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METHOD FOR APPLYING AN ACOUSTIC BARRIER

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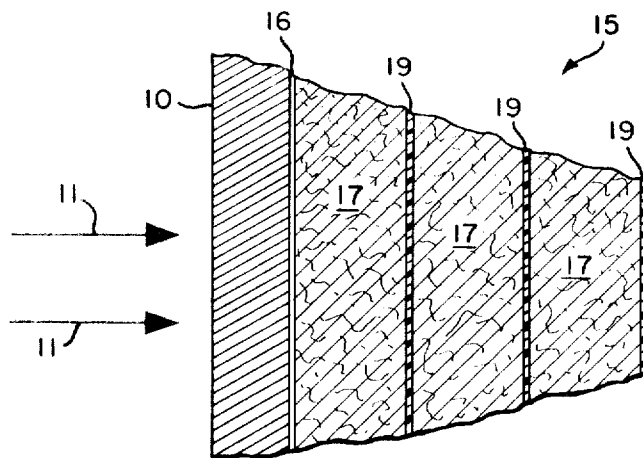


FIG. 1

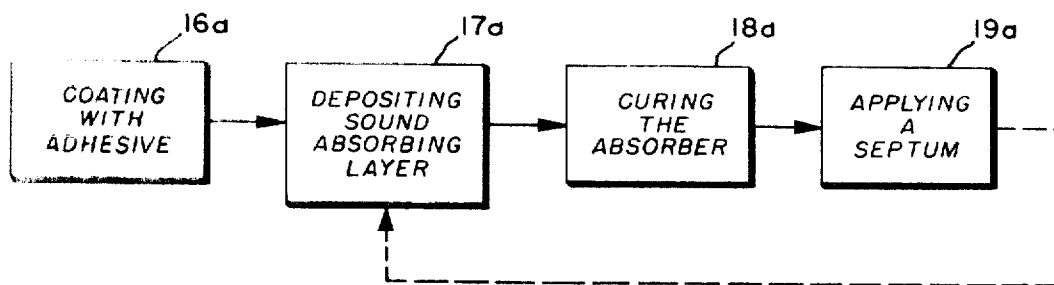


FIG. 2

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## 3,748,167 METHOD FOR APPLYING AN ACOUSTIC BARRIER

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1 Claim

### ABSTRACT OF THE DISCLOSURE

An acoustic barrier is coated on one side of a wall to effectively attenuate and reflect acoustic energy impinging the wall's opposite side. Spraying or brushing on a layer of a semiliquid sound absorbing material and covering the sound absorbing material after it has solidified with a sprayed-on adhesive resin septum allows a complete continuous covering of a wall surface irrespective of its configuration. Thusly, rigid mounting devices which otherwise act as sound conduits are eliminated and by applying successive layers of the sound absorbing material and septums, a highly effective acoustic barrier is fabricated at minimal cost.

### STATEMENT OF GOVERNMENT INTEREST

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

### BACKGROUND OF THE INVENTION

Contemporary methods of acoustically isolating the interior of a chamber from its surroundings have called for constructing external baffles as well as hanging cumbersome sound attenuation panels on the inside of the chamber. Smaller "acoustic tile" sections have been mounted on walls with some degree of effect, yet all rely on some sort of rigid mounting device such as pins, bolts, nails, etc., to secure the panels or tiles to the walls. These mounting devices, while quite adequately holding the panels or tiles in place, act as traverse sound conduits and pass noise to the chamber interior. In addition, if the panels or tiles are mounted on a metal surface, tapped bores with accommodating mounting bolts must be provided or some sort of welded stud arrangement must be included to accommodate the mounting pin or screw used to secure the panel. Even if it can be assumed that fasteners having satisfactory acoustic decoupling are available, the panels themselves require shaping to conform to the wall's surface and its irregularities to achieve an acceptable level of attenuation. The considerable time, spent by workmen while fashioning the panels to accommodate pipes, electrical conductors, and similar conduits, greatly increases their cost of installation and, in many cases, renders their modification highly impractical. An alternate approach calls for covering the wall's surface with a porous sound absorbing material. The material is sprayed or similarly deposited to keep application costs within tolerable limits. However, the exposed sound absorbing layer is susceptible to damage and, when used in a humid or moist environment, loses its effectiveness after a relatively short period of time. A need currently exists for a rugged, low-cost acoustic barrier which is quickly installed, conforms to surface irregularities, and effectively masks impinging acoustic energy.

### SUMMARY OF THE INVENTION

The invention is directed to providing a method of economically forming a continuous acoustic barrier across a surface having irregularities. The surface is first coated

with an adhesive agent over which a layer of a cohesive semiliquid sound absorbing material is deposited. A period of time elapses during which the deposited layer cures allowing the binding of it to the surface, via the adhesive, and its solidification throughout. An adhesive septum is then painted or sprayed over the cured layer of sound absorbing material and the two acoustically co-operate to provide a relatively rugged, continuous acoustic barrier across the surface.

It is the prime object of the invention to provide a highly effective barrier for impinging acoustic energy.

Another object of the invention is to provide an acoustic barrier readily conforming to the surface on which it is applied.

A further object is to provide an acoustic barrier which is quickly installed at low cost.

Yet another object of the invention is to provide a laminated barrier of acoustic energy combining the qualities of sound absorption and sound reflection.

Still another object is to provide an acoustic barrier which is rugged and resistant to the ambient effect of moisture.

These and other objects of the invention will become more readily apparent from the ensuing description when taken with the drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a representative sound absorbing material-septum laminate

FIG. 2 is a flow diagram showing the interrelated steps of the preferred method.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

A constantly reoccurring problem confronting builders and, in particular, marine designers is how to block noise originating on one side of a wall from the other side of the wall. The problem becomes particularly difficult to deal with when steel walls or other rigid structural members are employed since their sound transmission characteristics are better than air. For example, on ships where the crew quarters are near the propulsive machinery or sonars operating in the active mode, sleep is impossible and, after prolonged exposure, temporary or permanent damage to a crewman's hearing is a likely result.

Looking to FIG. 1 of the drawings, a steel wall or bulkhead 10 schematically is shown having ensnifying acoustic energy depicted by arrows 11, impinging on its left side. An acoustic barrier, generally designated by reference character 15, is fabricated of discrete laminae to diffuse and reflect those portions of the impinging acoustic energy that pass through the wall.

In a first embodiment, the wall is coated with an adhesive 16 either brushed or sprayed in place. The adhesive is one of many commercially available materials such as polyester polymers, urethane and polyester resins, epoxy, etc., each exhibiting the properties of being a high strength agent for bonding the metal wall to dissimilar materials.

While the adhesive coating remains tacky, a sound absorption layer 17 is deposited to cover and conform to the wall's surface. A sound absorption layer is selected from one of several widely known compositions of materials which, upon being bombarded by impinging acoustic energy, diffuse and scatter it throughout to function as a sound absorber. Fibrous glass coated with a commercial phenolic or silicone binder exhibits the desired characteristics and, when deposited to a depth of approximately one inch, a sound attenuation of approximately 28 decibels results. This is based on averaging the attenuations at 500, 1000, 2000 and 4000 Hz.

Optionally, the fibrous glass is mixed with the binder to a semiliquid consistency and sprayed onto the adhesive coating or, in an alternate embodiment, when a phenolic binder is selected having adhesive as well as cohesive characteristics, directly onto the wall to the one inch depth.

Following the spraying or brushing-on operation, the sound absorption layer is given time to cure, that is, certain vapors evaporate and other chemical reactions occur to solidify the deposited layer on the wall. Obviously, suitable heat sources and ventilation will hurry the curing process with some sound absorption layers and further elaboration is felt unwarranted at this point.

After curing, a septum covering 19 is applied over the complete external surface of the cured sound absorption layer. The septum is, for example, an adhesive resin coating brushed or sprayed on to a depth being only a fraction of the thickness of the sound absorption layer. In the alternate, a thin sheet of similarly applied lead-loaded vinyl or other equivalent material is substituted, either one possessing the characteristics of presenting a reflective surface to impinging acoustic energy as well as providing a protective sheath for the acoustic barrier.

A single layer of the sound absorption layer and the septum covering, fabricated in accordance with the foregoing teachings, significantly reduces the level of transmitted acoustic energy. It naturally follows that by repeating the process to produce a laminate having several layers, buys additional db loss.

While reference thusfar has been made only to a fiber glass-phenolic binder or fiber glass-silicone binder sound absorption layer, it is certainly within the scope of the present disclosure to substitute a material having a homogeneous consistency being formed during spraying and having the sound attenuation characteristics of the material commercially marketed under the United States trademark "Styrofoam." Similarly, other materials having granular or cellular type portions held in suspension are included in place of the fibrous glass as obvious, equivalent sound insulators.

FIG. 2 schematically shows in sequence the process by which the acoustic barrier is formed. First, the wall is coated with an adhesive, step 16a, after which a sound absorbing layer is uniformly deposited, step 17a. These steps are followed by the above-described curing process, step 18a, to bind the sound absorption layer onto the adhesive surface and to solidify the sound absorption layer. Next, a septum is applied, step 19a, to serve the twofold function of reflecting acoustic energy that was not totally diffused by its adjacent sound absorption layer as well as protecting the acoustic barrier from external damage. By noting the dotted process line returning to step 17a in FIG. 2, provision is made for repeating the final three steps of the flow diagram successively to build an acoustic barrier which serves to provide the desired degree of attenuation.

Installation costs of the acoustic barrier using this method are small when compared with the time consum-

ing process of fitting prefabricated acoustic panels and mounting them on various configured walls having randomly located fittings and conduits. In addition, having a combination of adhesive and cohesive binders eliminates mounting studs, bolts, or other rigid frameworks which, by serving as natural sound channels, defeat the purpose of the sound attenuation panels.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings, and, it is therefore understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than specifically described.

What is claimed is:

1. A method of forming a continuous acoustic barrier on an irregular surface comprising:
  - coating said surface with an adhesive;
  - depositing a layer having a uniform thickness of cohesive semiliquid sound absorbing material consisting of fibrous glass coated with a silicone binder contiguously on the adhesive coating;
  - curing the deposited layer of said semiliquid sound absorbing material, solidifying and binding said layer on said surface;
  - applying an adhesive resin septum having a depth being a fraction of said uniform thickness over the cured said layer of sound absorbing material to provide said continuous acoustic barrier irrespective of irregularities on said surface; and
  - repeating the aforesaid depositing, curing and applying steps to build up a more effective acoustic barrier.

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RALPH HUSACK, Primary Examiner

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