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ASPHALT PATCHING COMPOSITIONS

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The invention described herein may be manufactured and used by or for the Government of the Uniteed States of America for governmental purposes without the payment of any royalties thereon or therefor.

This is a continuation-in-part of application Serial No. 143,253 filed October 5, 1961, now abandoned.

This invention relates to asphalt patching compositions and a method of making the same. More particularly, the invention relates to hot asphalt patching mixtures and especially to mixtures of friable material comprising fine mineral aggregate of the type of fine sand, mineral filler, and asphalt adapted to be mixed with coarse aggregate to form an asphaltic concrete.

Prior art methods of preparing hot bituminous mixtures of asphaltic concrete or paving material are not suitable for the small quantities necessary for patching pavements. Cold mixes, composed of cut-back asphalts, slow-curing asphalts and emulsified asphalts which can be stock-piled, are in common use. These mixtures all depend upon the evaporation of solvents or water to cause hardening sufficient to prevent displacement under traffic. On airport runways and high-speed highways these cold patches are displaced before hardening can occur, resulting in the need for constant renewal. Hot mixes, which become stable upon cooling, make the best patches. These hot mixes can be used if hot asphalt plants are near the site of the work, but specified gradations of aggregates, mineral filler, and asphalt contents are not usually obtainable in small quantities. In using hot plant mixes from commercial sources, a full truckload is the minimum amount hauled to conserve heat. Much of the material becomes too cold to use and is wasted.

Small two to five cubic foot mixers are available for making hot asphalt mixes. These mixers are capable of producing satisfactory combinations of coarse aggregate, fine aggregate, mineral filler, and asphalt. However, since each ingredient must be weighed or measured separately, there are many chances for error. Hot liquid asphalt is difficult and dangerous to handle. Hot mixes made by existing prior art methods in small portable mixers usually do not contain ingredients in the specified proportions because of these aforementioned difficulties, and failures of the patches result.

An object of the present invention is to provide a hot asphalt patching mixture which embodies a convenient and accurate control of the relationship between the asphalt content and the extremely fine mineral aggregate content.

Another object of the invention is to provide a hot asphalt patching mixture which permits of using asphalt in the form of discrete particles, thus facilitating the packaging of weighed amounts in paper or other low-cost sacks or cardboard containers or the like.

A further object of the invention is to provide a friable material comprising aggregate of the type of fine sand, mineral filler, and asphalt containing all of the ingredients for a high-quality paving mixture except the coarse mineral aggregate and adapted to be mixed with coarse aggregate to form an asphaltic concrete or paving mixture.

Still another object of the invention is to provide a method for the manufacture of the aforementioned hot asphalt patching mixtures.

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

Asphaltic concrete of the type used in patching pavements and the like commonly is composed of asphaltic binder, mineral filler which may be limestone dust or the like in very fine particulate form typically all passing through a #200 sieve, and mineral aggregate coarser than a #200 mesh.

This latter mineral aggregate typically has a distribution of particle size ranging from those just large enough to be retained on say a #200 sieve to those just small enough to pass through say a ½" sieve. The smallest particles of this mineral aggregate can be called fine sand and typically might lie in the range of sizes such as to be all retained on a #200 sieve but all pass a #40 sieve. The limitations are not rigid, however, and the particles might still be called fine sand if they are just small enough to pass say a #30 sieve or a #10 sieve or any other size sieve that can reasonably be designated in view of the ordinary connotation of the words, "fine sand."

The next larger group of particles can conveniently be called coarse sand and would begin at just above the upper size limit of the fine sand and extend to just below the lower size limit of what can be conveniently called coarse mineral aggregate. The coarse sand typically might be of particle sizes such as are all retained on say a #40 sieve and all pass say a #4 sieve. Again, the limitations are not rigid and if the upper limit for fine said is chosen as say for passage through a #30 or a #10 sieve, then coarse sand would include sizes retained on these latter sieves.

The rock or stone particles coarser than coarse sand can handily be called coarse mineral aggregate and typically may be those large enough to be retained on say a #4 sieve. Once again the limitataions are not rigid but commonly for patching mixes the upper limit may be a size just small enough to pass a ½" sieve.

For purposes of the description of this invention, reference will be made generally to two categories of mineral aggregate: fine sand, as described hereinbefore; and relatively coarse mineral aggregate by which is meant coarse sand as described hereinbefore and coarse mineral aggregate as described hereinbefore.

The hot asphalt patching mixture of this invention typically comprises fine sand, mineral filler, emulsified asphalt of the slow-setting type, and a thickening agent for the asphalt emulsion present in sufficient amount to render the composition friable. Sufficient asphalt is included so that when this patching mixture is mixed with the usual relatively coarse aggregate, a high quality paving mixture is formed. Thus, there is sufficient asphalt in the paving mixture to coat the coarse aggregate. The aforementioned fine sand usually would be natural sand, but can be synthetic sand such as that made by pulverizing rock or stone. The mineral filler typically is limestone dust, but other such fillers can be used: dolomite, granite dust, or other stone dust or finely divided mineral matter.

The asphalt emulsion, as previously mentioned, is of the slow-setting type known in the art and usually designated with the letters SS. This type of emulsion and the tests to determine whether it meets the specifications common in the art for such emulsions are described in The Asphalt Handbook, Revised Edition, March 1960, published by The Asphalt Institute, College Park, Maryland and also in Federal Specifications SS–A–674b of November 25, 1952 entitled "Asphalt, Paving, Emulsion" and SS–R–406c, amendment 1, Part 1, June 7, 1955, entitled "Road and Paving Materials; Methods of Sampling and Testing." The cement mixing test is used to determine the amount of coagulation when Portland cement is mixed with the slow-setting type of asphalt emulsion. That is, this test is a demulsibility test which indicates the tendency of the colloidal globules of asphalt in the emulsion to

coalesce or "break" when spread in thin films on aggregate. Typical slow-setting asphalt emulsions exhibit less than 2% of the emulsion broken when subjected to the cement mixing test described in the aforementioned publications.

The thickening agent is hydrated lime in a preferred embodiment, this being a readily available inexpensive compound. However, other agents can be used also: other partially soluble hydroxides, sulphates, sulphides, or fluorides. The thickening agent serves to partially solidify the aqueous phase of the asphaltic emulsion to form discrete particles of the patching mixture but it does not break the emulsion.

In lieu of the pre-formed emulsified asphalt, such as can be bought on the open market, the asphalt emulsion can be formed at essentially the same time as it is mixed with the fine sand and mineral filler. Thus, asphalt liquified by heating can be incorporated with fine sand and/or stone dust or the like in the presence of water. Conveniently a slurry is first formed of these latter with water and when thoroughly mixed with the asphalt serves to form an emulsion. The emulsified asphalt thus produced is then already in combination with the fine sand and mineral filler and ready for the addition of the thickening agent to accomplish the formation of the friable material of the invention comprising discrete asphaltic particles.

A typical preferred embodiment of the product of this invention has the following approximate proportions by weight:

	Parts
Fine sand	75
Limestone dust	25
Slow-setting emulsified asphalt (58% asphalt content)	38
Hydrated lime	1

The emulsified asphalt is used to provide the necessary amount of asphalt, in this illustration approximately 22 parts by weight of the composition. Thus, if an emulsion containing a different percentage asphalt is used, the amount of it is altered to provide in the final composition the same desired approximately 22 parts by weight of asphalt.

The product is prepared by mixing the sand, limestone dust, and emulsified asphalt conveniently in a plaster mixer or similar mixer capable of handling stiff or viscous materials. Thereafter the hydrated lime (or other thickening agent) is added and the product mixed until "mealy" separated particles are formed. The product can then be readily placed in sealed containers or waterproof bags or boxes for convenient storage and shipment.

A typical mixture made according to the aforedescribed example and using a conveniently available fine sand has the following gradation and asphalt content when dehydrated:

Sieve size:		
#30	percent passing	100
#40	do	95
#80	do	47
#200	do	22
Percent asphalt (by weight of mineral matter)		21

In producing the total paving material for patching, the hot patch mixture of this invention is combined in a portable heater-mixer or small pug-mixer with an aggregate which is all retained on typically a #40 sieve and all passing some desirable maximum size screen, typically ½" for most patching. The packaged, pre-weighed hot patch mixture can be combined with coarse aggregate in any desired proportions to meet standard specifications and to provide a high-quality asphaltic concrete. The following are typical proportions and show the resulting gradation and asphalt contents in the combined mixture. The first figure in the heading of each of the last three columns denotes parts, by weight, of the hot patch mixture of this invention. The second figure in each of these three

headings shows the parts by weight of the coarse aggregate retained on a #40 sieve.

Sieve size	Percentage Passing		
	1 to 4	1 to 3	1 to 2
½ inch	100.0	100.0	100.0
⅜ inch	80.0	84.0	89.0
#4	55.0	60.0	73.0
#40	19.0	24.0	32.0
#30	9.0	12.0	16.0
#200	4.4	5.0	7.0
Percent asphalt	4.2	5.25	7.0

The combination of aggregate heated to approximately 350° F. and the hot patch mixture of this invention can be mixed in a pug mill. Alternatively, the aggregate and the hot patch mixture of this invention can be heated together and mixed in a heater-mixer. Each of these methods produces a hot asphaltic concrete especially suitable for patching pavements.

An advantage of this invention is the control of the relationship between asphalt and mineral filler. This relationship remains essentially constant during the preparation of the final asphaltic concrete, since the only variable in the total patching mixture is in the measuring of the coarse aggregate by the maintenance crew at the patching site. Variations in this coarse aggregate part of the mix can be tolerated, however, since the coarser particles have much less surface area and therefore much less influence on the stability of the patch. The invention has the advantage of convenience. Heating and measuring of the asphalt is not required. The hot patch material is not affected by freezing as is emulsified asphalt, and contains no inflammable solvents as do cut-back asphalts. The product of the invention is economical because only the amount needed for the planned patching is required, and none is wasted. The use of the product of this invention permits the preparation of asphaltic concrete mixes according to standard specifications in small quantity, and is therefore especially suitable for patching airport runways on which high-pressure tire loads are common, and for patching freeways where minimum interruption of traffic is a vital factor.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims this invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A composition of matter in friable form adapted to be mixed with relatively coarse mineral aggregate to form an asphaltic concrete, said composition comprising:
   - fine sand, essentially all the particles of which are large enough to be retained on a #200 sieve;
   - mineral filler, essentially all the particles of which are small enough to pass through a #200 sieve;
   - slow-setting emulsified asphalt; and
   - a sufficient quantity of thickening agent selected from the group consisting of inorganic hydroxides and salts to thicken the emulsion but not cause it to break, to render the composition friable.

2. A composition of matter consisting essentially of the following approximate proportions by weight:

	Parts
Fine sand	75
Limestone dust	25
Slow-setting emulsified asphalt (58% by weight asphalt content)	38
Hydrated lime	1

3. A composition of matter in friable form comprising the following approximate proportions by weight:

	Parts
Fine sand, essentially all retained on a #200 sieve	75
Mineral filler, essentially all passing #200 sieve	25
Slow-setting emulsified asphalt (58% by weight asphalt content)	38

sufficient quantity of thickening agent selected from the group consisting of inorganic hydroxides and salts to thicken the emulsion but not cause it to break, to render the composition friable.

4. A composition of matter in friable form comprising: fine sand, essentially all of which is retained on a #200 sieve; mineral filler, essentially all of which passes a #200 sieve; slow-setting emulsified asphalt; and sufficient quantity of thickening agent selected from the group consisting of inorganic hydroxides and salts to thicken the emulsion but not cause it to break, to render the composition friable.

5. A composition of matter in friable form adapted to be mixed with relatively coarse mineral aggregate to form an asphaltic concrete, said composition comprising: fine sand, essentially all of which is retained on a #200 sieve; mineral filler, essentially all of which passes a #200 sieve; slow-setting emulsified asphalt in an amount sufficient to coat said fine said, said mineral filler, and said relatively coarse mineral aggregate; and a sufficient quantity of thickening agent selected from the group of inorganic hydroxides and salts to thicken the emulsion but not cause it to break, to render the composition friable.

6. A composition of matter in friable form adapted to be mixed with relatively coarse mineral aggregate to form an asphaltic concrete, said composition comprising:

fine sand, essentially all the particles of which are large enough to be retained on a #200 sieve;

mineral filler, essentially all the particles of which are small enough to pass through a #200 sieve;

slow-setting emulsified asphalt; and

an amount of hydrated lime sufficient to render the composiiton friable but less than that which will break the asphalt emulsion.

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