April 4, 1950 E. R. POWELL 2,503,067

METHOD FOR FORMING MINERAL WOOL PRODUCTS

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Fig. 3.

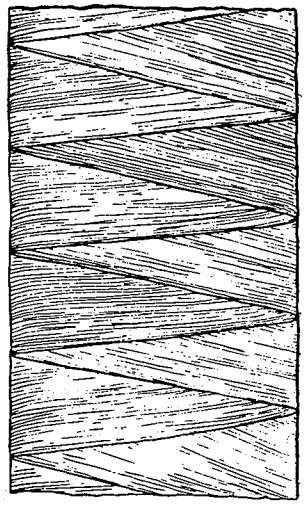


Fig. 2.

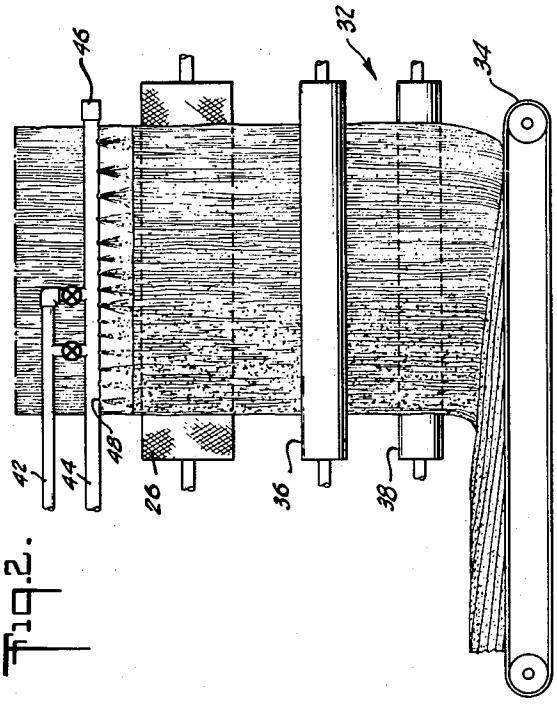


Fig. 1.

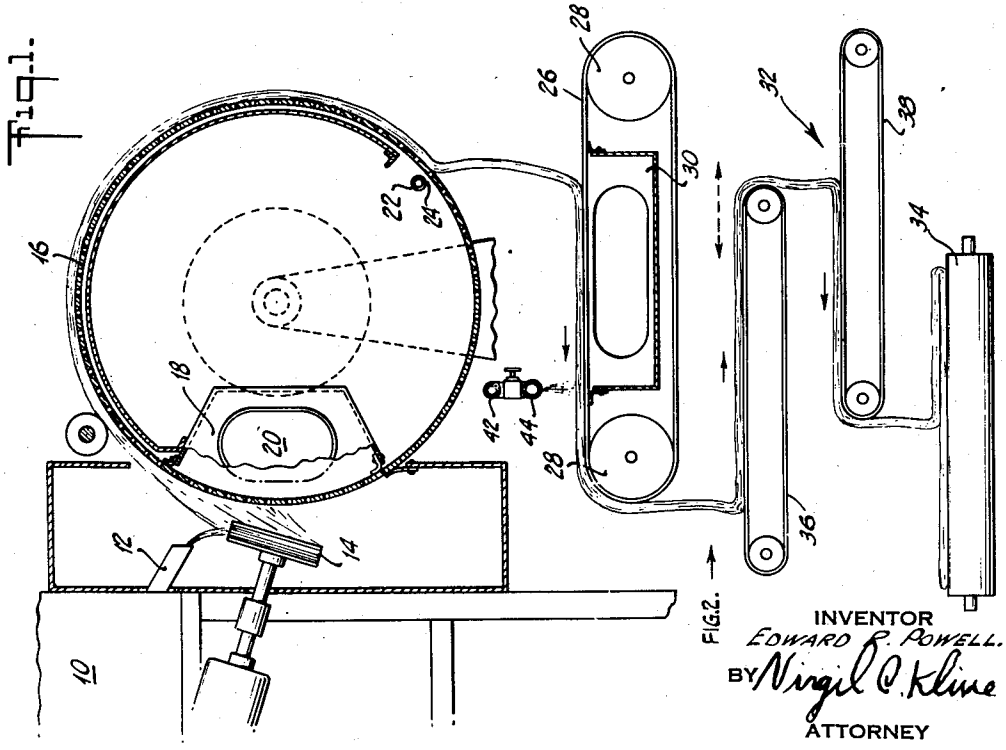


FIG. 2.

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Fig. 4.

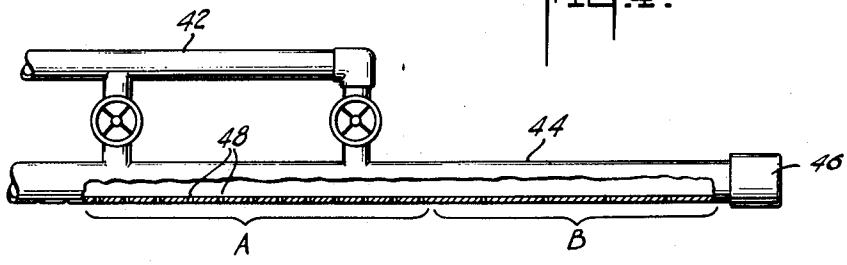


Fig. 5.

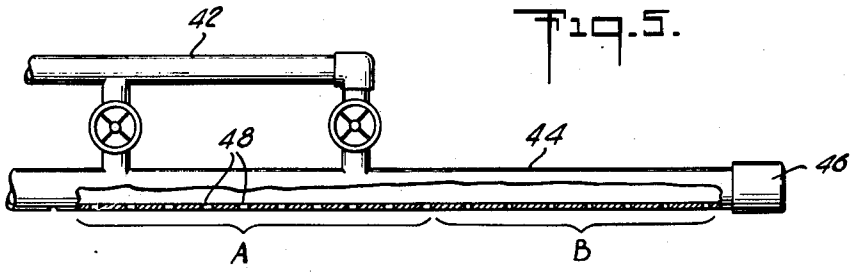


Fig. 6.

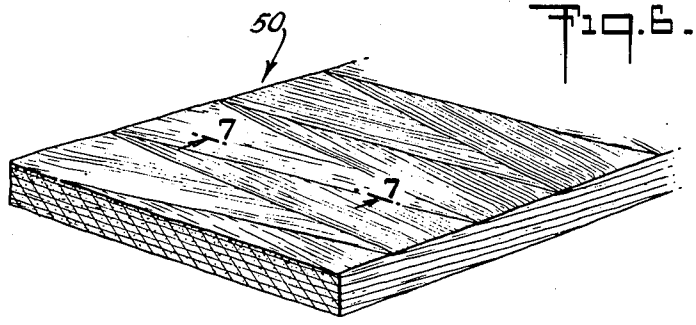
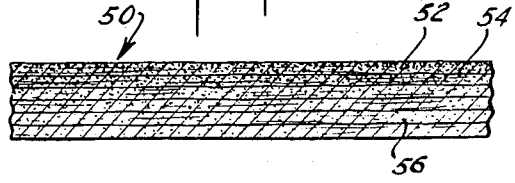


Fig. 7.



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METHOD FOR FORMING MINERAL WOOL PRODUCTS

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Application February 6, 1946, Serial No. 645,907

4 Claims. (Cl. 154—28)

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The instant invention relates to the manufacture of blankets or batts and, more particularly, to an improved mineral wool unit of such character that it finds a particular field of use in the insulating of stoves and the like where one side of the unit is exposed to relatively high temperatures. It will be appreciated, however, that the product may be applied to many other uses. The term "mineral wool" is employed herein in a generic sense to include fibers formed from rock, slag, glass and mixtures thereof, and other similar raw materials.

Insulating blankets and pads composed of mineral wool are conventionally made by disintegrating the slag or other raw material into a multiplicity of fibers and, while the fibers are in air suspension, or thereafter while they are in the form of a lap or mat, spraying a binder into the suspension or onto the mat to distribute the binder throughout the fibers. These methods do not permit control of the binder as is necessary to provide predetermined, localized areas of greater or lesser binder concentration desired in many cases. For example, in the insulating of stoves and in similar situations where relatively high temperatures are encountered, it has been found that an organic binder such as conventionally employed, if present in the usual concentrations in that portion of the insulating material adjacent the hot side, burns or chars with the emission of disagreeable odors and smoke.

The principal object of the instant invention is the provision of a method of forming an insulating batt in a manner to distribute the binder in accordance with a predetermined plan, whereby the binder may be in lesser concentration or may be omitted entirely in those parts of the batt exposed to high temperatures or where, for other reasons, lower concentration or omission of the binder is desired.

Another object of the invention is the provision of such method involving forming a relatively thin lap or layer of the insulating felt, applying a binder or other treating material thereto in a manner to provide a lesser concentration of the material in certain selected areas of the lap, and folding the lap into a plurality of layers or laminations to provide a blanket in which the portions of the lap of lower binder content are arranged in adjacent relationship to form a stratum, suitably a surface stratum, of the blanket.

A further object of the invention is the provision of a substantially homogeneous insulating product comprising a plurality of laminations of a continuous, thin, felted layer, with the laminations lying in planes extending angularly to the batt faces and from face to face thereof, the thin layer carrying a distributed binder.

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A still further object of the invention is the provision of a batt as referred to above in which the thin lap or layer has a lower binder concentration adjacent one of its edges and these edges define a surface of the batt.

My invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description of a preferred embodiment thereof which is to follow and to the accompanying drawings in which:

Fig. 1 is a diagrammatic, side elevational view of an apparatus for carrying out the method of the instant invention;

Fig. 2 is a diagrammatic, front elevational view of a portion of the apparatus of Fig. 1;

Fig. 3 is a top-plan view of a portion of the apparatus shown in Fig. 2;

Fig. 4 is a detail view, partially in elevation and partially in section and on an enlarged scale, of the binder applying device;

Fig. 5 is a view similar to Fig. 4 illustrating a modification of the binder applying device;

Fig. 6 is a perspective view of an insulating unit in accordance with the invention; and

Fig. 7 is a sectional view on an enlarged scale, taken on the line 7—7 of Fig. 6.

Referring now to the drawings and, particularly, to Figs. 1, 2 and 3, there is shown an apparatus including means for converting a stream of molten material, such as molten slag, rock, glass or the like, into a multiplicity of fibers and collecting said fibers in the form of a thin lap or layer. The apparatus illustrated is of the type described and claimed in my co-pending application, S. N. 556,541, filed September 30, 1944, now Pat. No. 2,450,915, issued October 12, 1948, as this has been found most suitable for the purpose but it will be understood that the invention in its broad scope is not limited to any particular method of producing a thin, porous, fibrous lap and that other procedures and apparatus than that shown may be employed. Also, although the invention is particularly concerned with the manufacture of mineral wool products, batts or blankets embodying the invention may be made of other types of fibers.

The apparatus includes a raw material melting furnace 10 which may be of any suitable type, such as a cupola, tank furnace or the like. Furnace 10 has a discharge trough 12 by which a stream of molten slag, rock, glass or the like is

drawn from the furnace and is discharged into position to be contacted by a fiberizing means, preferably one or more rotors 14 driven at high speed by suitable means (not shown). In the fiberizing operation the molten material discharged from trough 12 strikes the rotor or rotors and is broken up thereby and converted into fibrous form.

A drum 16 of relatively large diameter is mounted for rotation in the direction indicated by the arrow in Fig. 1. The surface of the drum is made up of a foraminous or open-work material, such as perforated metal sheets, relatively coarse mesh screen, or the like. The drum is supported for rotation in a suitable manner to permit of the inclusion within it of a suction hood 18 connected by means of a suction main 20 to any suitable air-exhausting device (not shown). The suction hood is in such fixed position within the drum as to draw air through a considerable area of the surface of the drum adjacent the fiberizing means 14, as shown.

In the fiber forming operation the molten stream contacting the rotor or rotors 14 is broken up and converted thereby into relatively fine threads or fibers. Drum 16 is rotated at a relatively high speed, such as to have a surface speed of, say, 1,000 to 3,000 feet per minute. The fibers are collected on the surface of the drum to form a thin layer by the inward movement of air through the surface of the drum created by suction box 18. The speed of rotation of the drum is controlled relatively to the rate of fiber formation to form a very thin, open layer of the fibers on the drum, say, one having a thickness of 1/8", more or less. It will be appreciated that, for purposes of illustration, this layer is shown of exaggerated thickness in the drawing. The thin lap or layer adheres to the surface of the drum and is carried with it.

A device is provided to strip the fibrous layer from the drum at the desired point. This device may comprise a pipe or nozzle member 22 of a length to extend substantially across the drum. The pipe, which will have its inner end closed off with a cap, plug or the like, is provided along its length with a plurality of nozzles 24 directed toward the adjacent inner surface of the drum, the nozzles suitably comprising holes drilled through the pipe wall. The pipe is connected into a steam line, compressed air line or other source of fluid under pressure.

A conveyor 26 supported on driven rolls 28 is located below drum 16 and in position to receive the thin lap or layer removed from the drum. A suction box 30 connected to any suitable air-exhausting means, may be provided below the upper reach of conveyor 26 to aid in the deposition of the fibrous layer on the conveyor.

Below the end of conveyor 26 is a lapper, indicated generally at 32, adapted to deposit the fibrous layer or lap in continuous folds back and forth across a conveyor 34. The latter extends at right angles to the lapper and is supported to be driven in either direction desired, for example, to the left as shown in Fig. 2. Lapper 32 may be of a type commercially available in the textile field and is not shown in detail. It comprises, however, conveyors 36 and 38 driven to travel in the directions indicated by the arrows. Conveyor 38 is mounted for reciprocating motion so that its forward end 40 traverses uniformly back and forth across, or substantially across, conveyor 34, to deposit the thin, fibrous layer in folds or laps thereon. Conveyor 36 is also reciprocated but at a different speed and through a shorter distance of travel than conveyor 38 to provide a path for the layer of a constant length between the point at which it leaves conveyor 26 and the point at which it is discharged from conveyor 38 to avoid bunching or stretching of the layer. The particular apparatus for the reciprocation of conveyors 36 and 38 is not shown but may be of any suitable type. Also, as previously indicated, the particular type of lapping device to be employed is not critical and another type such, for example, as the so-called "camel back," may be used in lieu of that shown. Operation of the lapper lays the thin felt or lap back and forth across conveyor 34 during forward travel of the latter to form continuous overlapping, zigzag folds, one margin of the fibrous layer defining the upper surface of the blanket built up on conveyor 34 and the other defining the lower surface. The thickness of the unit formed on conveyor 34 will depend upon the speed of the conveyor relatively to the rate of delivery of the fibrous layer.

Supported above conveyor 26 is a binder applicator consisting of a binder supply line 42 connected at one or more points into a spray nozzle 44. Nozzle 44 is suitably made of a section of pipe closed at one end by a cap 46 and having a plurality of nozzles 48 distributed along the length thereof which overlies the fibrous layer. The nozzles suitably comprise holes drilled through the pipe wall. Member 44 is connected to a source of fluid under pressure, such as a steam or compressed air supply (not shown).

Nozzles 48 are arranged in predetermined pattern to apply the binder or other treating material to the fibrous layer or lap in different concentrations in different portions widthwise of the lap. For purposes of illustration the nozzles illustrated in both Figs. 4 and 5 are of a character to spray the greater amount of the binder over somewhat more than one-half the width of the lap to provide a marginal portion of low binder concentration. In the form of the construction shown in Fig. 4, the binder distribution is obtained by spacing nozzles 48 at much closer intervals in the length A and at much wider intervals in the length B. In the form of the construction shown in Fig. 5, nozzles 48 are substantially equally spaced but the nozzles in length B are of smaller diameter than those in length A. Combinations of these constructions, or other equivalent means may be employed for securing the desired binder distribution.

In carrying out the method of the invention the fibrous lap is formed on drum 16, as previously described, and is removed therefrom by blow off means 22, and deposited on conveyor 26. As the lap travels beneath spray nozzle 44 a suitable binder is sprayed thereon in varying concentrations throughout the width of the lap as determined by the arrangement and/or character of nozzles 48. The binder to be used may be of any suitable or conventional type such as an asphalt, drying oil, resin, wax emulsion, or the like. Under the pressure of the steam or compressed air conveyed by line 46, the binder issues from the nozzles in the form of a spray of fine particles which readily penetrate into the mat to become substantially uniformly disseminated depthwise of the fibrous layer. As shown in Fig. 1, suction box 30 may be located to underlie the binder applying device to aid in securing penetration of the binder spray through the fibrous layer.

The fibrous layer is discharged from conveyor 26 onto the lapper 32 by which it is laid in continuous folds or laminations on conveyor 34, as previously described, to build up a blanket thereon of the desired thickness with the fibrous layer extending widthwise diagonally through the blanket from one surface to the other. As will be readily understood and as will be observed from an inspection of Fig. 2, due to the manner in which the blanket is built up from the lap, the portions of the lap having the greater and lesser binder concentrations will form continuous layers lying parallel to the upper and lower faces of the blanket.

The blanket formed in the manner described above is carried by conveyor 34 to any suitable location where finishing operations are carried out. These operations, all of which may be of known type, include compressing the blanket to the desired, finished thickness, setting the binder while the blanket is maintained under compression, trimming the blanket and dividing the same into a plurality of individual batts or units of the desired area.

Referring now to Figs. 6 and 7 a product 50, obtained by practising the method described above with the use of either of the nozzle constructions shown in Figs. 4 and 5, has the binder, indicated at 52, in substantially normal amounts in a stratum constituting approximately the upper half 54 of the product and in lesser concentration in the remaining portion 56. A product of this type is particularly adapted for the insulation of stoves and similar appliances as the surface having the low binder content may be placed against a heated wall without burning or smoking of the binder to an extent comparable to that obtained where the binder is distributed uniformly throughout the unit. At the same time the higher binder content of the major portion of the unit will maintain the handleability and strength characteristics required. A further important advantage of the product for such uses results from its flexible or pliable nature. Most stove insulations are presently made in one piece and bent around corners, although their relative rigidity resists such bending with resultant cracking and other deleterious effects. The present product may be readily bent or distorted as desired without harm.

The invention lends itself to any desired distribution of the binding ingredient depthwise of the unit. For an example of variations of the arrangement shown in Figs. 6 and 7, substantially no binder whatsoever may be employed adjacent that surface of the batt to be contiguous to a heated panel or the like, and a high concentration of the binder may be used adjacent the opposite surface with one or more intermediate steps or with a uniform gradation of the binder concentration from one surface to the other.

It will also be understood that treating materials other than binders, or materials which have functions in addition to a binding function, may be incorporated in the insulating unit in the manner described above, all such materials for convenience being described herein by the term "binder."

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. The method comprising continuously forming a thin, felted mat of mineral wool fibers, depositing a binder on said mat with said binder in lesser quantities adjacent one edge of said mat, moving said mat longitudinally and laying it in successive, overlapping folds on a conveyor moving continuously in a direction transverse to the longitudinal movement of said mat to build up a blanket of a plurality of thicknesses of said mat.

2. The method comprising continuously forming a thin, felted mat of mineral wool fibers, depositing a binder on said mat with said binder in lesser quantities adjacent one edge of said mat, moving said mat longitudinally, laying it in successive, overlapping folds on a conveyor moving continuously in a direction transverse to the longitudinal movement of said mat to build up a blanket of a plurality of thicknesses of said mat, compressing the blanket and setting the binder.

3. The method comprising collecting a thin, felted mat of mineral wool fibers on a foraminous means, spraying a binder on said mat continuously with its formation, controlling said binder spray to provide a predetermined longitudinal strip with greater binder concentration than the remainder of the mat, and laying said mat longitudinally in successive folds on a conveyor in a direction transverse to the direction of movement of the mat to build up a blanket of a plurality of thicknesses of said mat thereon.

4. The method comprising forming a continuous thin porous mat of mineral wool fibers, depositing a binder on said mat, controlling the binder deposition to provide a predetermined, longitudinal strip with greater binder concentration than the remainder of the mat, and laying said mat longitudinally in successive folds on a conveyor moving continuously in a direction transverse to the movement of the mat to build up a blanket of a plurality of thicknesses of said mat.

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