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ROOF STRUCTURE

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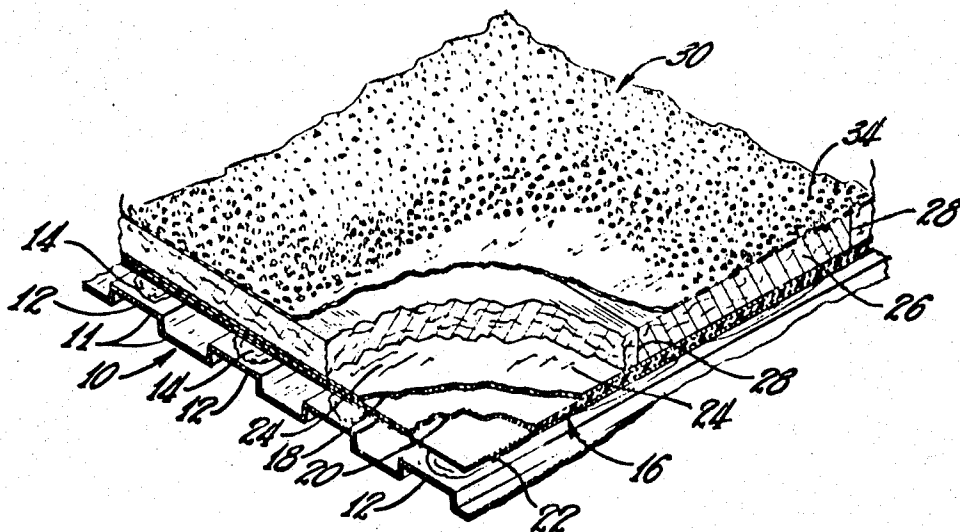


Fig. 1

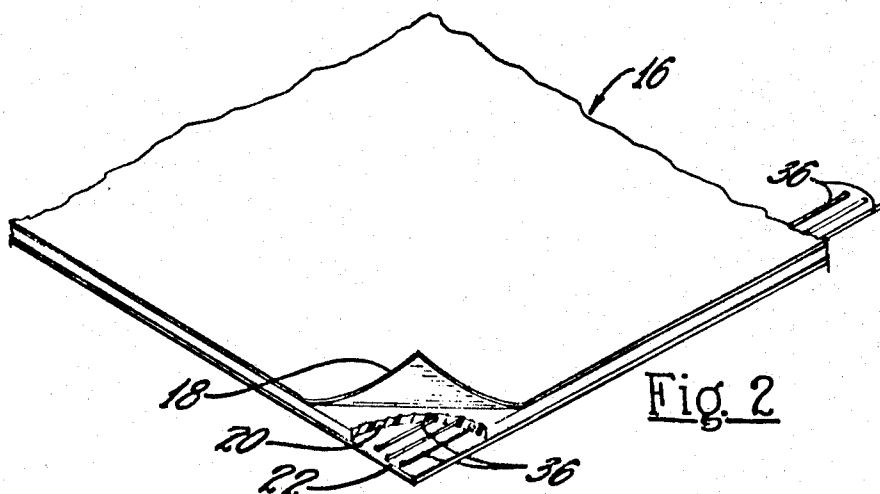


Fig. 2

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ROOF STRUCTURE

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2 Claims

ABSTRACT OF THE DISCLOSURE

An insulated roof comprising a structural surface member with a vapor barrier adhered thereto, comprising asphalt sandwiched between two pieces of paper, and thermal insulation adhered to said vapor barrier over which is applied a waterproof covering. Also, a method of constructing a roof structure of the foregoing type by means of a cold adhesive with a fugitive solvent for adhering the vapor barrier to the structural member, and a hot bituminous adhesive over said vapor barrier for volatilizing the fugitive solvent.

This application is a continuation of application Ser. No. 655,366, filed July 24, 1967.

BACKGROUND OF THE INVENTION

Field of the invention

This invention lies within the construction field, and specifically pertains to the art of built up roofing.

Description of the prior art

Metal buildings are now in common usage for purposes of warehousing, factory shelter, and general commercial usage. Other thin walled buildings have also been adopted such as reinforced plastic and precast concrete slabs. The foregoing buildings have generally employed insulated roofs lately because it has been discovered that heated shelters particularly of the foregoing metal construction have been extremely expensive to heat if insulation is not employed.

Metal buildings are now commonly using insulated built up roofs on top of the metal roofing sheets, or structural surfaces. The metal structural surfaces are usually fluted steel sheets. The built up roof generally comprises a vapor barrier to prevent condensation on the inside surface of the steel sheet with insulation thereover and a waterproof covering over the exposed portion of said insulation. The vapor barriers of the prior art are expensive but have been recommended by the American Heating and Ventilating Society for all metal roofed buildings above the 40th parallel. The foregoing assemblage of products is usually bound together with an appropriate adhesive and in many cases asphalt is employed.

Vapor barriers of the prior art employed between the structural steel sheets and the thermal insulation have generally been of plastic or bituminum saturated rag felts secured to the deck with asphalt. In the case of bituminum saturated felts, however, there is the problem of asphalt drip. Also the use of bituminum saturated felts as a vapor barrier secured to the metal deck with asphalt does not render the roof structure fire retardant as does the structure of the present invention.

In order to adhere plastic barriers to the structural metal sheet, a cold adhesive has generally been used to prevent dropping of the material through the steel deck on warm days and providing a better bond than hot asphalt on a steel deck because of the chilling of the asphalt when applied. Furthermore, if a hot asphalt above or below the plastic vapor barrier were used it would thermally decompose the plastic vapor barrier to a point where it

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would no longer be effective. As will be seen in this specification the inventor has overcome the necessity of an expensive plastic sheet as a vapor barrier, as well as enabling the use of a hot bituminous adhesive for adhering the thermal insulation to the vapor barrier to provide a more strongly integrated roofing structure. The inventor has further developed a method of applying a built up roof for improved wind resistance shortly after the roof structure has been finished.

SUMMARY

As indicated in the foregoing description of the prior art the invention hereinafter recited in the specification allows the use of a hot bituminous adhesive on either side of the vapor barrier, while at the same time providing an effective cheap vapor barrier. Furthermore, when the vapor barrier is adhered to the steel sheet with a cold adhesive, the hot asphalt spread over said vapor barrier volatilizes the fugitive material within said adhesive permitting a faster and more effective bonding of the vapor barrier to the steel sheet.

The vapor barrier of this invention comprises two sheets of kraft paper with a layer of asphalt generally coextensively sandwiching together the opposing faces of the paper. The vapor barrier is resistant to thermal and chemical decomposition by asphalt being spread thereover when used to adhere the thermal insulation thereto. Furthermore it is cheaper than the use of plastic membranes and vapor barriers. The kraft paper and the asphalt sandwiched between it when spanning the fluted portions of the structural steel member provides a greater tensile strength in the roof insulation to permit the insulation to withstand greater abuse from roofing traffic encountered in construction of the roof. For example, without the vapor barrier there is a greater chance of crushing the insulation into the flutes of the deck during installation of the insulation and roofing felts above. It also provides greater resistance to stress in the overall roofing against movement occurring through expansion or contraction of the structural supporting surface and members. Furthermore the vapor barrier of this invention prevents hot asphalt, when used over the thermal insulation as a waterproof covering, from passing through the joints between the insulation and decomposing the vapor barrier.

A cold roofing adhesive which generally comprises in the art a bituminous substance dispersed in a solvent, is often used to adhere the vapor barrier to the structural steel member. The solvent therein generally does not evaporate or volatilize at a sufficient rate to prevent wind uplift of the built up roof relatively soon after the roof has been applied. This invention provides a method, of applying thermal energy to the cold adhesive thereunder, thus speedily volatilizing the solvent within the adhesive providing a tacky and more viscous material for adhering the roof structure to the structural steel sheet and further providing a lesser fire hazard than the foregoing methods of construction. By speedily volatilizing the solvents in the above manner, the full strength of the adhesive is arrived at sooner than if the solvents were volatilized by ambient temperatures only. The foregoing invention has also yielded outstanding fire tests meeting Underwriters and Factory Mutual fire and wind-lift tests. Although asphalt and paper are combustible, the materials in the foregoing combination render a unit having a low burning rate which meet acceptable industrial and Underwriters' standards.

From the foregoing summary and description of the prior art it can be seen that an object of this invention is to provide a deck structure, with a vapor barrier, having a high integral strength throughout the entire built up structure.

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A further object of this invention is to provide an inexpensive vapor barrier capable of being used with hot asphalt as an adhesive and providing an acceptable fire and wind resistant combination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an insulated built up roof of the type disclosed herein with a vapor barrier extending over a fluted structural steel sheet member.

FIG. 2 shows the vapor barrier of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 of the drawings shows a structural fluted steel sheet 10 which has flutes or channels 11 therein for reinforcing purposes. As is well known in the art the structural steel sheet 10 can be held in place by any suitable beam or purlin structure. The joints between the steel structural sheet 10 generally cannot be made vapor or water resistant and it is quite common if the steel sheet 10 is not covered, leaks occur between the joints thereof. This being the case a waterproof covering 30 is usually applied thereover and in this instance a waterproof covering 30 is applied over the entire built up roof.

A vapor barrier 16 which is shown in greater detail in FIG. 2 is placed on top of the structural steel sheet 10. The vapor barrier 16 is generally placed over the structural steel sheet 10 after a suitable adhesive 14 is spread over the raised flutes 12. Although any suitable adhesive 14 may be used, it is found that a cold adhesive generally comprising a bituminous material dispersed in a material such as perchlorethylene, methylene chloride or naphtha provides the best results. An asphalt having a softening point, using the ring and ball test, of 170 to 180° F. with a flash point of 600° F. minimum using the Cleveland Open Cup test is highly workable when used in the foregoing dispersions.

The foregoing cold adhesive 14 is applied to the raised flutes 12 of the fluted deck 10 in sufficient quantity to adhere the vapor barrier 16 thereto. The application of the adhesive 14 may be made in any manner which is practical but in most cases can be easily spread on the raised flutes with a standard liquid spreader used in the roofing art.

The vapor barrier 16 shown in detail in FIG. 2 generally comprises a top sheet 18 of 40 pound natural kraft paper of asphalt grade, and a bottom sheet 22 of 40 pound natural kraft paper of the same grade. A bituminous substance is spread between the two sheets such as asphalt having a melting point of 180° F. It is generally spread between the two sheets at the rate of 20.8 pounds, plus or minus 2.5 pounds, per 1000 sq. ft. In order to reinforce the vapor barrier 16 and particularly the edge regions thereat, it is found that strands of glass fibers 36 on the outside edge region of the paper is effective, and furthermore provides an increased degree of tensile strength for the vapor barrier 16 when in use.

The foregoing vapor barrier 16 when laid over the cold adhesive 14 generally provides a perm-rating of .35 perm. A perm can be described as a measure of vapor transmission rate equivalent to one grain of water vapor per square foot per hour per inch of mercury pressure differential. The perm rating of the foregoing vapor barrier 16 provides an adequate vapor barrier to the interior of the building, and at the same time allows the use of a hot asphalt for adhesion of the thermal insulation 26 laid thereover. The vapor barrier 16 is thermally resistant to asphalt from the waterproof covering 30 when such asphalt drips through the joints 28 between the thermal insulation 26.

Although it is not necessary to use the cold adhesive 14 to adhere the vapor barrier 16 to the structural steel sheet 10 below, it is generally found desirable to use such a cold adhesive 14 because of the possibility of hot ap-

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plied asphalt leaking through the cracks in the structural member 10 on warm days.

After the vapor barrier has been applied in the foregoing manner a hot bituminous material 24 such as asphalt 24 is mopped over the vapor barrier 16. The thermal insulation 26 is laid on the hot asphalt 24 and bonded thereto after the asphalt 24 cures. The hot asphalt 24 when applied over the vapor barrier 16 provides a substantially superior adhesive when used with fibrous insulation, because of the way the asphalt 24 works its way into the interstices of the insulation 26.

A significant feature of this invention is the fact that when the hot asphalt 24 is mopped over the vapor barrier 16, which could not be done with plastic vapor barriers, the thermal energy therefrom drives off the dispersed volatiles of the cold adhesive 14. Thus the cold adhesive 14 is able to bond the total roof structure together sooner so that if any severe winds are encountered the roof structure will maintain its integrity shortly after installation. In previous roofing installations the roof was not subject to meeting wind test standards until 30 days had past from the time of the application of the cold adhesive 14. This was because the volatilization of the dispersion took place over a gradual period of time whereas in the instant invention the thermal energy of the hot asphalt 24 volatilizes the dispersion in a relatively short period of time.

After the insulation 26 has been laid over the hot asphalt 24 mopped onto the vapor barrier 16, a waterproof covering 30 is applied over the insulation 26. The waterproof covering 30 generally comprises a hot mopped asphalt or other bituminous material roofing felt combination with gravel or aggregate laid thereover. Previously the asphalt of the covering 30 had a tendency to pass through the joints 28 between the insulation 26 and thermally decompose any plastic vapor barrier. Of course a vapor barrier would be of little or no use after thermal decomposition by the hot asphalt 24 passing therethrough. This deficiency has been eliminated by the use of a vapor barrier 16 described herein.

The foregoing roofing structure can be modified to include the use of a hot asphalt applied to the raised flutes 12 and a subsequent application of the vapor barrier 16 of this invention thereover. However, as previously discussed hot asphalt has a tendency to melt and will seep through the joints between the structural steel sheet 10 on warm days. For this reason the hot asphalt is found undesirable when used in the foregoing manner and a cold adhesive 14 of the above mentioned type is generally used.

A further modification of the foregoing invention may be had by using a cold adhesive over the vapor barrier 16 for adhering the insulation 26 thereto. Although some of the meritorious reasons for using the foregoing invention would be obviated by use of the cold adhesive thereover, it would still maintain the advantage of a lack of thermal decomposition of the vapor barrier when hot asphalt is mopped on top of the insulation 26 for purposes of providing a waterproof covering 30 thereover.

This invention also allows the use of coal tar pitch between the insulation and the vapor barrier paper. This is an advantage since if coal tar pitch roofing felts are used above the insulation, it would not be necessary for the roofing contractor to use two kettles, one for pitch and one for asphalt. It is generally felt that there is incompatibility between coal tar pitch and asphalt, however, with the above invention the paper in the vapor barrier effectively separates the coal tar pitch from the asphaltic material used in the paper laminate and the cold adhesive between the vapor barrier and the deck.

The foregoing specific embodiment and modifications thereof enable a person skilled in the art of roofing structures to adequately construct a built up roof using this invention. However, such embodiment and modifications are deemed exemplary of the invention and are to be read in light of the following claims.

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I claim:

1. A method of adhering a vapor barrier between the structural surface and the insulation in an insulated roof system, comprising:

covering the structural surface of the roof with a first adhesive comprising bituminous material in a solvent which volatilizes at an increased rate when heated above the ambient temperature; 5

placing a vapor barrier impervious to hot asphalt in contact with said first adhesive; 10

spreading a second adhesive comprising hot asphalt onto the exposed surface of said vapor barrier, said second adhesive being sufficiently heated above the ambient temperature to transmit heat through said vapor barrier and accelerate the volatilization of the solvent of said first adhesive to thereby effect bonding of the vapor barrier to the structural surface faster than if volatilization of the solvent material was dependent only on ambient temperatures; and 15

applying a layer of insulation over said asphalt adhesive. 20

2. A method of adhering a vapor barrier in a built-up roof system, comprising:

applying a layer of a cold adhesive over the structural surface of the roof, said cold adhesive comprising bituminous material in a solvent material which volatilizes at an increased rate when heated; 25

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placing a vapor barrier which is impervious to heated asphalt in contact with said cold adhesive;

applying a layer of heated asphalt onto the exposed surface of said vapor barrier, said asphalt being sufficiently hot to transmit heat through said vapor barrier and accelerate the volatilization of said solvent of said cold adhesive to thereby effect a bond between the vapor barrier and the structural surface sooner than if volatilization of the solvent was dependent solely upon ambient temperatures.

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