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DIMENSIONALLY STABLE MINERAL WOOL FIBERBOARD

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Fig. 1

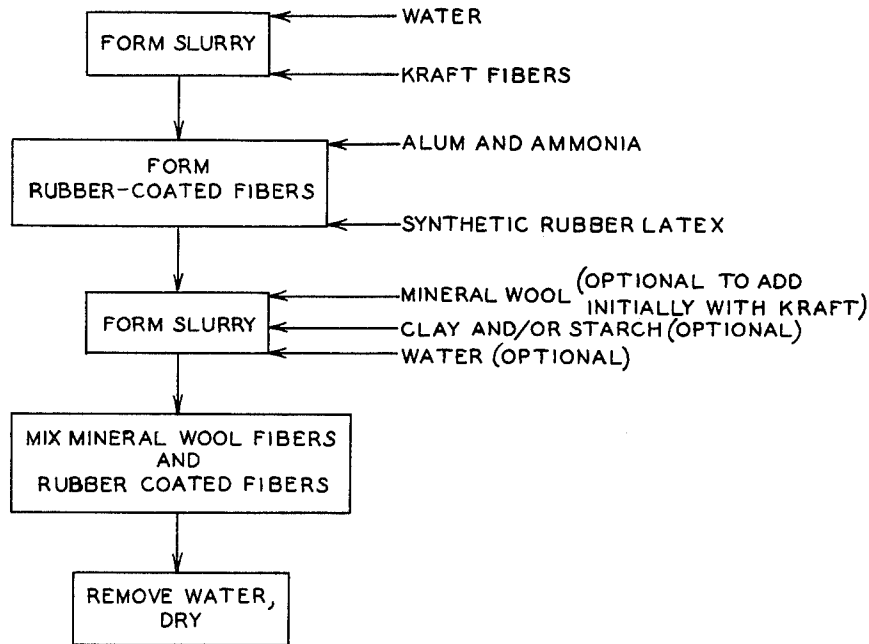
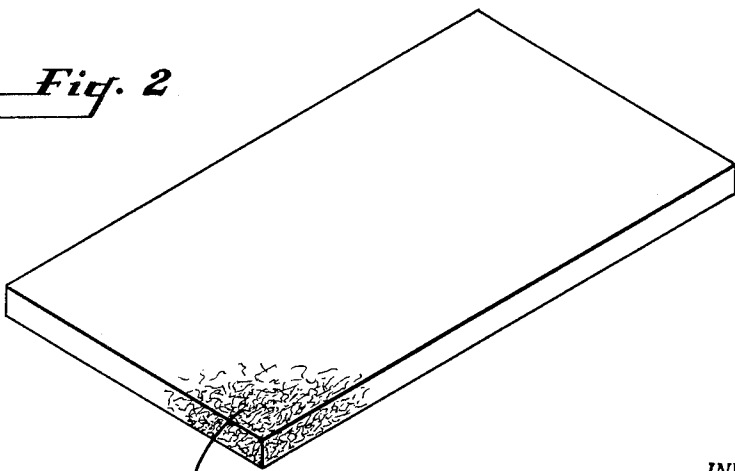


Fig. 2



FIBERBOARD OF MINERAL WOOL BONDED WITH RUBBER-COATED KRAFT FIBERS

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**DIMENSIONALLY STABLE MINERAL WOOL
FIBERBOARD**

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This invention relates generally to fiberboard and more particularly to a mineral wool fiberboard. Still more particularly, the invention relates to the production of a strong, dimensionally stable mineral wool fiberboard utilizing a novel, water-resistant binder.

Mineral wool fiberboard is widely used in the manufacture of acoustical tile. Such board is also used as a light, strong, incombustible, fireproof panel in applications where low density is of particular importance, as in fire doors and the like. Mineral wool fiberboard is normally made by adding a binder system to a slurry in water of mineral wool fibers. After sufficient mixing, the water may be removed in a mold or drainage wire to form a board. Oven drying normally is used to complete the water removal. The usual binder system for such fiberboard is starch. A starch binder falls in the necessary economical range and normally supplies good strength to the finished board. When starch is used, however, waterproof sizes are normally required, and special steps should be taken to impart dimensional stability to the finished fiberboard products, particularly where the products are made in the larger sizes such as 2 x 4 feet. An example of the special procedural steps to be taken with the usual mineral wool fiberboard and amylaceous binder is set forth in copending application Serial No. 28,547, filed May 12, 1960, by Walter T. Bulson. Dry formaldehyde treatment is utilized in that process. It should be emphasized, however, that such treating processes as described in the copending application are carried out on the finished fiberboard and are not incorporated during the normal manufacturing processes of the fiberboard. No improvement of the board itself resulting from the board-making processes can result from such subsequent treating processes.

There is, therefore, a need for a board-making process which reduces or eliminates the requirement of a starch binder, and which produces a bulkier, stronger, fire-resistant board without the need for special fireproofing agents.

It is the primary object of the present invention to supply such a board. It is an additional object of the present invention to describe a board which is more economical than prior boards by virtue of an improved board-forming process which produces a better board without the need for sizing or waterproofing agents. It is also an object of the present invention to supply a process for making such board.

These objects are obtained in an effective and straightforward manner. The invention contemplates a strong, dimensionally stable fiberboard having a thickness of at least $\frac{1}{4}$ inch comprising mineral wool fibers bonded together with a binder comprising kraft fibers coated with a synthetic rubber.

The mineral wool fibers will comprise 60–98% by weight of the finished board, and preferably 75–85% of the finished board. The mineral wool fibers are made by blowing air or steam through molten rock or slag to form a mass of fine intertwined fibers. Mineral wool, also known as rock wool, slag wool, and mineral cotton, is a known item of commerce and may be readily purchased as such. Normally the mineral wool fibers are taken up

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in water to form a slurry to which is then added the amylaceous binder system, the fillers, and a waterproof sizing. The agitation of such a slurry will normally be mild in order that the mineral wool fibers will not be unduly broken and reduced in size.

In the present invention, the binder system of the mineral wool fiberboard constitutes rubber-coated kraft fibers. Kraft fibers are a known item of commerce and are prepared by the digestion of wood chips by the sulfate process in which sodium sulfate is added to caustic liquors in which wood chips are cooked. Kraft pulps may be bleached or unbleached. For the present purposes, the unbleached variety will suffice since bleaching contributes primarily to the appearance of the kraft fibers. Such appearance is unimportant in the present invention since the fibers are to be coated with rubber. All kraft fibers have the requisite strength when coated with rubber to serve as a binder in the board of the present invention.

The kraft fibers may be coated with rubber by any of the usual beater-saturation techniques. The fibers may be treated with such known pretreating agents as cationic melamine-formaldehyde resins before the addition of the rubber latex to the treated slurry. Alternatively, the kraft fibers may be treated with alum, and the solution subsequently brought to a neutral pH by the addition of ammonium hydroxide in order to form aluminum hydroxide in situ. Aluminum hydroxide may even be separately prepared and poured into the slurry of kraft fibers in order to pretreat the fibers. The addition of a synthetic rubber latex subsequent to the aluminum hydroxide treatment will then bring about the smooth and even deposition of the rubber content of the latex onto the fibers. Alternatively, the latex may be added to the slurry of kraft fibers and carefully precipitated onto the fibers with agitation by the addition of papermakers' alum, preferably in the form of a solution, to the kraft fiber slurry. Once the rubber has been deposited on the fibers, the rubber-coated kraft fibers are admixed with the mineral wool fibers in order to form the slurry from which the board may be made. The amount of latex to go on the kraft fibers will vary generally in the range of 5–50% by weight rubber based on the dry weight of the fibers.

One of the outstanding advantages of the present process is that the mineral wool may be formed in a slurry, the uncoated kraft fibers added, and the rubber deposited onto the kraft fibers in the presence of the mineral wool fibers without coating any of the mineral wool fibers. This process is most conveniently carried out by the use of alum and ammonia or ammonium hydroxide, to be added to the mixed slurry of mineral wool and kraft. The nature of the mineral wool fibers is such that under the conditions of the alum-ammonia pretreating process, no rubber deposits on the mineral wool fibers. All the rubber deposits instead on the kraft fibers, thus forming a mixture of uncoated mineral wool fibers and rubber-coated kraft fibers as needed to form the board.

The amount of kraft fibers to be used will generally be in the range of 3–15% by weight of the finished board. Where amounts in the lower limits of this range are to be used, generally 3–6% by weight kraft, it may be desirable to add small amounts of additional binder such as a clay or even starch. Where starch is used, much smaller amounts of the starch may be used than is normally the case where starch serves as the only binder. It is one of the surprising features of the present invention that the combination of rubber-coated kraft fibers and starch as a binder produces a much stronger board than would be expected from the presence of the small amount of starch. The amount of starch convenient to use sometimes in the board of the present invention will generally run 0.5–3%

by weight starch based on the weight of the finished board.

Where clay is used, it may be used in an amount ranging from about 2-20% by weight of the entire board. To impart additional strength to the board, it is preferred that the clay have slight swelling properties such as is found in a bentonite or a montmorillonite, or one of the usual filler clays having some swelling properties in water. An additional feature of the present invention is that any clay used may itself be coated with rubber in order to serve as an additional binder along with the necessary rubber-coated kraft fibers. The same processes may be used to deposit rubber on the clay as were used to deposit rubber on the kraft fibers. The rubber may be deposited on the clay separately, admixed with the kraft fibers, or the whole admixed with the mineral wool fibers.

Still another advantage of the process of the present invention is that it lends itself peculiarly to a continuous process. The kraft fibers may be rubber-coated in conduits, troughs, or tanks which flow continuously into a common chamber in which the slurry is joined and mixed with the mineral wool slurry. Conveyor belts may be used to meter proper amounts of mineral wool and kraft fibers and clay, if used, into a water stream of known volume. The finished slurry may be dewatered by using a board-forming wire, or board molds for removing most of the water. Using the rubber-coated kraft fibers in accordance with the present invention as a binder for the mineral wool produces a board having a greater bulk (lower density) while showing improved strength as contrasted with boards made with a starch binder alone. An additional advantage of using the binder of the present invention is that the slurries drain appreciably faster and there is an appreciably better retention of fibers and clay particles, if clay is used. Boards from which the water has been drained may be more easily handled in an oven which may be used to remove the last amounts of water necessary to produce a dry, usable board.

The board will generally run about 1/2 inch thick, and will usually fall with the range 1/4 inch to 1 inch in thickness. The other dimensions of the board will be determined by the size of the deckles and the forming wire, or by the sheet mold used to drain the water from the slurry. It will be appreciated that such board formation is substantially different from felt and papermaking primarily because of the thickness of the products formed and the attendant drainage and board-forming problems that arise.

It is preferred that the synthetic rubber latex used in the present invention be a butadiene-styrene copolymer rubber (SBR) which contains generally 50% to about 75% by weight butadiene. Such rubbers are economical and yet serve the purpose of coating the kraft fibers and thus waterproofing and binding the mineral wool fibers in an excellent manner. Other latices are operable. For instance, the butadiene-acrylonitrile copolymers generally

containing 50% to about 80% by weight butadiene (MBR) may be used. The neoprenes (CR) may also be used. These neoprenes are polymers of 2-chlorobutadiene-1,3; the rubbers are also known as polychloroprenes. Isoprene rubbers (IR) may be used as well as homopolymers of butadiene (BR) and generally homopolymers and/or copolymers of butadiene homologs. These synthetic rubbers are added to the slurry in the form of their latices which generally contain 25% to about 50% by weight rubber solids. The latices contain additional compounding ingredients such as stabilizers and the like which are well known in the art and which form no part of the present invention.

In the drawings,

FIG. 1 is a simplified flow diagram of a process of the present invention, and

FIG. 2 shows in diagrammatic form a board of the present invention in which legends are used to designate the various elements.

We claim:

1. The method of making a strong, dimensionally stable fiberboard which comprises forming a slurry in water of kraft fibers, depositing a coating of synthetic rubber selected from the group consisting of butadiene homopolymer, butadiene-styrene copolymers, butadiene-acrylonitrile copolymers, polychloroprenes, and isoprene rubbers on the kraft fibers, forming a slurry in water of uncoated mineral wool fibers and said rubber-coated kraft fibers, said mineral wool fibers being used in an amount of 60-95% by weight of total solids and said kraft fibers being used in an amount of 2-20% by weight of total solids, mixing the slurry of uncoated mineral wool fibers and rubber-coated kraft fibers, and forming a board having a thickness of at least 1/4 inch from the mixed slurry by removing the water therefrom.

2. A method according to claim 1 wherein clay is added to one of said slurries.

3. The method according to claim 1 in which starch is added to one of said slurries.

4. The method according to claim 1 wherein said synthetic rubber is a butadiene-styrene copolymer.

References Cited by the Examiner

UNITED STATES PATENTS

2,615,806	10/1952	Marsh	162-145
2,698,788	1/1955	Greenman	162-145
2,773,763	12/1956	Scott	162-145
3,036,950	5/1962	Martin	162-145
3,057,772	10/1962	Magill	162-183
3,121,658	2/1964	Orsino	162-183

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