

May 3, 1938.

J. M. LE GRAND

2,116,270

BUILDING STRUCTURE

Filed Sept. 19, 1932

Fig. 1

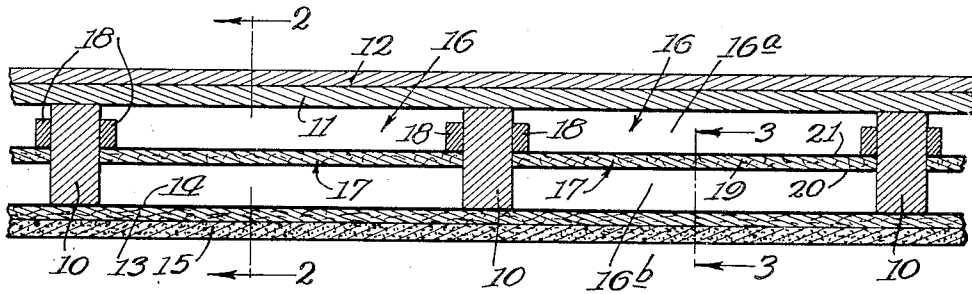


Fig. 2

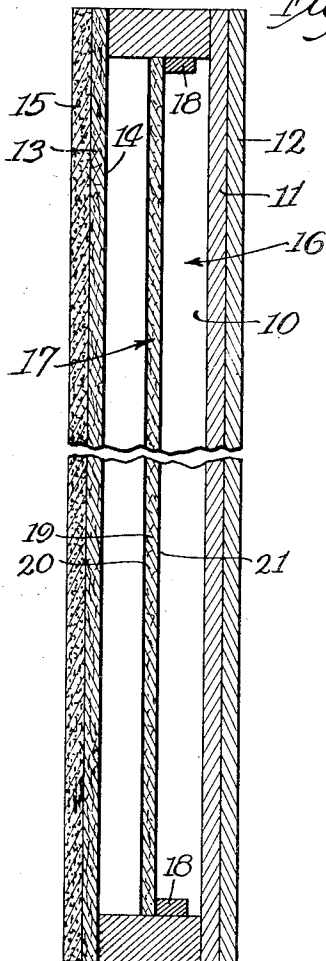
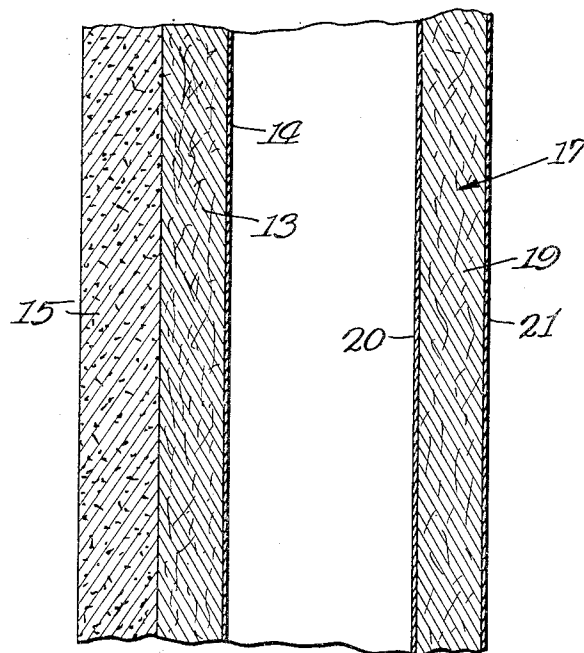


Fig. 3



Inventor
Joseph M. LeGrand
By Rector, Hilben, Davis & Macomber
Attys.

UNITED STATES PATENT OFFICE

2,116,270

BUILDING STRUCTURE

Joseph M. Le Grand, Chicago, Ill.

Application September 19, 1932, Serial No. 633,723

11 Claims. (Cl. 72-16)

My invention relates generally to building structure, and it has to do more particularly with novel means for forming walls and other surfaces of buildings, enclosures, and the like.

5 One of the objects of my invention is to provide a building arrangement which is simple in construction, inexpensive to manufacture, and easy to install and maintain, and which provides for increased sound deadening and thermal insulation efficiency.

10 Another and more specific object is to provide a wall-forming means which greatly reduces the transfer of heat by radiation, convection and conduction thereby aiding in maintaining a more nearly uniform temperature condition in homes, buildings or other enclosures at a minimum of expense and with a minimum of attention. To this end, I provide an arrangement which serves also the purpose of intercepting and neutralizing the transmission of sound waves in such a manner that sound-deadening ability of the wall structure is greatly increased.

A further object is to provide a wall structure which includes at least one surface formed of a section of comparatively thin fibrous material (vegetable or mineral) normally of low moisture content, which section has one of its sides covered and sealed by a metallic foil having characteristics tending to minimize the transfer of heat by radiation and its other side covered by plaster or other suitable material forming a substantially finished wall surface.

Additional objects are to provide means of the foregoing character which is practically weather-proof and damp proof and which is not materially affected by psychometric conditions so that the wall surfaces and elements thereof are practically free from condensation and the effects thereof; to provide a wall structure which is substantially flame and fireproof; to provide a wall surface which is warp proof whereby uniformly shaped wall surfaces may be formed and maintained over long periods of use; to provide a wall structure which is strong and durable; and to provide a wall surface of a character tending to prevent air transfer therethrough by the process of infiltration.

Other objects and advantages will become apparent as this description progresses and by reference to the drawing wherein,

Figure 1 is a horizontal sectional view of a portion of the wall structure of an enclosure having my invention applied thereto;

Fig. 2 is a vertical section taken substantially on line 2-2 of Fig. 1; and

Fig. 3 is an enlarged fragmentary section taken substantially on line 3-3 of Fig. 1.

In the drawing, I have illustrated my invention as applied to a wall structure such as may be used in connection with various forms of buildings and enclosures, such for example as homes, office buildings, vaults, storage chambers, and the like. The wall section shown is particularly adaptable for the outer walls of the enclosure, but it is to be understood that where the enclosure is divided into rooms or compartments, this wall structure may well serve for each of the walls thereof, including the sides, ceiling and flooring.

Now referring particularly to the drawing, the wall structure shown therein comprises the usual vertical studs 10 spaced apart in a conventional manner and supporting at the outer sides thereof the usual outer covering 11 which, in turn, supports the finishing surface which may take the form of weatherboarding 12 or any other suitable material. Although I have shown a particular form of outer wall section, it is obvious that this section may take any well known and desired form without departing from my invention.

The opposite edges of the studs 10 support an inner wall unit which will now be described. This unit, in its completed and assembled form, is made up of intimately joined parts which comprise an inner section 13 formed of a fibrous material which may take the form of a fiber-board or the like of any desired vegetable or mineral character. This section 13 may be formed of a single, continuous sheet of the dimensions of the inner wall surface or it may be formed of a plurality of sheets of desirable sizes and thickness, the adjacent sheets being arranged in firm abutting relationship to constitute, in effect, a continuous wall surface. The fibrous material 13 is, preferably, of a character (or is so initially treated) that its moisture content is reduced to the minimum and it is of quite compact form in section.

The inner side of the fiber section 13 is covered by a thin metallic foil 14 which may take the form of tin foil or aluminum foil or any other metallic foil, or the like, of light weight and having high reflecting values for minimizing the transfer of heat through the wall surface by radiation. This metallic foil is firmly, uniformly and permanently secured to the fiber section by a mineral cement or any other suitable adhesive which will effect proper union as between the foil and the section preferably without contacting the foil directly with the fibrous material.

The outer surface of the fiber section 13 has

a covering or layer of plaster 15 applied which may be of any suitable form having characteristics adapting the same to adhesively cling to and become intimately joined to the adjacent surface of the fiber section. This plaster may be applied to the entire wall surface as a continuous and unbroken layer and may constitute the finished wall surface or may be of a character adapted for further treatment and decoration to complete such surface. The thickness of this plaster layer may be varied to suit the particular conditions of use and without departing from my invention. The outer wall sections 11 and 12 and the inner wall unit 13, 14, 15 may be firmly secured to the upright studs 10 in any desired and well known manner and I have, therefore, not shown means for effecting this securement in detail.

In the structure so far described, it will be noted that the wall surfaces and studs 10 define closed air spaces 16 bounded on one side by unitary foil, fiber, and plaster unit. This arrangement provides increased efficiency in thermal insulation and also sound deadening. More particularly, I have found that approximately one-third of the total heat which would normally be transmitted through the space 16 is by radiation transmission. The aluminum or tin (as the case may be) foil 14 disposed on the inner side of the inner wall unit has also been found, under certain conditions, to reduce the normal transfer of radiant heat about 90%. Wherefore by the use of metallic foil according to my invention, total heat transmission through the wall surface hereinabove described may be reduced approximately 30%. The fiber material from which the board 13 is formed has, as is well known, due to its natural characteristics, low heat conducting value; wherefore transfer of heat by conduction is materially reduced by the use of the fiber-board 13. Also, by blocking off the wall spaces to define closed and sealed compartments 16, there is a tendency to reduce the transfer of heat by convection. Therefore, in carrying out my invention, the sum total of the effects of the foregoing agencies have been found in certain instances to be such as to reduce the total heat transfer through the wall approximately 20 to 35% or more. This is of considerable importance with respect to the maintenance of a more nearly uniform temperature and air condition with a minimum of expense and attention within the space defined by this wall structure.

In addition to the foregoing, the fibrous material of which the section 13 is formed has natural characteristics giving to it some ability for sound deadening. The plaster 15 is also of such a character as to have a dampening effect upon the transmission of sound waves. The fiber-section and the plaster, on account of their different well-known physical characteristics, have different vibratory frequencies; wherefore by intimately combining fiber-section and plaster so that the fiber-section serves as a firm, uniform backing for the plaster, this variation in vibration frequency establishes what I believe to be a neutralizing effect which produces high, sound deadening efficiency in the combined structure of greater value than the sum total of the individual sound deadening values of the respective fiber and plaster layers.

Still further, it will be recognized that in the normal use of fibrous material and/or plaster in an arrangement such as shown in the drawing, heated air under normal pressure will pass by

infiltration through the structure (due to its natural porous nature) thus conveying heat through the wall structure by convection notwithstanding the known insulating value of the material per se. However, I have found that in carrying out my invention and by placing the metallic foil over the surface of the fiber-section in a sealed fashion, as above described, this infiltration is prevented thereby additionally increasing the thermal value of wall structure embodying my invention.

I have also found that wall structure embodying the foregoing features is not materially affected by psychometric conditions. The fiber section, initially, embodies a minimum of moisture content and, in carrying out my invention, the entire structure is so sealed that the wall surface is water and damp proof preventing material deterioration and decomposition of the fiber-board. The normal insulating efficiency of this structure will be maintained over long periods of use. The wall surface as a whole is quite durable and it is materially strengthened and supported so that the warping, from psychometric conditions or otherwise, is practically eliminated.

For increased thermal insulation value, I preferably employ within the space 16 additional means for further blocking the transmission of heat by radiation, conduction and convection. Specifically, I mount within each space 16 a unit 17 having the same shape and dimensions in plan as the space 16. This unit may be secured in this space in spaced relation to the inner and outer wall surfaces by suitably located blocks to which the unit is secured so as to provide on the opposite sides thereof reduced sealed spaces 16^a and 16^b. The unit 17 preferably consists of a section 19 of fibrous material having its opposite side surfaces covered and securely sealed by sheets of metallic foil 20, 21 similarly to the foil 14 on the similar fiber section 13. This metallic foil 20, 21 may also be tin foil or aluminum foil or any other similar material having high reflective qualities for additionally preventing the transfer of heat by radiation. The fiber material 19 additionally blocks the transmission of heat by conduction, as above described; and, by dividing the space 16 into smaller sealed spaces, additional blocking of heat transmission by convection is provided for. This intermediate unit 17 is also of a fireproof, damp proof, and warp proof nature and is adapted to function with maximum efficiency over long periods of time as mentioned with respect to the unit including the fibrous material 13.

It will be understood that while I have shown only one form of structure embodying my invention, other changes in details and arrangements of parts may be made without departing from the spirit and scope of my invention as defined by the claims which follow. For example, I may employ more than one unit similar to the unit 17, which units may be arranged in abutting or in spaced relation within the space 16; a fiber section coated on one side only with metallic foil may be inserted in the space 16 alone or in combination with units similar to the units 17; the thickness of these several units may be varied to accommodate particular conditions of use to the end of highest efficiency; the thickness and depth of the spaces 16 may be varied; or a single metallic sheet or groups of metallic sheets may be inserted in the space 16 in accordance with

the disclosure in my copending application Serial No. 629,089.

I claim:

1. In structure of the class described, an inner wall unit which is comprised of a relatively thin sheet of comparatively stiff fibrous material of minimum water content adapted to extend substantially throughout the length and width of the space to be insulated, a metallic foil covering on the innermost side of said sheet adjacent the space to be insulated, said foil being permanently joined adhesively to said sheet in sealed fashion, a plaster covering on the other side of said sheet opposite said foil covering, said plaster having characteristics intimately joining the same to said sheet; and a separate intermediate wall unit mounted substantially parallel with and spaced inwardly from said inner wall unit, said intermediate wall unit comprising a relatively thin sheet of comparatively stiff fibrous material of minimum water content extending throughout the length and width of the space to be insulated, a metallic foil covering on and extending throughout the opposite sides of said intermediate sheet, and means adhesively joining said foil covering to said intermediate sheet in sealed fashion.

2. In structure of the class described, a unitary, integral wall unit extending throughout one of the walls of the space to be insulated, which unit is comprised of a sheet of fiber board of minimum water content extending throughout the length and width of said unit, a metallic foil covering on and extending throughout the side of said fiber board facing the space to be insulated, means permanently joining said foil to said fiber board in sealed fashion and with the foil out of direct contact with said fiber board, said foil having relatively high reflective value for reduction of heat transmission by radiation, and a plaster covering on the other side of said fiber board and intimately joined thereto; and another and separately-mounted wall unit spaced inwardly from said first wall unit in the space to be insulated and comprising a sheet of fiber board of minimum water content extending throughout the length and width of the space to be insulated, and a foil covering similar to said first foil covering adhesively applied to and extending throughout the opposite sides of said latter sheet of fiber board.

3. In structure of the class described, a pair of walls arranged to provide a space therebetween, the inner of said walls being formed of a thin sheet of relatively stiff fiber board of minimum water content having non-conducting thermal value, a highly reflective metallic foil covering the side of said sheet adjacent said air space, said foil being firmly and permanently joined to said sheet out of direct contact therewith, a plastic covering having a different vibration frequency than said sheet intimately joined to the other side of said sheet; and a separately mounted intermediate wall disposed in said space in spaced and parallel relation to said inner wall and dividing said space into a plurality of substantially parallel air chambers substantially sealed apart from each other, said intermediate wall comprising a sheet of relatively stiff fiber board of minimum water content having a metallic foil covering on and extending throughout the opposite sides thereof.

4. In structure of the class described, an inner wall unit bounding an air space to be insulated and comprising metallic means contacted by the

air of said space insulating against transfer of heat by radiation, separate means out of contact with the air of said space supporting said metallic means and insulating against the transfer of heat by conduction, a finishing covering for said second-named means, all said means being intimately joined together as a single integral piece with said covering located on the side of said unit opposite said air space; and another wall unit located in the space to be insulated parallel with and spaced from said inner wall unit, said other wall unit comprising a central section of low heat conductivity which section is covered on its opposite sides with a material adapted to insulate against the transfer of heat by radiation.

5. Wall structure for an enclosure which comprises means including a pair of spaced wall units forming a closed space to be insulated, the innermost of said wall units being comprised of a relatively thin and firm texture sheet of fiberboard extending substantially throughout the length and width of said space, a foil-like metallic sheet covering and sealing throughout the side of said fiberboard sheet adjacent said space, a relatively thin layer of plaster-like finishing material intimately joined to and covering the other side of said fiberboard sheet; and an intermediate partition unit separately mounted and dividing said space into substantially sealed and substantially parallel sub-spaces, said partition unit including a relatively thin and firm texture sheet of fiberboard extending substantially throughout the length and width of said space, and foil-like metallic sheets covering and sealing throughout the opposite sides of said fiberboard sheet.

6. A wall structure comprising studding and facing elements and having one or more air spaces and means disposed within said air spaces and attached to said studding for partitioning the air space into two or more air spaces, said means comprising sheeted non-metallic building material having a thin metal coating on at least one face thereof, parallel to the wall.

7. A wall structure comprising studding, spaced facing elements, and means disposed between said facing elements and attached to said studding for partitioning the space between said facing elements into a plurality of spaces, said means comprising non-metallic sheet material having a thin metal coating upon both sides thereof, substantially parallel to the wall.

8. A wall structure comprising studding, spaced facing elements, means subdividing the space between said facing elements into at least two disconnected air spaces, said means comprising non-metallic, fibrous sheet material having a thin metallic surface upon at least one side thereof, and means for attaching said sheet material to said studding and substantially parallel to the wall.

9. In structure of the class described, a wall having spaced surfaces adapted to be exposed to relatively higher and lower temperatures, and non-metallic sheet material having a thin coating of metallic foil on both sides thereof, said sheet material being substantially parallel to the wall and subdividing the space between said surfaces into at least two air spaces.

10. In a structure of the character described, a wall having a closed space to be insulated and partition elements extending substantially parallel to the wall and throughout the area of said space and dividing the same into a plurality of disconnected air spaces, said partition elements

comprising non-metallic sheet material having a thin metallic coating on at least one side thereof.

5 11. A structure of the character described comprising frame members supporting an outer surface exposed to the weather, a plurality of non-metallic fibrous sheets having a thin metallic

coating on at least one side thereof, and means for fastening said sheets in position between said frame members to provide closed air spaces intermediate said weather surface and said sheets.

JOSEPH M. LE GRAND.