

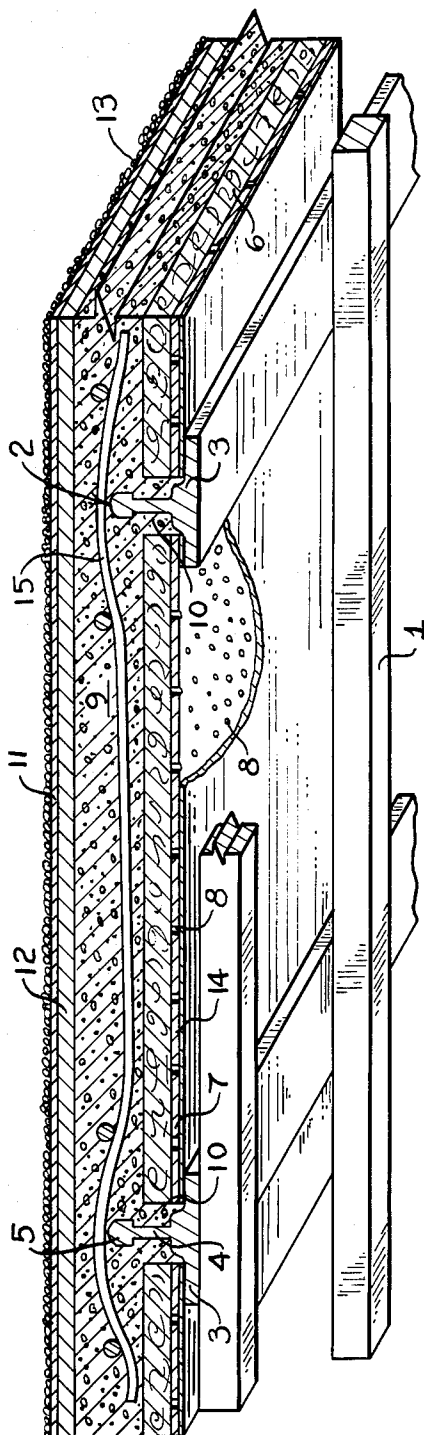
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WALL CONSTRUCTION

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1

3,203,146

WALL CONSTRUCTION

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3 Claims. (Cl. 52-328)

This application is a continuation of Serial No. 752,992, now abandoned.

This invention relates to wall constructions, such as, for example, roofs and the like; more specifically, it relates to a wall construction wherein a control is placed upon the moisture evaporating from within the construction and also upon the moisture that can penetrate into the construction, and at the same time, strength characteristics of the wall construction are improved, with cost advantages.

One of the common ways to effect constructions used in the building industry for walls, such as, roofs, side walls and the like, has been to fabricate such walls utilizing a cementitious mix poured on form boards, and, after the mix has set, to allow the form boards to remain in place thereby becoming part of the wall construction.

In fabricating a roof construction of this type, for example, the form boards are superimposed on the ceiling joists, purlins, roof rafters, ceiling beams, or the like, and secured thereto. The cementitious mixture is prepared and poured on the form boards to the desired thickness and allowed to set and harden. After a period of several days, the mixture has set sufficiently to permit walking on the surface thereof and also to permit a further covering to be adhered to the set cementitious mixture, as is usually done, commonly, by superimposing a plurality of layers of building paper in a mastic of asphalt, bitumen, or the like, and on which is placed a layer of gravel. The exterior or weather side of the wall is thus finished in a very short period of time; usually, this side of the wall is completed before the cementitious mixture has sufficient time to cure completely or has sufficient time to evaporate the moisture within the body of the mixture. The only avenue of escape for the moisture contained within the cementitious mixture is through the form boards upon which was poured the mixture. After a relatively long period of time, such as, for example, two or three months, the balance of the moisture has thus escaped from within the mixture through the form boards, and the cementitious mixture has taken on a substantially permanent cure. However, the construction is such that no effective vapor barrier is produced on the form board face or side of the wall (usually the warm, interior side) for subsequent periods of use, i.e., after this two or three month curing stage. Because of this lack of an effective vapor barrier, moisture, usually contained in the warm, moist interior air, permeates or pervades the form board where it eventually condenses; likewise, moisture penetrates through the joints between the form boards and the purlins or between the form board and the sub-purlins. After condensing, the moisture either tends to soak the board or, if the ambient air is at a low temperature, the moisture freezes, expands, and creates cracks or defects in the wall construction. It will also be seen that the load placed on the form boards by the mix, and by the loads carried by the hardened mix, are such as to require the form boards to have a high effective modulus of rupture.

An object of this invention, therefore, is to provide a novel method for fabricating a wall construction, or the like, whereby for a short period of time moisture is

2

allowed to escape from within the wall through both major faces and, after which, an effective vapor barrier is provided on the exterior face or side by a built up roof, and then, after further cure and loss of moisture through the interior face or side, an effective vapor barrier is also provided on that face or side of the construction to prevent moisture penetration from the ambient air to within the wall construction.

Another object of this invention is to provide a novel wall construction which allows moisture evaporation for a relatively short period of time, and after a relative lengthy period of time, prevents moisture from penetrating or being absorbed within the construction, while adequate strength characteristics are obtained, with favorable cost considerations.

In the type of construction herein under consideration, a light weight cementitious mixture is used as a basic wall construction and the form boards, used in the laying of the cementitious mixture, are provided with a covering which allows moisture to escape by evaporation from within the construction to the interior of the fabricated room unit during the setting of the concrete. After a considerable length of time, during which the concrete has hardened to a substantially permanent set condition, the construction is modified in such a manner that an effective vapor barrier is produced thereby preventing moisture penetration into, rather than out of, this set or hardened wall construction.

In brief, the invention comprises a novel method and apparatus for manufacturing a wall construction, such as, for example, a roof or the like, wherein a plurality of fibrous form boards are used as a basic form upon which a cementitious type aggregate or mix is poured and allowed to set or cure. After the initial set or curing, the aggregate or mix is covered with common roofing materials, such as, for example, roofing paper, asphalt, and grandules, thereby completing the basic wall construction. Each of the form boards used in this type of wall construction is fabricated with a perforated coating or covering of vapor impermeable material, such that during the curing of the cementitious aggregate or mix, moisture from within the aggregate is allowed to escape through the perforations in the form board covering. After a considerable length of time, during which most or all of the moisture has evaporated from within the interior of the wall, the perforations are sealed, thereby producing a completely vapor impermeable coating or covering. After this final stage of wall construction, moisture is prevented from passing to the interior of the construction from the exterior of the wall, because of the vapor impermeable wall covering in the form of a built up roof or the like, and also from the interior because of the sealed vapor barrier facing the interior compartments of the construction.

The foregoing and other objects will be readily apparent from the foregoing summary and the following more detailed description and attached drawing wherein:

The single figure is a pictorial view, partially in cross-section, of a typical wall construction fabricated according to the principles of the present invention.

In fabricating a wall, such as, for example, a roof, a plurality of purlins are spaced a predetermined distance apart to form the open frame construction of such a wall. The purlins may be studding, beams, joists, rafters, or the like. The description hereinafter disclosed is made with reference to a roof construction; it is to be understood, however, that other types of walls such as side walls, are within the purview of this invention even though the specific details of such other constructions are not recited herein. The ends or the approximate ends of

the purlins 1 are supported in a known manner, such as, by a roof rafter and/or by the walls or frame of a building. It is a common practice to space such purlins approximately 16-24 inches on centers; however, it is to be understood that any desired spacing may be utilized herein.

Across the purlins 1 are mounted sub-purlins 2 secured thereto by any form of common securing means; each sub-purlin comprises a member, extending transversely to the purlins 1, having an upper bulbous portion 5, a relatively thin supporting web or neck 4, from which extend a pair of flanges 3, herein used as the actual end support for the form board.

The form board or planking 6 comprises a relatively light weight fiber type board commonly fabricated in sizes from 32 in. by 8 ft. to 32 in. by 12 ft. Such form boards are well known to the building products industries and are manufactured of various materials, under various trade marks. Typical of such materials are wood, cane, or other vegetable fiber insulating board and ground wood insulating board. The specific gravity of such boards varies between .25 and .27; that is to say, their density is approximately 17 lbs. per cu. ft. A typical insulation board that may be used in the construction of the present invention comprises 60% fine ground, soft wood and 40% cooked hard wood, which may be asphalt impregnated if so desired. During mixing, the wood mixture is sized by a wax mixture which increases its weathertight characteristics. The mixture is passed through a forming mill where it is formed to the desired thickness, hardness, and density.

Prior to superposition of the form board 6 upon the flanges 3 of the sub-purlin 2, a perforated vapor barrier 7, having perforations 8 therein, is secured, as by cementing, to one of the two major faces of the form board 6. The particular vapor barrier that may be used is one of a group, well known in the building trade. An example of such a vapor barrier is a kraft asphalt duplex paper, 30-60-30. This type of paper consists of 2 layers of kraft vapor barrier paper having a weight of 30 lbs. per ream, that is to say, 30 lbs. per each 3,000 sq. ft., and which layers have sandwiched therebetween an inner stratum of asphalt, bitumen, or the like having a weight of 60 lbs. per ream.

Before adherence to one face of the form board 6, the vapor barrier 7 is perforated at a plurality of points to form a plurality of perforations 8 through the paper; however, if desired, these perforations 8 may be imparted to the paper after the paper covering has been applied to the board. These perforations 8 must be very tiny, not much larger than pin pricks, to allow for subsequent sealing. In practice it has been discovered that such perforations 8 preferably should not exceed $\frac{1}{32}$ inch (0.03") diameter in order to be effectively covered by a sealer. The perforations 8 may be imparted to the vapor barrier paper 7 by a plurality of piercing needles attached to a common base, such that, when the paper 7 is superimposed over the ganged piercers, a plurality of perforations 8 are formed in the vapor impermeable paper. Preferably, the perforations 8 are extended only to within a few inches of opposite edges of each board 6, as the facing adjacent the edges either rests upon a sub-purlin 2 or is adjacent a purlin 1 making such edge surfaces difficult to reseal.

After the form boards 6 are placed on the flanges 3 of sub-purlin 2, reinforcing wire 15 is placed upon the form board 6 and a cementitious type mixture 9 is poured over the form boards; the aggregate is subsequently allowed to set and harden. Within a relatively short period of time, that is to say, 2 or 3 days, the mixture 9 has sufficiently set or cured so that it may be walked upon. During pouring of the mixture, the mix encircles the wire 15 and the bulbous portion 5 of the sub-purlin 2, forming a tight bond therewith, and also forms a bead 10 between the form boards 6. The reinforcing wire

15 increases the tensile strength of the bottom portion of the hardened mixture since, under ordinary roof loads, this portion is subjected to considerable tension.

The cementitious mixture 9 is of the light-weight and quick setting type and may comprise basically a gypsum or Portland cement type aggregate, used in conjunction with a perlite or a vermiculite filler. A typical formulation contains, by weight, 4 parts of a light-weight filler, such as, for example, perlite or vermiculite, intimately mixed with 1 part Portland cement or gypsum. Sufficient curing water is added to the dry mix, and the subsequent wet mix is then poured over the form boards 6 of the wall construction.

After the initial setting or curing of the cementitious mixture, the top or open or exterior surface thereof is covered with roofing paper 11, embedded in a mastic 12 of asphalt or bitumen or the like. The roof is finished by the superposition of additional mastic and fine granules 13 over the mastic 12 and roofing paper 11 to provide thereby a tight, weather resistant, moisture impermeable covering on the cementitious mixture 9. Numerous other types of moisture impermeable roof coverings, as, for example, a shingle type covering, may be substituted for the covering specifically recited herein without departing from the spirit of the invention.

At this stage, the construction is such that the moisture within the cementitious type mixture 9 cannot escape through the vapor impermeable roof covering 11, 12, 13 but must pass through the form boards 6. Since the perforations 8 are provided in the vapor impermeable sheet or membrane 7, the moisture within the body of the construction is allowed to evaporate gradually into the interior of the room. This process of moisture evaporation continues for an extended period of time, such as, for example, a period of 2 or 3 months, during which time the mixture 9 takes on a permanent cure. However, once all or approximately all of the moisture has escaped from within the body of the wall thusly constructed, these ports or perforations 8, if not sealed, will allow moisture to pass from within the interior of the room compartment to within the interior body of the wall. After penetrating into the wall interior, such moisture eventually will condense and wet the form boards adjacent thereto. During periods of cold weather, this moisture can freeze and expand thereby causing weakening of the wall construction to such an extent that cracks may occur therein. To prevent such harmful occurrences, the membrane 7 is covered by a vapor impermeable sealer 14 which not only increases the weathertightness of the unperforated areas of the membrane 7 but also seals off the perforations 8, thereby providing a continuous vapor impermeable covering on the interior wall surface of the wall construction. Since the portions of the form boards resting on the sub-purlins 2 cannot be reached for sealing, the perforations within several inches of each supported edge of the boards are preferably omitted; in this manner, the original construction provides for an effective vapor seal at the supported edges of the form boards 6 superimposed upon the flanges 3 of the sub-purlins 2.

The waterproof layer or membrane provided by sealer 14 may be any type of waterproof covering, such as, for example, waterproof paint. It will be appreciated that such a sealer is effective to complete the sealing of a partial vapor barrier having pin holes as described, by sealing the pin holes, but that it is not sufficient merely to rely solely upon the sealer, such as waterproof paint, to impart complete vapor barrier characteristics to an otherwise vapor permeable surface on the form boards. In other words, the results obtained in accordance with this invention cannot be obtained merely by painting over, with a waterproof paint, an ordinary form board, having no perforated vapor barrier sheet on its surface, at a time corresponding to the time of application of the sealer 14 as referred to above. In covering or sealing the partial vapor barrier, a film is created over the per-

5

forations 8, since the perforations are so relatively tiny. On the other hand, if the partial vapor barrier was not provided, the sealer covering the form boards used in this invention would not be very effective as a sealer in view of the relatively high vapor permeability and high wicking properties of such boards.

Not only is an effective vapor control produced by following the precepts of this invention, but the modulus of rupture of the form board is increased by the adhesion of the perforated, vapor impermeable paper. As noted, the specific gravity of such fiberboards usually ranges from .25 to .27, or approximately 17 lbs. per cu. ft. density. With the addition of the membrane 7, the membrane is located at a position on the fiberboard 6 whereby the modulus of rupture of the form board is increased. This is important in view of the fact that the mixture 9 superimposes a weight load upon each of the fiberboards or form boards 6 so that the face adjacent the membrane 7 is placed in tension; additional loads are also imposed on the boards 6 by persons walking on the construction or by snow loads on the roof. However, membrane 7, to a considerable extent, reinforces the fibers adjacent this tensioned surface so that an increase in modulus of rupture is produced. Because of this factor, rather than being of a specific gravity of .25 to .27, that is to say, approximately 17 lbs. per cu. ft., the specific gravity of such form boards may be decreased to .22 or .20, that is to say, approximately 12 to 14 lbs. per cu. ft. An appreciable saving can thus be made in the initial cost of the raw materials used in formulating the form boards 6.

Having thus described my invention in rather full detail, it will be understood that such details need not be strictly adhered to and that other objects and advantages will become apparent to one skilled in the art, all falling within the invention as defined by the subjoined claims.

What I claim is:

1. A method for forming a wall comprising the steps of supporting a vapor permeable board having a vapor permeable sheet on one face thereof, providing a moist, hydraulic-setting cementitious mixture on the face of said board opposite said vapor permeable sheet, allowing said cementitious mixture to set initially to a condition in which it still contains excess moisture, sealing the exposed surface of said mixture with a moisture impermeable

6

covering, allowing the excess moisture in said mixture to escape through said vapor permeable board and sheet, and rendering said sheet vapor impermeable, thereby preventing passage of moisture therethrough and into said board.

2. A method for forming a wall comprising the steps of supporting a vapor permeable board having a perforated sheet of vapor impermeable material on one face thereof, providing a moist, hydraulic-setting cementitious mixture on the face of said board opposite said perforated sheet, allowing said cementitious mixture to set initially to a condition in which it still contains excess moisture, sealing the exposed surface of said mixture with a moisture impermeable covering, allowing the excess moisture in said mixture to escape through said vapor permeable board and said sheet, and sealing the perforations in said sheet to render said sheet vapor impermeable, thereby preventing passage of moisture therethrough and into said board.

3. A wall construction comprising a plurality of spaced supports, a plurality of vapor permeable boards contacting the supports adjacent the ends of the boards, a cementitious mixture adhering to the side of said boards opposite the side adjacent said supports and forming with said boards a solid continuous wall, a vapor impermeable covering on the side of said cementitious mixture opposite said boards, and a sheet of vapor impermeable material on the side of the boards opposite the cementitious mixture, said sheet having a plurality of minute openings in the areas not engaged by the supports, whereby vapor may pass from the cementitious mixture through the minute openings to allow said mixture to cure.

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