

Nov. 10, 1942.

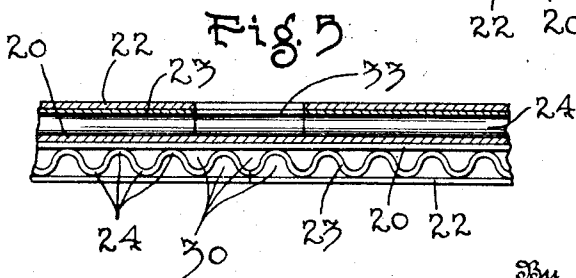
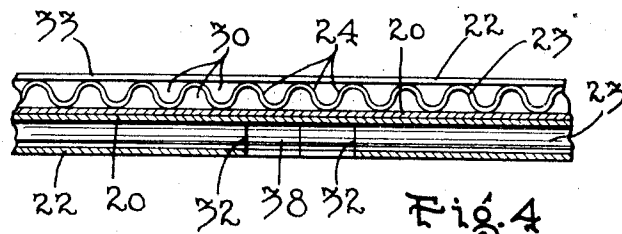
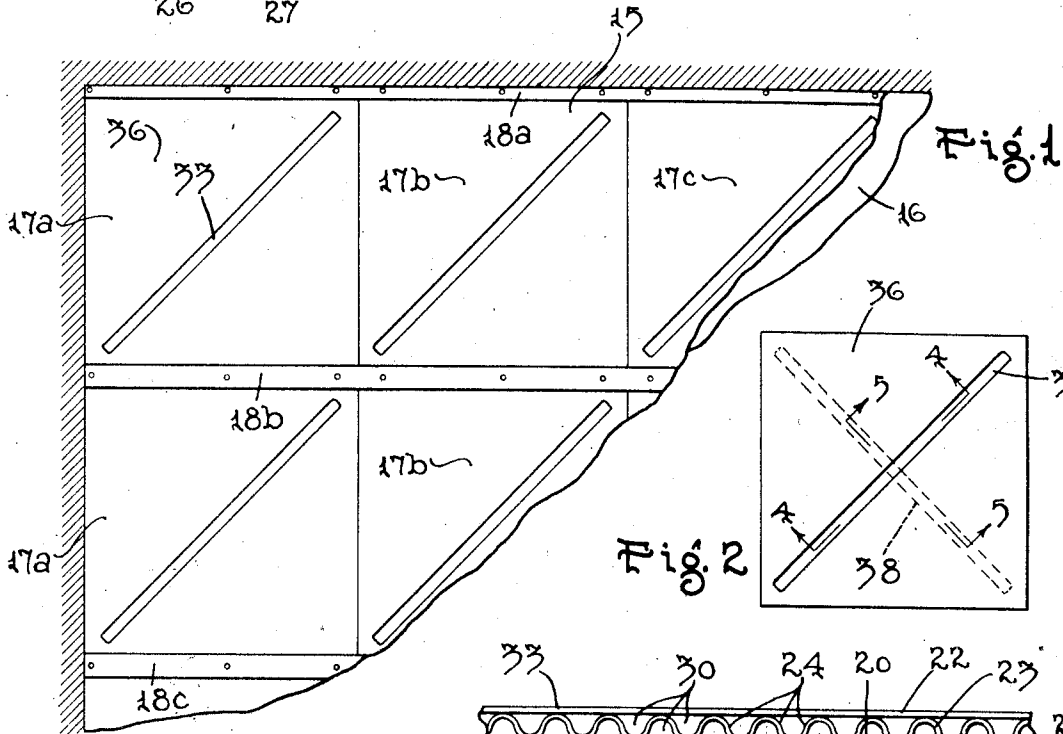
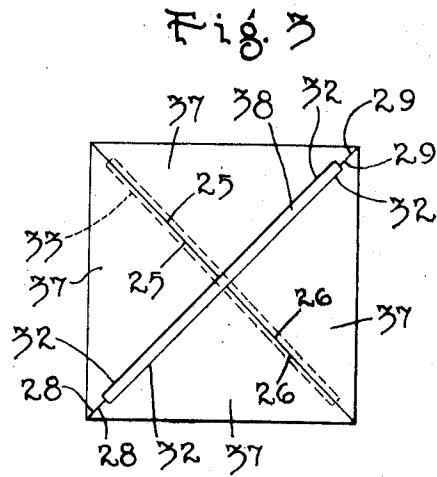
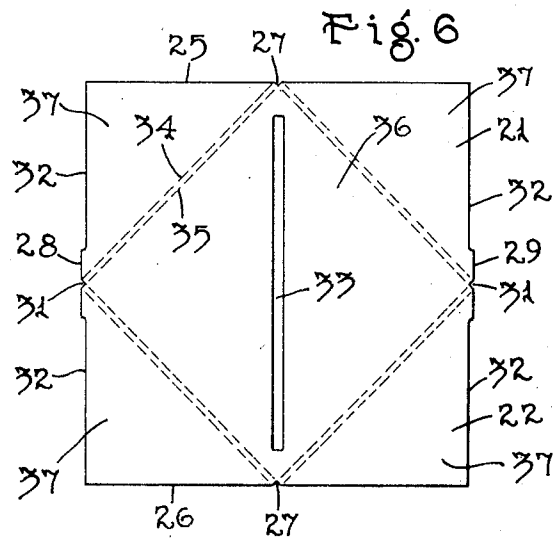
R. GUYER ET AL

2,301,538

SOUND INSULATING CONSTRUCTION

Filed June 4, 1938

2 Sheets-Sheet 1



Inventor
Henry E. Hartig
Reynolds Guyer

By *Corwell & Lagaard*

Nov. 10, 1942.

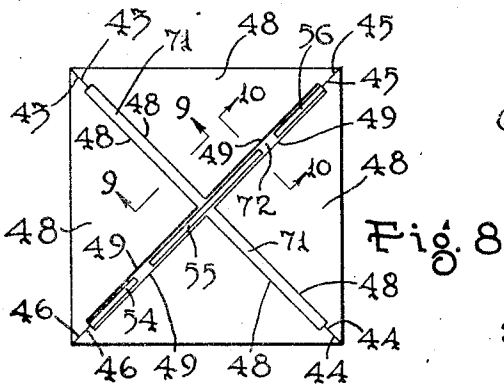
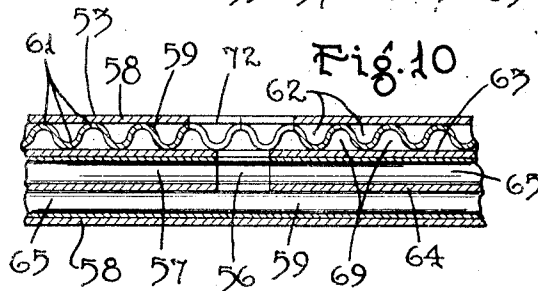
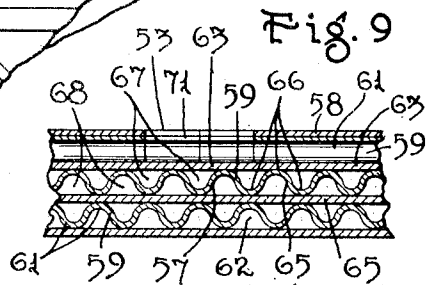
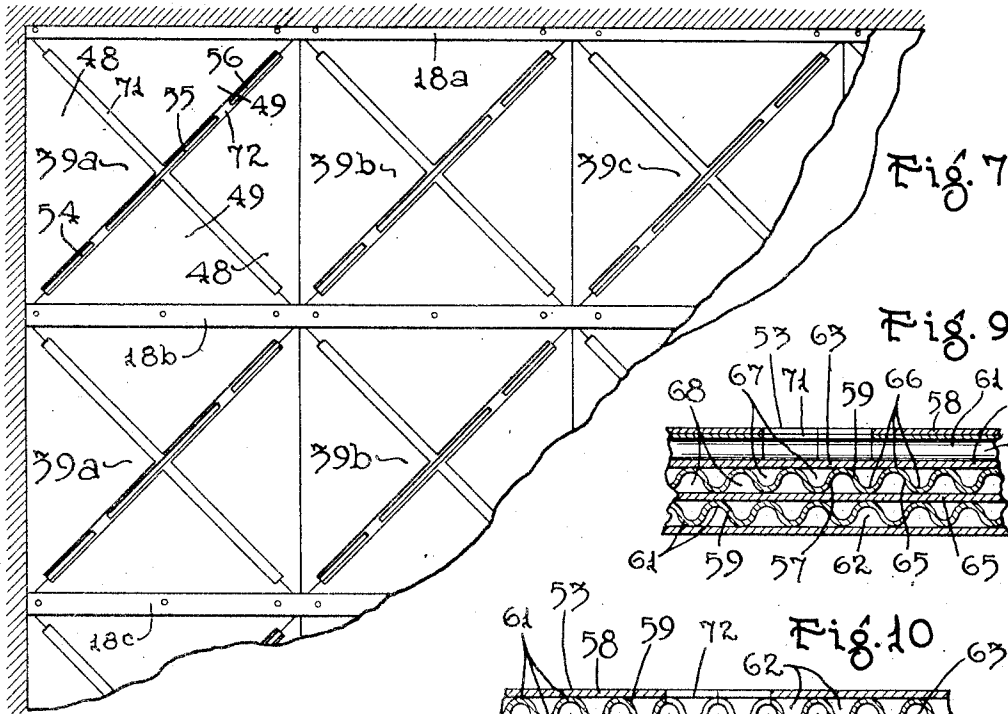
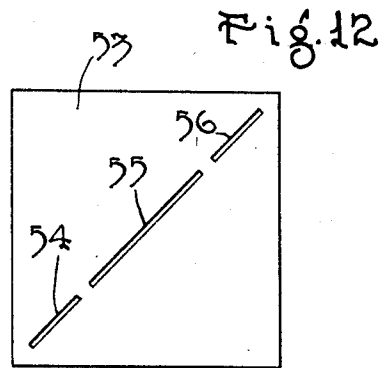
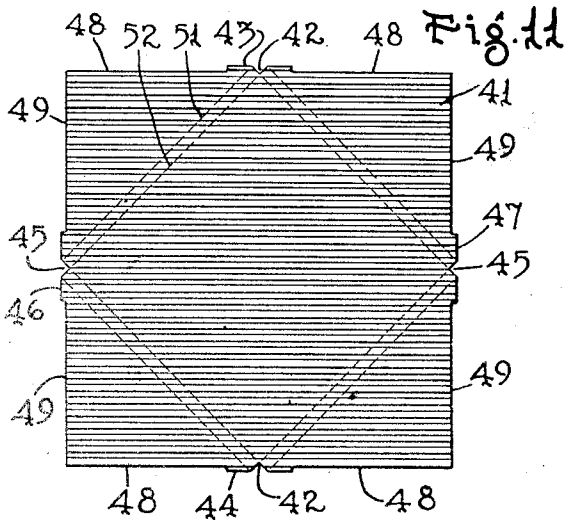
R. GUYER ET AL

2,301,538

SOUND INSULATING CONSTRUCTION

Filed June 4, 1938

2 Sheets-Sheet 2



Inventor
Henry E. Hartig
Reynolds Guyer

By *Carwell & Lagan*

UNITED STATES PATENT OFFICE

2,301,538

SOUND INSULATING CONSTRUCTION

Reynolds Guyer, St. Paul, and Henry E. Hartig,
Robbinsdale, Minn., assignors to Waldorf Paper Products Company, St. Paul, Minn., a corporation of Minnesota

Application June 4, 1938, Serial No. 211,868

11 Claims. (Cl. 154—45)

Our invention relates to sound absorbing construction and particularly to panels for forming sound absorbing coverings

An object of the invention resides in providing a panel capable of absorbing sounds of various frequencies and particularly sounds of relatively low frequency and long wave lengths.

Another object of the invention resides in providing a body structure formed with a plurality of elongated air cells, said cells being of a length greater than the maximum dimension of the panel.

Another object of the invention resides in providing a panel in which the marginal portions of the panel are covered to prevent fraying or injury to the panel.

A still further object of the invention resides in providing a panel in which the opening to the air cells is disposed inwardly of the edges of the panel so as to eliminate the necessity of properly spacing the panels to form the inlets.

An object of the invention resides in providing a panel which is constructed from corrugated board arranged to provide the various air cells and in which entry to the air cells is had intermediate the edges of the panel.

An object of the invention resides in providing a panel having air cells therein, said panel being formed with inlets to said air cells, said inlets being disposed intermediate the lateral edges of the panel.

Another object of the invention resides in providing a panel constructed from a rectangular sheet of corrugated board, said corrugated board being doubled back upon itself at opposite edges of the panel to bring the marginal portion of the sheet into juxtaposition whereby the inlets of the air cells are disposed intermediate the folded edges of the panel.

Another object of the invention resides in constructing the panel from a rectangular sheet of corrugated board folded diagonally across the corners to bring the marginal edges of the folded portions into juxtaposition.

A still further object of the invention resides in arranging the inlets to the air cells in the form of a cross extending diagonally across the panel.

Another object of the invention resides in utilizing an intermediate layer of corrugated board for providing additional air cells within the panel.

A still further object of the invention resides in providing a panel constructed from a square sheet of corrugated board folded diagonally along lines intersecting the edges of the sheet near the

centers thereof to provide a body portion and corner portions overlying the body portions.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is an inverted plan view of a portion of a ceiling of a room illustrating the application of a wall covering embodying our invention thereto.

Fig. 2 is a plan view of one of the panels illustrated in Fig. 1.

Fig. 3 is a view similar to Fig. 2 viewed from the opposite side of the panel.

Fig. 4 is an elevational sectional view taken on line 4—4 of Fig. 2 and drawn to a larger scale.

Fig. 5 is a view similar to Fig. 3 taken on line 5—5 of Fig. 2.

Fig. 6 is a developed view of the blank from which the panel shown in Fig. 2 is constructed.

Fig. 7 is a view similar to Fig. 1 showing a modification of the invention.

Fig. 8 is a plan view similar to Fig. 3 of one of the panels shown in Fig. 7.

Fig. 9 is a cross sectional detail view taken on line 9—9 of Fig. 8 and drawn to a larger scale.

Fig. 10 is similar to Fig. 9 taken on line 10—10 of Fig. 8.

Fig. 11 is a developed view of the blank from which the panel is constructed.

Fig. 12 is a developed view of the insert used in conjunction with the panel.

In the application of sound absorbing coverings to the walls and ceiling of a room or building it becomes highly desirable to utilize smaller units of covering in the form of panels or tiles which can be independently attached to the surface to which the covering is to be applied. Such panels constructed of corrugated board are formed with raw edges which readily break or fray and which do not give the panels a finished appearance when applied. The present invention, in addition to its other advantages, provides a construction whereby these disadvantages are overcome.

In Fig. 1 a wall covering 15 is illustrated which is applied to a ceiling 16 of any room or portion of a building in which sound absorption is desired. It readily can be comprehended that the covering will cover all portions of the walls and ceiling of the room. Since the manner of applying the covering is the same in both ceilings and walls, the entire installation has not been shown and the word "wall" will be used to describe the covering whether the same is applied to the cell-

ing or one of the vertical walls of the room. The covering 15 comprises a number of panels 17a, 17b, 17c, etc. which are supported in a manner to be presently described and which are identical in construction. For this reason only the panel 17a has been illustrated in detail in the drawings and will be described.

All of the panels of the covering are supported between T-shaped cleats 18a, 18b, 18c, etc. which are attached to the ceiling 16 in much the same manner as illustrated in the application for patent of Henry E. Hartig, Serial No. 162,471 filed September 4, 1937 for Sound insulating construction whereby the panels become spaced from the surface of the wall.

The panel 17a is constructed from a blank 21, shown in Fig. 6, formed from a sheet of double faced corrugated board having a facing 22, a backing 20 and a corrugated body 23 glued therebetween in the customary manner. This construction provides corrugations 24 in the sheet which produces air cells 30 in the sheet when the structure is folded together as will be presently described. The panels of the invention are preferably square in form. When so constructed the sheet or blank 21 is of a length and breadth substantially equal to the diagonal dimension of the panel proper. The blank 21 is formed at two of its opposed edges 25 and 26 with notches 27 at the centers of the same. The blank is further formed at its other opposed edges 28 and 29 with similar notches 31. These latter edges are, however, cut back as designated at 32 for a purpose to be presently described. In the center of the blank is provided a groove 33 which extends substantially throughout the width of the blank and which is at right angles to the corrugations therein. This groove extends through the facing 22 and the body 23 forming the corrugations 24 and up to the backing 20 so that the air cells 30 formed in the blank 21 are exposed to the exterior at localities intermediate the ends thereof. The blank 21 is scored along spaced parallel lines 34 and 35 which extend between the notches 27 and 31. These scores divide the blank into a square body portion 36 and into triangular shaped corner portions 37.

In the construction of the panel 17a the corner portions 37 are all folded along the score lines 34 and 35 back upon the body 36. The notches 27 and 31 facilitate such folding. The score lines 34 and 35 are so situated that the edges 25 and 26 of the blank meet one another, as shown in Fig. 3. Due to the cut away portions 32, at the edges 28 and 29, the said edges, when brought together, form a diagonal groove or slot 38 which exposes the corrugations at the ends of the same. The folded structure is attached in folded relation by means of glue applied to the adjoining portions of the backing 20 whereby the ultimate structure shown in Figs. 2 and 3 is formed. By the use of the two scores 34 and 35 the sheet is folded at each score through an angle of 90 degrees instead of 180 degrees. The folding of the board in this manner does not close up the corrugations at the folds whereby the air cells in the corner portions 37 lie in continuation of the air cells of the body portion 36 to give maximum length to the air cells.

In the assembling of the wall covering the cleats 18a, 18b, 18c, etc., are attached to the wall or ceiling, and the panels 17a, 17b, 17c, etc., slid into the grooves formed thereby. These cleats are preferably left loose at one end to permit of insertion of the end panels. The panels are pref-

erably arranged with the body portion 36 lowermost. This leaves the groove 33 exposed from beneath and the groove 38 next to the wall or ceiling.

The operation of the invention is as follows: When sound waves are set up in the air the air is alternately rarefied and compressed. This produces pressure on objects in the air including surfaces confining the air in which the sound waves are set up. If cavities or openings in such surfaces are present a pumping action of air into and out of such cavities or openings occurs. These principles are made use of in the instant invention. When sound waves set up in the air reach the panels of my invention, these panels act as diaphragms and upon receiving pressure from the pressure in the air caused by the sound waves bow inwardly toward the wall. Such movement of the panels causes compression of the air in the space between the wall and panels. At the same time compression of the air at the surface of the panels causes a pumping of the air into the air cells 30, the air entering these cells through the open ends thereof exposed at the grooves 33. This produces compression of the air throughout the length of the air cells and the air in the ends of said cells is discharged therefrom through the other open ends of the cells 30 at the grooves 38 and into the space between the panels and wall. Thus the air in this space also becomes compressed. The compression of the air in this space is also augmented by the diaphragm action of the panels themselves. When the air on the room side of the panels becomes rarified, the air in the space between the panels and wall being compressed causes a movement of the air through the air cells 30 in the opposite direction, and a bowing of the panels outwardly. To cause movement of the air along the air cells 30 due to friction and flexing of the panels requires energy, and the energy of the sound waves is thus absorbed, whereby the effect is to deaden the sound. It is a well known fact in physics that resonance of vibration in a pipe occurs when the length of the pipe bears a certain direct relation to the wave length. Since the movement of air in the pipe is a maximum at resonance the greatest sound absorption occurs at resonance. To procure absorption of sound waves of great wave length it becomes necessary to have long tubes. This we accomplish by running the cells along the surface of the board and folding over the corrugated board intermediate the ends of the air cells. At the same time one end of each cell communicates with the space in the room and the other with the space in back of the panels.

In Figs. 7 to 12 a modification of the invention has been shown in which the panels are supported in the same manner as in Fig. 1. For this reason the parts of the building and the cleats supporting the panels have been given the same reference numerals. The panels in this form of the invention are designated by the reference numerals 39a, 39b, 39c, etc., and due to the similarity of the panels only the panel 39a will be described in detail.

The panel 39a is constructed from a blank 41, shown in Fig. 11, which is formed from corrugated board and which is of substantially the same size as the panel 21. This panel is, however, formed from single faced corrugated board instead of doubled faced board which is provided with a facing 58 and a corrugated body 59 secured thereto in the customary manner. This

corrugated body has corrugations 61 which form air cells 62 between the facings 58 and the body 59. The blank 41 is constructed with notches 42 at the edges 43 and 44 thereof and with notches 45 at the edges 46 and 47 thereof. All of the edges 43, 44, 46 and 47 of this panel are cut away as designated at 48 and 49 for a purpose to be presently described in detail. The blank 41 is scored along spaced diagonal lines 51 and 52 which are spaced apart a distance somewhat greater than the scores 34 and 35 of the other form of the invention. The corrugations of the blank 41 run in a direction at right angles to the edges 46 and 47 thereof and parallel to the edges 43 and 44.

The panel 39a includes an insert 53, shown in detail in Fig. 12. This insert is constructed from double faced corrugated board in which the corrugations run parallel to two of the edges of the same. The board from which the insert 53 is constructed is formed with a facing 63, a backing 64 and a corrugated body 65 therebetween. This body provides corrugations 66 which form air cells 67 between said body and the facing 63, other air cell 68 between the body 65 and the backing 64. This insert is of lateral dimensions slightly less than the distance between the scores 52. Running diagonally along the insert 53 are formed three aligning slots 54, 55 and 56 which extend completely through the same and which expose most of the air cells 67 and 68 formed by the corrugations thereof to the exterior.

The manner of constructing the panels 39 is similar to that previously described. The insert 53 is placed upon the blank 41 and the corner portions of the blank folded along the scores 51 and 52 over and upon the insert 53. All of the parts are glued together and held until the glue sets, whereupon the panel is complete. It will be noted in Figs. 9 and 10 that the facing 63 and backing 64, of the insert 53, form additional air cells 69 between the body 59 of the blank 41 and said insert. Due to the cut away portions 48 and 49 of the blank, transverse slots 71 and 72 are formed in the panel which run diagonally thereof and intersect one another. It will further be noted that the slots 54, 55 and 56 are exposed through the slot 72. By means of the various slots formed substantially all of the air cells of the panel are exposed to the exterior from one side thereof. This permits of manufacturing the panel by merely shearing the parts of the blanks forming the slot instead of by grooving certain of the parts, as previously described. At the same time additional air cells are provided by the insert and all of the air cells are exposed to the exterior from one side of the panel.

In the use of the form of the invention, shown in Figs. 5 to 12, the panels may be arranged either with the various slots exposed to the interior of the room or disposed adjacent the wall or ceiling in conjunction with which the covering is to be used. If placed outermost, as shown in Fig. 7, relatively greater efficiency is procured. If arranged in the opposite manner with the smooth face of the panel outwardly less efficiency is procured but the appearance of the wall covering is greatly enhanced.

The advantages of our invention are manifest. An extremely simple and practical panel is provided which may be easily erected to form a suitable insulating and sound deadening wall covering. The panels are attractive in appearance and can be constructed at a nominal ex-

pense. The panels have fully protected edges so that fraying of the panels at the edges or injury thereto is greatly lessened. At the same time by means of the folding of the panels in the manner shown the same are greatly stiffened and reinforced. With our invention air cells of a length greater than the width or length of the panel can be produced.

Changes in the specific form of our invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of our invention.

Having described our invention, what we claim as new and desire to protect by Letters Patent is:

1. A sound absorbing panel comprising a body structure formed from a square sheet of faced corrugated board said sheet being folded diagonally along lines intersecting the edges of the sheet near the centers thereof to provide a body portion and corner portions overlying the body portion, the edges of said corner portions at the ends of the corrugations being spaced from one another to provide a space of fixed dimensions therebetween exposing the ends of the air cells whereby sound energy may be transmitted to the air columns within the cells for dissipation, said diagonal folds forming protected edges at the sides and ends of the panels adapted to be placed in contact with the corresponding edges of adjacent panels, said body portion having a groove formed therein upon the side thereof opposite said corner portions to form open ends to the air cells.

2. A sound absorbing panel comprising a body structure having a plurality of parallel elongated air cells therein, said body structure being formed with an elongated opening therein extending across said air cells and bringing said air cells into communication with the exterior, said opening being arranged at an angle with reference to the line of the ends of the air cell to divide the air cells into different lengths.

3. A sound absorbing panel comprising a plate like body structure of rectangular form having a plurality of elongated air cells arranged in the plane of the body structure and extending diagonally with respect to the edges thereof and said body structure being formed with an elongated opening extending transversely of the air cells and within the confines of the panel and bringing said air cells into communication with the exterior.

4. A sound absorbing panel comprising a body structure constructed of a sheet of faced corrugated board arranged to provide a plurality of elongated air cells, said sheet being folded at opposite portions of the sheet to bring the ends of the sheet into juxtaposition, said ends being disposed in spaced relation to form a groove therebetween situated intermediate the edges of the panel on the exposed face of the panel whereby the ends of the air cells are brought into communication with the exterior, at a locality inwardly of the edges of the panel.

5. A sound absorbing panel comprising a body structure formed from a square sheet of faced corrugated board said sheet being folded diagonally along lines intersecting the edges of the sheet near the centers thereof to provide a body portion and corner portions overlying the body portion, the edges of said corner portions at the ends of the corrugations being spaced from one another to provide a space of fixed dimensions therebetween on the exposed face of the panel exposing the ends of the air cells whereby sound

energy may be transmitted to the air columns within the cells for dissipation, said diagonal folds forming protected edges at the sides and ends of the panels adapted to be placed in contact with the corresponding edges of adjacent panels.

6. A sound absorbing panel comprising a body structure formed from a square sheet of faced corrugated board arranged with the corrugations running parallel to two of the edges of the sheet said sheet being folded diagonally along lines intersecting the edges of the sheet near the centers thereof to provide a body portion and corner portions overlying the body portion, the edges of said corner portions at the ends of the corrugations being spaced from one another to provide a space of fixed dimensions therebetween on the exposed face of the panel exposing the ends of the air cells whereby sound energy may be transmitted to the air columns within the cells for dissipation, said diagonal folds forming protected edges at the sides and ends of the panels adapted to be placed in contact with the corresponding edges of adjacent panels.

7. A sound absorbing panel comprising a body structure formed from a square sheet of faced corrugated board, said sheet being folded diagonally along lines intersecting the edges of the sheet near the centers thereof to provide a body portion and corner portions overlying the body portion, the edges of said corner portions at the ends of the corrugations being spaced from one another to provide a space of fixed dimensions therebetween on the exposed face of the panel exposing the ends of the air cells whereby sound energy may be transmitted to the air columns within the cells for dissipation, said diagonal folds forming protected edges at the sides and ends of the panels adapted to be placed in contact with the corresponding edges of adjacent panels, and an insert constructed of corrugated board disposed between said corner portions and body portion and having air cells therein, some of said air cells terminating at the locality of said space between the overlying portion of the body structure and being exposed to the exterior through said space.

8. A sound absorbing panel comprising a body structure formed from a square sheet of faced corrugated board said sheet being folded diagonally along lines intersecting the edges of the sheet near the centers thereof to provide a body portion and corner portions overlying the body portion, the edges of said corner portions at the ends of the corrugations being spaced from one another to form spaces therebetween and an insert constructed of corrugated board disposed between said corner portions and body portion and having air cells therein, said insert having a slot extending therethrough communicating with said air cells and registering with the space formed between said corner portions to expose the air cells of the insert to the exterior through the space formed between the edges of the corner portions.

9. A sound absorbing panel comprising a body structure constructed of a rectangular sheet of faced corrugated board arranged to provide a plurality of elongated air cells parallel with one of the edges of the sheet, said sheet being folded diagonally of the corrugations and across all of the corners to bring the portions of the sheet along the sides of the corrugation into juxtaposition and with the portions of the sheet at the ends of the corrugations in spaced relation to provide a groove inwardly of the edges of the panel communicating with the ends of the air cells and disposed on the exposed face of the panel.

10. A sound absorbing panel adapted to be applied to a wall surface in spaced relation therefrom to provide an air space therebetween substantially isolated from the space on the opposite side of the panel, said panel comprising a body structure constructed of a sheet of faced corrugated board arranged to provide a plurality of elongated air cells, said sheet being folded at opposite portions to bring the ends of the sheet into juxtaposed position, said ends being disposed in spaced relation to form a groove therebetween situated intermediate the edges of the panel and on one side thereof, said body structure being formed with another groove on the opposite side of said panel and communicating with said air cells, said air cells being continuous from one side to the other and about said folds, one of said grooves being in communication with the space between said panel and wall surface and the other being in communication with the air on the opposite side of said panel.

11. A sound absorbing panel adapted to be applied to a wall surface in spaced relation therefrom to provide an air space therebetween substantially isolated from the space on the opposite side of the panel, said panel comprising a body structure constructed of a rectangular sheet of corrugated board arranged to provide a plurality of elongated air cells parallel with one of the edges of the sheet, said sheet being folded diagonally of the corrugations and across all of the corners to bring the portions of the sheet along the sides thereof into juxtaposition and with the portions of the sheet at the ends of the corrugations in spaced relation to provide a groove inwardly of the edges of the panel communicating with the ends of the air cells and disposed upon one side of the panel, said panel being formed with a groove on the opposite side thereof communicating with the air cells at a locality intermediate the edges of the panel, said air cells being continuous from one side to the other and about said folds, one of said grooves being in communication with the space between said panel and wall surface and the other being in communication with the air on the opposite side of said panel.

REYNOLDS GUYER.
HENRY E. HARTIG.