May 10, 1938. E. R. POWELL 2,116,663

METHOD AND MEANS FOR SHAPING FELTS OF FRANGIBLE FIBERS

Filed April 7, 1934 2 Sheets-Sheet 1

Fig. 1.

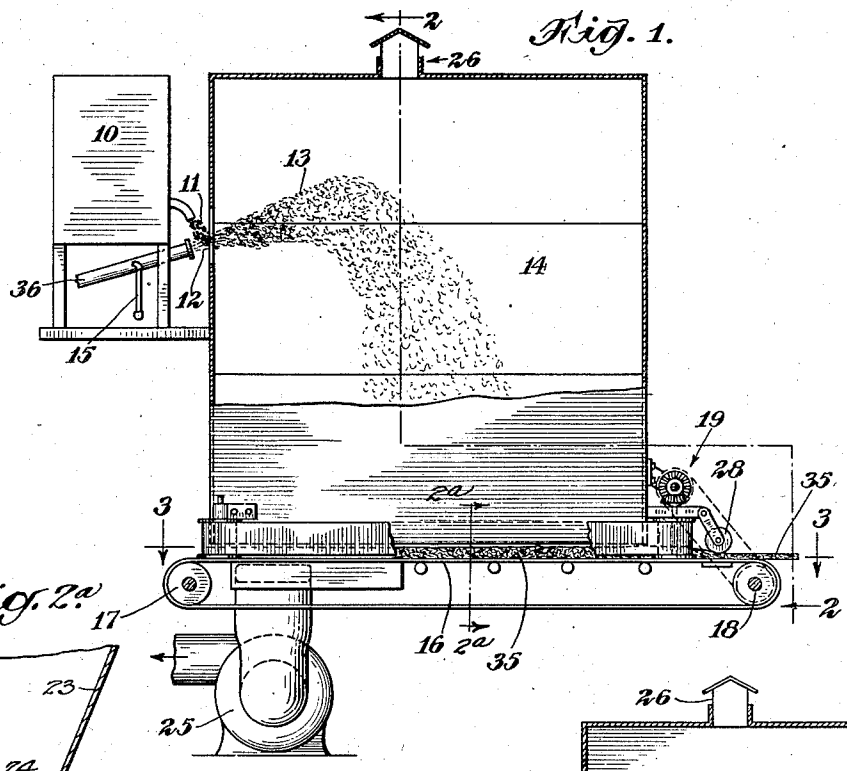


Fig. 2a

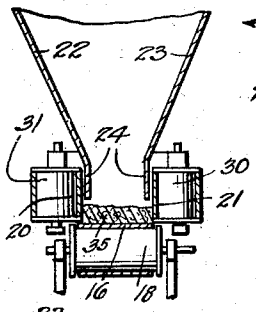


Fig. 2

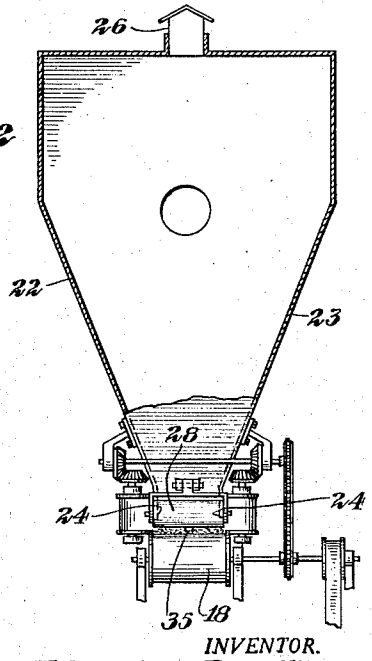


Fig. 3.

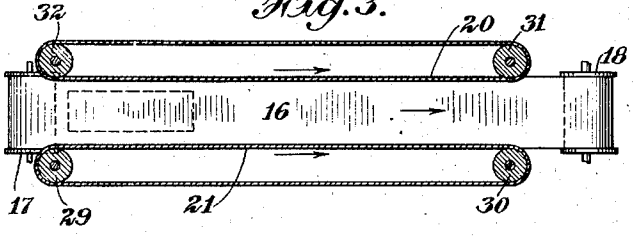
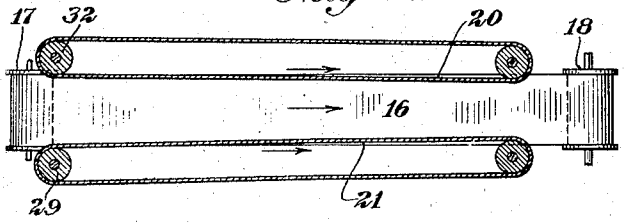


Fig. 4.



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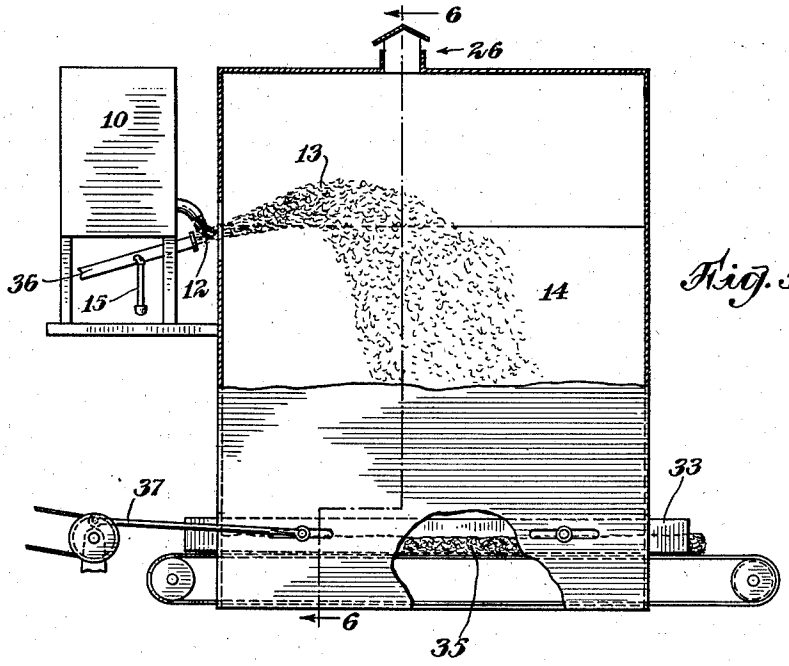


Fig. 5.

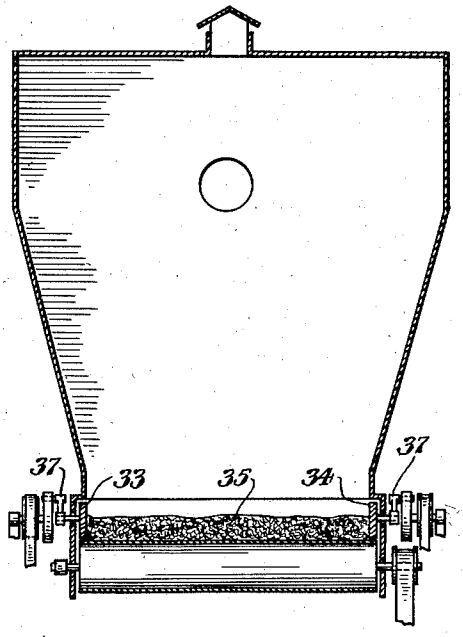


Fig. 6.

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UNITED STATES PATENT OFFICE

2,116,663

METHOD AND MEANS FOR SHAPING FELTS OF FRANGIBLE FIBERS

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Application April 7, 1934, Serial No. 719,478

8 Claims. (Cl. 19—156)

This invention relates to a method and means for shaping felts of frangible fibers of the type of mineral wool and is a continuation, in part, of my U. S. Patent 1,864,317.

In forming a felt of mineral wool, it is customary to melt a suitable slag, rock, or other selected material, allow the molten material to fall in a small stream into a blast of steam, introduce the thus formed suspension of fibers in the gaseous mixture of steam and air into a settling chamber, and permit settling of the fibers therein, to form a felt upon the bottom of the chamber. There has been described also the use, as the bottom member of the settling chamber, of a conveyor of gauze or the like upon which the felt forms; such a conveyor discharges the felt continuously from the chamber. Likewise, there has been known the use of various binder materials, to coat the suspended fibers of mineral wool and to settle therewith as an ingredient of the felt.

In preparing aeriformed felts of frangible fibers of the type of mineral wool, there has been difficulty heretofore in truing (shaping) and maintaining the established shape of the side edge portions of the felt. Since these fibers are fragile as compared to animal fibers and since the felt, as formed, contacts at its edges with members which limit the width of the felt, say, with the sides of the bottom portion of the settling chamber, the removal of the felt from this settling chamber, as by conveying the felt through the chamber, has been found to result in tearing and injury to the edges of the felt.

It is an object of the present invention to provide means and a method of forming a felt, of this type, in a settling chamber and removing it therefrom, without tearing or distortion of the edges of the felt by friction against the sides of the equipment in which the felt is formed. A further object is to form a felt comprising frangible fibers and a selected proportion of binder, deposited thereover, adapted to be yieldable when warm and relatively stiff when cold, shape the edge portions of felt while the binder therein is in yieldable condition, remove the felt with shaped edges from the settling chamber, and allow the felt to cool, whereby the binder is stiffened and the established shape of the edge portion made substantially permanent. Another object of the invention is to provide a settling chamber having walls adapted to facilitate proper distribution of the fibers over the selected area of the bottom member of the settling chamber, with minimized falling of the fibers from the walls in the form of large clusters.

Other objects and advantages will appear from the detailed description that follows.

An embodiment of the invention that is preferred at this time is illustrated in the drawings, in which

Fig. 1 is a side elevational view, partly diagrammatic, of an apparatus suitable for use in accordance with the present invention;

Fig. 2 is a cross sectional view on the broken line 2—2 of Fig. 1;

Fig. 2*a* is a cross sectional view on line 2*a*—2*a* of Fig. 1;

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

Fig. 4 is a similar sectional plan view of a modification of the invention;

Fig. 5 is a view, similar to that of Fig. 1, of a modification of the invention; and

Fig. 6 is a cross sectional view on line 6—6 of Fig. 5.

In the various figures, like reference characters denote like parts.

There are shown a furnace 10 for melting argillaceous limestone or other suitable material for forming mineral wool fibers, the discharge of the molten material, as a small stream 11, and the blast 12 which shreds the stream of molten material into fibers and carries it, as the aeriform suspension 13, into the settling chamber 14.

The blast 12 suitably includes a mixture of steam, supplied by the pipe 36, and a binder of the type of a solution of rosin or a hard asphalt, in heat or solvent softened condition, supplied through the inlet pipe 15, to the steam line 36.

As the fibers settle from the aeriform suspension, they strike the bottom or bottom closing member 16 of the settling chamber which, advantageously, is in the form of a conveyor that is gas-permeable. For this conveyor, I have used to advantage an endless belt, consisting of a gauze of metal, driven over the pulleys 17 and 18, by driving means indicated generally by 19.

The material settling upon the conveyor 16 is confined between upstanding edge-shaping members 20 and 21 contacting, respectively, with the two side edges of the felt, positioning the fibers therein, as the felt forms, and limiting the width of the felt. These side elements 20 and 21 may be endless belt conveyors moving over the end rollers 31, 32, and 29, 30 respectively. In the portion in contact with the felt, these edge conveyors move in the same direction as the upper part of the bottom conveyor 16, that is, in the direction of dis-

charge of the felt from the settling chamber. I have used to advantage a combination in which these three endless belts move at approximately the same speed, the driving means 19 moving all the elements 16, 20, and 21.

The settling chamber has side walls 22 and 23 that are sloped and that direct fibers settling thereupon to the conveyor 16. It has been found that, for best operating results, the lower portions of these side walls of the settling chamber should be inclined from the horizontal at an angle greater than 55°, suitably of the order of 60 to 72°. With such an inclination, there is eliminated the tendency of the fibers to hang upon the side walls or to fall therefrom in large bunches or clusters, these being difficulties experienced when the side walls are inclined less steeply than at the critical angle stated. At the same time, the felt is caused to be of substantially even thickness from side to side.

To act jointly with the remainder of the apparatus in providing satisfactory distribution of the settling fibers across the belt, while avoiding deposition of fibers in excessive amount near the edge portions of the conveyor 16, the side walls preferably overhang the edges of the said conveyor, as indicated at 24, in Fig. 2 and, particularly, in Fig. 2*a*. With such an overhang, the edges of the felt are disposed well inside the edge of the conveyor 16, that is, at some position between the edge and the central portion of the conveyor, and fibers falling from the walls do not accumulate at the extreme edge portions of the conveyor.

The side walls of the settling chamber may define between them an irregular sinuous channel, say, a zigzag path extending over the conveyor belt, from side to side, and, in general, in the direction of travel of the conveyor, as described in my said patent.

In forming a felt of satisfactory nature, with the equipment described, there may be utilized also the joint effect of the exhauster 25, say, a suction blower, which removes gases from the bottom of the settling chamber, at a position adjacent to the end thereof into which the suspension of the fibers in the gas mixture is first blown, and through the gas-permeable member 16. With such a position of the exhauster, there is a tendency, it is believed, for the gases entering the chamber to be deflected downward in the first part of the chamber, thus causing partial separation, at the inlet portion of the chamber, of gas which, otherwise, might cause increased turbulence in other parts of the chamber, with disturbing effect upon the uniformity of settling of fibers therein.

It will be understood that gases may also escape from the chamber through the vent or ventilator 26 located at the top of the chamber.

The idler roller 28 serves to slightly compress the felt 35.

In the modification shown in Fig. 4, the side conveyors or edge-shaping members, contacting with the edges of the felt, converge in the direction of movement of the conveyor 16.

In the modification shown in Figs. 5 and 6, the edge-shaping members move with respect to the side walls of the settling chamber, as is the case with the embodiment previously described, but, in the present modification, move in opposite directions, in reciprocating manner, to give a smoothing effect to the edges of the felt, as the felt is being formed. These edge-shaping members 33 and 34 are suitably metal plates which are sufficiently stiff to retain their preestablished alignment and are moved relatively rapidly, to and fro, by an eccentrically mounted driving rod 37 or by other suitable means. The idler roll and driving means for the conveyor 16 may be constituted as illustrated in Fig. 1.

The operation of the apparatus will be described, first, in connection with the embodiments illustrated in Figs. 1–4.

As the fibers settle from the aeriform suspension 13, they fall, in part, directly upon the bottom member 16 and partly upon the side walls 22 and 23 of the settling chamber, from which walls the fibers are directed to the conveyor 16. Because of the overhang of the lower edges of the said walls, inside the edges of the conveyor 16, the fibers falling upon the said conveyor are confined between the side conveyors 20 and 21. The side conveyors not only establish the width of the felt, but also shape the edges of the felt; a fiber that, as it falls, might otherwise extend outwardly, beyond the desired edge, is turned backwardly or oriented by the element 20 or 21 and is quickly interlocked in its thus established position by other fibers deposited subsequently thereupon. These said other fibers, also, are likewise oriented or placed so that the edge of the felt is shaped continuously and the fibers therein interlocked with each other, as the felt is being built up.

At the same time, the conveyor 16 and the elements 20 and 21, in the portions in contact with the felt, move, at the same speed, for example, towards the position of discharge of the felt from the settling chamber, whereby the felt is delivered from the chamber without substantial friction or tearing of the edge portions of the felt. This result is to be distinguished clearly from felts made in the conventional way in which the edge of the felt, as it is moved through the felting chamber, are dragged against the stationary sides of the heretofore known type of settling chamber.

In the modification shown in Fig. 4, the conveyor 16 transports the felt between the edge-shaping members 20 and 21 which, in this instance, being convergent in the direction of movement of the conveyor 16, give to the felt a moderate compression in an edgewise manner. This serves to further interlock the fibers and strengthen the edge portions of the felt.

If the form of the apparatus shown in Figs. 5 and 6 is used, the operation is the same, the reciprocating plates 33 and 34 replacing the side or edge-shaping belts 20 and 21.

Finally, the felt is moderately compressed by the idler roller 28 which rides upon the felt at a position adjacent to the point of discharge of the felt from the settling chamber.

The operations that have been described are performed while the fibers and binder thereon are warm. Under such conditions, the binder is yieldable and does not offer great resistance to the shaping of the edge portions. After the felt is removed from the settling chamber, it is allowed to cool to atmospheric temperature, during which cooling the binder becomes stiff and assists in maintaining substantially permanently the established shape of the edge portions of the felt.

It will be understood, also, that the details given are for the purpose of illustration, not restriction, and that variations may be made therefrom within the scope of the appended claims.

What I claim is:

1. In forming a felt of frangible fibers of the type of mineral wool, the method which comprises forming an aeriform suspension of the fibers, settling the fibers therefrom into a felt upon a bottom element and between edge-shaping members, moving the said members, in reciprocating manner, as the felt is being formed, thereby shaping the edge portions of the felt, depositing additional fibers upon the thus shaped edge portions, to interlock the fibers therein in previously established position, and removing the resulting felt from said element, with preservation of the shaped edge portions of the felt.

2. Apparatus for forming a felt of frangible fibers of the type of mineral wool comprising means for forming an aeriform suspension of the fibers, means for introducing the suspension into a settling chamber, conveyor means constituting the bottom member of the settling chamber and adapted to receive fibers settled as a felt thereon and to transport the felt through and finally out of the chamber, means including upstanding elements moving in reciprocating manner with respect to the conveyor means for shaping the edges of the felt continuously as the felt is formed and for minimizing tearing of the side edges of the felt, as the felt is conveyed through the chamber.

3. An apparatus for forming a felt of frangible fibers of the type of mineral wool comprising, in combination, means for forming an aeriform suspension of the fibers to be settled, means for introducing the suspension into a settling chamber, a bottom member of the settling chamber adapted to receive the settled fibers and to convey them therefrom, and shaping members adapted to shape the two edges of the felt, the said shaping members including each an upstanding reciprocating element providing a smoothing action upon the edges of the felt.

4. In forming a felt of frangible fibers of the type of mineral wool, the method which comprises introducing the fibers into a settling chamber, in the form of a suspension in a large volume of a gas, depositing the fibers in the form of a felt on a conveyor, continuously advancing the conveyor and the felt and contacting the edges of said felt with reciprocating members to shape the felt.

5. The method of forming a felted body of fibers comprising forming a mass of fibers from heat liquified material, depositing said fibers in a felted body upon a conveyer and continuously advancing said conveyer and deposited body of fibers, contacting the side edges of the felted body with moving surfaces during advance of the body to confine the side edges and thereby shape the body while the fibers are substantially above normal temperature but without tearing of the body, and applying pressure to a face of said felted fibers before they reach normal temperature for compressing them into a finished felted body.

6. The method of forming a felted body of fibers comprising forming a mass of fibers from heat liquified material, depositing said fibers in a felted body upon a conveyor and continuously advancing said conveyor and deposited body of fibers, contacting the side edges of the felted body with moving, converging surfaces during advance of the body to confine and compress the side edges and thereby shape the body while the fibers are substantially above normal temperature but without tearing of the body, and applying pressure to a face of said felted fibers before they reach normal temperature for compressing them into a finished felted body.

7. An apparatus for forming felted fibrous bodies comprising a device for forming discrete fibers from heat liquified mineral matter, a travelling conveyor for receiving and advancing said fibers, means movable substantially longitudinally of the conveyer for compressing and confining a side edge of the body of fibers on said conveyor without tearing said body, and means for compressing said fibrous body in the direction of its thickness.

8. In forming a felt of frangible fibers of the type of mineral wool, the method which comprises introducing into a settling chamber a suspension of the fibers in a large volume of a gas, causing a large part of the fibers to travel in a relatively smooth path and to settle on a gas permeable member forming the bottom of the said chamber predominantly at a position remote from the part of the chamber into which the said suspension is first introduced, and withdrawing a large proportion of the said gas from the chamber through the said member at a position adjacent to the said part of the chamber, thereby causing said large proportion of the gas to take a path through the chamber which turns more sharply than the path of the fibers so as to separate the gas from the fibers.

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