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MASTIC COMPOSITION AND FLOORING

Stuart P. Miller, Scarsdale, N. Y., assignor, by
mesne assignments, to Allied Chemical & Dye
Corporation, a corporation of New York

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This invention relates to a bituminous mastic composition particularly suitable for the formation of flooring and foot pavements, and to flooring and pavements formed of the new mastic composition.

Bituminous mastic compositions have been used in floorings for many years. Heretofore known compositions for such use have comprised asphalt, a mineral filler in the nature of mineral dust, and a mineral aggregate ordinarily comprising sand and gravel. Such compositions are applied as flooring by heating the mixture of asphalt and mineral material to a relatively high temperature at which the mixture is relatively soft and plastic, and spreading the mixture on a surface to be covered. Flooring employing these asphaltic compositions has suffered from the disadvantage that where it is subjected to the action of water it tends to absorb water and become crumbly. Further, asphalt mastic flooring is softened by the action of vegetable oils and petroleum oils and vapors, to which it may be subjected in oil refineries or garages, so as to become unfit for use. It has also been found that such floors exhibit an objectionable tendency to become soft at high temperatures, such as summer temperatures, to which they may be subjected.

It is an object of this invention to provide a new mastic flooring composition which is not substantially weakened or softened by water, by petroleum oils and vapors, or by vegetable oils, and which by reason of these properties is particularly suitable for use to form a smooth, wear-resistant flooring in factories, breweries, garages, oil refineries, etc., where the flooring is subjected to such agents.

It is a further object to provide a mastic composition which is applicable at lower working temperatures than compositions heretofore known but which has improved resistance to indentation at high temperatures and which is not readily cracked or shattered at low temperatures.

Other objects and advantages will appear from the following detailed description.

I have found that a mixture of a digestion pitch product such as coal-digestion pitch or an asphaltic pyrobitumen-digestion pitch product having a softening point (R. & B.) of 140° to 200° F., mineral filler, substantially all of which passes a 200-mesh sieve, and mineral aggregate of controlled graduated sizes as hereinbelow explained and in regulated proportions hereinafter specified, gives a mastic composition which can be applied at lower temperatures than used for ap-

plication of asphalt mastic, which is capable of use to form long-wearing flooring or other surface resistant to indentation and to the action of water, dilute acid, petroleum products and vegetable oils, and which is not significantly susceptible to temperature changes normally encountered in the use of which such flooring or other surfaces may be subjected, i. e. will not soften or bleed at summer temperatures, or shatter or crack at winter temperatures.

The coal-digestion pitch may be produced by heating, while agitating, bituminous coal, for example, New York steam coal, Pittsburgh Seam coking coal, or Ohio non-coking coal in intimate contact with tar, pitch, tar distillate or mixtures of these under specific temperature conditions so that the coal is blended with the tar or tar products in which it is digested and the resultant mixture, when molten, behaves substantially as a homogeneous fluid. The coal may be either a coking or a non-coking coal. The proportion of coal necessary will vary with the particular type of coal employed and also with the character of the pitch, tar or tar oil which is employed.

The temperature to which the coal and tar or pitch, which may be coal tar, water-gas tar, or their distillation products, are heated varies with the particular type of coal employed, but in general the temperature is around 300° C., say from about 270° to 340° C.

The heating period in practice will vary, depending upon the quantity of material in the heating vessel, the efficiency of the stirring apparatus, the amount of heating surface, etc. For small amounts of material, the period of heating to raise the temperature to around 300° C. may be only a couple of hours or less; with larger amounts in batch operation, especially where the agitation is less rapid, eight or ten hours, or more, may be required in order to avoid overheating portions of the charge.

Products especially adapted for the practice of this invention should contain in general from 10% to 25%, up to 30%, of coal and should have a softening point (R. & B.) of 140° to 200° F., penetrations at 0° C. of not less than 1, at 25° C. of 5 to 40, and at 46.1° C. of not more than 175.

The asphaltic pyrobitumen-digestion pitch product may be produced by digesting an asphaltic pyrobitumen, having a fixed carbon content of at least 50% and the chemical and physical properties listed below, with coal tar, water-gas tar, their pitches or distillate oils at a temperature of above about 240° C., and preferably

from 260° to 350° C., for a sufficient period that the asphaltic pyrobitumen is smoothly dispersed throughout the tar or tar products in which it is digested and the resulting product when molten behaves substantially as a homogeneous fluid.

The chemical and physical properties of the asphaltic pyrobitumen which is used to give the surprising result are: It is black in color; has a specific gravity of about 1.1 to about 1.25 at 77° F.; contains at least 50% fixed carbon, and may contain from 50% to 90%; contains a small amount of constituents soluble in carbon bisulfide, e. g. as little as 2% and not more than about 6%; it is constituted almost entirely of non-mineral constituents insoluble in carbon bisulfide, e. g. as much as 97% and not less than about 93%; is solid at atmospheric temperatures; is substantially infusible; and decrepitates on heating in a flame.

An example of such asphaltic pyrobitumen is the material known as impsonite, a large deposit of which occurs in La Flore County, Oklahoma.

The period of digestion may be as long as two hours or more when the temperature is below 260° C. and may be much shorter at higher temperatures. For example, in the digestion of impsonite at or above a temperature of 290° C., substantially complete digestion is attained within thirty minutes. Impsonite-digestion pitch products especially adapted for the products of this invention should contain from about 5% to 50% of impsonite and should have a softening point (R. & B.) of 140° to 200° F., and penetrations at 0° C. of not less than 1, at 25° C. of 5 to 40, and at 46.1° C. of not more than 175.

The softening points and penetrations are determined in accordance with procedure and using standard apparatus prescribed by the American Society for Testing Materials. Softening points referred to herein are determined by the Ring and Ball method. Penetrations are given in tenth-millimeters; in the case of penetrations at 0° C., 200 grams are applied for 60 seconds; for penetrations at 25° C., 100 grams are applied for 5 seconds; and for penetrations at 46.1° C., 50 grams are applied for 5 seconds.

The mastic composition of this invention is constituted of from 8% to 17%, preferably from 12% to 15%, by weight of the aforesaid coal-digestion pitch or asphaltic pyrobitumen-digestion pitch, from 5% to 30% by weight of mineral filler, substantially all of which passes a 200-mesh sieve, and from 53% to 87% by weight of mineral aggregate. The mastic composition may also include as much as 15% by weight of asbestos fibers. The mineral aggregate is constituted of graduated sizes so that in the final mastic composition from 10% to 30% by weight passes a #40 sieve and is retained on a #200 sieve, from 10% to 40% by weight passes a #10 sieve and is retained on a #40 sieve, from 5% to 40% by weight passes a #4 sieve and is retained on a #10 sieve, and 0% to 25% by weight passes a one-half inch sieve and is retained on a #4 sieve. The mineral filler may be slate dust, limestone dust, silica dust, clay, dolomite dust, pulverized slag, Portland cement, or similar fine mineral matter; the mineral aggregate may be sand, crushed stone, slag, rock screenings, fine gravel, or other mineral material of suitable size and grading.

Proper control of the proportions of mineral particles of different sizes has been found important in order to form a mastic composition resistant to mechanical injury. In mastic prod-

ucts in which from 8% to 17% of coal-digestion pitch or impsonite-digestion pitch is employed, I have found that mineral particles of graduated sizes within the limits of proportions given above combine smoothly with the digestion pitch and appear to interlock with each other to impart to the combination a high resistance to deformation.

The mastic may be made on the site of the work, in either suitable mechanically operated heaters and mixers, or by manual stirring in open pans or kettles. The coal-digestion pitch or asphaltic pyrobitumen-digestion pitch is heated to a temperature of from about 250° to about 350° F. The mineral filler and mineral aggregate are heated to a temperature of from about 212° to 300° F. and then added to the melted digestion pitch. The ingredients should be well mixed to effect uniform distribution of the particles. (During the mixing process, care should be taken to avoid local overheating of the mixture, the temperature of which should generally be maintained between 300° and 400° F.) In an alternative procedure, the digestion pitch and a portion of the mineral, preferably all of the mineral filler and a quantity of mineral aggregate passing a #10 sieve equal to the quantity of mineral filler, may be heated and mixed elsewhere, molded in the form of cakes, and brought to the site of the work. The mastic cakes are melted and combined with additional digestion pitch and mineral aggregate as may be necessary to form the desired mastic composition.

A flooring or protective coating of digestion pitch mastic composition is formed by applying the mastic composition to the work at a temperature of from about 300° to about 400° F. At such temperatures the mastic is a soft, spreadable mass which may be manipulated by suitable tools to form a layer of the desired thickness. The mastic may be applied in one or more layers to the surface to be covered to a uniform thickness of from three-quarters to two inches. The top surface of the mastic is troweled, after partially cooling, to form a compact mass having a smooth, wear-resistant surface. The flooring or coating of mastic firmly adheres to the base or surface to which it is applied, and is highly resistant to indentation.

The following examples are illustrative of experimental applications of coal-digestion pitch mastic flooring compositions according to my invention:

Example 1.—325 pounds of coal-digestion pitch, having a softening point (R. & B.) of 173° F. and penetrations at 0° C., 25° C. and 46.1° C. of 7, 18 and 49 respectively, were heated to a temperature of about 325° F. 200 pounds of mineral filler heated to a temperature of about 250° F., substantially all of which passed a #200 sieve, were added to the molten coal-digestion pitch and distributed therethrough. 2,095 pounds of mineral aggregate heated to a temperature of 250° F., composed of 365 pounds passing a #40 sieve and retained on a #200 sieve, 470 pounds passing a #10 sieve and retained on a #40 sieve, 920 pounds passing a #4 sieve and retained on a #10 sieve, and 340 pounds passing a one-half inch sieve and retained on a #4 sieve, were then incorporated in and uniformly distributed through the mixture of coal-digestion pitch and mineral filler. This mastic mixture was prepared on the site of the work which was a brewery, and the heated mixture

at a temperature held within the range of about 350° to 375° F. was applied to a portion of an old concrete floor in the receiving room for empty beer kegs in a smooth layer ranging from 1¼ to 1½ inches thick. The flooring was subjected to water and stale beer, and also to the impact of falling kegs. Inspection after more than one year of service showed the flooring to be in good condition.

Example 2.—Coal-digestion pitch mastic cakes comprising 23% coal-digestion pitch and mineral matter consisting of equal parts of mineral filler passing a #200 sieve and sand passing a #10 sieve were melted with additional coal-digestion pitch at a temperature of about 300° F., after which mineral aggregate at a temperature of 250° F. was added. The additional coal-digestion pitch and mineral aggregate were added in proportions to form a mastic having the following composition:

	Per cent by weight
Coal-digestion pitch, softening point (R. & B.) 171° F., penetration at 0° C., 9; penetration at 25° C., 21; penetration at 46.1° C., 54	13.6
Mineral filler, passing #200 sieve	8.6
Mineral aggregate, passing #40 sieve and retained on #200 sieve	13.8
Mineral aggregate, passing #10 sieve and retained on #40 sieve	31.1
Mineral aggregate, passing #4 sieve and retained on #10 sieve	29.4
Mineral aggregate, passing one-half inch sieve and retained on #4 sieve	3.5

The mastic composition described above was applied at a temperature of about 360° F. in a layer averaging about one inch thick to a section of the floor of an industrial laboratory, and the surface troweled to form a smooth flooring. This flooring was subjected to water, various solvents, oils of both tar and petroleum origin, and other chemicals which were spilled thereon. The flooring was also subjected to heavy traffic and impact from hand-trucks and heavy drums. After a year of such wear, inspection showed no deterioration of the coal-digestion pitch mastic flooring.

Thus it is seen my digestion pitch mastic composition, having the following analysis:

	Per cent by weight
Coal-digestion pitch or impsonite-digestion pitch, softening point (R. & B.) 140° to 200° F., penetration at 0° C., not less than 1; at 25° C., 5 to 40; at 46.1° C., not more than 175	8 to 17
Mineral filler, substantially all passing #200 sieve	5 to 30
Mineral aggregate, passing #40 sieve and retained on #200 sieve	10 to 30
Mineral aggregate, passing #10 sieve and retained on #40 sieve	10 to 40
Mineral aggregate, passing #4 sieve and retained on #10 sieve	5 to 40
Mineral aggregate, passing one-half inch sieve and retained on #4 sieve	0 to 25
Asbestos fiber	0 to 15

forms a flooring which is resistant to wear and to indentation or deformation at the temperatures and other conditions to which it may be subjected when in use. The composition is not substantially weakened or softened by the action of water, petroleum products, vegetable oils and other reagents, so that it forms a highly re-

sistant material for use in forming floorings or pavements in garages, oil refineries, laboratories, etc.

While the invention has been described in its application to flooring, it is to be understood that the digestion pitch mastic composition may be applied in other relationships such as covering railway structures where its mechanical strength and outstanding water-resisting qualities are desired. Still other applications of the mastic composition of the invention are waterproofing of subways and lining of reservoirs, tanks and ducts.

I claim:

1. A mastic composition consisting of from 8% to 17% by weight of a digestion pitch product obtained by heating a hydrocarbon-containing mineral substance with a member of the group consisting of coal tar, water gas tar and their oils and pitches at a temperatures above 240° C. and for a time such that the mixture is digested to form a product which, when molten, behaves substantially as a homogeneous fluid and having a softening point (R. & B.) of from 140° to 200° F., penetrations at 0° C. of not less than 1, at 25° C. of from 5 to 40, and at 46.1° C. of not more than 175, mineral filler, substantially all of which passes a #200 sieve, in amount from 5% to 30% by weight, and the remainder of the composition consisting substantially entirely of not more than 30% mineral aggregate passing a #40 sieve and retained on a #200 sieve, not more than 40% mineral aggregate passing a #10 sieve and retained on a #40 sieve, not more than 40% mineral aggregate passing a #4 sieve and retained on a #10 sieve, not more than 25% mineral aggregate passing a one-half inch sieve and retained on a #4 sieve, and not more than 15% asbestos fibers.

2. A mastic composition consisting of from 8% to 17% by weight of a digestion pitch product obtained by heating a member of the group consisting of coal tar, water-gas tar, their oils and pitches with an asphaltic pyrobitumen containing not less than about 50% fixed carbon at a temperature above 240° C. and for a time such that the mixture is digested to form a product which, when molten, behaves substantially as a homogeneous fluid, said digestion pitch product having a softening point (R. & B.) of from 140° to 200° F., penetrations at 0° C. of not less than 1, at 25° C. of from 5 to 40, and at 46.1° C. of not more than 175, mineral filler, substantially all of which passes a #200 sieve, in amount from 5% to 30% by weight, and the remainder of the composition consisting substantially entirely of not more than 30% mineral aggregate passing a #40 sieve and retained on a #200 sieve, not more than 40% mineral aggregate passing a #10 sieve and retained on a #40 sieve, not more than 40% mineral aggregate passing a #4 sieve and retained on a #10 sieve, not more than 25% mineral aggregate passing a one-half inch sieve and retained on a #4 sieve, and not more than 15% asbestos fibers.

3. A mastic composition consisting of from 8% to 17% by weight of an "impsonite-digestion pitch" having a softening point (R. & B.) of from 140° to 200° F., penetrations at 0° C. of not less than 1, at 25° C. of from 5 to 40, and at 46.1° C. of not more than 175, mineral filler, substantially all of which passes a #200 sieve, in amount from 5% to 30% by weight, and the remainder of the composition consisting substantially entirely of not more than 30% mineral aggregate passing a #40 sieve and retained on a #200 sieve,

not more than 40% mineral aggregate passing a #10 sieve and retained on a #40 sieve, not more than 40% mineral aggregate passing a #4 sieve and retained on a #10 sieve, not more than 25% mineral aggregate passing a one-half inch sieve and retained on a #4 sieve, and not more than 15% asbestos fibers.

4. A bituminous mastic composition consisting of from 8% to 17% by weight of "coal-digestion pitch" having a softening point (R. & B.) of from 140° to 200° F., penetrations at 0° C. of not less than 1, at 25° C. of 5 to 40, at 46.1° C. of not more than 175, mineral filler, substantially all of which passes a #200 sieve, in amount from 5% to 30% by weight, and the remainder of the composition consisting substantially entirely of not more than 30% mineral aggregate passing a #40 sieve and retained on a #200 sieve, not more than 40% mineral aggregate passing a #10 sieve and retained on a #40 sieve, not more than 40% mineral aggregate passing a #4 sieve and retained on a #10 sieve, not more than 25% mineral aggregate passing a one-half inch sieve and retained on a #4 sieve, and not more than 15% asbestos fibers.

5. A mastic composition resistant to the action of water and petroleum products and also resistant to deformation at temperatures to which it may be subjected, which comprises from 8% to 17% of "coal-digestion pitch" having a softening point (R. & B.) of 140°-200° F., mineral particles distributed therein, said mineral particles comprising from 5% to 30% passing a #200 sieve, from 10% to 30% passing a #40 sieve and retained on a #200 sieve, from 10% to 40% passing a #10 sieve and retained on a #40 sieve, from 5% to 40% passing a #4 sieve and retained on a #10 sieve, and from 0% to 25% passing a one-half inch sieve and retained on a #4 sieve, the percentages being based on the total weight of the mastic composition.

6. A flooring comprising a base and a wear-resistant layer secured thereto, said layer being composed of a mastic composition which is resistant to the action of water and petroleum products and also resistant to deformation at the temperatures encountered in use, and which comprises from 8% to 17% "coal-digestion pitch" having a softening point (R. & B.) of 140-200° F., mineral particles mixed therewith comprising, based on the total weight of the mastic composition, from 5% to 30% passing a #200 sieve, from 10% to 30% passing a #40 sieve and retained on a #200 sieve, from 10% to 40% passing a #10 sieve and retained on a #40 sieve, from

5% to 40% passing a #4 sieve and retained on a #10 sieve, and from 0% to 25% passing a one-half inch sieve and retained on a #4 sieve, and from 0% to 15% asbestos fibers.

7. A mastic flooring composition resistant to the action of water and petroleum products and also resistant to deformation at temperatures to which it may be subjected, which comprises from 8% to 17% "coal-digestion pitch" having a softening point (R. & B.) of 140°-200° F., mineral particles mixed therewith comprising, based on the total weight of the mastic composition, from 5% to 30% passing a #200 sieve, from 10% to 30% passing a #40 sieve and retained on a #200 sieve, from 10% to 40% passing a #10 sieve and retained on a #40 sieve, from 5% to 40% passing a #4 sieve and retained on a #10 sieve, and from 0% to 25% passing a one-half inch sieve and retained on a #4 sieve, and not more than 15% asbestos fibers.

8. A mastic composition resistant to the action of water and petroleum products and also resistant to deformation at temperatures to which it may be subjected, which comprises from 12% to 15% "coal-digestion pitch" having a softening point (R. & B.) of 140°-200° F., mineral particles mixed therewith comprising, based on the total weight of the mastic composition, from 5% to 30% passing a #200 sieve, from 10% to 30% passing a #40 sieve and retained on a #200 sieve, from 10% to 40% passing a #10 sieve and retained on a #40 sieve, from 5% to 40% passing a #4 sieve and retained on a #10 sieve, and from 0% to 25% passing a one-half inch sieve and retained on a #4 sieve, and from 0% to 15% asbestos fibers.

9. A flooring comprising a base and a wear-resistant layer adhered thereto, said layer being composed of a mastic composition which is resistant to the action of water and petroleum products and also resistant to deformation at the temperatures encountered in use, and which comprises from 12% to 15% "coal-digestion pitch" having a softening point (R. & B.) of 140°-200° F., and mineral particles mixed therewith comprising, based on the total weight of the mastic composition, from 5% to 30% passing a #200 sieve, from 10% to 30% passing a #40 sieve and retained on a #200 sieve, from 10% to 40% passing a #10 sieve and retained on a #40 sieve, from 5% to 40% passing a #4 sieve and retained on a #10 sieve, and from 0% to 25% passing a one-half inch sieve and retained on a #4 sieve.

STUART P. MILLER.