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ROOFING ELEMENT AND ROOF SURFACE

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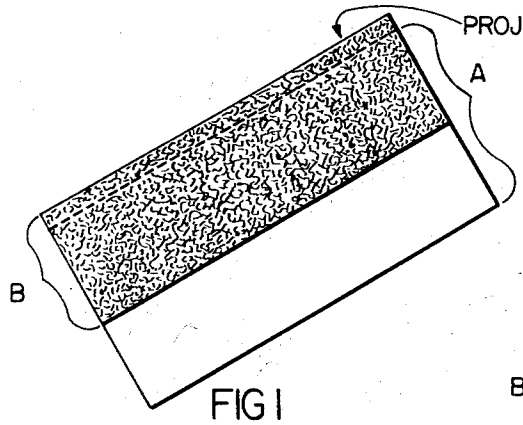


FIG 1



FIG 3

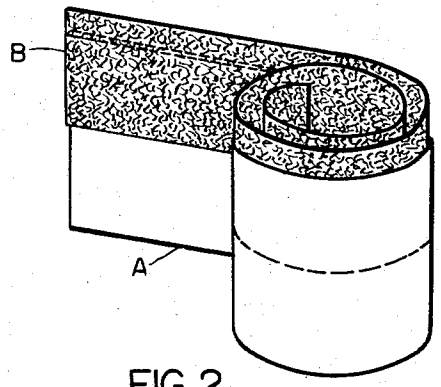


FIG 2

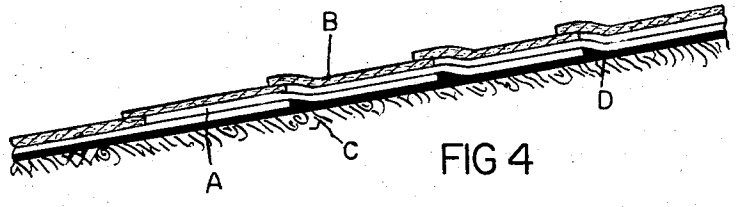


FIG 4

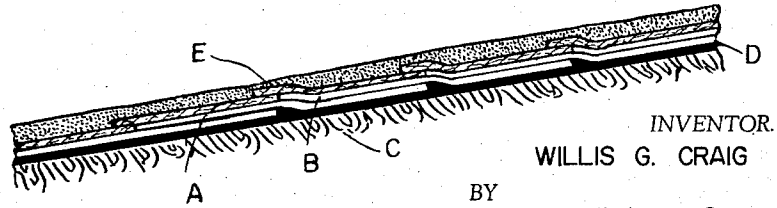


FIG 5

INVENTOR.
WILLIS G. CRAIG

BY
Oberlin, Maky & Donnelly
ATTORNEYS

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ROOFING ELEMENT AND ROOF SURFACE

Willis G. Craig, Willoughby, Ohio, assignor to The Lubrizol Corporation, Wickliffe, Ohio, a corporation of Ohio

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The present invention relates, as indicated, to a novel roofing element and to a roof surface comprising a plurality of said roofing elements. In a more particular sense, it relates to a roof surface comprising a plurality of said roofing elements, the weather surface of which comprises the residue of an aqueous clay-containing asphalt emulsion.

Perhaps the most common type of roof surface in use today on factories, auditoriums, office buildings, and the like is the so-called "built-up" roof surface. In its most simple embodiment, such a roof surface is made by securing a roofing felt, generally bitumen-impregnated roofing felt, to the roof deck and then applying a layer of molten asphalt or other molten bitumen. If additional strength and weather-proofing is desired, a second roofing felt is imbedded in the molten asphalt and a second top-coat of molten asphalt is applied. Such a "two-ply" roof surface is generally considered to be the minimal roof surface for commercial applications. In some cases, even a third or fourth roofing felt and a third or fourth top-coat of molten asphalt may be added in like manner. If desired, finely-divided gravel or flint chips may be imbedded in the final top-coat of asphalt to improve its weatherability. Although such built-up roof surfaces have found wide application, they have a number of disadvantages such as, for example, the heavy "dead" weight placed upon the supporting structure of the roof deck as the number of plies of felt and asphalt is increased; the tendency of the weather surface to crack as a consequence of its rigidity and inability to adjust to the movement of the roof deck; the penetration of water through the cracked weather surface, which causes the felts to rot and to curl ("fish-mouth") in lapped areas; and the high labor costs incident to the application of numerous successive layers of roofing felt and asphalt.

In recent years, workers in the roofing art have sought to alleviate some of the disadvantages of a built-up roof surface by making use of a glass mat made up of glass fibers and/or glass strands (generally bonded by means of a resinous binder such a phenolic resin) as a substitute for one or more plies of roofing felt. While the partial or complete replacement of conventional roofing felts by glass mats significantly improved the rot resistance of the final built-up roof surface, it did little to correct the other disadvantages noted above.

It is, accordingly, an object of the present invention to provide a novel and economical roofing element.

Another object is to provide an improved roof surface comprising a plurality of said novel roofing elements.

A still further object is to provide an economical, lightweight roof surface which is highly resistant to cracking, tearing, rotting, and fish-mouthing.

These and other objects of the invention are realized by means of a roofing element comprising a laminate of a substantially rectangular bitumen-impregnated roofing felt component and a substantially rectangular bonded glass mat component, said bonded glass mat component having at least 10 percent of voids which extend therethrough, and said laminate being characterized further in that (a) the width of the bonded glass mat component is from about one-third to about two-thirds the width of the bitumen-impregnated roofing felt component, and (b) a longitudinal edge of the bonded glass mat component projects in a substantially parallel manner at least about one inch beyond a longitudinal edge of the bitumen-impregnated roofing felt component. As noted hereinafter, the bonded glass mat component may be replaced in some cases by a bonded mat made of materials other than glass.

In making a roof surface of the present invention, a plurality of the hereindescribed roofing elements are secured horizontally to a roof deck in a manner such that the bitumen-impregnated roofing felt component of each roofing element faces the roof deck and the projecting edge of the bonded glass mat component of a roofing element overlaps the bonded glass mat component of an adjacent roofing element. In general, it is preferred to secure the roofing elements to the roof deck by means of an adhesive such as molten asphalt or an "asphalt cutback" (a solution of asphalt in a solvent such as petroleum mineral spirits). For best results, the adhesive should also be applied to the upper side of the bitumen-impregnated roofing felt component of a roofing element before a second roofing element is lapped to it. This serves to hold down the edge of the lapped roofing element and prevent fish-mouthing.

Thereafter, the voids of the bonded glass mat components are filled, optionally, with the residue of an aqueous clay-containing asphalt emulsion. This is accomplished simply by applying an aqueous clay-containing asphalt emulsion such as that described in U.S. Patents Nos. 2,503,246 and 2,652,341 to the roof surface and allowing the water to evaporate therefrom. The emulsion penetrates the voids of the bonded glass mat component of the roofing element of this invention and upon drying leaves a residue of clay and asphalt which provides excellent protection against water penetration.

Referring to the accompanying drawing:

FIG. 1 is a perspective view of a roofing element of the invention.

FIG. 2 is a perspective view of a roofing element of the invention in a preferred form, namely, a roll thereof.

FIG. 3 is a cross-sectional view of a roofing element of the invention.

FIG. 4 is a cross-sectional view of a roof surface prepared using a plurality of the roofing elements of the invention.

FIG. 5 is a cross-sectional view of a roof surface prepared using a plurality of the roofing elements of the invention and containing on the weather surface thereof the residue of an aqueous clay-containing asphalt emulsion.

Referring now in detail to the figures of the drawings which illustrate several specific embodiments of the present invention:

In FIG. 1, a roofing element of the invention is shown in which A represents a rectangular bitumen-impregnated roofing felt component to which B, the rectangular bonded glass mat component, is laminated by means of an adhesive or by subjecting A and superimposed B to heat and pressure to effect a strong bond between the two said components.

In FIG. 2 and FIG. 3, A and B are as defined in FIG. 1.

In FIG. 4, A and B are as defined in FIG. 1, and C represents a roof deck to which the bitumen-impregnated roofing felt component of the roofing element of this invention is secured by means of an adhesive D.

In FIG. 5, A, B, C, and D are as previously defined and E represents the residue of an aqueous clay-containing asphalt emulsion, which residue fills the voids of the bonded glass mat component of the roofing element of the invention and forms the weather surface of the roof.

The bitumen-impregnated roofing felt component of the roofing element of this invention may be any one of

the ordinary, commercial roofing felts made by impregnating or saturating sheets of fibrous material such as paper, wood fiber, rag fiber, mixed wood and rag fibers, asbestos, asbestos-cellulose aggregates, glass fibers, sisal, hemp, or synthetic fibers such as rayon, nylon, Dacron, and the like with a bitumen such as petroleum asphalt, coal tar, Trinidad natural asphalt, gilsonite, uintahite, pitch, etc. By reason of its availability, low cost, and excellent weather-proofing qualities, petroleum asphalt is generally preferred as the bitumen for saturating a sheet of fibrous material to form a roofing felt. Commercial roofing felts are available in a variety of thicknesses or "weights" ranging from about 3 pounds to about 100 pounds per "square" (a roofing square equals 108 square feet) and width ranging from about 32 to about 40 inches, generally 36 inches. Any of the various weight of roofing felts can be used for the purposes of this invention, although a preference is expressed for roofing felts weighing from about 10 pounds to about 45 pounds per square. By reason of their low cost and commercial availability, the roofing felts most commonly used in the practice of this invention will be asphalt-impregnated "rag" felts, i.e., felts in which the fibrous base is a cellulosic material such as wood fiber, rag fiber, mixed wood and rag fibers, etc. Nylon or Dacron base roofing felts have superior characteristics for the purposes of this invention, but their high cost severely limits their wide application.

The bonded glass mat component of the roofing element of this invention may be any loosely-woven mat or "fabric" of glass fibers (mono-filaments of glass) and/or glass strands (linear bundles containing from 25–300 or more mono-filaments), or, preferably, any loosely felted mat comprising relatively short lengths of glass fibers and/or glass strands haphazardly arranged, e.g., in a jackstraw pattern, which mat has been bonded with an adhesive, generally a petroleum asphalt, in a manner such as to leave at least about 10 percent of voids which extend through the mat. In lieu of asphalt, other adhesives such as phenolformaldehyde resins, acrylic resins, epoxy resins, and the like may be used to prepare the bonded mat. In some instances it is also possible to use bonded mats prepared from fibers and/or strands of materials other than glass such as, e.g., nylon, sisal, rayon, Dacron, hemp, etc., although glass is the preferred material because of its superior resistance to deterioration. The preparation of such bonded mats is well-known in the roofing art.

An asphalt-bonded glass mat which is particularly well-suited as the bonded glass mat component of the present invention is described in U.S. Patent 2,811,769. This preferred asphalt-bonded glass mat is prepared by forming a relatively loosely piled mass of glass strands which are from about 1 to about 6 inches long and which are haphazardly arranged and distributed throughout the mass, compacting the mass by flowing water thereon, spraying melted asphalt on the mass, and then heating the whole so as to drive off substantially all the water and to remelt the deposited asphalt, causing the latter to impregnate the glass strands and bond said strands at points of contact. Upon cooling, there results a strong, flexible, asphalt-bonded glass mat which contains at least about 10 percent and more often at least 30 percent of voids which extend therethrough. For the purposes of the present invention it is critical that the bonded glass mat component contain at least about 10 percent and preferably at least about 30 percent of voids which extend therethrough.

As indicated earlier, the bonded glass mat component should be from about one-third to about two-thirds, preferably about one-half, the width of the bitumen-impregnated roofing felt. When the width of the bitumen-impregnated roofing felt is in the range from about 32 to about 40 inches, the width of the bonded glass mat component will preferably be within the range from about 16 to about 22 inches. Furthermore, a longitudinal edge of the bonded glass mat component should project in a substantially parallel manner at least about 1 inch, more often about 1.5 to 6 inches and preferably about 1.5 to 3 inches, beyond a longitudinal edge of the bitumen-impregnated roofing felt.

The lamination of the bitumen-impregnated roofing felt component and the bonded glass mat component to form the roofing element of this invention may be accomplished in any one of several ways. For example, referring to FIG. 1 of the accompanying drawing, the upper half of the bitumen-impregnated roofing felt component A is coated with a thin layer of an adhesive such as an asphalt cut-back and then the bonded glass mat component B is superimposed on A in the shown position so that the edge of B projects in a substantially parallel manner at least about one inch beyond an edge of A. Upon evaporation of the solvent from the asphalt cut-back, B is firmly adhered to A. Another and more economical method of laminating components A and B is to position them as shown in FIG. 1 of the accompanying drawing and then to apply heat and pressure to the area where bonding or lamination is desired. Under the influence of heat and pressure, the bitumen in A and, optionally, B softens, and the said two components become firmly bonded together. Still another method is to apply the bonded glass mat component while yet warm from its manufacture to the bitumen-impregnated roofing felt under pressure.

In forming a roof surface from the roofing element of this invention, a plurality of said roofing elements are secured horizontally to a roof deck in a manner such that the bitumen-impregnated roofing felt component of each roofing element faces the roof deck and the projecting edge of the bonded glass mat component of a roofing element overlaps the bonded glass mat component of an adjacent roofing element. In most instances, it is preferred to secure the roofing elements to the roof deck by means of an adhesive such as an asphalt cut-back or a molten bitumen. Roofing nails can be used, if desired, to secure the bitumen-impregnated component of the roofing element to a wood roof deck or other nailable roof deck. They should never be used, however, to secure the bonded glass mat component to the roof deck; an adhesive should be used for this purpose. The relative position of the roofing elements with respect to each other in a roof surface of this invention can be visualized in greater detail by reference to FIG. 4 of the accompanying drawing.

Although the roof surface just described and illustrated in FIG. 4 of the accompanying drawing is serviceable as such, it is generally preferred to top-coat it with a layer of a commercial, aqueous clay-containing asphalt emulsion. Upon evaporation of the water therefrom, the residue of the aqueous clay-containing asphalt emulsion fills the voids of the bonded glass mat component, firmly bonds the projecting edge thereof to the underlying second bonded glass mat component, and forms a very effective weather-proof roof surface which does not develop fish-mouths. Such a roof surface can be visualized in greater detail by reference to FIG. 5 of the accompanying drawing.

In some environments, for example, areas where frequent and sudden rainfall can be anticipated throughout the entire year, it may be desired to top-coat the roof surface shown in FIG. 4 of the accompanying drawing with a molten bitumen rather than an aqueous clay-containing asphalt emulsion. Such a roof surface, although highly serviceable, economical in construction, and resistant to tear and puncture, is quite rigid and is therefore, susceptible to cracking when movement of the roof deck occurs. Furthermore, it does not have the superior weathering characteristics and freedom from cracking and "alligatoring" that characterize the preferred roof surface of this invention which has for its weather surface the residue of an aqueous clay-containing asphalt emulsion.

One of the salient advantages of a roof surface of this invention is that a serviceable roof of the type illustrated

in FIG. 4 of the accompanying drawing can be constructed during inclement weather, will serve well as a weatherproof roof surface for the duration of the inclement weather, and then can be top-coated with an aqueous clay-containing asphalt emulsion during good weather (most commercial emulsions require at least 24 hours of rain-free weather to dry at a temperature of 70° F.). Another advantage of a top-coated roof surface of the invention such as illustrated in FIG. 5 of the accompanying drawing is that the projecting edge of the bonded glass mat component is firmly bonded to the underlying second bonded glass mat component by the residue of an aqueous clay-containing asphalt emulsion which fills the voids of the said two lapped glass mat components and creates, in effect, a monolithic glass mat-clay-asphalt composite possessing great strength. The usual fish-mouthing exhibited by top-coated, conventional, rag felt roofing elements is completely eliminated.

A specific example describing the preparation of a roofing element of the present invention follows. A 19-inch x 72-inch rectangular sheet of a commercially available asphalt-impregnated glass mat made according to the teaching of U.S. Patent 2,811,769 from haphazardly distributed glass strands 2 to 3 inches long and containing 200–250 glass mono-filaments per strand was superimposed on a 36-inch x 72-inch rectangular sheet of a good, commercial, 30-pound asphalt-impregnated mixed wood fiber-rag fiber roofing felt in a manner such that (a) the 72-inch dimensions of the sheets were approximately parallel to each other, and (b) one 72-inch edge of the asphalt-impregnated glass mat projected 2 inches beyond an edge of the asphalt-impregnated rag felt. The thus positioned plies were laminated at a pressure of 50 pounds per square inch/250° F. by passing them through a hot-roller-press. The resulting roofing element of the invention corresponded in appearance to that shown in FIG. 1 of the accompanying drawing. In like manner there was prepared a roll of the roofing element comprising, when unrolled, a rectangle measuring 38 inches x 100 feet.

The principal commercial form of the roofing element of this invention is embodied in a roll thereof as shown in FIG. 2 of the accompanying drawing. Such a roll will ordinarily have a width of 34 to 42 inches, generally about 38 inches, and contain anywhere from 35 to 150 linear feet of material. In effect, a roll of the type illustrated in FIG. 2 of the accompanying drawing is a coiled, highly elongated rectangle of a single roofing element of the invention.

What is claimed is:

1. A roofing element comprising a laminate of a substantially rectangular bitumen-impregnated roofing felt component and a substantially rectangular bonded glass mat component, said bonded glass mat component having at least 10 percent of voids which extend therethrough; and said laminate being characterized further in that (a) the width of the bonded glass mat component is from about one-third to about two-thirds the width of the bitumen-impregnated roofing felt component, and (b) a longitudinal edge of the bonded glass mat component projects in a substantially parallel manner at least about one inch beyond a longitudinal edge of the bitumen-impregnated roofing felt component.

2. A roofing element according to claim **1** characterized further in that the bonded glass mat component is an asphalt-bonded glass mat.

3. A roofing element according to claim **1** characterized further in that the width of the bonded glass mat component is about one-half the width of the bitumen-impregnated roofing felt component.

4. A roofing element according to claim **1** characterized further in that a longitudinal edge of the bonded glass mat component projects in a substantially parallel manner about 1.5 to about 6 inches beyond a longitudinal edge of the bitumen-impregnated roofing felt component.

5. A roofing element according to claim **1** characterized further in that (a) the width of the bonded glass mat component is about one-half the width of the bitument-impregnated roofing felt component, and (b) a longitudinal edge of the bonded glass mat component projects in a substantially parallel manner about 1.5 to about 6 inches beyond a longitudinal edge of the bitumen-impregnated roofing felt component.

6. A roofing element according to claim **1** characterized further in that the width of the bonded glass mat component is from about 16 to about 22 inches, the width of the bitumen-impregnated roofing felt component is from about 32 to about 40 inches, and a longitudinal edge of the bonded glass mat component projects in a substantially parallel manner about 1.5 to about 3 inches beyond a longitudinal edge of the bitumen-impregnated roofing felt component.

7. A roofing element according to claim **6** characterized further in that the bonded glass mat component contains haphazardly arranged glass strands which are from about 1 to about 6 inches long and which are bonded together by asphalt.

8. A roof surface comprising a plurality of the roofing elements of claim **1** secured horizontally to a roof deck in a manner such that the bitumen-impregnated roofing felt component of each roofing element faces the roof deck and the projecting edge of the bonded glass mat component of a roofing element overlaps the bonded glass mat component of an adjacent roofing element.

9. The roof surface of claim **8** characterized further in that the voids of the bonded glass mat component are filled with the residue of an aqueous clay-containing asphalt emulsion.

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RICHARD W. COOKE, JR., *Primary Examiner.*

EARL M. BERGERT, *Examiner.*

G. D. MORRIS, A. C. PERHAM, *Assistant Examiners.*