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APPARATUS AND METHOD FOR MAKING MINERAL WOOL

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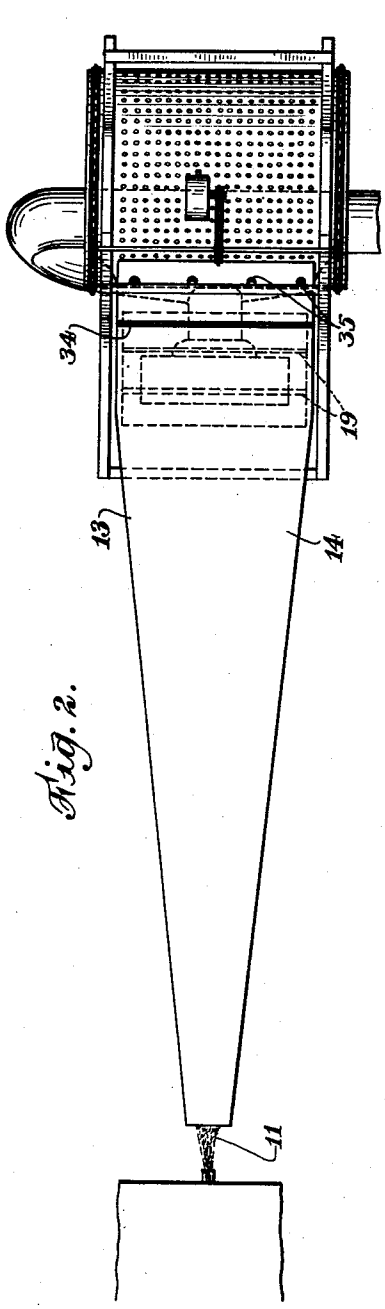


Fig. 2.

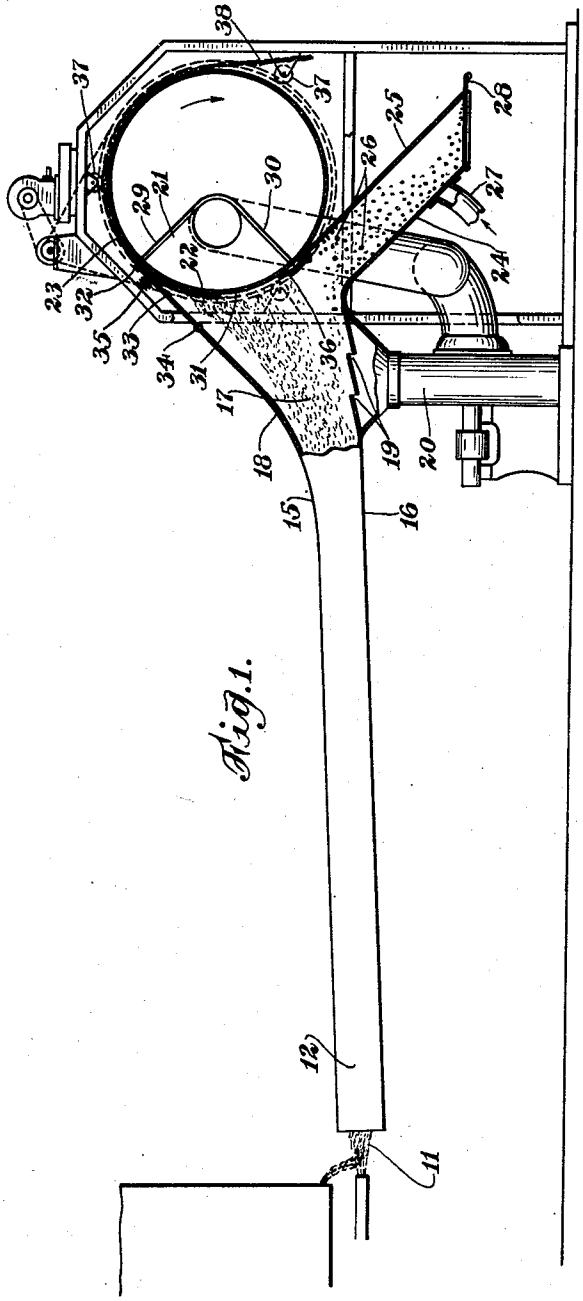


Fig. 1.

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APPARATUS AND METHOD FOR MAKING MINERAL WOOL

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20 Claims. (Cl. 154—27)

This invention relates to an apparatus and method for making mineral wool.

In the making of mineral wool, it is conventional to form, first, a melt of suitable material such as a silicate composition derived largely from blast furnace slag or rock. The molten material is then shredded, as, for instance, by allowing the said material to fall, as a small stream, at a temperature of about 2,400° F., into a rapidly moving blast of steam. The fibres thus formed, along with a lesser proportion of unfiberized and shot-like particles that it is practically impossible to avoid, are carried as a suspension in a gas stream into equipment for recovery of the suspended solid material from the stream. Thus, the suspension of fibres and shot may be introduced into a large settling chamber and the fibres and shot allowed to settle into a felt on the bottom of the chamber, suitably a moving conveyer belt of air-permeable material.

It is an object of the invention to provide means for separating effectively the desired fibrous material from the incidentally occurring shot-like particles in the suspension described. Another object is to recover, that is wash from the separated shot an additional amount of fibres that may be originally entangled therewith. Another object of the invention is to form a relatively uniform and coherent felt of the mineral wool fibres. A further object is to reduce the size of the blowing chamber required for a given rate of production of silicate wool. Other objects and advantages will appear from the description that follows.

The invention comprises the novel features of the method and apparatus herein described, particularly the method of and means for deflecting completely the stream of gas containing the suspended fibres and shot-like particles and then felting the fibres in the upwardly deflected stream. In one embodiment, the invention comprises the washing, by air or other gas, of the shot-like particles separated by the deflection of the suspension of fibres.

The invention is illustrated in the attached drawing and will be described for the purpose of exemplification in connection therewith.

Fig. 1 shows a side view of my improved apparatus, partly broken away for clearness of illustration.

Fig. 2 shows a plan view of the same.

A suspension of mineral wool fibres with a lesser proportion of shot-like particles is blown at position 11 into a somewhat tubular blowing chamber 12 that increases substantially in width (between the side edges 13 and 14) and becomes, progressively, substantially wider than the thickness of the tube, that is, than the distance between the top 15 and the bottom 16 thereof. For instance, I have used a tube of approximately 1 foot diameter at the end adjacent to the shredding position 11 that expands continuously to a maximum width, measured horizontally, of about 5 feet.

Suitably this tubular blow chamber may be 20 feet or so in length and may slope upwardly away from the shredding position 11, say at a pitch of about an inch to the foot. At the far end may be placed the air-permeable felting member 22, with means for producing suction therebehind.

The suspension of fibres and unfiberized materials in the gas is formed into a flat band as the suspension moves through the tube and there is a gradual reduction of the velocity of the stream or band as the tube increases in width. This produces separation of the unfiberized shot-like particles from the suspended fibres which are more buoyant and have a lower rate of settling.

At the zone indicated generally by 17, there is an upward deflection of the flat band or stream. The deflection follows the curvature 18 of the upper wall of the tube.

This deflection causes separation of shot-like particles from fibres, the said particles tending to continue nearly in their normal trajectories, whereas the relatively buoyant fibres follow closely the direction of the deflected stream of gas.

To wash out those fibres that may be entangled with the separated shot, there is introduced, into the primary gas stream described, an auxiliary stream of gas, such as air, through one or more louvers 19. Preferably, there is a series of louvers each extending substantially completely across the lower portion of the said tube. The louvers are preferably closely adjacent to the said zone of deflection of the primary stream and are in part at least disposed beyond the point at which the deflection begins, on the convex side of the stream.

The lowest part of the felting member 22 exposed to the stream is above the plane of the straight portion of the top 15 of the tube 12.

A result of these features described is deflection of the primary stream, generally in the direction of a smooth arc of a circle.

The gas admitted through the louvers 19 produces a progressive or repeated washing of the

separated shot by the several portions of the auxiliary gas stream 19, the latter of the portions washing a shot fraction that has been previously washed by an earlier contacting portion of the auxiliary stream. Furthermore, there is an increase in volume and consequent increase in rate of movement of the gas stream, from the position of admittance of the auxiliary air, towards the felting member.

The auxiliary washing stream 19 may be introduced through line 20, from a suitable blower or fan (not shown). Or, the auxiliary air may be introduced under the sole influence of suction applied in the suction box or part 21, as by means of a suction fan, disposed behind that portion or part of member 21 that extends across the wider end of the blowing tube. The suction box 21 is made sufficiently wide to insure the application of a strong suction at the sides of the blow chamber 12 to cause the edges of the felt 23 to be equally as thick as the center portion.

In the apparatus and method described, the suction in part 21 draws the gas, from the dilute suspension of fibres in air, rapidly through the felting member so that the fibres are recovered from the suspension and deposited on the said member. There is thus produced a felt 23 that is more nearly shot-free and more coherent and uniform in texture than the felts commonly formed by allowing mineral wool fibres, already agglomerated into large clusters, to fall to the bottom of a settling chamber. Also, the fibres in the felt made by me are predominantly oriented in direction generally parallel to a longer dimension (length or width of the felt) and transverse to the direction of the shortest dimension or thickness of the felt. For this reason, the felt is particularly strong.

The felting member 22 described may be a woven wire screen or other permeable member. I have used to advanatage perforated sheet metal provided with closely spaced holes, as, for instance, holes of $\frac{1}{16}$ inch diameter on about $\frac{1}{4}$ inch centers. As illustrated, the member may be approximately cylindrical. This shape of felting member makes unnecessary sharp bending or change of angle of curvature of the felt 23 thereon, previous to the separation of the felt from the said member.

There is shown a trap or receptacle for the separated and washed shot-like particles. This trap has front and rear walls 24 and 25, respectively, that, preferably, are either approximately parallel or parts of a tube. Furthermore, the rear wall is so disposed with respect to the trajectories of shot-like particles 26 that the particles are deflected downwardly into the trap.

To supplement the washing previously given to the separated shot, an additional stream of washing gas such as air, may be admitted through inlet 27. This additional gas rises through the shot trap, under the influence either of the suction 21 or of a blower (not shown), and insures satisfactory elimination of fibrous material from the particles of shot. At intervals or continuously, the shot may be removed from the lower part of the trap, as, for instance, through the sliding door 28.

The apparatus described may be operated under varying conditions. Thus, there may be used, in the part 21, suction of varying force, depending in part upon the thickness of felt 23 that is being formed on the drum. I have used suction corresponding, for instance, to 10 to 20 inches of water, as measured by a column of water exposed on one side to atmospheric pressure and, on the other side, to the reduced pressure maintained behind the felting screen.

The felting member is rotated slowly in the direction of the arrow, that is, in clockwise direction as viewed in Fig. 1. A suitable speed is 1 revolution per minute. A suitable radius of the cylindrical felting member is 2½ feet. The felting member is supported upon suitable rollers 37 and driven through suitable gearing by any suitable prime mover such as an electric motor.

Means such as the baffles 29 and 30 restrict the application of suction to the portion of the felting member exposed to the stream of suspended fibres in the arc 31.

To seal this portion of the arc, so as to minimise entrance of outside air, the blowing tube at its upper side may extend tangentially of the felt on the felting member, as at position 32, sealing at this position being provided by the plate 33 hinged at 34 and suitably pressed lightly against the felt, as by the spring 35. To seal against excessive admittance of air at the lower part of the arc 31, the wall 25 of the shot trap terminates at its upper edge in a plane approximately tangent to the felting member 22. A flexible gasket 36 may be secured to the top of the trap so as to be drawn by the vacuum in the part 21 closely against the felting member.

The felt 23 is lifted from the felting member, as at position 38.

The resulting felt may be used in the form separated from the drum or composited with other layers of felt, as may be desired.

It will be understood, also, that air ordinarily constitutes the major part of the suspending gas in the blowing tube.

The details given are for the purpose of illustration, not restriction. It is intended, therefore, that variations within the spirit of the invention are to be included in the scope of the appended claims. While the invention has been illustrated by deflection upwardly of the stream of suspended material to be felted and while particularly favorable results are so obtained, for some purposes the deflection may be in another direction, as, for instance, laterally; in that case the auxiliary stream of gas is introduced laterally. Also, it will be understood that conventional binders may be associated with the fibres, in a conventional manner.

What I claim is:

1. In making mineral wool, the method which comprises blowing a suitable molten material largely into fibres and, to a lesser extent, into unfiberized particles, the fibres and particles being thus suspended in a stream of gas, deflecting the stream of gas and fibres suspended therein, to separate fibres largely from the said particles, introducing into the said stream, adjacent to the zone of deflection and on the convex side thereof, an auxiliary stream of gas adapted to wash the said particles separated by the said deflection and to increase the rate of movement of gas therebeyond, the auxiliary stream of gas being introduced at a plurality of positions, each extending approximately across the entire primary stream of gas and being spaced from each other, in the general direction of movement of the primary stream, so that the washing of the separated particles and the increasing of the rate of gas movement is made progressive and the said particles are given repeated washing with gas, and then recovering the fibres from the deflected stream.

2. In an apparatus for making mineral wool, means for blowing a suitable molten material largely into fibres and, to a lesser proportion, into shot-like particles and suspending thus the fibres and particles in a stream of gas, means for forming the suspension into a band, means for deflecting the band flatwise, to separate shot therefrom, means for continuously washing the deflected shot, and means for recovering fibres from the deflected band.

3. In an apparatus for making mineral wool, means for blowing a suitable molten material into fibres and, unfiberized particles and suspending the fibres and particles in a stream of gas, suction means for deflecting the stream including the suspended fibres, a trap for the reception of the unfiberized particles separated by deflection of the stream and disposed at a position to the rear of the zone of the said deflection, the entrance to the trap being in the line of the trajectories of the separated particles, and the rear wall of the trap being positioned so as to deflect the particles into the trap, and means for recovering the fibres from the deflected stream.

4. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, progressively increasing the cross-sectional area of the stream horizontally and in the direction of movement of the stream to decrease the velocity of the fibres and to induce separation of the unfiberized particles therefrom, and recovering the fibres from the gaseous medium.

5. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the particles therefrom, applying suction to the stream to change the direction of movement of the fibres to a greater extent than the direction of movement of the particles and thereby producing further separation of the fibres and particles, directing the heavier particles away from the fibres, and recovering the fibres from the gaseous medium.

6. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the particles therefrom, applying suction to the stream to change the direction of movement of the fibres to a greater extent than the direction of movement of the particles and thereby producing further separation of the fibres and particles, and recovering the fibres from the gaseous medium.

7. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the said particles therefrom, changing the direction of movement of the fibres to a greater extent than the direction of movement of the particles by deflecting the moving gaseous medium and thereby producing further separation of the fibres and particles, directing the heavier particles away from the fibres, passing a gaseous stream counter-current to the particles to wash entangled fibres therefrom and return the washed fibres to the suspended fibres, and recovering the fibres from the gaseous medium.

8. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the said particles therefrom, applying suction to the stream to change the direction of movement of the fibres to a greater extent than the direction of movement of the particles and thereby producing further separation of the fibres and particles, directing the particles away from the fibres, and recovering the fibres on a foraminous surface with the aid of suction applied therethrough.

9. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the said particles therefrom, changing the direction of movement of the fibres to a greater extent than the direction of movement of the particles by deflecting the moving gaseous medium and thereby producing further separation of the fibres and particles, directing the particles away from the fibres, passing a gaseous stream counter-current to the particles to wash entangled fibres therefrom and return the washed fibres to the suspended fibres, and recovering the fibres on a foraminous surface with the aid of suction applied therethrough.

10. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, applying suction to the stream to change the direction of movement of the fibres to a greater extent than the direction of movement of the said particles and thereby producing separation of the fibres and particles, directing the particles away from the fibres, and recovering the fibres on a foraminous surface with the aid of suction applied therethrough.

11. A method of making mineral wool comprising projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, confining the moving gaseous medium to a definite cross-sectional area, changing the direction of movement of the fibres to a greater extent than the direction of movement of the particles by deflecting the moving gaseous medium and thereby producing further separation of the fibres and particles, directing the heavier particles away from the fibres, passing a gaseous stream counter-current to the particles to wash entangled fibres therefrom and return the washed fibres to the sus-

pended fibres, and recovering the fibres on a foraminous surface with the aid of suction applied therethrough.

12. An apparatus for making mineral wool comprising means for treating molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, means for confining said gaseous medium and suspended substances to a definite cross-sectional area which progressively increases in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and particles, means for changing the direction of movement of the gaseous medium to cause further separation of the fibres and particles, means for deflecting the particles away from the fibres, means for directing a stream of gas counter-current to the particles to wash entangled fibres therefrom and return the washed fibres to the suspended fibres, and means for recovering the suspended fibres.

13. An apparatus for making mineral wool comprising means for treating molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, means for confining said gaseous medium and suspended substances to a definite cross-sectional area which progressively increases horizontally and in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and said particles, and means for recovering the suspended fibres.

14. An apparatus for making mineral wool comprising means for treating molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, means for confining said gaseous medium and suspended substances to a definite cross-sectional area which progressively increases horizontally and in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and said particles, means for deflecting the particles away from the fibres, and means for recovering the suspended fibres.

15. An apparatus for making mineral wool comprising means for treating molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, means for confining said gaseous medium and suspended substances to a definite cross-sectional area which progressively increases in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and said particles, suction means for changing the direction of movement of the gaseous medium to cause further separation of the fibres and particles, and means for recovering the suspended fibres.

16. An apparatus for making mineral wool comprising means for treating molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, means for confining said gaseous medium and suspended substances to a definite cross-sectional area which progressively increases in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and said particles, means for changing the direction of movement of the gaseous medium to cause further separation of the fibres and particles, means for deflecting the particles away from the fibres, means for directing a stream of gas counter-current to the particles to wash entangled fibres therefrom and return the washed fibres to the suspended fibres, a foraminous member positioned in the path of the suspended fibres, and suction means for drawing the fibres upon the foraminous member.

17. An apparatus for making mineral wool comprising means for projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, a tube for receiving said suspension, said tube progressively increasing in cross-sectional area horizontally and in the direction of movement of the suspension, a fibre felting member positioned at the end of said tube remote from the jet, and a trap for the reception of the said particles in communication with said tube.

18. An apparatus for making mineral wool comprising means for projecting a fluid jet against molten material to form fibres and unfiberized particles suspended in a moving gaseous medium, a tube for receiving said suspension, said tube progressively increasing in cross-sectional area horizontally and in the direction of movement of the suspension, and a fibre felting member positioned at the end of said tube remote from the jet.

19. The method of producing mineral wool comprising forming fibres and unfiberized particles from heat liquefied raw material and suspending the fibres and particles in a moving gaseous stream, confining the moving stream to a definite cross-sectional area, increasing the cross-sectional area in the direction of movement of the stream to decrease the velocity of the fibres and induce separation of the particles therefrom, directing additional gas into the stream to increase the velocity thereof and draw the fibres away from the unfiberized particles, and recovering the fibres from the stream.

20. An apparatus for producing mineral wool comprising means for treating molten materials to form fibres and unfiberized particles suspended in a moving gaseous stream, means for confining said stream to a definite cross-sectional area which progressively increases in the direction of movement of the suspension, to thereby decrease the velocity of the fibres and induce separation of the fibres and said particles, means for directing additional gas into the stream to increase the velocity thereof and further separate the fibres from the particles, and means for collecting the fibres from the stream.

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