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Self adhesive roofing laminates having metal layer therein

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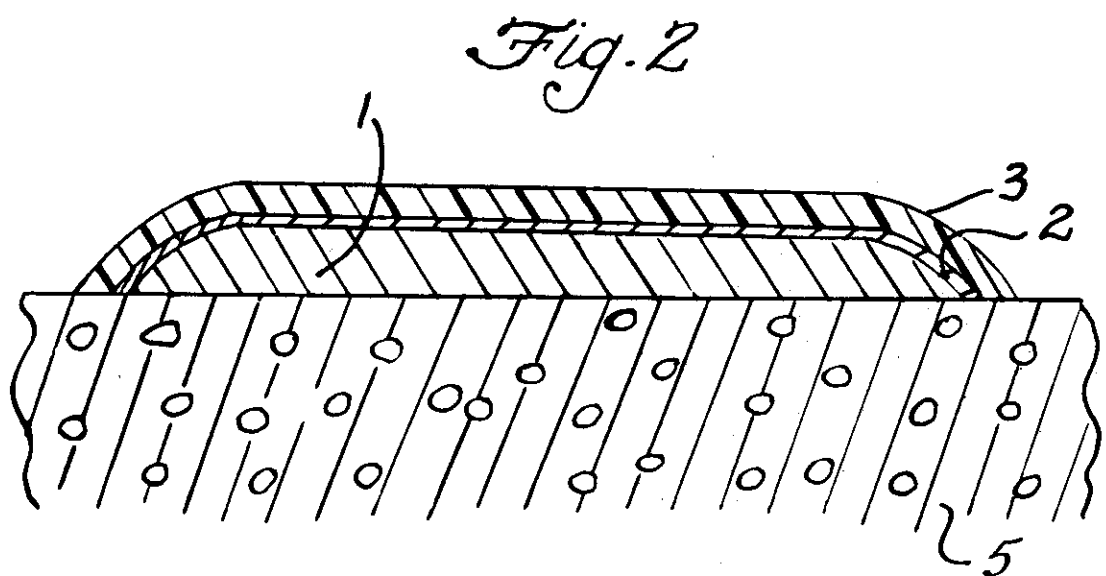
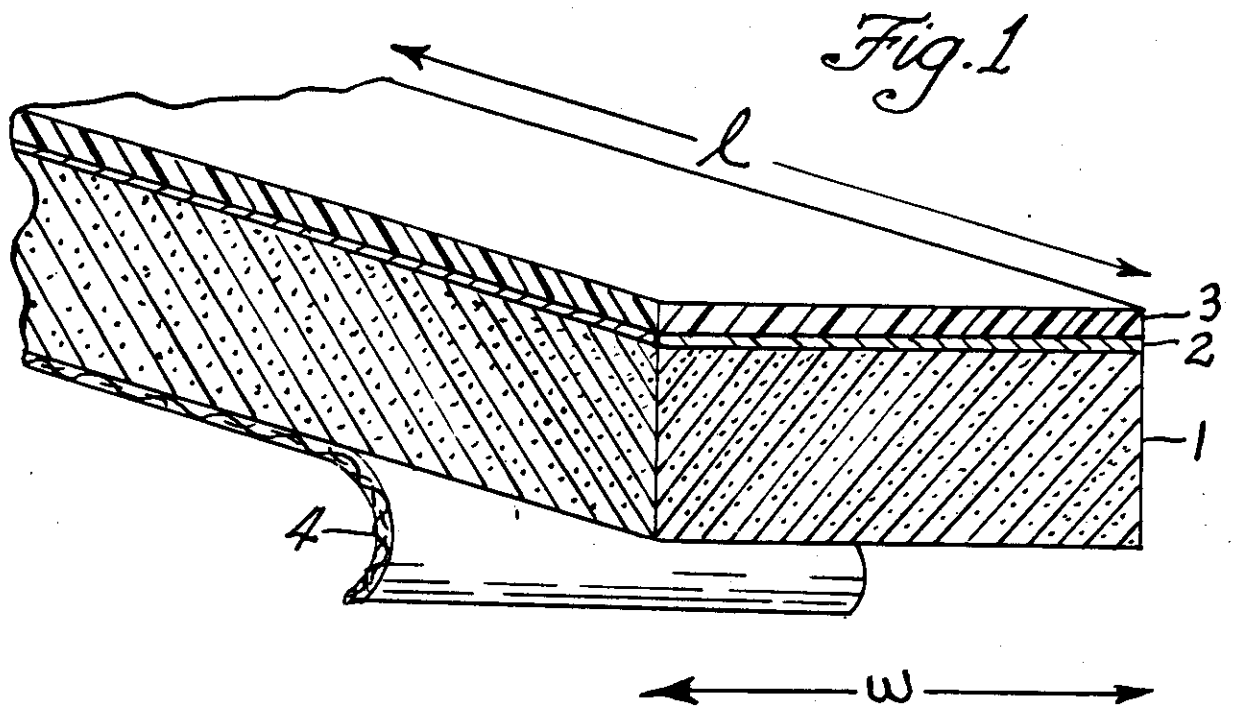


Fig. 3

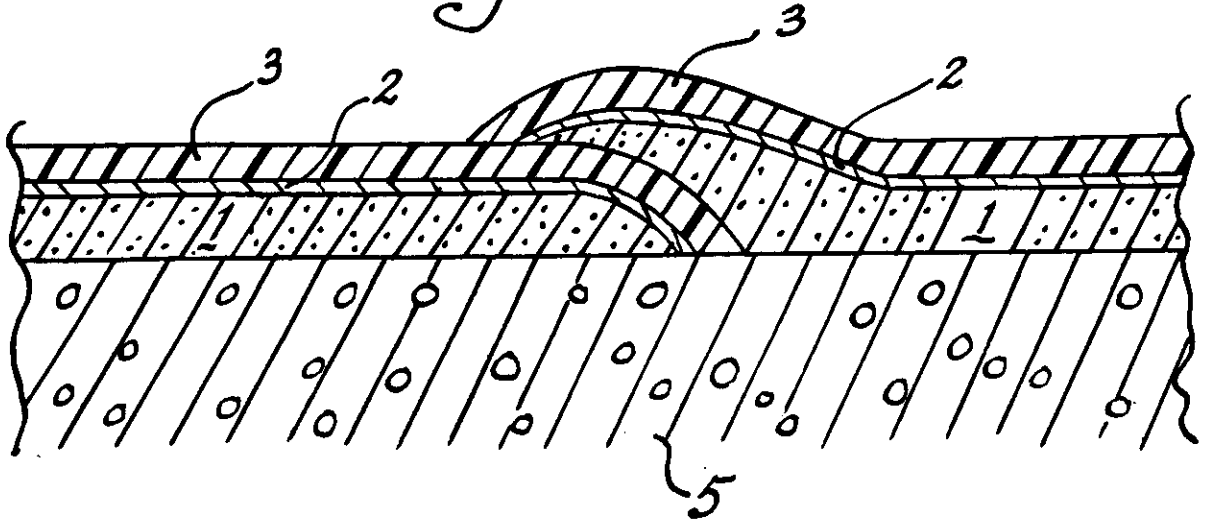
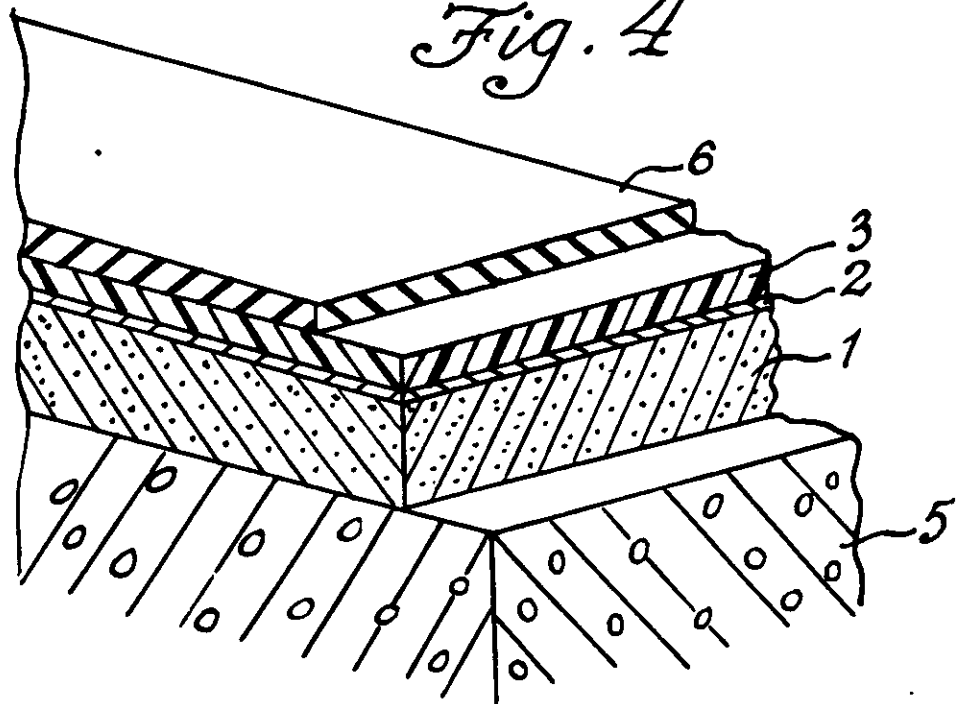


Fig. 4



- 1 -

"SELF-ADHESIVE ROOFING LAMINATES HAVING  
METAL LAYER THEREIN"

This invention relates to laminates containing bituminous waterproofing layers adapted for waterproofing and sealing structures.

Flexible sheet-like laminates of support films  
5 and self-adhesive bituminous waterproofing layers pre-formed in the factory have been successfully employed in roofing applications as substitutes for the more conventional waterproofing membranes which are constructed at the job site by plying together one or more layers of  
10 bitumen-saturated paper or felt and bituminous adhesives. The pre-formed, self-adhesive laminate-membranes offer many advantages including factory controlled preparation, avoidance of heating equipment and handling of hot materials at the job site, as well as many performance  
15 advantages.

Flexible pre-formed laminates of the aforementioned type and their use to form waterproofing layers in various kinds of building structures are described for example in U.S. Patent Nos. 3,741,856; 3,853,682 and  
20 3,900,102 to John Hurst. Such patents describe in particular the preparation of flexible laminates containing a support material, for example a layer of a polymeric or

metallic film, and a layer of self-adhesive, or pressure-sensitive adhesive, bitumen-elastomer waterproofing composition. As discussed in particular in U.S. Patent 3,900,102, such laminates may ideally be constructed in the plant in the form of a roll with a protective sheet, for example siliconized paper applied against the self-adhesive bituminous waterproofing layer, transported to the job site, and thereafter applied to a substrate adhesive side down, each successive laminate strip being made to overlap the edge of the previously-applied strip of laminate to ensure a continuous waterproofing seal.

In Canadian Patent No. 1,008,738 to Everett R. Davis, improved waterproofing laminates of the type described in the aforementioned U.S. patents are described which utilize, as the support material for such laminates, cross-laminated or biaxially oriented polymeric films. As discussed in the Canadian patent, such support films were found to provide laminates which exhibit reduced wrinkling following adhesion to a substrate and subsequent exposure to heat, for example, exposure to the sun. In recent years, flexible preformed laminates utilizing cross-laminated high density polyethylene films as the support layers for self-adhesive waterproofing layers of asphalt-rubber composition have been successfully applied in the form of overlapping strips to the rooftops of a variety of types of buildings to form long-lasting protective membranes

against the passage of water and moisture. Protective coatings containing for example inert aggregates, pigments, metal flakes, etc, have been applied to the exposed surfaces of the overlapped laminates which  
5 significantly increase the life of the waterproofing laminate-membrane. However, there is a continuing need in the art for improved flexible laminates for use as waterproofing membranes for roofs of buildings and the like.

10           According to the present invention, there is provided a waterproofed roof construction comprising a roof substrate and a continuous waterproofing layer adhered thereto made up of a plurality of strips of preformed, flexible waterproofing laminate, the said  
15 preformed laminates including an upper support layer of synthetic polymer film, a thin layer of metal positioned beneath and directly adhered to the support layer and a layer of waterproofing, pressure-sensitive bituminous adhesive composition which is beneath and adhered to the  
20 metal layer, said adhesive layer being adhered to the said roof substrate.

          The invention also provides a preformed, flexible roofing laminate in the form of a continuous strip having a length greater than its width and  
25 including an upper support layer of synthetic polymer film, a thin layer of metal positioned beneath and

- 3a -

adhered directly to the support layer, a layer of  
waterproofing, pressure-sensitive bituminous adhesive  
composition which is beneath and adhered to the metal  
layer, and removable means to protect the surface of  
5 the adhesive composition remote from the said metal  
layer.

The laminates may have protective coatings  
and/or films applied to the upper polymeric film  
layer before or after installation upon the substrate  
10 to be waterproofed.

In the accompanying drawings:

Figure 1 is a perspective cross-sectional view of a roofing laminate according to the invention;

5 Figure 2 is a cross-sectional view of a preferred laminate construction of the invention exhibiting a "built-in" edge sealing ability;

Figure 3 is a view in cross-section of two overlapped laminates of the invention exhibiting a "built-in" edge sealing ability; and

10 Figure 4 is a perspective, cross-sectional view of a roof waterproofed according to the invention.

In Figure 1, the new roofing laminate is shown as comprising a comparatively thick layer of self-adhesive bituminous waterproofing composition 1, adhered to a  
15 comparatively thin layer of metal foil 2, which in turn is adhered to an upper surface layer 3 of synthetic polymer film having a thickness greater than that of the metal foil 2, but less than that of the bituminous composition 1. The layers 1, 2 and 3 are well-bonded to one another, that  
20 is, are not separable from one another normally without physical damage resulting to one or more of the layers. Layers 2 and 3 are adhered to one another by a thin layer of adhesive (not shown in the drawing), the sole function of which is to adhere the two layers together. The self-  
25 adhesive bituminous waterproofing layer 1 normally has sufficient adhesive properties that additional adhesive to

bond it thoroughly to the metallic foil layer 2 is not necessary. To protect the surface of the bituminous adhesive layer remote from foil 2, a removable protective sheet 4, of, e.g., siliconized paper, is applied thereto.

5 The sheet 4 adheres sufficiently to the bituminous adhesive to keep it in place during handling of the laminate, but is easily removable therefrom without physical damage to the layer 1.

The roofing laminate shown in Figure 1 has a  
10 width ("w"), e.g., 36 inches (91.4 cm.), less than its length ("l"), e.g., 60 feet (18.3 m.), and can conveniently be packaged in the form of a roll which is simply unrolled at the job site. Thereafter the protective sheet 4 is removed and the exposed surface of the bituminous adhesive  
15 layer 1 placed adjacent the substrate 5 (Figs. 2, 3 and 4), to be waterproofed. Another like strip of waterproofing laminate (Figure 3) is then placed adjacent to the laminate, care being taken to overlap the edges of each laminate a short distance in the manner shown for example in Figures  
20 3 and 4 of U.S. 3,900,102 to Hurst. An additional continuous protective coating 6 in Figure 4, may then be applied to the exposed surfaces of the overlapped laminates.

The self-adhesive or pressure-sensitive bituminous waterproofing layer 1 useful herein is  
25 preferably of the type described in the aforementioned patents. The adhesive composition comprises a mixture of

(a) a bituminous material and (b) natural or synthetic polymer, preferably a rubber or other elastomer polymer. The amount of polymer employed in such compositions is typically from 1 to 100, preferably 20 to 50, percent by weight of the bituminous material. The term "bituminous material" as used herein includes compositions containing asphalt, tar such as coal tar, or pitch. The bituminous adhesive may be reinforced with fibres and/or particulate fillers. The adhesive composition may also contain a conventional extender component such as mineral oil. Suitable polymers include thermoplastic polymers such as polyethylene and the like. As aforementioned, the preferred polymer component is rubber which may be a virgin rubber or reclaimed rubber which is blended into the bitumen and preferably an extender oil component, preferably at elevated temperature to form a smooth mix. Generally, suitable adhesive compositions have softening points (measured by the Ring and Ball method) of 70° to 120°C., preferably 75° to 100°C., and penetration values of 50 to 400, preferably 50 to 100 dmm. at 25°C (150 g/5-ASTM D217), and are thermoplastic in nature.

As mentioned in the aforementioned patents, in order to give optimum sealing and waterproofing performance the adhesive layer should be at least 0.010 inch (0.25 mm.) thick and preferably in the range of 0.025 to 0.200 inch (0.6 to 5 mm.) thick. The adhesive layer can

be comprised of one or more layers of the aforementioned bituminous adhesive, not necessarily of the same composition, to give an adhesive layer within the overall aforementioned thickness range. Further, the adhesive layer can have a reinforcement such as an open weave fabric, gauze, scrim or the like located therein to strengthen it. The adhesive layer 1, at least at its surface remote from support sheet 3, is pressure-sensitive and tacky at normal ambient temperature in order that it be self-adhesive to the substrate. The bituminous adhesive layer serves to form a continuous waterproofing covering which is elastic and self-sealing against punctures at high and low temperature.

The synthetic polymer layer 3 comprises a pre-formed film layer which has been bonded to the layer 2 of metal film or foil. The layer 3 of synthetic polymer film serves as a strength imparting and supporting member in the laminate and also as a barrier to prevent moisture vapour transmission through the laminate. Thus while of less thickness than that of the bituminous waterproofing layer 1, the film utilized for layer 3 should be of sufficient thickness to impart e.g., tear and puncture resistance to the laminate. The film layer 3 thus differs from, for example, comparatively thinner and weaker polymer coating compositions which have been applied in the past to the surfaces of laminates as liquid solutions or emulsions

to impart colour, oxidation resistance, protection against ultra-violet light, reflectance, etc. The polymeric film layer 3 suitably has a thickness in the range of from 0.002 to 0.025 (0.05 to 0.6 mm.), preferably from 0.004 to 5 0.010 inches (0.1 to 0.25 mm).

The preferred films for use in the layer 3 are films of synthetic organic polymers such as polyethylene, polypropylene or other polyolefin; polyamide, polyester, e.g., polyethylene terephthalate, polyurethane, polyvinyl 10 chloride, a copolymer of vinyl chloride and vinylidene chloride, synthetic rubber such as polychloroprene or butyl rubber, etc. It is desirable that the film 3 have optimum weatherability characteristics. The films may be rendered opaque, for example, by the incorporation therein of a 15 material such as carbon black to render the film non-translucent. Protective coatings and films, for example, thin pigmented coatings and films, can be applied in the factory to the surfaces of the film 3 to be exposed to the weather. Moreover, the polymer film layer 3 may be 20 a single sheet of pre-formed film, or may itself comprise a plurality of such layers, not necessarily identical, laminated together to form a unitary layer 3.

Cross-laminated polymeric films and biaxially-oriented polymeric films are desirable films for use in 25 the layer 3. As discussed in the aforementioned Canadian patent, such films are more dimensionally stable when

laminated to bituminous adhesive of the type employed herein, adhered to a roof substrate, and exposed to heat from e.g., the sun. Any film-forming synthetic polymer or copolymer which can be oriented (biaxially or cross-laminated) is useful. Biaxially oriented films of such polymers as polyolefins, e.g., high and low density polyethylene, vinylidene chloride, polystyrene, polyvinyl chloride, rubber hydrochloride, polyethylene terephthalate, etc., are commercially available. Especially useful films are biaxially oriented polyolefin and cross-laminated polyolefins. Preferred polymeric films for use in the film layer 3 are cross-laminated high density polyethylene films and biaxially oriented polyesters such as polyethylene terephthalate, desirably containing a filler such as carbon black to render the film opaque.

The layer 2 of metal film or foil placed between the upper polymeric film 3 and lower bituminous waterproofing adhesive layer 1, is, as aforementioned, preferably relatively thin in cross-section as compared to layers 1 and 2. The metal foil as employed in the laminates of the invention has a thickness ranging from 0.00025 to 0.004 inches (0.25 to 4 mils or 0.006 to 0.1 mm.), preferably 0.00035 to 0.002 inches (0.35 mils to 2 mils or 0.0009 to 0.05 mm.). The preferred metal foil for use herein is aluminium, although films of other metals such as copper,

zinc, etc., could be used.

The provision of the metal film layer between layers 1 and 2 in the laminates of the invention leads to a number of desirable results. For example, metal films have been placed upon the surface of roofs to increase protection against extraneous fire sources, discarded cigarettes, etc. However, on the surface of the roof, the metal film is exposed to the elements and to potentially damaging impact by workmen, equipment, and the like. Even in instances where protective polymeric coatings have been applied to the upper surface of such metal coverings, exposure is likely as the comparatively thin polymer coating wears and/or is damaged by foot traffic and the like. In the construction of the present invention, the comparatively thick polymer film layer 3 provides excellent protection to the thinner metal layer against deterioration by weather, foot traffic, and the like.

It has been found that, surprisingly, the fire-resistant properties (as demonstrated by a "flame spread" test hereinafter described) exhibited by the inventive laminates having the metal film layer beneath the polymeric film layer appear to be nearly as good as a laminate construction wherein the metal layer is above the polymer film layer. The reason for this finding is not completely understood, although it is thought that the underlying metal film's high thermal conductivity helps to dissipate

the heat from the heat source to a temperature below the ignition point of the synthetic polymer film. In addition, the gas-impervious metal film in the construction of the invention acts to prevent potentially combustible gases in the bituminous adhesive layer 1 from being exposed to the heat (extraneous fire) source. The good fire-resistance properties of the roofing laminates of the invention can eliminate the necessity of conventional fire-protecting methods, for example, the placement of layers of non-combustible gravel, paving block, cement-asbestos tiles, etc., over the exposed surfaces of the applied laminates.

Separation of the polymeric film support 3 from the bituminous waterproofing adhesive layer 1 by the intermediate impervious metallic film is also desirable since it prevents oils present in the bituminous waterproofing composition from contacting the polymeric film 3. Contact of the oil and synthetic polymer film can adversely affect the film, for example adversely affect the dimensional stability of the film after adherence to the roof substrate.

The metal film layer 2 also imparts handling characteristics to the laminate which are desirable for many applications. The laminates containing the metal film layer are flexible yet possess a "deadfold" property which is desirable in instances where portions of roof substrates which are not flat are to be waterproofed, for

example corners or in roof flashing applications. The metal foil-containing laminates of the invention when folded for instance into a corner will maintain the detail and not spring back to the extent that a laminate not  
5 containing the metal foil film would in the same application.

Positioning the metal film layer 2 beneath the synthetic polymer film 1 further leads in many instances to a roofing laminate having a "built-in" edge sealing ability  
10 due to the relatively low linear thermal expansion co-efficient of metallic films as compared to most synthetic polymer films. As disclosed in our co-pending Application No 81 18059 (2 080 196) filed on even date herewith, self-adhesive waterproofing laminates exhibiting  
15 a "built-in" edge-sealing ability can be produced by adhering a relatively thick layer of self-adhesive, thermoplastic bituminous waterproofing material to an upper flexible support layer which is itself comprised of separately adhered layers of flexible sheet material, the  
20 layer adjacent the bituminous adhesive having a lower coefficient of linear thermal expansion than the layer remote from the adhesive. Our said co-pending application, while being directed to such constructions, disclaims constructions which have this edge sealing ability and  
25 which also fall within the claims of the present application, as described in greater detail below. After adherence to the roof substrate of such laminates, the edges of the laminate will bend to curl downwardly towards the substrate in a "self-sealing" fashion after a period of  
30 time has elapsed. This is because in actual practice the adhered laminates are

exposed to repeated periods of heating and cooling due to changes in atmospheric temperature. Since the upper flexible sheet layer in the support has a thermal expansion coefficient greater than the underlying sheet layer in the support and the two layers are intimately bonded to one another, the edges of the laminate tend to curl downwardly, effecting an enhanced waterproofing seal at its edges. This downward curl becomes irreversible because the thermoplastic bituminous adhesive retains the laminate in the downwardly curled position. As discussed in our aforementioned co-pending application, the sheet materials of differing linear thermal expansion coefficient employed in the support layer should be materials having (a) a substantially "lay-flat" appearance and (b) a relatively good thermal dimensional stability per se. By "substantially lay-flat appearance" is meant, that, when laid flat and non-adhered onto a flat, horizontal surface, the upper and lower surfaces of the sheet materials will be substantially parallel to such horizontal surface and exhibit substantially no curling upwardly or downwardly. By "good thermal dimensional stability" it is meant that the sheet materials when exposed to elevated temperature exhibit substantially no shrinkage, or at least do not shrink to an extent which would interfere with the desired "self-sealing" effect of the laminate described above. Should one or both of the sheet materials employed in the

support layer have, for example, a substantial degree of curl before application of adhesive layer 1, or shrink substantially when heated such "inherent" curl or shrinkability of the material could interfere with the  
5   aforedescribed desired "built-in" edge sealing ability of the laminate occasioned by the use of the layers of differing linear thermal expansion coefficient.

          The laminates of this invention can be constructed to exhibit the above described "built-in"  
10   edge sealing ability after adhesion to a roof substrate by first adhering, for example, a layer of high density polyethylene having substantially "lay-flat" characteristics and good thermal stability as described above as the film layer 3 to a sheet of aluminium foil  
15   as the layer 2 (the resulting laminate of layers 2 and 3 exhibiting such "lay-flat" and "dimensional stability" properties). To the exposed surface of aluminium layer 2 is thereafter applied adhesive 1. Since the polyethylene film has a linear thermal coefficient approximately 5 times  
20   as great as that of the aluminium film (see Table I below), the edges of the adhered laminate will bend or curl downwardly towards the adhesive layer as shown in Figure 2, in a "self-sealing" fashion after exposure to fluctuation in atmospheric temperature. In Figure 3, two such  
25   laminates applied to substrate 5 in overlapping fashion are shown after exposure to fluctuating temperature.

Note that polymeric support film 3 curls downwardly towards the substrate and also protects the underlying layer of adhesive 1 from harmful exposure to the sun and elements.

5           The "built-in" downward edge-curling effect shown in Figures 2 and 3 can be promoted by adhering to the face of metal foil 2 remote from film 3 prior to application of adhesive 1 an additional layer (not shown) of a film of good dimensional stability as described above  
10 and of lesser thickness than film 3 and having a thermal expansion coefficient lower than film 3. Similarly, the degree of downward edge-curling shown in Figures 2 and 3 can be offset or controlled to a desired extent by using as such additional film first adhered to the face of metal  
15 2 remote from film 3, a film having a linear thermal expansion coefficient greater than metal foil 2.

          The desired self-sealing downward edge curl shown in Figures 2 and 3 is obtained by preferably employing, as the upper film layer 3, polymeric films of  
20 good dimensional stability and having linear thermal expansion coefficients at least about twice as great as that of metal layer 2. Preferred synthetic polymer films 3 for use in achieving the desired "built-in" edge sealing properties of the laminates of the invention are those  
25 films which possess a linear thermal expansion coefficient greater than  $30 \times 10^{-6}$  per unit length per degree

Fahrenheit ( $5.4 \times 10^{-5}$  per degree Celsius). The linear thermal expansion coefficient of several films and foils are listed in Table I below.

TABLE I

| 5  | <u>FILM (FOIL)</u>      | <u>Approximate Linear Thermal Coefficient per °F (°C)</u> |       |
|----|-------------------------|-----------------------------------------------------------|-------|
|    |                         |                                                           |       |
|    | Polyester               | 10                                                        | (18)  |
|    | Aluminium               | 12                                                        | (22)  |
| 10 | Polyvinyl Fluoride      | 28                                                        | (50)  |
|    | Nylon (polyamide)       | 55                                                        | (99)  |
|    | Polycarbonate           | 36                                                        | (65)  |
|    | Polymethyl methacrylate | 39                                                        | (70)  |
|    | Polyethylene            | 66                                                        | (119) |

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11.02

15           The "life" of waterproofing membrane layers formed using the waterproofing roofing laminates of the invention can be increased by the application of protective coatings, 6 in Figure 4, thereover at the job site following installation of the laminates upon the roof

20   substrate. Such "field-applied" coatings are now in conventional use in connection with waterproofing laminates of the type described in the aforementioned patents and have been found to add significantly to the endurance of the laminate-membranes. The coatings further protect the

exposed synthetic polymer support films from harmful  
ultra-violet radiation and weather damage. Conventional  
"field-applied" coatings for this purpose are generally  
bitumen-, e.g., asphalt, based compositions, containing  
5 plasticizers, fillers, antioxidants, pigments, etc.  
Reflective particles in such coatings, such as particles  
or flakes of metal such as aluminium, reduce the  
temperature of the laminate-membrane layer. The protective  
coatings are typically applied to the surfaces of the  
10 installed laminate-membrane layer in thickness of from  
0.002 to 0.070 inches (0.05 to 1.8 mm).

The invention is further illustrated by the  
following Examples.

Example I

15 Three sample laminates useful for waterproofing  
purposes were constructed and tested for fire-resistance  
properties and also for tendencies to curl at their edges  
after exposure to high and low temperatures. The  
construction of each laminate (NOS. 1 to 3) is shown in  
20 Table II.

TABLE II

Laminate Construction

(LAYERS - TOP TO BOTTOM)

| NO. 1 | NO. 2                  | NO. 3                   |
|-------|------------------------|-------------------------|
| 5     | Protective Coating     | Protective Coating      |
|       | Polymer Film "A"       | Polymer Film "A"        |
| 10    | Waterproofing Adhesive | Aluminium Foil          |
|       | Waterproofing Adhesive | Polymer Film "B"        |
| 15    |                        | Water-proofing Adhesive |

The polymer film "A" used in the laminates of Table II was a cross-laminated, high-density polyethylene composite film (four, 2-mil thick, 0.05 mm., films pre-laminated together, having a total thickness of 0.008 inches (8 mils, 0.2 mm.)). The aluminium foil layer had a thickness of 0.35 mils (0.009 mm.). The waterproofing adhesive layer was 60 mils (1.5 mm.) thick and comprised a self-adhesive, normally tacky mixture of asphalt, styrene-butadiene rubber and mineral oil. The water-proofing adhesive layer was applied to the laminates last. The polymer film "B" was a 1 mil (0.025 mm.) thick layer

of ionomer resin film. The protective coating applied to the top of each laminate comprised a 7 mil (0.18 mm.) thick layer of a proprietary "field-applied" coating composition containing asphalt, plasticizers, and aluminium flakes for heat reflectance.

Portions of each of the laminates of Table I measuring 12 inches by 12 inches (30 cm by 30 cm.) were adhered, adhesive side down, to a substrate and subjected to a "flame spread" test to determine the rate of spread of a flame applied to the upper surfaces thereof while the laminates were maintained at an angle to the flame. The flame directed at the surface of laminate No. 1 spread 12 inches (30 cm.) after 2 minutes had elapsed while the flame directed at the surfaces of laminates Nos. 2 and 3 spread 7.5 inches (19 cm.) after 5 minutes had elapsed.

Portions of each of the sample laminates Nos. 1 to 3 measuring 3 inches by 6 inches (7.5 by 15 cm.) were also again adhered to a substrate, adhesive side down, and the tendency of each to curl at its edges was observed at 70°F (21°C,) after exposure to a temperature cycle ranging from 150°F to minus 15°F (55°C to -26°C). Laminate No. 1 exhibited no edge curl. The edges of laminate No. 2 curled upwardly away from the substrate, while the edges of laminate No. 3 curled downwardly towards the substrate in the manner of Figure 2, ideally exhibiting a "built-in" edge sealing ability.

Example II (Comparison)

Several rolls of a self-adhesive waterproofing laminate strip measuring 3 foot (91.4 cm.) wide by 60 feet (18.3 m.) long and having a sixty mil-thick (1.5 mm) layer of waterproofing bituminous adhesive as in the laminates of Table II, were applied to the roof of a department store in Long Island, New York, U.S.A., in March of 1978. The rolls were sold to a commercial roofing installer who applied them to the roof as part of the flashing used in the roof. The laminate was similar in construction to that of Sample No. 2 in Table II (the metal foil above the polymer film "A"), the difference being that in place of the 7 mils thick (0.2 mm.) protective coating used in Table II, a thin, protective coating of "Surlyn" brand ionomer resin ("Surlyn" is a trademark of DuPont de Nemours, E.I. & Co.) was factory applied to the surface of the aluminium foil remote from polymer film "A" to give it weather protection. Approximately one month later a visual observation made of the applied laminate strip showed the edges tending to curl upwardly away from the substrate.

While the inventive roofing laminate strip has been described in connection with its usage in the formation of a continuous waterproofing membrane upon a roof where for practical reasons a laminate having a width of at least 36 inches (91.4 cm) is desired, strips

having narrower dimensions can be utilized in other roofing applications. For instance, strips of the inventive laminate having a width of about 4 inches (10 cm) can be used to cover the joints between, e.g.,  
5 insulation boards in roofs. Also for, e.g., use as flashing strips in roofing applications, the laminate strips of the invention may have a width of, e.g., 12 inches (30 cm).

Reference is made to our copending application  
10 No 81 18059. In that application we claim a water-proofed construction comprising a substrate having a continuous adherent waterproofing layer, the said waterproofing layer comprising a plurality of pre-formed, flexible pressure-sensitive adhesive water-  
15 proofing laminates, the said pre-formed laminates being comprised, prior to application to the said substrate, of an upper support layer (a) laminated to a lower layer (b) of waterproofing, pressure-sensitive, thermoplastic bituminous adhesive composition, adjacent to  
20 the said substrate, the said support layer (a) comprising first and second layers of flexible sheet material laminated together, the said second layer being between the said first layer and the said lower layer (b) of adhesive composition, the said first layer having a  
25 higher coefficient of linear thermal expansion than the said second layer, the said upper support layer

(a) having relatively good thermal dimensional stability and exhibiting substantially "lay-flat" appearance prior to lamination to the said adhesive layer (b), so that, because of the said differing coefficients of thermal expansion, the edges of the said laminates are caused to curl downward towards the said substrate after application of the said laminates to the said substrate and exposure to elevated temperature. We also claim a laminate for use in such a construction and comprising an upper support layer (a) laminated to a lower layer (b) of waterproofing, pressure-sensitive thermoplastic bituminous adhesive composition, the said support layer (a) comprising first and second layers of flexible sheet material laminated together, the said second layer being between the said first layer and the said lower layer (b) of adhesive composition, the said first layer having a higher coefficient of linear thermal expansion than the said second layer, the said upper support layer (a) having relatively good thermal dimensional stability and exhibiting substantially "lay-flat" appearance prior to lamination to the said adhesive layer (b) so that the edges of the said laminates are caused to curl downwards after application to a substrate and exposure to elevated temperature.

However, we specifically disclaim from that application subject matter within the scope of the claims of the present case.

C L A I M S

1. A waterproofed roof construction comprising a roof substrate and a continuous waterproofing layer adhered thereto made up of a plurality of strips of preformed, flexible waterproofing laminate, the said  
5 preformed laminates including an upper support layer of synthetic polymer film, a thin layer of metal positioned beneath and directly adhered to the support layer, and a layer of waterproofing, pressure-sensitive bituminous adhesive composition which is beneath and adhered to  
10 the metal layer, said adhesive layer being adhered to the said roof substrate.
2. A roof construction according to claim 1, wherein the said adhesive composition comprises a mixture of a polymer and bitumen.
- 15 3. A roof construction according to claim 2, wherein the said polymer is natural or synthetic rubber and the said bitumen is asphalt.
4. A roof construction according to claim 2, or 3, wherein the said adhesive composition additionally  
20 contains mineral oil.
5. A roof construction according to claim 1, wherein the said adhesive composition is thermoplastic.

6. A roof construction according to any of Claims 1 to 5, wherein the said metal film has a thickness of from 0.00025 to 0.004 inches (0.006 to 0.1 mm), the said upper support layer of  
5 polymer film has a thickness of from 0.002 to 0.025 inches (0.05 to 0.6 mm), and the said adhesive layer has a thickness of at least 0.010 inch (0.25 mm).

7. A roof construction according to any of Claims 1 to 6, wherein the said metal is aluminium.

10 8. A roof construction according to any of Claims 1 to 7, wherein the said laminate is in the form of a continuous strip having a width of at least 36 inches (91.4 cm), and a length greater than the said width.

15 9. A roof construction according to any of Claims 1 to 8, wherein the said laminate prior to utilization in the said roof has a protective coating or film on the surface of the said upper layer of polymer film remote from the said metal film.

20 10. A roof construction according to Claim 9, wherein the said protective coating or film is pigmented.

11. A roof construction according to Claim 10, wherein the said pigment is carbon black.

12. A roof construction according to any of  
25 Claims 1 to 8, having a continuous protective coating over said waterproofing layer applied after the formation of the said waterproofing layer on said roof.

13. A roof construction according to Claim 12, wherein the said protective coating is a bitumen-containing composition.

14. A roof construction according to Claim 12 or 13, wherein the said protective coating contains metal particles.

15. A roof construction according to any of Claims 1 to 14, wherein the said upper support layer is a film of polyolefin, polyamide, polyester, polyurethane, polyvinyl chloride, a copolymer of vinyl chloride and vinylidene chloride, or a synthetic rubber.

16. A roof construction according to any of Claims 1 to 15, wherein the said upper support layer of polymer film comprises a cross-laminated polymeric film or a biaxially-oriented polymeric film.

17. A roof construction according to Claim 16, wherein the said film comprises high density polyolefin or polyethylene terephthalate.

18. A roof construction according to any of Claims 1 to 17, wherein the said upper support layer of polymeric film comprises a polymer film having a higher coefficient of linear thermal expansion than the said metal film layer, so that the edges of the said laminates curl downward towards the said roof substrate after application of the said laminates to the said roof and exposure to elevated temperature.

19. A roof construction according to claim 18, wherein the said upper support layer of polymer film is a film having relatively good thermal dimensional stability and is adhered to the said metal film to form  
5 a first laminate prior to lamination to the said lower layer of adhesive composition, and the resulting first laminate exhibits a substantially "lay-flat" appearance.

20. A roof construction substantially as hereinbefore described with reference to the accompanying  
10 drawings.

21. A preformed, flexible roofing laminate in the form of a continuous strip having a length greater than its width and including an upper support layer of synthetic polymer film, a thin layer of metal positioned  
15 beneath and adhered directly to the support layer, a layer of waterproofing, pressure-sensitive bituminous adhesive composition which is beneath and adhered to the metal layer, and removable means to protect the surface of the adhesive composition remote from the  
20 said metal layer.

22. A laminate according to claim 21, wherein the removable means includes a layer of sheet material removable from the said adhesive without substantial damage thereto.

23. A laminate according to Claim 21 or 22, wherein the said adhesive composition comprises a mixture of a polymer and bitumen.

24. A laminate according to Claim 23, wherein  
5 the said polymer is natural or synthetic rubber and the said bitumen is asphalt.

25. A laminate according to Claim 23 or 24, wherein the said adhesive composition additionally contains mineral oil.

10 26. A laminate according to Claim 21 or 22, wherein the said adhesive composition is thermoplastic.

27. A laminate according to any of Claims 21 to 26, wherein the said metal film has a thickness of from 0.00025 to 0.004 inches (0.006 to  
15 0.1 mm), the said upper support layer of polymer film has a thickness of from 0.002 to 0.025 inches, (0.05 to 0.6 mm), and the said adhesive layer has a thickness of at least 0.010 inch (0.25 mm).

28. A laminate according to any of Claims 21  
20 to 27, wherein the said metal is aluminium.

29. A laminate according to any of Claims 21 to 28, wherein the said width is at least 36 inches (91.4 cm).

30. A laminate according to any of Claims 21  
25 to 29, having a protective coating or film applied to the said upper support layer of polymer film remote from the said metal film.

31. A laminate according to Claim 30, wherein the said protective coating or film is pigmented.

32. A laminate according to Claim 31, wherein the said pigment is carbon black.

33. A laminate according to any of Claims 21 to 32, wherein the said upper support layer is a film of a polyolefin, polyamide, polyester, polyurethane, polyvinyl chloride, a copolymer of vinyl chloride and vinylidene chloride, or a synthetic rubber.

34. A laminate according to any of Claims 21 to 33, wherein the said upper support layer of polymer film is a cross-laminated polymeric film or a biaxially-oriented polymeric film.

35. A laminate according to Claim 34, wherein the said film comprises high density polyolefin or polyethylene terephthalate.

36. A laminate according to any of Claims 21 to 35, wherein the said upper support layer of polymeric film comprises a polymer film having a higher coefficient of linear thermal expansion than the said metal film layer so that the edges of the said laminate curl downward towards the said roof after application of the said laminate to said roof and exposure to elevated temperature.

37. A laminate according to Claim 36, wherein the said upper support layer of polymer film is a film

having relatively good thermal dimensional stability  
and is adhered to the said metal film to form a first  
laminate prior to lamination to said lower layer of  
adhesive composition, and the resulting said first  
5 laminate exhibits a substantially "lay-flat" appearance.

38. A laminate according to claim 21,  
substantially as hereinbefore described in Example 1,  
laminate No 3.

39. A preformed, flexible roofing laminate  
15 constructed and arranged substantially as hereinbefore  
described with reference to and as illustrated in the  
accompanying drawings.

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RENEWAL DETAILS

PATENT No ..... 2078612 .....

RENEWAL DATE ..... 12/6/81 .....

5<sup>th</sup> year due 12/6/85  
RENEWAL FEE PAID FOR ..... YEAR ON .....

NOTE :

.....  
FOR THE COMPTROLLER

RENEWALS FILED WITHIN THE LAST FEW DAYS MAY NOT  
APPEAR IN THE RECORDS

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W.R. GRACE & CO, 62, Whittemore Avenue, Cambridge, Massachusetts 02140, United States of America, a Connecticut Corporation,

PAUL EDWARD ROWE, 41, Watertown Street, Lexington, Massachusetts 02173, United States of America.

Self-adhesive roofing laminates having metal layer therein:

Address for Service:

J.A. Kemp & Co., 14 South Square, Gray's Inn, London WC1R 5EU.

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