March 10, 1942. J. L. FINCK 2,276,076

MEANS FOR INSULATING BUILDING AND LIKE STRUCTURES

Original Filed Sept. 23, 1932

FIG. 1.

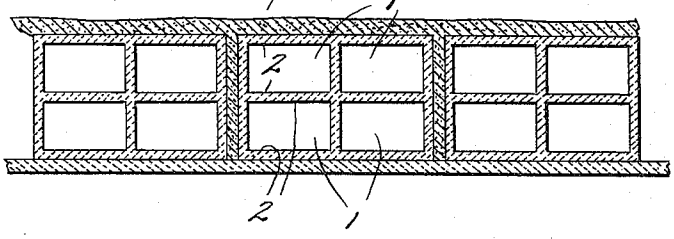


FIG. 2.

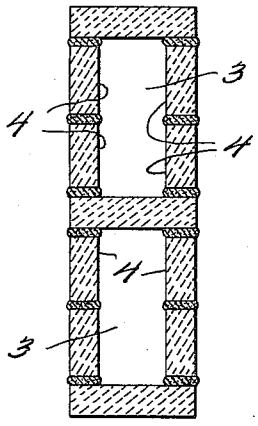


FIG. 3.

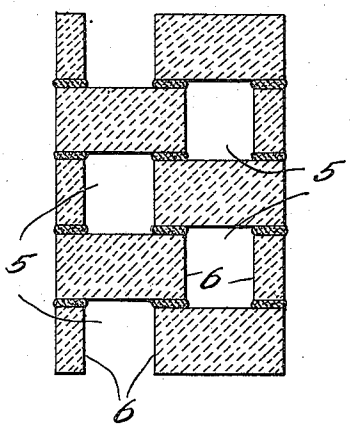


FIG. 4.

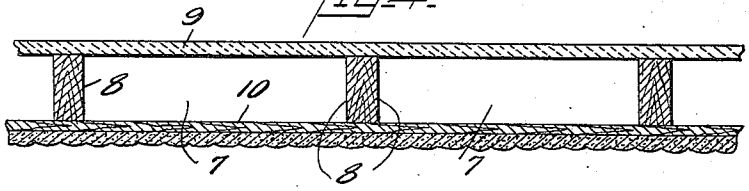


FIG. 5.

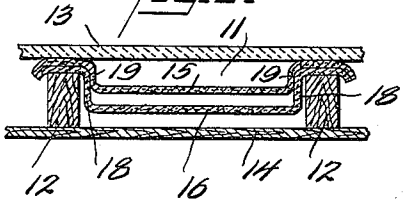
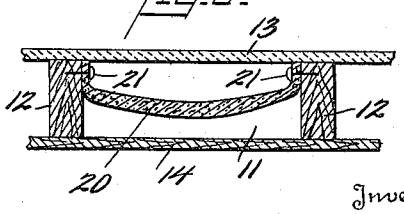


FIG. 6.



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MEANS FOR INSULATING BUILDING AND LIKE STRUCTURES

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Original application September 23, 1932, Serial No. 634,604. Divided and this application October 13, 1937, Serial No. 168,822

6 Claims. (Cl. 72—16)

This invention relates to the art of heat insulation, and more particularly to the insulation of building and like structures.

The total heat transfer through any structure may be considered as taking place in some or all of the following three forms: (*a*) conduction, (*b*) convection and (*c*) radiation. The first form occurs when heat is being transferred through a solid, or through a quiescent fluid. The second occurs in a fluid, and is manifested by natural convection currents within the fluid. The third occurs in open spaces, whether those spaces be evacuated or filled with a fluid, as for example, air.

This invention is concerned entirely with the last form, radiation. If one should carry out numerical calculations of the magnitude of the heat transferred by radiation at room temperature, basing the calculations on Stefan-Boltzmann's law for total radiation, and also bearing in mind that the emissivity of materials ordinarily entering into building construction, such as wood, brick, paper, etc., may be as high as 80 or 90 per cent, one will find that this form of heat transfer is a very large fraction of the total heat transfer. At the present time, where a large number of air spaces are intentionally introduced into a structure, by using hollow tile, studding or a brick construction so arranged as to form air spaces, radiation becomes the chief mode of heat transfer.

I propose to reduce the amount of heat transfer by radiation through a simple and effective method, namely by utilizing the high reflecting power of metals. My method is to coat with metal the surfaces of materials which enter into the construction of buildings and the like, in order to reduce the heat transferred by radiation. It will be evident that only those walls which define the air spaces need be coated with metal.

A few practical examples of how the invention may be carried into effect are shown in the accompanying drawing, in which:

Figure 1 is a horizontal cross-sectional view of a wall built of hollow tile illustrating one application of the invention.

Figures 2 and 3 are more or less diagrammatic views illustrating the application of the invention to a brick wall.

Figure 4 is a horizontal sectional view showing the application of the invention to a wall space formed by a wooden studding.

Figure 5 shows another form of the invention.

Figure 6 shows another modification of the invention.

As previously indicated, in carrying this invention into effect, it is proposed to provide a rigid structure such as a building or other wall which is intended to prevent heat exchange from one zone or space to another. That is to say, it is proposed to metalize one surface of a non-metallic sheet or wall in such a way as to utilize the high reflecting power of metal to the best advantage.

It is practical, at the present time, to spray metal on any surface such as brick, wood, paper, etc. Of course, one would naturally select a metal that is comparatively cheap, easy to work, which has a reasonably low emissivity, and which will not oxidize very readily. Tin or some alloy of tin and lead, or aluminum might suit the purpose very well. However, no restrictions need be made as to the kind of metal to be used, or to the method of applying the metal. Practically all metals will have emissivities much lower than those of building materials, and there will be material gain in using any metal. Further, one method of applying the metal may be easier than another, but however the metal is applied, whether by spraying or by pasting on metal foil, the result, as far as the reduction in heat transfer by radiation is concerned, will be the same.

Referring more particularly to the drawings, it will be observed from Figure 1 that the air spaces **1**, **1** of the hollow tile are defined by the surfaces **2**, and these latter surfaces are to be coated with metal so as to reduce the heat transferred by radiation across these air spaces. Similarly, the surfaces **4**, **4** of the air spaces **3** of Figure 2, and the surfaces **6**, **6** of the air spaces **5** of Figure 3 are to be coated with metal to reduce the radiation. In a frame wall, such as is represented in Figure 4, the air spaces **7**, **7** are usually formed by the studs **8**, lath and plaster **9** and building paper or sheathing **10**. To reduce the heat transfer by radiation in this case, the several components may be coated with metal on those surfaces bordering on the air spaces **7**, **7**, or the bordering surfaces may be coated with metal after the materials are installed in the wall.

While as shown in the drawing both faces bordering on air spaces may be coated with metal either in the form of a spray coat or in the form of metal foil, only one such face parallel to the wall surface may be coated with metal without any great loss of the effectiveness if the reflecting power of this metal surface is high. For example, in case of aluminum foil the reflecting power may be as high as 95%, and therefore

such metal on one wall reduces the transmitted radiation to a very small value.

The plaster 9 may be applied in the form of preformed sheets or slabs of plaster having the face bordering on the air space coated with a thin layer of metal as by metal foil or by a sprayed metal coating. Similarly, other sheet material, such as boards made of fibrous material, laminated or otherwise, may be coated with a thin metal coating on one face thereof and employed in the customary manner in buildings, taking care that the metal covered face borders on the air space.

If desired the lateral walls of air spaces, namely those surfaces which are disposed transversely to the wall and border on the air spaces may also be covered with a metal coating. The metal coating on these surfaces will increase the heat conductance of these lateral walls by a negligible amount but this will be more than compensated by the reduction in the passage of radiated heat caused by the metalized surfaces. In order to minimize the conductance of these walls, these lateral or transverse surfaces may be coated with metal over the area extending say one-third from each end of the surface and leaving a portion thereof uncoated. In this way the increase in conductance of the lateral or transverse walls of the air spaces is minimized and the advantages of the metal coating are obtained. This form of the invention is particularly applicable to hollow tile or the like where the expense involved in coating the heat transmitting surfaces or the surfaces which are parallel to the wall is not substantially increased by coating also the adjacent portions of the lateral walls. In other forms of the invention disclosed herein the expense involved in coating the lateral walls or surfaces may not be warranted by the advantages that flow therefrom. It is understood, of course, that by far the major portion of the radiated heat flowing across the air space is transmitted or emitted by one or the other surface which is parallel to the wall. Where, however, it is possible to obtain the advantages of the metalized surface on a lateral wall of the air space without any substantial increase in expense involved, such surfaces or interrupted portions thereof may also be coated.

From the foregoing description it is believed that the essential features of the invention will be fully understood, and that it also is the intent to make the claimed invention applicable generally to the construction of walls, partitions, ceilings, floors, roofs and like structures, or wherever air spaces are employed to reduce the transfer of heat from one zone to another.

If desired, the dry aluminum bronze for example may be employed during the process of manufacture of some of the above mentioned sheet materials so as to coat one face thereof. This metal is particularly applicable to such of these materials which, in the course of their manufacture, have a tacky surface. Such surface may then be sprinkled with an excess amount of dry aluminum bronze powder, the material being then rolled down and the excess powder brushed off. This process applies particularly to asphalt coated building paper in which case the dry aluminum bronze powder is sprinkled over the asphalt coated paper while the asphalt is still tacky. After rolling the excess powder is brushed off. The process may also be applied to such materials as plaster board or the like, and also to such other materials as fibre board and particularly to such fibre board which is coated with a water-proof layer in which case the dry aluminum bronze powder is sprinkled over the surface while the water proof coating is still tacky.

In the case of bricks and hollow tile, as shown in Figures 1, 2 and 3, the present commonly employed processes of manufacturing the same need not be at all modified and the present invention may be applied to such bricks and hollow tile after the present processes of manufacturing the same have been completed. For this purpose it is sufficient to coat such surfaces of the brick or hollow tile which are desired to be metalized with an adhesive such as asphalt or water glass or the like and then sprinkle over this adhesive coated face metal powder such as aluminum bronze or the like, to thoroughly cover the face. Then this brick or hollow tile is permitted to dry.

When such metal coated brick or hollow tile is employed in fire-proof constructions, the presence of the metalized faces against the air spaces, which minimizes the transfer of heat through the wall, greatly increases the fire-proof quality of the wall. The reason is that in case of a conflagration radiation is the principal form by which the heat is transferred across the air space, and the retardation of this heat transfer by the metalized wall delays the rise in temperature on the opposite side of the wall, and permits escape and removal of material during the time gained. In fire-proof constructions the present invention may be applied not only to outer walls, ceilings, and roofs, but may also be applied to partitions, without adding combustible material to the wall.

In the case of asphalt coated building paper it is also possible to apply the present invention during the process of manufacture of the building paper. This is accomplished by sprinkling an excess of aluminum bronze or powder over the asphalt coated face and passing the building paper through heated calender rolls; the calender rolls being heated just sufficiently to impart to the asphalt a desired degree of tackiness, thereby causing the aluminum bronze or powder to adhere to the asphalt. Lead or aluminum foil may also be pasted on to building paper by means of heated calender rolls, and such paper may serve the same purpose.

In the case of studded wall, ceiling or roof structures which have an air space of three or four inches in depth or thickness, the present invention may be applied, particularly as shown in Figures 5 and 6 of the drawing. In Figure 5 a studded air space 11 is shown which is formed by the studs 12. Such studs generally form air spaces of three or four inches. In the form of the invention as shown in Figure 5, the interior of the wall may be finished in any desired manner, as represented by the reference character 13 which may represent either any type of wall board, commonly used for this purpose, or it may represent plaster in the form of pre-formed sheets such as plasterboard or wall board or it may represent plaster formed on lath applied to the wall. The reference character 14 represents the building material, such as sheathing, which is placed on the outer face of the wall.

From the description of the invention thus far described, it will be understood that the materials represented by the reference characters 13 and 14 may bear a metalized face or if desired building paper having a metal coat on one face thereof may be interposed between the building

materials 13 and/or 14 and the studs so as to present a heat reflecting metal face to the air space. More specifically, however, Figure 5 discloses a form of the invention in which the air space is broken up into several air spaces each of smaller depth or thickness than the air space 11 in its original form. An air space of three or four inches offers no appreciably greater resistance to the transfer of heat than an air space of one inch. In the present form of the invention, therefore, means are provided for breaking up this air space into two, three or four approximately equal spaces, thereby increasing the heat resistance of the total wall several fold. More specifically, the air space is broken up by means of several layers of building paper 15 and 16 which are disposed in the manner shown in the drawing. Moreover, in the present invention the building paper 15 and 16 is provided with a metal coating on one or both faces thereof, thereby serving to minimize the transmission of radiated heat through any of these air spaces.

If paper having only one metal coated face is employed the same is so employed that each air space has at least one metal coated face. It will be understood, therefore, that if the material 13 has a metal coated face disposed toward the air space, the paper 15 will have its metal coated face disposed away from the layer 13 and similarly the paper 16 will have its metal coated face disposed toward 14. With this arrangement each air space will have at least one metal coated face. If desired the layers 13 and 14 may be uncoated with metal and one of the sheets, say sheet 15 will have both faces metal coated, while the other sheet, 16, will have one face coated and so disposed that its unmetalized face is disposed toward 15.

It will now be understood that by the use of this form of the invention the air space is broken up into two or more air spaces and each air space is provided with at least one metalized face thereby reducing to a minimum the passage of radiated heat through the wall.

If desired the building paper 15 and 16 employed in the manner shown in Figure 5 may be metalized only on the portions thereof which are disposed approximately parallel to the wall, the portions 18 and 19 thereof remaining unmetalized.

In the form of the invention shown in Figure 6, one or more blankets of insulating material 20 may be employed for the general purpose of breaking up the air space into two or more air spaces, the blanket being nailed to the studs 12 as shown at 21. In order to take full advantage of the present invention the blanket 20 is provided on one or both faces thereof with a layer of metal foil or with a layer of metalized paper.

The present application is a division of application Serial No. 634,604, filed September 23, 1932, now Patent No. 2,098,138, granted November 2, 1937, which is a continuation as to common subject matter of the copending Patent No. 1,883,774, granted October 18, 1932

Having thus described my invention, I claim:

1. As a new article of manufacture, a building board having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs, and to form air spaces within the wall bordered by one face of the building board on the interior side of the wall, one face of said board having a metal coating for exposure to the air spaces within the wall to minimize the transfer of radiated heat across the air space, the coating being too thin and inadequate to withstand the wear and abrasion of an exposed wall surface and of such thickness as adequately to cover the surface for the purpose of substantially eliminating the transfer of radiated heat across the air space, the other face of said board being uncoated and adapted to receive any desired finishing or decorative coating thereover.

2. As a new article of manufacture, a building board having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs, and to form air spaces within the wall bordered by one face of the building board on the interior side of the wall, one face of said board having a coating of very thin metal foil for exposure to the air spaces within the wall to minimize the transfer of radiated heat across the air space, the metal foil being too thin and inadequate to withstand the wear and abrasion of an exposed wall surface and of such thickness as adequately to cover the surface for the purpose of substantially eliminating the transfer of radiated heat across the air space, the other face of said board being uncoated and adapted to receive any desired finishing or decorative coating thereover.

3. A building board, having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs and to form air spaces within the wall bordered by one face of the building board on the interior side of the wall, the board comprising plaster board for its essential component, one surface of said board having a metal coating for exposure to the air spaces within the wall to minimize the transfer of radiated heat across the air space, the coating being too thin and inadequate to withstand the wear and abrasion of an exposed wall surface and of such thickness as adequately to cover the surface for the purpose of substantially eliminating the transfer of radiated heat across the air space, the other face of said board being uncoated and adapted to receive any desired finishing or decorative coating thereover.

4. A building board, having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs and to form air spaces within the wall bordered by one face of the building board on the interior side of the wall, the board comprising plaster board for its essential component, one surface of said board having a coating of very thin metal foil for exposure to the air spaces within the wall to minimize the transfer of radiated heat across the air space, the metal foil being too thin and inadequate to withstand the wear and abrasion of an exposed wall surface and of such thickness as adequately to cover the surface for the purpose of substantially eliminating the transfer of radiated heat across the air space, the other face of said board being uncoated and adapted to receive any desired finishing or decorative coating thereover.

5. A plasterboard, having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs to form air spaces within the walls, the board having a core of gypsum, one surface of said board having a metal coating for exposure to the air spaces within the wall to minimize the transfer of radiated heat through the air space, said coating being only of such thickness as adequately to cover the surface for the pur-

pose of substantially eliminating the transfer of radiated heat across the air space, but inadequate for exposure on an exposed wall surface, the other face of said board being uncoated for receiving a decorative finishing coating thereover.

6. A plasterboard, having a width greater than the distance between adjacent wall studs in frame dwelling construction, for attachment to such wall studs to form air spaces within the walls, the board having a core of gypsum, one surface of said board having a coating of metal foil for exposure to the air spaces within the wall to minimize the transfer of radiated heat through the air space, said foil being only of such thickness as adequately to cover the surface for the purpose of substantially eliminating the transfer of radiated heat across the air space, but inadequate for exposure on an exposed wall surface, the other face of said board being uncoated for receiving a finishing decorative coating thereover.

JOSEPH L. FINCK.