

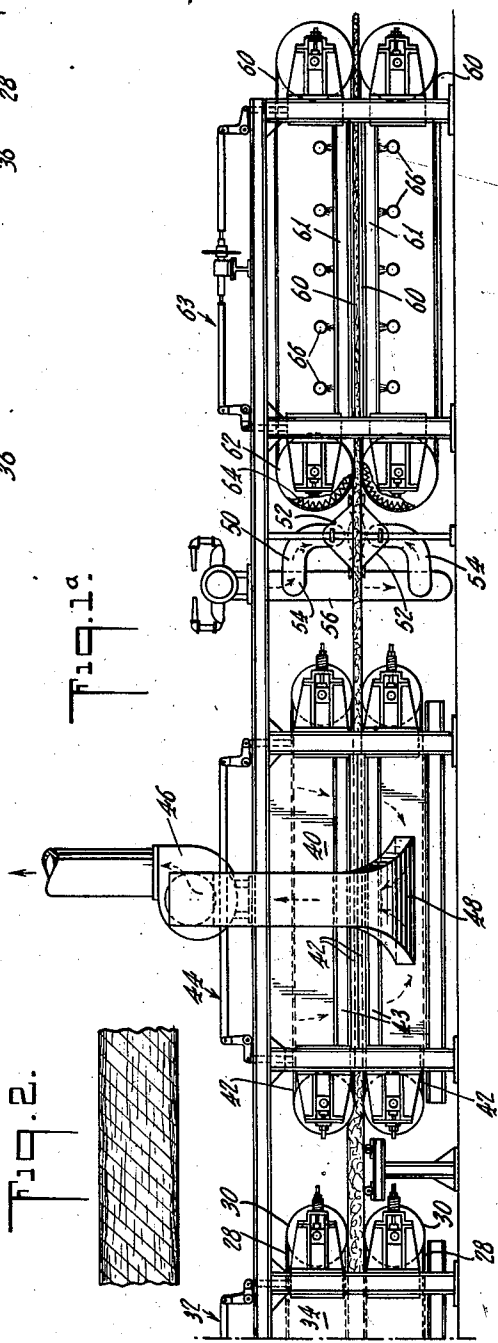
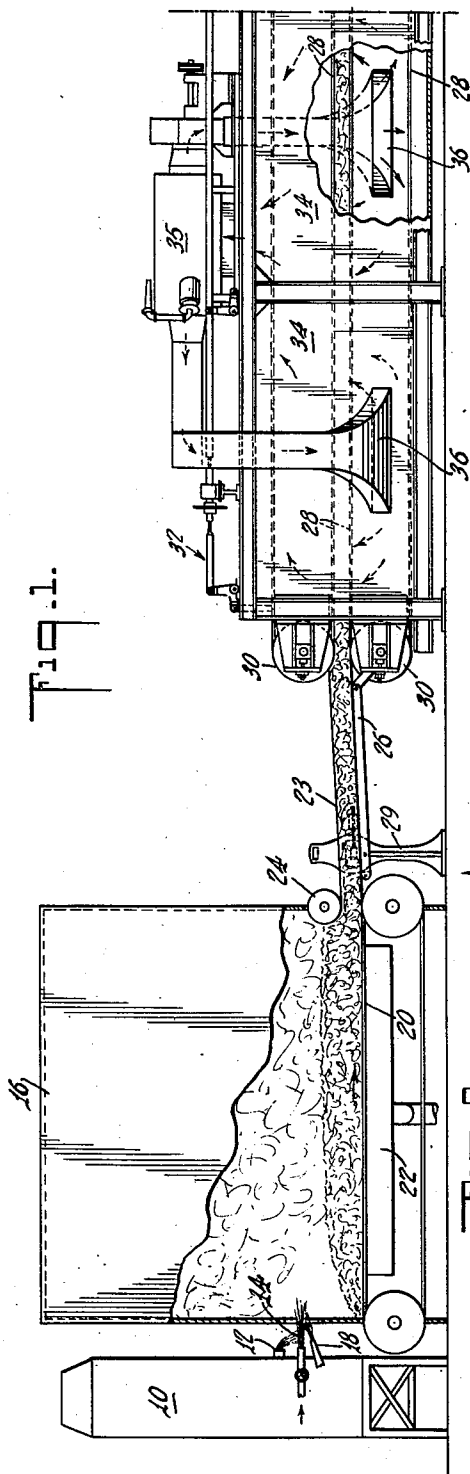
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METHOD OF MANUFACTURING MINERAL WOOL AND PRODUCT

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METHOD OF MANUFACTURING MINERAL WOOL AND PRODUCT

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The present invention relates to felted mineral wool products and to a method of making the same, and more particularly, is directed to a dry process for the manufacture of mineral wool thermal insulating products of relatively high density and having the desirable properties of insulating materials sold under the registered trade-mark "Rock Cork." It will be understood that the term "mineral wool" is employed herein in a generic sense to denote fibres formed from rock, slag, glass, and other conventional raw materials and mixtures thereof.

In the manufacture of Rock Cork in accordance with the procedure that has heretofore been followed, a suitable raw mineral wool forming material is melted and the molten material shredded by means of a high pressure steam jet or the like into a multiplicity of fibres, which are collected in a blow chamber. The fibres are mixed with a water suspension of a binder, comprising, for example, asphalt intermixed with paper or wood pulp in such a manner that the asphalt adheres to the pulp particles in the suspension. The mixture is then discharged into a suitable form, the water drained off, and the material is then pressed into the desired shape and dried.

The prior method, though producing a serviceable and meritorious product, has presented certain disadvantages. Thus, the known method is relatively slow and expensive, due to the separate operations involved. The mixing of the fibres in the wet suspension of pulp and asphalt results in the mashing or breaking of a substantial portion of the fibres, thereby increasing the density and weight of the product to an undesirable extent and decreasing its insulating efficiency. In addition, the mixing operation results in a heterogeneous arrangement of the fibres which also reduces the insulating properties of the product. Furthermore, the large percentage of the organic material, usually 28 to 30 per cent, due to the presence of the paper pulp, greatly lessens the resistance of the material to combustion. Also, the molded product is surface ground to remove the undesirable crust formed in the molding operation, thus requiring a further step in the process and also resulting in a loss of material.

The principal object of the instant invention is to provide a method for the manufacture of a product having the desirable characteristics of the present Rock Cork, in which the above noted disadvantages, both in operation and product, are overcome. More specifically, an object is to provide such method in which the operation is con-

tinuous from the formation of the fibres to the packing of the final product, all wet mixing of the fibres being eliminated and the fibres being retained in substantially the orientation which they take when settling in the blow chamber. An object, also, is to provide an improved product of the type referred to with enhanced insulating properties and adapted for a wider range of uses.

Our invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawing, in which:

Fig. 1 is a diagrammatic elevational view of a portion of an apparatus employed in the method of the instant invention;

Fig. 1a is a continuation of the apparatus disclosed in Fig. 1; and

Fig. 2 is a diagrammatic sectional view taken through an insulating product made in accordance with the invention.

Referring now to the drawing, and particularly to Figs. 1 and 1a, there is diagrammatically shown an apparatus suitable for carrying out the method of the invention. As will be understood, conventional portions of the structure are not shown in detail and may take different forms. The apparatus generally comprises a cupola or tank furnace 10 of any conventional design, in which the raw material, such as slag, rock, or mixtures thereof, is melted. The molten material issues from orifice 12 and falls into the path of a steam jet 14, which shreds it into a great multiplicity of extremely fine fibres which are carried by the force of the steam jet and in gaseous suspension into blow chamber 16. A binder, which will be hereinafter described in detail, is forced into the suspension of fibres by any of the known conventional means for this purpose. It has been determined, however, that an atomizing binder jet, as indicated diagrammatically at 18, is most suitable. The binder is added in proportions of, say, between 10 and 30% of the weight of the fibres, preferably between 18 and 24%. The mineral wool fibres and the minute binder particles settle in the blow chamber, the binder particles collecting on the fibres.

Suitable binders for use in the present invention may comprise a multiplicity of different specific formulae, all of which, however, must meet certain requirements. Thus, the binder must be sufficiently fluid to permit atomization and distribution of the same on the fibres; its viscosity must not increase excessively when the binder is stored at a high temperature for a reasonable period,

say, from 8 to 12 hours; when applied to the fibres and solidified it must be hard and preferably tough, although some degree of brittleness is permissible; and it must not be sufficiently combustible to ignite in the collecting chamber. It may be stated that preferably the binder is one which is hard at 150-175° F. and has a sharp break in viscosity at, say, 350-375° F. so that it will be highly fluid at 400-450° F.

Binders which meet the above desiderata may be classified generally as those (1) comprising a hard pressure still residue toughened with a softer, blown or refined asphalt, or petroleum tailings, (2) comprising Gilsonite fluidified with a pressure still residue asphalt, and (3) comprising a thermoplastic resin. The binders include a suitable proportion of a fireproofing ingredient, preferably a chlorinated aromatic or cyclic hydrocarbon with a minimum chlorine content of 45%. For the sake of brevity, this material and equivalents are hereinafter referred to as chlorinated compounds.

Specific formulae for the binders of the several classes referred to above are given below, it being understood that these formulae are given only as examples and, although they have been found particularly suitable, many different specific formulae may be used as long as the several requirements previously referred to are met.

	Per cent
(1) Insulating asphalt.....	33.2
Rock Cork asphalt.....	33.2
H. P. asphalt.....	26.6
Chlorinated compound.....	7.0
(2) Gilsonite.....	37.6
Rock Cork asphalt.....	56.5
Chlorinated compound.....	6.0
(3) Rosin.....	90.0
Chlorinated compound.....	10.0

In the above-referred-to formulae, the insulating asphalt comprises, for example, a pressure still residue of approximately 214° F. melt point and 1.0 penetration at 77° F. Rock Cork asphalt is an asphalt having a melt point of from 190-205° F. and a penetration of less than 3 at 77° F. H. P. asphalt is a fairly hard, rubbery asphalt having a melt point of 210-220° F. and a penetration of 5-9 at 77° F. Gilsonite is a natural asphalt having a melt point between 270-325° F. and 0 penetration at 77° F. In each case, the penetration given is that determined by standard A. S. T. M. tests. The rosin may be gum or wood rosin, limed rosin, an ester gum, or the like.

The blow chamber 16, which receives the suspension of fibres and minute binder particles, has a bottom wall comprising a continuously moving endless belt or conveyor 20 traveling in the direction indicated by the arrow, on which the fibres settle in felted relationship, with the binder particles disseminated substantially uniformly throughout the felt. To aid in securing a uniform density throughout the width of the blow chamber, the belt is of a foraminous nature and suitably, a suction device, as indicated diagrammatically at 22, is provided below the upper reach of the belt.

The felted mass of fibres is carried from the blow chamber by conveyor 20 and preferably is compacted to a slight extent to form a relatively thick blanket 23 by press roll 24 as it leaves the blow chamber. The rate of movement of conveyor 20 is correlated to the rate of deposition of the fibres to obtain uniform and desired density of the product. This may be accomplished in any

suitable manner, for example, by means of a weighing scale 29, over which the felt passes, operatively connected to the drive of conveyor 20 by any suitable means (not shown) whereby increase in the weight of the blanket increases the speed of movement of the conveyor and vice versa.

The blanket, after leaving table 26, passes between endless foraminous conveyor belts 28 driven by suitable pulleys 30 in the direction indicated by the arrows. The upper conveyor belt 28 is suitably made vertically adjustable as by means of the mechanism diagrammatically illustrated at 32 and in the operation of the device the belts are so spaced that the blanket is only slightly compressed as it passes therebetween. Belts 28 are enclosed by an oven or drier structure 34. Air, at a temperature, say, between 200-300° F., depending upon the melting point of the particular binder employed, is circulated from any suitable air heating means, such as furnace 35, through ducts 36 opening into the oven below the upper reach of the lower conveyor 28 and the air is forced through the conveyors and the blanket held therebetween. The warm air serves to soften the binder and may even cause it to spread to at least some extent over the fibres.

Alternatively, the conditioning of the binder for subsequent operations may take place in the blow chamber 16, whereby the heating oven 34 and its appurtenant structure may be eliminated. Depending upon the particular type of blow chamber employed, the residual heat in the fibres may be sufficient for this purpose, or if this is not the case, the temperature of the blanket may be raised to that necessary as by providing heating units or introducing heated air into the blow chamber.

The blanket passes from the oven 34 to a chamber 40, in which the blanket is compressed to substantially its finished thickness and cooled and the binder set. The compression is accomplished by means of foraminous conveyor belts 42, the adjacent reaches of which are suitably supported as by means 43 to prevent yielding as the blanket is held therebetween. As before, the upper conveyor belt is preferably adjustable as by the means indicated diagrammatically at 44, whereby the blanket may be compressed to any predetermined thickness. While the blanket is maintained in its compressed state between the conveyor belts, cooling air is drawn therethrough as by means of blower 46 and duct 48, which includes a mouth opening into the chamber 40 below the conveyor belts and the blanket. The air may simply and preferably be at room temperature, but if desired, pre-cooled air may be supplied to the upper portion of the chamber. In lieu of the air cooling shown, water cooling or other cooling methods may be employed if desired.

The felt, after passing through chamber 40 and having been compressed to substantially its final thickness and set in such condition by the hardening of the binder, passes to a surface heating device 50, which may comprise, for example, hoods 52 connected to conduits 54, which, in turn, are connected by a conduit 56 to a suitable hot air source. The heated air at a temperature of, say, 400° F. is blown against each surface of the blanket but is not forced through the same, whereby only a surface heating results. Batteries of infra-red lamps or other means may optionally be used to heat the surfaces.

The blanket is carried from the surface heaters between a third pair of endless belts 60, supported similarly as the belts 42 by means 61

against yielding, whereby they may exert a compressing action on the blanket. The upper belt is arranged for adjustment relative to the lower belt as by raising and lowering device 63. The belts in this instance preferably comprise thin steel bands continuous the width of the blanket. Preferably, the belts are dusted with talc or a similar material to insure against sticking of the blanket. Within drums 62 supporting the belts at the forward end are provided a plurality of heating means 64, such as gas jets, lamps, or the like, whereby the belts are heated above the melting point of the binder employed, the thus heated belts supplementing the surface heating action of the heater 50. The gap between belts 60 is adjusted so as to compress the blanket to exactly its final desired thickness or slightly below such thickness.

Located between the drums supporting belts 60 are a plurality of cold water sprays 66 or other cooling means which serve to quickly chill the belts. The cooling action thus provided is sufficient to solidify the binder adjacent the surface of the blanket, and also to remove any substantial quantity of residual heat carried by the interior of the blanket.

The blanket, after leaving the belts 60, passes through any suitable cutting and trimming devices where it is sub-divided into blocks or sheets of the desired size and is ready for packing and shipment.

In the operation of the method for the production of a material, say, of 2" finished thickness, a felted blanket, approximately 12" in thickness as it leaves the blow chamber and containing a binder of the type previously referred to in a proportion between 10 and 30% of the weight of the fibres, preferably between 18 and 24%, is warmed to a temperature, say, of 220° F. to 250° F. in oven 33, or in the blow chamber 16 if the alternative method is employed, to soften the binder and is then compressed to a thickness of approximately 2 1/8" to 2 3/8" between belts 42 in chamber 40. The circulation of cooling air through the felted blanket while the same is held between the belts solidifies the binder and after the compressive forces are released by issuance of the blanket from between the belts, the blanket will retain substantially the thickness to which it was compressed. After the felted blanket leaves the surface heaters 50, it is further compressed between the belts 60 to the final 2" thickness.

In the product made as described above, the fibres lie in planes substantially parallel to the major surfaces, due to the manner of felting, and this parallelism is accentuated by the several compressing steps. The resulting product not only exhibits increased insulating efficiency as compared to a product in which the fibres are in a heterogeneous arrangement, but also the modulus of rupture is much higher. For example, a product in accordance with the invention has been found to have a modulus of rupture of the order of 125 lbs. per square inch as compared to 27-35 lbs. per square inch for the present Rock Cork.

The surface heating by heaters 50 and 64 and immediate cooling by water sprays 66 serve to case harden the blanket, with the result that the final product has relatively smooth, hard, distortion resistant surfaces, whereby the handleability of the product is enhanced while the thermal insulating properties are maintained. Notwithstanding the relatively large amount of binder, the binder being present in proportions from 10

to 30% by weight of the mineral wool, the product is resistant to combustion due to the character of the binder.

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

What we claim is:

1. In the method comprising forming a suspension of mineral wool fibres and a thermoplastic binder, and depositing said fibres to form a felt of substantially uniform density with the binder disseminated therethrough, the improvement comprising heating the felt to soften the binder, compressing and simultaneously cooling the felt to set the binder, surface heating and compressing the felt, and further cooling the felt.

2. In the method comprising forming a felt from an air suspension of mineral wool fibres and a thermoplastic binder, the improvement comprising heating the felt to soften the binder, compressing the felt to a uniform predetermined thickness and simultaneously cooling the felt, subjecting the felt to surface heat to soften the binder adjacent the surfaces and immediately cooling the felt while maintaining the felt under slight extra compression between smooth surfaces.

3. In the method comprising forming a felt from an air suspension of mineral wool fibres and a thermoplastic binder with the binder disseminated throughout the felt, the improvement comprising employing said binder in a proportion of the order of 10 to 30% by weight of the fibres, heating the felt to soften the binder, compressing and simultaneously cooling the felt to set the binder, surface heating and compressing and cooling the felt surfaces.

4. In the method for the manufacture of felted mineral wool products comprising forming an air suspension of newly formed mineral wool fibres and a thermoplastic binder, and felting said fibres in a blow chamber with the binder substantially uniformly disseminated through the felt, the improvement comprising employing said binder in a proportion of the order of 10 to 30% by weight of the felt, heating the felt in the blow chamber to soften the binder, compressing and simultaneously cooling the felt to set the binder, surface heating and compressing and cooling the felt surfaces.

5. The method including forming a suspension of mineral wool fibres and a binder, said binder comprising bitumen and a fireproofing ingredient, with the binder present in a proportion of the order of 10 to 30% by weight of the fibres, depositing said fibres to form a felt of substantially uniform density with the binder disseminated therethrough, compressing the felt, heating the felt to soften the binder, and compressing and simultaneously cooling the felt to set the binder.

6. The method comprising forming a felt from an air suspension of mineral wool fibres and a thermoplastic binder comprising a hard pressure still petroleum residue, a softer bituminous material, and a fireproofing ingredient, with the binder disseminated throughout the felt and in a proportion of the order of 10 to 30% by weight of the fibres, heating the felt to soften the binder, compressing the felt to a uniform predetermined thickness and simultaneously cooling the felt, subjecting the felt to surface heat to soften the

binder adjacent the surfaces and immediately cooling the felt while maintaining the felt surfaces under compression.

7. The method comprising forming a suspension of mineral wool fibres and a binder, said binder comprising a thermoplastic resin and a fireproofing ingredient, with the binder present in a proportion of the order of 10 to 30% by weight of the fibres, depositing said fibres to form a felt of substantially uniform density with the binder disseminated therethrough, heating the felt to soften the binder, and compressing and simultaneously cooling the felt to set the binder.

8. The method comprising forming a felt from an air suspension of mineral wool fibres and a thermoplastic binder comprising Gilsonite fluidified with a pressure still residue asphalt and a chlorinated compound, with the binder disseminated throughout the felt and in a proportion of

the order of 10 to 30% by weight of the fibres, heating the felt to soften the binder, compressing the felt to a uniform predetermined thickness and simultaneously cooling the felt, subjecting the felt to surface heat to soften the binder adjacent the surfaces and immediately cooling the felt while maintaining the felt surfaces under compression.

9. The method comprising forming a mineral wool body containing a hardened thermoplastic binder, subjecting the body to surface heat to soften the binder adjacent the surfaces while leaving the remainder of the binder substantially unaffected, and immediately cooling the surfaces while maintaining them under compression.

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