Dec. 15 1925. 1,565,682

C. M. STRAHAN

COMPOSITE PAVEMENT OR ROADWAY AND METHOD OF CONSTRUCTING THE SAME

Filed March 7, 1923

Fig. 1.

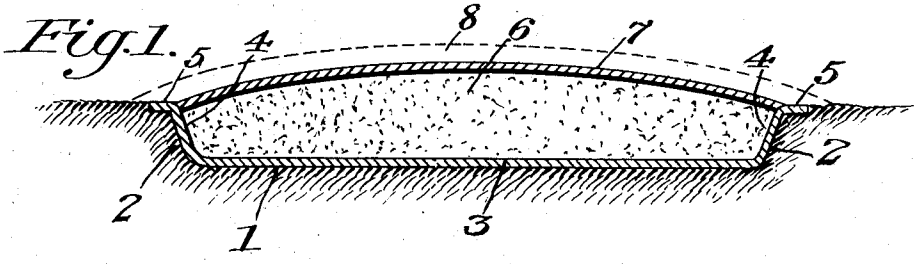


Fig. 2.

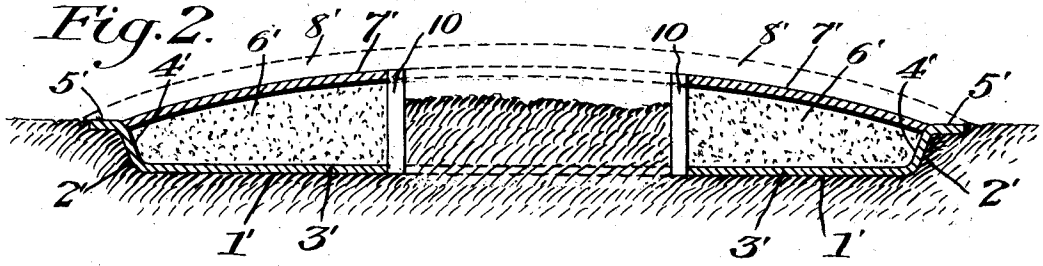


Fig. 3.

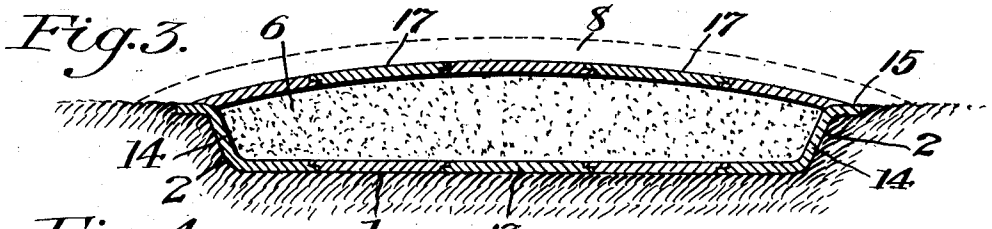
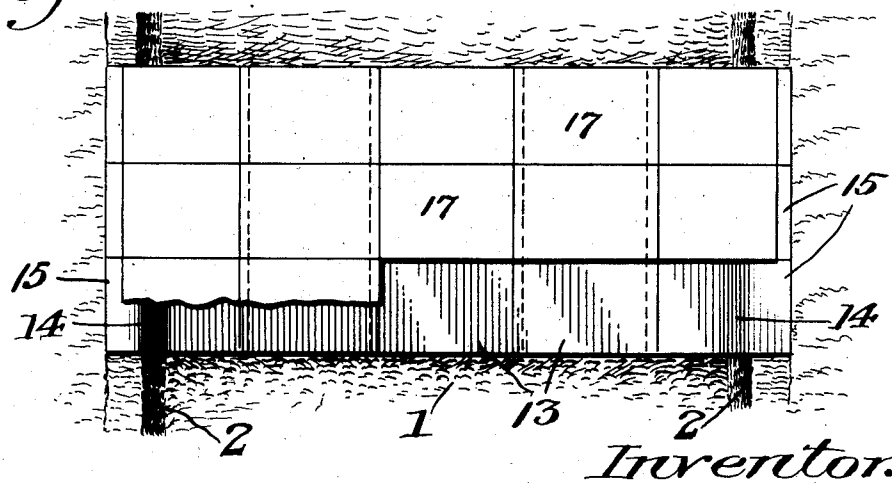


Fig. 4.



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Patented Dec. 15, 1925. 1,565,682

UNITED STATES PATENT OFFICE.

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COMPOSITE PAVEMENT OR ROADWAY AND METHOD OF CONSTRUCTING THE SAME.

Application filed March 7, 1923. Serial No. 623,481.

To all whom it may concern:

Be it known that I, CHARLES M. STRAHAN, a citizen of the United States, residing at the city of Athens, in the county of Clarke, State of Georgia, have invented certain new and useful Improvements in Composite Pavements or Roadways and Methods of Constructing the Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to a new and useful form of pavement, roadway, or similar structure, and to the novel method of constructing the same, the object being to produce a construction of the character indicated that is comparatively cheap to construct and maintain, and that when constructed in accordance with the prescribed method, from a wide range of comparatively cheap and abundant materials, will possess to an unusual degree the desirable qualities or characteristics of durability, resiliency, strength and stability, under the most severe conditions of traffic or loading, and will also be waterproof and immune to the deteriorating effects of varying climatic conditions.

To these ends, the invention comprises the application, either in the foundation or base structure, of a road, sidewalk, pavement, or similar structure, or in the main body portion of such structure, of one or a series of associated hollow cellular units or elements composed of waterproof material, preferably in sheet-like or slab-like form, constituting the bottom, sides and top of the cellular construction, the interior of the cellular unit or units being supplied with a properly assembled or compacted filling mass, which latter may consist of earth or earthy materials, mineral aggregate, or any of the materials commonly employed in the building or fabricating of similar constructions.

Typical examples of the application of the invention are illustrated in the accompanying drawings, in which,—

Fig. 1 is a vertical cross section through a roadway involving the cellular construction;

Fig. 2 is a similar view showing a modified form of application of the invention;

Fig. 3 is a similar view showing a further modification;

Fig. 4 is a plan view of the modification shown in Fig. 3.

As illustrated in the drawings, the basic principle of the invention is the provision and construction of a substantially waterproof and resilient cell or cells, either underlying or including the travelled surface of the road, pavement or the like, which by reason of the inherent properties or characteristics thereof, will effectively resist and distribute the impacts and stresses to which roads and pavements and similar structures are commonly subject, and which, by reason of the particular type or character of the material used as the filling mass for the cell or cells, will endure and more effectively resist the normal wear and tear of traffic and the widely varying weather and climatic conditions.

Referring to Fig. 1 of the drawings, which illustrates the simplest method of constructing a roadway, the procedure is as follows:—A trench or excavation is prepared on the site of the roadway, preferably for the full width of the latter, and of any desired or convenient length, and of such depth that the maximum unit weight and volume of the anticipated traffic, or the special nature and exposure of the immediate subgrade of the road may require. The bottom of the trench is made smooth, and, if necessary, compacted, and the sides 2, which are preferably inclined, are similarly prepared, the upper portion of the latter terminating in horizontal shoulders. If desired, the bottom may be finished to any desired crown or shape. After the trench or excavation has been thus prepared, a coating or layer of waterproof material is applied to the entire interior surface of the trench, including the bottom, sides, and the lateral shoulders. In the preferred form of the invention, this waterproof material is in the form of relatively heavy bitumen or

asphalt, which may be applied to the trench by any of the well-known and accepted modes of distributing these materials to roadways, the character and quantity of the applied layer being such that the latter will form a semi-plastic, resilient, waterproof envelope of a definite and substantially uniform thickness, comprising a bottom covering section 3, side covering sections 4, and sections 5 overlying the lateral shoulders. If desired, any other suitable material may be substituted for the bitumen or bituminous mixture, provided such other material possesses the necessary qualities of being waterproof, and having sufficient strength to support the superposed road structure and the traffic to be borne by the latter. When the covering for the interior of the trench is of heavy bitumen, or a bituminous mixture such as is commonly employed in road building, after the application of the material to constitute a lining for the whole interior of the trench, a thin layer of soil, sand or other loose, finely divided material is spread over the surface of the lining, and the latter is compacted by means of a roller or other appropriate implement, to consolidate the lining into a continuous and impervious sheet.

The interior of the cellular unit, constituted by the lined excavation, is then supplied with a suitable filling mass 6, which may be of any desired character or quality of material, capable of being compacted, and consolidated into a solid and elastic or semi-elastic body possessing the necessary strength and resilience to meet the traffic conditions to be imposed upon the ultimate surface of the roadway.

Because of the fact that the filling mass is never directly subjected to the wheels of traffic or the loads supported by the roadway, pavement, or other structure, or to the effects of moisture and varying weather conditions, it has been found that many different types of materials heretofore regarded as wholly unsuitable for permanent road constructions may be employed as the filling mass for the cellular units. For example, the cell may be filled with earthy material such as ordinary soils or mixtures of soil ingredients including loams, clays, sands and the like, which should be charged with sufficient moisture or other binding medium so that, when the mass is compacted, as by rolling, tamping or other mechanical means, it may be readily brought to a uniform, firm, strong, cohesive body entirely filling the cell, with the surface of the mass worked up to the desired crown, or level, as the particular character of the construction may require. Obviously, if other types or characters of filling material, such as broken stone, mineral aggregate, gravel, slag or the like, are available, or found to be desirable, they may be employed, provided they are in proper condition to be compacted and consolidated into a uniform, firm, strong, cohesive mass. When finely divided earthy material is employed, or when the larger aggregates or mixtures of filling materials associated with binding media, are used, sufficient time is allowed for the filling to dry out, or set up, after which a covering layer or sheet 7, preferably of the same material as employed in the lining of the trench, is applied to the surface of the filling mass, and united to the sides 2 of the lining by an impervious or water-tight joint. In case the covering sheet or layer 7 is in the form of a heavy bitumen or bituminous mixture, the sealing of the joint between the edges of the cover sheet and the lining of the trench will be effected automatically, provided care is taken to clean the portions of the trench lining with which the edges of the cover sheet 7 engage, so that the edges will coalesce and form an integral union with the lining. If the material of the cover sheet 7 is of such a character that it will not effect an automatic seal with the lining sheet, a hermetic joint or closure between the engaging portions of these elements may be effected by means of a bituminous or asphaltic cement poured into the interstices, and covering the lines of jointure.

Obviously, the cover sheet 7 may also constitute the ultimate surface or wearing course of the roadway, sidewalk, or other structure, in which event the said cover sheet 7 will be made of proper materials to effect this object, and still preserve the waterproof character of the cover sheet and the joint between the latter and the lining of the trench; for example, the entire cover sheet may consist of an ordinary asphaltic mixture such as is commonly employed in surfacing roadways. In many cases, however, it will be found desirable to apply a separate wearing course, such as 8, to the surface of the cover sheet 7, and obviously this wearing course may take any desired or appropriate form, depending upon conditions of use.

When thus constructed, it will be noted that each given section of roadway comprises a unitary, hollow, cell-like structure, with a complete envelope of waterproof and weatherproof material, which completely seals the compacted lower supporting filling mass from access of moisture, and therefore protects the latter against the effects of changing weather conditions, and constitutes a strong, durable, resilient, wear-resisting roadway, that will not be adversely affected by even the most extraordinary traffic conditions, or by extreme variations in temperature conditions due to the weather or climate.

Moreover, a very important consideration

in connection with the instant invention is the fact that the employment of the substantially waterproof, flexible, resilient cell or cells, makes possible the wholly satisfactory and economic employment of many natural soils or mixtures of soil ingredients, such as loam, sand, clay, fine gravel, weathered rock, loose mineral aggregate, and other natural or artificial material in subdivided condition, which, because of inherent structural weakness, friability, or susceptibility to disintegration, have heretofore rendered them wholly inapplicable to the construction of permanent roadways and similar enterprises. It has been long recognized that many soils containing clay, sand, gravel and the like were well adapted to road building purposes, provided a suitable binding medium is employed, either in the form of moisture or in the form of various chemical solutions, natural asphalts, oils and the like, but when so employed, such materials suffer from direct abrasion of vehicular traffic, are softened by rains and loosened by frost, so that they very quickly become unserviceable under such adverse conditions. This variable behavior, however, of these particular road-building materials, and of many other materials heretofore regarded as wholly unavailable for road-building, is completely compensated or obviated by enclosing the materials in the waterproof, weatherproof, cellular units, as hereinbefore described.

Experience has also demonstrated the desirability in road beds, pavements, and the like, of those types of construction and character of materials which will supply not only inherent strength against pressure, abrasion, impacts and climatic forces, but which also present and possess the properties of ample mass and weight, and such resiliency and recovery under stress as are included in the terms "elasticity, flexibility, cohesiveness, cushioning, springiness and the like", which conditions not only make for stability and durability of the roadway, but tend to prolong the life of vehicles and improve the conditions of travel. A roadway constructed in accordance with the present invention possesses all of these qualities and characteristics to an extraordinary degree.

It is frequently found desirable to construct or repair a roadway without suspending traffic thereover, and under such conditions, the instant invention is particularly effective. An application of the invention to this type of construction is illustrated in Fig. 2. Instead of excavating the entire site of the road bed, only one or more longitudinal sections thereof are excavated in trench-like form, such, for example as the two lateral sections illustrated in Fig. 2, leaving the central section intact and open to traffic. Each of the lateral trenches is finished as to the bottoms 1′ and the sides 2′ thereof, as was the case in the previously described application of the method of construction. Each of these lateral trench sections has then applied to the bottom and side thereof a coating of waterproof material represented by the sections 3′, 4′ and 5′. Preferably, suitable plates or partitions 10 are set up longitudinally of the roadway to define the inner walls of the lateral trenches and to support the unexcavated central portion of the old road. After the lining has been applied to each trench section, a suitable filling mass 6′ is applied to completely fill each trench section, and after the latter has been properly consolidated and the surface worked to the desired contour, the cover sheets 7′ are applied to the surface of each of the filling masses, and the edges of said sheets united to the lining sheet by means of an impervious joint. If desired, a wearing course 8 may be applied to each of the lateral road sections. The middle section is then excavated, and the bottom and end walls provided with a coating similar to that applied to the other sections, the division plates or partitions 10 being removed, and an amount of the filling mass sufficient to bring this section of the roadway up to desired grade is supplied to the lined excavation, this middle filling mass being consolidated with the similar masses in lateral sections by pressure. The middle section of the cover sheet 7′ is then applied, and the surface course, if such is employed, added to complete the entire structure of the roadway. In effecting the union between the sections of the trench lining and the sections of the cover sheets, it is highly essential that the joints be made wholly waterproof, and if the character of the materials employed is such as not to produce this effect automatically, the joints may be sealed by means of asphaltic or bituminous cement or other suitable binding medium.

Instead of applying the lining of the trench and the cover sheet in situ, the latter may be furnished in the form of pre-cast or formed sheets of suitable material, that may be applied in the manner indicated in Figs. 3 and 4. For example, the lining sheets and the cover sheets 13 and 17 may be made of bituminous or asphaltic materials or mixtures, either with or without metallic reinforcements, preferably in rectangular form and having mitered or recessed edges to form overlapping joints where the sheets meet. Such sheets may be made up at any convenient place, transported to the roadway, and laid in position indicated in the drawings, the lining sheets being first laid to cover the surface of the trench, the sheets along the edges being bent, as at 14, to conform to the trench walls and the shoulder. The joints between the

contiguous sheets are then sealed by a suitable cementitious or binding medium, such as bitumen, asphalt, or similar materials. The filling mass 6 is then applied, as hereinbefore described, and the cover sheets 17 laid over the same, the joints between the sheets properly sealed to exclude air and moisture, and the joints between the lateral sheets and the lining similarly hermetically sealed. If desired, in this particular adaptation of the invention, the cover sheets 17 may be made of suitable material, and of the necessary thickness, strength, durability, and wearing qualities, to constitute the ultimate surface of the roadway, or, as indicated, the associated cover sheets 17 may be employed merely as the top sealing element for the substructure or base of the roadway, and a wearing coat 8 of any appropriate character applied thereto.

It will be understood by those skilled in the art that the number, form, character, and arrangement of the cellular units may be varied within wide limits to accommodate the varying conditions of road construction. Obviously, under certain conditions, relatively long sections of the roadway may include a single cellular unit in which the filling material is completely encased in the waterproof and weatherproof envelope, or the entire roadway, or any portion thereof, may be subdivided into multiple cellular units longitudinally or transversely disposed, or the subdivision extending both longitudinally and transversely of the roadway.

While the invention is well adapted to the employment of standard road building materials, such as mineral aggregate, gravel, sand, asphalt, bitumen, and various mixtures of these materials, the invention will find a particularly efficacious and economical application in localities where these high-grade materials are not available, but which afford an abundant supply of inferior material, such as soil, or earthy materials, that have not heretofore been regarded as suitable for construction of permanent roadways, but which may be employed, according to the present invention, as the filling mass when properly treated and applied and enclosed within waterproof and weatherproof cellular unit or units.

What I claim is:

1. The method of constructing roadways pavements and the like which comprises forming hollow cellular units with closed sides and bottoms in the body of the road structure of waterproof cementitious material in sheet-like form, packing the cellular units with a filling material, and applying a cover of waterproof material to the cell units.

2. The method of constructing roadways pavements and the like which comprises forming hollow cellular units with closed sides and bottoms in the body of the road structure of waterproof cementitious material in sheet-like form, packing the cellular units with a filling material, applying a cover of waterproof material to the cell units, and cementing the cover to the cell walls to form water-tight joints between the cover and the walls.

3. The method of constructing roadways pavements and the like which comprises excavating the site of the road to the desired width and subgrade, lining the bottom and the sides of the excavation with waterproof sheeting of cementitious material, packing the lined excavation with filling material to the desired surface grade, applying a cover of waterproof sheeting to the surface of the filling and the sides of the lining, and uniting the cover to the sides with water-tight joints.

4. The method of constructing roadways pavements and the like which comprises excavating the site of the road to the desired width and subgrade, lining the bottom and sides of the excavation with waterproof sheeting of cementitious material, consolidating and compacting the lining by pressure, packing the lined excavation with filling material to the desired surface grade, applying a cover of waterproof sheeting to the surface of the filling and the sides of the lining, and uniting the cover to the sides with water-tight joints.

5. A roadway pavement or the like comprising a base or foundation of a cell-like form having imperviously united bottom and side sections of waterproof material, a filler of suitable material packed in the cell-like formation, and a covering of waterproof material applied to the surface of the packing and sides of the lining to form water-tight joints with the latter.

6. A roadway pavement or the like comprising a base or foundation of cell-like form having imperviously united bottom and side sections of waterproof material, a filler of suitable material packed in the cell-like formation, a covering of waterproof material applied to the surface of the packing and sides of the lining to form water-tight joints with the latter, and a wearing course superposed on said covering.

7. A roadway pavement or the like comprising a base or foundation course including multiple hollow cellular units having bottom and side sections of waterproof material, a filling mass compacted within each cellular unit, a waterproof covering for the cellular units overlying the filling mass and hermetically united with the sides of the units, and a surfacing or wearing course superposed on said covering.

8. As a component element of the structure of roadways and the like, a hollow cellular unit having its bottom, sides and top

formed of waterproof material and the joints between the parts hermetically sealed.

9. As a component element of the structure of roadways and the like, a hollow cellular unit having its bottom, sides and top formed of a self-sustaining elastic waterproof material and the joints between the parts hermetically sealed.

10. As a component element of the structure of roadways and the like, a hollow cellular unit having its bottom, sides and top formed of bituminous material and the joints between the parts hermetically sealed.

In testimony whereof I affix my signature.

CHARLES M. STRAHAN.