Dec. 9, 1941. C. L. NEUMEISTER 2,265,244

BUILDING WALL AND MATERIAL THEREFOR

Filed May 19, 1938

Fig. 1.

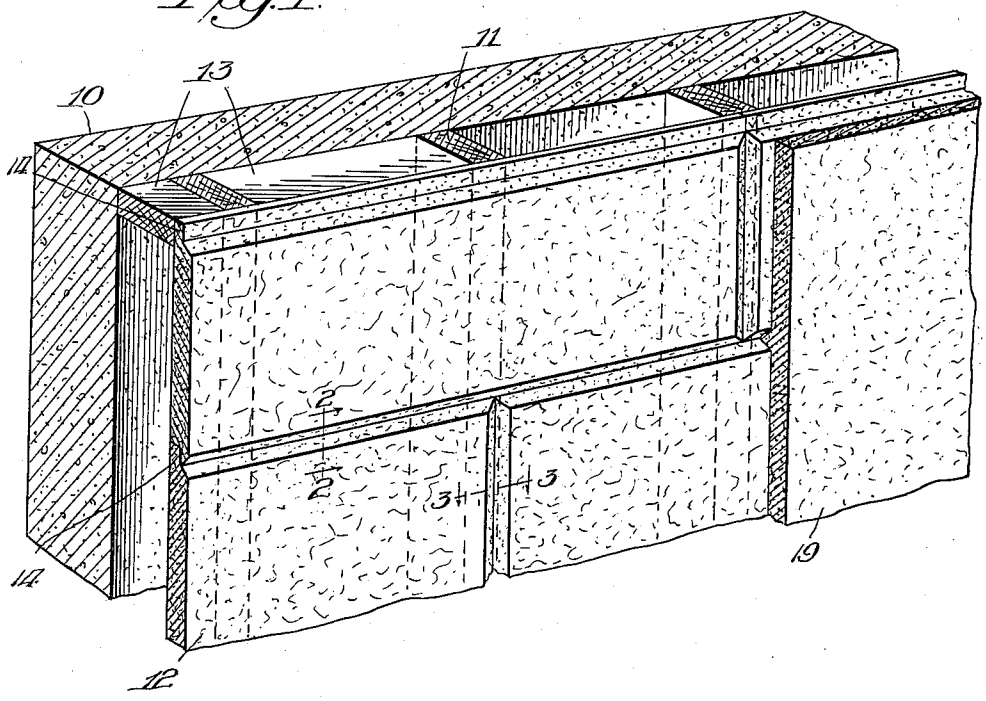


Fig. 2.

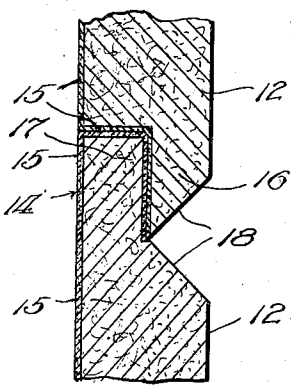
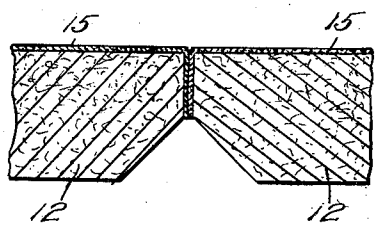


Fig. 3.



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BUILDING WALL AND MATERIAL THEREFOR

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3 Claims. (Cl. 72—31)

In view of the most recent developments in the building industry and particularly because of the relatively high humidity condition which is being maintained, particularly in residences in connection with air conditioned heating, it has become necessary to devise improved structures and materials therefore to meet new problems which have arisen in connection with these new conditions.

In many of the older building structures the exterior walls were relatively air permeable so that the stud spaces in the walls, that is, the space between the interior of the exterior wall and the backside of the interior finish wall, were relatively freely ventilated but in modern buildings this condition does not exist if the construction is sound. In the modern building the exterior walls are being built tight, that is, they provide less air leakage into the stud space than was quite common in older forms of construction, and stud spaces are being sealed off more completely by stops extending from stud to stud, which stops tend to prevent the circulation of air in the stud spaces.

In the more modern building, particularly in homes, it is quite common that there is installed air conditioning warm air heating, or in conjunction with other forms of heating there is provided some means for humidifying so that it is quite common now in residences for humidity of around 35 to 45% to be maintained during the heating season.

In the winter time, particularly due to the relatively low exterior humidity which commonly exists, there is a decided tendency for the moisture in the air in a building to diffuse through the walls from the interior to the exterior and due to the fact, that, as mentioned, the stud spaces are relatively sealed chambers with little air circulation therethrough, it is quite common that the humidity within the stud spaces in a wall is substantially that of the interior of the structure, that is, of a relative humidity of around 35 to 45%.

Through a goodly portion of the United States during the winter it is common that the exterior temperature is at freezing or below and, therefore, it results that through a building wall from the interior to the exterior there is a temperature gradient drop from the interior temperature of about 70 to 75° down to the exterior temperature which, as stated, is often around 32° or lower. In those parts of the United States where the winter temperatures are relatively low, it is certain that during a good portion of the heating period that because of the temperature drop from the interior to the exterior of a building wall that somewhere between the interior thereof and the exterior a dew-point temperature will exist for the conditions of humidity existing and that consequently at such plane of the wall, that is, at the plane of the dew-point temperature, there will be condensation of the moisture in the air confined in the wall with the consequent deposit of the moisture therefrom, as water.

If dew-point conditions exist in a wall and water is deposited therein, it immediately follows that through diffusion more moisture from the interior humid air will diffuse into the air from which the moisture was condensed and, therefore, so long as dew-point conditions exist within a wall structure water will continue to be condensed out of the air until eventually sufficient water may be condensed to thoroughly saturate the wall structure, which water, if the exterior temperature is below freezing will quite likely freeze and in some cases it has been known that sufficient water has collected and frozen within a wall that portions of the wall have been more or less disrupted by the expansion consequent to the freezing of the water. The water which is condensed in the wall structure even though it may not freeze, is otherwise deleterious. The presence of such water promotes rotting of wood members, disintegration of brick, etc., and particularly in wood frame buildings the wetting of the siding boards causes the paint to blister and peel off of the exterior walls.

The invention herein disclosed relates to a manner of building walls and materials therefor to overcome these disadvantages above particularly pointed out.

Particularly the object of the invention is the provision of a building wall construction and of materials therefor which will prevent to a very substantial degree, if not entirely, the condensation of water within the interior structure of building walls.

The objects of the invention are further to provide interior wall forming materials which will almost entirely, if not completely, prevent the diffusion of the moisture, present in the air in the interior of a building, into the open wall spaces thereof, and a further important object of the invention is to provide such an inner wall forming material which has other advantages resulting from the accompaniment of the primary objects of the invention, as for example the inner wall forming material provides a wall surface which is more level or rather which is more

merely planar than that provided by similar inner wall forming materials which do not incorporate the inventions disclosed in this application.

The invention of this application is disclosed in the accompanying drawings, which, when considered in view of the description of this specification disclose the inventions hereof and the manner of practice thereof.

In the drawing:

Figure 1 is a perspective view of a portion of a building wall constructed in accordance with the inventions hereof;

Figure 2 is a fragmentary end view of two adjacent inner wall forming units to show the edge joint along the long edge, as the impervious coating at the edge joint would appear at 2—2, parts being broken away; and

Figure 3 is a fragmentary end view of two adjacent inner wall forming units to show the edge joint along the short edge as the impervious coating at the edge joint would appear at 3—3, parts being broken away.

The invention described briefly is with reference to a building wall construction wherein 10 indicates an outer wall which may be composed of brick, concrete, wood or other suitable exterior wall surfacing material, and 11 indicates appropriate studs or the like which are interposed between the outer wall 10 and inner wall surfaces 12, which inner wall surface forms the wall surface of the space enclosed, or upon which may be applied an inner wall surfacing material such as plaster 19 or other suitable inner surfacing.

Since in any well-constructed building the exterior walls are quite air impervious and it is usual to apply between the studs 11 stops such as 13, and as the inner wall surface material 12 is applied in relative large sheets with ship-lapped joints such as is shown at 14, it results that within the stud space in the interior of the wall there is little or no air circulation and therefore there is substantially no opportunity for the exterior air of low humidity to enter into the stud space and dilute the air contained therein which will be of relatively high humidity.

It is a well-known physical phenomena that with air of different humidities on opposite sides of a partition there are strong natural forces tending to cause the moisture content of the air to diffuse through the interposed barrier to bring about an equilibrium of the moisture content of the air on the two sides of the barrier, and that since the materials ordinarily used for the interior surfaces of walls are not impervious to the diffusion of water vapor therethrough, it results that if there is a lower moisture content on one side than on the other, that the moisture does diffuse through the intervening material to equalize the moisture content on the two sides of the interposed barrier. This condition which has just been described, can be overcome by providing in conjunction with the interior surface of the wall, a vapor stop, that is, by providing in conjunction with the interior surface of the wall structure a layer of material which serves to prevent the diffusion of the water vapor from one side of the interior wall surface to the other side thereof, that is, from the interior of a room into the stud space.

In accordance with the invention hereof, the objects of the inventions are accomplished by providing in conjunction with the interior surfacing material of the wall structure, a layer of material substantially impervious to water vapor which layer of water vapor-impervious material may comprise a coating of asphalt or of any other materials which serves the purposes of this invention by having the property of functioning to prevent or effectively resist the passage of water vapor therethrough.

In the drawing, the interior wall 12, and which may be one of the commercial fiber insulating boards, gypsum wall board, etc. generally available, has applied to the back surfaces thereof a layer 15 of asphalt or other material serving the desired function as above described. The interior wall forming material 12 in the drawing is indicated as a sheet of fiber insulating board in a form which is commonly available, that is, as insulating lath, approximately 18" x 48" in dimension, and having a thickness of ½", although commercially available in other thicknesses such as ¾" and 1". The particular interior wall forming material, as stated, illustrated as an insulating lath is provided on its two long edges with a ship-lapped and beveled joint in which the tongues 16 and 17 overlap and in connection with which due to the bevels 18 provided, there is formed between the edges or adjacent such laths, or units 12, V-shaped grooves which serve as plaster receiving recesses whereby when plaster 19 is applied to the surface of a unit, the back side of such applied plaster sheet is provided with plaster reinforcing ridges formed in the recesses provided by bevels 18. Usually at the ends along the narrow edges of such insulating laths 12, there is merely provided a bevel since, as these ends are ordinarily positioned on studs 11 it is unnecessary that the overlapping tongues be provided to prevent free communication from the space on one side of the lath to a space on the other side of the lath.

In the drawing, the vapor proof coating applied to the lath 12 is shown as applied to the rear face thereof and it is, of course, to be understood that such coating is applied in a manner so that insofar as possible, it provides a continuous and complete coating over the back surface of layer 12.

In building the wall of a building in accordance with the inventions of this application, after the exterior wall has been erected and the studs have been properly placed and secured and the interior wall erected by the application of the insulating laths 12, applied to the studs, the interior surfaces may, if desired be plastered so as to provide a continuous and unbroken wall surface. It is, of course, well known that the plaster when it is applied contains a large amount of water so that immediately upon the application of plaster to the surface of the insulating laths 12, even though ordinarily the fibers thereof have been treated to be water-repellent, water is absorbed into the body of the lath and, of course, water vapor from the water contained in the plaster diffuses into and permeates the interior of the body of the insulating lath 12. As these insulating laths are composed of fibers derived from vegetated growth which fibers tend to swell upon the application of moisture thereto and shrink upon the removal of the moisture therefrom, it follows that when plaster is applied to laths 12 that immediately the fibers nearest the surface to which the plaster is applied begin to expand and as a result this surface tends to increase in area, whereby, due to the fact that the laths are secured to the studs 11 the laths 12 tend to bow inwardly or assume a convex curvature with respect to the room space, and at the same time, due to the fact that the plaster thus applied

does not immediately set, the surface of the plaster assumes a like curvature. In a short time the moisture from the plaster diffuses throughout the lath 12 and tends toward equalization of moisture content therethrough so that there is a tendency then for the lath to assume a flat condition, that is, the curvature tends to decrease, but for a lath 12 which does not have the coating 15 thereon, it results that at this time moisture begins to diffuse from the rear face of the lath and there remains an appreciable tendency for the convex condition thereof to persist, that is, for the front face to be expanded more than the rear face.

Still later on, that is, for a lath not having the coating 15, as the plaster sheet and fibers of the lath dry out by diffusion of the moisture content therefrom, the lath tends to assume a still further convexity because the diffusion is much more rapid from the rear surfaces than from the front surfaces where moisture must in addition diffuse through the plaster sheet. The shrinkage of the rear face is greater than that of the front face of the fiber lath and there is created an unbalanced condition which tends to further convex the lath between adjacent studs 11. By the time that the interior wall structure, that is the insulating lath and plaster sheet, have dried out the plaster sheet will have taken its permanent set and as a result it will be found that the exposed plaster surface comprises a series of waves or convexities from stud to stud over its entire surface.

In a plastered interior wall where the insulated laths 12 have had applied thereto the asphalt coating 15 the conditions are somewhat different from those above described. When the plaster is applied to the untreated surface of the lath there is, of course, the same tendency for the fibers of this surface to expand and to cause convexity between adjacent studs and then there is the same tendency for the moisture to diffuse throughout the fibers of the lath 12 but due to the fact that the back of the lath 12 has the relatively impervious coating 15 thereon, there is a very decided tendency for the entire lath to expand uniformly, that is the back surface tends to expand to the same extent that the front surface expanded and thus the lath tends to straighten out or assume a plane surface and to, as a consequence, move the exterior surface of the plaster sheet likewise to a plane. Since the moisture contained in the plaster sheet and insulating lath 12 cannot evaporate from the rear face, the moisture must evaporate from the exposed surface of the plaster, and, therefore as a result the entire body of the insulating lath 12 remains of substantially uniform but slowly decreasing moisture content not decreasing appreciably before the plaster is fully set, so that as a result there is practically no tendency whatsoever for the plastered surface to be again stressed to a convex surface between adjacent studs 11.

In a building wall construction as has been above described, even though the humidity within the space enclosed in relatively high, say 40%, and though this humidity may diffuse into the plaster sheet and into the insulating lath 12 further diffusion thereof is prevented by the asphalt sheet 15 applied to the rear surface of the lath and as a consequence the moisture from the enclosed space is not diffused into the stud space. In view of the fact that the relatively high moisture content of the enclosed space cannot pass into the space between the studs, with consequently relatively low humidity existing in the stud space, it follows that the dew point in the stud space is low and that under all ordinary and usual conditions the dew point in the stud space is sufficiently low that the temperature gradient line representing the temperature drop from the interior surface of the building wall to the exterior surface thereof, does not include the dew point temperature for the humidity condition existing in the stud space. The dew point temperature not being reached across the stud space, it consequently follows that moisture is not condensed out of the air within the stud space and that, therefore, no deposit of water occurs therein with the attendant adverse consequences as were mentioned as arising under conditions where water is condensed out of the air and deposited in the stud space in the absence of provisions for preventing such condensation as disclosed in this application.

For best results the individual sheets forming interior wall 12 should have the vaporproof coating 15 extending onto their edges. In the drawing the vaporproofing 15 is shown as extending up on the abutting edges of individual units of the interior wall 12 and on the long edges extending also across the contacting faces of the overlapping tongues 16 and 17.

In view of the above description it will be seen that by building a wall in accordance with the teachings of the invention hereof, wherein the interior surface of the wall is provided with a water vapor barrier that there is provided a wall construction wherein not only are the adverse effects of the condensation of water vapor in the wall structure avoided but that in the use of the materials hereof, there is the further advantage that an interior plastered wall surface applied on such materials as a base result in the provision of a smoother and a more nearly plane wall surface.

The preceding description and explanation of the invention is to be understood as illustrative of the preferred embodiment of the invention and is not to be taken as in limitation thereof. The invention heretofore described is susceptible of many and various modifications thereof which will occur to those skilled in the art to which such invention pertains without departure from the principles of the teachings hereof. It is intended that this specification shall be general in nature, but it is to be understood that it is generally descriptive of the various modifications of the general disclosure thereof.

The invention hereof is not to be in any manner deemed by the inventor thereof as in any manner limited other than as limited by the specific terms and limitations of the appended claims.

What I claim is:

1. In a wall structure a vapor barrier comprising fiber insulating units positioned in edge to edge contact forming a continuous construction, the units on a face thereof having a continuous coating of a substantially vapor impervious substance, such coating extending onto the edges of the units and on assemblage thereof providing a continuous and sealed barrier between contiguous units and a seal against the transmission of vapor from one side thereof to the other side thereof.

2. A construction unit adapted to be assembled in contiguous relationship with other similarly formed units, comprising a sheet of heat insulating material, the sheet of heat insulating ma-

terial having a continuous stratum which is substantially impervious to the transmission of water vapor, a heat insulating plaster base unit comprising a fibrous plaster receiving sheet material, a face surface of the sheet having thereon a continuous film substantially impervious to the transmission of vapor therethrough, the film extending onto the edges of the unit; whereby on assemblage thereof, the film on the edges of the unit is adapted to form a continuous and sealed barrier between contiguous units and a seal against the transmission of vapor from one side of the assemblage thereof to the other side thereof.

3. A heat insulating plaster base unit adapted to be erected in contiguous relationship with other similarly formed units, comprising a fibrous plaster receiving sheet material, opposed edges of the unit formed for complementally overlapping complementing edges of adjacent like units, the unit having a continuous substantially water impervious vapor barrier, the vapor barrier extending onto the overlapping faces of said formed edges of the unit; whereby, on assemblage thereof, the vapor barrier is adapted to form a continuous and sealed barrier against the transmission of vapor from one side of the assemblage thereof to the other side thereof.

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