

June 30, 1964

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3,138,897

SELF-SEALING SHINGLE

Filed Nov. 6, 1959

2 Sheets-Sheet 1

Fig. 1.

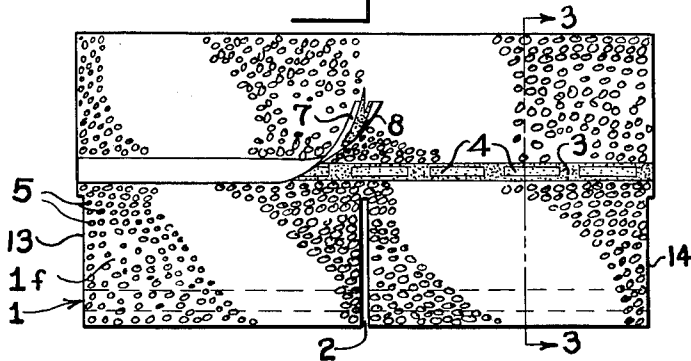


Fig. 2.

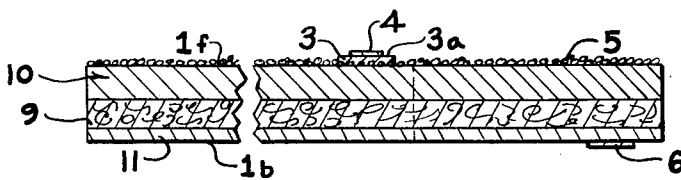
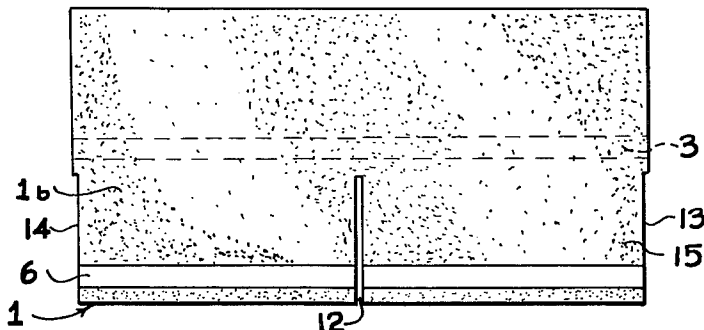


Fig. 3.

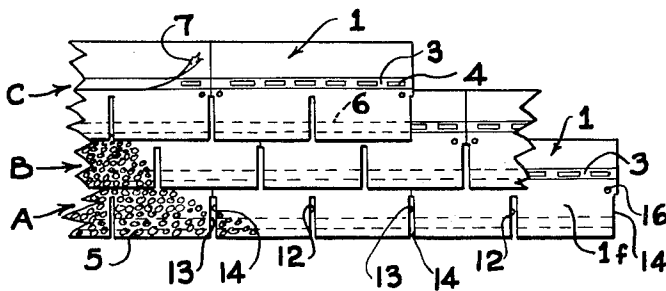


Fig. 4.

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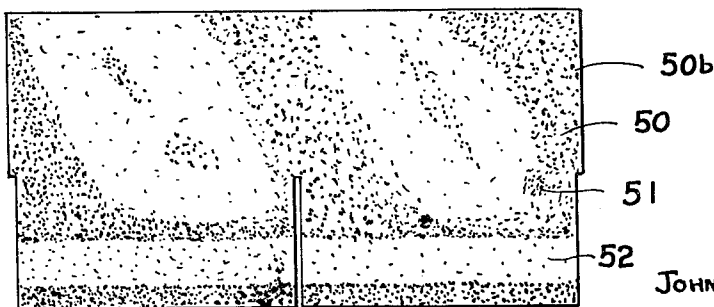
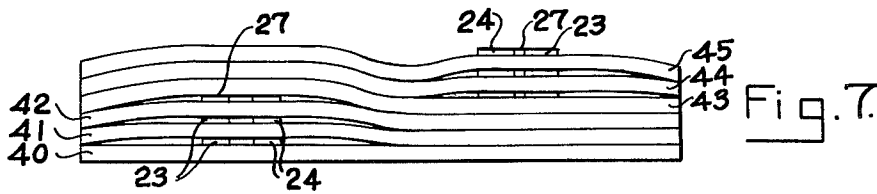
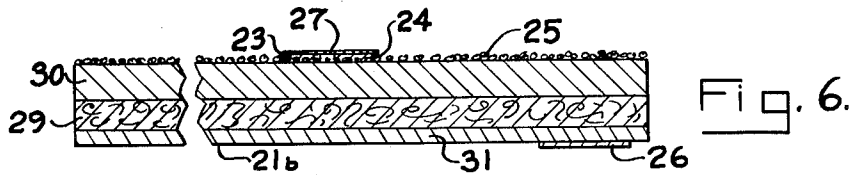
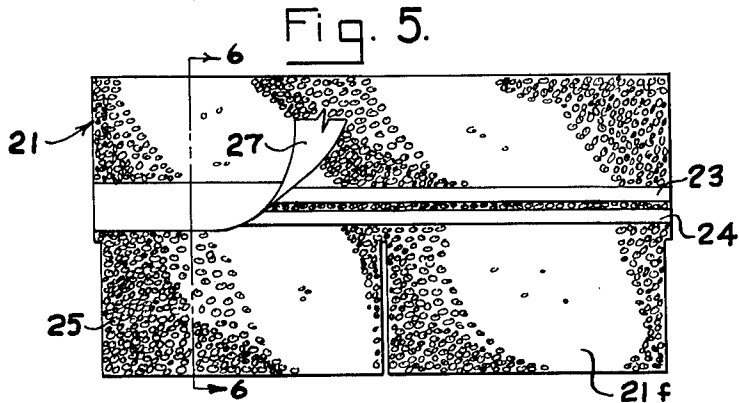
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2 Sheets-Sheet 2



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SELF-SEALING SHINGLE

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8 Claims. (Cl. 50—243)

This invention relates to flexible roofing shingles; more particularly, it relates to flexible roofing shingles of the self-sealing type, as for example, self-sealing asphalt shingles.

In roofing constructions using flexible sheets, as for example, asphalt shingles, an effective method of securing the shingles to a roof deck and to each other is by nailing the individual shingles to the roof deck, and, by means of a caulking-type gun, to insert a dab of adhesive between overlapping portions of shingles whereby the face side of a shingle is securely adhered to the back side of an overlying shingle, locking the two shingles together. In this manner, each course of shingles is securely fastened to the roof deck and has its exposed tab portions also securely locked, by the added adhesive, to the preceding course of shingles at the central portions or at the head portions thereof. This manner of applying shingles on a roof deck has been used extensively in the past and is still used to a great extent to the present day. The most serious drawback of such an operation is the manual aspect of the roofer injecting the dab of adhesive individually under each shingle tab. This operation is very time-consuming, and, in addition, the amount of adhesive under the tabs often varies from one tab to the next. Quite often also, the roofer inadvertently omits the application of the adhesive under some of the tabs, thereby leaving such tabs non-adhered to the underlying shingle faces.

To eliminate this time-consuming operation of applying individual dabs of adhesive between overlapping portions of the shingles, a shingle of the asphalt type has been developed by the siding and roofing industry, which is commonly known today as a "self-sealing" shingle. Basically, the shingle may comprise, for example, an adhesive stripe running across the back side of the shingle from side to side at the butt edge thereof, and which stripe, after layment of the shingle, adheres to the face of an underlying shingle in a preceding course. The asphalt shingles are also individually tacked to the roof deck, so that a mechanical bond is obtained between the individual shingles and the roof deck and an adhesive bond is also obtained between the head or central portions of the faces of the shingles in one course and the tab back sides of overlying shingles in a subsequent course. Thus, the adhesive sealing arrangement is utilized, as in the method of laying-up asphalt shingles with individual dabs of adhesive added manually from a caulking-type gun, but the adhesive sealing between overlying courses of shingles is all done, in a sense, automatically without any added operations on the part of the journeyman laying the roof covering.

The adhesive stripe in such self-sealing shingles is usually basically of either of two types. The first type comprises a stripe of adhesive predominantly of a heat sensitive nature. With this adhesive, permanent bond is obtained between the courses of shingles during the warm months or days when adequate roof temperatures are obtained, since the adhesive is heat sensitive; one such adequate temperatures are available to sensitize the adhesive, a permanent bond is created between overlapping courses of shingles. However, one of the objections of this type of adhesive applied to asphalt type shingles is that if such shingles are applied to a roof deck in areas of the country having relatively cold winter months, only a temporary,

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relatively weak bond is obtained during such months, and the permanent, tight bond is temporarily delayed to a time when the roof is subjected to such higher temperatures.

In the other distinct type of adhesive used for the adhesive stripe, noted heretofore, the adhesive is predominantly of the pressure sensitive type, wherein adhesion is obtained between overlapping courses of shingles by the weight of the tabs of the shingles upon the adhesive between the courses and upon the molecular action of the adhesive. The most serious disadvantage of this type of adhesive is that the adhesive bond produced between shingles, as a rule, does not appreciably increase with the passage of time but remains at a relatively constant adhesive level after full intimate contact between overlapped shingles.

In an attempt to obtain the beneficial characteristics of the two basic types of adhesives, a compromise is often made by utilizing an adhesive mixture exhibiting both, heat sensitive characteristics and pressure sensitive characteristics. However, with such a compromise or with such a single adhesive exhibiting both adhesive characteristics, most such adhesives do not perform as well in each characteristic as compared to adhesives exhibiting predominantly only one of such characteristics, i.e., either the pressure sensitive or the heat sensitive characteristic.

An object of this invention, therefore, is to provide an asphalt type shingle of the self-sealing type which has a novel type of adhesive stripe or stripes superimposed thereon to form a portion of the shingle.

An additional object of this invention is to provide an asphalt type shingle which can be applied effectively in cold weather, and which has an adhesive stripe thereon which produces a tight adhesive bond during such cold weather between partially overlapping courses of shingles, and which bond increases in strength or holding power with the passage of time.

An additional object of this invention is to provide an asphalt shingle of the self-sealing type which has a combination adhesive stripe superimposed thereon, that is to say, a stripe exhibiting distinct heat sensitive characteristics and also distinct pressure sensitive characteristics.

A further object of this invention is to provide an asphalt shingle of the self-sealing type having an adhesive stripe thereon exhibiting both heat sensitive and pressure sensitive characteristics, with the portion of the stripe exhibiting the heat sensitive characteristics also providing excellent load bearing properties at least at room or storage temperatures, or thereabouts, and which properties may be utilized to advantage by the entire stripe.

A still further object of this invention is to provide a novel asphalt type shingle with a self-sealing adhesive stripe thereon, which stripe does not require heavy or bulky equipment for application to the shingle.

Still an additional object of this invention is to provide an asphalt shingle of the self-sealing type which provides an adhesive bond between overlapping courses of shingles without the necessity of applying an external load or pressure to the shingles, other than the weight load of one shingle upon another, to result in a tight bond regardless of the ambient temperatures normally encountered during application of such an asphalt type roof covering.

A still further object of this invention is to provide an adhesive stripe for shingles of the self-sealing type, which stripe is a combination of adhesives exhibiting distinct heat sensitive and pressure sensitive characteristics, and in one modification thereof, the pressure sensitive adhesive is secured to the thermal sensitive adhesive or to the shingle in a novel manner.

In brief, this invention comprises an asphalt shingle of the self-sealing type wherein an adhesive stripe running

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from side edge to side edge on one surface of the shingle laid on a roof deck is utilized to adhere, by adhesion, superimposed tab portions of an overlying or overlapping asphalt shingle or shingles. The stripe comprises a distinct band of adhesive of the heat sensitive type, and which, in one embodiment of the invention, has superimposed thereover an additional stripe of adhesive of the pressure sensitive type to produce a single combination stripe exhibiting distinct heat sensitive and pressure sensitive characteristics. Self-sealing shingles, having such stripes thereon, can be laid to provide a covering for a roof deck regardless of the ambient temperature, whereby an effective adhesive bond between shingles is immediately produced and which bond increases with the passage of time.

In another embodiment of the invention, the pressure sensitive and heat sensitive adhesives are superposed upon a surface of the shingle in juxtapositioned bands, stripes, or globules to form the single combination stripe of adhesive exhibiting both adhesive characteristics, noted heretofore. The heat sensitive portion of the stripe, at room temperature or at temperatures at which the shingle is expected to be stored, exhibits marked load bearing characteristics thereby widening the range of pressure sensitive adhesives permissible under the precepts of this invention, since the pressure sensitive adhesive is relieved of any load bearing function.

In one method of application of the pressure sensitive adhesive, the latter is transferred to the shingle from an anti-stick or release paper utilized to cover at least the pressure sensitive portions of the adhesive stripe to prevent superimposed shingles, while packaged, from adhering to each other.

In addition, a special adhering surface is provided in each of the embodiments on the complementary side of each underlying or overlying shingle, whereby the adhesive stripe locks itself to such surface when the shingles are laid up on a roof deck.

These and other objects will be readily apparent from the preceding brief description and from the following more detailed description and the attached drawings wherein:

FIG. 1 is a plan view showing a face of an individual shingle with the adhesive stripe superimposed thereon;

FIG. 2 is a plan view of an individual asphalt shingle of this invention showing the back side of the shingle with the special non-adhering surface forming a part thereof;

FIG. 3 is an enlarged cross-sectional view along lines 3-3 of FIG. 1;

FIG. 4 is a plan view of a plurality of shingles assembled together to cover a roof deck;

FIG. 5 is a plan view of a modification of the adhesive stripe of FIG. 1 used in conjunction with a shingle;

FIG. 6 is an enlarged cross-sectional view along section lines 6-6 of FIG. 5;

FIG. 7 is a view in elevation of a plurality of shingles, as they would be stacked upon each other to form a bundle; and

FIG. 8 is a plan view of a shingle showing a modification of the non-adhering surface formed on the back side of a shingle.

Asphalt shingles, as contemplated by this invention, are of many different types and kinds, but usually consist of a base felt saturated with an asphaltic bitumen, or some other form of bituminous composition, and have superimposed on both sides, in either a single layer or a plurality of layers, additional bituminous compositions securely bonded to the bituminous impregnated base felt. On the weather side of the shingle, roofing granules are commonly embedded into the bituminous surface of the shingle, thereby greatly increasing the weathering characteristics and qualities of such shingles. On the back side of such a shingle, a common practice is to surface it with talc, mica, sand, or some other similar substance, to pre-

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vent adhesion between shingles, that is to say, between the back side of one shingle and the face side of an underlying or overlying shingle or between the back sides of the shingles as determined by the method of packaging, when a plurality of such shingles are bundled together to form a package for shipping and storage purposes.

Numerous modifications may be used in various parts or portions of the individual shingle to obtain certain desired advantages or characteristics, and, it is understood that such changes, for the purposes of this invention, do not alter the basic shingle, as such a shingle is still termed an asphalt shingle. For example, the composition of the base felt may be rag, bagasse, asbestos, glass fiber, or any other form of organic or inorganic type of felt. Likewise, the weight of such a felt may be altered from a light weight felt to a very heavy felt depending upon the characteristics desired to be imparted to the final asphalt shingle. Similarly, such felt can be used singly, or a plurality of such felts may be laminated directly together to form a unitary base felt.

In addition, the bituminous composition used for impregnating the base felt and for providing the coatings on both sides of the felt may be formulated in different manners depending upon the characteristics desired to be imparted to the shingle. For example, the bituminous composition may have added thereto various types of fillers, as, for example, limestone dust, oyster shells, or similar fillers, to improve the durability and weathering characteristics of the bituminous composition. Other types of additives or fillers also used are, for example, asbestos fiber, asbestos dust, mineral wool fiber, glass fiber, cotton fiber, vermiculite, and mica to increase the fire resistant characteristics or some other property of the bituminous composition and the subsequently formed shingle.

The granular facing applied to the weather side of the shingle may be applied in various ways depending upon the effect or property desired to be imparted to the shingle, as, for example, the application of a double coating of such granular material, or the application of multi-colored granules, or the application of special types of granules to obtain better adhesion or penetration between the granules and the bituminous composition.

The shingle may be cut into a variety of shapes to obtain certain desired esthetic qualities or shingle locking characteristics when applied on a roof deck. Thus, for example, the individual shingles may be cut in a manner to provide square type butts, individual spaced on the roof deck; the shingles may be also fabricated in a manner to produce an octagonal pattern, a circular or curved effect, or other forms of rectangular, diamond, or hexagonal patterns when laid. Likewise, rather than being formed into individual shingles of single, double or triple width, the shingles of this invention may be formed in a continuous manner, commonly referred to as "roll roofing," wherein the shingles, rather than being individually formed, are continuous, similar to a roll of paper.

For the purposes of this invention the terms "shingles" and "asphalt shingles" will be used generically to refer to individually cut shingles of single, double or triple width, for example, and also to such roll roofing, and to all flexible shingles of the basic type, noted heretofore, with or without the various modifications or changes in the various components, as, for example, the felt, bituminous composition, or granules, also noted heretofore.

Referring to FIGS. 1, 2 and 3, the asphalt shingle of this invention comprises a base felt 9, ordinarily impregnated with a bituminous composition, and having superposed on one side a weathering coating 10 and on the opposite side a protecting coating 11. The weathering coating 10, if desired, may be comprised of a plurality of built up layers of the desired thickness. On the surface of the weathering coating, a myriad of small granules 5 are embedded therein to improve the weathering characteristics of the exposed surface layer. The reverse or back side 1b of the coating 11 is usually covered with a

light surfacing 15 of talc, powder, sand, mica, or the like, to provide a non-adhering surface, so that when the shingles are assembled into a package or bundle, the reverse side 1b does not adhere to the back or the face of a shingle, depending upon the manner of packaging, directly beneath or above itself in the bundle. However, this surfacing on the side 1b may be omitted depending upon the characteristics of the bituminous composition in coating 11. The granule side of the shingle, thusly formed, is commonly referred to as the "face" or "face side," while the side containing the surfacing materials of talc, mica, sand, or the like, is commonly referred to as the "back face," "back" or "back side"; the face side and the back side are considered to be the "major faces" of the shingle.

The adhesive stripe 3 comprises a band on the face 1f of the shingle running the full width of the shingle from side to side and is approximately 1/4"-2" in width. As seen in FIG. 3, the adhesive, of the heat sensitive type, when applied as a band 3 flows into the small crevices between adjacent granules to form a tight bond between itself and the face 1f of the shingle; thus, the lower or bottom surface of the adhesive stripe 3 is irregular in contour and follows the contour of the granules upon which the stripe is superimposed. The upper surface 3a of the band 3, on the other hand, is approximately uniplanar and presents a smooth surface for the superposition of the pressure sensitive stripe 4. The stripe 4, comprised of pressure sensitive adhesive, appears as a thin film superimposed upon the surface 3a and which runs the full width of the shingle from side to side. Thus, the heat sensitive adhesive stripe 3 presents a beneficial surface, i.e., a surface that is planar whereby only a very thin film of pressure sensitive adhesive need be used to form the stripe 4. In the particular shingle illustrated, the heat sensitive stripe or band 3, is continuous from side to side of the shingle, while the pressure sensitive stripe or band 4 is intermittent from side to side of the shingle. However, it is to be understood that the stripe or band 4 may also be continuous with the continuous stripe 3, or the stripe 3 may be intermittent with a continuous stripe 4 of pressure sensitive adhesive, or the stripe 3 may be intermittent in addition to having the pressure sensitive stripe 4 also intermittent. As used in this invention, the terms "band" and "stripe," therefore, contemplate both a continuous band or stripe and intermittent bands, stripes, dabs, or globules of adhesive formed in an approximately continuous line and also refer to the individual heat sensitive band or stripe, or to the individual pressure sensitive band or stripe, or to the combination layer or layers of the two adhesives.

The adhesive vehicles 3 and 4 are illustrated as being located approximately midway between the head and butt portions. However, it is to be understood that the combination stripe may be located almost anywhere on the shingle depending upon the shingle exposure or upon the coverage desired. Thus, for example, if single coverage is desired, the stripes 3, 4 may be located close to the head of the shingle.

To protect the adhesive stripes and also to prevent the stripes from adhering to a superimposed shingle when packaged, a strip of non-adhesive material 7, commonly known as a "release paper" or a "release material," is applied over the stripes. The release strip 7 usually is subsequently removed by a journeyman prior or subsequent to the laying of the shingles on a roof deck. In an adaptation of the release paper, the latter is permanently adhered to a shingle and the exposed side or surface of the release paper is superposed over the adhesive stripe or stripes during packaging. When the shingles are separated and laid on the roof deck to form the covering, the release paper remains with the shingle and forms part of the covering; in such a covering, the release paper would, of necessity, be out of register with a stripe on an underlying or overlying shingle in order to obtain adhesion

between shingles. Obviously, this modification of the release paper eliminates the need for separately stripping the release papers from the shingles upon removal of the latter from the bundle prior to layment.

On the back side 1b of the shingle 1, a non-adhering surface 6 is formed as a strip or stripe running the full width of the shingle measured from side to side. Such a surface is necessary in most instances, since the pressure sensitive adhesive does not readily adhere to the back side 1b of an overlying asphalt shingle when laid, due to the surfacing of talc, mica, sand, or the like, commonly found in most manufactured asphalt shingles. Consequently, the surface 6 presents a surface to which the pressure sensitive vehicle 4 can securely bond, thereby to lock adhesively overlapping shingles to each other. The expression or term "non-adhering" as applied to surface 6 is used to denote that the surface 6 does not adhere to other surfaces of its own accord, especially to other shingle surfaces mating with such a surface in a bundle, but is compatible for adhesion to the heat sensitive and pressure sensitive adhesives utilized.

The particular shingle illustrated also has a cut-out 12 therein running from the butt portion to approximately one-half the width of the shingle, measured from the butt portion to the head portion; recesses 13, 14 are made in the shingle sides and are each approximately one-half the width of cut-out 12. When the shingles are laid as a roof covering, the cut-outs 12 and recesses 13, 14 contribute to produce an effect of individual shingles assembled together, rather than the double type shingle effect shown, which is the actual construction. However, as noted, the shingle illustrated is not restricted to the particular planar configuration described herein and may include various other configurations, either in individual shingle or strip form, as for example, roll roofing, depending upon the particular effect desired to be produced.

The adhesive stripe 3 comprises an adhesive of the heat sensitive type, which, ordinarily at room temperature, is relatively non-tacky. Since the maximum roof temperatures likely to be encountered are in the vicinity of 175° F., the heat sensitive adhesive contemplated by this invention is of the type which becomes tacky and effectively wet and flowable between temperatures of 70° F. to 200° F. Preferably, this adhesive is of a bituminous nature, as many such bituminous base adhesives are well adapted for the base stripe because of their heat sensitive characteristics and because of their load bearing characteristics, as noted hereinafter. The adhesive is applied as a stripe approximately 1/4"-2" in width running continuously or intermittently from side to side of the shingle and projects approximately from 1-25 mils above the granular surface.

Examples of heat sensitive adhesives found to be satisfactory as the base stripe are as follows:

Example #1:

Petroleum resin, %	50
Unfilled coating asphalt, %	50
Mixture softening point (R&B) (glycerine), ° F.	185
Mixture penetration at 77° F.	10
Mixture penetration at 115° F.	25

Example #2:

Petroleum resin, %	100
Mixture softening point (R&B) (glycerine), ° F.	175-195
Mixture penetration at 77° F.	0-5
Mixture penetration at 115° F.	5-25

The above examples are primarily of a bituminous nature, it is understood, however, that other ingredients, or mixtures of ingredients, will perform equally as well, provided that they provide the same basic adhesive characteristics as the adhesives in the examples given and fall within the specifications hereinafter disclosed. Thus, for example, the following mixtures also have been proven to be satisfactory.

Example #1:

Naptha insoluble extract of wood rosin, % (Manufactured under the trademark Vinsol)-----	65
Methyl ester of rosin, % (Manufactured under the trademark Hercolyn)-----	35
Mixture softening point (R&B), ° F-----	160
Mixture penetration at 77° F-----	0
Mixture penetration at 115° F-----	18

Example #2:

Polmyerized product derived primarily from coumarone and indene which are obtained from coal tar (marketed under the trademark Cumar T-3), %-----	78
Solvent extract from lube oil (marketed under the trademark Indonex W-2), %-----	22
Mixture softening point (R&B), ° F-----	175
Mixture penetration at 77° F-----	0
Mixture penetration at 115° F-----	12

While the common bituminous base adhesives are preferred for the heat sensitive stripe for this invention, it is evident that numerous other adhesive mixtures or ingredients may be utilized for the base stripe, as, for example, other forms of natural and synthetic resins, coal tar pitches, pressure still pitches, etc., all of which are intended to be within the scope of the term "bitumen" or "bituminous substance" or "bituminous material" provided, of course, such adhesives exhibit the characteristics noted herein. Thus, as used herein, "bitumen" is deemed synonymous with "bituminous substance," "bituminous material," and phrases of similar import, and it is used in its broadest sense and includes all naturally occurring hydrocarbons, residues obtained from the distillation of petroleum, and artificial hydrocarbon substances, as, for example, tars and pitches, as well as asphalts, asphaltic bitumens, and asphaltic substances, the latter of which are also used in their broadest sense. The heat sensitive adhesives known at the present time and which are applicable for this invention are relatively non-tacky at room temperatures and at temperatures at which such shingles are expected to be stored. This is not to say that the heat sensitive adhesive must not exhibit any adhesive or tacky properties whatsoever at room temperatures, or thereabouts, as tackiness is not objectionable. More important, the heat sensitive adhesive used should be effectively flowable between temperatures of 70°-200° F., that is to say, in this temperature range, exhibit relatively strong or marked wetting, adhesive or tacky characteristics. Adhesives, activated by solar radiation and which exhibit these marked wetting or tacky properties in this range of temperatures, are the preferred heat sensitive adhesives for the purposes of this invention. Adhesives exhibiting these characteristics are further identified by having a softening point of a minimum of approximately 140° F., preferably in the range of 170-190° F.

The softening point of a material, recited herein, is understood as being determined by the standard Ring & Ball testing method, utilizing either glycerine or distilled water depending upon the fusing point of the material tested. For the purposes of this invention, there is no maximum range of softening points for the heat sensitive adhesive; however, the heat sensitive adhesives applicable for this invention are further identified by their degree of penetration at 77° F. and 115° F.

Penetration is defined as the consistency of the material, expressed as the distance that a standard needle vertically penetrates a sample of the material under known conditions of loading, time, and temperature; the distance is commonly expressed in millimeters/10 (mm./10). The loading and time are, by standard, 100 grams and 5 seconds at 77° F. (25° C.) and 50 grams and 5 seconds at 115° F. (46.1° C.). To perform satisfactorily according to the precepts of this invention, the heat sensitive adhesive should have a penetration between 0-35 mm./10 at 77° F., preferably between 0-20 mm./10. At 115° F.,

the penetration should be maintained between 0-60 mm./10 preferably, in the range of 5-35 mm./10.

The pressure sensitive adhesive, on the other hand, contemplated by this invention is of the type having appreciable tackiness between temperatures of 0° F. and 100° F. The term "pressure sensitive" or "pressure sensitive adhesive" has been used in different ways, depending upon the particular trade using the expression. For example, the Pressure Sensitive Tape Council of Glenview, Illinois has attempted to define "Pressure Sensitive" for the tape industry as follows:

"A term commonly used to designate a distinct category of adhesive tapes and adhesives which in dry (solvent free) form are aggressively and permanently tacky at room temperature and firmly adhere to a variety of dissimilar surfaces upon mere contact without the need of more than finger or hand pressure. They require no activation by water, solvent or heat in order to exert a strong adhesive holding force toward such materials as paper, cellophane, glass, wood and metals. They have a sufficiently cohesive and elastic nature so that, despite their aggressive tackiness, they can be handled with the fingers and removed from smooth surfaces without leaving a residue. General trade usage by leading tape manufacturers does not sanction extension of the term 'pressure sensitive' to embrace tapes and adhesives merely because they are sticky (e.g. fly-papers), or merely because they cling to a surface (e.g. protective sheets and frisket papers coated with latex or plain rubber), or merely because they adhere or cohere to a particular type of surface (e.g. self-sealing envelopes); and terms other than 'pressure sensitive' should be used in such cases to avoid confusion."

However, it is evident that for the purposes of this invention the term "pressure sensitive" or "pressure sensitive adhesive" is not restricted to the limitations recited in the proposed tape industry definition. For the purposes of this invention, a more apt definition of "pressure sensitive" or "pressure sensitive adhesive" is as follows:

"The term is used to designate a category of adhesives which in dry (solvent free) form are aggressively and permanently tacky at temperatures between 0°-100° F. and firmly adhere to a variety of dissimilar surfaces, preferably, but not necessarily, without the need of more than finger or hand pressure or merely by contact ordinarily encountered between flexible shingles when laid to form a roof covering. They require no activation by water, solvent, or heat in order to exert a strong adhesive holding force toward other materials."

For the purposes of this invention, the pressure sensitive adhesive should show or exhibit marked tacky or adhesive characteristics in a temperature range between 0°-100° F., preferably one exhibiting a marked tackiness or exhibiting strong adhesive characteristics between temperatures of 40°-100° F. and noticeably retaining such tackiness or adhesive characteristics between temperatures of 0°-40° F. Many of the adhesives falling into such a category have rubber as one of the primary constituents therein. Thus, for example, an adhesive of

50% Butyl rubber	
50% polyisobutylene—ave. molecular weight=8,700 (marketed under the trademark "LM-MS Vistanex")-----	10,000
Melting point of mixture, ° F-----	257
Penetration at 77° F-----	103

was found to be very satisfactory.

Other examples of pressure sensitive adhesives satisfactory for the stripe 4 are as follows:

Example #2:

Butyl rubber, %-----	20
Asphalt roofing flux (105-115° F. softening point, 125-175 penetration at 77° F.) %-----	80
Mixture softening point (R&B), ° F-----	205
Mixture penetration at 77° F-----	100

Example #3:

Powdered rubber precipitated on barytes (marketed under the trademark Ruborite), %	40
Asphalt roofing flux (105–115° F. softening point, 125–175 penetration at 77° F.), %	60
Mixture softening point (R&B), ° F	230
Mixture penetration at 77° F	75

Example #4:

Air blown solvent precipitated stock from Pennsylvania crude oil (marketed under the trademark Kendex 3430), %	100
Mixture softening point (R&B), ° F	200
Mixture penetration at 77° F	65

Example #5:

Low susceptibility air-blown asphalt (250°–275° F. softening point, 35–80 penetration at 77° F.), %	85
Soft petroleum extract resin (80°–100° F. softening point), %	15
Mixture softening point (R&B), ° F	200
Mixture penetration at 77° F	65

Example #6:

Butyl rubber, %	25
Soft petroleum extract resin (80°–100° F. softening point), %	75
Mixture softening point (R&B), ° F	180
Mixture penetration at 77° F	170

Example #7:

GR-S rubber emulsion concentrate, %	50
Resin emulsion (designated E-10888 resin emulsion by the Rubber Corporation of America), %	50

The pressure sensitive adhesive can be applied to the shingle in a number of different ways, as, for example, by using a solvent emulsion, or a water emulsion, or by applying the adhesive directly to the shingle as a hot melt. The manner of application of the pressure sensitive adhesive utilizing the solvent emulsion system must utilize some type of transfer operation, as the adhesive cannot be applied directly on the shingle since the solvent would dissolve the asphaltic material with which it would come into contact; however, the pressure sensitive adhesive may be applied directly to the base stripe since the evaporation of the solvent is very rapid when such adhesive is applied to a smooth surface, such as surface 3a. A method well adapted for the transfer operation is through the medium of the release paper 7, applied over the stripes 3 and 4 for protection thereof. In this transfer operation, the release paper has applied thereto a wet film of adhesive of approximately 0–10 mil thickness, and the solvent is evaporated therefrom. The release paper is attached to the shingle 1 to cover properly the adhesive stripe 3. Upon subsequent removal of the release paper 7, as would be the case prior or subsequent to the application of a shingle on a roof deck, the adhesive, formed as the stripe 8 on the release paper 7, is seen to be transferred as a stripe 4 to the subjacent stripe 3 on the face 1f of the shingle 1. As noted heretofore, the paper 7 can also be permanently adhered to an adjacent shingle in a bundle to form an integral part thereof; however, the transfer operation is still the same as described.

Utilizing one of the adhesives, heretofore noted, a mixture of

20% Butyl, 150 rubber
20% Polyisobutylene—ave. molecular weight=8,700—10,000
60% Hexane

was prepared, and which, at room temperature, had a consistency similar to that found with molasses. The mixture was applied as a wet film on the release paper 7 of a wet adhesive thickness of approximately 5 mils,

which upon evaporation of the solvent, gave a dried adhesive thickness of 2 mils. After application of the release paper, with the dried adhesive attached thereto, to the heat sensitive adhesive stripe 3, and, upon subsequent stripping of the release paper, the adhesive was effectively transferred from the paper to the adhesive stripe 3.

As an alternate method of applying the pressure sensitive adhesive utilizing the solvent system, it can be applied and dried on an endless revolving transfer belt and then transferred to the adhesive stripe 3. In this transfer system, the release paper 7 would have to be applied, of course, in a separate operation.

With the water emulsion system of applying the adhesive, the transfer operation, described with the solvent system, may be utilized. In addition, the water emulsion adhesives may be applied directly to the shingles and subsequently dried in place, since the water does not tend to dissolve an asphaltic surface with which it comes into contact.

With the hot melt systems of application, the adhesive is heated to a temperature whereby the adhesive becomes flowable, at least to the extent that it can be applied directly to the shingle.

The release paper 7 found to be very satisfactory for the purposes of this invention was a 40 pound sulfite paper coated on one side with a baked silicone release coating; such a paper is manufactured by the Daubert Chemical Company of Chicago. However, other release papers likewise would be satisfactory for this operation and for the purposes of this invention; for example, aluminum foil, silicone treated metallic foil, or other types of metallic sheeting or papers also would be satisfactory as release papers for many of the adhesives.

The non-adhering surface 6 on the back side 1b of the shingle 1 was applied as a thin film of approximately 1 to 2 mils thickness. Shellac was discovered to be a very good composition for such non-adhering surface. It is hard and non-tacky, so that there is no tendency for it to stick to an overlying or underlying surface in the bundle, and it presents an excellent surface to which the adhesive stripe 3 and adhesive stripe 4 may be adhered. Ordinary orange shellac supplied in a concentration of 4 pounds per gallon of alcohol has been proven to be satisfactory; flake orange shellac dissolved in an aqueous ammoniacal solution also performed well. It is to be understood, however, that numerous other types of organophyllic compositions may be substituted for the shellac mixtures, noted herein, to provide the non-adhering surface 6 on the back side of the shingle.

In a modification of the non-adhering surface 6 on the back side of the shingle (referring to FIG. 8), the shingle 50 is fabricated in the manner described and has a surfacing of talc, mica, sand, 51 or the like, adhering to the bituminous coated back 50b. In lieu of applying a special mixture to form the non-adhering stripe, a portion of the back is brushed to form a relatively clean lane or stripe 52. The brushing is performed sufficiently to remove most of the surfacing. Some of the surfacing material, however, remains in the stripe 52, as the remaining, individual grains of surfacing material are sufficiently embedded in the bituminous composition forming the back of the shingle to form an integral part thereof. Consequently, the adhesive stripe 3, 4, after application of the shingles, readily adheres to this brushed surface.

If the shingles are bundled so that the stripe 52 overlies or underlies the adhesive stripe, the release paper prevents the adhesive from coming into direct contact with stripe 52. It may occur that the shingles are packaged so that stripe 52 overlies or underlies a granulated face or a surfaced back; no adhesion would occur with surfacing material contact as this material is applied to prevent such action between shingles; with granule contact, there would be insufficient bleeding of the bituminous composition in such a narrow lane to effect any appreciable amount of adhesion.

In laying the shingles to form a covering for a roof deck (referring to FIG. 4), the shingles 1 are individually removed from the bundle and are then tacked by fasteners to the roof deck, as, for example, by nails 16. In the event the release paper 7 is adhered to a shingle to form an integral part thereof, the shingles would be mated in the bundle in such a manner as to have paper 7 secured to a shingle superimposed over the stripe 3 of an adjacent shingle. The pressure sensitive stripe 4 may be adhered to the strip 7 before mating of the shingles, and upon subsequent separation of the mated shingles, the stripe 4 is transferred to the stripe 3 of the adjacent shingle in the bundle rather than remaining with the strip 7. It is understood that with this latter modified construction of the release paper, the position of the stripes 3, 4 relative to the strip 7 while bundled is different from the position of the stripes 3, 4 relative to the strip 7 when such shingles are applied as a roof covering, or, in other words, the strip 7 overlies stripe 3 when the shingles are bundled but does not overlie the stripe when the shingles are applied as a roof covering. Release paper 7 is removed or stripped from each shingle, before or after the shingle is thusly fastened to the deck, thereby leaving the pressure sensitive vehicle superimposed upon the heat sensitive vehicle, regardless of the manner of original application of the pressure sensitive adhesive, and thereby exposing the two stripes 3 and 4 to view.

This operation of applying the shingles to the deck is repeated until course A has commenced to take form, and continuously repeated to form courses B, C, etc. After a plurality of such courses have been, at least, partially completed, the esthetic effect is such that the roof has the appearance of having a plurality of individual shingles juxtapositioned to form the covering, with recesses 13, 14 combining to give the appearance of a cut-out 12. During the application of the shingles 1 on the deck, the tabs of each shingle are superimposed over the heads of the subjacent shingles so that nonadhering surface 6 (FIG. 3) or brushed surface 52 (FIG. 8) is accurately superimposed over the bands 3, 4 of the underlying shingle heads and the surface 6 or 52 immediately adheres to the pressure sensitive band 4. If the shingles are laid on a sunny summer day, the temperature of the roof covering gradually builds up and the heat sensitive adhesive soon becomes sufficiently flowable, wet, and tacky, under the action of this heat build-up, thereby to supplement the pressure sensitive adhesive, in a sense, almost immediately. At the opposite extreme, if the shingles are applied on a cold winter day, the pressure sensitive adhesive provides an immediate bond between overlapping portions of the shingles. During the warmer winter days, a certain degree of adhesion by the heat sensitive adhesive occurs, since a certain amount of temperature build-up of the covered roof occurs. However, the principal adhesion between surfaces at this time, results from the action of the pressure sensitive adhesive. Under the action of snow or ice loads on the covered surface, the adhesion by the pressure sensitive adhesive between the tabs and heads becomes slightly greater, due to the greater degree of contact between shingles adjacent the adhesive stripes. This increased degree of contact can also be produced immediately upon the laying of the roof covering by having a journeyman walk over the roof covering. When the roof covering is eventually subjected to warm days, regardless of season, the heat sensitive adhesive comes gradually more into the fore, and subsequently becomes the main, tighter, bonding ingredient between the overlapped shingles.

Since only a very thin film of pressure sensitive adhesive is required to maintain the tab-to-head bond during the colder winter months or days, which results from the fact that an almost uniplanar heat sensitive adhesive surface is presented to the pressure sensitive adhesive, it is conceivable that, under continual wetting or cold flow of the thermal sensitive stripe 3, a gradual fusion of the

two adhesives may come into effect. This would depend, of course, on the compatibility of the two adhesives. This possible fusion, over an extended period, is not detrimental to the bond, as the primary bond, after even a short period of warm weather, is obtained through the action of the heat sensitive adhesive.

In the modification of the invention illustrated in FIGS. 5-7, the pressure sensitive stripe is applied to the shingle relative to the heat sensitive stripe in a somewhat different manner. In this modification, the basic shingle 21 is manufactured in the manner described and has a base felt 29, bituminous compositions 30, 31 on both sides of the felt, granules 25 embedded in the coating 30, and a surfacing of talc, mica, sand, etc. on the back 21b. The non-adhering stripe 26, as defined herein, may be a thin film of shellac, or some other suitable non-adhering composition as described, or the back 21b may be brushed to form the non-adhering lane, as described herein with relation to FIG. 8.

The heat sensitive adhesive is applied as a continuous stripe 23, measured from side to side, on the face 21f of the shingle. The pressure sensitive stripe 24 is juxtapositioned the heat sensitive adhesive stripe and is parallel thereto. In the modification illustrated and described, the two stripes 23, 24, of approximately the same thickness, are both continuous; however, it is evident that numerous other modifications are possible. Thus, for example, either or both may be intermittent; likewise, a single stripe may be formed comprised of intermittent bands or globules of heat sensitive and pressure sensitive adhesives. The formulations of the two adhesives are as described herein with reference to the shingle of FIGS. 1-3, as the same basic principles of adhesion are relied upon. However, this modification delineates more clearly some of the desired characteristics of the heat sensitive adhesive utilized for sealing the shingles and for load bearing while the shingles are packaged.

Referring to FIG. 7, the shingles may be packaged with the first three shingles 40, 41, 42, front face-to-back face and with all the heads on one end and all the butts at the opposite end. For the purpose of simplicity the stripe 26 has been omitted as the non-adhering stripe may comprise either a stripe as shown in FIG. 6 or a brushed surface as shown in FIG. 8. Subsequent shingles 43, 44, and 45, also front face-to-back face, have their head and butt portions reversed relative to the head and butt positions of the previously stacked shingles to level the bundle; otherwise, the bundle would tend to be thicker adjacent the end containing the adhesive stripe.

The adhesive stripes 23, 24 of the first shingle 40, if of equal height, theoretically support, in part, the weight of the load of the remainder of the shingles in the bundle. However, the heat sensitive adhesive of stripe 23 actually supports the load since it is preferably hard and tough at room temperatures and thereabouts, thereby protecting the pressure sensitive stripe 24 from being subjected to the load. As a result, the pressure sensitive adhesive may be formulated from materials that are relatively soft at room temperatures, or thereabouts, since there is no danger of the latter adhesive spreading under the action of a shingle load, unless, of course, it is made initially higher than the heat sensitive adhesive. In such a construction, the pressure sensitive adhesive will spread slightly until the adhesive levels are approximately the same at which time the load is borne by the heat sensitive adhesive.

This hard and tough characteristic at room temperatures, or thereabouts, is utilized to excellent advantage during sealing of the shingles. Thus, after the shingles are laid to form a roof covering, the shingles are eventually subjected to temperatures, wherein an effective flow of the heat sensitive adhesive occurs. The tabs of overlying shingles are effectively wetted, and, since the adhesive also becomes tacky, they are adhesively tacked to the underlying shingles, thereby forming the permanent bond

between the shingles. This bond is maintained upon lowering of roof temperatures, which would occur, for example, during cooler summer weather or during the winter months. Thus, this hardness characteristic of the heat sensitive adhesive serves a two-fold function; the first, to bear the brunt of the load-bearing while the shingles are bundled and therefore to relieve its adhesive mate from this duty, and the second, eventually to create the strong, permanent adhesive bond between shingles after the shingles are laid to form a roof covering.

Referring back to FIGS. 5 and 6, the two stripes 23, 24 are superimposed upon the face 21f, with each adhesive entering the crevices between the granules firmly bonding itself to the shingle face 21f. The width of the stripes ordinarily is in the range of approximately 1/4"-2", while the thickness of each varies between approximately 1-20 mils. A release paper 27 is used to cover the stripes, as described. The manner of application of the stripes may be the same as described with respect to the shingle illustrated in FIGS. 1-3. However, the solvent emulsion system is not suitable for application of the pressure sensitive adhesive, since no "beneficial surface," i.e., a planar surface, is present as in the embodiment illustrated in FIGS. 1-3.

The shingles are laid on a roof deck to form the roof covering as described in relation to FIG. 4. Since the asphalt shingles are flexible in nature, good contact is obtained between the upper surface of the pressure sensitive stripe 24 and the overlying tab or tabs, and through molecular action, an immediate adhesive bond occurs between overlapping surfaces via the action of the adhesive of stripe 24. When effective temperatures are obtained, subsequent to the time of laying of the shingles, the adhesive of stripe 23 becomes noticeably effective to wet the overlapped surfaces and eventually to create the permanent adhesive bond between shingles as described herein.

Although the shingles have been described as being packaged front face-to-back face (or often referred to merely as face-to-back), it is evident that other relative shingle relationships may be utilized in packaging. Often, this relationship is governed by the relative positions on the shingles of the adhesive stripes 3, 4 or 23, 24. Thus, for example, the shingles may also be bundled front face-to-front face in pairs, or back-to-back in pairs.

The pressure sensitive adhesive, in any of the modifications, can be applied at high machine speeds in a high production system utilizing the systems of application, noted herein. Consequently, heavy duty equipment, oftentimes used in applying a combination pressure sensitive and heat sensitive adhesive to asphalt shingles, is, therefore, not required.

While the invention has been described in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may suggest themselves to one skilled in the art,

all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. A self-sealing shingle comprising a band of predominantly heat sensitive adhesive adhering to a major face of the shingle, said adhesive having a minimum softening point of 140° F. and a penetration at 77° F., 100 gr., 5 sec., in the range of 0-35, and a distinct band of predominantly pressure sensitive adhesive adjacent the first band, said pressure sensitive adhesive being in tacky condition at temperatures above 0° F.

2. A self-sealing shingle as recited in claim 1, wherein both the pressure sensitive and heat sensitive adhesive bands are in engagement with said major face of the shingle.

3. A self-sealing shingle as recited in claim 2, wherein at least one of the adhesive bands comprises spaced areas of adhesive.

4. A self-sealing shingle as recited in claim 1, wherein the pressure sensitive adhesive band is superimposed over a portion of the heat sensitive adhesive band, whereby both pressure sensitive and heat sensitive adhesives present substantial areas of exposed surface.

5. A self-sealing shingle as recited in claim 4, wherein the pressure sensitive adhesive band comprises spaced areas of adhesive.

6. A process for manufacturing self-sealing asphalt roofing shingles comprising the steps of adhering to a major surface of the shingle a stripe of predominantly heat sensitive adhesive, superimposing a stripe of predominantly pressure sensitive adhesive to a strip of anti-stick material, the surface area of the pressure sensitive adhesive being substantially less than the surface area of the heat sensitive adhesive, placing the strip of material upon the heat sensitive adhesive stripe of adhesive so that the adhesive stripes mate with each other, and removing the anti-stick material, leaving at least a major portion of the pressure sensitive adhesive mating with the heat sensitive stripe.

7. A process for manufacturing self-sealing shingles as recited in claim 6, wherein the pressure sensitive stripe of adhesive comprises spaced areas of adhesive.

8. A process for manufacturing self-sealing shingles as recited in claim 6, wherein the thickness of the pressure sensitive adhesive stripe is substantially less than the thickness of the heat sensitive adhesive stripe.

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