Sept. 26, 1961 R. B. TAYLOR 3,001,602

LOAD BEARING SOUND ABSORBING CLAY TILE UNIT

Filed Jan. 25, 1960 2 Sheets-Sheet 1

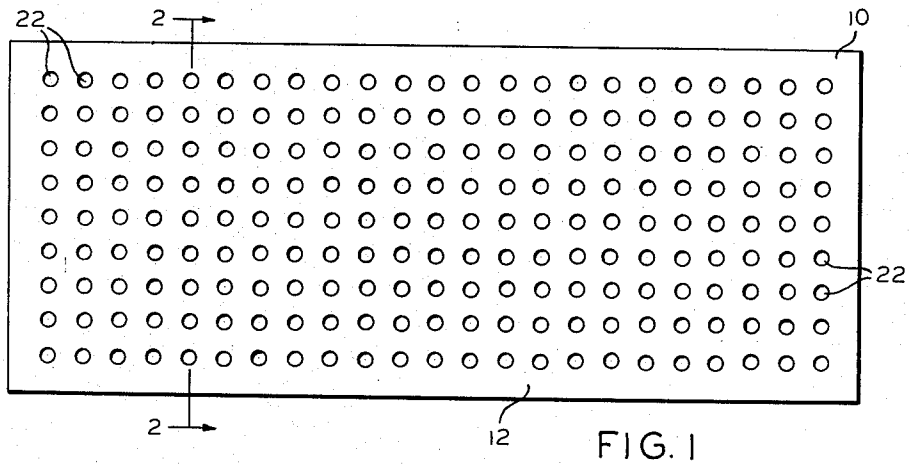


FIG. 1

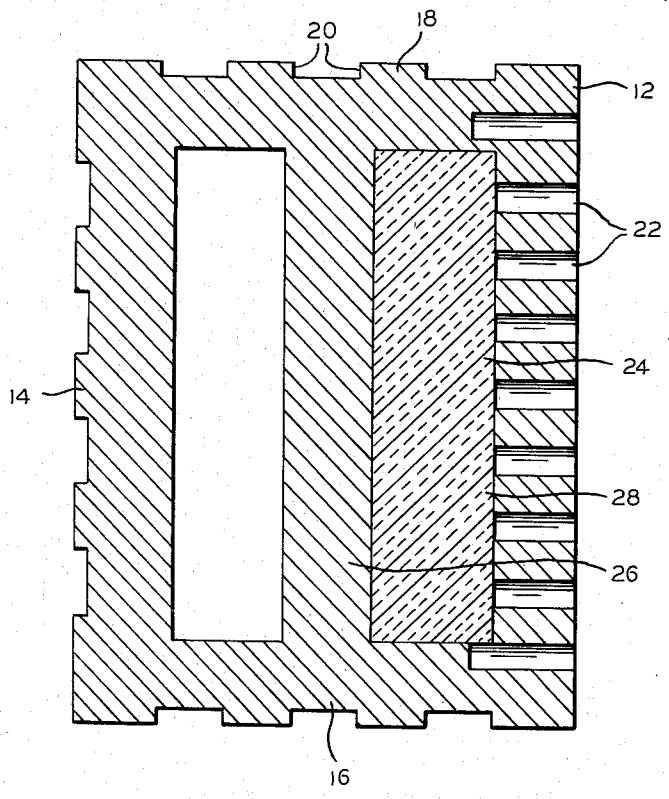


FIG. 2

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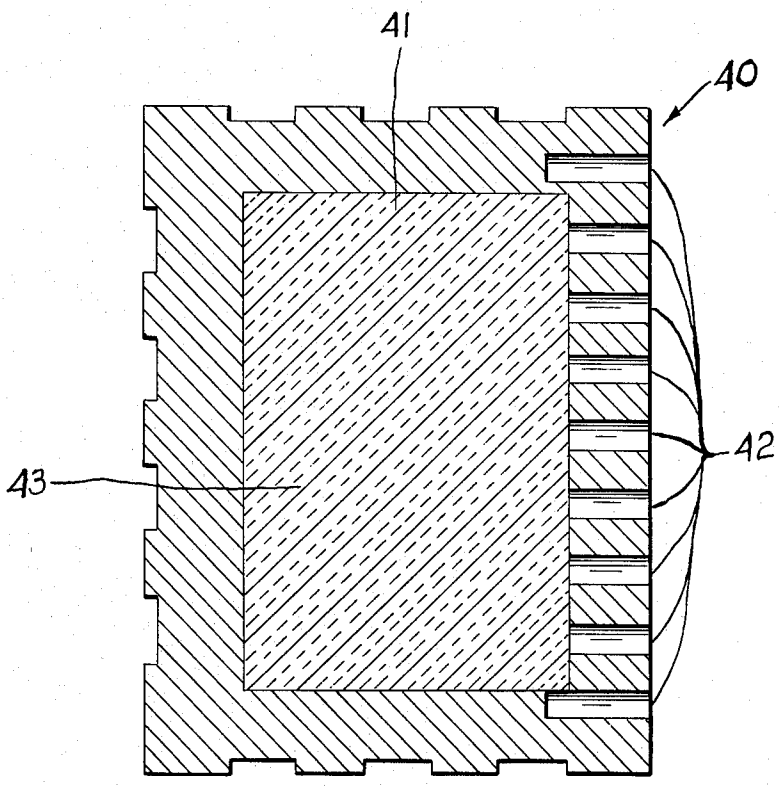


FIG. 3

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United States Patent Office 3,001,602 Patented Sept. 26, 1961

3,001,602

LOAD BEARING SOUND ABSORBING CLAY TILE UNIT

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Filed Jan. 25, 1960, Ser. No. 4,478
5 Claims. (Cl. 181—33)

This invention relates to a structural clay product and more particularly it relates to a structural clay tile unit having sound absorbing properties.

An increasingly important demand in the construction of buildings is that the materials used in buildings have acoustical properties or that materials having acoustical or sound absorbing properties be applied to the material out of which the building is constructed. In this respect, there are many panels and veneers made of fibrous and fiber-glass materials which are attached to or overlay the materials out of which a building is constructed.

Clay tile blocks, which are formed into wall elements, ordinarily have relatively poor sound absorption characteristics. On the other hand, clay tile is a relatively good insulator against the passage or transmission of sound from one room to an adjoining room. The sound transmission loss in the passage of sound waves from one room to an adjoining room usually can be figured as a function of the density and thickness of the tile; that is, the denser and thicker the tile, the greater the sound transmission loss.

Sound absorption in a wall can be improved by providing resonating chambers within the wall wherein sound is allowed to enter such chambers or cavities in a wall through apertures that are small with relation to the volume of the cavities. The provision of such chambers, however, by decreasing wall material thickness, ordinarily increases sound transmission. In an acoustical wall construction, therefore, the facilities that are best for sound transmission loss are poorest for sound absorption whereas the facilities and features best for sound absorption are poorest for sound transmission loss.

In a tile wall element, it is highly desirable to provide an acoustical tile which is balanced in terms of sound transmission loss and sound absorption while at the same time retaining sufficient strength in the tile with a minimum of weight in the tile body. Accordingly, a major purpose of the present invention is the provision of a load bearing wall tile element which has balanced acoustical properties in terms of a relatively high transmission loss and a relatively high sound absorbing property, while at the same time holding the weight of the tile to a minimum and providing adequate load bearing strength.

There have been attempts made to have the materials out of which a building is constructed possess sound absorbing or acoustical properties. One such form is shown in the prior art United States Patent No. 2,281,121, issued to Mr. M. T. Straight. I have found that the unit shown therein does possess acoustical properties, but that the absorption of sound waves of this type of unit is fairly low and the constant control of the range of acoustical qualities is difficult.

A general object of this invention, therefore, is to provide a load bearing structural clay tile unit having high sound absorbing qualities.

Another object of this invention is to provide a load bearing tile unit which will absorb and diffuse audible sound waves striking a wall or partition made from the subject tile units to prevent reflection of the sound waves to such an extent that undesirable echoes may be eliminated within the room or building formed of said tile units.

Another object of this invention is to provide a load bearing clay tile unit which may be made by methods and machinery now in common use by the manufacturers of clay units.

Still another object of this invention is to provide a load bearing structural clay tile unit, unglazed or ceramic glazed, having high sound absorbing qualities which can be readily cleaned or provided with decorative substances, such as paint, after the tile units have been placed into a wall or partition without interfering with the sound absorbing qualities of the tile unit.

This invention contains additional novel features which make it an inexpensive and practical unit to manufacture and place into a wall. These and other objects and advantages will hereinafter appear; and for purposes of illustration, but not limitation, a preferred embodiment of this invention is shown in the accompanying drawings, in which:

FIGURE 1 is an elevational view of the exposed or face side of my new structural clay unit having sound absorbing qualities; and

FIGURE 2 is a cross-sectional view taken on line 2—2 of FIGURE 1; and

FIGURE 3 is a cross-sectional view of a further embodiment of the invention.

Referring now to the drawings in detail, the numeral 10 generally designates the new clay tile unit. The clay tile unit is preferably formed of a plastic material having all the properties of a vitrified building block as to strength, appearance and density and, in most respects, is manufactured in the same manner as clay tile units are made today.

The tile unit 10 is comprised of the usual exposed or face side 12, a back side 14, a bottom wall 16 and a top wall 18. Of course, the top and bottom walls may be inverted depending upon which way the exposed or face side 12 of the tile unit is positioned. The tile unit may be provided with ribs 20 to present a greater area for mortar (now shown) when the tile unit is laid into the wall to give greater strength to the wall.

In the face side 12 of the tile unit 10, I have provided a plurality of openings 22 which extend into the cavity 24 formed by the back of the face side 12 of the unit and a web 26 which runs longitudinally and substantially centrally of the tile unit 10, as well as between the interior portions of the inner wall of the top and bottom walls 16 and 18 respectively. The web thus provides a cavity 24 which as is seen in the drawings has considerable height and width, the width approximating at least one fourth of the width of the block while the height is a major portion of the height of the block. The cavity is thus large enough to provide a resonating chamber effect. The openings 22 may be made by a conventional method such as punching them into a column of clay while it is still in a plastic stage or by any other method known in the art. The openings are preferably arranged in a design pattern, as shown in FIGURE 1; but, of course, other design arrangements may be used without departing from the spirit of this invention, so long as they attain the results to be described hereinafter.

The cavity 24 is preferably filled with a sound absorbent material 28 such as "fiberglass." This type of sound absorbing material, as well as others, comes in a sheet form and may be easily inserted into the cavity 24 after the tile units have been burned and are ready to be shipped from the plant. The web 26 is connected with the inner wall of the exposed side 12 of the tile unit 10 acts to retain the sound absorbent material within the tile unit at all times.

The openings 22 are preferably of such a size as to permit ready entrance of the audible sound waves into the cavity 24 and the sound absorbing material 28 where the sound waves are absorbed and diffused. The openings 22

should also be large enough as not to be clogged when the face or exposed side **12** is cleaned or covered with a decorative substance such as paint. Conversely, the openings **22** should not be so large as to detract from the appearance of the tile unit or to permit access of foreign materials such as pencils and the like. This would especially be true in school buildings having walls made of the subject tile unit. I have found that a diameter of approximately 7/32 of an inch accomplishes these objects and purposes without detracting from the sound absorbing qualities of the unit.

Preferably, this invention contemplates a tile unit **10** having a glazed finish made with permanent porcelain finishes and the like, on the face side **12** of the unit **10**. As is well known, glazed surfaces are impervious to acids, stains, smoke or soot; and can be easily cleaned with soap and water. A glazed surface offers the additional advantages of easy and low-cost maintenance.

From the foregoing, it will be seen that the tile body has wall thicknesses such as to provide adequate load bearing strength. The compressive strength of the tile so formed may be on the order of 3000 lbs. per square inch or more, which is entirely satisfactory for building walls. The dimensions of a typical tile may be 4" x 5" x 12". The four inch width of the tile is divided into relatively large internal cavities which are highly efficient in terms of sound absorption. Sound waves may pass through the apertures and into the cavity **24** so as to provide the aforementioned resonating chamber effect. Absorption of the sound waves is enhanced by the fiberglass body in the cavity **24**. At the same time, the tile element is highly effective in descreasing the transmission of sound through the tile body and into an adjoining room.

For economy of construction, a satisfactory resonating chamber effect, high sound transmission loss and high sound absorption, the fiberglass filled cavity should have a width of at least 3/4 of an inch, a height of at least one inch, and a length equal to the length of the tile. The height may be as much as five to eight inches in large tile elements providing the increased height in a specific unit is shown by test to not reduce the strength of the unit below that needed for load bearing purposes.

The central web serves to strengthen the tile body and at the same time, by providing a dead air space, provides what is generally equivalent to the same thickness of tile if the dead air space were not present. In other words, the width from the central web to the rear face of the tile may be considered, in terms of sound transmission properties, as generally equivalent to solid tile of this dimension. The use of the central web also increases the fire resistance of the tile. The central web provides a cavity of practical dimensions for the resonating chamber effect and for holding the fibrous pad in place.

The fiberglass body may be provided from fiberglass in the sheet form. Fiberglass has a relatively low density. It may be as low as one pound per cubic foot. The body of a sheet of fiberglass, as is well known, consists of many fibres which are more or less interlaced with a substantial portion of the volume of such a sheet being consumed by air spaces. This type of material is highly effective as a sound absorbent. The many fibres of the body tend to break up and disperse sound waves.

It is advantageous to have the fiberglass body of a width slightly greater than the width of the cavity. For example, in the case of a cavity having a 15/16" width in a tile having a 3 3/4" overall width, the fiberglass sheet may be advantageously of a width equal to one inch. Thus the fiberglass body is slightly compressed when inserted into the cavity, which slight degree of compression is highly effective in holding the fiberglass body in position.

FIGURE 3 illustrates a modified form of the invention. In FIGURE 3, the external configuration of the tile body **40** corresponds to the configuration of the tile body in FIGURES 1 and 2. In FIGURE 3, however, a single large cavity **41** is provided in the tile body which cavity **41** extends throughout the length of the body and has a height of the body. The overall width of the resonating chamber formed by the cavity **41** in FIGURE 3 with relation to the width of the tile body is greater than the width of the cavity **24** in FIGURES 1 and 2. A plurality of apertures **42** similar to the apertures of the blocks in FIGURES 1 and 2, are spaced throughout the face of the tile and the majority of these apertures are in communication with the single resonating chamber **41**. In FIGURE 3, a body of sound absorbent material such as fiberglass of the type aforementioned is positioned in the cavity **41**. This body **43** of sound absorbent material may have a normal thickness, in the normal sheet form, slightly greater than the width of the cavity **41** so that when inserted into the cavity **41**, the slight degree of compression of the body **43** is effective in exerting an expanding outward force so as to hold the body of sound absorbent material within the cavity.

In the embodiment of FIGURE 3, the wall thickness of the tile may be slightly greater than the wall thickness of the tile body in FIGURES 1 and 2 so as to insure adequate strength. The desired proportions and sizes of the tile body, apertures and cavities set forth with regard to the form in FIGURE 1 are also applicable to the form of FIGURE 3.

In both forms of the invention, the sound absorbent tile element has a weight generally equivalent to that of normal hollow tile elements and at the same time has generally the same load bearing strength.

For light weight, while providing relatively large internal chambers, the volume of the tile material in the body should be approximately 75% or less than the overall volume of the tile body.

The tile elements, when formed in the manner herein described, have a much superior sound absorbing characteristic and a greater sound transmission loss than that of ordinary hollow tiles. In this respect, the apertures in the face of the tile allow the transmission of sound waves to the interior of the tile body and minimize reflection thereof. By providing the relatively large resonating chamber in the tile body and the fiberglass insert, sound absorption is greatly enhanced. The tile also has a relatively high sound transmission loss.

The apertures in the face of the tile elements have such a size and are so spaced that they do not detract materially from the strength of the wall section in which these apertures are located. The cross-sectional area of all of the apertures should be in the range of 5 to 18 percent of the area of the tile face in which they are located. At the same time, each aperture should be relatively small and of the dimension aforementioned. The arrangement of the apertures over the entire facial area of the tile with the substantial portion of these apertures in communication with the large internal cavities of hollow tile elements provides the resonating chamber effect without destroying the wall supporting and load bearing strength properties of the tile.

In sound absorbing tests of units comprising this invention, the Riverbank Acoustical Laboratories reports that these tile units have a sound absorption of .60 or 60 percent which is substantially higher than tests conducted upon tile units of the type shown in United States Patent No. 2,281,121.

Thus, it will be seen that I have provided a load bearing clay tile unit which is capable of being laid in partition walls of a building or in the exterior walls, and at the same time have provided an ornamental exposed surface in which a large percentage of audible sound waves will be absorbed therein, thereby adding to the acoustical effectiveness of a room or building having such units. Additionally, I have provided a sound absorbing clay tile unit which can be manufactured in substantially the same manner and with the same equipment as used to manu-

facture and make ordinary tile units with the exception that a perforating machine is necessary to place the openings 22 into the tile.

Whereas the invention is shown and described, as using circular holes 22 in the tile wall, it should be understood that the holes may have other shapes, as for example, square or triangular shapes.

This application is a continuation-in-part of my copending application Serial No. 475,768, filed on December 16, 1954, which application is now abandoned.

Although I have shown and described a specific embodiment of my invention, I am fully aware that modifications are possible. My invention, therefore, is to be limited only by the spirit of the appended claims as equivalents, obviously, can be substituted within the skill of the mechanic without departing from the principle of the invention.

I claim:

1. A load bearing acoustical tile comprising a tile body having top, bottom, front and rear walls of clay-like material, said walls having thicknesses such as to have substantial strength and to be load bearing when a plurality of such bodies are superimposed upon one another to form a building wall, said front wall providing an exposed front face, said body having an opening therethrough from end to end, said opening being substantially filled with low density fibrous material, the front face of said body having apertures therein over substantially its entire area extending from the opening through said front face.

2. A load bearing acoustical tile comprising a tile body having top, bottom, front and rear walls of clay-like material, said walls having thicknesses such as to have substantial strength and to be load bearing when a plurality of such bodies are superimposed upon one another to form a building wall, said front wall providing an exposed front face, said body having an opening therethrough from end to end, said opening being substantially filled with low density fibrous sheet "Fiberglass" material having substantial air spaces between the fibers thereof, the front face of said body having apertures therein over substantially its entire area extending from the opening through said front face.

3. A load bearing acoustical tile comprising a tile body having top, bottom, front and rear walls of clay-like material, said walls having thicknesses such as to have substantial strength and to be load bearing when a plurality of such bodies are superimposed upon one another to form a building wall, the walls of the tile body comprising approximately 75% or less of the volume of the overall body, said front wall providing an exposed front face, said body having an opening therethrough from end to end, said opening being substantially filled with low density fibrous material, the front face of said body having apertures therein over substantially its entire area extending from the opening through said front face.

4. A load bearing acoustical tile comprising a tile body having top, bottom, front and rear walls of clay-like material, said walls having thicknesses such as to have substantial strength and to be load bearing when a plurality of such bodies are superimposed upon one another to form a building wall, said front wall providing an exposed front face, said body having an opening therethrough from end to end, said opening having a width at least equal to approximately ¼ of the width of the overall tile body, said opening being substantially filled with low density fibrous material, the front face of said body having apertures therein over substantially its entire area extending from the opening through said front face, said opening having a height such that a substantial number of vertically spaced apertures are horizontally opposed to said opening.

5. A load bearing acoustical tile comprising a tile body having top, bottom, front and rear walls of clay-like material, said walls having thicknesses such as to have substantial strength and to be load bearing when a plurality of such bodies are superimposed upon one another to form a building wall, said front wall providing an exposed front face, said body having a central vertically extending web in the interior thereof, said web dividing the interior of said body into two openings, the opening adjacent to said front face being substantially filled with low density fibrous material, the front face of said body having apertures therein over substantially its entire area extending from the opening through said front face, the other opening in said body providing a dead air space.

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