March 6, 1956 C. U. GRAMELSPACHER 2,737,092

RUBBER-COATED PLYWOOD FOR ROADBED ON HIGHWAYS

Filed July 19, 1952 2 Sheets-Sheet 1

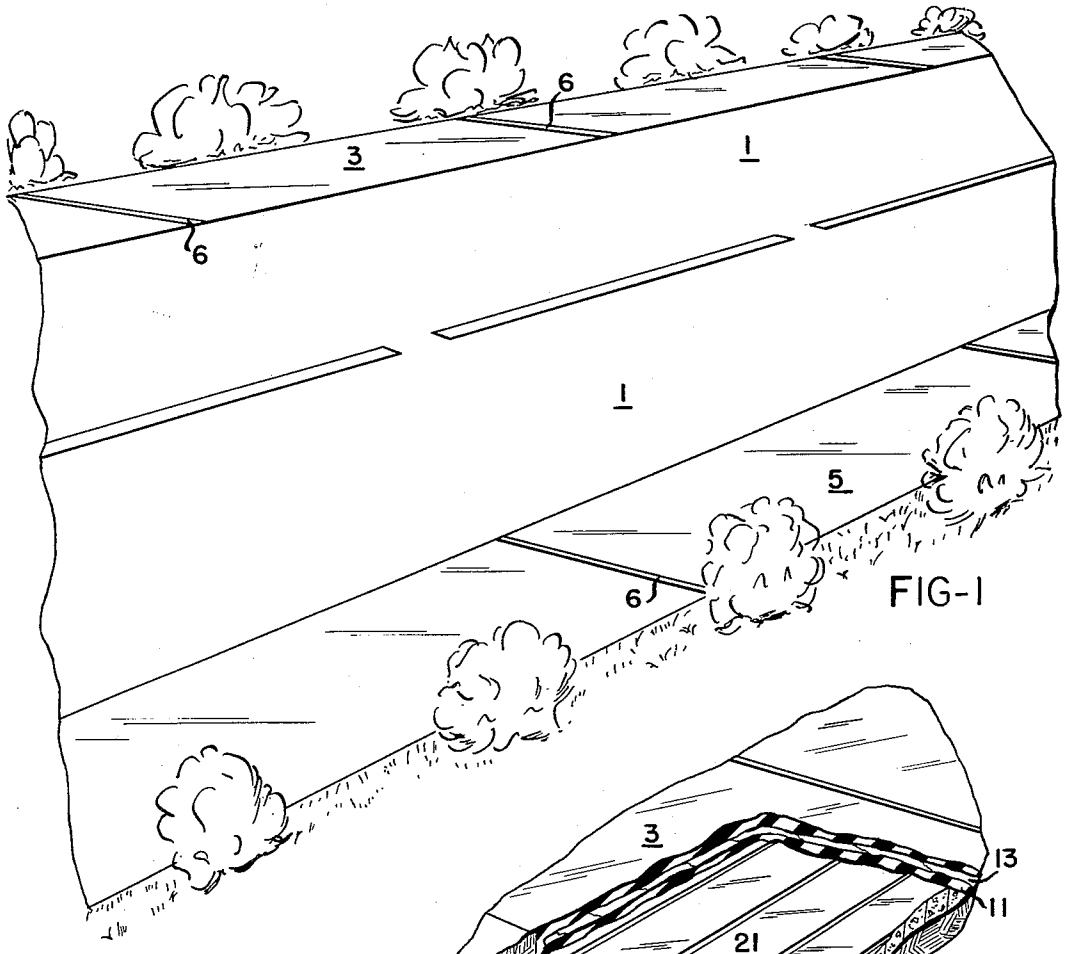
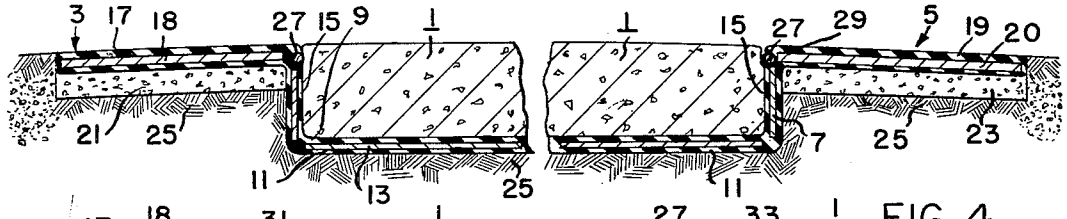


FIG-1

FIG-5

FIG-2



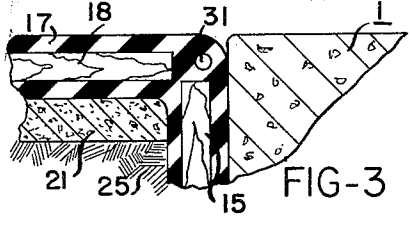


FIG-3

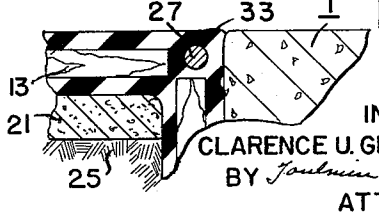


FIG-4

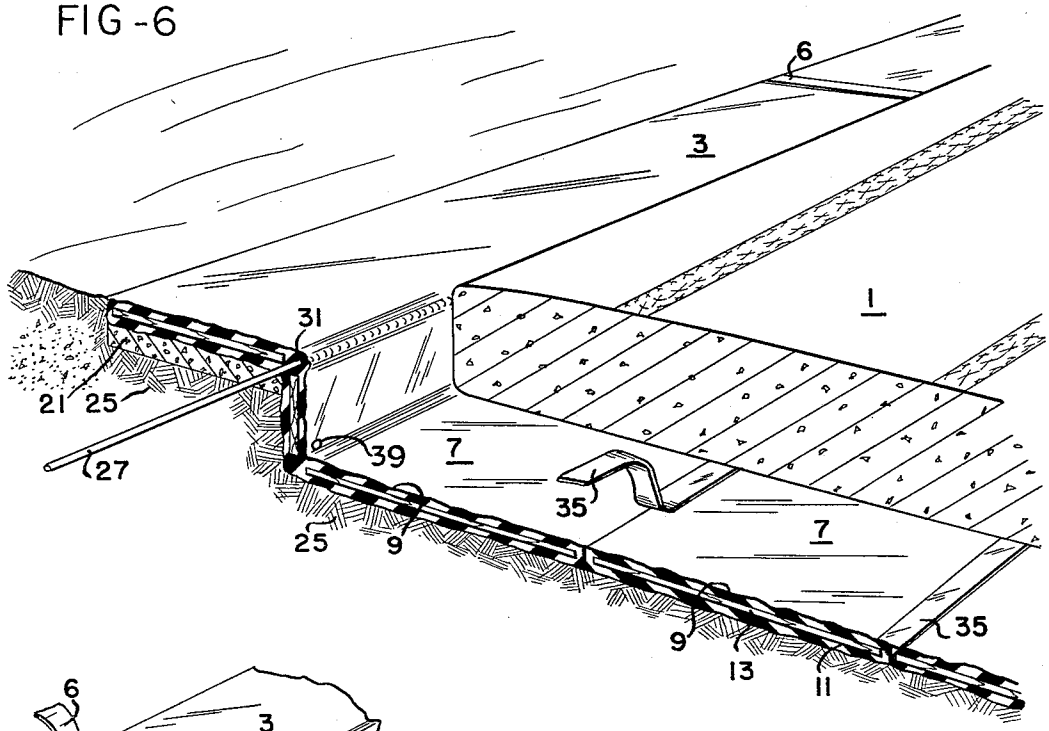
INVENTOR
CLARENCE U. GRAMELSPACHER
BY Paulmin & Paulmin
ATTORNEYS

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FIG-6



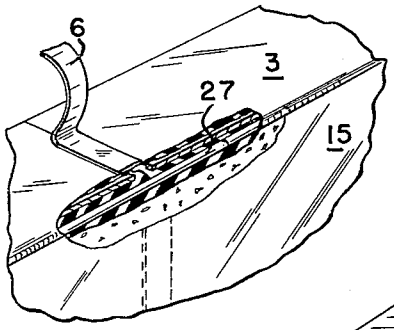


FIG-7

FIG-8

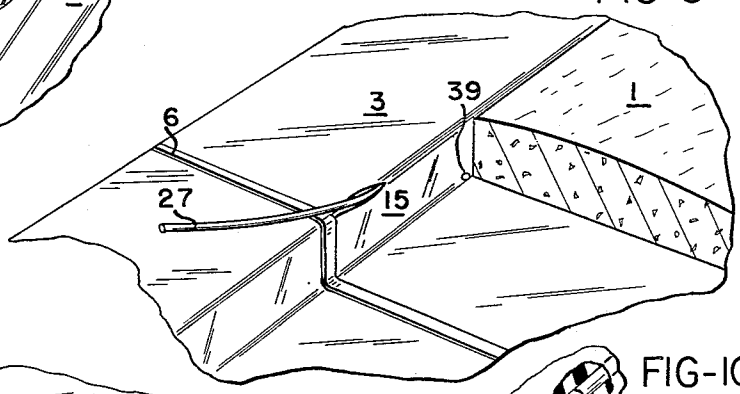


FIG-9

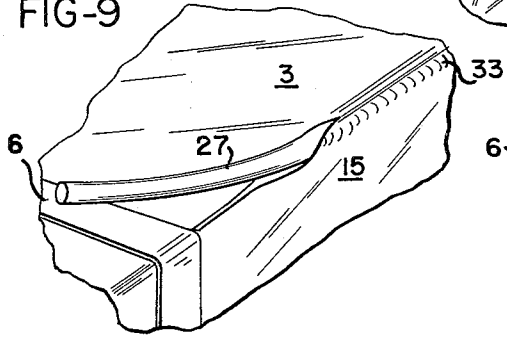
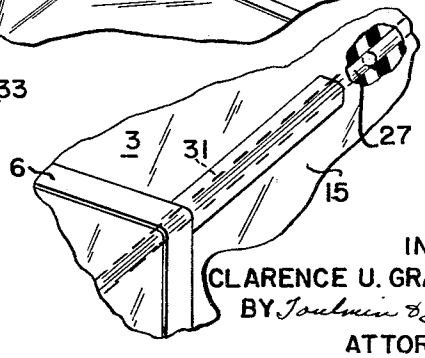


FIG-10



INVENTOR
CLARENCE U. GRAMELSPACHER
BY Toulmin & Toulmin
ATTORNEYS

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RUBBER-COATED PLYWOOD FOR ROADBED ON HIGHWAYS

Clarence U. Gramelspacher, Jasper, Ind.

Application July 19, 1952, Serial No. 299,858

3 Claims. (Cl. 94—4)

My present invention relates to roadbeds, for example highway roadbeds, and also contemplates a new and useful shoulder for highways.

Generally speaking pavements and bases for highways are divided into the broad classifications of "flexible" and "rigid." The latter term is most usually applied to those structures which consist of Portland cement concrete, the theory in this respect being that the concrete possesses considerable flexural strength which permits it to act as a beam. The terminology "flexible" as applied to a pavement structure embraces substantially all other types which include as primary components a wearing surface layer, a base layer and a subgrade layer; with this latter pavement type distortions occurring in the subgrade or base layers are reflected in each of the other layers and the tendency is for all layers of the structure to conform to the same shape under loading.

With roadbeds of either type the subgrade and base are of fundamental importance in the construction of adequate roadways since they support the pavement load and efforts have been made to overcome defects associated therewith. Primary among the problems are those associated with frosting and pumping, the latter being particularly important in connection with concrete pavements.

Frost action results in very severe damage to bases and subgrades of both the rigid and flexible pavements and is occasioned by the existence of freezing temperatures in these areas. In many instances the pore water of the base or subgrade is supplemented, after freezing, by the attraction thereto of additional water through means of capillary forces as well as seepage, and the resulting expansion in volume upon complete freezing of the water induces a severe roadway upheaval. Preventive measures for this destructive action have included the removal of soils which are particularly subject to frost action and the replacement thereof with granular materials to the frost line depth or greater. These expedients are costly and frequently ineffective particularly in the presence of relatively shallow water tables.

Pumping and/or subgrade failure, is evidenced in connection with concrete pavements by spalling primarily at joints, resulting in the ejection from the joints and cracks formed, of water, subgrade soil and mud, and ultimately complete breaking of the roadway structure takes place. The formation of cracks in the pavement also permits seepage of surface waters to the subgrade resulting in the further erosion of the same, finally deteriorating the subgrade to the point where it is incapable of sustaining the required traffic loads, also thereby causing breaking up of the roadway or pavement. To inhibit this end result it is necessary in maintenance of the road to continually seal all cracks as they occur and in the case of severe deterioration to drill holes in the road and thereafter force suitable materials in slurry form through the holes to the subgrade, to fill the openings between the subgrade and pavement bottom. This constant

maintenance problem is highly undesirable and wasteful and in the net only prolongs for a short period the time within which the roadway must be completely replaced.

It is a primary object of this invention to provide a new and superior roadbed structure.

It is a particular object of this invention to provide a roadbed structure which prevents undesired seepage and thereby hinders road destruction by freezing action.

It is an important object of this invention to provide a roadbed structure which is not susceptible to the effect of "pumping."

It is also within the contemplation of this invention to provide in association with a roadbed structure a new and novel roadway shoulder.

It is further within the contemplation of this invention to provide a novel sealing relation between the roadbed structure and shoulder.

These and other allied objectives are attained by providing on a uniform subgrade foundation a roadway support comprising a plywood slab having at least one surface thereof covered with rubber. Preferably to completely insure of moisture proofness the plywood is embedded in rubber. This composite slab is laid across the foundation and is adapted to receive thereon the concrete or other road material forming the upper roadway.

The rubber composition is not critical but should be of the soft variety and may be compounded to have a high degree of abrasive resistance similar to those compositions customarily employed in conveyor belting.

The plywood has definite advantages in this structure over other materials such as the metals. First of all it has a high tensile strength per unit weight factor equal or superior to the common metals. Normal birch or beech plywood for example has a factor of about 19,700 while high density plywood exhibits a factor of about 29,400. In contrast thereto aluminum of an ultimate tensile strength of 40,000# has a factor of 14,200, while heat treated steel of an ultimate tensile strength of 100,000 has a factor of only about 12,900.

Secondly, plywood has a high stiffness factor, spruce and birch exhibiting coefficients of 416 and 178 respectively, while aluminum and steel are respectively 22 and 3.1.

In addition to these favorable characteristics the number of plywood constructions available is exceedingly large and a ready selection of wood, ply angular arrangement of adjacent layers, type of adhesive and so forth may be selected for specialized service conditions.

The composite slab may be formed by simply laying down a suitable thickness of unvulcanized rubber plies, placing thereon the plywood and covering the whole with another thickness of rubber; thereafter the rubber may be cured to completely enclose and seal the plywood. The preferred structural arrangement of the plywood with respect to the rubber will be discussed in more detail hereinafter.

The roadbed structure is itself positioned below the roadway and is provided with sidewalls which extend upwardly to the roadway. In one embodiment of the invention shoulders, which also are of the same rubber-plywood composite, extend laterally of the roadway. These shoulders extend over a firm foundation but are in themselves sufficiently flexible to cause, under the applied weight of a vehicle moving thereon, a breaking up of ice formations, thus providing a skidding preventer. Further, even when the shoulder is wet, skidding will be inhibited since the rubber of the shoulder is engaged by the rubber of the tire providing a high traction.

In order to insure of good sealing between the rubber-plywood sidewall and the concrete of the roadway rod

means which will be more particularly described hereinafter, are provided to expand the rubber into contact with the concrete to prevent ingress of moisture.

Summarizing, a roadbed structure is provided which is of adequate strength to resist applied loads, and at the same time provides surfaces in contact with the soil which have the double function of resisting moisture and conforming intimately to the soil contour.

The invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

Figure 1 is a perspective view of a roadway embodying the features of this invention;

Figure 2 is a cross-sectional view of the roadway of Figure 1 having a central portion omitted;

Figure 3 is an enlarged view of the left hand portion of Figure 2 with the rubber expansion rod means omitted;

Figure 4 is an enlarged view of the left hand portion of Figure 2 including the rod means;

Figure 5 is a view partially in section of the left hand end of Figure 2 with a portion of the rubber cut away;

Figure 6 is a perspective view partially in section illustrating the makeup of the roadway including the rod sealing means;

Figure 7 is a perspective view partially in section illustrating the position of the rod sealing means;

Figure 8 is a perspective view illustrating the sealing together of adjacent composite rubber plywood sections and the relation thereof to the rod sealing means;

Figure 9 is an enlarged view of the rod sealing means similar to Figure 8 and indicating a manner of passing the rod sealing means into the rubber; and

Figure 10 is a view partially in section indicating the rod sealing means positioned beneath the sealing strip for adjacent sections.

Referring to the drawings there is shown in Figures 1, 2 and 3 a roadway which embodies the principles of the present invention. In Figure 1 there is shown a roadway having a pavement **1** and shoulders **3**, **5** across which extend sealing strips **6**. As shown more clearly in Figure 2 the pavement **1** is positioned on a road structure support indicated generally at **7** and comprising an upper layer of rubber **9** in contact with the pavement and a lower layer of rubber **11** in contact with the subgrade. Positioned between the layers of rubber is a plywood sheet **13** which may extend across the full width of the roadway or may be sectioned as desired; this sheet, as shown, is of substantially the same thickness as the rubber.

Walls **15** extend upwardly from the base of the roadway structure on either side thereof and similar to the base comprise a plywood sheet embedded in rubber. Extending from the upper portion of the side walls are shoulders or aprons **3**, **5**, consisting of rubber **17** and plywood **18** which may be identical to the plywood and rubber employed in the base or may vary therefrom to suit particular conditions. Similarly, rubber **19** and plywood **20** need not be of the same composition as the base, but under normal service requirements the aprons or shoulders and the base will be an integral unit having the same composite structural arrangement.

The shoulders **3**, **5** are each respectively supported on concrete blocks **21**, **23** which provide a firm foundation. Each of the blocks **21**, **23** and the base portion of the roadway structure are supported as at **25** on a subgrade which preferably consists of gravel or closely compacted earth to the shape of which the lower rubber layer readily conforms.

As shown in Figures 3 and 4 the rubber is formed at the upper portion of the walls with a longitudinal opening therein at **31** and a rod **27** (Figures 2 and 4) during assembly is inserted into this opening, whereupon a bulge is caused to appear in the rubber as at **33**, firmly sealing the rubber against the pavement **1**.

Referring now to Figure 6 it will be noted that the roadbed structure **7** may, if desired, be formed in two or more portions, in which case a rubber sealing strip **35** is provided across the joint of the portions to insure of the elimination of moisture from the structure. This rubber sealing strip, as is well known, may be provided with a cement and the surfaces **7** at the joints may be roughened to receive the cement and sealing strip.

Referring to Figures 6 to 10, inclusive, it will be noted that each section of roadway support is secured to an adjoining section in a water-proof manner through means of sealing strips **6** which extend laterally of the roadway and are similar to sealing strips **35** provided on the roughened surface of the roadway structure utilizing cement to effect tight sealing.

The sealing rod **27** may, after the concrete is poured on the roadway support and has set, be inserted into the rubber as indicated in Figure 6 by simply pressuring or hammering the rod **27** into the opening **31**. In some instances in order to provide for the insertion of the rod it may be necessary, as shown in Figures 7 to 10, inclusive, to slit the rubber slightly to provide for the initial insertion. After such slitting and insertion of the rod, as indicated particularly in Figure 9, the rubber may be resealed as indicated in Figure 10.

In producing the roadway of invention the soil forming the subgrade, whether it be silt or granite, should be first compacted and then the roadway **7** including the side walls **15** laid thereacross. The various sections of roadway may then be secured together as required by the sealing material **35** and sealing material **6**. As the sections of roadway support are laid the concrete may be poured, utilizing the normal steel forms of the industry as required.

When the roadway is laid in sections as indicated in Figure 6 the steel rod **27** may be driven into the opening **31** immediately after pavement **1** has set. The rod **27** may be completely driven into the opening in such manner that the next section of roadway may be abutted against the first section. In this instance the sealing strip **35** would then be continued on to the second section and the process repeated.

Alternately, as shown in Figures 6 to 10, inclusive, the sections of roadway support may be first formed together including the longitudinal and lateral sealing strips. Thereafter a portion of the pavement is formed as indicated at **1** in Figure 8 and then a slit is made in the rubber between the apron **3** and side wall **15** to permit the entrance of rod **27** which is hammered into position, thereby bulging the rubber of the support against the pavement and to effectively seal the same against the entrance of moisture.

Where the roadway is to have rubber shoulders or aprons it is preferable, after formation and compacting of the subgrade, to lay the cement supports **21**, **23** into position before proceding with the placing of the roadway supports **7**.

As will be noted in Figure 6 there is shown at **39** drainage openings which permit any slight amount of moisture which may seep into the structure to be drained therefrom without danger of moisture entering from the subgrade.

It will thus be noted that there has been provided a novel type of roadway structure which prevents the entrance of moisture to the pavement portion of the roadway and thus protects the same against the erosive influences of such moisture. Further the support is of relatively light weight, high strength and great durability and when employed in conjunction with an adequate subbase will have long life without material maintenance costs. The shoulders of rubber, which may or may not be employed, offer an excellent safety factor under all types of weather conditions, since due to the flexibility of the rubber, ice will readily break up thereon under the stress of an applied load and the normal high friction between rubber to rubber surfaces will be attained by rubber tired vehicles in all kinds of weather.

It will be understood that this invention is susceptible to modification in order to adopt it to different usages and conditions and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. A moisture-proof roadbed comprising a roadbed support having a base and lateral walls each consisting of plywood embedded in rubber, said walls each having a tubular opening in the rubber thereof extending longitudinally of the walls, a pavement supported on said base, means suporting the lateral walls of the roadbed supports, and rigid means in the openings of the wall of a greater dimension than the openings extending longitudinally of the roadbed and embedded within the rubber expanding the rubber of said lateral wall into contact with said pavement thereby sealing the same.

2. A roadway comprising a subgrade, a roadway structure supported on said subgrade, said structure comprising a series of composite base slabs, each said slab comprising plywood and rubber coverings encasing the plywood, the base slabs being sealed together in end to end relation, a pavement of greater thickness than said base slabs supported on the slabs, the slabs having upstanding side walls in sealed relation with the pavement laterally and extending to the upper surface of the pavement, the plywood of the side walls and the plywood of the base slabs being separated by a rubber portion extending from the base slabs to the upstanding side walls and joining the same, the side walls having extensions laterally from the upper edge thereof substantially on a level with the surface of the pavement shoulders, said rubber portion contiguous with the surface of the pavement shoulders being sealed by means expanding said rubber portion thereagainst to thereby prevent the entrance of moisture, lateral extensions comprising a composite slab of plywood embedded in rubber and of substantially the same thickness as the base slabs, and means beneath the shoulders rigidly supporting the same.

3. A moisture proof road bed comprising a road bed support having a base and lateral walls consisting of plywood embedded in rubber, said walls each having a tubular opening in the rubber thereof extending longitudinally of the walls, a pavement supported on said base, means supporting the lateral walls of the road bed support, and rod means in the openings of the walls of a greater dimension than the openings extending longitudinally of the road bed support, embedded within the rubber, and expanding the rubber of said lateral walls into contact with the said pavement thereby sealing the same.

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