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SOUND DEADENING BITUMINOUS CEMENT

Henri M. Marc, Cincinnati, Ohio, assignor to The
Philip Carey Manufacturing Company, a cor-
poration of Ohio

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This invention pertains to bituminous sound deadening coatings and cements, and particularly pertains to bituminous cements composed of blended high melting point asphaltic material cut back with a solvent, and containing mineral filling materials.

The sound deadening cements are intended to be applied as coatings for metal sheets or panels to be used in motor vehicle body construction, building construction, and other places where it is desired to deaden sound caused by metal vibration. Some of the advantageous features of the cements made in accordance with the present invention are that they have a consistency such that they can be sprayed on slightly-oiled steel plates or panels at a pressure of 100 to 150 lbs. per square inch, and they adhere and bond securely to the steel when so applied. In commercial practice of applying sound deadening coatings to auto body panels, 60 to 90 minutes after application of the cement to the steel body panels they are immersed in a 5 per cent caustic soda bath for about 20 minutes at a temperature of 200° to 212° F., and then, after drying, are heated further at 250° to 300° F. for from one to three 30-minute periods. After these heat treatments the bituminous coatings of my invention adhere tightly and will not flake or break off the metal previously brought to -15° F., when struck with a hammer on the uncoated side of the metal plate. Their very high efficiency as sound deadeners for vibratile metal panels is demonstrated by the fact that when applied at a rate of 0.6 lb. per square foot (dry weight) on a one-fourth inch thick calibrated cold rolled steel plate twenty inches square, this test plate when subjected to impact under standard test conditions will show a sound decay of sixty decibels or more in eight seconds. They thus virtually eliminate the objectionable rumble or "drumming" of steel panels used in automobile body construction.

The invention is generally typified by a blend of high melting point blown asphalts having mixed therewith fine fibers, finely divided mineral material, and a solvent. The solvent serves to bring the coating composition to suitable consistency for application and is removed during the air drying and subsequent heat treatments given the steel panels. The finely divided mineral material gives body to the cement and improves sound deadening efficiency. The fine fiber component reinforces and stabilizes the composition and prevents it from sliding off the metal, particularly at elevated temperatures, even as high as those which are necessary for the spot

welding of the metal panels, and decreases its brittleness at low temperatures.

The asphalt component of the cement is a blend of what, for convenience, may be referred to as "C" and "D" types of asphalt. There are produced in petroleum oil refining plants several separate and distinct asphaltic fluxes which differ from one another because of the different treatment each receives in the refining process, especially the temperature at which they are made. In the usual process of refining crude petroleum, as for example, Mid-Continent crude, the crude petroleum is subjected to fractional distillation by heating in an "atmosphere pipe still," usually with super-heated steam. Various volatile fractions, such as gasolene, naphthas, kerosene and "gas oil" are distilled off as the temperature is raised up to about 500° F., leaving a residue, known as "reduced crude," comprising about 20 fifty per centum of the original crude. This "reduced crude" is then subjected to further refining by distillation, in a "vacuum pipe still," under high vacuum with steam, at still higher temperature than that employed in the fractional distillation. The products derived from the "reduced crude" under this vacuum refining are, (1) heavy gas oil, (2) paraffin distillate, (3) cylinder stock, and (4) "pipe still bottoms" or asphalt flux. The higher the temperature in the "vacuum pipe still," the higher vacuum, and the greater the amount of steam introduced, so progressively smaller is the yield of asphalt flux from the original crude. Also, with increasing temperature, vacuum, and steam, the amounts of waxy or paraffinaceous substances remaining in the asphalt flux are progressively reduced, with accompanying changes in the properties of the asphalt flux and of refined asphalts made from the flux by further heat treatment or oxidation. For example, vacuum pipe still treatment of reduced crude from Mid-Continent petroleum, under 29 inch vacuum, at a temperature of approximately 550° F. yields about 15 per cent of asphalt flux (calculated on the original crude). This flux is referred to as "A." The same "reduced crude" processed at about 790° F. yields about 6 per centum of asphalt flux, designated as "B," and if processed at about 760° F. yields about 8 per centum of asphalt flux, designated as "D." The "B" and "D" fluxes may be described as highly refined, but uncracked, asphalts. Each flux distinctly differs in properties from the others although all are derived from the same crude petroleum. There may be variations in the conditions of refining which will yield fluxes varying

in properties from the extremes A and B, of which "A" is the most waxy in character and "B" is the least waxy, with "D" representing an intermediate type between the two extremes.

Another separate refining process generally used consists in subjecting the "gas oil" obtained from the "atmospheric pipe still" and the "vacuum pipe still" to a cracking treatment under extreme heat and pressure, as at about 1000° F. and under about 1000 lbs. pressure, in a pressure still. This cracking treatment yields light "cracking coil tar" or "reduced pressure still tar." Further refining of "reduced pressure still tar" in a vacuum pipe still yields about 18 per cent of a fourth type of asphaltic flux which for convenience may be designated as "C," and which in commerce is usually referred to as "cracked asphalt."

These different fluxes A, B, C, and D, each need to be further heat treated and oxidized to give them the particular properties required for use alone or with two or more of them blended together.

In fluxes A, B and D blown to penetration 128-136 at 77° F. and "C" as received from the refinery, the respective softening points (ball and ring method) are about as follows: "A"—127; "B"—108; "C"—102; and "D"—112. The viscosities at 400° F. (MacMichael) are: "A"—41; "B"—47; "C"—13; and "D"—53. A most conspicuous difference between them is found in the pliability test at 0° F. Flux "A" in the form of a $\frac{3}{8}$ " thick strip, will bend 180° of arc around a $\frac{3}{8}$ " mandrel at this low temperature, but "B" will bend only 8°; "C" only 5° and "D" only 14°. The differences are again manifest when these fluxes are air blown (oxidized); for at any given softening point, the penetration of the asphalt from each flux is quite different from that of another. At a softening point of 200° F. (ball and ring method) the respective penetrations are as follows: "A"—41; "B"—12; "C"—3; and "D"—28. Using penetration as a reciprocal index of hardness, these values show "C" to be the hardest, "A" the softest, with "B" and "D" intermediate in this property.

I have discovered the surprising fact that asphalt with a softening point of about 200° F. blown from "C" flux, blended with blown "D" flux having a softening point of about 220° F. (this latter being a grade of coating asphalt such as is ordinarily used for coating saturated foundation fabrics in the manufacture of asphalt roofing), provides a novel and greatly improved sound deadening coating or cement when mixed with fine asbestos fibers and sand and cut back with a suitable solvent for application. The coating asphalt for roofing is of a character set forth on pages 501 and 502 of "Asphalt and Allied Substances" by Abraham (third edition).

The unexpected and surprising improvement in sound deadening efficiency afforded by the compositions of my invention may be illustrated by the following examples. A sound deadening coating made from blown "D" flux with a softening point of about 220° F., fine asbestos fiber, "Wedron" fine sand and a suitable mixture of petroleum solvents, of approximately the following composition by weight:

	Per cent
220° F. melting point "D" asphalt.....	32
No. 16 asbestos fiber.....	32
Wedron fine sand.....	8
Petroleum solvents.....	28

when applied at a rate of 0.6 lb. per square foot, dry weight, on a standard steel plate for sound decay test, showed a sound decay of 22 decibels in 8 seconds after passing all the heat tests, and did not flake or break off the metal plate under the low-temperature impact test. Another cement made from blown "C" flux with a softening point of about 200° F., fine asbestos fiber, Wedron fine sand and a suitable mixture of petroleum solvents, of approximately the same composition by weight as given above, did not adhere to the steel plate at the oven temperature of 250° F., and slid off so that it could not be tested for sound decay efficiency, thereby showing its unsuitability for application to steel surfaces as a sound deadener for motor vehicle body construction. However, another cement composition having approximately the same amount of each of the ingredients as the cement given above, but the asphalt content of which was made up of an approximately equal mixture by weight of blown "C" asphalt with a softening point of about 200° F. and blown "D" asphalt with a softening point of about 220° F., when applied at a rate of 0.6 lb. per square foot, dry weight, on the standard steel plate and put through the heat tests as stated above, showed a sound decay of 64 decibels in 8 seconds and also met the low-temperature impact test. These results show that the sound deadening composition made with the blend of these two different asphalts has much superior properties in comparison with those of the composition made from either one alone.

The above example of one preferred embodiment of my invention is not to be construed as limiting its scope to the particular composition given. I have found that the blended asphalt may vary from about 20 per cent to 35 per cent by weight of the total, the mixture of fine asbestos fiber and fine sand may vary from about 35 per cent to 55 per cent by weight, and the petroleum naphtha solvent mixture may vary from about 18 per cent to 30 per cent by weight of the composition and the resulting sound deadening coating will still have the advantageous properties above set forth.

My preferred range of composition for the sound deadening coating comprises the following proportions of the several ingredients:

	Per cent by weight
Two-component blended asphalt, as described.....	30-35
Fine asbestos fiber and fine sand mixture.....	40-50
Petroleum naphtha solvent mixture.....	20-25

I have found further that the proportions of the blown "C" asphalt and the blown "D" asphalt may be varied considerably in the blend of asphalts used in my sound deadening composition without detracting appreciably from its advantageous properties, although it is essential that both types of asphalt, the air-blown highly-refined uncracked asphalt and the air-blown, cracked asphalt, be included in the composition. The ratio of the blown "D" asphalt to the blown "C" asphalt by weight may vary from about 0.6 to 1.5 within the scope of my invention, although I prefer to have these asphalts present in the blend in approximately equal proportions.

Although I prefer to use in the composition blown "D" asphalt having a softening point of about 220° F., this property of the asphalt may be varied somewhat and I am able to use this

type of asphalt blown to a softening point in the range from about 205° to 235° F. and still obtain a sound-deadening coating having excellent properties. Likewise, the blown "C" asphalt which, preferably, has a softening point of about 200° F. will still enable me to obtain the advantageous qualities of my sound deadening composition when it has a softening point in the range from 180° to 220° F.

The fiber content is preferably asbestos fiber and particularly the grade which is known in the trade as No. 16 (Quebec Asbestos Producers Association grade 7T). It is relatively short and substantially all of it will pass through a 14-mesh standard sieve. It shows approximately the following retained percentages by weight when 100 grams of the fiber are screened for 30 minutes in a standard Rotap sieve shaker:

Typical
sieve analysis

Retained on 20-mesh screen,	1.4 to	5.7--	3.1
Retained on 28-mesh screen,	7.1 to	13.7--	9.3
Retained on 35-mesh screen,	14.9 to	24.0--	17.7
Retained on 100-mesh screen,	17.8 to	26.8--	23.6
Retained on 200-mesh screen,	11.5 to	17.6--	12.6
Retained on 325-mesh screen,	9.2 to	12.0--	10.3
Through 325-mesh screen,	16.1 to	26.2--	23.2

The fibers are of sufficient length to reenforce and toughen the bituminous composition, but are sufficiently small to permit the composition to be sprayed in place without clogging the nozzle of the spray gun. I also have found other grades of "asbestos powder" and "asbestos dust," including the Q. A. P. A. 7R and 7RF grades, asbestos "air floats" and asbestos "milled tailings," suitable for this purpose.

The finely divided granular material in my sound deadening composition is preferably of the character of "Wedron" sand or other fine sand of approximately the following screen grading when 200 grams of the sand are screened for 60 minutes in a standard Rotap sieve shaker:

	Per cent
Retained on 50-mesh screen.....	4.6
Retained on 70-mesh screen.....	39.2
Retained on 100-mesh screen.....	26.2
Retained on 140-mesh screen.....	20.0
Retained on 200-mesh screen.....	8.3
Retained on 325-mesh screen.....	1.5
Through 325-mesh screen.....	Trace

Although other suitable finely granulated materials can be used, such as barytes, iron scale, ground trap rock, ground slate and the like, and while I do not wish to limit myself to the use of fine sand only, the following data show the advantage of fine sand over ground trap rock of approximately similar sieve analysis, in my sound deadening composition.

	Sample C-16a	Sample C-16b
Per cent "D" flux, 220° F. melting point.....	16.3	16.3
Per cent "C" flux, 200° F. melting point.....	16.6	16.6
Per cent petroleum solvent mixture.....	22.3	22.3
Per cent No. 16 asbestos fiber.....	32.1	32.1
Per cent Wedron fine sand.....	12.7	12.7
Per cent ground trap rock.....	88.0	70.4
Sound decay, decibels in 8 seconds.....		

I have found that the proportion of fine asbestos fiber to fine sand may be varied considerably within the scope of my invention. While I prefer to use the fine asbestos powder, such as the

No. 16 grade, in the ratio by weight of about 2.5 to the weight of the fine sand, I have found that the ratio of the fine asbestos fiber to the fine sand may vary from about 1.2 to 4.0 and the resulting sound deadening composition has satisfactory properties in respect to adhesion to steel, freedom from flowing when heated, resistance to impact shock, and rapid decay of sound caused by vibration of the metal panel on which the coating has been applied.

In preparing my improved sound deadening coating the blended asphalt composition is cut back with any suitable petroleum solvent mixture to a suitable viscosity for being applied to the metal surface, preferably by spraying. A petroleum naphtha with a boiling range between 300° and 400° F., approximately, has been found suitable, but a greater concentration of total solids (asphalt plus fiber and sand) can be maintained when hydrogenated petroleum naphthas, such as "Solvesso No. 2" or "Solvesso No. 3" are added in suitable proportions to the ordinary petroleum naphtha.

I prefer to use a mixture of ordinary petroleum naphtha and hydrogenated petroleum naphtha in about equal proportions by weight. However, the cost of the hydrogenated petroleum naphtha is higher than that of the ordinary petroleum naphtha obtained by fractional distillation and I have found that I can prepare a sound deadening coating composition of very satisfactory properties by using a mixture of these two solvents in which the ratio by weight of ordinary petroleum naphtha to hydrogenated petroleum naphtha lies in the range from about 0.7 to 4.0.

Having thus completely described my invention and the distinct advantages thereof, it will be evident to those skilled in the art that numerous changes or modifications may be made therein, without departing from its scope as defined in the appended claims.

What I claim is:

1. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of two air-blown asphalts, one of said asphalts having been produced by air-blowing highly refined, but uncracked, petroleum residuum to a softening point of about 220° F. and the other of said asphalts having been produced by air-blowing cracked petroleum residuum to a softening point of about 200° F., the ratio by weight of the air-blown uncracked asphalt to the air-blown cracked asphalt in the blend being in the range from 0.6 to 1.5, said asphalt blend having admixed therewith a substantial proportion of fine asbestos fiber and fine granular material to stabilize said coating against flowing under the application of heat, and said asphalt blend also having a petroleum solvent admixed therewith to facilitate application of the coating composition by brushing or spraying.

2. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of two air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., about 35 per cent to 55 per cent of a mixture of fine asbestos fiber and fine granular material, the ratio by weight of asbestos fiber to granular material being in the range from 1.2 to 4.0, and a petroleum solvent.

3. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., about 35 per cent to 55 per cent of a mixture of fine asbestos fiber and fine granular material, and a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha in which the ratio by weight of petroleum naphtha to hydrogenated petroleum naphtha lies in the range from 0.7 to 4.0.

4. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., the ratio by weight of said air-blown, uncracked asphalt to said air-blown, cracked asphalt being about 1.0, about 35 per cent to 55 per cent of a mixture of fine asbestos fiber and fine sand, the ratio by weight of said asbestos fiber to said sand being about 2.5, and a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha, the ratio by weight of said petroleum naphtha to said hydrogenated petroleum naphtha being about 1.0.

5. A sound deadening coating composition comprising about 30 per cent to 35 per cent by weight of a blend of asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., about 40 per cent to 50 per cent of a mixture of fine asbestos fiber and fine granular material, and about 20 per cent to 25 per cent of a petroleum solvent to make the coating composition of suitable consistency for application by spraying.

6. A sound deadening coating composition for vibratile metal sheets comprising about 30 per cent to 35 per cent by weight of a blend of asphalts, one of said asphalts being an air-blown, highly refined but uncracked petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., the ratio by weight of said air-blown, uncracked asphalt to said air-blown, cracked asphalt being about 1.0, about 40 per cent to 50 per cent of a mixture of fine asbestos fiber and fine sand, the ratio by weight of said asbestos fiber to said sand being about 2.5, and about 20 per cent to 25 per cent of a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha, the ratio by weight of said petroleum naphtha to said hydrogenated petroleum naphtha being about 1.0.

7. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of asphalts, one of said asphalts having been produced by air-blowing uncracked petroleum residuum to a softening point of about 220° F. and the other of said asphalts having been produced by air-blowing cracked petroleum residuum to a softening point of about 200° F., about 35 per cent to 55 per cent of fine mineral, and about 18 per cent to 30 per cent of

petroleum naphtha, said coating composition being characterized by its ability to produce a film on a metal surface capable of resisting flow at elevated temperatures and having good adhesion to the metal, said film after drying being highly resistant to mechanical shock and having a high efficiency as a sound deadener for the metal on which the film is deposited.

8. A sound deadening composition for coating vibratile metal panels comprising a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., and a substantial proportion of finely divided mineral dispersed in said blend of asphalts to stabilize said composition against flowing at elevated temperatures.

9. A sound deadening coating composition characterized by its ability to produce a strongly adherent film on a vibratile metal surface, said film being resistant to flow at elevated temperatures and said film after drying being highly resistant to mechanical shock and said film being capable of causing rapid decay of sound produced by vibration of said metal, comprising about 20 per cent to 35 per cent by weight of a blend of asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point in the range from 205° to 235° F., and the other of said asphalts being an air-blown, cracked asphalt petroleum residuum having a softening point in the range from 180° to 220° F., the ratio by weight of said air-blown, uncracked asphalt to said air-blown, cracked asphalt being in the range from 0.6 to 1.5, about 35 per cent to 55 per cent of a mixture of fine asbestos fiber and fine sand, the ratio of asbestos fiber to sand by weight being in the range from 1.2 to 4.0, and about 18 per cent to 30 per cent of a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha, the ratio by weight of petroleum naphtha to hydrogenated petroleum naphtha being in the range from 0.7 to 4.0.

10. A sound deadening composition for coating vibratile metal panels comprising a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., and a substantial proportion of finely divided mineral fibrous material dispersed in said blend of asphalts to stabilize said composition against flowing at elevated temperatures.

11. A sound deadening composition for coating vibratile metal panels comprising a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown, cracked petroleum residuum having a softening point of about 200° F., and a substantial proportion of finely divided asbestos material dispersed in said blend of asphalts to stabilize said composition against flowing at elevated temperatures.

12. A sound deadening composition comprising blown asphalt flux "D" having a softening point of about 200 degrees F., blended with blown asphalt flux "C" having a softening point of about

220° F., a substantial proportion of fine inert material, and about 18 to 30 per cent of solvent, characterized by its ability to produce a film on a metal surface capable of resisting flow at elevated temperatures and having good adhesion to iron and steel, said film after drying being resistant to mechanical shock at low temperatures and having a high efficiency as a sound deadener for the metal on which the film is deposited.

13. A sound deadening composition comprising about 20 to 35 per cent blended asphalt composed of blown asphalt flux "D" having a softening point of about 200 degrees F. and a blown asphalt flux "C" having a softening point of about 220 degrees F., about 35 to 55 per cent of fine inert material, and about 18 to 30 per cent of solvent, characterized by its ability to produce a film on a metal surface capable of resisting flow at elevated temperatures and having good adhesion to iron and steel, said film after drying being resistant to mechanical shock at low temperatures and having a high efficiency as a sound deadener for the metal on which the film is deposited.

14. A sound deadening composition comprising a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown cracked petroleum residuum having a softening point of about 200° F., a substantial proportion of filling of fine fiber and granular material, and a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha.

15. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of air-blown asphalts, one of said asphalts being an air-blown, highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and the other of said asphalts being an air-blown cracked petroleum residuum having a softening point of about 200° F., the ratio by weight of said air-blown, uncracked asphalt to said air-blown, cracked

asphalt being about 1.0, about 35 per cent to 55 per cent of a mixture of fine fibers and fine granular material, the ratio by weight of said asbestos fiber to said fine granular material being about 2.5 and a solvent mixture of petroleum naphtha and hydrogenated petroleum naphtha, the ratio by weight of said petroleum naphtha to said hydrogenated petroleum naphtha being about 1.0.

16. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of air-blown asphalts, one of said asphalts being highly refined but uncracked, petroleum residuum having a softening point of about 220° F. and another of said asphalts being cracked petroleum residuum having a softening point of about 200° F., the ratio by weight of the uncracked asphalt to the cracked asphalt in the blend being in the range from 0.6 to 1.5, about 35 per cent to 55 per cent of fine fiber and granular material, the ratio by weight of the fiber and granular material being in the range from 1.2 to 4.0, and a petroleum solvent.

17. A sound deadening coating composition comprising about 20 per cent to 35 per cent by weight of a blend of two air-blown asphalts, one of said asphalts having been produced by air-blowing highly refined, but uncracked, petroleum residuum to a softening point of about 220° F. and the other of said asphalts having been produced by air-blowing cracked petroleum residuum to a softening point of about 200° F., the ratio by weight of the air-blown uncracked asphalt to the air-blown cracked asphalt in the blend being in the range from .06 to 1.5, said asphalt blend having admixed therewith about 35 per cent to 55 per cent of fine inert filling material to stabilize said coating against flowing under the application of heat, and said asphalt blend also having a petroleum solvent admixed therewith to facilitate application of the coating composition by brushing or spraying.

HENRI M. MARC.