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(54) **MAKING RUMBLE STRIPS FROM RECLAIMED TIRE TREAD STRIPS**

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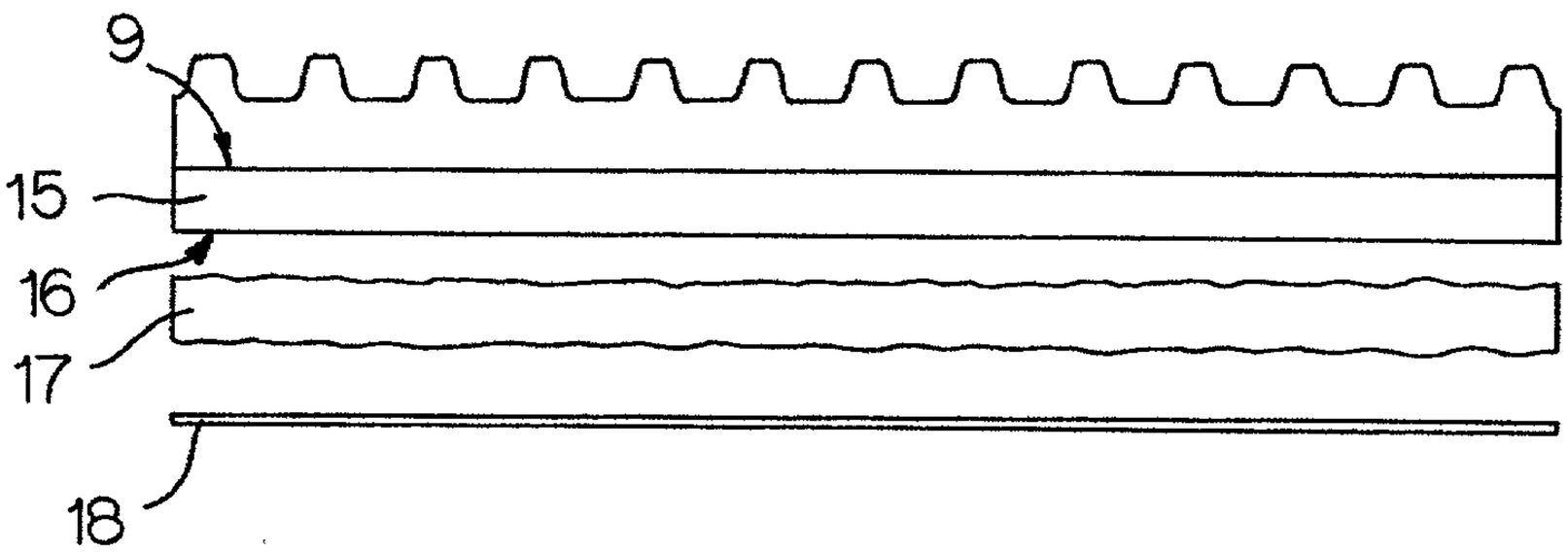
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(57) **ABSTRACT**

A basic tire tread strip product is reclaimed from tire carcasses by cutting away and discarding opposed sidewalls at a position leaving a flat central tread portion exclusive of resiliently biased downwardly extending tread portions at outer edges, thereby to form a product that lies flat on utility surfaces including roofs, floors, roadways and multilayered tread strips forming beams and parking stops. This product ideally serves as a rumble strip for adhering to flat roadway surfaces as a tough, long-wearing structure that encounters vehicle wheels with a distinctive audible warning signal, particularly since it can be removed and reused for example in the winter time to avoid being damaged by snow plows. Also tread strip laminations ideally rest flatly on top of each other to form multi-layered beams of precision widths of the type that may be employed as parking stops for statically intercepting and impeding vehicle wheels in parking lot locations for example.



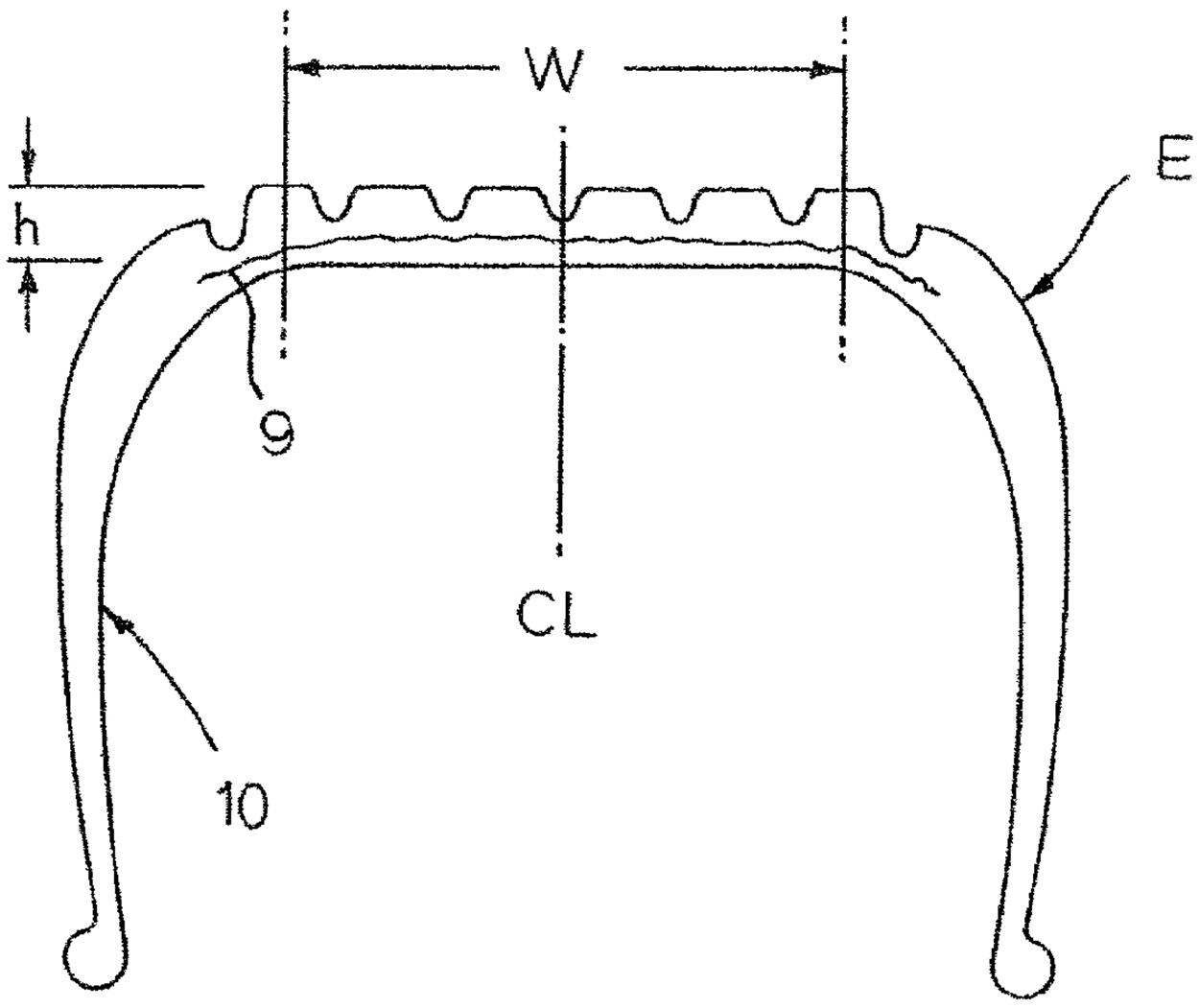


FIG. 1

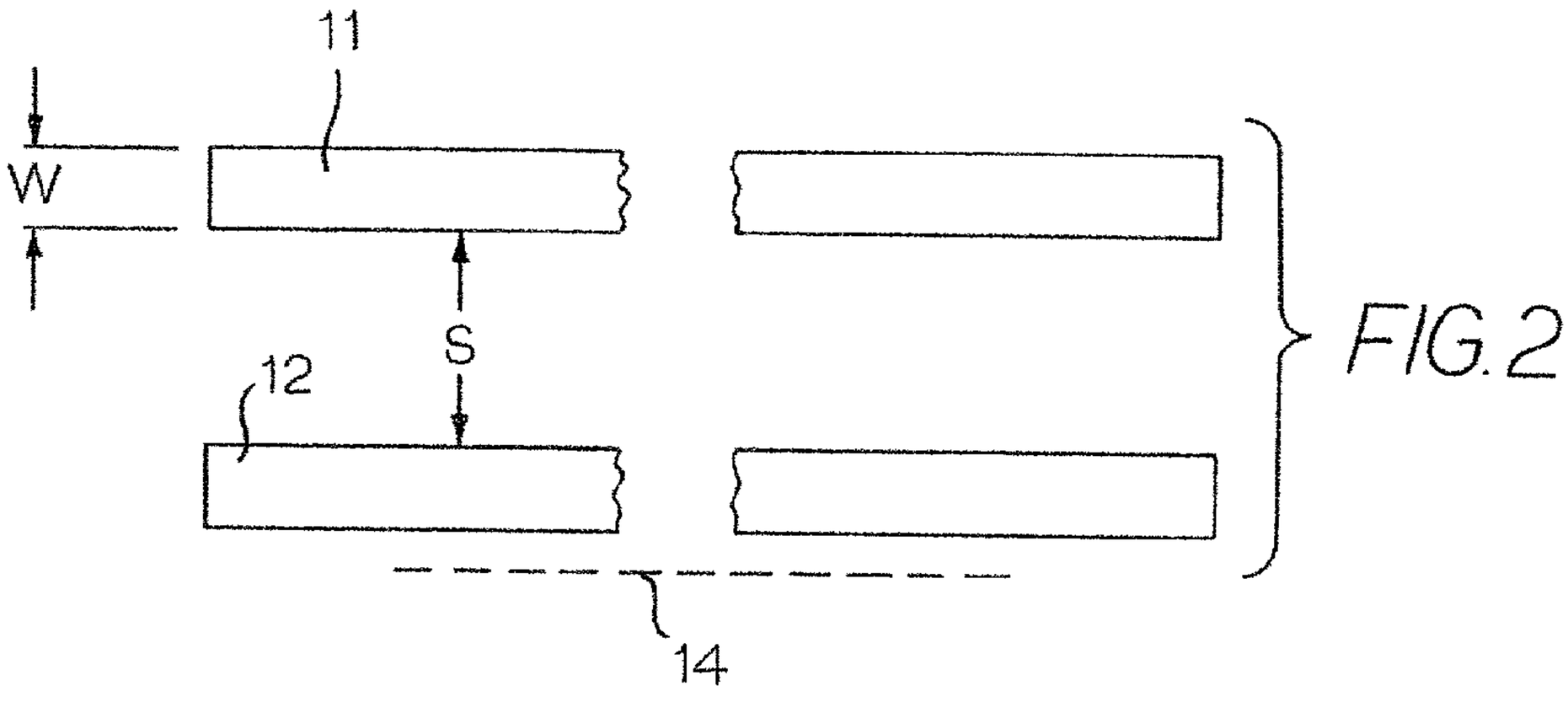


FIG. 2

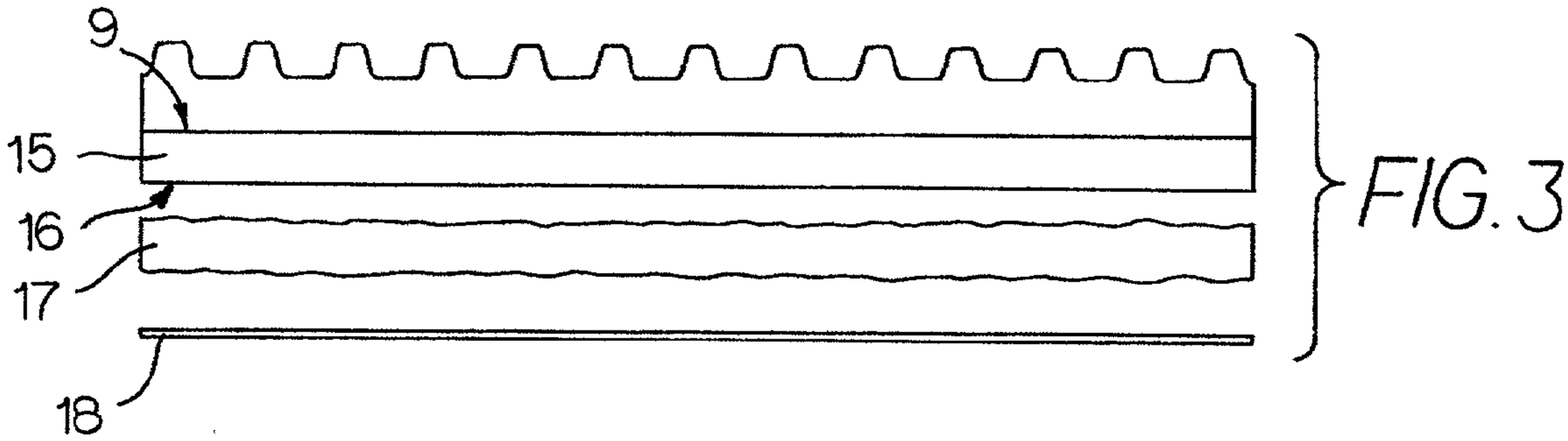

9
15
16
17
18

FIG. 3

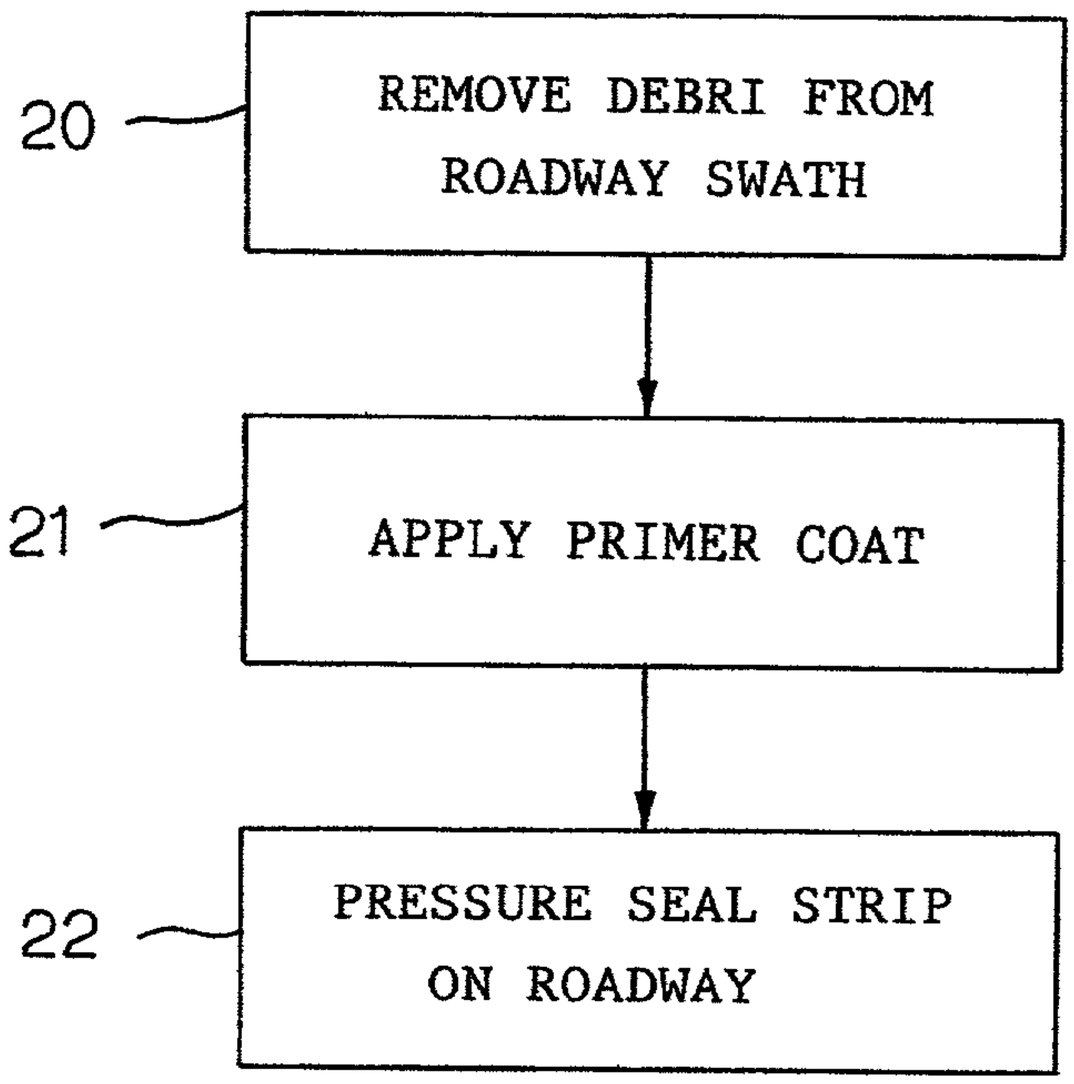
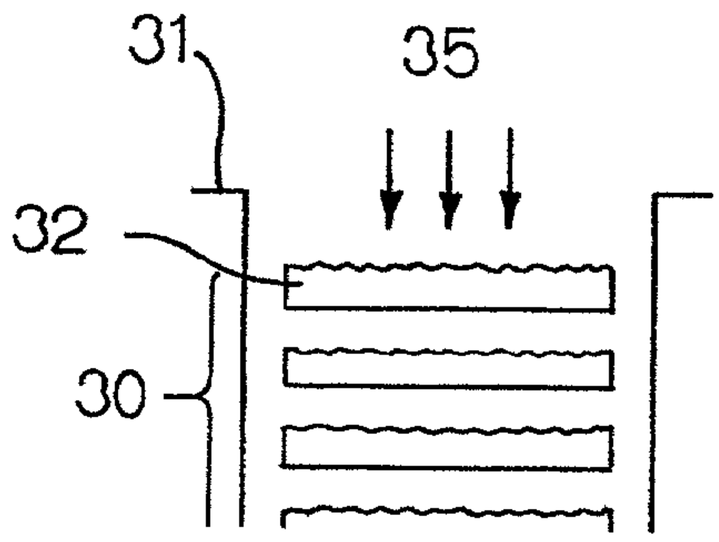

20
REMOVE DEBRI FROM ROADWAY SWATH
21
APPLY PRIMER COAT
22
PRESSURE SEAL STRIP ON ROADWAY

FIG. 4


31
35
32
30

MAKING RUMBLE STRIPS FROM RECLAIMED TIRE TREAD STRIPS

FIELD OF THE INVENTION

[0001] This invention relates to the use of reclaimed discarded tire carcasses to produce tread strip products thus removing discarded tires from the environment thereby to prevent the breeding of disease carrying mosquitos in discarded tread carcasses, and more specifically it relates to the processing of tire casing tread strips to lie flat in an unstressed condition upon a flat surface, typically a driving surface to thus serve as acoustic warning devices for encountering vehicle tires known as rumble strips, which when adhered in patterns upon a flat driving surface audibly warn drivers of upcoming driving conditions as a car passes over the rumble strips, or other products such as multi-layered parking stop assemblies for engaging vehicle tires in a static condition.

BACKGROUND ART

[0002] As taught in U.S. Pat. No. 4,813,811 issued to W. B. Adams on Mar. 21, 1989, for PREFABRICATED PAVEMENT DEVICES, rumble strips are formed as shaped preformed units of paving material, typically blacktop or bituminous, which is difficult to form with long wearing sharp leading edges for audibly encountering overrunning tires of a moving vehicle. These disclosed rumble strips are pre-fabricated into self standing units formed from a pavement mixture and supplied with a lowermost adhesive outer layer for adhering to the previously formed similar paving material of a road surface. The preferred embodiment of this assembly has two preformed layers of pavement material separated by an internally disposed fortifying web of wire mesh or the like. It is noted that these rumble strips cannot be removed non-destructively for further use for example in the wintertime when they would be damaged by snow plows.

[0003] In U.S. Pat. No. 4,490,069 issued to R. P. Cushman, et al. on Dec. 25, 1984 for PORTABLE HIGHWAY WARNING APPARATUS, there is disclosed a network of rumble strips formed into a multi-strip mat of several substantially parallel rumble strips made as a unit from a resilient composition with an area of nearly one-hundred square feet defining a pattern of slots approximately six inches by forty inches separated to produce gaps of about eight inches. This type of mat is inconsistent with the requirements for rumble strips set up by State Highway authorities, and is difficult to handle and install because of the size. Furthermore such mats would not be useful at high overrunning vehicle speeds requiring much greater spacing between successive strips.

[0004] Benjamin A. Tripp in U.S. Pat. No. 5,340,630 Aug. 23, 1994 for TWO PLY MATERIAL MADE FROM USED VEHICLE TIRES, discloses substrate structural materials made from longitudinal tread strips cut from discarded tire carcasses. Useful strips for carrying bending loads must be formed by bonding together adjacent tread surfaces from two single tread strip plies as an elongated two ply laminated structural member. There is no recognition that one ply strips have utility in use as rumble strips, and there is no disclosure of attachment of the two ply strips to a flat road surface in service as a rumble strip.

[0005] Alfred J. Pignataro, Jr in U.S. Pat. No. 5,834,083, Nov. 10, 1998 entitled, USED TIRE RECYCLING INCLUDING SORTING TIRES, SHREDDING SIDEWALLS, STACKING TREAD STRIPS, AND UNIFORMLY DIMENSIONING AND BONDING THE TREAD STRIPS TOGETHER, stacks and adheres separate plies into two ply load bearing strips of the nature disclosed by Tripp at their inner surfaces opposite to the tread, and dovetails the two ply assemblies end-to-end to form elongated strips for use in multi-layered bundles to form construction beams and the like. Stacks of two ply units are bolted into various structural configurations by superimposed metallic frames with multiple holes.

[0006] Rick L. Bove, et al. in U.S. Pat. No. 6,316,069, Nov. 13, 2001 for LAMINATED STRUCTURES MADE FROM RECYCLED TIRES, provides parking stop beams by stacking a plurality of two-layered tire tread strips in which individual strips are cut to form a plural of edge flaps separated by closely spaced inwardly directed slots distributed along the opposite parallel edges of each individual strip, a procedure necessary to make the tread strips cut from a tire carcass to lie flat for bonding together multiple layered parking stop stacks without inherent bubbles or separation of the layers as a result of inherent permanent resilient bias forces at the outer edges of the strips.

[0007] Problems not overcome by this prior art include: (a) the construction of rumble strips from road materials such as asphalt or cast rubber-like materials requires a series of costly manufacturing procedures for fortification of wear life and adherence to flat road surfaces; (b) the low-cost, long life use and preferred acoustic warning properties inherent in a tire tread strip cut from a discarded tire carcass has not been recognized to produce improved long-life re-usable rumble strips; (c) the problems of dealing with inherent retained elastic bias in reclaimed tire tread strips cut from tire carcasses, including either the cutting of slits in the tough wire embedded strip edges or the forceful adhesion of strip layers by heat, pressure and adhesives, has resulted in high costs particularly in the presence of insufficient technological processing equipment for cutting myriads of slits into outer edges of steel belted treads removed from discarded tire carcasses, and the expensive tooling and operating costs of vulcanizing equipment for using such strips in laminated strip pairs; and (d) in particular any attempt to use the prior art versions in a single layer embodiment for long-life use as rumble strips, tire tread strips cut from reclaimed tire carcasses having retained elastic bias at downwardly turned outer edges, even that residual bias retained at the outer edge of any flaps appearing between slits in the outer edges, would result in catastrophic failure of the outer edges, that must receive the significant repeated impact of high speed overriding vehicle tires, to remain firmly secured to asphalt or concrete roadway surfaces.

DISCLOSURE OF THE INVENTION

[0008] This invention resolves the aforesaid problems of the prior art by the discovery that the basic tire tread strip is substantially flat at the center portion of reclaimed tire carcasses with the retained elastic bias that prevents tire tread strips from lying in a relaxed flat condition being confined to the downwardly directed outer edges of the strip. Thereby the inherent elastically biased edge portions of the tire carcass are cut off and discarded, leaving the flat central portion of the tire tread strip. In this manner the simply processed reclaimed tire tread strips tend to lie flat on an

adjacent receiving surface such as a roadway where they lie flat and remain firmly secured at the outer edges to the road surface for acoustically encountering the tires of an over-passing vehicle. Alternately such center-portion strips may be layered on top of each other to form a multi-layered laminar assembly with precisely squared vertical walls as a construction beam capable of superior utility as a tire stop for encountering a parked vehicle. Thus, a tough longer-life rumble strip is produced having superior acoustic warning properties encountered at the resilient but securely attached outer edge when adhered to a road surface to encounter tires of oncoming vehicles as rumble strips.

[0009] In accordance with this invention single layered tire tread strips reclaimed from discarded tire carcasses will flatly lie upon and thus can be securely adhered to a contiguous flat surface such as a roadway or a similar tire tread strip layer. These basic tire tread strips are cut uniquely from the substantially flat central treaded portion of reclaimed tire carcasses with down-turned edges removed thereby to lay flat upon a contiguous surface.

[0010] Thus these flat lying single layer strips may be adhered firmly in a desired spaced pattern of generally parallel oriented rumble strips to a road surface following preparatory cleaning and preparation of the road surface. Also the resilient strips may be removed non-destructively for further use, such as winter time removal to avoid snow plow damage, by use of an adhesive having permissible peel strength and high sheer strength. Thus the strips are securely held to have a long life in the presence of overrunning high-speed vehicle tires and present a straight upturned leading edge which is resiliently impacted by vehicle tires to provide a sharp and distinctive acoustic warning signal.

[0011] In a preferred embodiment, a pressure sensitive adhesive layer is carried integrally upon the rumble strip formed of the basic tread strip being disposed on the surface opposite to the upwardly extending tread surface pattern surface. The rumble strips are thereby simply adhered by adhesively bonding in place by pressure. For storage and handling purposes a protective outer strip such as wax paper is carried by the adhesive layer on its outer surface to be removed prior to the adhesion step. For removing and reusing reclaimed rumble strips the pressure sensitive adhesive on the tough elastic strip is simply peeled from the roadway surface for later re-use. Preferably the roadway surface carries a primer coating that preserves the pressure sensitive adhesive surface for reuse.

[0012] Rumble strips formed of such re-usable tire tread layers are superior in performance since these strips having a tough resilient steel-belt-reenforced long-wearing leading edge profile that produces a distinctive audible warning signal when encountered by a moving vehicle.

[0013] The propensity to lie flat nature of the tire strip products furthermore ideally permits stacking a plurality of strips on top of each other to form a strong multiple layer laminated beam of precise dimensions similar to lumber but superior in toughness and strength, wherein the layers are adhered to each other. Such beams have general utility in the construction arts, and are explicitly superior for forming a low-cost, long-life parking stop for statically intercepting vehicles in a parking slot.

[0014] The preparation of a driving surface for placement of the rumble strips comprises simply cleaning and smoothing the driving surface pattern for better adhesion and non-destructive removal of the rumble strips. Thus a pressure sensitive adhesive layer integrally is carried on the surface of the rumble strips opposite to the tread. The inside casing side of the basic rumble strip product opposite from the tread is thus prepared for application of the adhesive substance for affixing the rumble strips securely to the driving surface pattern, typically by cleaning with alcohol, or other solvent, to remove any surface contamination from substances such as oil used in original manufacture of the tire carcasses or generated in active life during the use of the tire. Then preferably a primer coat is applied to prevent any later migration of residual oils, etc. Similarly the road surface is cleaned by blowing off debris and residue, and applying a primer coating from which the rumble strip may be non-destructively peeled.

[0015] Other features and advantages of the invention will be found throughout the following drawings, specification and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] In the accompanying drawings, wherein like reference characters signify similar features throughout the various views:

[0017] **FIG. 1** is an end view sketch in section of a typical discarded tire carcass for illustrating how the exterior tread pattern strip is derived in accordance with this invention,

[0018] **FIG. 2** is a plan view sketch of lengths of tire tread strips employed in a rumble strip application upon a driving surface in accordance with this invention,

[0019] **FIG. 3** is an exploded end view sketch section of a rumble strip employing a tire tread strip in accordance with this invention,

[0020] **FIG. 4** is a block diagram illustrating the process of adhering the tire tread strips into a rumble strip pattern upon a roadway surface, and

[0021] **FIG. 5** is an end view section sketch of a laminated unitary set of adhered contiguous tire tread strips made in accordance with this invention to form a tough long lasting construction beam of precise dimensions.

THE PREFERRED EMBODIMENTS

[0022] Preferred dimensions for rumble strips are five and one-half inches in width (w), one-half inch thick (h). Various lengths are produced by fastening five or six foot length tread strips or portions thereof derived from typical discarded tire casings into respective end to end arrays.

[0023] The long-life steel-belting reinforced elastic rubber leading edges of the rumble strips, which protrude above the roadway surface, present ideal acoustic warning signals when impacted by overrunning vehicle tire treads These rumble tread strips lie flat upon the road surface and thus are adhered securely thereto at opposite edges without the presence of conflicting elastic forces residual in the tread strips from their prior tire manufacturing stage that might tend to loosen % adhesion of the strips particularly at the critical edges receiving the impact of overrunning vehicle tires at high speeds. Thus these tough resilient tire tread strips have very long life expectations in use as rumble strips thanks to straight line tread strip edges simply and firmly

secured to the roadway surface without counteracting residual elasticity by a low-cost pressure sensitive adhesive coating retained upon the lower surface opposite to the protruding tread.

[**0024**] The simple procedure afforded by this invention for processing the reclaimed tire strips in a form that inherently lies flat in a relaxed condition without any significant retained elastic memory is discussed with reference to the cross section sketch of **FIG. 1**.

[**0025**] The periphery portion of the tire tread upon the carcass supplied in accordance with this invention is cut from the circumference of the toroid-like carcass **10** by removing sidewall portions from the tire carcass in a manner different from the foregoing prior art. The width (w) of the tire tread strip critical to this invention is cut along its length at a precise width inside opposed edges E to dispose of those elastically biased outer edges E, preferably by the stripping shaping apparatus and method set forth in my co-pending application Ser. No. 10/005,696; filed Dec. 7, 2001 for Methods and apparatus for processing reclaimed tire tread strips, which application is contained herein in entirety by reference. Thus a longitudinal tread strip having a propensity for lying flat along its length when placed upon a substantially flat surface is obtained by cutting a strip of six inches or less in width extending in opposed directions three inches or less from the peripheral centerline CL of the toroid carcass, as shown in **FIG. 1**, thereby excluding the downwardly shaped edge portions E.

[**0026**] The opposed edges E of the carcass tread are curved downwardly and carry a strong residual elastic bias. It has been found in accordance with this invention that these biased edge sections in single tread strip layers used as rumble strips prevent the single strips, when the edge sections E are integrally disposed on the strip layer, from lying flat upon and being permanently adhered to a substantially flat contiguous surface such as a roadway surface or similar strip layer. This defect is thus solved in accordance with this invention simply by removal of the elastically biased opposed edge portions (E) from a tire tread strip obtained from the tire carcass, thereby to leave a flat tread strip of width (w) extending on opposite sides of the center line CL. By cutting the tread strip to a width that eliminates the curved outer edges E, which retain a downwardly directed elastic bias as shown in **FIG. 1**, the strips will lie substantially flat upon an adjacent flat surface such as a road surface in a relaxed condition without otherwise processing the strips to remove the adverse effects of such elastic bias which tend to prevent the strips from attaining substantially flat contact surfaces. Typically this width (w) is under six inches and preferably is five and one-half inches. Thus, the rumble strips of this invention have a typical width of five and one-half inches and a preferable height (h) of the tread strip of one-half inch for serving as a rumble strip. Carcasses that have height irregularities or significantly greater thickness may be cut or ground to maintain the preferable height. Rumble strips of ten, eleven or twelve feet in length may be obtained by securing tire carcass tread strips having a length of five feet or six feet end-to-end. The steel belting **9** of the tire tread strips produces long life at rumble strip impact edges and stabilizes the width dimension w and sharp vertical leading edges of the tread strips that are cut from the outer periphery of the tire carcass **10**.

[**0027**] As seen in **FIG. 2**, two rumble strips **11** and **12** are shown spaced in parallel array a distance (S) of eight feet, four inches apart, or such other distance specified by any local highway specifications. Other parallel rumble strips may be added as desired typically in six parallel strip arrays, as indicated by dotted line **14**. The length of the rumble strips are either ten, eleven or twelve feet. Thus the strips cut from the carcasses are five feet and six feet in length, and two such strips are attached end-to-end by vulcanization, riveting, dovetailing or other suitable process to form the longer rumble strips.

[**0028**] The rumble strips are further processed into a self contained unit to be securely adhered to a roadway surface from which they may be nondestructively removed for reuse, as suggested in the format shown in **FIG. 3**. The tire tread strips **15**, as inherently reinforced by steel belting **9**, are formed into a single tread strip unit laminated with an integrally disposed adhesive layer **17** externally covered by a manually removable transport cover sheet **18** of a film such as wax paper. Preferably the adhesive layer is of a strong sheer strength material with a low peel strength that adheres to a roadway surface such as asphalt or concrete. A preferred layer is a commercially available one-sixteenth inch thick double coated pressure sensitive mounting tape of high density cross linked polyethylene foam coated with a high tack and high shear pressure sensitive adhesive on both sides. These mounting tape strips have a typical peel adhesion of about 90 ounces per inch width, a sheer adhesion of about ten psi and a temperature resistance of 200 degrees F. These the rumble strip units may be installed in-situ under pressure obtained from a heavy roller such as a truck tire The peel adhesion characteristic permits the tough flexible tire tread strip units to be nondestructively released from a roadway surface for reuse, for example if they must be removed in the winter time to avoid snow plow damage. The protective transport and storage layer **18** is a masking plastic layer that temporarily adheres to the adhesive layer **17** subject to manual removal at the time of applying the rumble strips upon the roadway surface.

[**0029**] Preparation of the tread strip for receiving the adhesive layer **17** is desirable to remove any contaminants or irregular surface defects remaining on the inner surface **16** of the tread strip from manufacturing of the tire carcasses and historic use before the carcasses are discarded. The surface **16** is cleaned with a solvent such as denatured alcohol to remove any residual oil in the tire tread strip. Preferably the surface **16** is buffed with an abrasive wire brush wheel or the like to remove any residual fragmental materials and to improve the adhesive layer bonding surface. Then a primer material coating, such as a commercially available "Antorbond" primer, is sprayed or wiped on to block permanently any oils from seeping through. The adhesive layer **17** is then applied and covered with the manually removable protective film layer **18** for protection in storage and transit before application to the reception surface such as a roadway surface. If the strips are stacked flatly one on top of another to form a multi-layer laminated beam during manufacture, the protective film layer **18**, such as wax paper, is not used.

[**0030**] The process of preparing the road surface for receiving these rumble strips is discussed with reference to the block diagram of **FIG. 4**. Thus the road surface is cleaned of debris at block **20**, such as by applying com-

pressed air at 80 psi to remove debris and sediment in a swath wide enough to receive a rumble strip. Then the cleaned surface is primed, typically with the above identified primer coating as shown by block **21**. Then the rumble strip with protective layer **18** is put in place on the cleaned and primed roadway swath, for the pressure sensitive adhesive exposed surface to be attached firmly in place by a heavy roller such as a truck tire.

[**0031**] Now with reference to **FIG. 5**, there is shown a laminated set **30** of contiguous tread strips **32** being assembled into a unitary multilayer beam of a desired length attained by end-to-end attached strips of treads reclaimed from tire carcasses if necessary. The bottom strip layer **32'** thus needs no lower adhesive layer. All of the strips of the set **30** are cut to precision width to provide beams of precision width dimensions. The uppermost strips each lie flatly on top of each other without conflicting elastic characteristics tending to separate the opposite edges that would have been introduced had the outer elastically removed edge portions of the tire strips not been removed.

[**0032**] The tire strip laminations are stacked into the container **31** of precise width and sealed together adhesively by pressing downwardly **35** on the uppermost layer to form a unitary rectangular beam of appropriate length.

[**0033**] Because of the propensity of the individual laminar tire tread strips **32** to lie flat without interference from residual elastic counter-forces tending to separate the laminations or lamination edges, a stable long-life, high strength tough structural beam is formed, which may for example be employed as a parking stop member.

[**0034**] Having thereby introduced novel tire tread products and methods in which tread strips removed from discarded tires lie flatly in place upon a facing flat surface, thereby to serve as rumble strips formed from tire treads or other products including laminated beams, those novel features introduced by this invention are set forth with particularity in the following claims.

1. A method of producing a tread strip product of designated length, thickness and width reclaimed from a substantially toroid shaped outer periphery of a discarded tire carcass characterized by a substantially flat central treaded portion terminating on opposite edges in downwardly curved outer edges forming an upper extremity integral with two downwardly-directed sidewall portions, said outer edges retaining pre-conditioned elastic bias tending to curve the flat central treaded portion downwardly from the intervening flat central treaded portions at the opposite edges, comprising in combination the steps of:

removing with the two sidewall portions adjacent said downwardly directed outer edges with the retained elastic bias adjacent to the resulting intermediate tread strip product, and

forming said longitudinal tread strip product from said intervening flat central treaded portion of the tire carcass exclusive of adjacent downwardly curved opposite tire carcass edge extremities whereby the resulting longitudinal tread strips lie in an unstressed flat configuration on a contiguous flat surface.

2. The method of claim 1 wherein the longitudinal tread strip product is cut to a width spanning three inches or less on opposite sides of a tread pattern centerline on said outer periphery.

3. The method of claim 1, including the step of supplying the longitudinal tread strip product with an adhesive layer integrally applied upon the inward carcass surface of the strip opposite the tread surface for adhering the tread strip product onto said accompanying flat surface.

4. The method of claim 3 with the modified step of applying a pressure sensitive adhesive layer.

5. The method of claim 3 including the step of adhesively attaching the longitudinal tread strip in position as a rumble strip to a flat road surface for intercepting the tires of an approaching motor vehicle to produce an audible warning signal.

6. A structural building member formed of a strip of tire tread with opposed continuously straight lateral edges cut from the central treaded periphery of an abandoned tire carcass of a width extending between and excluding opposing tread shoulders that carry a pre-disposed downwardly directed bias thereby producing a relaxed structural strip member disposed to lie unstressed in a flat configuration upon an adjacent flat surface.

7. The structural building member of claim 6 having an adhesive substance on a mounting surface for retaining the building member firmly in place upon an adjacent substantially flat surface.

8. A laminated assembly of a plurality of said structural building members in claim 6 adhered together surface to surface into a multi-layered unit.

9. A rumble strip system comprising a plurality of the structural building members defined in claim 6 having the strips of tire tread secured in a pattern on a driving surface as a warning system for emitting acoustical signals to a vehicle driver overrunning said pattern for indicating a special road location, said straight lateral edges providing a tough, resilient, long-wearing edge profile of a thickness that produces said acoustical warning signal when encountered by the overruning tires of a moving vehicle.

10. The rumble strip system of claim 9 having the structural building members firmly affixed by an adhesive substance to said driving surface.

11. The rumble strip system of claim 10 wherein said adhesive substance is a pressure sensitive material firmly adhered to said driving surface.

12. The rumble strip system of claim 10 wherein said adhesive substance has a peel adhesion factor that permits non-destructive release of the tire tread strips from said driving surface for reuse.

13. The method of adhering a system of a plurality of elongated rumble strips in a pattern upon a substantially flat roadway driving surface for providing an acoustic warning of a special road condition to a moving car driver driving over the adhered rumble strips, comprising in combination the steps of:

cutting a longitudinal strip of tread having a tread side and opposed casing side from a reclaimed tire of appropriate length and thickness to serve as at least a longitudinal portion of one of said elongated rumble strips,

preparing a pattern upon the roadway driving surface for receiving adjacent thereto of the casing side of said rumble strips comprising the step of cleaning and smoothing the driving surface pattern to produce substantially flat contiguous surfaces at the roadway surface and the casing side of said strips of tread,

preparing the casing side of said rumble strips for receiving an adhesive layer for affixing the rumble strips securely to the driving surface in said pattern,

securing said adhesive layer to said casing side of the rumble strips for securely affixing the rumble strips in a position in the driving surface pattern to thereby withstand normal wear and tear of vehicle tires passing over the rumble strip system, and

affixing the rumble strip adhesive layer to the driving surface pattern.

14. The method of claim 13 further comprising the steps of applying said adhesive as a pressure sensitive substance to the casing side of the rumble strips, and affixing the adhesive layer to said roadway surface by applied pressure is said step for affixing the layer to the driving surface pattern.

15. The method of claim 14 further comprising the steps of applying said adhesive layer of a characteristic peeling factor permitting non-destructively removal of the rumble strips from the roadway surface pattern.

* * * * *