Dec. 17, 1946. G. H. BURT 2,412,713

ACOUSTICAL TILE

Original Filed Dec. 19, 1941

Fig. 1.

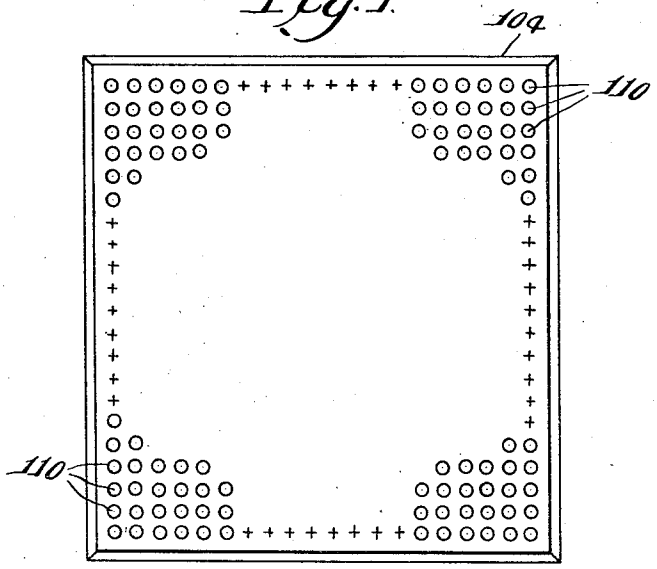


Fig. 2.

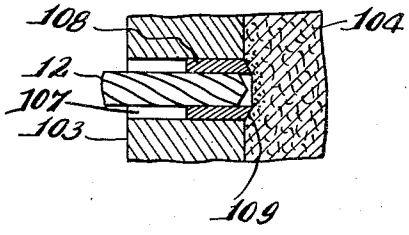
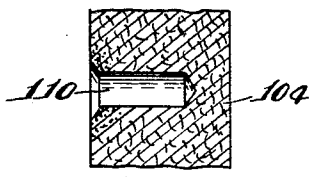


Fig. 3.



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ACOUSTICAL TILE

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3 Claims. (Cl. 181—30)

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This invention relates to perforated material, and particularly to an acoustical tile formed of fibrous material requiring a large number of perforations within a relatively small area.

The principal object of this invention is to provide a perforated sound-absorbing tile, that is, one with formed holes or openings extending from a face into the body, and in which the material of the tile is of increased density immediately around each of such holes or openings, particularly at and adjacent the surface of the tile.

A further object is to provide a tile, as in the foregoing, wherein at the face, in that portion of increased density immediately surrounding the holes or openings, there is provided an indentation of the surface or chamfer which improves the appearance of the tile and assists in the direction of sound waves into the tile perforations when the tile is in use.

With these and other objects in view the invention resides in the novel product, all as will be disclosed more fully hereinafter and particularly covered by the claims.

Referring to the accompanying drawing forming a part of this specification and in which like numerals designate like parts in all the views,

Fig. 1 is a plan view of one form of acoustical tile which has been drilled or perforated according to this invention;

Fig. 2 is a detail sectional view illustrating a drill about to penetrate a piece of acoustical material;

Fig. 3 is a detail sectional view illustrating a perforation made in acoustical material by one of the drills.

This application for patent constitutes a division of my copending application filed December 19, 1941, under the Serial Number 423,700 and entitled Method of and apparatus for perforating material, patented, No. 2,378,618, June 19, 1945.

In my copending application for patent filed October 28, 1939, under the Serial Number 301,708 and entitled Multiple spindle drilling apparatus, patented, No. 2,342,251, February 22, 1944, there was fully disclosed a multiple spindle drill head substantially the same as herein contemplated, as well as a mechanism by which rotary motion of a main operating shaft was translated into circular oscillatory motion of an eccentric disk which latter had journaled therein the cranks formed at one end of the multiple spindles having the drills at their other ends, wherefore it is not necessary here to repeat such disclosure since this invention has to do with the formation of

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an acoustical tile by the operation of a plurality of similar drills upon the rotary motion is imparted simultaneously to all of the plurality of drills.

The invention hereof contemplates in particular the drilling or perforating of sound absorbing material with an apparatus such as that disclosed in the patents heretofore referred to, but, however, it is not contemplated as limited thereto and relates broadly to methods for perforating particularly sound absorbing material such as fiber insulation board to form an acoustical correction material, said material comprising vegetable and/or wood fibers which have been felted into sheet formation having a relatively compressible surface and which may have been subjected to such proofing as is desired. Such material is well known in the market under various trade-marks as "Celotex," "Insulite," "Masonite," "Flintkote," "Homasote," and numerous others, but this invention also contemplates material other than lignocellulosic, such as tile and/or panels fabricated from rock wool, glass wool, etc., particularly inorganic fibers of various kinds.

Such fibrous material, when utilized as an acoustical corrective material, is preferably formed into tile substantially 12 inches by 12 inches, or multiples thereof, and substantially ¼ inch to 1½ inches in thickness depending upon the amount of sound absorption desired. Such material is then drilled or punched with a multiple spindle apparatus to form similar perforations spaced substantially $\frac{17}{32}$ of an inch apart so that each square foot of the tile has substantially 441 perforations (see Fig. 3) uniformly spaced, of a uniform depth, and each having a diameter of substantially $\frac{3}{16}$ of an inch. It is obvious that variations in the size and shape and number of perforations may be had without departing from the scope of the invention, and that the arrangements of such perforations may be varied to form any desired design.

The process of perforating a fibrous sheet material to produce an acoustical tile involves the placing of a fiber board unit 104 between a supporting platen, which is not shown in the attached drawing, but for which reference is made to patents previously referred to, and stripper plate 103, whereupon, by appropriate operation of the perforating mechanism, whether drill or punch or the like, the fiber board will be suitably perforated as desired. Upon referring to the patents heretofore mentioned, it will be seen that it is contemplated that the fiber board sheet 104 shall be perforated with a multiple spindle drill

whereby a large number of perforations are made in sheet 104 simultaneously. In here describing the perforation of the sheet, merely the operation providing a single perforation will be described, but it is readily understood, of course, that such procedure applies likewise to multiple perforations.

Stripper plate 103 is provided with an opening or hole 107 through which passes a drill or perforating member 12.

Preferably, however, each drill hole such as 107 in the stripper plate is of a diameter greater than the diameter of a drill, in order to accommodate a hardened steel bushing 108 serving as a bearing and/or guide for the drill. This bushing is made cylindrical and so positioned and secured in its hole 107 that a slight portion of the end of the bushing extends out of, or beyond the tile-engaging face of, the stripper plate, and this extending end of the bushing has its outermost edge bevelled or chamfered as indicated in the drawing so that said end has the shape of a truncated cone. By this construction, the conical end of each bushing is forced into the yieldable surface of the fibrous tile when the tile is clamped between the stripper plate and the drill platen, thereby placing the fibers of the tile under increased compression at 109 (see Fig. 4) in the face of the tile at the area where a drill is to penetrate the tile. With the fibers under such increased compression, the drill will make a cleaner or sharper cut hole in the tile, and be less liable to malform the edge of the tile perforation upon removal of the drill, leaving a perforation in the tile as indicated at 110 in Fig. 5. The conical indentation formed by the conical end of the bushing may partially remain in the face of the perforated tile but this will not impair, and rather will improve, the appearance of the tile, and further will assist in the direction of sound waves into the tile perforation when the tile is in use.

It will be readily understood that in perforating a fiber sheet by means of the preferred methods, that is with an apparatus such as is shown in my patents previously referred to, that the compression of the fibrous material around the periphery of the perforation, and which compression is brought about by the clamping of the fiber sheet between the drill platen and the stripper plate, not only compresses the fiber sheet for the perforating operation, but in addition it imparts some degree of increased density to the sheet about the periphery of the perforations since, after the sheet has been perforated and released from between the platen and stripper plate, while there may be some comeback due to resilience, there is, nevertheless, at least a degree of residual compaction or increased density.

Reference has heretofore been made to perforations made either by drills or punches. It is

obvious that punches may be substituted for the drills 12 since either type of perforator will produce the desired tile product, namely a tile having apertures extending inwardly from a face thereof to receive and absorb sound waves, whether the such apertures extend only part way or entirely through the tile. Punches are also contemplated which are given partial twist or no axial rotation and which, like the drills, may be hollow or not, as found most suitable. Punches may be employed since the platen is moved toward and away from the stationary drill head by mechanical power sufficient to cause the punches, mounted on the drill head, to make the desired perforations in the tile. Whether drills or punches are employed, the stripper plate 103 is utilized for the purpose heretofore explained.

It is obvious that those skilled in the art may vary the details of construction and arrangements of parts constituting the apparatus, as well as vary the steps and combination of steps constituting the method, to produce the article herein contemplated, without departing from the spirit of this invention, wherefore it is desired not to be limited to the exact foregoing disclosure except as may be required by the claims.

What is claimed is:

1. An acoustical tile comprising a fiber sheet having a plurality of independent, artificial sound-absorbing perforations extending inwardly from a face of the sheet, the fiber sheet compacted immediately about the openings of the perforations and the peripheral walls of the perforations comprising principally ends of fibers forming the fiber sheet.

2. An acoustical tile comprising a fiber sheet having a plurality of independent, artificial sound-absorbing perforations extending inwardly from a face of the sheet, the face of the tile indented immediately around each perforation, the fiber sheet compacted immediately about the openings of the perforations and the peripheral walls of the perforations comprising principally ends of fibers forming the fiber sheet.

3. An acoustical tile formed by subjecting a sheet of fiber material to pressure and concurrent action of a gang of perforators, said tile having a plurality of sound receiving perforations extending inwardly from a face of the tile, the body of the tile compressed in the region immediately surrounding the opening of each of the perforations at the surface of the tile and of a density higher than the density throughout the remainder of the tile and the face of the tile beveled inwardly immediately around each perforation; all as the result of the formation of the perforations and the interior periphery of the perforations comprising principally the ends of fibers forming the fiber sheets.

GEORGE H. BURT.