

UNITED STATES PATENT OFFICE

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BUILDING BOARD

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1 Claim. (Cl. 92—3)

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This invention relates to a process for manufacturing building and insulating board and more particularly a board comprising expanded perlite, a thermoplastic binder, and a fibrous substance of organic or inorganic origin, or a mixture of such fibers. This application is related to applicants' co-pending concurrently filed applications Serial Number 795,128, relating to a composition of uncoated, expanded perlite and a fibrous substance; and to 795,130, relating to a composition containing coated expanded perlite and a fibrous substance.

Perlite is a generic term for certain volcanic glasses which contain a relatively small amount of water entrapped in the glassy structure. Upon rapidly heating perlite to the point of incipient fusion it suddenly expands due to the internal pressure of the vaporized water. If the operation is carefully controlled as to temperature and time a product is formed comprising bubbles, most of which are sealed and have a sub-atmospheric internal pressure. A lightweight material of excellent thermal and sound insulating properties is thus obtained. If the temperature is high and the expansion rapid, the bubbles may burst, forming shattered fragments having curvilinear surfaces and thin walls and a low bulk density.

The major part of the sealed bubble type of expanded perlite floats on water and there may be as much as 90 to 98% of material that can be floated. Most of the shattered fragment type of material sinks when put in water. The sealed bubble type is of particular interest in this invention.

In a broad embodiment, the invention relates to a building board made by forming a slurry of expanded coated or uncoated perlite or mixture with a fibrous substance, water and an emulsion of a thermoplastic material such as asphalt, forming the resulting mixture into a sheet or web and drying it.

The present invention provides a means by which the desirable properties of the expanded perlite can be used to full advantage in the form of boards or slabs which may be nailed or otherwise attached to building, e. g., ceilings, walls and the like.

This invention has the advantage of producing a board, sheet or mat which may contain higher percentages of asphalt while retaining strength, light-weight, and excellent insulating properties, than is the case with fiber or other types of board made by conventional methods.

One type of light-weight commercial insulat-

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ing board is made by forming a fiber board or sheet from material such as wood pulp, etc., by the usual wet process. This sheet is dried and is then partially impregnated usually by dipping into hot asphalt. The asphalt is permitted to penetrate only a short distance into each side of the board which leaves a core of uncoated fiber. This board may be water resistant provided the barrier set up by the asphaltic outer coating is not penetrated. If the coating is penetrated in any manner or if the board is nailed, sawed or cut, leaving exposed edges, water can penetrate to the interior. If this happens the board disintegrates because the wet strength of the uncoated fiber is low. If, on the other hand, such a fiber board is completely saturated with asphalt, it loses its desirable light-weight characteristics and the insulating factor becomes substantially that of asphalt itself. To illustrate, a cellulose-fiber board weighing about 800 pounds per thousand square feet may be treated with about 400 pounds of asphalt. This increases the weight to 1200 pounds per thousand feet of board.

A board of this invention comprising coated expanded perlite, fiber, and asphalt from an emulsion can be made by the wet method so that it will have a weight of about 950 pounds per thousand feet, will contain over 400 pounds of asphalt, will have high insulating value, resistance to water, and high wet strength. It will be seen from this, as much or more asphalt can be incorporated into the board as in the example above given for the prior art saturated board but, at the same time producing a lightweight product, one which is water resistant throughout, and which can be cut, sawed, nailed, and otherwise treated without fear of penetrating through an impervious coating to a weak core. This is due to the fact that the asphalt is uniformly distributed throughout the entire structure of the board. Boards lighter than the above can be made by this process.

Furthermore, only comparatively low melting asphalt can be used to impregnate a fiber board by hot dipping or the like, because the temperatures which are necessary to melt asphalts of 220° F. melting point or above, may char the fibers of the board, thereby weakening the structural materially.

In contrast to this, are the boards of the present invention. The process makes possible the incorporation of high melting point asphalt e. g., of 220°-400° F. melt point, into boards or sheets containing fiber, while retaining the light-weight

characteristics possible to be realized by the wet method of forming fiber boards. At the same time the invention provides a method for making the entire board of high wet, as well as dry, strength, and of substantial water resistance. Moreover, the boards of this invention can be cut or sawed to any desirable shape or size without in any way changing the characteristics of the board after it has been applied insofar as water resistance and the like is obtained. The distribution of asphalt throughout the board can be controlled, which can not be done in connection with the prior art boards made by the impregnation method.

The boards of this invention likewise have a substantial advantage over fiber boards made by dry hot methods in which the fibers are saturated with asphalt and then pressed into a board.

Advantage can be taken by means of this invention of the conventional type of board making machines used in the fiber board and paper industry. Advantage can also be taken of the light-weight boards produced by the wet method and, at the same time retaining the desirable characteristics of the fiber board, and realizing to the full extent, the desirable characteristics of boards containing varying percentages of asphalt, especially in the higher range.

It is possible by this method to put more asphalt into a board than can be put there by any other known method.

In a specific embodiment the invention relates to a product comprising a consolidated, intimate mixture of expanded perlite coated or uncoated, a finely divided fibrous substance such as vegetable fiber, together with an aqueous emulsion of asphalt.

In a specific embodiment the invention relates to an insulating or building board which comprises forming a slurry of expanded perlite which may be coated with a thermoplastic substance such as asphalt, and a fibrous material, and an asphalt emulsion, thereafter forming the mixture into a board while simultaneously removing the water, consolidating the material and finally drying it.

The expanded perlite used, as previously indicated, preferably is of the vesicular or sealed bubble type comprising a major portion of particles having sealed bubbles therein, but may also comprise the shattered bubble type. The bulk density of material suitable may range from about 1 to 20 lbs. per cubic foot and is preferably of the order of 5 to 15 lbs. per cubic foot. Mesh sizes as large as or larger than 10 mesh may be used, although for some purposes material passing 30 mesh is desirable. Light weight finished products are produced in this way.

The perlite, or a portion of it, may be coated prior to use in the board, with a thermoplastic material such as asphalt having a melting point above about 100° F., for example about 100°-400° F., and preferably about 140°-250° F., by mixing the expanded perlite with molten asphalt or other thermoplastic in the proper proportions. The perlite is quickly and easily wetted by the asphalt which should be molten, and a comparatively uniform mixture can be easily prepared. Other methods of applying the asphalt can be used. If the melting point of the asphalt is in the range described and the material is cooled to room temperature after the coating operation, the coated particles will flow much like sand. It is preferred to correlate the amount and melting point of the asphalt so that it can be handled in this manner.

The coated perlite has the advantage of being water proof. The finished board does not absorb water to a damaging extent either when in contact with it, or from moisture from the air. The wet strength is higher than any commercial fiber insulating board. There is also a manufacturing advantage in that filtering and drying time is reduced.

The proportion of asphalt or other coating substance may vary substantially, depending upon the particle size of expanded perlite and its bulk density and the type and quality of board desired. Thus, for expanded perlite weighing in the neighborhood of about 8 to 15 pounds per cubic foot each 100 parts by weight of expanded particles may be coated with from about 1 to about 150 parts by weight of asphalt. The proportion of asphalt to a large extent depends upon the amount of surface of the expanded perlite. In general the greater the particle surface, the more asphalt it is possible to incorporate on a given weight of expanded perlite without the particles sticking together. The actual amount that can be used is to some extent governed by the melting point of the asphalt and by the method that is employed for applying it. The character of the expanded perlite is also important, i. e. whether it is of the sealed bubble type or has many shattered fragments.

Instead of asphalt for coating the perlite, petroleum pitch, coal tar pitch, wood tar pitch, various types of thermoplastic synthetic resins, latex either of synthetic or natural origin, and other like materials may be employed. These form an excellent film on the particles, tending to prevent segregation into sizes during shipment and adds to the strength of the particle, causing it to resist breakage during handling. Of these, asphalt is preferred from the standpoint of availability, cost and ease of handling. Thermosetting resins or plastics may be used although not necessarily with exactly equivalent effects.

In certain instances, substances having special properties may be incorporated on the coated expanded perlite. These may comprise the entire coating or may be incorporated in the coating material. For example, inhibitors, accelerators, vulcanizing agents, plasticizers and the like, may be incorporated which will act upon the coating material or which may modify the properties of the board by acting upon or with the substance which is incorporated into the mixture by way of the emulsion. As an example of this, an emulsified resinous material might be used, and it might be desirable or necessary for the best results, to have a plasticizer present in the final mixture, but the desired plasticizer should not be introduced in the emulsion. By incorporating the plasticizer in the coated perlite, the combination in the final board could be readily effected.

The use of the emulsions of asphalt or related hydrocarbonaceous materials, is generally preferred because of availability, cost and ease of handling. However, it is within the scope of the invention to use other emulsifiable substances which may or may not be of a thermoplastic character but which have specific bonding or other desirable properties. Among these are materials which exist in nature as emulsions or may be produced in the form of an emulsion. Natural or synthetic rubber latices, casein, emulsions of various plastics, and mixtures thereof. Other specific materials are: buna rubber, neoprene, styrene polymers, stearines, vinyl resins, and the like. These exist or may be formed into

emulsions usually with water, generally with the use of emulsifying agents which are known in the art.

The fibrous substances used herein, may vary substantially depending upon the service for which the board is intended. When making insulating board both from a standpoint of cheapness, availability of material and the benefit to be derived, relatively short fiber materials such as paper pulp, kraft paper, rags, pulp, newsprint 10 pulp, bagasse, ground redwood bark and other naturally occurring vegetable fibers may be employed. Some of these have been used alone in insulating board available under various trade names. Long vegetable fibers, such as hemp, 15 cocoa, jute, and the like; or animal fibers, such as hair, pulped leather, silk, and the like; or artificial fibers, such as rayon, nylon, vinyon and the like, may be used. These are classed as organic fibers and are of vegetable, animal or synthetic origin. Instead of organic fibers, inorganic fibers including rock wool, asbestos, glass wool, mineral, and the like, may be employed. These materials yield products which are fire resistant and as a rule are used for special purposes where fireproofness or fire resistance are desired.

In certain instances the fibers may also be treated with a material which will coat, penetrate, or waterproof the fibers, such as thermoplastic substances, kerosene, wax emulsions, linseed oil, drying oils, and the like. These can be added to the slurry before the forming step.

The fiber may be pulped by any suitable method of which several are known and conventionally used, to produce a slurry of fiber in water. Stocks composed mainly of longer individual fibers can be made into a slurry by agitation or any suitable method.

A slurry is made of coated, expanded perlite, fiber and water to such a consistency as will readily form on the board machines. These may include continuous rotary vacuum filters, Fourdrinier machines, suction mold machines, or the continuous cylinder type of board machine.

The amount of expanded perlite ranges from about 10-75% by weight of the total suspended solids. Other useful ingredients of the finished board can be included such as sizing material of which rosin, paraffin emulsions, etc., are examples; termite repellants; materials which will prevent the formation and growth of algae, and the like. These can be added at any desired point before the forming machine or can be added after the web is formed.

A wetting agent for the perlite may be employed when using the coated expanded perlite. This tends to reduce the amount of water mechanically retained by the perlite and also reduces the time for mixing and time for filtering. Less water is retained after filtering, hence the drying time is reduced. These manufacturing advantages are outstanding for this invention.

The asphalt emulsion employed in this invention comprises an asphalt having a melting point of about 100° to about 220° F., mixed by known methods with water under such conditions as to form an emulsion that can be further dispersed or diluted in water. Known emulsifying agents are used. Such emulsions are available on the market and are used for various purposes including the impregnation of paper. Asphalt having a melting point of about 140-185° F., has been found to be satisfactory when made into an appropriate aqueous emulsion.

The melting point of the emulsified asphalt is preferably lower than that of the coating material on the perlite. This acts as a flux for the higher melting point asphalt on the perlite thereby forming a better bond. The use of asphalt of two melting points is not possible in other procedures. To use high melting point asphalt on fiber is impossible without charring the fiber or resorting to a solvent. By the present invention 5 as much asphalt as desired can be used of any melting point however high. The reason for this is that the perlite is not effected by the temperatures employed in coating it.

When a board of high asphaltic content and considerable strength and resiliency is desired, the amount of asphalt added as emulsion may run from about 10-50% of the total mixture. Other binders may be used in about the same percentages.

The use of asphalt emulsions is particularly beneficial in connection with coated particles of expanded perlite, especially those coated with asphalt. The board has improved strength when coated expanded perlite is used instead of uncoated perlite. Insulating boards which have relatively low mechanical strength requirements may be made with low percentages of the asphalt emulsion. Material that is to be used as siding or for external wall purposes, or shingles, and the like, require larger amounts of asphalt, the total amount of asphalt being as much in some cases as 150% of the fiber plus perlite in the mixture. At the upper limits of asphalt content the board formed as described can be hot molded under pressure. The same is true of other thermoplastic boards of this invention.

The mixture is kept agitated to prevent the solids from settling out prior to being deposited on the board-making device. The wet board is then passed between rolls or otherwise compressed to force out additional water and to consolidate the web or units. By regulating the pressure, differing degrees of density of the finished board can be obtained. The board thus produced may be cut into sections of desired size and dried in an oven, generally over a period of about 1 to 24 hours. The moisture content is usually reduced to about 5% by weight.

A sandwich of webs or sheets can be made according to this invention. Thus, a core of material, which may have a substantially higher insulating value but relatively lower strength than is desired in the final board, can be made. External sheets or webs of greater strength can be produced, if desired, these being of lesser thickness than the core. The sheets can be laid one on top of the other prior to consolidating or pressing them to produce the final board.

It is also possible to produce a so-called thermoplastic board by this process. To do this the perlite is generally coated with as much asphalt as possible, is made into a slurry and formed into a board, mat or sheet, as previously described, and then, during or after drying, is subjected to a high temperature consolidation under pressure conditions which will cause the asphalt to flow from the perlite into the surrounding spaces. Instead of expanded perlite, other expandable volcanic glasses may be used, e. g. volcanic ash, tuff, pumicite, and the like.

The following example is given to illustrate the invention but should not be construed as limiting it to the exact proportions or conditions used therein.

Expanded perlite passing a 30 mesh screen,

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having a bulk weight of 8 lb./cu. ft., and coated with seven pounds of 220° F. melting point asphalt per cubic foot of perlite, was suspended in an aqueous kraft pulp, using 70 parts of coated expanded perlite, to 30 parts pulp, calculated on a dry basis. An emulsion of 185° F. melt point asphalt in water was added in the proportion such that the mixture contained 20% asphalt based on the total dry mix. The mixture was formed into a board on an Oliver rotary vacuum type filter. The board thus formed was removed continuously, pressed to a thickness of about 0.5 inch, and finally dried to a moisture content of about 5%. The board was tough, flexible and useful as a wall board especially for outside application. It could be nailed, was water repellent, and while it could be partially burned by playing a flame on it, would not of itself support combustion. The expanded perlite remained in position even after burning away the organic material in the board, hence it provides substantial fire protection.

I claim as my invention:

A consolidated, low density asphalt-expanded-perlite composition useful as a building board, consisting essentially of fibers and an intimate mixture of essentially cellular expanded perlite coated with a relatively high-melting-point asphalt, said mixture having a uniform deposit throughout of relatively lower melting asphalt derived from an emulsion, said coated perlite being present as discrete particles of less than 10-mesh size and having a bulk density of 1-20 lbs.

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per cu. ft. and coated with 1-150 lbs. per cu. ft. of asphalt melting at 140-400° F., the asphalt from said emulsion melting substantially below the asphalt coating of said particles and in the range of 100-220° F., the ratio of coated perlite to fiber being about 10-75% by weight of perlite and about 90-25% of fiber, the asphalt from the emulsion comprising 10-50% of the total composition.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,537,949	Kirschbraun -----	May 19, 1925
1,722,434	Kirschbraun -----	July 30, 1929
1,825,869	Keller -----	Oct. 6, 1931
1,905,541	Wiener et al. -----	Apr. 25, 1933
1,925,584	Fisher -----	Sept. 5, 1933
1,978,923	Wiener et al. -----	Oct. 20, 1934
2,388,060	Hicks -----	Oct. 30, 1945
2,501,698	Stecker -----	Mar. 28, 1950
2,501,962	Pierce -----	Mar. 28, 1950
2,542,721	Stafford -----	Feb. 20, 1951

OTHER REFERENCES

University of Arizona Bulletin, vol. 15, No. 4, October 1944, page 35.