

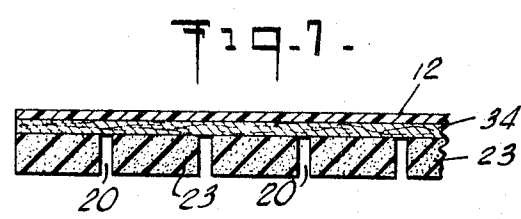
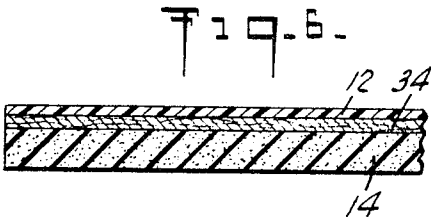
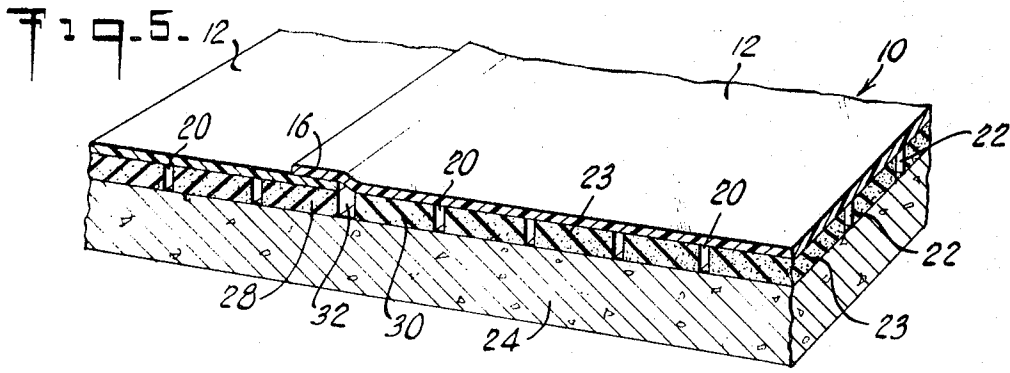
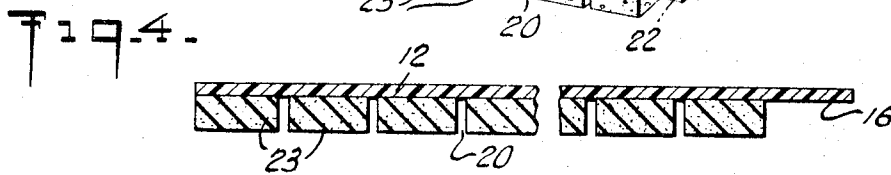
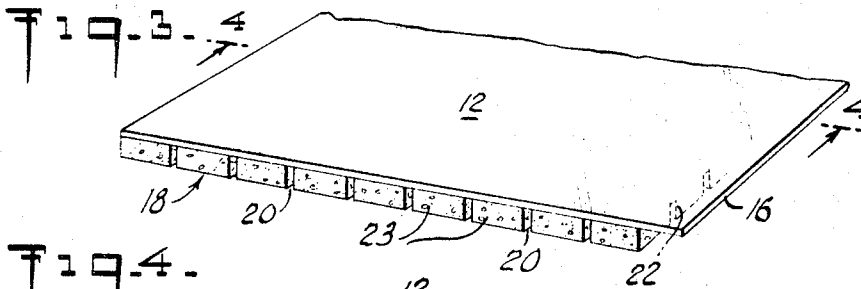
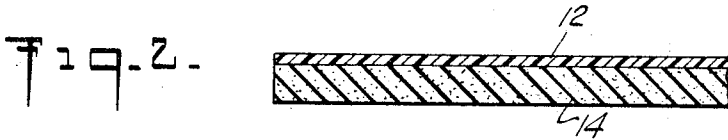
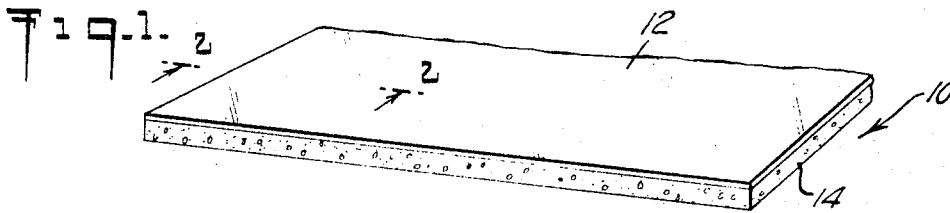
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3,455,076

ROOFING MEMBRANE WITH FIBROUS REINFORCING MATERIAL

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3,455,076

ROOFING MEMBRANE WITH FIBROUS REINFORCING MATERIAL

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Continuation of application Ser. No. 332,405, Dec. 23, 1963. This application Aug. 1, 1967, Ser. No. 657,711
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U.S. Cl. 52—302

11 Claims

ABSTRACT OF THE DISCLOSURE

A roofing membrane comprised of an outer weathering film and a laminated resilient sponge layer protects against roof membrane failure by its ability to take up stresses caused by building movement. The resilient sponge backing can be grooved to further increase the ability to take up stress and to provide an outlet for trapped water vapor and a reinforcing fabric may be provided between the backing and the film.

This is a continuation of application Ser. No. 332,405, filed Dec. 23, 1963, now abandoned.

This invention relates to roof covering materials, and more particularly, to a single-membrane roofing.

Built-up roofing has been employed for many years, usually comprising a plurality of layers of roofing felt adhered together and to the roof deck by a suitable adhesive, such as asphalt. When applied to monolithic structures, such as, for example, concrete roof decks, built-up roofing is subject to cracking, wrinkling, and separation due to its inability to accommodate itself to the usual expansion and contraction of the roof deck. In addition, air and water vapor often accumulate between the roof deck and the roofing, and expand with rising temperatures to cause blistering of the roofing membrane. Built-up roofing is particularly susceptible to such action during the period in which moisture evaporates from a concrete roof deck as the concrete dries. Heretofore, special ventilating felts have been required between the roof deck and the roofing felts to permit the escape of water vapor and air.

A further disadvantage of built-up roofing is the relatively long time required for its application. In addition to time spent in applying layers of roofing felts, time is lost in other areas of building construction which cannot be started until the building is closed by the roofing.

An object of the invention is to provide a single membrane roofing which is capable of accommodating itself to movement of the roof deck during expansion and construction thereof.

Another object of the invention is to provide a single membrane roofing which permits the escape of air or water vapor trapped between the roof deck and the roofing.

A further object is to provide a single membrane roofing which can be rapidly installed on a roof deck.

Another object is to provide a single membrane roofing which can accommodate roof deck movement and which incorporates a layer of insulation material.

Briefly, the invention comprises a roofing membrane having a weather resistant and relatively elastic film bonded to an underlying layer of a compressible, resilient material, capable of being distorted to a considerably greater degree than the film. The roofing membrane is adhered in a single layer to a roof deck by any suitable adhesive that does not have a detrimental effect on the membrane material. The compressible, resilient underlying layer, which advantageously may be a suitable

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sponge material, can be distorted by building movement without transmitting the stresses to the surface film in amounts greater than the film can withstand.

The underlying layer may be provided with a plurality of intersecting grooves or channels through which air or water vapor may flow to the atmosphere. If desired, an intermediate layer of material may be provided between the compressible material and the film.

The nature of the invention will be more fully understood and other objects may become apparent, when the following detailed description is considered in connection with the accompanying drawing, wherein:

FIG. 1 is a pictorial representation of the roofing material or laminate of the present invention;

FIG. 2 is an enlarged partial sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1, but showing a modified arrangement of the laminate;

FIG. 4 is an enlarged sectional view taken on line 4—4 of FIG. 3;

FIG. 5 is a pictorial representation of a section of roofing including the modified laminate;

FIG. 6 is a sectional view similar to FIG. 2, but showing a further modified arrangement; and

FIG. 7 is a sectional view similar to FIG. 6, but showing another modified arrangement.

Referring to FIGS. 1 and 2 of the drawing, a roofing membrane is indicated generally at 10, and comprises a film 12 adhered to a compressible, recoverable, resilient material 14. The film or layer 12 is not limited to any particular material, but it should be of an elastic and highly durable nature, and should be waterproof and capable of withstanding the rigors of weathering. Examples of suitable film materials are polyisobutylene, butyl rubber, and neoprene.

The material 14 similarly is not limited to any particular material, but it should be capable of being distorted to a considerably greater degree than the film 12. Sponge rubber, sponge polyurethane foam, and sponge polystyrene foam are examples of suitable underlying materials. Since these materials are highly compressible and resilient, and can recover their original shape even after protracted periods in a stressed condition, they are capable of being distorted without transmitting such distortion to the upper film in amounts greater than the film can accommodate. Such a laminate installed on a monolithic roof deck structure is not adversely affected by normal fractures in the decking caused by building movement.

The dimensions of the film and underlying layer may vary according to the desired properties of the laminate and according to available manufacturing capabilities. A film of about 20 to 80 mils thick, bonded to a sponge layer about $\frac{1}{16}$ to $\frac{1}{4}$ inch thick is a preferred example of a laminate which offers a number of desirable features. This laminate can be readily manufactured by foaming the sponge material directly to the film and packaging the laminate in roll form. Such a product is lightweight and can be easily handled and shipped. Application to a roof deck is simple, since it merely involves applying a suitable adhesive to the deck, and unrolling the laminate in place. The adhesive selected would of course be compatible with the sponge layer in order to avoid any possible detrimental effect.

With this arrangement, the film provides a tough, weather resistant surface, and the sponge layer provides insulation. In addition, cracks or fractures of the roof deck causing distortion of the membrane or laminate are not usually troublesome because such distortion is taken up primarily by the sponge layer. The small amounts of distortion transmitted to the film through the sponge layer can be readily accommodated by the film.

The laminate may be modified as shown in FIGS. 3 and 4, wherein a selvage edge 16 is provided. This may be accomplished by applying the sponge material to the undersurface of the film except along one side edge, the resulting strip of uncovered film being used to provide a lap joint between adjacent courses of the laminate. If no selvage edge is provided, the edges of adjacent laminates may be butted and taped to provide water tight joint.

Instead of employing a uniform layer of sponge material, as shown in FIGS. 1 and 2, a sponge layer 18 may be provided which has a plurality of intersecting grooves 20 and 22. By providing a sufficient number of grooves of adequate cross-sectional area, air and water vapor, which may become entrapped between the roof deck and the roofing membrane, can flow through the channels and out to the atmosphere. The spacing of the grooves may vary, but it is preferred to make them no closer than 1/2 inch on centers. The grooves extend to the edges of the sponge layer in order to interconnect with grooves in adjacent courses of membrane and to connect with suitable ventilating louvers at the eaves, parapets, or ridges of the roof. With this arrangement, the laminate would be adhered to the roof deck at spaced locations to prevent the grooves from filling with adhesive and possibly blocking flow of air and water vapor. The grooves or channels are shown as extending completely through the sponge layer, but they need not in all cases. Grooves may be formed of less depth than the thickness of the sponge layer, so long as the resulting channels can adequately handle the flow of air and water vapor which may accumulate. Grooves may be provided by any convenient means, such as by sawing the sponge material to the proper depth after it has been laminated.

In addition to ventilating the space between the roof deck and the membrane, the grooves divide the sponge layer into a plurality of spaced small blocks or panels 23. The spacing between these small blocks permits them to readily deform and take up any stress to which they may be subjected. Since the over-all deformation or distortion of the sponge layer is dependent upon the cumulative effect of stresses on the small blocks 23 of which it is comprised, and since the spacing permits increased deformation to take place, this arrangement can withstand greater stress and more distortion than the arrangement shown in FIGS. 1 and 2.

Referring to FIG. 5, the grooved embodiment of the roof covering laminate just discussed is shown after it has been applied to the surface of a monolithic concrete roof deck 24. The selvage edge 16 of the laminate at the right of FIG. 5 overlaps the edge of the adjacent laminate to form a lap joint. Because the edge of the laminate at the left necessarily abuts the undersurface of the selvage edge 16 along a line spaced from the end insulation blocks 30, the end insulation blocks 28 of the left laminate are spaced from the blocks 30 to form a gap or passageway 32 between the laminates. This passageway is parallel to the channels 20 and connects the transverse channels 22 of adjacent courses of laminates, thus ensuring a continuous flow path from one laminate to the next.

In order to provide the laminate with more body, and in some cases to preclude the adhesive used to bond the laminate to the roof deck from attacking the film, a third layer of material may be interposed between the film and the sponge layers, as shown in FIG. 6 at 34. Conveniently, this is a felted material to which the film 12 is first bonded; the combined film and felt are then laminated to the sponge layer 14. Any of the known felts may be used, comprised of either organic or inorganic fibers, such as cellulosic, mineral wool, asbestos, or glass fibers. As an example of utilizing the felt to protect the film from attack by the adhesive, it may be used when the film is comprised of polyisobutylene, which is adversely affected by asphalt. To prevent asphalt from seeping through the sponge and felt, rubber bonded asbestos felt is provided, through which asphalt cannot penetrate. The thickness

of the felt may vary, but a layer of felt about 20 to 80 mils thick, which is the suggested thickness range for the film, would serve its purpose and yet not interfere with the ability of the laminate to be rolled and easily handled.

As shown in FIG. 7, a layer of felt 34 may also be provided in the embodiment utilizing a grooved sponge layer. With such a sponge layer, the felt may be necessary, depending upon the material employed as the film. If polyisobutylene is used as the film material, for example, it tends to flow and conform to its supporting layer. If the grooves 20 extend all the way through the thickness of the sponge layer, it may be necessary to provide a felt layer to support the polyisobutylene film, thus preventing the film material from cold flowing into the spaces or grooves 20.

It should now be apparent that the roofing material provided by the present invention enables a roof deck to be covered by a single layer or membrane of material which waterproofs and protects the roof, as well as providing insulation. Because of its unique construction, the material can withstand fractures in the roof deck without splitting or cracking or being otherwise adversely affected. The space between the roof deck and the roofing membrane can be ventilated, thereby preventing accumulation of air and water vapor which could cause subsequent blistering. The material is light, and is easily handled, packaged, shipped and installed.

While the invention has been described in connection with a monolithic roof structure, and while major benefits are obtained by such an application, it should be understood that the roofing material can also be applied on other types of roof decks as well.

It is to be understood that other variations and modifications of the invention may be made without departing from the spirit of the invention. It also is to be understood that the scope of the invention is not to be interpreted as limited to the specific embodiments disclosed herein, but only in accordance with the appended claims, when read in the light of the foregoing disclosure.

What I claim is:

1. A prefabricated roofing membrane, comprising
 - (a) a weather resistant, durable film,
 - (b) fibrous reinforcing material bonded to the film, and
 - (c) a layer of highly compressible and resilient spongy material capable of being distorted to a considerably greater degree than the film,
 - (d) the combined film and fibrous reinforcing material being bonded to the layer of spongy material,
 - (e) the exposed surface of the layer of spongy material containing a plurality of intersecting grooves extending to the edges of the spongy layer to provide for flow to the atmosphere of air and water vapor entrapped between the spongy layer and a roof deck to which the roofing membrane may be adhered, and to increase the ability of the spongy material to deform in response to stresses.
2. A prefabricated roofing membrane as recited in claim 1, wherein the fibrous reinforcing material is comprised of inorganic fibers.
3. A prefabricated roofing membrane as recited in claim 2, wherein the inorganic fibrous reinforcing material is comprised of glass fibers.
4. A roofing membrane as recited in claim 1, wherein the layer of spongy material is comprised of plastic foam.
5. In a roof construction,
 - (a) a roof deck,
 - (b) a membrane covering the roof deck,
 - (c) the membrane comprising
 - (1) an exposed film of weather resistant, durable material,
 - (2) fibrous reinforcing material bonded to the film, and
 - (3) a layer of highly compressible and resilient spongy material capable of being distorted to a considerably greater degree than the film,

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(4) one side of the layer of spongy material being bonded to the combined film and fibrous reinforcing material and the other side of the layer of spongy material being adhered to the roof deck,

(d) the layer of spongy material being adhered to the roof deck by an adhesive, and the fibrous reinforcing material being a barrier to passage of the adhesive toward the film.

6. A roof construction as recited in claim 5, wherein the fibrous reinforcing material is comprised of inorganic fibers.

7. A roof construction as recited in claim 6, wherein the inorganic fibrous reinforcing material is comprised of glass fibers.

8. A roof construction as recited in claim 5, wherein the layer of spongy material is comprised of plastic foam.

9. A roof construction as recited in claim 5, wherein the film is comprised of polyisobutylene and the fibrous material is a rubber bonded felt.

10. In a roof construction,

- (a) a roof deck,
- (b) a membrane covering the roof deck,
- (c) the membrane comprising

(1) an exposed film of weather resistant, durable material,

(2) fibrous reinforcing material bonded to the film and

(3) a layer of highly compressible and resilient spongy material capable of being distorted to a considerably greater degree than the film,

(4) one side of the layer of spongy material being bonded to the combined film and fibrous rein-

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forcing material and the other side of the layer of spongy material being adhered to the roof deck,

(d) the side of the layer of spongy material adhered to the roof deck containing a plurality of intersecting grooves communicating with the atmosphere to provide for the flow to the atmosphere of air and water vapor entrapped between the membrane and the roof deck and to increase the ability of the spongy material to deform in response to stresses.

11. A roof construction as recited in claim 10, wherein the layer of spongy material is adhered to the roof deck by an adhesive and the fibrous reinforcing material is a barrier to passage of the adhesive toward the film.

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JOHN E. MURTAGH, Primary Examiner

U.S. Cl. X.R.

52—309, 403, 408; 161—123, 159