Feb. 25, 1969 E. G. GOLDSTONE ET AL 3,429,728

SOUND INSULATING BARRIER AND METHOD OF MAKING THE SAME

Filed May 27, 1965 Sheet 1 of 2

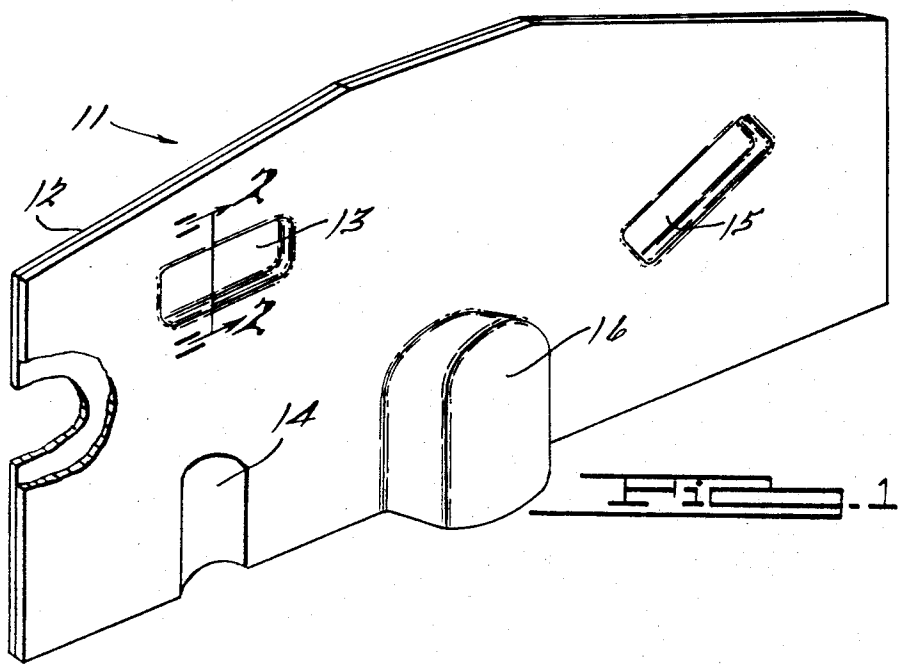

Fig. 1.

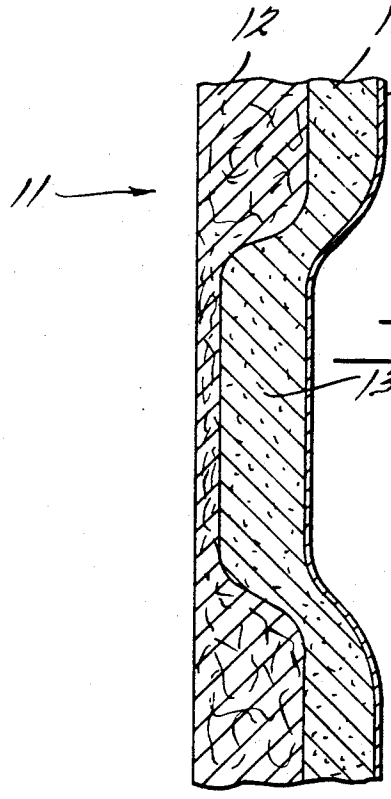

Fig. 2.

INVENTORS.
Edward G. Goldstone
Hans K. Neumann
BY
Adams, Dicky & Price
ATTORNEYS.

Feb. 25, 1969 E. G. GOLDSTONE ET AL 3,429,728

SOUND INSULATING BARRIER AND METHOD OF MAKING THE SAME

Filed May 27, 1965 Sheet 2 of 2

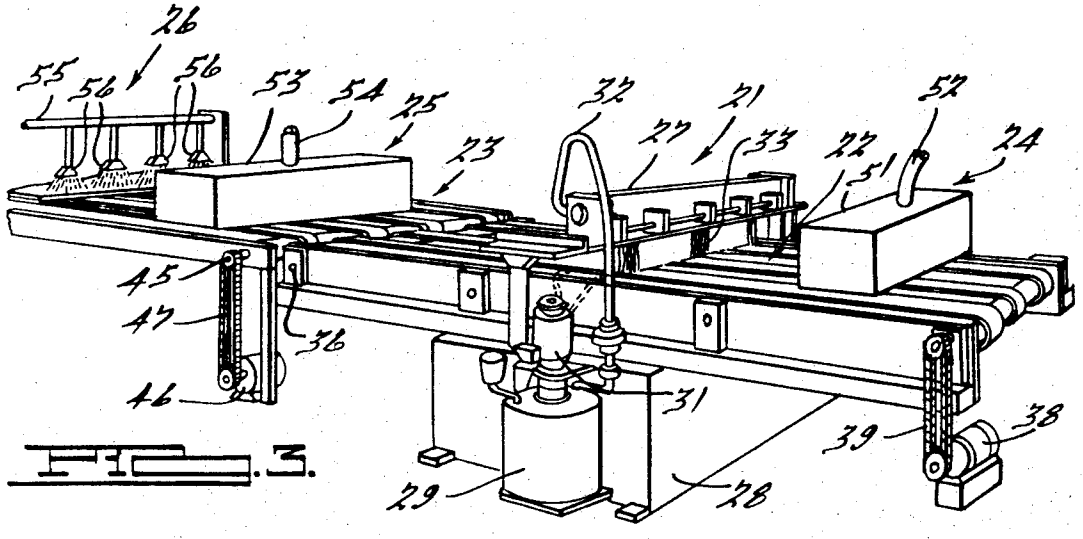

FIG. 3.

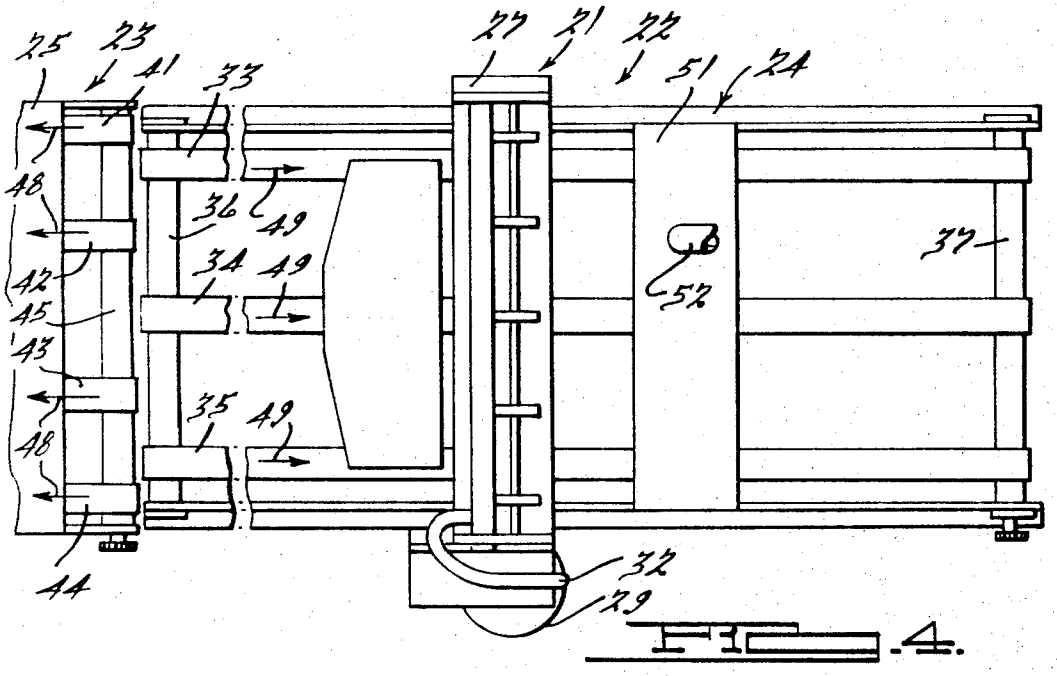

FIG. 4.

INVENTORS.
Edward G. Goldstone
Hans K. Neumann
BY
Johnson, Dickey & Pierce
ATTORNEYS.

United States Patent Office 3,429,728
Patented Feb. 25, 1969

3,429,728

SOUND INSULATING BARRIER AND METHOD OF MAKING THE SAME

Edward G. Goldstone and Hans K. Neumann, Detroit, Mich., assignors to Allen Industries, Inc., a corporation of Delaware

Filed May 27, 1965, Ser. No. 459,217
U.S. Cl. 117—11 7 Claims
Int. Cl. B44d 1/40, 1/44

ABSTRACT OF THE DISCLOSURE

A method for making a sound insulating barrier of a preselected size and contour in which a fibrous mat is molded to a predetermined size and shape-retaining contour and thereafter is passed through a curtainous stream of a heat-liquefied asphaltic material effecting the deposition of a substantially uniform coating of the asphaltic material thereon and which coating is substantially immediately chilled thereafter so as to prevent a puddling of the material due to the variations in the angular contour of the surface thereof. The asphaltic material which is not deposited on the surface of the precontoured mat is continuously recovered and recycled to the curtainous stream.

This invention relates to a sound insulating barrier and method by which a sound insulating barrier may be formed.

There is a growing demand for sound insulation in many applications. Automotive vehicles are but one example of the use of increasing amounts of sound insulating material. The engine compartment of a motor vehicle is sound insulated from the passenger compartment by an insulating mat or barrier that is positioned upon the dash panel and toeboard of the vehicle. The insulating barrier normally comprises a fibrous mat onto which a more dense sound insulating material has been deposited. With the growing demand for sound insulation, greater thicknesses of sound-deadening material have been required. The sound-deadening materials heretofore used, such as polyvinyl chloride, are quite expensive and the cost places a practical limit upon the thickness which may be used.

Since the mats upon which the insulated material are deposited are contoured and the insulating material is normally deposited upon the mat in the form of a liquid, the problem of puddling is also prevalent. Puddling occurs when the liquid flows to the depressed areas of the mat. This puddling masks the desired contour of the mat and is unacceptable.

It is, therefore, a principal object of this invention to provide a relatively dense low cost sound insulating barrier and a method of making such a barrier.

It is a further object of this invention to provide a method for making a contoured insulating barrier that reduces the possibility of puddling even though the insulating material is deposited as a liquid.

Asphalt has been proposed as an effective insulating media to its high density and low cost. The use of asphalt with a suitable filler as an insulator has several problems which must be overcome before it can be effectively used, however. For example, the asphalt must be heated to maintain it in the liquid state so that it can be conveniently deposited upon the mat. Heating of the asphalt increases the puddling problem. In addition, the asphalt is tacky at room temperatures and thus makes handling, stacking and transportation of the finished insulating barriers difficult. Asphalt also gives rise to a problem called "fogging." Fogging results when the liquid solvent of the asphalt evaporates into a vehicle interior and condenses upon its windows.

Thus, it is a further object of this invention to provide an improved method for asphalt coating a mat to form a second insulating barrier.

It is a further object of this invention to provide a method for asphalt coating a fibrous mat that permits the finished insulated barrier to be conveniently handled, stacked and transported.

The method of making an insulating barrier embodying this invention comprises the steps of coating a fibrous mat with a relatively dense layer of a material that is a liquid at a temperature greater than room temperature and tacky at room temperature. A curtainous stream of the liquid is formed and the mat is passed through the stream to deposit the liquid upon it. After the mat has been coated, a protective film is formed on the coating layer. The protective film is applied in the form of a spray comprising a solution of a protective material and a solvent.

Other objects and advantages of this invention will become more apparent as this description proceeds, particularly when considered in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view, with a portion broken aay, of an insulating barrier embodying this invention;

FIGURE 2 is a cross-sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a perspective view of an apparatus for forming the insulating barrier shown in FIGURES 1 and 2; and

FIGURE 4 is a top view of a portion of the apparatus shown in FIGURE 3.

Referring now in detail to the drawings and in particular to FIGURES 1 and 2, a sound insulating barrier embodying this invention is identified generally by the reference numeral **11**. The sound insulating barrier **11** is particularly adapted for use in automotive vehicles and is shown in the form of an insulating pad that is adapted to be positioned adjacent the sheet metal dash panel that separates the passenger compartment from the engine compartment.

The barrier **11** comprises a contoured mat **12** that is formed from a fibrous or felted material that has been resin impregnated and molded to a predetermined contour. The method of forming such mats is well known and generally comprises the formation of a mat from a plurality of interwoven fibers. The fibers may be comprised of any of the known synthetic or natural fibers and may have uniform or varying diameters and length. The density of the fibrous mat as initially formed may be varied also, however, it is less dense than in its final contoured form. A thermosetting resinous binder of any known type is interposed throughout the mat. The dusted mat is placed into a press having contoured dies and is heat cured to the desired shape. The heat curing of the fibrous mat causes the binder to set and forms a relatively rigid mat that is more compact than that which existed previous to the curing. The desired contour may be altered to suit any particular application and the illustrated mat is illustrated with indentations **13**, **14**, and **15** and an embossment **16**. These contours are exemplary of typical forms which may be formed in such mats.

A thick layer **17** of sound insulating material is deposited upon the surface of the mat **12**. The layer **17** is comprised of an asphalt base material or of any other relatively dense material that is a liquid at an elevated temperature and a solid at room temperature. A suitable filler such as powdered slag, slate flour, fly ash, limestone, or the like is preferably admixed with the asphaltic material. The filler comprises 30–80% by weight of the layer **17** and adds weight to it and prevents soaking into the mat **12**. When the term "asphalt" is used herein it is intended to cover asphalt and the filler material. A protective coating **18** is deposited upon the outer surface of the

asphalt layer 17. The coating 18 is relatively thin, one mil being a normal thickness. The protective coating 18 forms an impermeable barrier upon the asphalt layer 17 to preclude further liquid from evaporating from the asphalt 17 after the barrier 11 has been formed and to facilitate handling and stacking. The coating layer 18 also insures that any carpeting or other floor mat which may be laid upon the barrier 11 will not adhere to the asphalt 17.

Referring now to FIGURES 3 and 4, the apparatus and method for forming the insulating barrier 11 will be described. The apparatus generally includes a curtain coater, indicated generally by the reference numeral 21 and including a conveyor 22, an unloading conveyor 23 adjacent the conveyor 22, a first cooling shroud 24 above the conveyor 22 adjacent one side of the curtain coater 21, a second cooling shroud 25 above the conveyor 23 on the opposite side of the curtain coater 21, and a series of spray heads 26 adjacent to the second cooling shroud 25.

The curtain coater 21 includes a coating head 27, a base 28, which includes a return trough (not shown), a supply tank 29, a circulating pump 31 and a feed line 32. Asphalt is contained within the supply tank 29 that is formed with a suitable heating jacket to raise the temperature of the asphalt to a point at which it becomes sufficiently fluid to flow readily. A temperature in the range of 320° to 380° F. at the coating head 27 has proven satisfactory. The pump 31 draws the liquid asphalt from the supply tank 29 for delivery through the feed line 32 to the coating head 27. The head 27 has a plurality of openings in its lower surface so that a substantially curtainous stream of asphalt issues from the lower head of the coating head, as indicated by the reference numeral 33. The curtainous stream 33 passes into the return trough contained within the base 28 for return to the return tank 29 where the asphalt is reheated. This type of curtain coating apparatus is well known in the art and thus will not be described further.

The conveyor 22 comprises three belts 33, 34 and 35 that are wound around idler pulleys fixed to an idler shaft 36 at the unloading side of the apparatus. The other end of the belts 33, 34 and 35 are wound around drive pulleys that are fixed to a drive shaft 37. The drive shaft 37 is driven by a motor 38 by means of a belt 39. A suitable electrical control circuit (not shown) is provided for the motor 38 so that it will be driven in opposite directions alternatively for a reason which will become more apparent as this description proceeds.

At the unloading side of the machine the unloading conveyor 23 comprises conveyor belts 41, 42, 43 and 44 wound around pulleys affixed to a drive shaft 5. The drive shaft 45 is driven by means of an electric motor 46 through a belt 47. The belts 41, 42, 3 and 4 are driven continuously in the same direction, as indicated by the arrows 8.

The area between the coating head 27 and the unloading conveyor 23 forms a loading area. When the belts 33, 34 and 35 are being driven in a direction toward the coating head 27 from the left hand side of the machine, as indicated by the arrows 49, the molded fibrous mat 12 which has been formed in a semi-rigid shape in the manner previously described, is loaded onto belts 33, 34 and 35. The motion of the belts 33, 34 and 35 carries the mat 12 through the curtainous stream 33 so that a portion of the liquid asphalt will be deposited upon the upper surface of the mat 12.

Due to the fluidity of the heated asphalt, there is a very distinct possibility of puddling. That is, the asphalt may flow to the bottoms of the depressions 13, 14 and 15 (FIGURE 1) from their sides and also may flow from the higher surface of the projection 16. To guard against this possibility, the mat is passed under the cooling shroud 24. The cooling shroud 24 comprises a sheet metal plenum chamber 51 in which a cooling spray is generated. The cooling spray may be in the form of a carbon dioxide or water spray or may be a blast of cold air. Cold water is preferred because of its low cost. The water is sprayed as a fine mist so that it will evaporate from the heated asphalt rapidly. A blast of drying air is also delivered to the plenum chamber 51 by means of a conduit 52 to remove excess water from the asphalt. It is important that the excess water be removed before the next layer of asphalt is deposited upon the mat. When the liquid asphalt comes in contact with the cooling spray within the plenum chamber 51 its viscosity will immediately increase and it will set up to preclude puddling.

After the mat has passed beneath the plenum chamber 51, the direction of travel of the belts 33, 34 and 35 is reversed by reversing the direction of rotation of the motor 38 so that the mat, upon which a first layer of the asphalt has been formed, will be again passed through the curtainous stream 33. The double pass of the mat 12 in opposite directions through the curtainous stream 33 insures a uniform coating of the contoured shape of the mat. If the mat were passed in only one direction through the curtainous stream 33, there would be a possibility of shading. That is, the higher portions of the mat surface would shade the adjacent lower portions from receiving a full layer of coating. The effect of this shading is reduced by passing the mat in opposite directions through the stream 33. In addition, the double pass of the mat 12 through the stream 33 permits a heavier or thicker layer of asphalt to be deposited thereon. If the asphalt were deposited in a single thick layer, the cooling might not penetrate sufficiently to prevent puddling to the necessary degree. It is to be understood, however, that in some instances a single pass of coating may be sufficient and this invention is not limited solely to double pass coating.

If desired, two in-line curtain coaters may be provided to permit a straight line operation. In such an event, some suitable structure should be provided between the curtain coaters to reverse the relative direction of travel between the mat and the stream generated by the curtain coater to preclude the shading aforenoted. If a flat surface is being coated, the turn-around mechanism need not be employed since shading is not a problem.

After passing through the stream 33 a second time, the mat 12 is delivered to the conveyor belts 41, 42, 43 and 44 by the belts 33, 34 and 35. Since the belts overlap to a limited extent, the mat 12 will continue in the direction of the arrows 8 and be transferred from the belts 33, 34 and 35 to the belts 41, 42, 43 and 44. The coated mat then passes beneath the second cooling unit 25 which also comprises a sheet metal plenum chamber 53, in which a cooling spray, for example cold water is delivered as in the previously described plenum chamber 51. A blast of drying air is delivered to the plenum chamber by a conduit 54. The second chilling prevents puddling of the second layer of asphalt and sets it up to permit it to be conveniently handled at the unloading end of the machine.

After passing through beneath the plenum chamber 53, the conveyor belts 41, 42 43 and 44 deliver the mat 12 on which the complete asphalt insulation layer 17 has now been deposited to the spray heads 26. The spray head 26 comprise a manifold 55 which feeds a plurality of individual spray nozzles 56. The protective coating 18 is deposited upon the asphalt 17 by the spray nozzles 56. The protective coating comprises a coating material which is dissolved in a suitable solvent to form a liquid spray. The solvent, however, is one that is both volatile at room temperature and will not dissolve the asphalt layer 17. If the solvent has sufficient volatility it is not necessary for the asphalt

layer **17** to be insoluble in it. Therefore, the solvent readily evaporates leaving the protective coating **18** upon the asphalt **17**. (Phenolic resin dissolved in alcohol or an acrylic water emulsion are typical examples of suitable coating sprays.) After passing through the spray heads **56** the finished insulating barrier **11** may be removed from the conveyor belts **41**, **42**, **43** and **44** for stacking and shipping.

It is to be understood that the invention shown and described is illustrative only of a preferred form the invention may take. Various changes and modifications are possible within the purview of the invention. As has been noted, the mat may be passed only a single time through the curtainous coating stream. In addition, one or both of the cooling steps may be omitted. Certain insulating materials do not require the protective coating and, in this instance, the spray unit **26** may be deleted or may be rendered inoperative. Various other changes in modification may be made without departing from the spirit and scope of the invention.

What is claimed is :

1. The method of making a sound insulating barrier which comprises the steps of forming a relatively rigid bonded fibrous mat of a predetermined size and shape-retaining contour, heating an asphaltic material to an elevated temperature to effect a liquefying thereof, forming a continuous curtainous stream of the liquefied said material, passing said contoured mat through said curtainous stream to deposit a layer of said material thereon, immediately chilling said layer to prevent puddling thereof, and recovering and recycling the excess of said material from said curtainous stream that is not deposited on said mat.

2. The method as described in claim **1** wherein said mat is passed through a curtainous stream of said material a plurality of times to effect a progressive deposit of a substantially uniform layer of said material thereon and wherein each pass is immediately followed by a chilling of the last deposited layer to prevent puddling thereof.

3. The method as described in claim **2**, wherein said mat is reoriented in position between each successive pass through the curtainous stream to provide a substantially uniform layer of said material on the contoured surface thereof.

4. The method as described in claim **1**, including the further step of applying a protective film of an adherent film-forming substance dissolved in a volatile solvent of the exposed face of said layer and thereafter evaporating the solvent therefrom.

5. The method as described in claim **1**, wherein said chilling of said layer is achieved by applying a water spray thereto.

6. The method as described in claim **1**, wherein said asphaltic material includes from about 30% to about 80% by weight of a dense filler.

7. A sound insulating barrier made in accordance with the process as described in claim **1**.

References Cited

UNITED STATES PATENTS

1,762,336	6/1930	Kirschbraun	117—119.2 X
2,532,196	11/1950	Rowe	117—92 X
2,550,465	4/1951	Gorski	117—92 X
2,550,465	4/1955	Stanton et al	117—92 X
2,721,146	10/1955	Hardman	117—92
2,768,091	10/1956	Cubberley	117—92 X
2,858,231	10/1958	Watson	117—92 X
3,067,060	12/1962	Glaus	117—120 X

WILLIAM D. MARTIN, *Primary Examiner.*

R. HUSACK, *Assistant Examiner.*

U.S. Cl. X.R.

117—119.2, 119.4, 102, 158, 120, 140, 76, 92; 181—33

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,429,728 February 25, 1969

Edward G. Goldstone et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 3, "second" should read -- sound --; line 23, "aay" should read -- away --. Column 3, line 54, "5" should read -- 45 --; line 56, "3 and 4" should read -- 43 and 44 --. Column 4, line 52, "8" should read -- 48 --; line 67, "head" should read -- heads --. Column 6, line 28, "2,550,465" should read -- 2,707,157 --.

Signed and sealed this 14th day of April 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents