

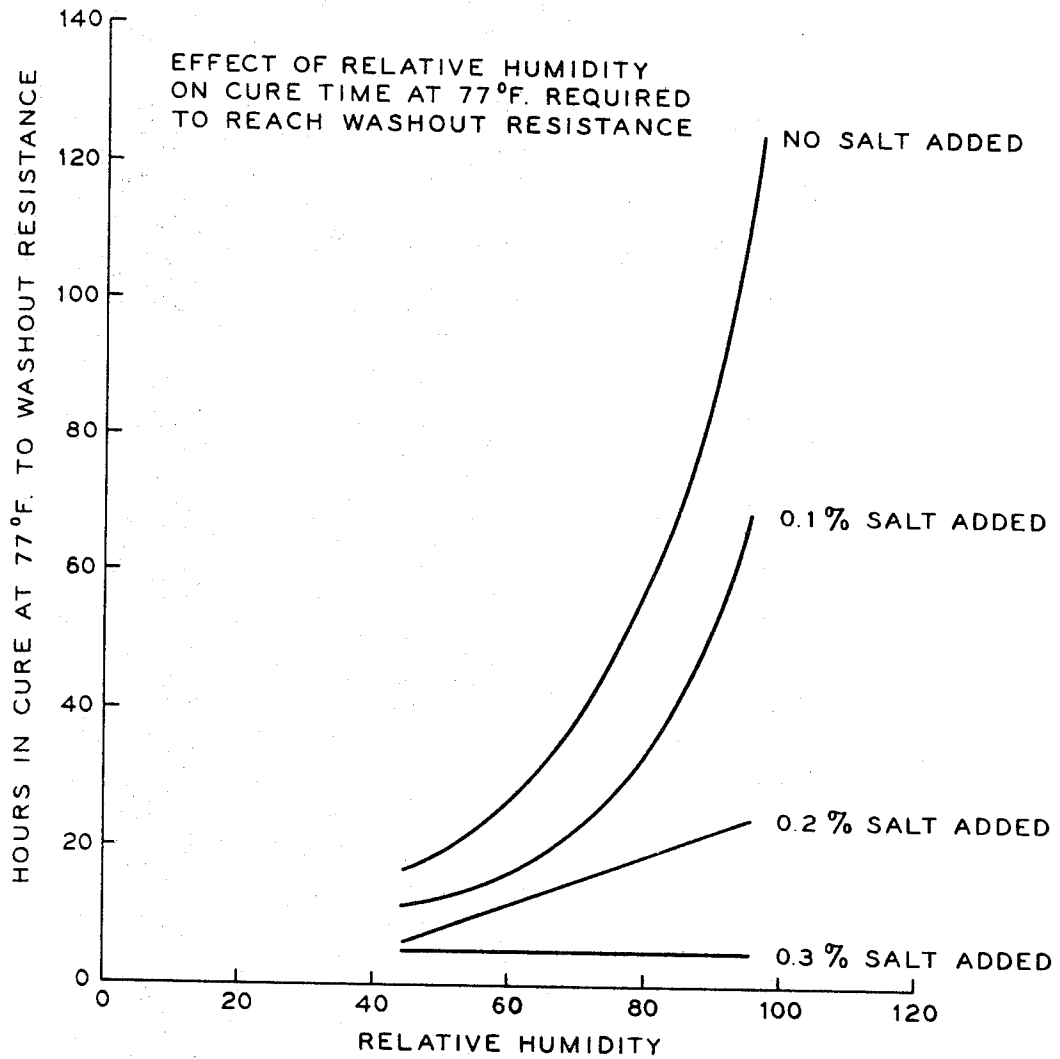
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BITUMINOUS SURFACING COMPOSITIONS

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3,539,369

BITUMINOUS SURFACING COMPOSITIONS

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Continuation of application Ser. No. 671,489, Sept. 28, 1967, which is a continuation of application Ser. No. 376,093, June 18, 1964. This application Nov. 18, 1968, Ser. No. 777,553

Int. Cl. C08h 13/00; C08k 1/62; C09d 3/24
U.S. Cl. 106—277

4 Claims 10

ABSTRACT OF THE DISCLOSURE

Addition of from about 0.1 to about 0.5% by weight of quaternary ammonium halide salts, in particular of "tal-low" trimethyl ammonium chloride, to slow-setting, anionic asphalt emulsions combined into aqueous mortars by admixture of inert fillers and water, enables the mortars to set by normal evaporation of water until at least 60% of the water is evaporated, while boosting the resistance of the mortars to washout by rain.

This application is a continuation of application Ser. No. 671,489, filed Sept. 28, 1967, which is a continuation of application Ser. No. 376,093, filed June 18, 1964, both now abandoned.

This invention is concerned with an improvement in the construction of running tracks, runways for athletic field events, tennis courts, and the like, and with an improved method of construction, which significantly reduces the threat of damage to the surface being constructed by sudden precipitation of rain. More particularly, it is concerned with a method of construction which boosts unexpectedly the resistance to washout by rain of bituminous surfacing compositions or mortars containing from as low as 2 to as much as 80% by weight of inert fillers during the setting of these compositions.

Because of the continuing great interest in sports of the people throughout the world, and particularly in the United States, the engineering of recreational pavements, such as the aforementioned runways on athletic fields, running tracks, tennis courts, etc., has made great strides in the last 30 or 40 years, and a large number of good and durable recreational pavements have been constructed using various methods, mainly based on the use of bituminous materials, such as asphalt or asphalt emulsions in combination with appropriate mineral aggregate and fibrous components. To be satisfactory, recreational pavements must be tough, true to plane, fast-draining, grit-free, texture smooth and sufficiently resilient. These pavements are conventionally formed in the paving art by laying first a stable base course of mineral aggregate and bituminous binder, such as an asphalt, followed by a true (accurately graded) leveling course of a similar content and then by a smooth and resilient surface coating or carpet of a bituminous composition, which may be applied by screeding, this last composition being formed by intimately mixing an asphalt emulsion with suitably chosen, weather-resistant fibers (of either mineral, vegetable or synthetic origin), such as asbestos, bagasse, and the like. If desired, this surface carpet of asphalt and fibers may receive a seal coating of an asphaltic weatherproof composition and, finally, a decorative color finish.

While once they are firmly set (cured), the bitumen-fiber based surface carpets of recreational pavements are usually quite satisfactory and lasting, their construction and repair is often an extremely vulnerable operation. Sudden rain, and even a relatively mild but continuing precipitation of moisture is apt to wash out the bituminous emulsion from the surface carpet and thus to damage it

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physically at any time before the emulsion in its mixture (mortar) with fibers begins to break, which occurs when about 60% of the water in the mixture has evaporated. This may take several days, if the thickness of the laid surface carpet is from about 1/4" to about 1/2" thick, and if the conditions of drying are unfavorable, that is, without sunshine and in the absence of breeze.

The bituminous emulsions, such as asphalt emulsified in water, suitable for use in the aforementioned resilient surface carpets in the construction of recreational pavements are commonly employed in the form of mixing-grade slow-setting (SS) anionic emulsions of from about 40 to about 65% by weight of bitumen (asphalt) in water, cationic emulsions having been found for a number of reasons unsatisfactory for this type of construction. Preferably such suitable anionic emulsions, being slow-setting, have permanent stability and would contain from about 55 to about 60% by weight of bitumen (asphalt) residue. Any suitable anion-active emulsifier may be used in conventional amounts of from about 0.5 to about 2.5% by weight of the emulsion for preparing these emulsions whose pH generally lies between about 9.0 and about 11.0.

A mixing-grade slow-setting emulsion prepared by emulsifying asphalt in water with the aid of such an emulsifier may, and usually does, contain small quantities of other conventional additives which may be desirable in paving emulsions, for instance, pH regulators, e.g., boric acid; stabilizer preventing settlement and imparting better consistency, e.g. clay; fillers, e.g., limestone or diatomaceous earth, etc. These slow-setting emulsions are then combined into a mortar, mixing from about 15 to about 50% by weight of the emulsion with an adequate proportion of cut fibers, preferably in amounts of from about 2 to 20%, and higher, by weight of the final composition, and added to the emulsion in from about 10 to about 60% by weight of water. A typical effective composition of this kind for use in surfacing the leveling course of a recreational pavement, such as a tennis court, may contain for instance:

35% by weight of an asphalt-in-water emulsion (55% of asphalt)
10% by weight of vegetable fibers (bagasse)
5% by weight of mineral fibers (asbestos fibers)
50% by weight of water.

The surfacing carpet compositions are either used as such or are diluted even further with more (15-20%) water, before their application on the leveling courses of pavements.

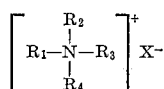
However, as pointed out already, the surfacing carpets applied from these dilutions are susceptible to damage by atmospheric precipitation, such as a sudden rain, while in the process of setting, before enough water has evaporated from the surfacing carpet and before the fiber-containing emulsion has a chance to break down and to form a solid resilient asphalt-fiber texture. Additions of hydrated lime and cements for the purpose of accelerating emulsion breakdown were found to cause embrittlement and to reduce the coating strength.

It is a surprising feature of the present invention that by adding to the mortar of the surfacing carpet composition, just prior to the application on the leveling base course, a very small amount of from about 0.05 to about 1.0% by weight, based on the weight of the mortar, of a particular kind of water-soluble quaternary ammonium salt, amount insufficient to cause premature breakdown of the anionic bituminous emulsion component of the mortar, one is enabled to apply the mortar and let it set normally to the desired durable texture without exposing it to a risk of damage that may result from a sudden rainfall. In actual practice, entirely adequate protection against washout is provided by adding from about 0.10

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to about 0.50% by weight of the quaternary ammonium salt. In fact, if more of this salt than about 0.50% by weight is added, a premature breakdown of the emulsion and undesirable coagulation of the asphalt in the mortar, in the process of setting and before sufficient water evaporated, is likely to occur, and this tends to impair the quality of the desired surface coating. Furthermore, the mortar is apt to become so viscous in consistency as to be unworkable.

This ability of the aforementioned quaternary ammonium salts, added in the water phase and consequently unaffected by the viscosity of the asphalt, to provide the necessary resistance to washout by rain during the drying of the mortar and before it is set, is wholly unexpected, considering that only from 0.05 to about 1.0% by weight of the salt additive, and preferably from about 0.10 to about 0.5 by weight thereof, suffices to protect the surface while the mortar is drying. Salts effective as "washout-resistant" additives are water-insoluble quaternary ammonium halides of the general formula:



in which R_1 is a hydrocarbon radical of from 12–25 carbon atoms (preferably a C_{12} – C_{25} alkyl chain), while R_2 , R_3 and R_4 may be hydrocarbon radicals, hydroxy-substituted hydrocarbon radicals, or ether-substituted hydrocarbon radicals, so selected that the sum of the carbon atoms in R_2 , R_3 and R_4 is a number from 3 to 10. X in the above formula designates a halogen atom. The long chain R_1 radical may be derived from natural (animal or vegetable) products, for instance, tallow, hydrogenated tallow, coconut oil, soybean oil, tall oil, paraffin wax, olive oil, lard oil, etc.

Among suitable quaternary ammonium halides operative in preventing mortar washout according to this invention, there may be specifically mentioned: dodecyl trimethyl ammonium chloride, "tallow" trimethyl ammonium chloride, "hydrogenated tallow" trimethyl ammonium chloride (these two excellent additives being available under trademarks "Arquad T" and "Arquad TH"); also dodoceryl trimethyl ammonium chloride, docosyl trimethyl ammonium chloride, dodecyl methyl di(hydroxyethyl) ammonium chloride, octadecyl methyl di(hydroxyethyl) ammonium chloride, hexadecyl dimethyl ethyl ammonium bromide, "tallow" dimethyl benzyl ammonium chloride, dodecyl dimethyl benzyl ammonium chloride, dodecyl dimethyl ethoxyethoxyethyl ammonium chloride, octadecenyl dimethyl benzyl ammonium chloride, hexadecyl trimethyl ammonium bromide, hexadecyl dimethyl ethylbenzyl ammonium chloride, tetradecylphenyl diethyl hydroxyethyl ammonium chloride, dodecyl dimethyl furfuryl ammonium chloride, "hydrogenated tallow" furfuryl dimethyl ammonium chloride (trademarked material "Adogen 446"), dodecyl dimethyl benzyl ammonium bromide, octadecadienyl trimethyl ammonium chloride, octadecyl methyl di(hydroxypropyl) ammonium chloride, oleyl methyl di(ethoxyethyl) ammonium chloride (trademarked material "Ethoquad 0/12"), etc.

Whatever be the mechanism which imparts washout resistance to the setting fiber-asphalt emulsion mortar, the fact is that the physical properties of the finally set composition are not noticeably influenced by the minute amounts of the added quaternary ammonium salts.

This is plainly seen from the comparison of the physical properties of several fiber-asphalt surfacing carpets constructed using a composition of 35% of asphalt emulsion, 16% of fibrous components and 49% of water, similar to that described hereinabove, the whole diluted with more water (10%) before being applied over the leveling course. The asphalt emulsion was prepared by emulsifying a California asphalt (56% residue) in water with the aid of an anionic emulsifying agent which was formed by combining 2.5% of a 50:50 blend of a pinewood resin

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material sold under the trade name of "Vinsol Resin" and sodium salt of the by-product of sodium lignin, sold under the trademark of "Indulin C," with about 0.2% by weight of potassium hydroxide. Two of the mortars contained a typical, commercially readily available quaternary ammonium salt, namely, tallow trimethyl ammonium chloride (50% active), sold under the trademark "Arquad T-50," in different concentrations as shown in Table I below:

TABLE I

Property	Percent of quaternary ammonium salt added (based on the weight of mortar)		
	None	0.25	0.5
Tensile strength, lbs./sq. in.	111	107	95
Elongation, percent.	5.6	6.4	5.6
Stiffness (modulus of elasticity), lbs./sq. in.	4,500	4,100	3,850

A laboratory test was developed to correlate the improvement in the resistance to damage by rain to the mortar, as obtainable according to the invention, with field experience on actual construction jobs. In this test, a sample of mortar is troweled into the hollow space in the lid of a gallon can to a thickness of about $\frac{1}{4}$ " and is allowed to cure. Once cured, at the desired moment during the cure, the sample on the lid is placed at an angle of 45° under a stream of tap water falling vertically from a distance of 6" through $\frac{1}{4}$ " pipe at a rate of one gallon per minute. The time it takes to wash away the sample from the lid and to expose the metal is recorded.

In this "washout" treatment, at the mentioned rate of water flow (one gal./min.) and other specified test conditions, the mortar without added quaternary ammonium halide is washed out completely within 20 seconds, even after having been left to dry for as long as 20 hours at room temperature. This treatment fairly corresponds to what does happen under service conditions encountered in paving work, when such a mortar, i.e., without added quaternary ammonium halide, is subjected to the action of a sudden thunder shower, resulting in heavy precipitation of rain, at any time between the application of the mortar in actual surfacing work and as much as 20 hours thereafter while the mortar is in the process of drying.

In a representative series of tests, two different mortars were tested at different dilutions, each mortar having been treated with a quaternary ammonium halide, namely tallow trimethyl ammonium chloride, in small amounts within the range effective in accordance with the invention. Each of these two mortars, designated A and B, was formulated using a mixing-grade, slow-setting anionic emulsion of a different asphalt. In mortar A the emulsion was that of 55% by weight of a Venezuelan (Boscan) asphalt with penetration values of 85–100 at 77° F. This emulsion was formulated with the aid of a 50:50 blend of "Vinsol Resin," and "Indulin C," and potassium hydroxide as the emulsifying agent. In mortar B the emulsion was that of 56% by weight of a California asphalt (a blend of Midway and Montalvo asphalts). The penetration of this asphalt blend was 50–60 at 77° F. The emulsion of this asphalt was prepared with the aid of a known protein blood stabilizer. Mortar A was diluted with water to 30%. Mortar B was similarly diluted to 10%. Addition of about 1.0% by weight of "Arquad T-50" (a 50% dilution of the salt) to mortar A after 29 hours of drying at room temperature prevented washout when subjected in the aforementioned test to the effect of the stream of water for 120 seconds.

Addition of 0.5 and 1.0% by weight of the same "Arquad T-50" to mortar B prevented washout after less than ten hours of drying at room temperature, when subjected to the action of the stream of water for 120 seconds, as specified by the test. In contrast, samples of either mortar, which contained no added salt, were com-

pletely washed away in less than 20 seconds after 60 hours of drying at room temperature.

It was observed in the same series of tests that dilution of the mortar lengthens the time required to reach washout resistance by about one hour for each 1% of dilution, and this even in the presence of the quaternary ammonium salt additive, particularly when the drying conditions are poor, that is, in the absence of sun and breeze and, for instance, with humidities being above about 70% and temperatures being low, in the range from about 40 to about 50° F.

Generally the addition of quaternary ammonium halide in accordance with the invention will bring about the necessary degree of rain (washout) resistance within 24 hours. In fact, even though only 12 to 25% of moisture has evaporated from the mortar, addition of quaternary ammonium salt tends to increase washout resistance, despite the high content of water yet to be evaporated from the mortar. Even though the desired washout resistance has been reached upon addition of, say, 0.2% by weight of tallow trimethyl ammonium chloride, the mortar continues to dehydrate, and it is only after 60% or more of the water did evaporate that the asphalt emulsion component breaks down and asphalt sets into one coherent mass with the fibrous components of the mortar.

The relative humidity does exert an effect on the time of cure required to reach washout resistance upon addition of a quaternary ammonium salt, in accordance with the invention. This is illustrated by the curves in the drawing. The higher is the humidity, the slower will be the rate of evaporation and the more removed will be the time in which the desired washout resistance is attained. Also the colder is the temperature, the slower will be the rate of evaporation from the mortar and the more removed will be the time in which the washout resistance will be reached. Furthermore, drying time (rate of evaporation) will be influenced by the air movement over the surface (that is, absence or occurrence of wind).

The curves in the attached drawing were obtained on a mortar prepared by mixing 35% by weight of an anionic asphalt-in-water emulsion (56% of asphalt residue), 16% by weight of fibers, and 49% by weight of water, diluting this mortar with 9% more water and admixing thereto, just prior to beginning the test, different quantities of tallow methyl ammonium chloride.

A number of commercially available, water-soluble quaternary ammonium salts were also added in different concentrations to a similar mortar of an asphalt emulsion and a mixture of fillers (rubber and fibers), introducing into the mortar from 0.10 to 0.5% by weight of the salt in accordance with the preferred embodiment of the invention. The mortar was formulated with 36% by weight of an anionic SS-type emulsion (56% of asphalt residue), 11% of asbestos fibers, 13% of comminuted rubber, the balance to 100% by weight being water. The results of the corresponding washout tests are tabulated in Table II where the composition of the six representative additive salts labeled M, N, O, P, R and S is disclosed.

TABLE II.—EFFECT OF ADDITION OF QUATERNARY AMMONIUM HALIDES TO CURING AQUEOUS ASPHALT FIBER MORTARS

(R ₁ R ₂ R ₃ R ₄ N)+Cl ⁻ additive	R ₁	R ₂	R ₃	R ₄	Concentration in percent		
					0.15	0.30	0.45
					Hours required to reach washout resistance		
M.....	Oleyl	methyl	hydroxyethyl	hydroxyethyl	11.0	3.6	
N.....	hydrogenated tallow	methyl	methyl	furfuryl	20.0	6.0	4.0
O.....	C ₈ -C ₁₈ -alkyltolylmethyl	methyl	methyl	methyl	15.0	5.1	
P.....	tallow	methyl	methyl	benzyl	15.0	5.5	
R.....	tallow	methyl	methyl	methyl	22.0	8.0	8.0
S.....	hydrogenated tallow	methyl	methyl	methyl	10.0	8.9	
None.....					Withstood washout test only after more than 24 hours		

These results clearly indicate that addition of quaternary ammonium salts in accordance with the invention decreases the curing time required to prevent damage

(washout) of the mortar by rain to as little as one-tenth the time required in the absence of the salt. Quaternary ammonium halide salt dilutions of 0.15, 0.30 and 0.45% were used in these tests; all of these tests reflect the fact that the addition of such salts imparts a pronounced increase of washout resistance.

In order to confirm the operativeness of the invention in actual practice, a mortar having the same composition as the previously described Mortar A was employed in the construction of a variety of recreational pavements, namely broad jump and pole vault runways, and a high jump area on an athletic field. A hot asphalt mix leveling course was put down first with a half-ton roller at 9 a.m. on a cloudy day. The temperature throughout the day ranged from 38 to 48° F., and the relative humidity was 73%. The wind blew at 20–25 miles per hour. At 12:30 p.m. the application of the asphalt fiber mortar on to the leveling course was begun. A 20% by volume solution in water of tallow trimethyl ammonium chloride was prepared, and one-half gallon of the solution was added to each one-half drum (50 gallons) of the mortar in a plaster mixer. For constructing the broad jump and pole vault runways the mortar was diluted with one gallon of water for each half drum, and the time it was worked in the mixer was five minutes, whereupon the mortar was troweled on the leveling course. In the preparation of the high jump area, the residence in the mixer was shortened to one minute, and four gallons of diluent water per half drum was used. Here, a pipe roller was used to spread the mortar. The whole job was completed at 4:30 p.m. At 9 p.m. it started to rain, and the rain continued, on and off, throughout the night. At 8 a.m. the next day it was cloudy and cold again with relative humidity increasing to 90%; and at 9:30 a.m. rain started again. No damage to the surface was observed, however. On the next day, the relative humidity was 84%, and on the day following, it was 89%. The track was opened to foot traffic by athletes within two weeks. About fourteen weeks later, the runways and the high jump area were inspected, and it was observed that, even though shoes with spikes have been used in the meanwhile in daily athletic practice thereon, the surfaces were in excellent condition without evidence of excessive wear, and remained resilient, despite the temperature during this entire period of use being only in the mid-forties.

Before concluding this specification, it must be pointed out that the addition of quaternary ammonium halides in accordance with the invention is not solely beneficial for increasing the washout resistance of surfacing carpets of emulsified asphalt and fibrous fillers in the construction of recreational pavements, but that it is, in fact, generally effective in increasing the washout resistance of any kind of surfacing composition, compounded from SS-type bituminous emulsions, such as those of 40 to 65% of asphalt residue, containing up to about 80% by weight of fillers, and applied on the course or base to be protected in the form of a mortar.

The term "fillers," as used herein, is intended to in-

clude the whole gamut of particulate discrete aggregates, whether in natural state, e.g., sand; or comminuted, e.g., limestone dust, crushed slate, etc.; various animal, vege-

table, mineral and synthetic fibers, e.g., wool, bagasse, asbestos, crushed glass; and other inert fillers, e.g., comminuted cork, rubber, mica, and so forth.

Such compositions include the so-called "resurfacing compositions" for use in school playgrounds, outdoor walks, etc., to insure a smooth, true-plane surface. These resurfacing compositions are generally prepared by mixing into a mortar from about 15 to about 50% by weight of an anionic bituminous (asphalt) emulsion characterized by bitumen asphalt content of from 55 to 60%, from about 20 to about 80% of fillers, and water to make up 100% by weight of the mortar to be applied over the underlying base.

These filled surfacing compositions also include a variety of "industrial coatings" formulated from bituminous (asphalt) anionic slow-setting emulsions and containing substantial amounts of fillers, such as asbestos fibers, limestone dust, and so forth. These industrial surface coatings find their use, applied as mortar-like compositions on the base surface of insulated tanks, refinery towers, reservoirs, ventilation ducts, etc. Generally, these mortars contain from about 40 to about 60% by weight of the emulsion and from about 15 to about 30% by weight of fillers, the balance to 100% being water. These protective industrial coatings and the resurfacing compositions are susceptible to damage by rain during the period of their setting after application, similarly to what is apt to happen in laying recreational pavements.

Addition of quaternary ammonium halides in accordance with the invention, for instance, of 0.3% by weight of tallow trimethyl ammonium chloride, reduces the time of setting or cure required to attain washoff resistance by any of these bituminous surfacing compositions. As a general rule, each 0.05% of added quaternary ammonium salt reduces this time by about five hours—a substantial saving.

The following Table III unmistakably shows the improvement of washout resistance in the case of two typical industrial surfacing compositions used in the test series conducted to determine the time required to reach washout resistance. In these tests two resurfacing compositions—A and B—were used. Composition A was formulated using 16% by weight of an anionic, slow-setting emulsion of asphalt of California origin (asphalt residue of about 55–60%), 3.5% of asbestos fibers and 61% of stone aggregate of from No. 8 to No. 100 mesh. In addition, the composition contained about 7% of mineral aggregate fines and about 3.0% of synthetic rubber. The asphalt emulsion was prepared with the aid of a known protein blood emulsifier. In the case of resurfacing composition B, a similar asphalt emulsion was employed along with other fillers, as recited hereinabove, the difference being in that the asphalt emulsion was prepared with the aid of potassium hydroxide and a blend of "Vinsol Resin" and "Indulin C," as the emulsifier. Both compositions A and B were diluted with 10% of water to facilitate handling and addition of the quaternary ammonium salt additive. The typical additive, tallow trimethyl ammonium chloride in different concentrations was used in the tests.

TABLE III.—HOURS OF CURING BEFORE REACHING WASHOUT RESISTANCE

Quaternary salt added in percent by wt.	Composition A at 70–80° F. humidity= 50–60%	Composition B at—	
		70–80° F. (humidity= 50–60%)	at 45° F. (humidity= 0–70%)
None.....	13	24	33
0.1.....	9	18	29
0.2.....	5	14	22
0.3.....	3	8	18

In another series of tests a mortar, suitable for use as an industrial coating and formulated by combining 58% by weight of an anionic SS-type emulsion (56% of Cali-

fornia asphalt residue), 21% of asbestos fibers, 21% of limestone dust and water, was tested in accordance with the aforescribed test procedure for determining improvement in washout resistance. The mortar was diluted with additional 10% of water, again the typical quaternary ammonium salt additive tallow trimethyl ammonium chloride was added to the mortar, before its use in the test, in different amounts, namely, 0.05, 0.10, 0.15 and 0.20%. The following Table IV conclusively shows the effectiveness of the addition of quaternary ammonium halide in accordance with the invention.

TABLE IV

Number of hours in drying after appli- cation of coating	Additive in percent			
	0.05	0.10	0.15	0.20
Washout time in seconds				
2.....	1	3	18	20
4.....	2	4	29	112
6.....	8	13.0	120+	120+
8.....	26	47	120+	120+
24.....	120+	120+	120+	120+

The invention definitely includes within its scope the application of quaternary ammonium halides in the aforementioned effective range of amounts of from 0.05% to about 1.0%, and preferably from about 0.10 to about 0.5%, by weight to impart washoff resistance to similar mortars of other bituminous materials susceptible to washoff during their setting on recreational pavement jobs or in playgrounds, and so forth. The choice of tallow trimethyl ammonium chloride, sold in commerce under trademark "Arquad T," in a number of specific examples in the above specification was made not only because this material was one of the most effective, and for this reason preferred, quaternary ammonium halides, but also because it was readily available in adequately large quantities for use in the washout tests. Thus, the preceding description and examples are merely given to illustrate the invention, and all variations thereof apparent to those skilled in the art and falling within the scope of the appended claims are likewise contemplated by the invention.

What is claimed is:

1. A method of preparing filled bituminous surface coatings, which comprises the steps of:

- (1) making a mortar of from about 15 to about 60% by weight of an aqueous, slow-setting, anionic emulsion of about 40 to about 65% by weight of bitumen, from about 2 to about 80% by weight of inert fillers, the balance of the mortar to make up 100% by weight being water, wherein the emulsifier used to form said emulsion is comprised of a combination of an alkali metal salt of pinewood resin and a sodium salt of sodium lignin;
- (2) admixing to said mortar, prior to its application as a surface coating over an underlying base, from about 0.1 to about 0.5% by weight of a water soluble, tallow N-alkyl trimethyl ammonium chloride, whereby the washout resistance of the mortar is increased and a premature breakdown of the emulsion component thereof is prevented until at least 60% of its water has evaporated therefrom;
- (3) immediately thereafter applying the mortar to an underlying base; and
- (4) allowing the mortar to set by normal evaporation of water therefrom to form a uniform, smooth bituminous surface coating.

2. A method as defined in claim 1, wherein the aqueous anionic emulsion of bitumen is an anionic emulsion of asphalt in water.

3. A method as defined in claim 1, wherein the inert filler component of the mortar is from about 2 to about 20% by weight of inert cut fibers.

4. A method as defined in claim 1, wherein the emulsifier comprises a combination of a potassium salt of pinewood resin and a sodium salt of sodium lignin.

References Cited**UNITED STATES PATENTS**

2,378,235 6/1945 Miles.
3,050,468 8/1962 Wright.

3,257,231 6/1966 McEachran et al.
3,126,350 3/1964 Borgfeldt.

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U.S. Cl. X.R.

94—20, 23; 106—280, 283; 252—311.5

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,539,369 Dated November 10, 1970

Inventor(s) GEORGE G. SAPP

It is certified that error appears in the above-identified patent
and that said Letters Patent are hereby corrected as shown below:

└

Col. 3, line 19, "water-insoluble" should read --water-
soluble--.

Signed and sealed this 6th day of April 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

└