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BITUMINOUS COMPOSITION

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This invention relates to bituminous compositions and methods of preparing same, and it has particular relation to compositions comprising mixtures of coal-tar and petroleum asphalt.

My invention has for its object to provide mixtures of coal-tar and petroleum asphalt, which form homogeneous products in any desired mixing proportion, and to provide valuable products comprising said homogeneous mixtures, such as materials for road-making, roofing paper, waterproofing and insulating masses, mastic, poured asphalt, bituminous emulsions, etc.

It is known in the art that homogeneous products can be obtained by mixing in any desired proportions coal-tar and Trinidad asphalt, whereas the preparation of homogeneous products from coal tar and petroleum asphalt is restricted to definite proportions. It is known that only up to 20% of petroleum asphalt can be incorporated with coal tar, and only up to 30% of coal tar can be incorporated with petroleum asphalt, if homogeneous mixtures should be obtained. Mixtures of coal tar and petroleum asphalt, which contain more than 20%, but less than 70% petroleum asphalt, are not homogeneous, as in such mixtures separation of certain constituents in flakes occurs.

This difficulty can be overcome, according to my invention, by using for the preparation of coal-tar- petroleum asphalt- mixtures a petroleum asphalt which has been obtained by an oxidizing treatment or by distillation under high vacuum. Mixtures of different kinds of such oxidized or blown petroleum asphalts and mixtures of different kinds of coal-tar may also be used in carrying out my invention.

I have discovered that viscous coal tars, which are rich in pitch, and have a dropping point over 25° C, can be converted with petroleum asphalt in any desired mixing proportion into homogeneous mixtures, by using for the preparation of such mixtures an oxidized or blown petroleum asphalt or a petroleum asphalt which has been distilled off under a high vacuum. Said viscous coal tars can, for instance, be obtained by distilling off raw coal tar until a tar of the desired quality is obtained as residue, or by mixing coal tar pitch with high boiling coal tar oil in suitable proportions. By mixing such viscous coal tars having a dropping point over 25° C in any desired mixing proportion with oxidized petroleum asphalt or with petroleum asphalt which has been distilled off under a high vacuum, homogeneous mixtures similar to unmixed petroleum asphalt are obtained, which show softening points over 25° C. Such mixtures are distinguished by high dropping points and can, therefore, be used for all purposes for which coal tars could not hitherto be used on account of their relatively low dropping points or on account of the too small differential between their dropping point and solidifying point.

The mixtures of coal tar and petroleum asphalt according to my present invention show a considerable resemblance to unmixed petroleum asphalt having the same softening point as said mixtures. Thus, my invention affords the significant possibility of obtaining binding agents of high softening points which contain a great percentage of coal tar and yet possess properties like unmixed petroleum asphalt. Mixtures according to my invention were prepared in accordance with the following examples, and were tested with regard to their practicability in comparison with unmixed petroleum asphalt. It has been found that these mixtures meet with all requirements of petroleum asphalt. Valuable, viscous binding agents can thus be obtained which may be used, for instance, in road-making (for surface treatments, impregnation, preparation of bituminous concrete, and poured coverings), in the manufacture of roofing paper and for insulation purposes. Some typical compositions embodying my invention would be, for example, as follows:

Example 1.—Mixture for surface treatments in road-making:

50% of coal-tar having a dropping point of about 30° C;

50% oxidized petroleum asphalt having a softening point of 50–60° C.

The mixture shows a softening point of about 26–27° C.

Example 2.—Mixture for insulations in road-making:

50% of coal-tar of a dropping point of 34° C;

25% of normally distilled petroleum asphalt having a softening point of 54–58° C;

25% of oxidized petroleum asphalt having a softening point of 90–100° C.

The mixture has a softening point of 34° C.

Example 3.—Mixture for bituminous concrete:

50% of coal-tar having a dropping point of 40° C;

20% of normally distilled petroleum asphalt having a softening point of 54–58° C;

30% of oxidized petroleum asphalt having a softening point of 75–85° C.

The softening point of the mixture is about 36° C.

A similar mixture having a softening point of about 38° C may be obtained from

50% of coal-tar having a dropping point of 33° C;

50% of petroleum asphalt which has been distilled off under a high vacuum and has a softening point of 60–70° C.

Example 4.—For poured pavings:

50% of coal tar having a dropping point of 42° C;

25% of normally distilled petroleum asphalt having a softening point of 54–58° C;

25% of oxidized petroleum asphalt having a softening point of 110–120° C.

The softening point of the mixture amounts to about 45°–46° C.

Example 5.—For mastic, insulations and grout fillers:

40% of coal-tar having a dropping point of 45° C;
30% of normally distilled petroleum asphalt having a softening point of 54°–58° C;
30% oxidized petroleum asphalt having a softening point of 130°–150° C.

The mixture has a softening point of about 54.5° C.

Thus, as shown by the above examples, according to my invention mixtures having a high content of coal tar can be obtained which can be used for all purposes instead of unmixed petroleum asphalt. These mixtures, which combine the advantages of petroleum asphalt with those of coal tar, can be obtained, for instance, by mixing together the individual components in the heat.

I have found that it is preferable in some cases to use in the mixtures according to my present invention as an additional component normally distilled petroleum asphalt, i. e. a petroleum asphalt which has been obtained without an oxidizing treatment and without distillation under high vacuum. By such admixture of normally distilled petroleum asphalt a certain protection of the components can be obtained during the mixing process which is carried out under heat. In addition a greater variability in the quality of the mixtures can be attained by using such admixtures. The addition of normally distilled petroleum asphalt, when used in suitable proportions, does not affect the unlimited miscibility of the other components, i. e. coal tar and oxidized or high-vacuum-distilled petroleum asphalt. I have found that for instance additions of 20–30% of normally distilled petroleum asphalt can be used, as shown in the above examples.

Furthermore, according to my invention, coal-tars, which have dropping points below 25° C, and an anthracene-oil content less than 40%, can also be worked up to homogeneous mixtures with petroleum asphalt in any desired mixing proportion.

It is known in the art that coal-tars of high anthracene-oil content, i. e. more than 40% of anthracene-oil, can be converted with petroleum asphalts into homogeneous mixtures in any desired proportion. Many kinds of coal-tars, particularly certain standardized road-tars contain, however, less than 40% of anthracene-oil. Homogeneous mixtures can only be obtained from such tars and petroleum asphalt, if the latter is admixed with coal-tar in a proportion not exceeding 15–20% of the mixture, or if the coal-tar is admixed to petroleum asphalt, the proportion of coal-tar not exceeding 30% of the mixture.

I have now found that such coal-tars having dropping points below 25° C and an anthracene-oil content less than 40%, can be worked up to homogeneous mixtures with petroleum asphalt in any desired mixing proportion, if petroleum asphalt is used which has a softening point higher than 54° C according to Kraemer-Sarnow, and has been obtained by an oxidizing treatment or by distillation under high vacuum. Such petroleum asphalt of high softening point can be incorporated with said coal-tars to obtain homogeneous mixtures without any difficulty. The mixtures, which may be obtained preferably by mixing together the preheated components, possess the advantages of petroleum asphalt as well as those of coal-tar, and, therefore, an increased usefulness in comparison with the individual components of the mixtures.

The selection of the petroleum asphalt, which is used for the preparation of the above described homogeneous mixtures, depends upon the properties of the coal-tar employed. I have found that the higher the softening point of the petroleum asphalt, the easier it is to obtain homogeneous mixtures. In the preparation of such homogeneous mixtures I use a petroleum asphalt whose softening point corresponds to the properties of the coal-tar employed. As a rule, the higher the pitch content, and the lower the anthracene-oil content of the coal-tar, and the higher its benzene-insoluble content, the higher the softening point of the petroleum asphalt should be.

Even coal-tars, which cannot be converted into homogeneous mixtures with 20% of a petroleum asphalt which has a softening point of 41°–45° C according to Kraemer-Sarnow, and the use, of which is customary in the preparation of coal-tar-asphalt-mixtures, give homogeneous products when mixed in any desired proportion with a petroleum asphalt, which has been obtained by an oxidizing treatment or distillation under high vacuum and has a very high softening point, for instance, preferably 80°–100° C according to Kraemer-Sarnow. I have further found that also in the preparation of mixtures containing about 30–40% of petroleum asphalt, preferably such a petroleum asphalt having a high softening point of about 80°–100° C should be used, as certain coal-tars, particularly those having a low anthracene-oil content, show an increased tendency of forming inhomogeneous products within the range of these mixing proportions. Such tendency can be easily overcome by using a petroleum asphalt of a very high softening point.

The following Examples 6–8 show some typical compositions containing coal-tars which have a dropping point below 25° C and an anthracene-oil content up to 40%.

Example 6.—A homogeneous mixture is obtained by mixing in the heat

40% of a road-tar II (viscosity 83 seconds at 30° C) and
60% of an oxidized petroleum asphalt having a softening point of 75°–85° C.

Example 7.—A homogeneous mixture is obtained by mixing

50% of an anthracene-oil-tar 65/35 and
50% of a molten petroleum asphalt obtained by distillation under high vacuum and having a softening point of 60°–70° C according to Kraemer-Sarnow.

Example 8.—A homogeneous mixture is prepared by mixing in the heat

50% of an anthracene-oil-tar 60/40, which cannot be converted into a homogeneous mixture with 15% of a petroleum asphalt having a softening point of 41°–45° C according to Kraemer-Sarnow, and
50% of an oxidized petroleum asphalt having a softening point 105° C according to Kraemer-Sarnow.

The homogeneous mixtures obtained in accordance with the above examples show an excellent applicability to road surface treatments, impregnation, waterproofing, and similar purposes.

I have found that the products obtained according to my invention can be used for the preparation of mastic, not only in masses which contain mineral dust, but also in masses which have been prepared with pulverized native rock asphalt.

Asphalt mastic consists, as known in the art, of a mixture of a bituminous binding agent, and either mineral constituents being essentially mineral dust (mostly limestone dust) and sand, or pulverized native rock asphalt, if desired with an admixture of sand. It is further known that the bituminous substance contained in the pulverized native rock asphalt has a very low softening point. In order to obtain asphalt mastic from pulverized native rock asphalt with or without the addition of mineral constituents, a further amount of a binding agent must be incorporated with the pulverized native rock asphalt. Petroleum asphalt has hitherto been used as such additional binding agent, whereas coal-tar could not be used, as it caused separation of the individual components within the product obtained. I have now found that by using instead of petroleum asphalt the homogeneous mixtures obtained according to my invention from coal-tar and petroleum asphalt having a very high softening point, as an addition to pulverized native rock asphalt, a homogeneous asphalt mastic can be obtained. This effect is surprising. The bituminous binder contained, for instance, in the asphalt mastic prepared according to my invention contains 50% of the binder which has been originally present in the purverized native rock asphalt, and 50% of the added mixture of equal parts of coal-tar and petroleum asphalt of high softening point. Thus the bituminous binder contains 75% of petroleum asphalt and 25% of coal-tar and is composed of 50% of bitumen having a low softening point, 25% of coal-tar and 25% of petroleum asphalt of high softening point. It is an entirely unexpected effect that this mixture contained in the mastic remains homogeneous, and that an addition of only 25% of the petroleum asphalt of high softening point is sufficient to ensure homogeneity of the bituminous binder. I prefer to use in the coal-tar-petroleum asphalt-mixture a petroleum asphalt the softening point of which depends upon the softening point of the bituminous binder originally contained in the pulverized native rock asphalt: The lower the softening point of the bitumen contained in the pulverized native rock asphalt, the higher the softening point of the petroleum asphalt used as an admixture to coal-tar should be.

Thus according to my invention from pulverized native rock asphalt mastic-like masses can be obtained which, in spite of the addition of an essential amount of coal-tar, contain the whole amount of the bituminous binder as a homogeneous mixture. The following compositions may, for instance, be used.

Example 9.—Mastic for poured asphalt can be obtained from

45% of pulverized native rock asphalt of Sicilian origin;

4% of a binder consisting 50% of coal-tar having a dropping point of 36° C and 50% of a petroleum asphalt obtained by distillation under high vacuum and having a softening point of 80°–90° C according to Kraemer-Sarnow;

40% of stone chips 3/8 and

11% of sand o/3.

The mixing of these components may be carried out in the usual manner.

Example 10.—Mastic for luting can be obtained from

84% of pulverized native rock asphalt of German origin, and

16% of a binder consisting of 50% of a coal-tar having a dropping point of 36° C and 50% of oxidized petroleum asphalt having a softening point of about 75°–85° C according to Kraemer-Sarnow.

I have further found that the homogeneous mixtures obtained according to my invention from coal-tar and the above described petroleum asphalts, can be used instead of unmixed petroleum asphalt in the preparation of poured asphalt.

In the preparation of poured asphalt, as known in the art, petroleum asphalt having a softening point of about 45°–50° C is mixed and heated with limestone dust, sand and stone chips. The mixing is carried out at temperatures of about 200°–210° C in stationary heaters or in heaters mounted on trucks, and the mass is continuously agitated by stirring arms during the heating in order to protect it from being burnt. The time which is necessary for carrying out this mixing process in the heat depends upon the amount of the mass treated. In a heater containing, for instance, 4 tons (4000 kilograms) of the mass, the heating process takes about 4–4½ hours. During the heating process the individual parts of limestone dust, sand and stone chips are coated with the bituminous binder and the interstices are filled up.

I have found that in order to obtain by means of the above described homogeneous mixtures of coal-tar and petroleum asphalt a poured asphalt which possesses the same valuable mechanical properties as a product which has been prepared by means of unmixed petroleum asphalt, a mixture of bitumen and coal-tar should be used whose softening point is about 10°–15° C lower than the softening point of an unmixed petroleum asphalt which is used under similar conditions. A coal-tar and petroleum asphalt mixture having a softening point of about 28°–40° C can therefore, be used. This fact is surprising, as it could be expected that a soft and impractical product will be obtained if such a soft binder is used.

A thorough investigation has, however, shown that a directly opposite result is attained. A poured asphalt, for instance, which has been prepared by using a mineral aggregate of entirely normal granularmetiric composition, and a binder consisting of a homogeneous mixture of coal-tar and petroleum asphalt, and having a softening point of 33° C only, possesses the same mechanical properties as a normal poured asphalt product which has been prepared by means of unmixed petroleum asphalt. The coal-tar-petroleum asphalt binder was thereby used in an excess of 0.5% in comparison with the usual amount of an unmixed bitumen binder.

Example 11.—50 parts of coal-tar having a dropping point of about 36° C are mixed with

50 parts of an oxidized petroleum asphalt having a softening point of 60°–70° C according to Kraemer-Sarnow.

Thereby 100 parts of a mixture having a softening point of about 33° C according to Kraemer-Sarnow are obtained.

A poured asphalt can be obtained by working up as described above, 9.2% of the above mixture, 25.0% of limestone dust, 25.8% of sand o/3 and 40.0% of stone chips 3/8.

Furthermore by using the homogeneous coal-tar-petroleum asphalt mixtures obtained according to my present invention, emulsions can be prepared in which the softening point of the bituminous binder is as high as it could be obtained hitherto by the use of an unmixed petroleum asphalt only. A binding agent consisting of a homogeneous coal-tar-petroleum asphalt mixture and having a softening point of about 26°–30° C may for instance be used. The use of such emulsions in road-making affords the benefit of obtaining after the breaking of the emulsions an immediately coherent, well adhering coating of the binder which holds firmly together the mineral particles. It is known in the art that such coating cannot be obtained if the known coal-tar-bitumen emulsions are used, whereas the emulsions prepared with homogeneous mixtures of coal-tar and petroleum asphalt according to my invention, possess the same favorable properties as the known emulsions used in road-making and prepared by means of unmixed petroleum asphalt.

Example 12.—50 parts of coal-tar having a dropping point of about 30° C are mixed with

50 parts of oxidized petroleum asphalt having a softening point of 60°–70° C according to Kraemer-Sarnow.

100 parts of a binder having a softening point of 28° C according to Kraemer-Sarnow are obtained.

50 parts of said binder having a softening point of 28° C

1 part of an emulsifying agent (alkali soap) and 49 parts of water are worked up in the usual manner to an emulsion, whereby a stabilizing agent or other additions, known per se, may be used.

Example 13.—50 parts of coal-tar having a dropping point of 30° C are mixed with

50 parts of oxidized petroleum asphalt having a softening point of 50–60° C according to Kraemer-Sarnow.

100 parts of a coal-tar-bitumen mixture having a softening point of 25° C according to Kraemer-Sarnow are obtained.

56 parts of said coal-tar-bitumen mixture,

1 part of an emulsifying agent (alkali soap) and 42.5 parts water are worked up to an emulsion.

The emulsion can be prepared, for instance, by intimately mixing by means of a suitable apparatus water and the molten bituminous substance containing an emulsifying agent.

The term "petroleum asphalt" is applied in the present specification and claims to the semi-solid to solid residues obtained from the distillation of semi-asphaltic and asphaltic petroleums. In the present application the "softening points" were determined according to the known method of Kraemer-Sarnow; the "dropping points" were termined according to the known method of Ubbelohde, and the "solidifying points" were determined according to the known method of Metzger.

The term "high vacuum" is applied in my present specification and claims to a vacuum which is obtained by nearly complete evacuation of the distillation apparatus, and corresponds, for instance to 10 mm. mercury.

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