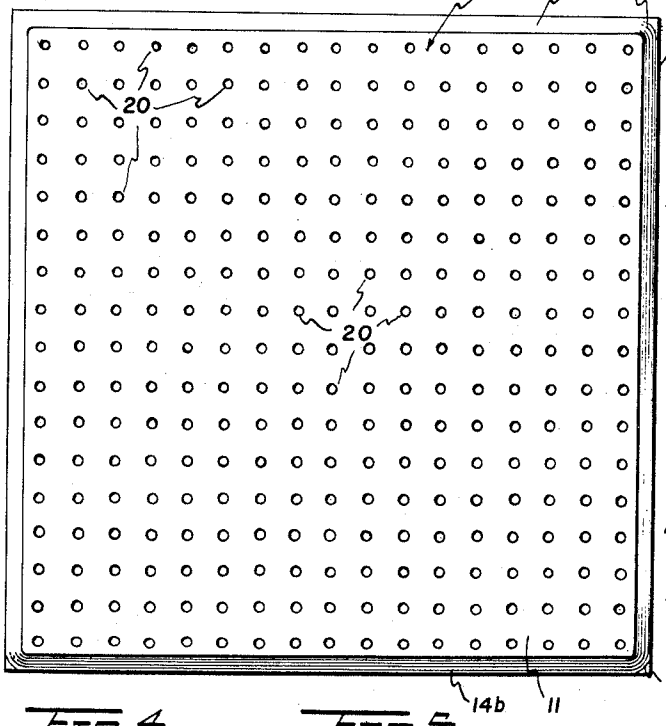
April 5, 1960 M. MACCAFERRI 2,931,214

ACOUSTICAL TILE

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Fig 1.



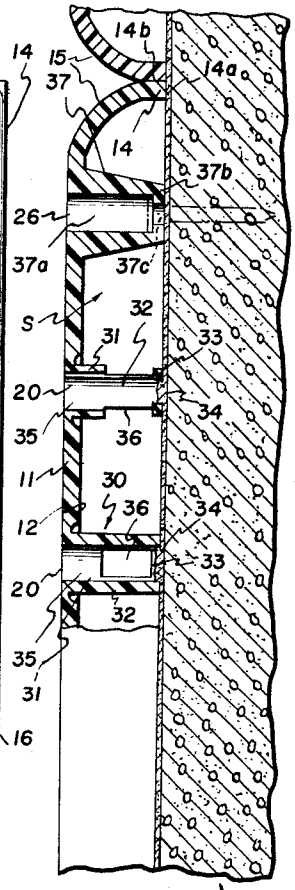


Fig 3.

Fig 4.

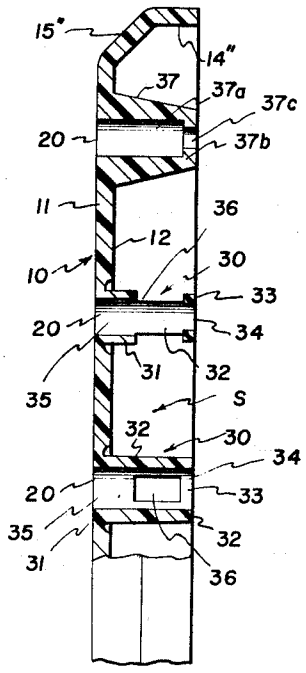


Fig 5.

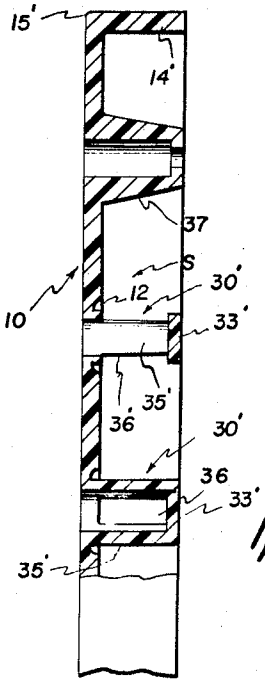
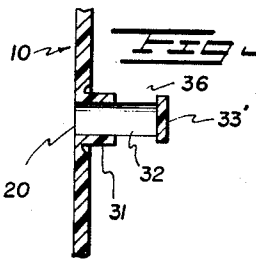


Fig 5A.



INVENTOR.
Mario Maccaferri
BY
Pack & Pack
attorneys.

April 5, 1960 M. MACCAFERRI 2,931,214

ACOUSTICAL TILE

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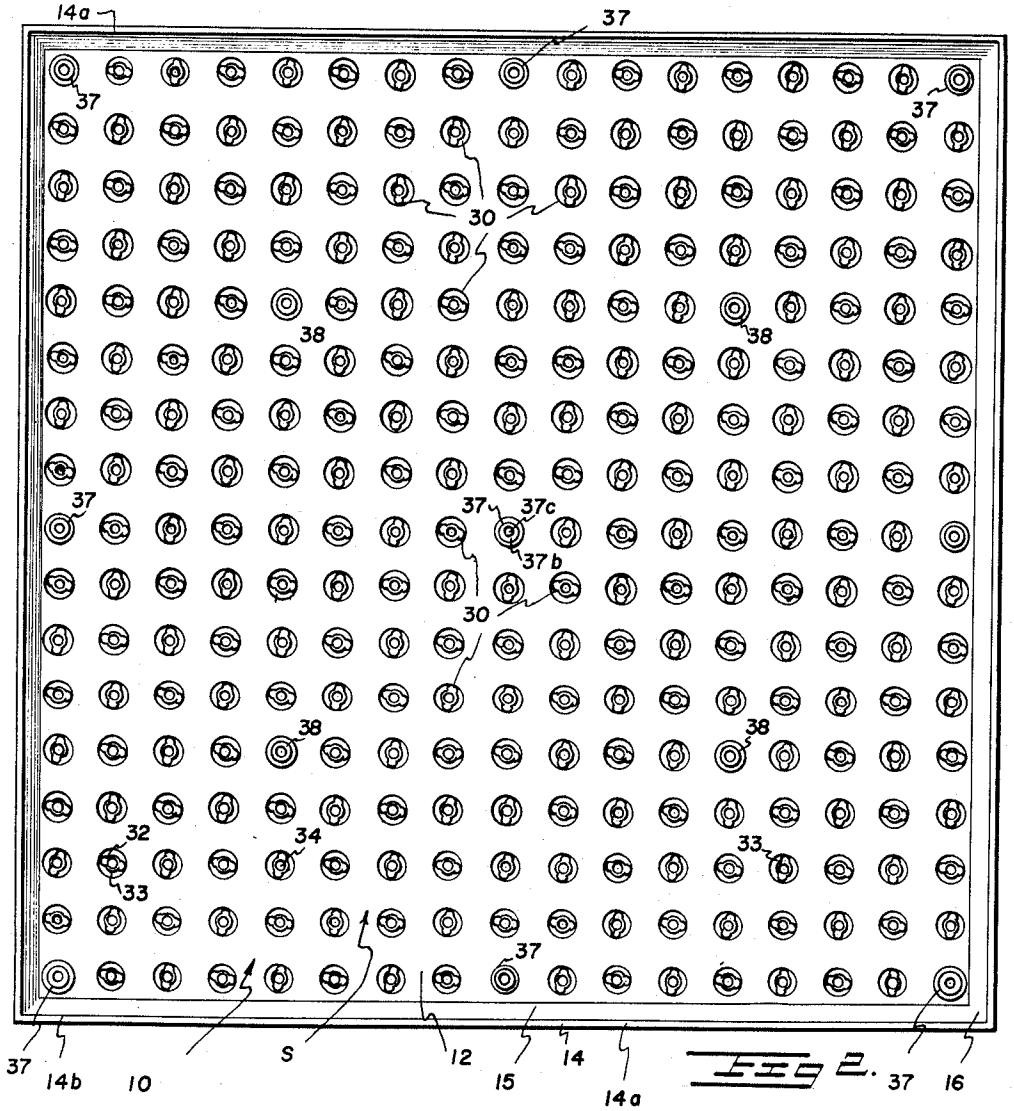


Fig 2.

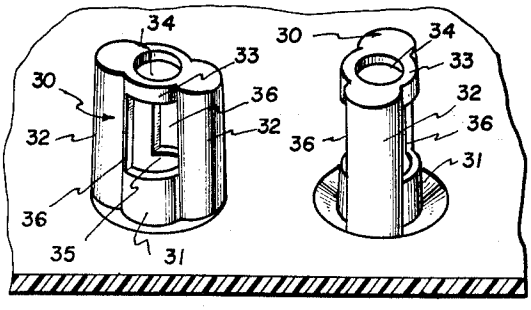


Fig 6.

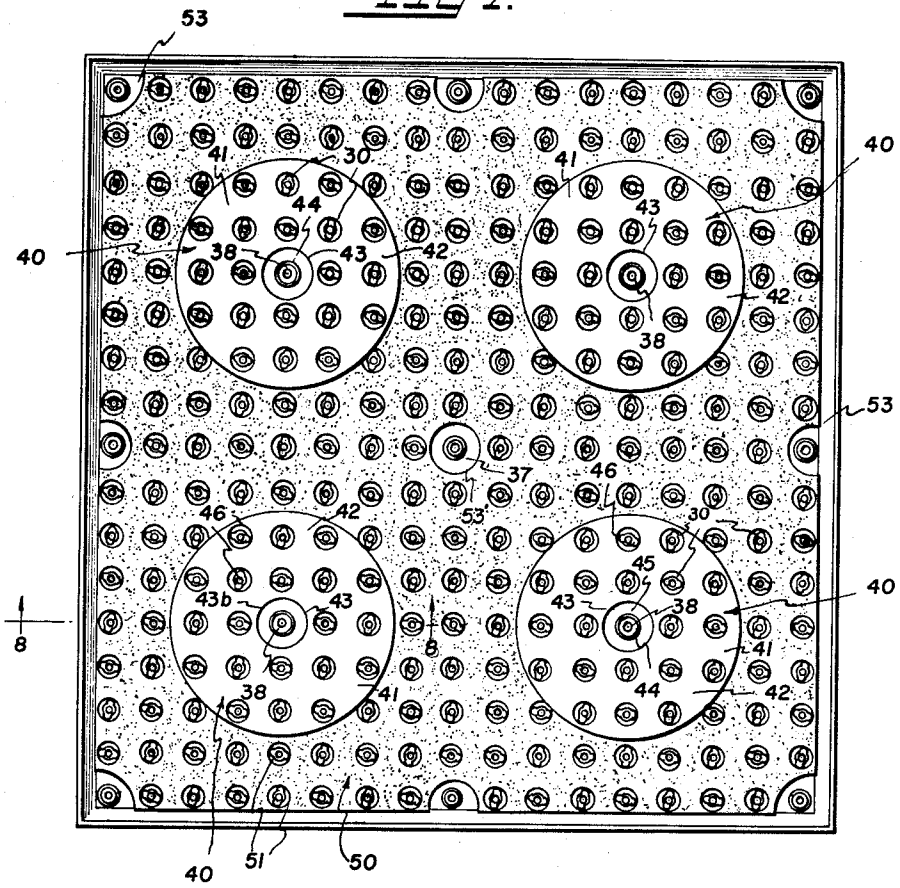
INVENTOR.
Mario Maccaferri
BY Peck + Peck
Attorneys

April 5, 1960 M. MACCAFERRI 2,931,214

ACOUSTICAL TILE

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Fig 7.



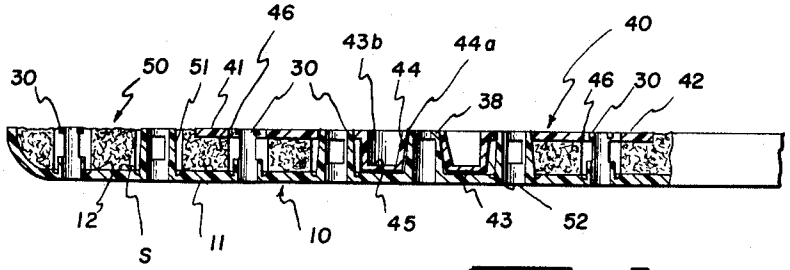


Fig 8.

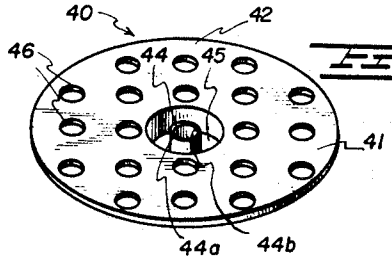


Fig 9.

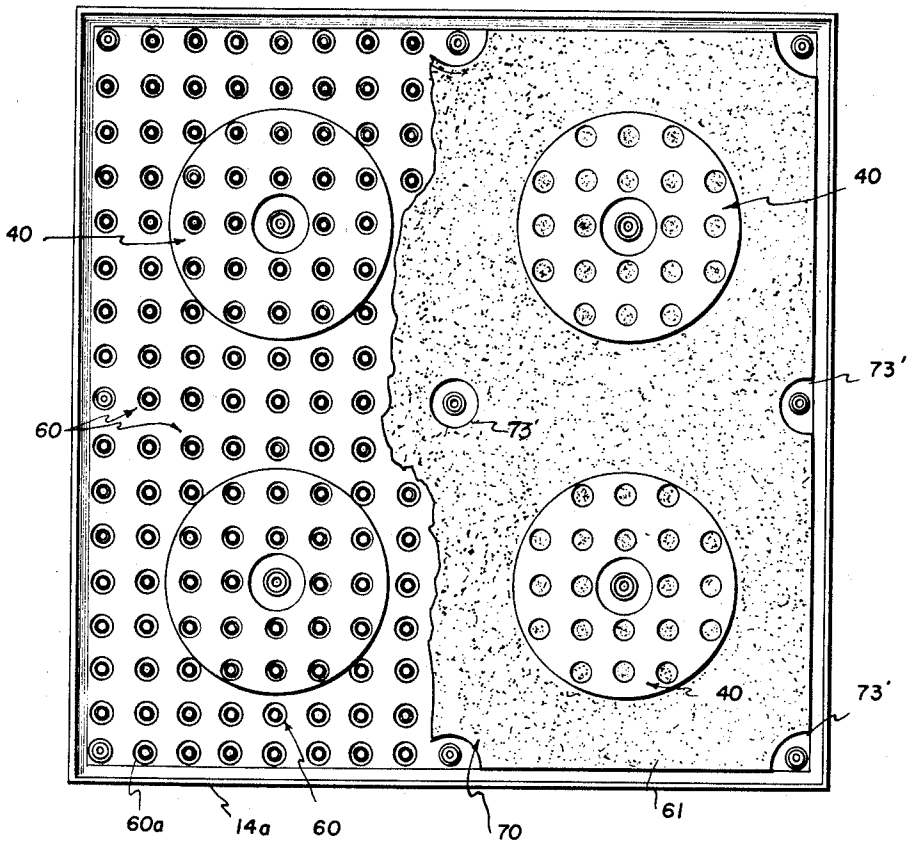
INVENTOR:
Mario Maccaferri
BY
Peck & Peck
Attorneys.

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ACOUSTICAL TILE

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Fig 10.



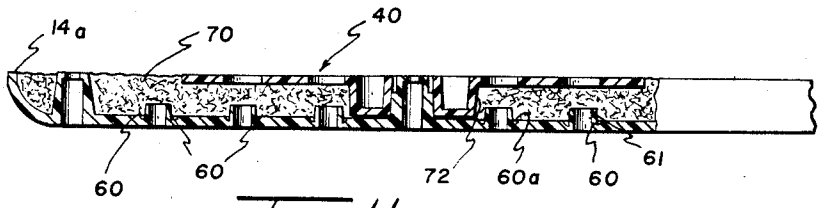


Fig 11.

INVENTOR.
Mario Maccaferri
BY
Pack & Pack
Attorneys.

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2,931,214

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ACOUSTICAL TILE

Mario Maccaferri, Rye, N.Y.

Application September 14, 1953, Serial No. 379,918

5 Claims. (Cl. 72—18)

My invention is directed to acoustical tiles; and the nature and objects of the invention will be readily recognized and understood by those skilled in the arts involved in the light of the following explanation and detailed description of the accompanying drawings illustrating what I now believe to be the preferred embodiments or structural and acoustical expressions of the invention and the various features thereof, from among other forms, expressions, embodiments, modifications, constructions and combinations of which the invention is capable within the broad spirit and scope thereof as defined by the appended claims.

This application is filed as a continuation-in-part of my pending application Serial No. 283,707, filed April 22, 1952, for Acoustic Tiles, now Patent No. 2,755,882 issued July 24, 1956.

A general object of the invention is to overcome the color limitations of and the necessity for coating or otherwise finishing and treating either before or after installation, the various types of acoustic tiles such as now in general use, by providing acoustic tiles of materials which may have any desired permanent color or color variations and which provide finished surfaces requiring no treatment of any character before or after installation, with the faces or exposed surfaces of the tiles being capable of ready cleaning by mere dry wiping or dusting of the faces or exposed surfaces thereof.

In carrying out the above general object, I have provided acoustic tiles of the dense, hard-surfaced type formed of materials having no substantial inherent sound-absorbing characteristics; and a further object is to so design and construct such a tile as to cause the tile itself to function to damp out and dissipate a substantial percentage of the sound energy or sound waves striking against the exposed surface thereof with the tile being adapted to the efficient mounting and combination therewith of suitable sound-absorbing material pads or mats for obtaining with the damping effect of the tile structure the maximum sound absorption from an installed tile and mat or pad combination.

Another general object is to provide an acoustic tile having the foregoing characteristics which is primarily adapted for installation by the use of a mastic or cement by which the tile is adhered to the surface of the structure on which the tile is to be positioned, with or without the use of additional mechanical fastening means, and by unskilled installers without the use of special tools or equipment and with a minimum of tile breakage and of tile surface marring or disfiguration.

A further object is to eliminate the necessity for applying a mastic or cement coating to the surface on which the tile is to be mounted, by providing the tile itself with limited area mastic or cement receiving or carrying surfaces on which a sufficient quantity of mastic or cement may be applied by the installer to each tile as such tile is prepared for mounting in position adhered to the surface of the structure on which it is to be installed.

Another object is to provide an acoustic tile having sound wave damping tubes thereon which project from the inner or rear side of the tile body with sound receiving passages through the tubes opening through the outer, sound wave receiving surface of the tile body.

A further object is to provide a mastic installable acoustic tile having such sound wave damping tubes in which the rear ends of the tubes are so formed as to be engaged and keyed in the mastic or cement coating when the tile is pressed into position thereon to thereby securely bond and fix the tile in its mounted, installed position.

Another object is to provide an acoustic tile having plate units or portions providing mastic receiving surfaces located spaced apart in positions at and spaced rearwardly from the rear surface of the tile body for the application thereto of a mastic and the abutment and seating of such mastic carrying plate units against the structure on which the tile is to be installed to thereby fix the tile in the desired mounted position.

Another object is to provide as a self-contained and complete unit an acoustic tile having at the rear side thereof a suitable sound absorbing material in the form of a pad or mat assembled into the unit as a permanent component thereof with the mastic receiving plate units at the rear side of the tile engaging and securing such sound absorbing pad or mat in assembled position in the tile unit against displacement therefrom.

I have determined that certain plastic materials have, when molded, the requisite structural characteristics from which to efficiently form an acoustic tile having the foregoing features in construction and in function; and a further object is to provide a design and construction for such a plastic acoustic tile which will permit of the tiles being efficiently manufactured on a quantity production basis with readily available standard types of molding equipment at relatively low production costs per tile.

And a further object is to provide an acoustic tile formed of a plastic material capable of being pigmented prior to molding to give to the tile molded therefrom any desired permanent color, shade or color variation, and which aside from permanency of color will produce a tile which requires no further finishing or conditioning after discharge from the mold and prior to the installation of the tile.

With the foregoing and various other objects, features and results in view which will be readily apparent from the following description and explanation, my invention consists in certain novel features in design, construction, materials and forms, and in combinations and sub-combinations of elements, parts and components, all as will be more fully and particularly referred to and specified hereinafter.

Referring to the accompanying drawings in which similar reference characters refer to corresponding parts and elements throughout the several figures thereof:

Fig. 1 is a view in plan of the exposed or front face side of acoustic tiles of my invention of the forms thereof having the multiplicity of sound wave damping tubes projecting from the rear side of the tile and opening through the front or face surface thereof.

Fig. 2 is a view in plan of the rear side of a tile of Fig. 1.

Fig. 3 is a view partly in section and partly in elevation of portions of adjacent tiles in mastic adhered, installed position on a wall, a portion of which is schematically shown in section.

Fig. 4 is a transverse, fragmentary section through a portion of the tile of Figs. 1 and 2, but showing a beveled form of edge flange.

Fig. 5 is a view similar to Fig. 4 showing another modified form of tile edge flange.

Fig. 5A is a detail view in section through a modified damping tube of the type of tubes of Figs. 1 and 2 having a closed end wall.

Fig. 6 is a detail perspective view of a portion of the tile of Figs. 1 and 2 and of adjacent damping tube members at the rear side of the tile.

Fig. 7 is a view in plan of the rear side of a tile, sound absorbing pad, and cement receiving members in assembled combination to form a complete tile unit of the invention.

Fig. 8 is a transverse vertical section through a portion of the tile unit of Fig. 7, taken as on the line 8—8 of Fig. 7.

Fig. 9 is a perspective view of one of the cement receiving members of the tile unit of Fig. 7.

Fig. 10 is a view in plan of a modified form of tile, sound-absorbing pad and cement-receiving member unit of the invention.

Fig. 11 is a view partly in transverse section and partly in edge elevation of a tile unit of Fig. 10.

The selected forms of tiles of the invention here presented, are in each instance square in plan form with maximum outside dimensions of 12" x 12", that is to say, each tile of the selected examples presents approximately one (1) square foot of wall covering when in installed position. A tile of this approximate size is generally considered by the art as a tile adapted primarily for ceiling installation but it is to be understood that with the plastic tiles of my present invention, due to the design and construction thereof and to the visual appearance of the tiles when in installed position, these so-called larger area or "ceiling" tiles may be as readily effectively used, if desired, for installation for the acoustic treatment of side walls or various other structures. Hence, there is no intention by the disclosed examples of larger area tiles to in any way limit the intended use thereof or use for which such tiles are or may be found to be adapted. While I have shown by the examples, tiles of the above specified over-all plan dimensions, it is not thereby intended to in any way limit the plan dimensions or area of the tiles whether they be intended for ceiling, side wall, or other installation locations.

All of the tiles of the examples hereof have the common characteristic of having been injection molded into the form of a thin, flat sheet or plate of a thermoplastic material forming the body of the tile and having a thickness in this instance within the range of the order of approximately .05" to .10", that is to say, approximately 1/20" to 1/10". As disclosed by way of example in my hereinabove identified pending application Serial No. 283,707, the bodies of the tiles of the examples hereof may be considered to have a maximum thickness of approximately .06" with a minimum of thickness of approximately .055" with the thickness of the tile body progressively varying in accordance with the pattern and arrangement thereof as claimed in my above identified pending application. While the present exeamples of the inventions herein disclosed may be considered to have the bodies of the tile so formed, it is to be understood that they are not necessarily so limited as if desired or found expedient, the thickness of the tile body may be substantially uniform throughout or varied in any other arrangement or manner found desirable or practicable.

Each of the example tiles herein disclosed is formed with a continuous integral flange therearound which is comprised of an outwardly and rearwardly curved edge portion along each side of the tile which terminates in an edge wall disposed generally normal to the plane of the front surface of the body of the tile, such edge wall of the tile having a substantially straight, planar outer surface also generally normal to the plane of the tile body front surface or face. The rounded edge and rearwardly extended flange wall along each side of the tile body is integrally joined at its opposite ends with the ends of the rounded edges and edge flange walls of the adjacent sides of the tile to form in effect the four corners of the tile unit. In the tile embodiments of th examples hereof the walls forming the rounded edges and the rearwardly extending flange forming walls making up the continuous flange of the tile are of substantially uniform thickness throughout, which in this instance may be considered to be approximtely .06".

In the form of the tile illustrated in Figs. 1 through 6, the tile body is constituted by the thin, sheet-like plate **10** having the maximum thickness in this instance of approximately .06", and providing the flat, planar front surface or face **11** and the generally flat rear surface **12**. The tile body has the continuous integral flange therearound comprised by the rearwardly extended flange wall **14** joined with the tile body by the curved edge forming wall portion **15** along each of the four side edges of the body **10**. The flange wall **14** is formed with a straight rear edge surface **14***a* which is adapted to form an elongated seat which may be abutted and seated against the surface of a wall W or other structure as schematically indicated in Fig. 3 of the drawings. The flange walls **14** and the curved edge walls **15** along each side of body **10** are integrally joined at their opposite ends with the ends of the adjacent flange walls and edge walls to thereby form the corners **16** of the tile unit. Thus, the flange walls **14** together form a hollow-square seating base for locating and positioning the tile in installed position on a structure to be acoustically treated, as well as forming a space or chamber within which there may be mounted a suitable mat or pad of sound-absorbing material, as will be referred to hereinafter. In the example tiles, the rear edge surfaces **14***a* of the tile flange wall **14** lie in a plane spaced approximately 1/4" from the plane of the front surface or face **11** of the body of the tile, so that with the tile in installed position on a wall, the tile body is spaced outwardly from the surface of the wall a distance to provide a space S which is enclosed within the tile flange between the tile body and the wall or other structure on which the tile is mounted. The outer side of each flange wall **14** of the continuous flange of the tile, is formed to provide a surface **14***b* for abutment against the corresponding and facing surface **14***b* of an adjacent tile in an installation of tiles, so that a clean, visually satisfactory and mechanically tight joint between adjacent tiles may be had with the joint so formed in effect providing a seal against the passage of foreign material therebetween and access thereof to the space S at the rear of the installed tiles.

Other forms and shapes of edge and flange walls may be employed, such for example as shown in Fig. 5, in which a sharp edge **15'** is provided joining flange **14'** at a substantially 90° angle and with no radius, or as shown in Fig. 4, in which a bevel wall **15"** is provided joining the tile body **10** with the flange wall **14"**.

The tile body **10** of the form of tile of Figs. 1 through 6, is formed with a multiplicity of circular apertures, openings or holes **20** distributed over the entire area of the plate-like body **10** of the tile and opening through the front, exposed surface or face **11** thereof. In this example with the tile plan dimensions as hereinbefore specified, I have provided a total of 289 of such apertures **20** which are arranged and located over the area of surface **11** spaced equidistant apart in seventeen parallel rows spaced equal distances apart across the surface **11** with each row being comprised of seventeen apertures spaced equidistant apart along the row formed thereby. Hence, there results a pattern of apertures through the surface **11** in an equal distribution over the area thereof, which is comprised of seventeen rows of seventeen apertures each across the tile parallel with opposite edges thereof in one direction, and seventeen rows of seventeen apertures each across the tile in a direction perpendicular to the first mentioned rows. While in this example I have disclosed

a specific arrangement and number of apertures **20**, it is to be understood that other arrangements made up of a greater or lesser number of apertures **20** may be utilized if desired but as a general rule, it will be found that the greater the number of apertures in a surface **11** of given area, the greater will be the total resultant sound wave damping effect of such apertures.

With the tile thus apertured and comprised of the thin, plate-like body **10** and the integral edge flange **14—15—16** therearound, I have provided as an important feature of my invention, a multiplicity of sound damping tube members **30** integral with the tile body **10** and projecting rearwardly from the rear side **12** thereof at each location of an aperture **20** through the body **10** in positions generally normal to the plane of the face **11** of the tile. These tube members **30** in addition to their sound wave damping function, also function to key or bond the tile to a mastic or cement coating onto which the tile is manually pressed in the installation thereof on a wall structure, as will be hereinafter fully described and explained. In the illustrated form of the tile, each tube member **30** is molded as an integral part of the plate-like body **10** and is comprised of an unbroken wall portion **31** of cylindrical cross-section which extends a distance rearwardly from the rear surface **12** of the tile body and which has joined integrally therewith and extending rearwardly therefrom at diametrically opposite locations in continuation thereof, the posts or column forming tube wall portions **32**, each of which is of arcuate cross-section with the inner surface thereof in continuation of the inner surface defining the bore through the cylindrical wall portion **31** of the tube member. Each post or column portion **32** of a tube member **30** is of greater thickness than the thickness of the wall portion **31** and projects outwardly from the outer surface of wall portion **31**, as will be clear by reference to Figs. 3, 4 and 6. At the ends thereof, the posts **31** of each tube member **30** are joined and connected by an integral end wall **33** having a circular aperture or opening **34** therethrough in axial alignment with the aperture **20** through tile body **10** with which such tube member is associated, this end wall **32** in the specific example hereof constituting what is in effect a ring member connecting the posts **31** and having the circular aperture **34** therethrough of slightly less diameter than the diameter of the aperture **20** in body **10** with which it is axially aligned.

There is thus provided by each tube member **30** what is in effect an axial bore or passage **35** therethrough which is open at its outer or forward end through an aperture **20** in the face **11** of the tile body **10**, and is open at its inner or rear end through the circular opening **34** through the end wall **33**, and which is open at diametrically opposite sides of each member **30** through what are in effect the side wall openings **36** each having substantial width relative to the diameter of the tube member and each having substantial length axially of the tube member between the rear edge of wall **31** and the inner surface of the end wall **33** of the tube member **30**. Thus, in normal functioning of each tube member **30** sound waves may enter and are received through an aperture **20** of the tile face **11** and then pass through the bore or passage **35** to and outwardly through the side wall openings **36** into the space S at the rear side of the tile, with resulting damping and dissipation of the sound wave energy. In the example embodiment the rear surfaces of the end walls **33** of the tube members **30** are preferably located in the plane passing through the rear edge surfaces **14***a* of the flange walls **14**, although my invention is not critically limited to such location. Some or all of the rear surfaces of tube member end walls **33** may be located in a plane or planes spaced inwardly from the plane passing through the rear edge surfaces **14***a* of flange walls **14**, with th rear edges of the flange walls thus providing the primary or major seating surface for the tile in installed position.

Preferably, as clearly shown in Fig. 2 of the drawings, each of the damping tubes **30** is positioned on the rear side of the tile body **10** with the tube rotated or turned about its axis to position the side wall openings **36** thereof angularly related to the positions of the side wall openings **36** of each of the adjacent tube members **30** in the row of such tube members in which said first-mentioned tube is located. In this manner a more effective keying or bonding of the tile to the mastic coating in installed position of the tile may be obtained to resist forces acting in any direction on the tile tending to break the adherence of the tile from the mastic.

While I have shown the tubes **30** in the form thereof illustrated in Figs. 1 through 6, as each having the circular opening **34** through the rear or inner wall **33** thereof, it is to be understood that these end walls may be formed solid across the end of the tube as shown by the wall **33'** in Fig. 5A of the drawings. If it should be desirable or found expedient, my invention contemplates and includes providing a tile with both tubes of the type of tube **30** having the circular opening **34** in the end wall **33** thereof and tubes of the form of Fig. 5A in which the end wall **33'** is closed. With tubes having the closed end wall **33'** and the side wall openings **36** extending between the rear edge of the circular wall portion **31** and the inner surface of the closed end wall **33'**, when the tile is applied and pressed against the mastic, the closed end walls will extend into the mastic with the mastic being forced around the closed end walls and over into the side wall openings **36** to firmly key and bond such tubes into the mastic.

In the tile of the form of Figs. 1 through 6, I have provided for the use of mechanical fastening members, such as nails or the like, to lx the tile in position on the structure on which it is to be installed. For instance, I may provide nailing bosses **37** at certain locations in the rows of damping tubes **30** in place of the tubes at those locations. In the illustrated arrangement I have provided a nailing boss **37** at the center of the tile body **10** in position extended rearwardly from the rear surface **12**. This nailing boss **37** is formed with an axial bore **37***a* therethrough with a rear end wall **37***b* providing a reduced diameter aperture **37***c* in axial continuation of the bore **37***a*. This bore **37***a* of the nailing boss **37** located at the center of the body of the tile opens at its outer or forward end through the aperture **20** which opens through the center point of the face **11** of the tile body **10**. Substantially similar nailing bosses **37** are provided at each corner at the rear side of tile body **10** and also as the center member of each outer row of tube members **30** along the adjacent edge flange **14**. I have also provided at the center of each quarter-section of the area of the rear surface **12** of tile body **10**, a nailing boss **38** similar to the bosses **37** but which perform an additional function in connection with a further feature of a tile combination of my invention as will be referred to in detail hereinafter. Each of the nailing bosses **37** and **38** is formed integral with the wall body **10** and preferably has the rear surface of the rear end wall **37***a* thereof located in the plane which passes through the rear surfaces of the end walls **33** of the tube members **30** and through the rear edge surfaces **14***a* of the flange walls **14**.

The tile as thus constructed and constituted provides a completed acoustical tile ready for mounting and installation by the use of a mastic alone or without the use of a mastic and solely by using nail fastening members driven through the nailing bosses, or by both a mastic and nail fastening members.

In accordance with a further feature of my invention I have made it possible to eliminate the necessity for applying a coating of mastic or cement to the surface onto which the acoustic tiles are to be mounted and installed in advance of such installation, by an arrangement and construction which provides at the rear side of and as

a part of the tile structure itself, suitable mastic receiving surface areas to which the mastic may be applied just in advance of and as each tile is ready for installation. Referring to Figs. 7 through 9, I have illustrated a tile of the design and construction of the tile of Fig. 1 as hereinbefore described, with a plurality of mounting units 40 which provide mastic receiving discs or plates 41 of circular form in plan in this example, and which are positioned and located at the rear side of the tile spaced equidistant apart with the rear, mastic receiving surfaces 42 thereof being flat or planar and located in the plane which passes through the rear edge surfaces 14*a* of the flange walls 14 and the rear surfaces of the rear end walls 33 of the damping tubes 30. In the example tile, which as hereinbefore explained happens to be 12" x 12" in plan dimensions, I have provided the plate 41 of each of the units 40 as having a maximum outside diameter of approximately 3½" and I have provided or mounted one of these mastic receiving plate units centrally located on each quarter-section of the area of the rear surface of the tile body 10 so that these units are spaced equal distances apart around and are equally spaced from the central point of the rear surface of the tile as represented by the central nailing boss 37.

In the selected form expressing this feature of my invention, I have provided the mastic receiving plate units 40 as separate components which are cemented or otherwise suitably fastened to and assembled with the tile. However, it is to be understood that my invention is not limited to the formation of the units 40 as separate components. Such units may be formed integral with and as a part of the tile structure with the rear surfaces 42 thereof located as hereinabove explained. And similarly, while I have shown the discs or plates 41 of the units 40 as of circular plan form, they may, if desired, be formed of any other desired shape in plan.

In the selected example each of the mastic receiving plate units 40 is molded or otherwise formed from a suitable plastic and is comprised of the circular disc or plate 41 presenting at one side thereof (the rear side in mounted position) the mastic receiving surface 42, together with a circular mounting base 43 which extends forwardly (with the unit in mounted position) from the side thereof opposite surface 42. The mounting base 43 of each unit 40 is circular in form and of substantially reduced diameter relative to the diameter of the disc or plate 41 of the unit. In the present example, the base 43 of each unit 40 has an external diameter of approximately 1". This mounting base 43 is hollow and is provided with a central tubular hub portion 44 which extends rearwardly therethrough and axially thereof from the base wall 45 of the hub to terminate at its rear end in the annular edge 44*a* located approximately in the plane of the mastic receiving surface 42 of plate 41 of the unit. This central tube or hub 44 provides a bore 44*b* therethrough which is open at its opposite ends through the outer surface of the base wall 45 of the mounting base 43 and through the inner end of the hub 44, respectively. Thus constructed and arranged the hollow mounting base 43 with its tubular hub 44 provides an annular chamber 43*b* therein which surrounds the hub 44 concentric therewith and with plate 41 and which is open at its rear side through the rear, mastic receiving surface 42 of the plate 41 of the unit 40. The disc or plate 41 of each unit 40 is provided with a plurality of circular holes or apertures 46 therethrough each of which is preferably of a diameter slightly greater than the maximum width of the rear end wall 33 of a damping tube 30 for receiving therein the damping tubes of the tile that are located in the area covered by the plate 41 of a unit when the unit is in mounted position attached to the rear side 12 of the tile body 10.

In the assembled position of the mounting and mastic receiving units 40 in the completed tile, one unit is mounted in position on each of the four nailing bosses 38 that is located at the central point of each quarter-section of the rear surface 12 of the body 10 of the tile with the boss 38 on which mounted being received in and extended rearwardly through the tubular hub 44 of the unit. Each mounting unit 40 is secured and affixed in assembled position against displacement by cementing the outer side of the base wall 45 of the base 43 of the unit to the abutting surface of the rear side 12 of the tile body. When so mounted and assembled, the holes 46 in the mounting and mastic receiving plate 41 of the unit receive therein the rear ends of the damping tubes 30 which are located over the area covered by the plate, as will be clear by reference to Fig. 7 of the drawings.

With the tile and its mounting units 40 having the dimensions of the present example, if a greater total area of mastic receiving surface on the tile is desired, another (a fifth) mounting unit 40 may be provided mounted in position on the central nailing boss 37 at the rear side of the tile body 10. And it is to be here pointed out, the nailing bosses for the tile may be dispensed with and damping tubes, such as the tubes 30 substituted therefor. In such event the mounting units 40 would be positioned on tubes 30 at the desired locations of such tubes on the tile.

With the tile in the form of Figs. 1 through 6, having the mounting units 40, the tile may be mastic installed without the necessity of applying mastic to the structure on which the tile is to be attached, by merely applying the required quantity of mastic onto the surfaces 42 of each of the discs or plates 41 of the units 40, and then pressing the tile manually into installed position. It will be noted that the mastic applied to the surface 42 of each plate 41 will be well-keyed or bonded to that plate and to the tile by entering into the holes 46 in the plate around the damping tubes 30 as well as entering into the end wall openings 34 of those tubes when the tubes are of the open end form. In addition, if desired, the annular recess or chamber 43*b* may receive mastic, although with the aggregate area provided by the four plates 41, sufficient area of mastic will be provided to firmly and tightly cement the tile into its desired installed position. It is also to be noted that with the tile of the form having the damping tubes 30 of either the open or closed end wall type, if it should be found desirable or necessary, additional cementing for the tile can be obtained by applying the mastic to the surface on which the tile is to be installed as well as to the plates 42 so that the damping tubes 30 throughout the area uncovered by the plates will be keyed into the surface coating of mastic.

While the mounting units 40 are shown in the example as embodied in a tile of my invention of the type provided with the damping tubes 30, I contemplate and intend the use of such mounting units with a plain type of tile having no damping tubes extended from the rear side thereof. In such adaptation of the invention the plates 41 of the units 40 are positioned as in the illustrated form, spaced rearwardly from the rear surface 12 of the tile the desired distance from the tile, and in such adaptation the plates 41 may or may not be provided with holes or openings therethrough depending upon the extent of keying of the mastic to the plates which may be found necessary or desirable.

As hereinbefore pointed out, the forms of perforated tiles with the rearwardly extending damping tubes 30 provide for efficient and substantial sound wave damping and absorbing functioning when installed with the space S surrounded by the continuous edge flange 14—15—16 unoccupied by any additional sound absorbing medium or material. However, for maximum damping and absorption I prefer to provide the tile with a pad or mat 50 of a suitable sound absorbing material

and of a plan area to fully occupy the space S within and surrounded by the tile edge flange.

Referring now to Figs. 7 and 8, I have illustrated therein as an important feature of my invention an assembly and combination of plastic tile, mastic receiving mounting units **40** and a suitable sound absorbing pad or mat **50**, which together form as a new article of manufacture a complete self-contained tile unit embodying as a permanent component therein such a sound absorbing pad or mat **50**. This tile unit or "package" is assembled and completed as a unit for distribution and delivery to the installer so that the difficulties and disadvantages of having to separately handle and assemble a tile and absorbing pad or mat on the job are eliminated.

In the example hereof of the unit tile with its sound absorbing mat as shown in Figs. 7 and 8, I have selected and shown such a pad or mat **50** formed of a suitable mineral wool or the like material, preferably a glass fibre material, and I have provided this mat with a series of holes **51** therethrough spaced and arranged to receive therein the damping tubes **30**, respectively, when the mat is in mounted position in the space S at and covering the rear side **12** of the tile body **10**. In addition to the damping tube receiving holes **51** I have also provided circular, enlarged diameter openings **52** therethrough located to receive axially therein the nailing bosses **38** which are located at the centers of the quarter-sections, respectively, of the rear surface **12** of the tile body. The openings **52** are of a diameter in this instance to receive the bases **43** of the mounting units **40** when the latter are installed and cemented into position on and over the bosses **38**. Similarly, I may provide edge cut-outs **53** in the pad **50** located to receive therein the nailing bosses **37** positioned adjacent the side edges and corners of the tile, along the side edges of the mat, and I may also provide a circular opening **53'** at the center of the mat for receiving the center nailing boss **37** and also for receiving therein a central mounting unit **40**, if it should be desired to provide the tile with such an additional mounting unit.

In the assembly of the completed tile unit of the form of Fig. 7, the sound absorbing pad or mat **50** is positioned in the space S at the rear side of the tile and against the rear side **12** of the tile body **10** with the damping tubes **30**, the nailing bosses **37** and the nailing bosses **38** received in their respective openings **51**, **52**, **53** and **53'** formed through the mat. The mat **50** has a thickness such that in mounted and installed position in the space S at the rear side of the tile, its outer side surface **54** lies substantially or generally in the plane passing through the rear edge surfaces **14***a* of the flange walls **14**. After the mat or pad **50** is assembled into position, the mounting units **40** are then assembled in position and cemented by their base walls **45** to the rear side **12** of the tile body on each of the nailing bosses **38** with the disc or plate **41** of each unit **40** being extended over the area of the pad or mat **50** at the rear side of the plates. The discs or plates **41** of the mounting units **40** thus clamp and confine the sound absorbing pad or mat **50** in its assembled position as a permanent component of the tile unit against displacement in handling and in mounting of the tile in its installed position. The resulting tile unit is complete and ready for immediate installation by the use of a mastic and/or mechanical fastenings without the necessity of the installer assembling therewith any sound absorbing material, while the proper positioning of the sound absorbing material with the tile is insured. Due to the perforations or sound openings **20** through the face **11** of the tile body and the damping tubes **30** at the rear side **12**, together with the pad **50** in the space S at the rear side of the tile into which the tubes **30** discharge sound waves through the side wall openings **36**, a unit having maximum sound wave damping and absorbing with high acoustical efficiency is provided.

In connection with the tile unit of Fig. 7 which embodies the mounting units **40** and the sound absorbing mat **50**, together with the mastic keying damping tubes **30**, the tile may be efficiently used in a modification which eliminates the mounting units **40** and merely uses the perforated sound absorbing mat **50** at the rear side **12** of the tile surrounded by the continuous edge flange **14—15—16**. In such forms it is possible to cement or otherwise attach the pad **50** in its proper position on the tile so that the tile may be manufactured and assembled as a complete tile and sound absorbing mat unit.

In another form of the tile, mat and mounting unit combination, as shown in Figs. 10 and 11, instead of the damping tubes of the forms of the tubes **30** hereinbefore described, I may provide the tile with damping tubes **60** in the form of a circular, closed wall **61** which has a length or depth axially less than the distance between the surface of the rear side **12** of the tile and the plane passing through the surfaces of the rear edges **14***a* of the tile flange. Each of these tubes **60** may have an annular recess **60***a* around its inner end at the area in which it joins integrally with the tile body **10** so as to provide a thin supporting base for each tube to assist a tube in vibrating in response to the sound waves received therein. And in this connection the same thin vibratory bases may be provided for the tubes **30** hereinbefore described in connection with other forms of the tile. This vibratory base feature is disclosed and claimed in my pending application Serial No. 283,707 referred to hereinabove.

With the tile in the form of Fig. 10, a different form of sound absorbing mat or pad is provided, such pad or mat **70** having eliminated therefrom the damping tube receiving holes **51** of the pad **50** but having circular openings **72** and **73'** and cutouts **73**, which correspond in form and in function to the openings **52**, **53'** and **53** of the form of the pad **50** hereinbefore described. The pad **70** is mounted and secured in position at the rear side **12** of the tile body **10** by the use of mounting units **40** in the identical manner hereinbefore described with the form of the tile of the Fig. 7, but in this modified tile form the sound damping tubes **60** instead of extending through the pad or mat **70** engage against the inner surface thereof and thus discharge sound waves passing therethrough directly into the body of the mat for sound absorption.

In the form of the damping tube **30** of the tile of Figs. 1, 2, 3, 4 and 6, the tube side wall openings **36** terminate at the inner ends thereof spaced a distance rearwardly from the rear surface **12** of the tile body **10** to provide the unbroken rearwardly extending tubular portion **31**. However, such closed-wall portion **31** of a damping tube may be eliminated with the side wall openings of the tube extending inwardly of the tube approximately to the inner surface **12** of the tile to provide a tube as of the form of tube **30'** of Fig. 5. Such a tube **30'** has the diametrically opposite side wall openings **36'** thereof extending along the tube from the rear end wall **33'** to the inner surface **12** of the tile body **10**. In the form of the tube **30'** of Fig. 5 the rear end wall **33'** of the tube may be closed as shown or may be provided with an opening or aperture therethrough such as an aperture **34** of a tube **30** of the form of Figs. 1 through 3. By providing the side wall openings **36'** extending to the rear surface **12** of the tile body **10** the tubular portion **31** of a tube of the form of tube **30** is eliminated and the opposite side posts or columns **35'** of a tube **30'** thus extend rearwardly from the rear surface of the tile body to the rear end wall **33'** of the tube.

In connection with a tile having the mounting units, such as the units **40** of the examples hereof, a suitable permanent type of adhesive, such as an adhesive of the so-called pressure sensitive type, may be applied on and to the rear faces or surfaces **42** of the units, preferably at the time of manufacture of the tiles, to thus eliminate the necessity of applying a mastic to these units or

to the surfaces on which the tiles are to be mounted, at the time and place of installation. The tiles may be furnished with a permanent adhesive on the mounting units over which any suitable readily removable paper sheet or such like protective covering may be applied for removal to expose the adhesive at the time of installation of a tile. Thus provided with a permanent adhesive, the tile is furnished to the user as a completely prepared tile unit ready for installation merely by pressing it into place against the surface on which it is to be mounted and without the necessity of separately applying a mastic or adhesive either to the tile itself or to the surface on which it is to be mounted.

It will also be evident to those skilled in the art that various other changes, modifications, adaptations, substitutions, eliminations, additions, combinations and constructions may be resorted to without departing from the broad spirit and scope of my invention, and hence I do not desire or intend to limit the invention in all respects to the exact embodiments and forms or to the specific constructions thereof of the selected examples thereof, except as may be required by intended limitations thereto appearing in any of the appended claims.

What I claim is:

1. An acoustic tile comprising, in combination, a tile body of plate form having a rear side and an opposite front face side; a plurality of rearwardly extending bosses on the rear side of said tile body at locations spaced apart thereover; a plurality of separate and independent mounting units each comprising a plate member having a reduced diameter central base portion extending from one side thereof formed to provide therein a tubular member disposed axailly thereof and therethrough; each of said mounting units being mounted on one of said bosses with such boss received in said axially located tubular member of said base portion; said mounting units including said plate members thereof being spaced from and unconnected with each other; and said plate member of each of said mounting units being positioned with said mounting unit in mounted position on its said boss spaced a distance rearwardly from the rear side of said tile body providing a mastic receiving and carrying surface substantially parallel with the general plane of said tile body.

2. An all-plastic acoustic tile comprising, in combination, a thin plastic material body of plate form having a rear side and an opopsite front face side; a plurality of rearwardly extending tubular members on and spaced apart over the area of the rear side of said tile body; a plurality of tile mounting units each comprising a plate member having a central opening therethrough and a plurality of apertures therethrough spaced apart over the area of said plate member around said central opening; each of said mounting units being located in fixed position on the rear side of said tile body with said plate members thereof substantially parallel with and spaced rearwardly from said rear side with one of said tubular members being received in the central opening thereof and those other of said tubular members extending from the area of the rear side of said tile body around said central opening and covered by said plate member being received in said plate member apertures, respectively; and said rear side of each of said plate members of said mounting units providing a mastic receiving and keying surface thereon substantially parallel with the general plane of said tile body.

3. An acoustic tile of plastic material comprising, in combination, a thin tile body of plate form of plastic material having a rear side and an opposite front face side; a rearwardly extending outer edge flange around and integral with said tile body; a plurality of rearwardly extending tubular members of plastic material integral with said tile body extending rearwardly from the rear side thereof at locations spaced apart thereon; a plurality of tile mounting units formed of plastic material; each of said tile mounting units comprising a plate member having a central, hollow base portion formed integral therewith extending outwardly from and centrally of one side thereof; said hollow base portion of each of said tile mounting units having an end wall at the end thereof opposite said plate member and being open at the end thereof through said plate member; said tile mounting units each being positioned on one of said rearwardly extending tubular members with said end wall of said hollow base thereof being affixed to said rear wall of said tile body and with said plate member of such tile mounting unit being positioned spaced rearwardly from said rear wall located substantially in the plane passing through the rear edges of said outer edge flange; said plate member of each of said tile mounting units being spaced laterally from each of said plate members of each of said other tile mounting units; and said rear side of each of said plate members of said tile mounting units providing a mastic receiving and carrying surface thereon in a plane substantially parallel with the plane of said rear edges of said outer edge flange of said tile body.

4. A plastic tile comprising, in combination, a thin plastic material tile body of plate form having a rear side and an opposite front face side; a plurality of rearwardly extending plastic material bosses on and integral with the rear side of said tile body at locations spaced apart thereover; a plurality of separate and independent mounting units of plastic material each including a plate member having a reduced diameter tubular base portion extending from one side thereof; each of said mounting units being mounted on one of said bosses with such boss received in said tubular base portion; said mounting units including said plate members thereof being spaced from and unconnected with each other; and said plate member of each of said plastic material mounting units being positioned spaced a distance rearwardly from the rear side of said tile body providing a mastic receiving and carrying surface substantially parallel with the general plane of said tile body.

5. A tile of plastic material comprising, in combination, a thin plastic material tile body of plate form having a rear side and an opposite front face side; a rearwardly extending outer edge flange around and integral with said tile body; a plurality of rearwardly extending tubular members of plastic material integral with said tile body extending rearwardly from the rear side thereof at locations spaced apart thereon; a plurality of tile mounting units formed of plastic material; each of said tile mounting units including a plate member having a tubular base portion formed integral therewith extending outwardly from one side thereof; said tubular base portion of each of said tile mounting units having an end wall at the end thereof opposite said plate member and being open at the opposite end thereof through said plate member; each of said tile mounting units being affixed in position on one of said rearwardly extending tubular members with said tubular base portion mounted on and over said tubular member and with said plate member of such mounting unit being spaced rearwardly from said rear wall located substantially in the plane passing through the rear edges of said outer edge flange; said plate member of each of said tile mounting units being spaced laterally from each of said plate members of each of said other tile mounting units; and said rear side of each of said plate members of said tile mounting units being exposed and providing a mastic receiving and carrying surface thereon in a plane substantially parallel with the plane of said rear edges of said outer flange of said tile body.

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