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WALLBOARD

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3 Claims. (Cl. 154—45.9)

It will be understood that this invention is susceptible of many modifications, and, accordingly, I do not wish to be limited in my protection, except as set forth in the accompanying claims.

This invention relates to the production of improved building materials, referring more particularly to an improved wall board having remarkable qualities of heat, cold, and sound insulation and sound absorption.

It is old to manufacture boards to serve as bases to receive the application of plaster or other finishes, or to serve as a substitute for both lath and plaster, or for general insulation purposes, these boards being of two general types—namely:

(*a*) The material commercially known as plaster board, generally consisting of two thicknesses of material such as paper or chipboard, between which is confined a desired thickness of stucco or gypsum plaster or similar plastic, which plastic is often mixed with woody or vegetable fibres, paper pulp or a soapy or effervescing agent.

(*b*) Materials commercially known as insulating boards which may be laminations of paper or chipboard or varying thicknesses of matted woody or vegetable fibres combined with suitable cementing agents.

Both serve distinct purposes—having many advantages and disadvantages, those classed above as (*a*) serving well as a plaster base and offering attractive appearance when used as an exposed finish. Little insulation value is had, however, whereas, in direct contrast, are the materials classed above as (*b*), offering splendid insulating value, but poor qualities as finishing materials or as plaster bases, due to their springiness or lack of rigidity and alternating expansion and shrinkage when subjected to the moisture embodied in plaster prepared for application.

The object of this invention is to provide a new and improved material combining the good qualities embodied in both the plaster and insulating boards described above, plus other advantages hereinafter to be described.

A further object of this invention is to produce a moulded material composed, to a great extent, of inorganic ingredients, which moulded materials shall be low in cost and light in weight, having a low thermal conductivity due principally to the porosity of its basic material.

Other and further objects will appear from the following description and accompanying claims.

The wall board may be of varying thicknesses, having paper, chipboard, sheet metal, or any other type of membrane liners on either one or both sides, or it may be made without liners or covering members of any kind. The principal purpose of the material is for use as sheets or blocks to form or become part of walls or ceilings. Plaster or other surface finishing materials may be applied, if desired; or the material may serve as the exposed wall or ceiling finish, being left undecorated or not, as desired.

The thickness of the finished wall board may be anything from a small fraction of an inch to several inches, depending on the efficiency in heat and sound insulation which the installation may require and the special conditions which may prevail in the particular installation. The membranes, in all cases, will be specially selected in view of the intended use.

In carrying out my invention, I use the product generally known as "rock sponge" described in the copending application filed by William T. Dean, Serial No. 575,119, filed November 14, 1931, for Heat and sound insulating materials and methods of making same. The following is a brief description of the method of preparing the said rock sponge.

I take limestone, sandstone, and clay in such proportions that the mixture shall have approximately 35% SiO_2, 15% Al_2O_3, 44% CaO, and 1% to 1.5% S. The other 5% will usually be made up of miscellaneous impurities. Preferably, raw materials are used for this material, although it is possible, under certain conditions, to use blast furnace slag.

The materials are mixed and melted in a furnace, and when the proper temperature is reached, the molten mixture is drawn off through a spout which is located at a substantial distance above a drainable platform or tank. As the stream of molten material issues from the spout, a small stream of water at high pressure is directed thereagainst, so that the material is broken up into fine particles and simultaneously cooled. The particles, upon cooling, swell into a sponge-like structure having many times the volume of the original material and being made up almost completely of minute gas containing cells. The amount of water used is that amount which will be substantially all turned to steam, at least momentarily, as it contacts with the molten material. Too much water will result in the formation of granulated slag or artificial sand having a high density or specific gravity, very little insulating value, and being substantially useless for my purpose. Too little water will re-

sult in the formation of substantial quantities of a coarse cinder-like material having a high density and poor insulating qualities, which is also useless for my purpose.

The highly cellular rock sponge produced in accordance with the above procedure is not to be understood as made up entirely of small gas containing cells. In the process of expanding the molten material under the influence of a stream of water directed thereagainst, every cell formed does not remain as a distinct and individual cell since to some extent some of the cells in formation expand to break into other cells and form elongated cells which impart to the rock sponge a porosity rather than cellularity. Further, of course, at the surface of the individual pieces of rock sponge, some of the cells in forming open to the exterior surface and thus form surface pockets or pores rather than cells, and likewise when large chunks of the rock sponge are broken into smaller pieces, partial cells are exposed at the fractured surfaces of the particles.

The above descriptive matter concerning features of the formation of rock sponge, as is well known by those skilled in the art to which this invention appertains relates to the formation of the structure of rock sponge which imparts to the resulting product that structure which herein elsewhere is referred to as a sponge-like structure and due to which structure the product is designated as "rock sponge," that is the formed rock sponge has a structure which, with respect to cellularity and porosity is such as is ordinarily understood to be referred to in speaking of substances as having sponge-like structure.

The pressure of the water should be so regulated as to break up the rock sponge into small particles as it cools. The higher the pressure, the smaller will be the particles, and by regulating the pressure, particles of the most suitable size can be obtained.

The rock sponge is then drained, and may be partially or completely dried, sifted to size, if necessary, and then mixed with suitable binders such as stucco or gypsum plaster, quick setting cements or highly viscous cements such as silicate of soda, casein, starch, dextrine, resin, and asphaltic or bituminous cements, in a manner whereby sufficient strength for handling is developed. However, where greater strength and flexibility are required, I find it essential to incorporate in the mixture suitable amounts of fibrous material which may be in the form of either mineral or organic fibres, the quantity of same used being governed by the strength or toughness desired. The percentage of fibres used naturally varies also in boards which are confined between membranes and those not to be, the former requiring less fibre to develop the required strength, owing to the strength secured from the membranes.

While I have described one method of producing an aggregate suitable for the purpose, it will be understood that any other aggregate having similar characteristics might be used. It will also be understood that a slightly less porous material, such as pumice, or even slag which has been partially but not completely expanded, may be used for certain installations, particularly where greater strength is desirable, but where greater weight, less insulating value and less sound absorbing efficiency are permissible.

The expanded rock sponge hereof in large chunks has a density of about 5 pounds per cubic foot and when broken up into aggregates suitable for formation, with binder substances, into molded or formed products has in such particle size a density which may range from about 6 pounds to 9 pounds per cubic foot. The rock sponge hereof when broken into aggregate ranging from about 6 to 9 pounds density per cubic foot will have a conductivity in the neighborhood of a little under .025 B. t. u./inch thickness/sq. ft./hour/degree Fahrenheit.

In manufacturing board of the membrane or sheathed type, I find that a very satisfactory product can be made by using varying mixes of cements of the gypsum class which are quick-setting and an aggregate consisting of "rock sponge" or other cellular aggregate; which ingredients are mixed for hydration before or at the time of insertion between the membranes. Since the density and, naturally, the insulating value are dependent greatly upon the cellularity of the aggregate, I find it advisable, when high insulation value is desired, to use as much aggregate and as little binder as possible. Successful material can be manufactured from mixes ranging from one part binder to four parts aggregate to four parts binder to one part aggregate, the former having advantages of low density and high insulating value, whereas the latter gives greater strength. Varying percentages of fibres may be added to either of the materials in advance of the addition of the liquid or may be added at the same time.

When the binder or cementing agent is to be of the more viscous type, such as sodium silicate or other highly concentrated liquids or powders, still better results may be had in the way of still lower density resulting in greater insulating value. I find that with sodium silicate, varying results are had by varying the amount of silicate. For good general results, I use from four to ten pounds of 40° Baumé silicate to a cubic foot of the loose aggregate. It is possible, however, to vary these extremes considerably. In the manufacture of wall board, it is rather essential to secure a quick set to the plastic mix, which I secure by adding an ingredient such as sodium silico fluoride or alum having the qualities and capabilities of reacting with sodium silicate and "rock sponge" or similar aggregates. When these three ingredients are combined, an early "set" is had. Also, the silicate becomes essentially insoluble, and little chance of "efflorescence" is had when the finished material is subjected to dampness. The quantity of sodium silico fluoride, alum, etc., used varies from one half ounce to three ounces per pound of sodium silicate. The addition of fibrous materials described above also tends to lend strength to this board. In the manufacture of my wall board, no major deviations from standard wall board making practices are necessary, excepting that with certain mixtures it becomes necessary to use more compression in forcing acceptable engagement between the particles of aggregate and in securing an even, complete knitting between the conglomerate and the covering membranes when same are to be used. The operations of manufacture may consist of gauging and mixing the conglomerate, then placing same between membranes, when same are to be used, then compressing by means of rolls, platens, etc., then conveying by means of slow moving belts, etc., and then drying—preferably in multi-level progressive dryers or kilns. I have found that when rock sponge is used for a filling material, the chipboard membranes are not perforated or

broken by its sharp edges during the compression of the board between the rolls or platens, due to the low crushing strength of the material. I have found that when rock sponge is used for a filling material the chip board membranes are not perforated or broken by its sharp edges during the compression of the board between the rolls or platens due to the low crushing strength of the material.

For certain purposes, particularly where a board is desired which will readily receive nails without crumbling, and which will have great flexibility, "hot" binders such as asphalt or the like may be used. In such cases the binder will of course harden upon cooling, and the above described method of drying in kilns will be eliminated. Gums, resins, latex and similar easily meltable materials may also be used if desired.

It will be understood that the edges of the wall board may be reinforced in accordance with the usual practice, and any other refinements applicable to this type of board may be adopted.

Recent developments have indicated that the above described board, even the type having membranes, has great value for absorbing sound; and it is believed that its use for this purpose will result in great economy. Due to its lightness and strength, it may be applied in much larger blocks or sheets than heretofore used for materials of similar sound absorptive powers and qualities of fire-resistance and permanence. My molded filler has considerable sound absorptive power, even though covered with ordinary unperforated membranes, but best results in this respect are obtained only when the facing membrane is entirely removed or is perforated mechanically at some stage of the manufacture or erection. It is also possible to use certain membranes which are naturally porous and, therefore, susceptible to passage of sound waves.

Accordingly, where the material is to be used for sound absorbing purposes, I provide for the removal of one of the membranes between which the rock sponge and binder are retained, or else perforate the one of these membranes which is to be exposed.

I claim:

1. A wall board comprising a pair of separated membranes, rock sponge particles in the space between said membranes, and a binder in which said rock sponge is imbedded and which retains the said particles and said membranes in position each with respect to the other, said binder comprising a mixture of sodium silicate, and sodium silico fluoride, substantialy in the proportions of five to nine pounds of binder per cubic foot of loose rock sponge.

2. A rigid plaster board structure comprising a core of a substantially uniform mixture of granules of artificially expanded highly porous and cellular lithic material and a gypsum binder, the lithic material being about 20% by weight of the mixture and fibrous cover sheets adhering to the surfaces of the board core.

3. In a wall-board, a core comprising rough irregular granules of highly expanded, irregularly porous and cellular lithic material of a silicate of lime base, relatively rigid means internally reinforcing the board and segregating the core material, and a reinforcing and protective envelope for said core and said means.

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