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APPARATUS AND METHOD FOR MAKING MINERAL WOOL

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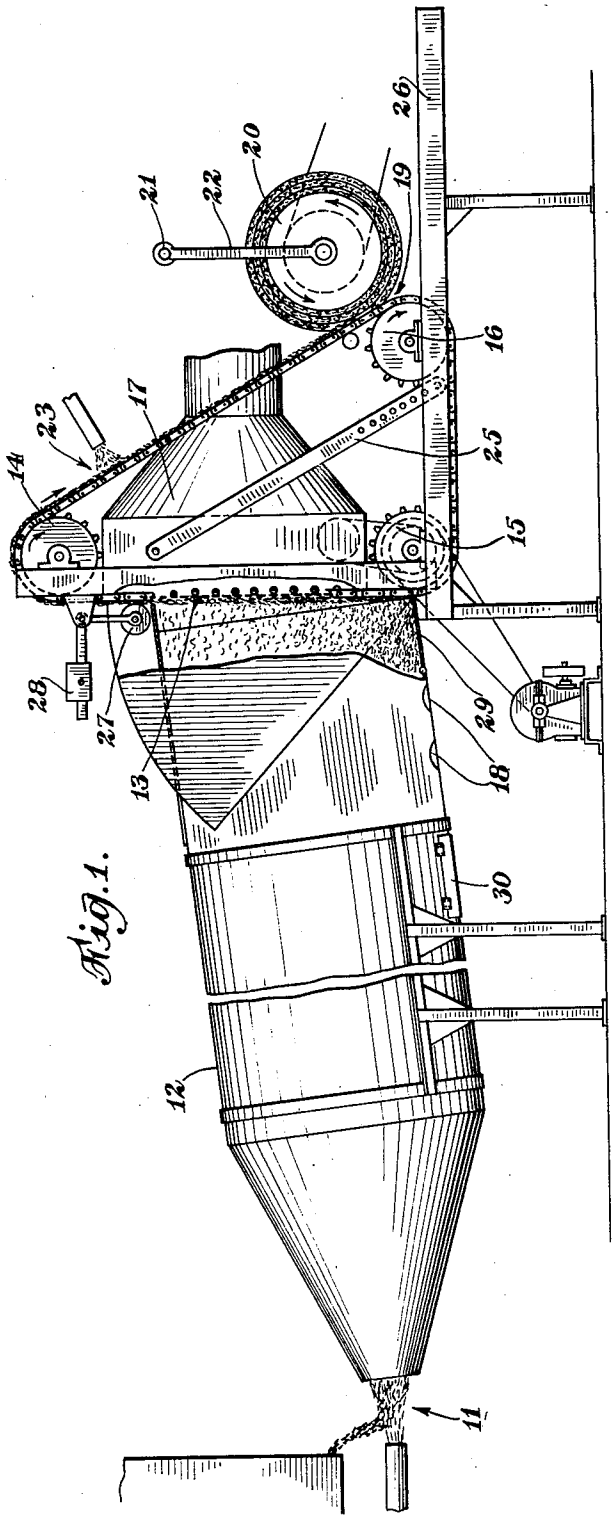


Fig. 1.

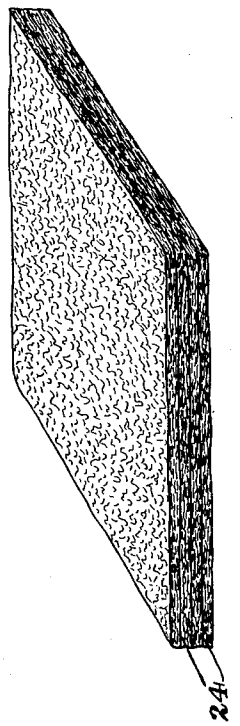


Fig. 2.

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APPARATUS AND METHOD FOR MAKING MINERAL WOOL

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7 Claims. (Cl. 154—27)

This invention relates to a mineral wool product and the apparatus and method for making the same.

In the manufacture of mineral wool, it is conventional to provide a suitable slag, rock or other composition in molten condition and to form the molten material into fibres, by allowing the molten material, in the form of a small stream, to fall into a high speed stream of steam. The result is a suspension of the fibres in a gaseous medium that is largely air. This suspension is received in a settling chamber. The fibres are there allowed to settle as, for instance, onto a conveyor screen closing the bottom of the chamber and moving slowly in direction away from the end of the chamber into which the suspension is first introduced.

An objection to this operation and the product resulting therefrom is the fact that granular or incompletely fiberized material, known as "shot", settles along with the fibres. Furthermore, the fibres, while still suspended, agglomerate to a large extent into clusters that are inherently weak and that become bonded in the finished felt, chiefly over the exterior only of the weak clusters. The result is a non-uniform poorly coherent felt.

It is an object of the present invention to form a more uniform and coherent felt of mineral wool fibres than previously made from a chemically comparable composition. Another object is to form a felt comprising mineral wool fibres predominantly oriented in direction generally parallel to the face of the felt and individually felted. Other objects and advantages will appear from the detailed description that follows.

The invention comprises the novel features of apparatus, method and product hereinafter described or illustrated and, particularly, the means and method for and product resulting from felting mineral wool fibres suspended predominantly in individualized, spaced relationship to each other upon a gas-permeable felting member, such as a screen, provided with suction means disposed therebehind.

The invention is illustrated in the attached drawing and will be described in connection therewith.

Fig. 1 is a side elevational view, partly broken away for clearness of illustration and partly diagrammatic, of a preferred embodiment of the invention.

Fig. 2 is a perspective view of our improved product.

There are shown means indicated generally at 11 for forming fibres of mineral wool from a suitable molten material and suspending the fibres in a gaseous medium within the chamber 12.

The chamber 12 may be approximately circular in cross section and may extend for a substantial distance in a generally horizontal direction, as, for example, at the illustrated slight inclination upward, in direction away from the position of forming of the fibres.

Exposed to the suspension in the chamber, say, extending across the chamber or a portion thereof, at the end remote from the position of forming of the fibres, is the gas-permeable felting member 13, such as a screen suitably supported and driven over sprockets 14, 15, and 16. The chamber 12 serves as a conduit to conduct fibres from the fiberizing means to the felting means.

Disposed behind the member 13 are means, such as a funnel-shaped vent 17 connected to a suction fan (not shown) for drawing the gaseous suspension of the fibres through the chamber, forming a felt of the fibres upon the member 13 and exhausting, through the resulting felt, gas from the said suspension.

Under the influence of the strong suction used, say, equal to 5 inches of water in vent 17, the dilute suspension of the fibres in a very large volume of gas is drawn at high speed and in a generally horizontal direction, preferably in substantially non-sinuous manner, through the chamber in direction towards the felting member 13. The fibres remain predominantly in individualized spaced relationship to each other. They are caused to strike the felting member before they become associated to an important extent into large weak clusters and are caused thus to be individually interlocked (seated) in the felt. Under the influence of the suction and of fibres subsequently deposited, individual fibres, once they are seated, are caused to lie predominantly in direction generally parallel to the plane of the face of the felt. The result is a relatively smooth textured, coherent felt having the fibres extending chiefly transversely to the direction of heat flow from face to back of the felt when used as thermal insulation.

While the individualized buoyant fibres in suspension are being drawn rapidly through the chamber to the right, there is settling of unfiberized particles, such as the "shot", mentioned above, as well as of some fibrous clusters that may have been formed in spite of precautions to the contrary. Such material may be removed from the system by means of a door 29.

To improve separation of the suspended fibres from settled material, the component of velocity of the suspension in a horizontal direction should be greater than the component of velocity downward, this downward velocity being due primarily to the force of gravity or to turbulence of the gas suspension.

To minimize, further, settlement of desired fibrous material while permitting the settling out of the shot and heavier materials, there may be admitted a stream or a plurality of streams of secondary or washing gas, as through the ports 18 disposed adjacent to the bottom of the chamber 12. The gas, such as air drawn through these entrances, under the influence of the suction applied through the means 17, passes inwardly and somewhat upwardly against the stream of material settling in the chamber, thus buoying up the light fibres while permitting settling of the heavier materials. The effect is washing away, from settling material, of fibres that may be dislodged easily, with consequent increase in amount of the total fiberized material that is obtained in the form of a felt without recycling. Thus the only material collecting on the felting member is the light, fibrous material comparatively free of the less desirable portions formed during the fiberization of the molten mineral material.

The felting member 13 may be moved at a selected speed. Other conditions being equal, the slower the speed of movement of the said member across the end of the chamber the thicker is the felt formed. We prefer to move the member slowly across the chamber and to form a felt of thickness of the order, say, of a quarter to one inch.

Felts so formed may be plied together to give a composite product of any thickness desired. Thus, the felt may be removed from the felting member or screen, as at position 19, and wrapped upon itself, as around the rotated mandrel 20. The mandrel in turn may be pivotally supported at 21 by means of a bracket 22 that extends downwardly in direction somewhat away from the vertical, so that gravity holds the mandrel 20 lightly against the felt that is being wound spirally therearound.

A light coating of an adhesive, such as a solution of prevulcanized rubber, latex, an oxidizing oil, a resin, and/or asphalt may be applied in a suitable manner, as by spraying at position 23. The adhesive, if used in this manner, forms a thin superficial coating over the felt and adheres together the several plies in the composited product, as illustrated at 24, Fig. 2.

For most purposes, it is desirable to provide thoroughly incorporated binder in small proportion, as, for, for example, by spraying a limited amount of an asphaltic, rubber, oxidizing oil, resin or other conventional binding material into the suspension of fibres near the position of the formation of the said fibres. Thus, a solution of the selected binder in a volatile solvent may be allowed to fall as a small stream into the steam jet at 11, preferably prior to impingement against the molten stream.

While various spacings, arrangements, and dimensions may be used, the distance between the position of initial forming of the fibres, as at 11, and that of felting upon the gas-permeable member 13 should be much greater, as measured in a horizontal direction, than the distance of the position 11, of formation of the fibres above the bottom of the chamber 12. In other words, the difference in level between position 11 and the lowermost position of exposure of the felting member in the chamber is very small, so that the fibres that strike the felting member are moving predominantly under the influence of the suction rather than settling under the influence of gravity. The result is a classification or separation of the individualized fibres from the undesired heavy particles or aggregations that collect on the bottom of the chamber, the felted fibres being moved continuously away from the bottom of the chamber. We have used to advantage such an inclination of the felting screen that it extends approximately vertically and approximately at a right angle to the general direction of movement of the suspension through the chamber, particularly at the end of the chamber, that is, at the position immediately preceding the felting zone.

The inclination of the screen is adjustable, as by the setting of the supporting arm 25 with respect to the frame member 26.

As sealing means for minimizing the entrance of air between the top of the chamber and the felt moving thereby, there may be used the roller 27. This roller may be forced lightly against the felt, as by the weight 28, so that the roller exerts a gentle smoothing effect upon the felt. Although air is substantially excluded from entering between the top of the chamber and the felt, it is not prevented from entering between the bottom of the chamber and the felting member. Air which so enters at the bottom of the chamber serves to buoy up the light fibres while permitting separation of the heavier particles.

A door 30 provides access to the interior of the chamber for inspection and occasional cleaning.

The binders that are preferred for introduction at position 11 are soft when warm and adapted to be hardened on cooling, as is the case with such binders as the asphalt that has been mentioned and the common resins, such as rosin. When such binders are used, then the large volume of air drawn through the chamber by the suction causes quick cooling and setting of the binder as well as the production of a felt that may be handled directly after removal from the chamber. On the other hand, excellent results have also been obtained with binders requiring some additional heat treatment such as rubber, oxidizing oils, and convertible resins. An oxidizing (drying oil) such, for example, as linseed and perilla oil, functions especially well in this process, possibly because of the thorough aeration to which the felt is subjected on the felting screen. We have used to advantage about 2 to 4 parts of boiled linseed oil to 100 parts of the rock wool.

It will be understood that the details given are for the purpose of illustration, not restriction, and that variations within the spirit of the invention are intended to be included within the scope of the appended claims.

What we claim is:

1. In an apparatus for forming and felting mineral wool fibres, means for converting a suitable molten material into fibres and suspending the fibres in a gaseous medium, a generally horizontally extendng chamber positioned to receive the resulting suspension, a gas-permeable conveyor member exposed in the said chamber at the end thereof remote from the position of shredding the molten material, means for felting fibres from the

suspension upon the said member and drawing therethrough gas from the said suspension, and means for admitting additional gas through the lower portion of the said chamber to provide gas-washing of fibrous material tending to settle in the said chamber.

2. In making a felt of mineral wool fibres, the method which comprises forming a suspension of the fibres in a gas, drawing the suspension substantially horizontally and at a relatively high velocity through a substantially horizontally extending chamber, drawing additional gas into the said chamber at the lower portion thereof so as to provide gas-washing of material settling in the chamber, forming a mixture of the said additional gas with the said suspension, and felting the fibres from the said mixture on a gas-permeable felting member.

3. An apparatus for producing mineral wool, comprising means for forming fibres from heat liquified raw material and for suspending the fibres in a moving gaseous stream, a chamber for confining and directing the moving stream, openings in the sides of the chamber for admitting additional gas to promote suspension of the fibres, and a foraminous felting member disposed transversely of the direction of movement of the stream of suspended fibres.

4. An apparatus for producing mineral wool comprising means for forming fibres from heat liquified raw material and for suspending the fibres in a moving gaseous stream, a chamber for confining and directing the moving stream, openings in the bottom of the chamber for admitting additional gas to promote suspension of the fibres, and a foraminous felting member disposed transversely of the direction of movement of the stream of suspended fibres.

5. An apparatus for producing mineral wool comprising means for forming fibres and unfiberized particles from heat liquified raw material and for suspending the fibres and said particles in a moving gaseous stream, an elongated chamber for confining and directing the moving stream, the vertical and longitudinal dimensions of said chamber being of sufficient magnitude to enable the particles to settle away from the more buoyant fibres, means for supplying additional gas to said chamber in a direction to separate fibres from the settling solid particles, and a foraminous felting member disposed transversely of the direction of movement of said stream.

6. An apparatus for producing mineral wool comprising means for forming fibres and unfiberized particles from heat liquified raw material and for suspending the fibres and said particles in a moving gaseous stream, an elongated chamber for confining and directing the moving stream, the vertical and longitudinal dimensions of said chamber being of sufficient magnitude to enable the particles to settle away from the more buoyant fibres, means for supplying additional gas to said chamber in a direction to separate fibres from the settling particles, a foraminous felting member disposed transversely of the direction of movement of said stream, and means for drawing gas from the suspension through said foraminous member and causing felting of fibres thereupon.

7. The method of producing mineral wool comprising forming discrete fibres and unfiberized particles from heat liquified raw material and suspending the fibres and said particles in a moving gaseous stream, confining said stream to a definite cross sectional area and directing its movement for a sufficient distance to enable the particles to settle away from the more buoyant fibres, directing additional gas against the settling particles to wash away entangled fibres and promote suspension of the fibres, and collecting the fibres on a foraminous member with the aid of suction applied behind said member.

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