United States Patent Office

2,863,841

Patented Dec. 9, 1958

2,863,841

PAVING MIXTURE COMPRISING VERMICULITE, RUBBER, SAND, AND BITUMINOUS BINDER

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No Drawing. Application January 31, 1956
Serial No. 562,591

3 Claims. (Cl. 260—28.5)

This invention relates to a surfacing or paving material for use on playgrounds, tennis courts, parking lots and floors.

Heretofore several types of asphalt base paving materials have been used in connection with playgrounds, tennis courts, parking lots and floors, but such materials have been found to be deficient in one or more respects, such as strength, stability, resiliency, weight, resistance to impact and abrasion, waterproofing and weathering.

Accordingly the primary object of this invention is to provide a surfacing or paving material that is especially suitable for playgrounds, tennis courts, floors and other surface areas normally subjected to extensive use by pedestrians.

Other objects, the nature and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description.

The invention here described comprises a mixture of exfoliated vermiculite and rubber in particle form. To this mixture, which we prefer to call a "premix," there is added at the time of use predetermined quantities of fine sand or stone screenings and a bituminous binder. These materials are mixed together in a mechanical mixer; then the resulting mixture is laid on a prepared base and rolled to a smooth surface in the usual manner. It has been found the bituminous binder penetrates the vermiculite. This vermiculite has a high affinity for bitumen or bituminous materials and allows use of the latter in quantities as high as 25% by weight which is two to three times greater than the amount that can be utilized in dense bituminous concrete without bleeding. The additional bitumen results in a much more elastic pavement. It has also been determined that the rubber is a necessary component if a surface having the desired characteristics is to be obtained. The rubber imparts greater resistance to abrasion and imparts greater flexibility which becomes important when the temperature drops below 60° F. Moreover, by virtue of its own characteristics, the rubber counteracts, makes up for, and even reduces the tendency of bitumen to crack, disintegrate or harden under oxidation and weathering. Although vermiculite is flexible and resilient it will not bounce back like rubber. This allows the pavement to give underfoot and to bounce back when the compressive load is removed.

In developing and practicing the invention it has been found that several criteria must be followed if a surface having all of the aforesaid desired characteristics is to be obtained.

First of all, with respect to the loose premix, for every part by weight of verimculite there should be approximately 2.2 to 4.0 parts of rubber. The preferred ratio is 1 to 3. Stated another way, the loose vermiculite-rubber premix should constitute 20–30% vermiculite and 70–80% rubber and preferably 25% vermiculite and 75% rubber.

Secondly, the vermiculite, rubber, sand (or stone screenings) and the bitumen should be combined in such proportions as to fall within the following formula:

	Percent by weight
(1) Exfoliated vermiculite	2 to 8
(2) Granulated rubber	6 to 18
(3) Fine sand or stone screenings	45 to 80
(4) Bituminous binder	12 to 28

It has been determined from tests that the various characteristics which a paving for playgrounds, tennis courts, parking lots, floors, etc. should have cannot all be obtained unless the paving material is formulated in the proportions herein set forth.

Vermiculite, for example, should be present in amounts of at least 2% by weight. The function of the vermiculite is to render the surface more fluffy and light and to absorb the bituminous binder. Sand does not absorb asphalt and limits the quantity of bituminous material that can be present in the mixture. With vermiculite present to absorb the binder, more of the latter can be added to the mixture. However, if too much vermiculite is used, the pavement will be too soft and will give too much under pressure.

The rubber renders the paving more resilient and imparts to the paving the ability to give under impact and to bounce back after the compression is removed. Too much rubber increases the weight of the mixture and reduces the effective binding power of the bituminous material. Rubber has less affinity for asphaltic materials than vermiculite. Consequently an increase in rubber content at the expense of a decrease in vermiculite content limits the quantity of bituminous material that can be used and thus lowers the stability of the paving. On the other hand, if too little rubber is included in the mixture the paving will lack the proper resiliency and bounce.

The function of the sand or stone screenings is to impart bearing power and body to the paving material. Sand also has the advantage of low cost. While the sand or stone content may vary over a wide range, it should not exceed or be less than the tolerable limits established by the foregoing formula. If too much sand is used, the paving will will lack resiliency and be brittle. If too little sand is used the paving will lack body and stability.

The asphaltic or bituminous component not only coats the sand, rubber and vermiculite but also penetrates and is absorbed by the flakes of vermiculite. If too much binder is used the paving will be sticky and bleed. If too little is used the paving will not hold together.

Not only does the rubber add bounce to the paving but it also combines with the vermiculite under rolling. The rubber penetrates the crevices in the flakes of vermiculite and makes a strong mechanical or cementitious bond with the latter.

The sizes of the vermiculite, rubber and sand are also to be considered. The rubber aggregates should have a size not greater than approximately ¼" and not less than approximately .04". The size of the vermiculite flakes should not exceed approximately 5/16" and should not be less than approximately .04". The sand or stone screenings should be relatively fine, not exceeding approximately ⅛".

Vulcanized rubber is preferred. However, natural crepe rubber, synthetic rubbers such as butadiene styrene and neoprene, and reclaimed natural and synthetic rubbers can be used with the same results. Accordingly it is to be understood that the term "rubber" as used in this specification and the appended claims is to be construed as embracing vulcanized and reclaimed rubbers, both natural and synthetic. Furthermore, the term "aggregates" as applied to rubber is to be construed as denoting small solid particles or granules of rubber, regardless of shape. Neo-

prene was originally called Duprene and is more properly identified as μ-polychloroprene.

The bituminous cementitious component may comprise one or more of the following: liquid asphalt cement, liquid tar, bituminous emulsion, cut-back asphalt, natural asphalt, and powdered asphalt with an oil solvent such as kerosene or fuel oil. The choice of bituminous material determines whether the paving mixture can be applied in a cold or hot state. If liquid tar, cut-back asphalt, bituminous emulsion or dissolved powdered asphalt is used, the mixture can be applied in an unheated state. If natural asphalt or asphalt cement is used, the mixture will be applied while in a heated state.

An example of a paving mixture formulated according to this invention and capable of producing a pavement of excellent characteristics is as follows:

	Percent by weight
Exfoliated vermiculite	5
Granulated rubber	15
Fine sand	60
Asphalt cement	20
	100

One advantage of this invention is that the rubber and vermiculite can be premixed and bagged in the proper proportion so that the contractor in charge of laying the pavement only need add the correct amount of sand and binder as determined by instructions supplied with the premix to obtain a proper paving mixture. On the other hand, the rubber and vermiculite can be added to the sand and bitumen separately without departing from the present invention.

As determined by approved tests, pavements constructed according to the present invention are far superior to ordinary or standard type asphalt pavements. They have: (1) a high degree of durability as determined by the A. S. T. M. Freezing and Thawing Test, (2) a high degree of soundness as determined by the A. S. T. M. Magnesium Sulfate Test, (3) a high degree of resistance to abrasion as determined by the Standard Rattler Test, (4) excellent resistance to stripping as determined by the Standard Federal Stripping Test for Bituminous Coated Aggregate, (5) a high degree of water tightness as determined by the conventional absorption test, (6) a high degree of resiliency at temperature below 60° F., and (7) a high degree of stability at high temperature. In addition there is a high resistance to weathering action. The large percentage of the surrounding bitumen limits oxidation and cracking of the rubber aggregates and the large percentage of rubber below the surface produces an elastic, flexible and resilient pavement that counteracts surface hardening of bitumen due to weathering. Thus the completed pavements offer high resistance to cracking, disintegration and raveling.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. Therefore, it is to be understood that the invention is not limited in its application to the details specifically described, and that within the scope of the appended claims it may be practiced otherwise than as specifically described.

We claim:

1. A paving mixture comprising by weight 2 to 8% exfoliated vermiculite, 6 to 18% granulated rubber, 45 to 80% sand, and 12 to 28% of a bituminous binder selected from the group consisting of tar and asphalt, said vermiculite having a particle size in the range of approximately .04 inch to approximately 5/16 inch, said granulated rubber having a particle size in the range of approximately .04 inch to approximately ¼ inch, and said sand having a maximum particle size of approximately ⅛ inch.

2. A paving mixture as defined by claim 1 wherein for every part by weight of vermiculite there are 2.2 to 4.0 parts of rubber.

3. A paving mixture as defined by claim 1 wherein the ratio by weight of rubber to vermiculite is approximately 3 to 1.

References Cited in the file of this patent

UNITED STATES PATENTS

1,976,946	Kiefoth	Oct. 16, 1934
1,977,874	Denning	Oct. 23, 1934