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SOUND DEADENING SHEET MATERIAL AND BONDING MATERIALS THEREFOR

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My invention relates to improvements in sound deadening sheet material and bonding emulsive mixtures therefor of the type disclosed in my U. S. Letters Patent No. 2,636,543, granted April 28, 1953, of which this application forms a continuation-in-part.

It is the object of my invention to improve the properties of sound deadening sheet material and emulsive mixtures carrying a heavy load of mineral filler by utilizing finely divided air as a fluid diluent to replace some of the water formerly required in such mixtures. Thus it is my object to increase the percentage of mineral matter and decrease the percentage of water and asphalt in sound deadening material composition which is more efficient in sound deadening properties and less expensive and better adapted, when combined with plies of felt, to high speed production die cutting operations.

Broadly, like the product of my Patent No. 2,636,543, granted April 28, 1953, and of my copending application Serial No. 346,271, filed April 1, 1953, the product of my improved technique has improved characteristics in sound deadening properties and when used as the combining layer for plies of felt, the sheet will more easily conform to the shape of metal parts. My improved technique further provides material which has greater toughness, thermal insulation value, mass effect, stability against flow under heat and freedom from brittleness at low temperatures.

In some applications of the sound deadening sheet material of my Patent No. 2,636,543, granted April 28, 1953, it was found that in high speed die cutting operations there was a tendency for the filler ingredients to stick to parts of the die press. One object of my invention, when the emulsive mixture is used between layers of felt, is to reduce the water content in the internal bonding layer without causing the mixed ingredients to lose their free flowing characteristics.

To provide improved physical characteristics of sound deadening mixtures; to facilitate their flow; and to reinforce the lubricating effect of a minimum per cent of water, I decrease the bulk weight of the bituminous mix by the introduction of a myriad of fine bubbles of such minute size as to remain largely self-sustaining in the mixture after application. This I accomplish by the addition to the final mix of from two to three per cent of a commercially available synthetic detergent consisting of a sulfated alcohol sold under the trademark Orvus W. A. The bubbles formed by such a reagent produce in the bituminous mix a myriad of bubbles of air having a diameter of substantially not more than 100 microns. Further the lightening of the gravity of the emulsion containing the evenly distributed air bubbles made it more free flowing so that I was again able to reduce the water and bitumen content and increase the sand or other mass producing mineral ingredients materially, so that from a high percentage of solids in the bituminous emulsion mix of approximately 90% solids I was able to bring this up to the range from 91.5% to 96% solids. Thus I was able by the change in the physical structure of the

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bituminous emulsion to produce a sound deadening material which, when used as a bonding layer between two plies of felt had up to 96% solids, and the layer was still thin enough to flow freely in the mixer. This was very surprising.

Further because the bonding layer had such a lowered specific gravity, I was able to use thinner webs of partially saturated felt and a thicker bonding layer thus replacing by a single sandwich (i. e. two layers of felt with a layer of emulsion mix between them) a three decker type sandwich with three plies of felt and two bonding layers of hot applied asphalt, one on each side of the center ply between it and the outside plies.

In my improved sandwich type sound deadening sheet material with a combined thickness of about one quarter of an inch, I produced a sheet weighing from 130 to 160 lbs. per square foot. Heretofore nothing of such weight and having an equivalent sound deadening effect had been produced having less than $\frac{3}{4}$ inch thickness. This made my new product cheaper in price and more readily susceptible to high speed multiple die cutting operations. Thus not only is the material cost reduced, but the labor cost of fabricating the sheet is also materially reduced.

In order to give a specific example of my improved sound deadening material I shall explain its use in combination with the mixed type of emulsion disclosed in my copending application Serial No. 346,271, filed April 1, 1953. In my copending application of which this is a division-in-part, and a continuation-in-part, where the felt layers are partially saturated with bituminous saturant, this leaves the felts moisture permeable. I use this moisture permeability not only to withdraw moisture from the emulsion mixtures but to enable it to remain in the felts to increase their flexibility and workability.

THE EMULSION MIXTURES

Emulsion A

Into a heavy duty mixer I continuously pump 1650 to 1800 lbs. of asphalt having a melting point of from 100 to 130° F. (less than 150° F.). With this asphalt I simultaneously pump into the mixer from 57 to 100 lbs. of bentonite or other suitable emulsifying clay suspended in from 1040 to 1350 lbs. of water. This I thoroughly mix until the globules in the emulsion have a diameter size range of from 20 to 100 microns. This is an emulsion formed by interfacial trituration of the asphalt with the water.

Emulsion B

Through a colloid mill I pump continuously from 650 to 700 lbs. of asphalt having a melting point below 150° F. and from 20 to 30 lbs. of soft soap such as potassium oleate, potassium stearate, potassium palmitate or other suitable lathering wetting agent such as potassium vinsol resin and from 300 to 350 lbs. of water containing 1 lb. of potassium hydroxide and 1 lb. of tripotassium phosphate. The colloid mill produces emulsion by interfacial surface tension continuously from the above combination having particles of asphalt having a diameter of from 1 to 10 microns.

The emulsions A and B are then mixed together. The A emulsion constitutes a substantially greater part of the final mix than the emulsion B. A typical mixer lot of 2600 gallons contains 2750 lbs. emulsion A and 2250 lbs. emulsion B. 75 lbs. of Kaolin clay is then added. The clay need not be bentonite. I then add 187 lbs. of 33% solids, Orvus W. A. paste mixed with water, keeping the paddle mixer continuously in operation while also adding fine glass sand (not coarser than 20 mesh) which averages between 35 and 200 mesh to bring the total percentage of sand and clay in the mixture up to more than 80% by weight. In the specific mixture the sand and clay total 81.9% by weight.

By weight the bituminous emulsion composition of the above specific example, used as the bonding layer will contain about 2½% clay, about 83.0% sand, about 8.5% sphalt and the balance will be water (about 6 per cent). The total solids will vary from 91 to 96.0 per cent by weight. Preferably the water content does not exceed .5 per cent. My preferred composition contains not less than 80 per cent finely divided mineral matter, about 0 per cent of bituminous material and about 6 per cent water, by weight. The weight of the air bubbles in the composition is, of course, negligible but their effect on the fluid behavior of the mixture is very important in obtaining my improved product.

The effect of the addition of the Orvus W. A. paste is to fill the emulsion with fine air bubbles. The bulk volume of the mix will be about 42½% air, 6.9% water, 0.1% asphalt and 39.7% sand. The fluidity of the mix is such that it may be readily applied in a suitable laminating or combining machine such as is diagrammatically shown in my copending parent application of which this is a continuation-in-part.

Using two webs of felt each having a thickness of about .060 inch, I am able to incorporate a layer of coating material of about .130 inch in thickness so that the aliper of the sound deadening material is from 225 to 50 points (i. e. .225 to .250 inch).

Since the felt webs are only partially saturated with bitumen (containing about 45% to 75% bitumen based on the dry weight of the desaturated felt), they are moisture absorbent and as the moisture from the coating layer is absorbed by the felt the emulsion inverts and becomes stabilized and bonded to the felt.

I purposely avoid air drying the sheet material and I find it desirable to ship a series of sheets cut to desired size, on skids or in rolls. During shipment the closely packed sheets maintain substantially the percentage of water present as the web is discharged from the combining machine.

While I have outlined within rather narrow limits a fairly definite percentage of ingredients these may, of course, be varied to suit the varied requirements of use. My improvements involve reinforcing the lubricating and effect of the water in the emulsion by the distribution therethrough of air bubbles in such a fine state of subdivision as to increase the bulk from 20 to 50 per cent, said air bubbles being of such minute size as to avoid substantial shrinkage when the emulsion carrying a high percentage of solids inverts and becomes stabilized between the outer plies of felt.

By elevating the temperatures of the emulsion mixers may utilize asphalts and bituminous mixtures of higher

melting point than 150° F., and the presence of the finely divided air bubbles provides the same improved lubricating properties permitting the reduction of water and asphalt and the increase of mineral filler. Where there is no adjacent moisture permeable sheet material as in the case of felt air drying will cause the emulsion to invert and become a tough and stable mass, stable against flow under heat and free from brittleness at low temperatures.

Having thus described my invention, what I claim as new and desired to secure by Letters Patent is:

1. A highly filled bituminous emulsive mix composed of not less than 80% by weight of finely divided mineral matter, about 10% by weight of bituminous material and about 6% of water wherein the bulk volume of the mix is increased by the incorporation therein of from 20 to 50 per cent by volume of intimately mixed air bubbles having a minute size substantially less than 100 microns.

2. A highly filled bituminous emulsive mix as set forth in claim 1 wherein the finely divided mineral matter is sand composed substantially of a size less than 20 mesh but larger than 200 mesh.

3. A filled asphaltic emulsive mix for incorporation in sound deadening sheet material composed of not less than 80% by weight of finely divided mineral matter, about 10% of bituminous material and not more than 7.5% of water, and having its volume increased by the presence in intimate admixture therein of from 20 to 50 per cent by volume of air bubbles having a minute size substantially less than 100 microns.

4. A filled asphaltic emulsive mix as set forth in claim 3 wherein the percentage of solids by weight is from 91.5 to 96 per cent.

5. A filled asphaltic emulsive mix as set forth in claim 3 wherein the emulsified bituminous material is composed of a mixture of a clay asphalt emulsion, particles of which have a diameter of 10-50 microns and an asphalt emulsion the particles of which are 1-5 microns in diameter and in which the emulsion is formed with a soap emulsifier.

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