor being so positioned with respect to said fiberizing means that molten material thrown centrifugally from the periphery of said receiving face will be fiberized by said fiberizing means, a rotatably mounted shaft supplying said rotor having a duct therein, means for directing hot gases of combustion into said duct of the shaft, said rotor having discharge openings around its periphery, and means in the rotor for conducting said hot gases of combustion from the duct of said shaft to said peripheral discharge openings, said peripheral discharge openings being angled toward the material being thrown from the rotor to direct hot gases toward said material before it is acted on by said fiberizing means and to prevent premature cooling thereof.

2. In an apparatus for manufacturing mineral wool having a rotor with a peripheral wall and with an end wall having a receiving face closing one end of said peripheral wall and said apparatus having means for fiberizing molten material, means for feeding molten material onto said end wall receiving face while the rotor is rotating, said rotor being so positioned with respect to said fiberizing means that molten material thrown centrifugally from the periphery of said receiving face will be fiberized by said fiberizing means, a rotatably mounted shaft supporting said rotor and having said duct therein, means for directing hot gases of combustion into said duct of said shaft supplying said rotor and having a duct therein, means for directing hot gases of combustion into said duct of the shaft, said rotor having discharge openings around its periphery, and means in the rotor for conducting said hot gases of combustion from the duct of said shaft to said peripheral discharge openings, said peripheral discharge openings being angled toward the material being thrown from the rotor to direct hot gases toward said material before it is acted on by said fiberizing means and to prevent premature cooling thereof.

3. In an apparatus for manufacturing mineral wool having a rotor with a peripheral wall and with an external end receiving face closing one end of said peripheral wall, said apparatus having means for fiberizing molten material, means for feeding molten material onto said external receiving face while the rotor is rotating, said rotor having internal gas directing means and being so positioned with respect to said fiberizing means that molten material thrown centrifugally from the periphery of said receiving face will be fiberized by said fiberizing means, a shaft for the rotor having a duct therein in communication with said internal gas directing means, said rotor having discharge means around its periphery in communication with said internal gas directing means, and means in communication with the duct in the shaft for causing hot gases including flame to be discharged from said peripheral discharge means of the rotor, said peripheral discharge means being located sufficiently close to the material being thrown from the external receiving face of the rotor that said hot gases prevent premature cooling of said material before it is acted on by said fiberizing means.

4. In an apparatus for manufacturing mineral wool having a rotor with a peripheral wall and with an external front end receiving face closing one end of said peripheral wall and with a rear end wall, said apparatus having means for fiberizing molten material, means for feeding molten material onto said external receiving face while the latter is rotating, said rotor being positioned so that molten material thrown centrifugally from the periphery of said front end receiving face will be directed into a position to be fiberized by said fiberizing means, a shaft for said rotor having a duct therein, said rotor having discharge openings around its periphery in communication with said duct of the shaft, the rear end wall of the rotor and the periphery of the rotor providing walls for said chamber, a separate cooling chamber interposed between the front end...
of the rotor and said gas chamber and nest with the latter, said gas chamber having an annular portion of diminishing cross-section in communication with said discharge openings of the rotor, and means communicating with said duct of the rotor shaft for causing hot gases including flame to be discharged from said discharge openings of the rotor, said discharge openings being positioned to direct said hot gases toward material thrown centrifugally from the receiving face of the rotor to prevent premature cooling thereof before it is acted on by said fiberizing means.

5. In an apparatus for manufacturing mineral wool having means for fiberizing molten material, a rotor having a peripheral wall and having front and rear end walls, said front end wall having an external receiving face, and said front end wall also having an internal face, a cup-shaped member within the rotor having a rim in sealing engagement with the rotor adjacent the periphery of the internal face of said front end wall and providing a cooling chamber between said internal face of the front end wall and said cup-shaped member, said rotor also having an interior gas chamber located between the rear end wall of the rotor and said cup-shaped member, the periphery of the rotor also forming the periphery of said gas chamber, a shaft for said rotor and having a duct therein, said cooling chamber surrounding a portion of said shaft, said rotor having discharge openings around its periphery located adjacent the periphery of the receiving face of the front end wall of the rotor, and said interior gas chamber having an annular portion surrounding said cooling chamber which is of diminishing cross-section and which communicates with said discharge openings, means for circulating a cooling medium through said cooling chamber, and means communicating with said duct of the rotor shaft for causing hot gases including flame to be discharged from said discharge openings of the rotor, and means for feeding molten material onto said front end receiving face while the rotor is rotating, said rotor being so positioned with respect to said fiberizing means that molten material thrown centrifugally from the periphery of said front end wall receiving face will be fiberized thereby, and said discharge openings of the rotor being positioned to direct hot gases including flame toward said thrown material to contact the latter before it is acted upon by said fiberizing means to prevent premature cooling thereof.

6. Apparatus for manufacturing mineral wool as recited in claim 5, wherein the gas directing means is an internal gas chamber and wherein the peripheral discharge means comprises discharge openings around the periphery of the rotor leading from said internal gas chamber and an external groove with which the discharge openings communicate, said discharge openings of the rotor and the sides of the groove being angled toward the material being thrown from the rotor.

7. Apparatus for manufacturing mineral wool as defined in claim 3, wherein the gas directing means comprises ducts in the end receiving face wall of the rotor.

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