

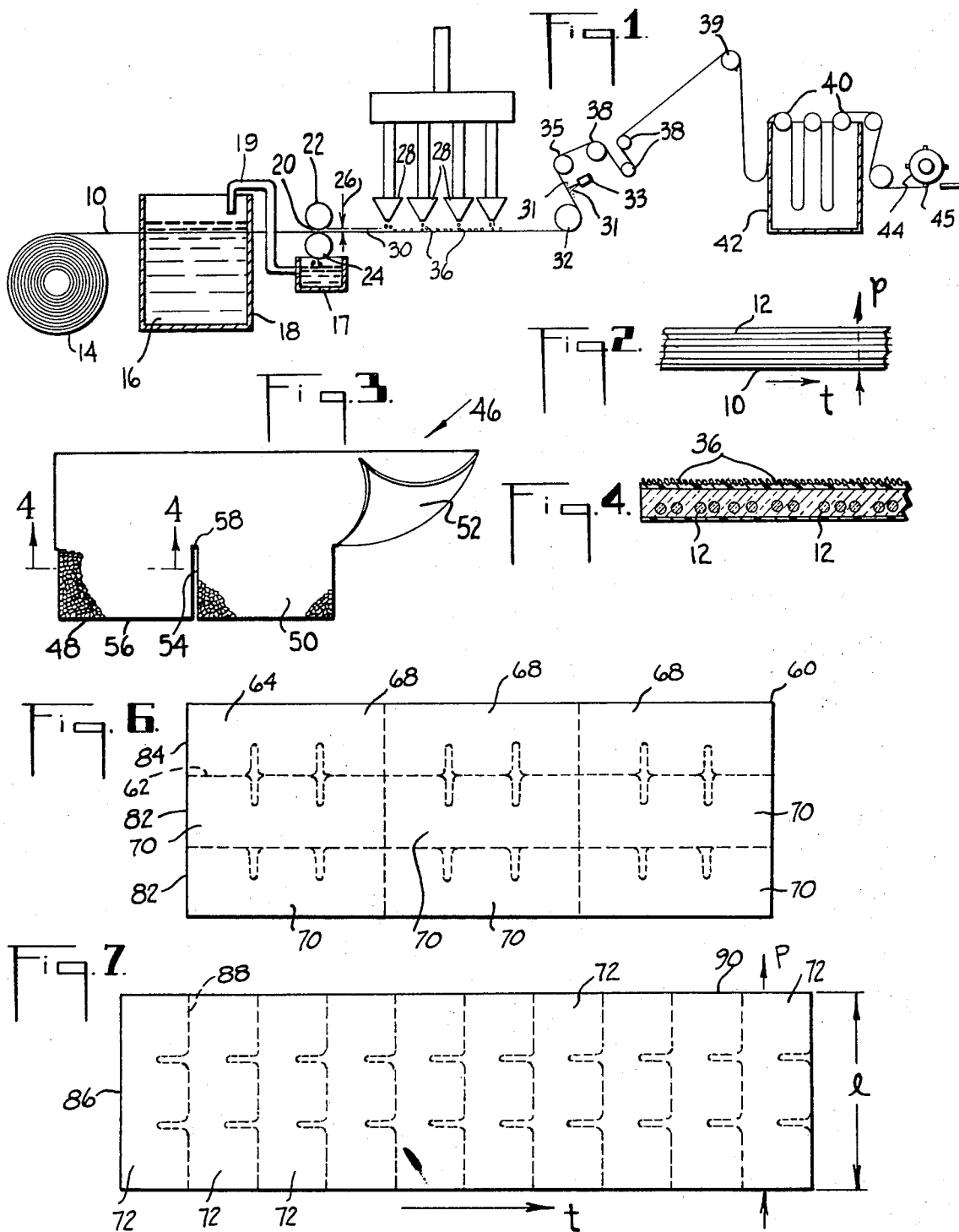
Dec. 26, 1972

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REINFORCED FIBROUS FELTS FOR ROOFING
SHINGLE MANUFACTURE

3,707,432

Filed May 7, 1971

2 Sheets-Sheet 1



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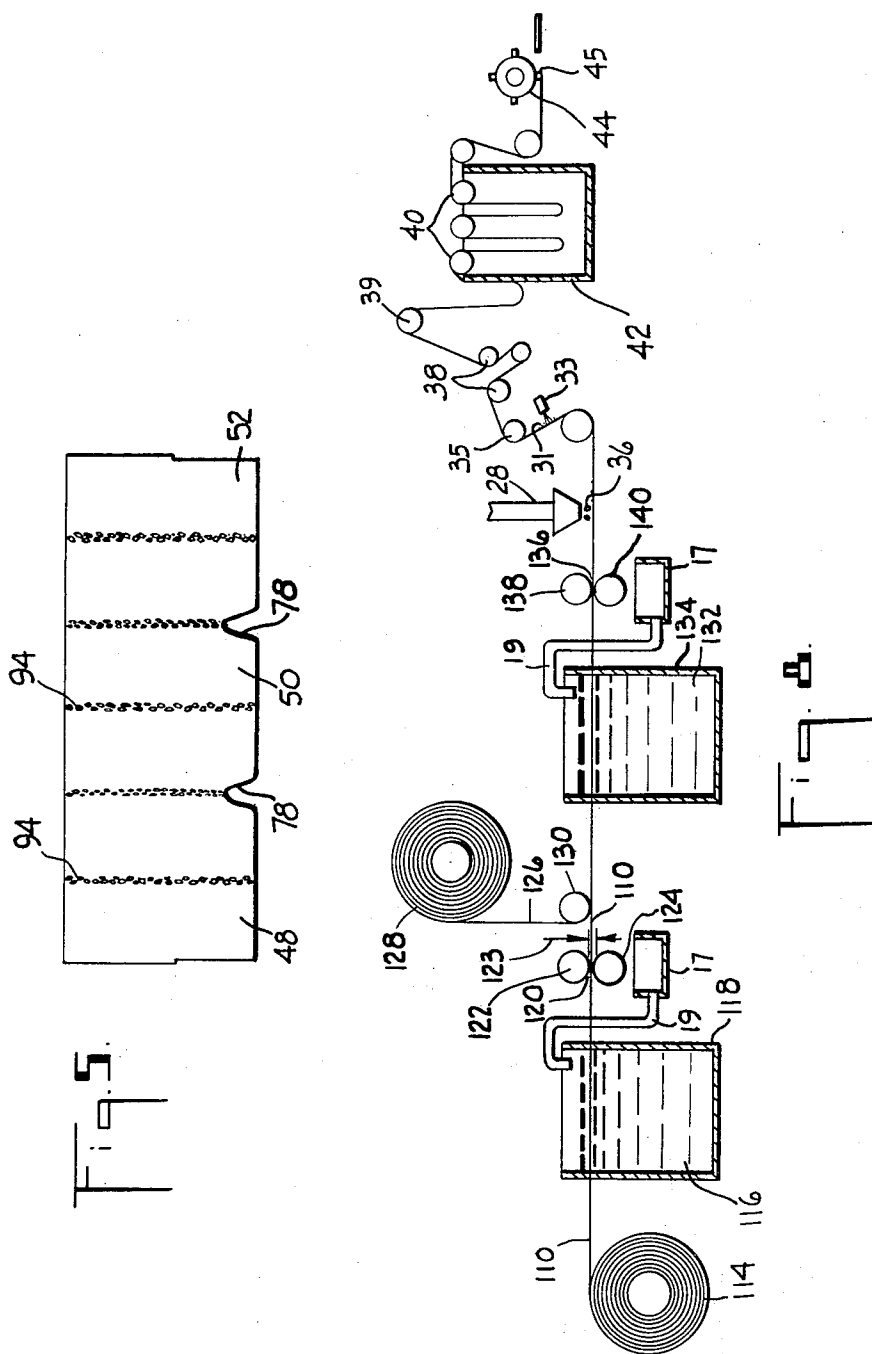
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14 Claims

ABSTRACT OF THE DISCLOSURE

A glass fiber felt is reinforced with longitudinally extending glass fiber strands applied in parallel from about $\frac{1}{8}$ to about 1 inch apart so as to provide increased tensile strength evenly distributed throughout the felt. Each shingle's length is cut from the felt transversely of the direction of felt travel so that the reinforcing strands extend from the head portion into the butt portion of the shingle. The strand arrangement permits faster saturation and coating of thinner felts and increases the tear resistance of the shingles.

FIELD OF THE INVENTION

The present invention relates to roof covering elements and methods of making the same, and is particularly concerned with strip or self-sealing shingles in which a bituminous mixture saturates and envelops a glass fiber mat. Although the principles of the invention will be explained in connection with such shingles, it will be understood that these principles are applicable to other inorganic base shingles as well.

DESCRIPTION OF THE PRIOR ART

In the manufacture of strip or self-sealing shingles of the present type the principal reinforcement used is filamentary glass media in the form of a fibrous mat, but to date considerable problems inherent in such felts have not yet been solved. One problem in this field is to find a glass felt which is thin enough to be adequately coated without prolonged periods of residency in an asphalt bath. The felt must additionally possess sufficient strength to withstand asphalt coating temperatures and considerable tensile stresses resulting from rapid machine speeds. Another problem in this field is to eliminate the tearing of light weight shingles during and after their installation on a roof.

It has been proposed to solve the above problems by employing glass fiber rovings in a jack straw or hatched pattern to reinforce the felt. Such methods increase the number of fibers per unit area of the felt and decrease coating rates. It has also been proposed to reinforce pre-selected areas of the felt with parallel glass strands extending in the machine direction. In conventional three lane shingle manufacturing operations in which the head edge of each shingle extends longitudinally of the felt, parallel glass strands have been positioned to extend longitudinally of the felt within the head portions but not within the tab portions of the shingles of each lane. Such methods cause the unreinforced portions of the felt to stretch at a different rate than the reinforced portions. The felt bunches up, loses proper alignment and eventually breaks. It has been proposed to avoid the felt alignment and breakage problems present in the above described shingle manufacturing machines by applying the reinforcing strands evenly across the felt. Such methods weaken the tab portions and reduce the field performance of light weight shingles. The shingles tend to tear along a reinforcing strand located in the tab portion and extending in the length direction of the shingle. The prob-

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lem which it is the primary objective of the present invention to solve, is to produce a tear-resistant light weight shingle comprising a glass fiber felt which is thinner, yet stronger and more rapidly coated at higher felt speeds than glass fiber felts employed in shingles now in use.

Thus, an object of the instant invention is to provide a method useful in the continuous fabrication of light weight glass fiber base asphalt shingles having sufficient felt weight, tensile strength and tear resistance to prevent felt breakage during rapid coating at high production speeds and subsequent handling operations.

Another object of the present invention resides in the provision of a shingle employing a single glass fiber mat of reduced weight, increased tensile strength, and sufficient tear resistance to withstand handling during manufacture, packaging and installation and to prevent the shingles from blowing off a roof subjected to high wind velocities.

SUMMARY OF THE INVENTION

To accomplish the stated objects my novel method utilizes an inorganic mat such as a glass fiber felt reinforced with parallel strands of glass fiber applied thereto in the direction of felt travel from about $\frac{1}{8}$ inch to about 1 inch apart so as to impart increased tensile strength evenly distributed throughout the felt. After saturation, coating, granule embedment, and cooling has occurred, the processed felt is cut along a path transverse to the parallel glass strands so that the length of the shingle is cut along a path transverse to the direction of felt travel. The reinforcing strands will then extend from the head portion into the tab portion of the shingle. In addition as explained hereinafter in more detail, for each shingle cut head to butt along a length coincident with the width of the felt, the granules will become embedded in the same direction relative to the same edge of each shingle cut from the felt defining the length of the shingles head portion. A variety of textural and coloring effects heretofore prevented by existing felt speeds and previous cutting arrangements can now be achieved. The increased tensile strength permits faster saturation and coating of thicker felts without breakdowns during continuous production of glass fiber base asphalt shingles having sufficient tear resistance to withstand handling during manufacture, packaging and installation and to prevent shingle blow-off from roofs subjected to high wind velocities.

Significant structural features are incorporated into the elements of my novel invention, whereby parallel glass reinforcement strands extending from the head portion and into the tab portion of the shingle protect the finished product against failure by tearing due to stresses concentrating adjacent the ends of cutouts as the shingle is grasped at an end tab and pulled up by a "peeling" motion during packaging and installation. The fiber strands act as hinges to resist tearing in the cutout region during handling and after installation. Nail heads bridging one or two reinforcing strands afford an increased holding power which in combination with the strand hinge action provides the tabs with sufficient strength and flexibility to prevent the lifting effect of the wind from blowing them off the roof.

Additional objects and advantages will in part be obvious and will in part appear hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a diagrammatic representation of a typical roofing material manufacturing line incorporating among

other components, an embodiment of the present invention.

FIG. 2 is a plan view of a continuous inorganic fiber mat reinforced with parallel fiber strands for use in the embodiment of the invention pictured in FIG. 1.

FIG. 3 is a top plan view of the front face of an embodiment of the invention fabricated by the roofing machinery of FIG. 1, shown with one end being lifted.

FIG. 4 is a transverse sectional view taken on line 4—4 of FIG. 3.

FIG. 5 is a top plan view of an alternate embodiment of the invention fabricated by the roofing machinery of FIG. 1.

FIG. 6 is a plan view of a continuous sheet of prepared roofing, the dotted portions depicting prospective perimeters of conventionally cut shingles.

FIG. 7 is a plan view of the continuous inorganic mat of FIG. 2, the dotted portions depicting prospective perimeters of shingles embodying the present invention.

FIG. 8 is a diagrammatic representation of a portion of a roofing material manufacturing line incorporating among other components, an alternate embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The prepared roof covering of the present invention may be constructed in a number of relatively simple configurations. In addition the invention will be found to function with shingles which have inorganic bases comprised of other than glass fiber felts. For the present illustrative purposes the invention is described in connection with a glass fiber base asphalt multitable shingle in which the inorganic felt is both saturated and coated at a single station with the coating material. It should be apparent, however, that the invention can additionally be utilized with shingles having inorganic bases comprising felts which are conventionally saturated and coated by operations which occur consecutively and at different stations. To facilitate the discussion to follow, the component parts of the product which remain identical throughout are provided with the same numeration.

Referring more particularly to the drawings, in FIG. 2 there is shown a dry glass fiber felt 10 weighing from about .9-3 pounds per 100 square feet and reinforced with parallel strands of glass fiber 12 applied to the felt at from about 1/8 inch to about 1 inch intervals so as to impart increased tensile strength evenly distributed throughout the felt. As illustrated in FIG. 1, the felt 10 is drawn from jumbo roll 14 through an asphalt-stabilizer filled coating 16 in coating tank 18 and between the nip 20 of metering rolls 22 and 24. The space 26 between metering rolls 22 and 24 determines the thickness of asphalt applied to the upper and lower surface of felt 10. Roofing granules 36 released from hoppers 28 above felt 10 are embedded or pressed into coating 30 by pressing roll 32.

After roofing granules 36 are bonded with and embedded in the coating 30, felt 10 is dusted with talc or mica 31 falling from hopper 33 before continuing around turn-over drum 35. Felt 10 then continues around water-cooled drums 38, over guide roll 39, and onto a plurality of festoons 40 for passage through cooling loop 42. The cooled felt is then transferred to cutting cylinder 44 where knife 45 passes through felt 10 along a path transverse to the direction of felt travel and coincident with the length of each shingle. Each shingle cut from felt 10 in this manner will be provided with glass fiber strands 12 extending from the head portion into the tab portion. The arrow labeled *t* in FIG. 2 indicates the direction of felt travel, while the arrow designated by the letter *p* indicates the path along which the approximate length dimension of the shingles are cut from felt 10.

Referring to FIG. 8 there is shown an alternate method by which the shingles of the present invention can be

produced. A dry glass fiber felt 110 weighing from about .45 to about 1.5 pounds per 100 square feet and reinforced with parallel strands of glass fiber applied to the felt at from about 1/8 to about 1 inch intervals so as to impart increased tensile strength evenly distributed throughout the felt is drawn, from jumbo roll 114 through asphalt-stabilizer filled coating 116 in coating tank 118 and between the nip 120 of metering rolls 122 and 124. The space 123 between metering rolls 122 and 124 determines the thickness of asphalt applied to the upper and lower surface of felt 110. A second dry glass fiber felt 126 is then drawn from jumbo roll 128 and guided onto felt 110 by guide roll 130. The two felts then move through asphalt-stabilizer filled coating 132 in coating tank 134 and between the nip 136 of metering rolls 138 and 140. Thereafter the two felts are processed in generally the same manner as the single felt 10 of FIG. 1. As illustrated in FIG. 8 and in FIG. 1, asphalt which drips from the metering rolls into container 17 is returned to the coating tank through conduit 19.

Referring to FIG. 4, the transverse section of a roofing shingle prepared in accordance with the invention is revealed in more detail. Reinforcing strands 12 can be sandwiched between layers of laminated glass fibers or glued to the outside of the felt to provide a uniform tensile strength sufficient to prevent weaker portions of the felt from stretching or bunching during passage between rolls 22 and 24. A tensile strength which is sufficiently uniform across felt 10 to prevent some portions of the felt from stretching at a different rate from other portions can sometimes be achieved even though each reinforcing strand 12 is not adjacently spaced at identical or regular distances. For maximum strength, tear resistance and increased nail holding power, it is preferable to apply reinforcing strands 12 at about 1/8 inch intervals regularly spaced across the felt 10. The above described reinforcing strands are generally connected to glass fiber felts ranging from 10-45 mils thick and weighing from about .9-3 pounds per 100 square feet of glass fiber after application of a thermosetting binder. Phenolic resin is frequently employed as the binder, but any thermosetting binder capable of withstanding the temperature of hot asphalt to which it is exposed during manufacture and present in quantities permitting adequate asphalt penetration can be used. When an asphalt shingle, shown generally at 46 in FIG. 3 with three tab portions 48, 50 and 52 formed by cutouts 54 extending transversely of the length of the shingle from the butt edge 56 is picked up at one end by a workman prior to or during installation, considerable stress concentrates near the end 58 of cutout 54. Surprisingly, however, shingles constructed in accordance with the present invention do not tear during installation or blow off a roof subjected to high wind velocities. The moment of inertia travels across reinforcing strands connected to felts less dense and less highly felted than organic mats weighing typically 11.5 pounds per 100 square feet. Acting as hinges, the reinforcing strands provide greater I-beam strength within the cutout region during handling and after installation.

In one illustrative use of the invention for high speed fabrication of glass fiber base asphalt shingles, a continuous glass fiber felt 10 shown in FIG. 2 with parallel fibrous reinforcing strands 12 spaced at from about 1/8 inch to about 1 inch intervals so as to impart increased tensile strength uniformly across the felt is saturated and coated with bituminous compound prior to the granule embedment, cooling, cutting and packaging operations. The increased tensile strength provided by the reinforcing strands permits faster saturation and coating of thinner felts without felt breaks, fire hazards, and coating consistency changes resulting in undesirable variances in product quality and loss of production during shutdown. Finished shingles grasped at one end and lifted from a stack of shingles by the workman are reinforced from head to tab so as to resist considerable stresses

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forming in the cutout region and traveling in a direction parallel to the length of the shingle. Inasmuch as such stresses, occasionally augmented when a shingle adheres or sticks slightly to the next lower shingle in the stack, can be encountered both during and after installation, the lightweight glass fiber base shingles of the present invention are particularly useful.

Referring to FIG. 6 there is illustrated a standard three lane felt. FIG. 7 illustrates a felt in which the length of each shingle is cut transversely of the direction of felt travel. FIG. 6 shows a portion of a shingle sheet 60 comprising a reinforced inorganic felt which has not yet been cut into shingles. Each dotted portion 62 on textural surface 64 of the sheet 60 connotes an area appointed to be severed by knife 45 of cutting cylinder 44. Granules 36 falling in a substantially vertical direction from granular hoppers 28 to contact the tacky asphalt coating become oriented or tilted up to 45° from a line drawn perpendicular to the horizontal surface of the felt. This orientation or angle of inclination of the granules is in a direction opposite to the direction in which the felt is traveling and may be defined relative to the surface of the shingles. The granules may additionally be described as having an orientation relative to a given edge on the major exterior surface of each shingle. In standard three lane shingle manufacturing machines shingles cut from certain lanes have granules oriented relative to the same edge of each shingle in a direction different from that of granules embedded in shingles cut from other lanes. The reason for this difference will become more apparent with reference to FIG. 6. Note that in FIG. 6 two lanes or rows of shingles have butt portions facing in opposite directions. Since granules 36, when applied to shingle sheet 60 tend to become inclined in one direction, shingles 68 from the third lane of the felt will have granules pointed in a direction different from shingles 70 of the other two lanes. When the sun's rays reflect from a roof on which shingles 68 and 70 are installed in close proximity to each other, shingles 68 from lane three may appear to be a different shade from shingles 70 produced in lanes one and two. Unless the sun is directly overhead granules inclined toward edges 82 of shingles 70 and granules inclined toward edges 84 of shingles 68 will reflect light in respectively different directions. Differences in the direction of light reflectance sometimes produced by shingles installed in close proximity on a roof are popularly referred to as "left and right" reflectance variations. Appropriate precautions have heretofore been required to prevent proximate installation of shingles produced on three lane shingle manufacturing machines, as light reflectance variations not observed by the roofer become more apparent when viewed from an angle at a distance. As illustrated by FIG. 7, shingles 72 cut head to butt along a path, *p*, extending in the length direction of each shingle 72 and transversely of the direction of felt travel, *r*, do not produce "left and right" light reflectance variations. Granules applied to each shingle 72 on shingle sheet 90 become inclined in the same direction relative to edge 86 defining the length, *l*, of the shingle's head portion. For each shingle 72 cut along dotted portions 88 from sheet 90, light reflectance variations creating conspicuous shade differences between adjacent shingles are visually unapparent not only when the sun is directly overhead.

High felt speeds and cutting techniques in which the shingles are severed from the felt along a path in which the shingle's length extends in the same direction as the direction of felt travel, do not permit granules of different colors and sizes to be applied to roofing shingles in a thin continuous strip extending from the head portion and into the butt portion of each shingle. Unlike the latter cutting arrangements the width of vertical granular strips applied to shingles cut in accordance with the present invention does not depend upon the speed of the felt. Granules can thus be continuously applied to the surface

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of shingles of the present invention in strips or bands 94 as narrow as ½ inch in width and extending from the head portion into the butt portion of the shingles. Inasmuch as the granules of a given vertical strip can vary in size and color from granules of other vertical strips, shingles of the present invention can be provided with a variety of vertical strips or bands having different colors and textures. Numerous shingle surface patterns previously prevented by conventional speeds and cutting techniques can be achieved. In addition, the low cost, fire resistant, shingle is more rapidly fabricated from thinner felts lending greater strength and tear resistance during and after manufacture, packaging and installation. Since shingle designs and construction techniques previously though inappropriate are now feasible, glass fiber base shingles having variegated textural surfaces and sufficient tensile strength and tear resistance to be compatible with contemporary aesthetic and economic requirements can be produced.

It will be apparent to those versed in the science of shingle construction that shingles comprising fibrous felts having the increased tensile strength and tear resistance produced by the present invention may assume a variety of configurations depending upon the type of felt employed and the aesthetic effect desired. Where appropriate, as discussed in connection with FIG. 1, the arrangement may be utilized to increase the saturation and coating rates of thinner inorganic felts during faster production of shingles on a fully integrated material handling system. When employing a plurality of glass fiber felts to form a shingle base weighing at least 9 pounds per 100 square feet, for example, the arrangement of the invention permits exceedingly thin glass fiber felts weighing from about .45–1.5 pounds per 100 square feet to be utilized. For shingle fabricating systems currently in use, the invention may be incorporated as an alternative production method in the manufacture of lightweight high tensile strength prepared roofing products having variegated textures and numerous tab designs. In place of the rectangular portion of cutout 54, arcs of varying radii or a rounded non-arcuate shape can be employed. Straight portion 76 could be curved to form portion 78, shown in FIG. 5. Tab portions 48, 50, and 52 can be fabricated to create a wide variety of tab configurations. Since certain changes may be made in our novel shingle without departing from the scope of the invention herein involved, it is intended that all matters contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. A bituminous roofing shingle, comprising:

- (a) an inorganic base comprising at least one fibrous felt;
- (b) said base coated with bituminous material and comprising a head portion and a butt portion;
- (c) granules of particulate material adhered to the bituminous coating;
- (d) a plurality of substantially parallel inorganic reinforcing strands connected at from about ⅛ inch to about 1 inch intervals to the felt;
- (e) said reinforcing strands extending transversely of the length of the shingle from the head portion into the butt portion.

2. A bituminous roofing shingle as recited in claim 1, wherein the reinforcing strands are regularly spaced and comprise glass fibers.

3. A bituminous roofing shingle as recited in claim 2, wherein the base comprises glass fibers and weighs from .9 to 3 pounds per 100 square feet.

4. A bituminous roofing shingle as recited in claim 3, wherein said base is formed from a plurality of glass fiber felts each weighing from about .45–1.5 pounds per 100 square feet.

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5. A bituminous roofing shingle as recited in claim 3 having at least one cutout extending transversely of the length of the shingle.

6. A bituminous roofing shingle as recited in claim 5 wherein the reinforcing strands extend the entire width of the shingle.

7. A bituminous roofing shingle as recited in claim 6 wherein the particulate material adheres to a surface of the shingle in a band at least $\frac{1}{2}$ inch wide and extending from the head portion into the butt portion of the shingle.

8. A bituminous roofing shingle as recited in claim 7 including a plurality of said bands of particulate material having different colors and textures.

9. In a continuous manufacturing process wherein at least one continuously moving inorganic felt forms a base which is saturated and coated with bituminous compound, embedded with granules of particulate material, cooled and cut into bituminous roofing shingles each of which has a head portion and a butt portion, the improvement comprising the steps of:

(a) connecting at from about $\frac{1}{8}$ inch to about one inch intervals relatively thin, continuous and substantially parallel strands of glass fiber to at least the one inorganic felt;

(b) said strands extending in the direction of felt travel; (c) cutting shingles from said base, after the saturation, coating, embedment and cooling steps, the length of each shingle being cut transversely of the direction of felt travel, whereby said reinforcing strands extend transversely of the length of each shingle from the head portion into the butt portion.

10. A process as recited in claim 9, including the step of spacing the reinforcing strands at regular intervals across a glass fiber base weighing from about .9 to 3 pounds per 100 square feet.

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11. A process as recited in claim 9 including the step of connecting said strands at said intervals to at least a second inorganic felt, said first felt and said second felt forming the base of the shingle, said strands extending in the direction of felt travel, and each felt weighing from about .45 to about 1.5 pounds per 100 square feet.

12. A process as recited in claim 10, including the step of embedding each granule of particulate material in the bituminous coating material on the surface of the felt at substantially the same angle from said surface and relative to an edge of each shingle cut from the felt defining the length of the head portion of the shingle.

13. A process as recited in claim 12, wherein a band of particulate material at least $\frac{1}{2}$ inch wide is adhered to the surface of said shingle the band extending from the head portion into the butt portion of the shingle.

14. A process as recited in claim 13, wherein a plurality of said bands of particulate material are adhered to the shingle, adjacent bands having different colors and textures.

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