UNITED STATES PATENT OFFICE.

GEORGE C. WARREN, OF NEWTON, MASSACHUSETTS.

PAVING COMPOSITION AND METHOD OF MAKING IT.

1,164,041. Specification of Letters Patent. Patented Dec. 14, 1915.

No Drawing. Application filed September 9, 1911. Serial No. 648,575.

To all whom it may concern:

Be it known that I, GEORGE C. WARREN, citizen of the United States, residing at the city of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Paving Compositions and Methods of Making Them, of which the following is a specification.

This invention relates to shell roadways, and has for its object to provide a bituminous binding or cement for incasing particles of shell in a peculiar manner so that when the mixed material is applied as a roadway the shell or particles of shell will overlap each other approximately horizontally and the said particles of shell will be separated from one and another by the bituminous material so that the roadway will have a suitable amount of resistance to traffic and the surface will be hard and resilient without being slippery.

As is well known shell roads at the present time are exceedingly dusty and grind away rapidly under the traffic, the small particles being displaced by automobiles and vehicles and even by light winds. The removal of such particles opens spaces between the individual shells or pieces of shell, thereby forming pockets which collect moisture, etc., and the disintegration of the surface portion of the road rapidly progresses.

In the use of the present invention, particles of shell are freed from shell dust, are mixed with sand or gravel and this aggregate is mixed with a bituminous material which holds the particles of the aggregate firmly in position, preventing them from grinding and turning and presenting new surfaces. The mixed material is water-proof and thereby readily sheds the water and prevents the same from soaking into the body of the road and disintegrating the same.

It has been discovered that economical and successful roadways can be constructed by using a mineral aggregate of crushed stone or similar material which is bound and cemented together by a bituminous cement, but not so with shell in its natural state, for the reason that shell possesses peculiar characteristics and is of such contour or shape that it must be especially prepared before it is incorporated with the binding material. Shell, oyster and clam shell, is laminated in its texture and if this shell is broken the laminæ may be readily detected at the edge portion of the broken particles.

It is the aim of the present invention to take advantage of the peculiar characteristics of shell in this respect to apply to the edges of broken portions of the same a cement or binding material of a bituminous nature for the purpose of coating the shell so that the said material may properly anchor in the particles thereof and at the same time may join with similar coatings of adjacent particles to form a retaining means for the shell. If the shell of this character is used without breaking the same, the laminæ of the shell is not made ragged or exposed to any considerable extent and therefore the coating has little or no chance of adhering to the same. Therefore in the present instance the feature of exposing the laminæ of the shell and rendering the particles thereof ragged at their edges is of the greatest importance.

An important feature of the invention resides in the preparation of the shell and the application of the coating of binding material thereto in such a manner as to cause the particles to connect one with the other throughout the said material when the mixture is laid as a road. This coating holds the particles of shell in desired positions and relation with respect to each other.

In carrying out the invention, the shell is first broken for the purpose of exposing at the edges of the particles the laminæ of the shell in ragged or irregular configuration.

In actual practice I have found that when the shell is broken it is attended with a quantity of very fine crushed or pulverized particles, and if these particles are in excess they are detrimental by reason of their relatively soft texture and making the mixture undesirably tough and unworkable. I therefore prefer to separate these particles from the larger particles of shell and discard any

excess of the same, and add a sufficient quantity of hard sand or gravel either with or without a portion of the fine particles of shell previously separated. Instead of discarding fine particles, I may in some cases reduce the proportion of fine particles which may be in excess of requirements by adding additional coarse particles of shell, crushed stone or gravel in any desired proportion. This added material provides the desired quantity of fine material and renders the mixture easy and cheap to handle, spread and compress. The material thus prepared is then mixed with a suitable bitumen which spreads over the particles of shell and anchors between the laminæ at the ragged edges thereof and also incases the particles of sand or gravel.

When this material is laid upon the foundation of a road and compressed by rolling or tamping, the coatings about the particles come in contact with each other and although they separate the particles from each other each piece of shell is surrounded with a layer of bituminous mortar and therefore each particle of shell is cushioned so that as the wear goes on there is always enough mortar around the shell to cling to the particles which may be crushed, thereby retaining them and maintaining a resisting, dense, tough, resilient surface.

It is to be understood that this surface can be laid to any desired thickness depending on the nature of the grade or subgrade and the amount of traffic that the pavement is to resist or support and the surface mixture may be made by mixing the ingredients at normal temperatures or by heating the ingredients to facilitate their mixing, spreading and compressing.

The principal advantage had by a pavement constructed in accord with the present invention is the economy of construction and the wearing qualities, making it possible to utilize shell and effect a good substantial, serviceable, resilient and at the same time water-proof road which will withstand the water and the wear and tear of traffic of mechanically driven and horse drawn vehicles.

Inasmuch as the particles of shell are of spatular configuration and are coated with the bituminous material as stated, these particles when they are deposited and spread over the foundation of a road will have a tendency to turn from edgewise positions under pressure of a roller and lie flat or approximately horizontal. Inasmuch as the bituminous material cannot cling as readily to the smooth portions of the shell these portions at the surface of a road will sooner or later become exposed and will in fact constitute the major portion of the surface of the road. The soft bituminous material will work into the ragged edges and between the laminæ of the particles of shell and bind and thoroughly bond the particles together.

In my co-pending application Serial No. 648,574, filed concurrently herewith, I have described a modification of the process of the present application, in which roads originally formed from shells, such as oyster shells, clam shells and the like, can be repaired, by removing a portion of the broken up shells, separating all or a portion of the fine material therefrom, mixing sand or other hard fine material therefrom, incorporating this mixture with asphalt, or similar bituminous cementing agent and applying the mixture to a road to be repaired. Obviously such modification is included within the scope of the present invention.

It will be noted that the step of removing the fine portions of the shell, and substituting other, and materially different fine materials therefor, produces a very different aggregate, for application for roads, from the mixture of coarse and fine shell material, because, by crushing of the shells, an excessive amount of exceedingly fine particles are produced. The mixing of crushed shell, containing such an excessive amount of fine, soft particles is inexpedient since it would require an excessively large amount of the bituminous cementing agent, and also since a mixture of such crushed shell with bitumen is too tough to handle properly. On the contrary, the mixture of sand and coarse shell is more easy to handle and with the bitumen, produces a much more wear-resistant road, which is less likely to cause displacement of the surface, known in the art as "shifting or ridging". On account of the better working properties of the mixture, a much better road surface can be produced, which is less likely to become slick and slippery.

Having thus described the invention, what is claimed as new is:

1. A composition of matter suitable for forming pavements, comprising mollusk shells having their edges broken to expose the laminæ thereof, and freed from excess of the fine particles composed of the softer parts of said shells produced by such breaking; a fine mineral material of a hardness materially greater than the fine material removed from said shells, intimately mixed with the relatively larger broken particles of shell; and a bituminous cementing agent intimately mixed with the larger pieces of shell and the finer particles of hard mineral material in amount sufficient to coat substantially all the particles of the coarser shell aggregate and the finer mineral matter.

2. The herein described method of producing a plastic material suitable for the construction of roads, which consists in breaking the edges of mollusk shells to ex-

pose the laminæ thereof; removing the excess of fine particles composed of the softer parts of said shells, produced by such breaking operation; adding fine particles composed of a mineral materially harder than said removed fine material, to the large particles of broken shell to compensate for the removal of the fine particles of shell; and thereafter mixing bituminous material with the broken shell and fine mineral particles to provide an agglutinated mass.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE C. WARREN.

Witnesses:
RALPH L. WARREN,
G. H. PERKINS.