United States Patent [19]

Freeman

[11] **3,763,605**

[45] **Oct. 9, 1973**

[54] **ROOFING SYSTEM AND METHOD OF APPLICATION**

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[22] Filed: **June 30, 1972**

[21] Appl. No.: **268,157**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 205,219, Dec. 6, 1971, abandoned.

[52] **U.S. Cl.** **52/58,** 52/94, 52/302, 52/408, 156/71

[51] **Int. Cl.** **E04d 1/36**

[58] **Field of Search** 52/58, 302, 94, 408, 52/411, 748; 156/71; 161/160, 236

[56] **References Cited**

UNITED STATES PATENTS

R8,387	8/1878	New	52/411
1,958,871	5/1934	Tucker	52/408
3,373,074	3/1968	D'Eustacio et al.	156/71 X
3,411,256	11/1968	Best	52/408
3,483,664	12/1969	Funk et al.	156/71 X
3,561,334	2/1971	Gerosa	52/411 X

FOREIGN PATENTS OR APPLICATIONS

865,910	3/1971	Canada	52/94

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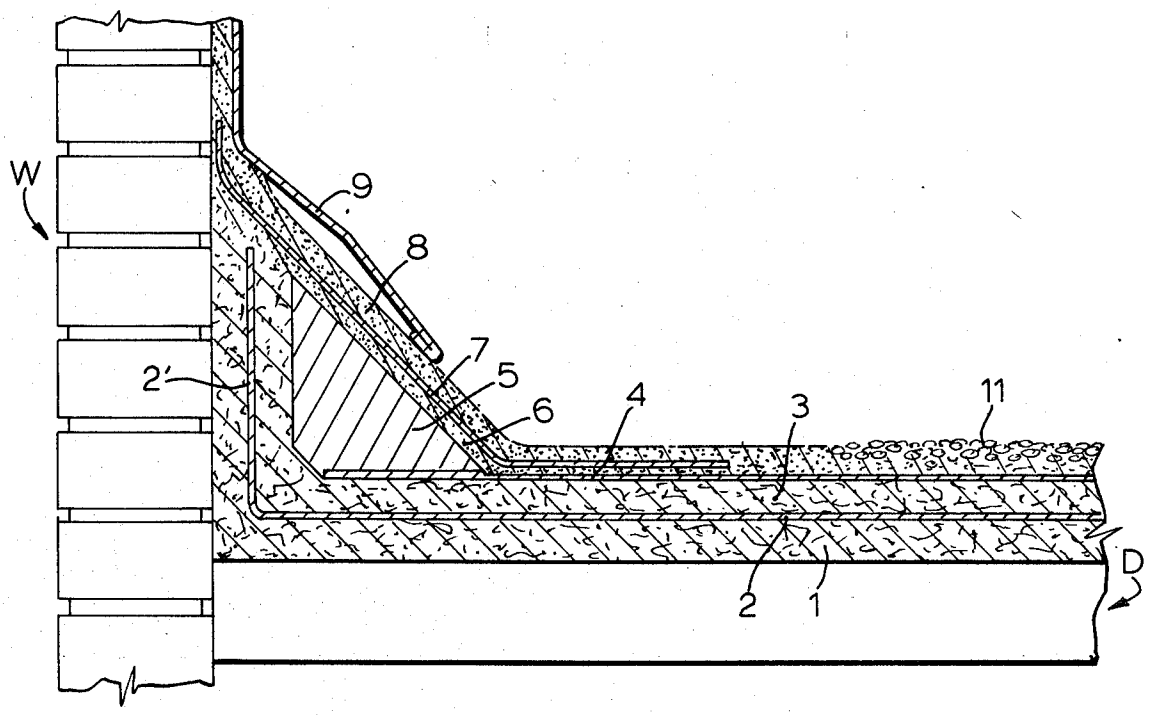
[57] **ABSTRACT**

A roofing system characterized in that it employs a first loading or insulating coat of asphaltic cement and a suitable inert insulating material preferably an igneous, glassy, siliceous or micaceous rock such as vermiculite (exfoliated), pearlite (popped) or the like applied to and covering a roof deck, a waterproof membrane applied over said first loading coat and extending at least substantially to the edges thereof, and a second loading coat of asphaltic cement and a suitable inert insulating material preferably an igneous, glassy, siliceous or micaceous rock such as vermiculite (exfoliated), pearlite (popped) or the like applied over said waterproof membrane.

21 Claims, 5 Drawing Figures



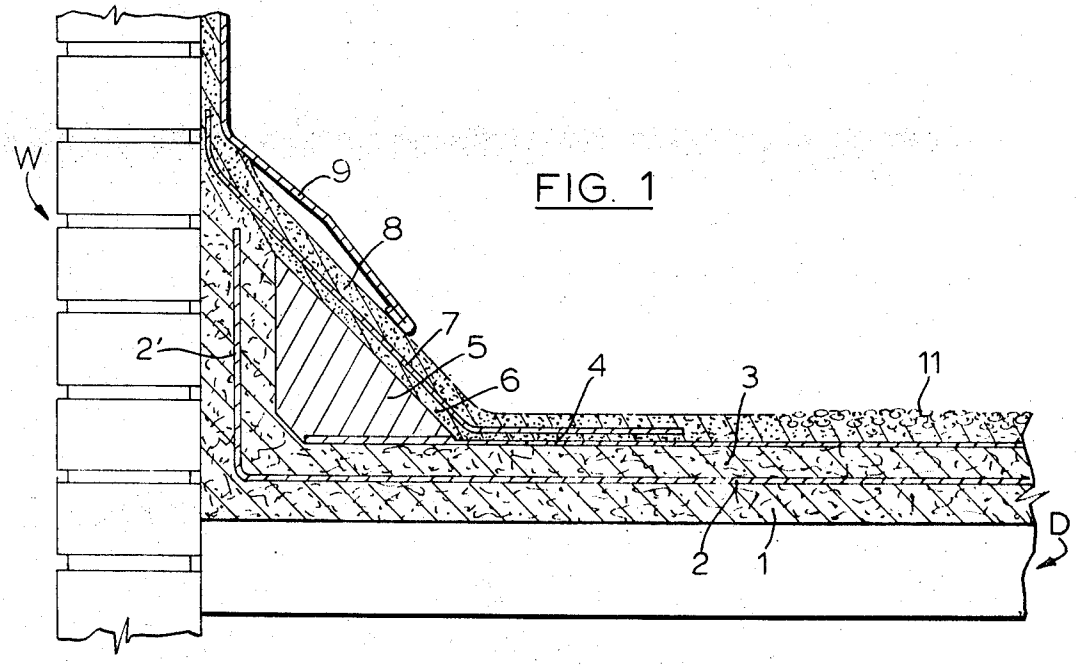


FIG. 1

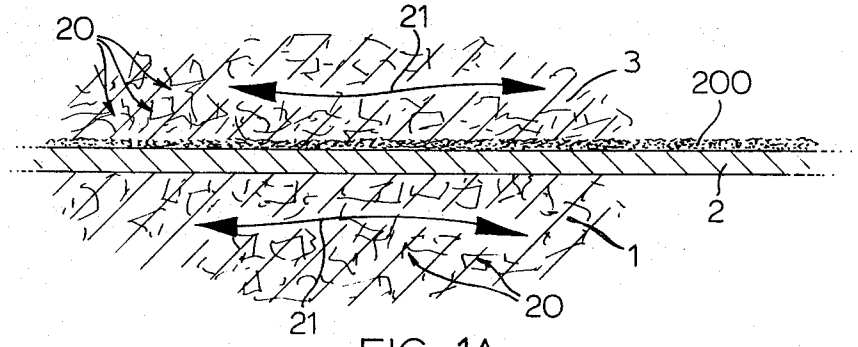


FIG. 1A

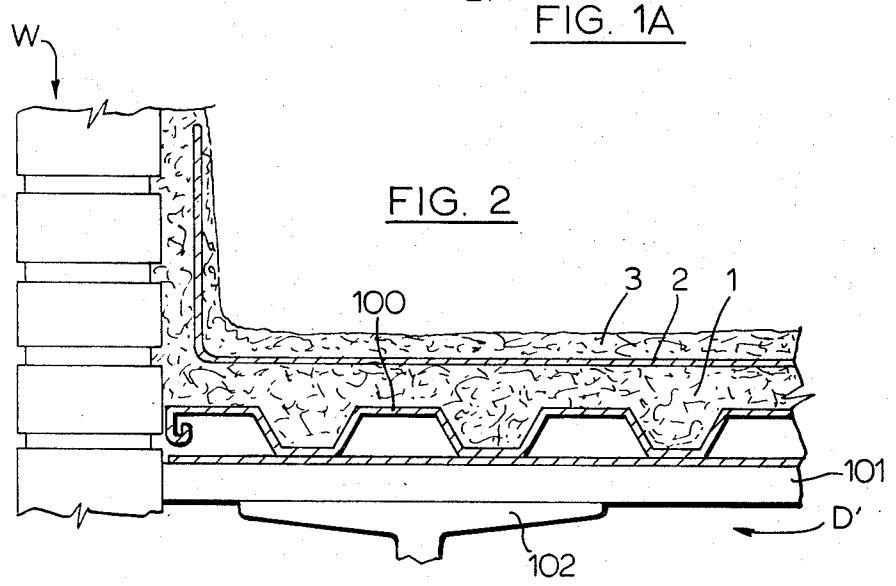


FIG. 2

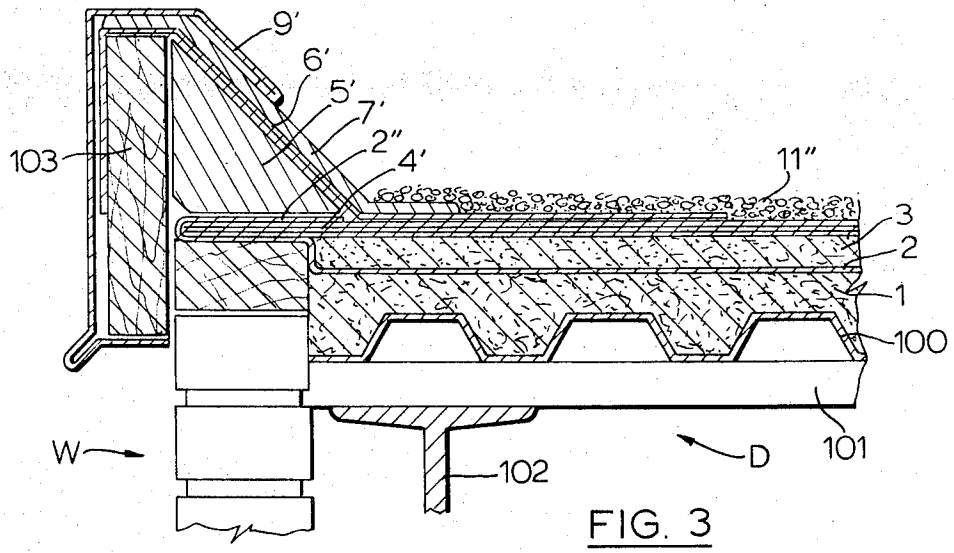


FIG. 3

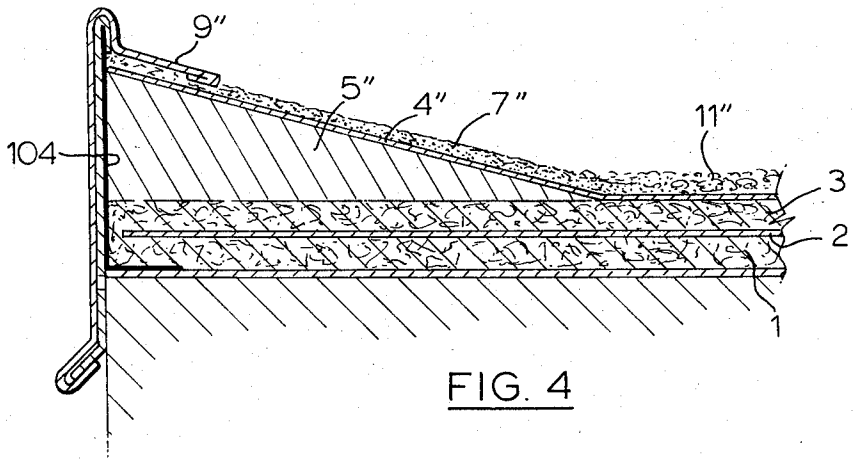


FIG. 4

ROOFING SYSTEM AND METHOD OF APPLICATION

This application is a continuation-in-part of U.S. Patent application Ser. No. 205,219, filed Dec. 6, 1971 and now abandoned.

FIELD OF THE INVENTION

This invention relates to improvements in roofing and the installations thereof and more particularly to a novel roofing system for waterproofing and insulating the main roof structure of buildings of all types, which incorporate roof decks.

BACKGROUND OF THE INVENTION

There have been innumerable built-up roofing systems proposed for use on roof decking in the prior art but no entirely satisfactory roofing system has heretofor been devised. In such prior art roofing, the attempt to render the roofing impervious to water is frequently nullified by the very means such as nails intended to hold the roofing in place, which pierce or puncture the roofing. Often, too, the roofing punctured by the assembly of other equipment on the roofing or by the dropping thereon of heavy objects such as masonry objects or the like during work in progress on and around the roofing.

Even where great care is taken to minimize or to prevent actual piercing or puncturing of present roofing systems, such systems almost invariably contain some moisture particles which under changing ambient conditions on either side of the roofing build up pressure and effect blistering and ridging of the roofing and in time the rupture of the intended water proofing barriers to render such roofing pervious to water.

Another difficulty with present roofing is that it is adversely affected when rain falls on the components during application or when application is made in cold weather. Still again, many of the present roofing systems are totally unsuitable for tropical climates.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention, the above problems are overcome by first applying to the roof deck a first protective insulating or loading layer of an asphaltic cement or bitumen and a suitable inert insulating material preferably an igneous, glassy, siliceous or micaceous rock such as vermiculite (exfoliated), pearlite (popped) or the like, over which is applied a waterproof membrane and over which in turn is applied a second protective or loading coat of asphaltic cement or bitumen and a suitable insulating material as referred to above. Thereafter any desired protective or decorative roof surfacing may be applied. Preferably the waterproof membrane comprises asphalt saturated and coated sheeting to provide for intimate bonding with the asphalt-insulating material loading coats. Also, preferably, but not necessarily, the waterproof membrane is extended beyond the first loading coat and is turned upwardly to envelop the surrounding edge of the second loading coat. The system according to the invention thus provides a waterproof membrane barrier or core member isolated against physical damage from all external sources, between two loading coats of asphaltic cement or bitumen and insulating material which in themselves provide for lateral passage of vapours which normally cause pressure build-ups. Thus

the loading coats also protect the waterproof membrane from physical damage from all internal sources.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a broken-away, part-elevational, part-vertical sectional view of a roofing system according to the invention, applied to a concrete deck.

FIG. 1A is an enlarged broken-away vertical sectional view of the loading coats and centre core membrane of the roofing system of FIG. 1.

FIG. 2 is a view similar to FIG. 1 but showing the system applied to a steel decking and omitting the surface wearing course.

FIG. 3 is a view similar to FIG. 1 but showing a modified roofing system arrangement in which the centre core membrane is returned inwardly to envelop the edge of the roofing thereabove.

FIG. 4 is again a view similar to FIG. 1 but showing a further arrangement in which the centre core membrane terminates at the edge of the roof.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring first to FIG. 1, there is shown applied over the roof decking D a first layer or coat 1 which is formed of asphaltic cement or bitumen and an aggregate of a suitable inert insulating material preferably an igneous, glassy, siliceous or micaceous rock such as vermiculite (exfoliated), pearlite (popped) or the like. Applied over this layer 1 is a centre core membrane 2 whose essential requirement is that it must be moisture and vapour impervious. This layer 2 may conveniently and economically be formed from asphalt saturated and coated felted sheet material in order to achieve an intimate surface contact or bond with the layer 1. Applied over and in intimate contact with the centre core membrane 2 is a second layer 3 of asphaltic cement or bitumen and again an aggregate of a suitable inert insulating material preferably an igneous, glassy, siliceous or micaceous rock such as vermiculite (exfoliated), pearlite (popped) or the like.

These layers 1, 2 and 3 form the basic roofing system of the invention over top of which the desired wearing or decorative roofing courses, canting and flashing may be applied. The layers 1 and 3 of asphaltic cement or bitumen and exfoliated vermiculite, popped pearlite or the like aggregate may be considered as roof insulating or loading coats which serve the additional essential function of isolating and protecting the moisture and vapour proof centre core membrane 2. Each of the coats 1 and 3 forms an essentially waterproof layer in the sense that water will not percolate therethrough. At the same time, as illustrated in FIG. 1A, each coat comprises a lens or honeycomb system made up of cementitiously coated insulating aggregate particles 20, bonded together by the asphaltic cement or bitumen. Thus, as indicated by the arrows 21, each coat will allow the migration therethrough of moisture vapour created by the vapourizing of any moisture trapped within the layers under the effects of temperature variations internally and externally of the roofing. In this way the invention precludes any moisture trapped in the insulating or loading coats 1 and 3 from effecting a pressure build-up at the surfaces of the centre core membrane 2 which would cause rupture thereof. Instead, the moisture is free to migrate through the lower loading coat 1 laterally beneath the centre core membrane to escape at the edges of the roofing or in the case of the upper loading

coat 3, laterally and upwardly away from the membrane 2 where it will cause no impairment to the moisture imperviousness of the roofing. Thus the loading coats 1 and 3 not only physically isolate the membrane 2 from damage by external forces but they insulate the membrane by virtue of their insulating honeycomb structure from the effects of temperature and humidity extremes, as well as eliminating all potential pressure build-up by entrapped moisture therewithin.

Preferably, as shown in FIG. 1, the centre core membrane 2 is turned upwardly at the edge as at 2' around the periphery thereof to in effect form a tank having side walls 2' and a bottom wall 2. This tank ensures any migration of moisture vapour which may be present in the upper loading coat 3 from migrating around the centre core membrane 2 at the edges thereof. However, if adequate roof edge flashing is provided the upturned edge 2' of the centre core membrane 2 may be omitted, as more particularly illustrated in FIG. 4.

FIG. 1 illustrates one particular example of a surface protecting or wearing coat and flashing arrangement. As illustrated, applied over top of the second loading coat 3 is a wearing course membrane 4 preferably comprising asphalt saturated felting which will intimately bond with the asphaltic cement or bitumen and aggregate structure of the coat 3. The wearing course membrane 4 extends to beneath the cant 5 which may conveniently comprise an asphalt coated and saturated fibre or wood structure, the upturned edge 2' of the centre core membrane extending upwardly between the cant 5 and the outer wall W.

Applied over the cant 5 and the upper ends of the upturned loading coats 1 and 3 and the centre core membrane 2 is a layer 6 of an asphalt plastic cement supporting and anchoring an under flashing membrane 7 which again may be asphalt impregnated and coated felting. A second layer 8 of asphalt plastic cement is applied over the under-flashing membrane 7 and above the second asphalt plastic cement layer is a metal counter flashing 9.

The general area of the roofing system as illustrated in FIG. 1 is covered by roof aggregate 11 which may be anchored in asphalt 10 applied over the wearing course membrane 4. It will be appreciated of course that any form of decorative surface finish may be utilized in place of the roof aggregate. In accordance with the invention, the roofing is applied by first applying the first insulating and loading coat 1 while hot. The exfoliated vermiculite popped pearlite or the like aggregate and the asphaltic cement or bitumen may be mixed in approximately the proportions of 1 bag (4 cubic feet) of aggregate to 4 gallons (40 pounds) boiling asphaltic bitumen or cement heated to a temperature not exceeding 450°F. Such asphaltic cement or bitumen for warmer climates should be such as to have a fairly high softening point, e.g. about 200°F and a very suitable material in such cases is Canadian Standards Association Specification No. A 123-7, type 3. For colder climates, the asphaltic cement may have a lower softening point. The mixture may be conveniently heated in a paddle type mixing machine until thoroughly mixed and is applied while hot to the decking D to provide a layer having a fairly even surface. The thickness at this stage of application should be approximately one-fourth inch thicker than the desired finished thickness (e.g. 1 inch). This applied layer is consolidated by means of tampers or heated rollers in preparation for the application of the centre core vapour proof membrane 2.

A very satisfactory centre core membrane is provided by a 40 pound ply sheet of asphalt impregnated and coated felt sheeting provided on the upper surface thereof, as illustrated in FIG. 1A, with a coating 200 of silica, sand, or other abrasive particles. The sheeting or membrane 2 should be applied snooth and free from air pockets, wrinkles, fishmouths, prominent lap joints or tears. The sheeting 2 may be conveniently applied by mopping down with hot asphalt. Over top of the centre core membrane 2 the second loading coat 3 is applied while hot. This second layer should be applied to a depth of approximately one-fourth inch thicker than the required total consolidated finished thickness of the roofing and after applied, should be tamped or consolidated as in the case of the first loading coat. By the provision of the mineral particle coating 200, a keying effect is provided which assists in anchoring the second loading coat during the rolling or consolidation thereof and forms a mechanical lock therewith.

The wearing course membrane 4 may then be applied over top of the second loading coat and may be united thereto by hot (boiling) asphaltic cement. Various other constituents may then be installed including the protective asphalt bound aggregate 11, the cant 5, the asphalt plastic cement (steam refined) layers 6 and 8, and the flashing members 7 and 9.

The utilization of the two loading coats and centre core membrane provide a very lightweight compactible insulating roofing structure and because the first loading coat is applied as a hot flowable spread, it can be applied over all forms of roof deck systems and will flow into and fill all surface irregularities in such systems. Since the basic roofing system is comprised of the layers 1 to 3 and these layers are applied as, or with the use of, hot flowable material having temperatures up to about 450°F, the ambient climatic temperature has no appreciable effect on their application. Thus the roofing system can be applied in extremely hot or cold weather. Further, the inherent inertness of the insulating and protecting coatings 1 to 3 render the roofing system highly adaptable to tropical climates when the asphaltic cement chosen has a sufficiently high softening point as mentioned above.

As previously explained, each of the layers 1 and 3 provides for the migration of moisture which may initially be present to prevent vapour pressure build-up and enables the roofing system to be installed in damp or wet weather without concern regarding entrapping moisture within the layers.

It will be understood that the system also allows the roofing to be graded to falls and contours in the roof to ensure positive roof drainage simply by controlling the spreading of the spreadable layers 1 and 3.

As mentioned, because of the spreadability of the loading coats 1 and 3, the roofing system is adaptable to all types of roof deck arrangements and FIG. 2 illustrates the application of the invention to a steel decking D' which has a corrugated steel decking 100 supported on crossbeams 101 carried on main structural I beams 102. In FIG. 2, all protective or decorative roof surfacing structures have been omitted. It will be seen from FIG. 2 that the first loading coat 1 completely fills the grooves of the corrugated decking 100 to provide an additional strengthening and stiffening effect.

FIG. 3 shows a modified roofing arrangement in which the roofing system of the invention is applied to a steel decking D' similar to that illustrated in FIG. 2. In this case, however, the centre core membrane 2 is not only turned up at the edges of the roofing but is turned inwardly at 2'' to enclose the membrane 4' which again may comprise asphalt impregnated and coated felt layers. It will be understood that the inturned edges 2'' of the centre core membrane 2 will be anchored to the asphalt impregnated and coated wearing course layer 4' by asphaltic cement and it may be further anchored by being placed under the cant 5' over which is applied a mastic flashing 7' which extends beneath a metal flashing 9' carried by a roof facing block 103. Located between the mastic flashing 7' and the cant 5' in place of the asphaltic plastic cement used in the arrangement of FIG. 1 is a layer of asphalt impregnated and coated felt flashing 6'.

FIG. 4 illustrates a further arrangement in which the centre course membrane 2 terminates at the edge of the roofing and a metal termination strip 104 is utilized to contain the roofing edge and is turned upwardly to extend beneath the metal counter flashing 9''. Again the roof is provided with a cant 5'', a wearing course membrane 4'' overlying the cant and covered by a steam refined asphaltic plastic cement 7'', and the main body of the roofing system is covered by aggregate 11''.

It will be understood that the several arrangements of roofing systems according to the invention shown are illustrative only and variations in the nature of the decking to which the roofing system is applied, the canting, flashing and surface details, may be made within the spirit of the invention and without departing from the scope of the appended claims.

I claim:

1. In a roofing system, a roof deck, a first loading coat of asphaltic cement and an igneous rock aggregate applied to and covering said roof deck, a waterproof membrane applied over said first loading coat and extending at least substantially to the edges thereof, and a second loading coat of asphaltic cement and an igneous rock aggregate applied over said waterproof membrane.

2. A roofing system as claimed in claim 1 in which said aggregate is selected from exfoliated vermiculite and popped pearlite.

3. A roofing system as claimed in claim 2 in which said waterproof membrane is formed of asphalt impregnated and coated sheeting.

4. A roofing system as claimed in claim 3 in which said sheeting is provided on its upper surface with a coating of abrasive particles in interlocking relation with said second loading coat.

5. A roofing system as claimed in claim 3 in which the edges of said waterproof membrane are turned upwardly to define a waterproof tank within said upturned edges.

6. A roofing system as claimed in claim 3 in which at the edges of said roof deck said first and second loading coats with said waterproof membrane embedded therebetween are extended upwardly to define a waterproof tank within said upturned edges.

7. A roofing system as claimed in claim 3 in which said edges of said waterproof membrane are extended beyond said first loading coat and are turned upwardly and inwardly to envelop the edges of said second loading coat.

8. In a roofing system, a roof deck, a first loading coat resistant to water penetration but permitting migration of water vapour such as to prevent vapour pressure build-up applied over and covering said deck, a moisture and water vapour proof membrane applied over said loading coat and in intimate contact therewith, said moisture and vapour proof membrane extending at least substantially to the edges of said first loading coat, and a second loading coat resistant to water penetration but permitting migration of water vapour such as to prevent vapour pressure build-up applied over and in intimate contact with said moisture and waterproof membrane, said first and second loading coats being formed of asphaltic cement and igneous rock aggregate.

9. A roofing system as claimed in claim 8 in which said aggregate is selected from exfoliated vermiculite and popped pearlite.

10. A roofing system as claimed in claim 9 in which said moisture and water vapour proof membrane comprises asphalt impregnated and coated sheeting.

11. A roofing system as claimed in claim 10 in which said sheeting is provided on its upper surface with a coating of abrasive particles in interlocking relation with said second loading coat.

12. A roofing system as claimed in claim 9 in which the edges of said waterproof membrane are turned upwardly to define a waterproof tank within said upturned edges while leaving the periphery of said first loading coat exposed for the lateral escape of any water vapour present in said first loading coat beneath said tank prior to the application of said water and moisture proof membrane.

13. A roofing structure as claimed in claim 9 in which the edges of said waterproof membrane are extended beyond said first loading coat and are turned upwardly to envelop the edges of said second loading coat while leaving the periphery of said first loading coat exposed for the lateral escape of any water vapour present in said first loading coat prior to the application of said membrane.

14. A roofing structure as claimed in claim 9 in which said first and second loading coats comprise an intimate mixture of asphaltic cement and aggregate in the proportions of about 4 gallons of asphaltic cement to about 4 cubic feet of aggregate.

15. A roofing structure as claimed in claim 9 having a surface protective layer applied over said second loading coat.

16. A method of applying a roofing system to a roof deck comprising applying a first layer of hot intimately mixed asphaltic cement and igneous rock aggregate to the roof deck and compacting said layer to form a first loading coat having a substantially smooth upper surface, applying a water and vapour proof membrane over said first loading coat while eliminating air pockets therebeneath, then applying a second layer of hot intimately mixed asphaltic cement and igneous rock aggregate over said water and vapour proof membrane.

17. A method as claimed in claim 16 in which said igneous rock aggregate is selected from exfoliated vermiculite and popped pearlite.

18. A method of applying a roofing system as claimed in claim 17 in which the asphaltic cement and aggre-

gate are mixed in the proportion of about 4 gallons of asphaltic cement to about 4 cubic feet of aggregate.

19. A method as claimed in claim 16 in which said membrane is turned upwardly at the edges to define a water and vapour proof tank overlying said roof deck.

20. A method as claimed in claim 16 in which said membrane is extended beyond the edges of said loading coats and turned upwardly to envelop the edge of said second loading coat.

21. A method as claimed in claim 16 in which said waterproof membrane comprises as asphalt impregnated and coated sheeting and said sheeting is applied by mopping with hot asphalt.

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