Jan. 27, 1959 E. E. GOLDSTEIN 2,870,857

TRANSLUCENT ACOUSTICAL CORRECTION CEILING CONSTRUCTION

Filed March 6, 1956

Fig. 1.

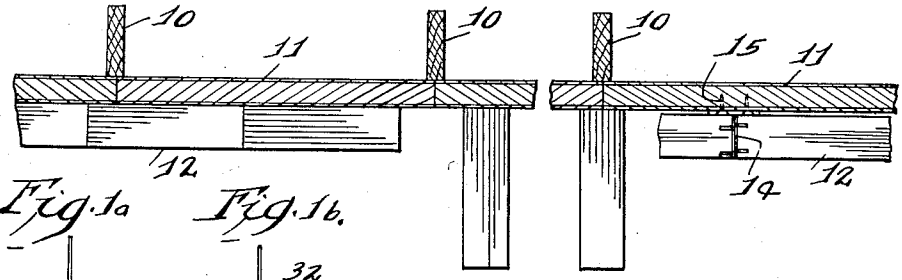


Fig. 1a

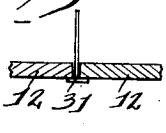


Fig. 1b.

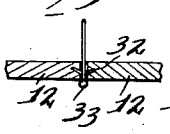


Fig. 2.

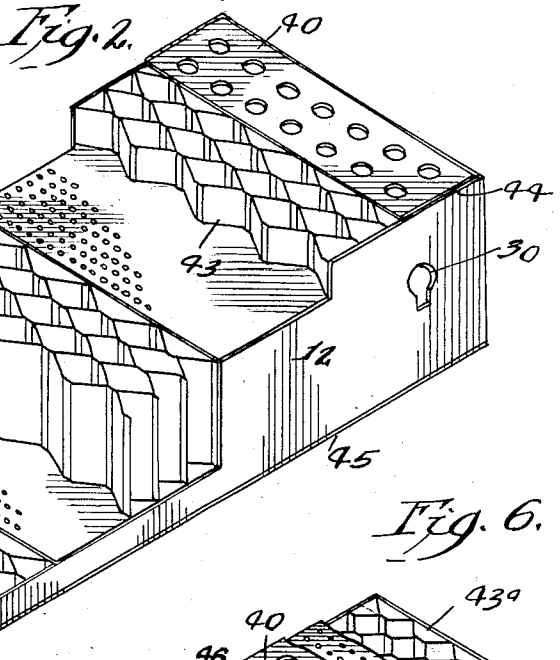


Fig. 4.

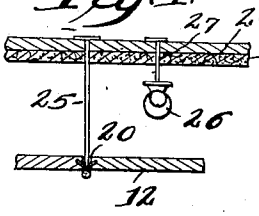


Fig. 5.

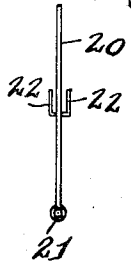


Fig. 6.

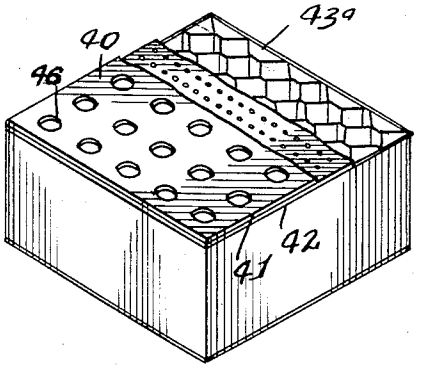
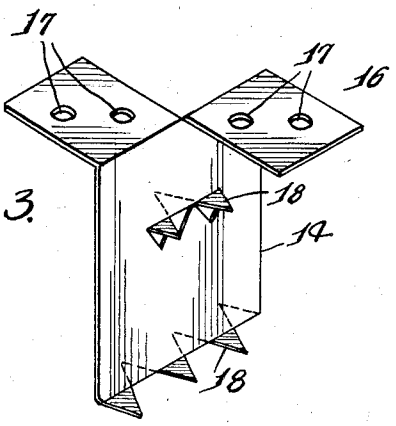


Fig. 3.



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TRANSLUCENT ACOUSTICAL CORRECTION CEILING CONSTRUCTION

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Application March 6, 1956, Serial No. 569,748

10 Claims. (Cl. 181—33)

The invention relates to a new and improved ceiling construction which combines translucency or light transmission and acoustical correction or sound conditioning.

The modern trend is toward illumination of rooms and the like through the use of lighting which is transmitted through translucent ceiling materials, and in particular wherein the lighting is largely over-all lighting; that is, where the entire ceiling is comprised of the translucent material and behind which the light source is located, usually fluorescent tubes. A modification of such over-all translucent lighting is that where the entire ceiling is not comprised of the translucent material but relatively large panels or areas of the ceiling are comprised of translucent illuminating panels.

Acoustical correction or sound absorption is being widely used to the extent that in many cases it is almost a "must," particularly for all types of public and semi-public places of assembly, including stores, offices, restaurants, and so on.

Where an ordinary translucent ceiling construction is installed, comprised of the various translucent sheet materials and the like which are available on the market, it substantially precludes the installation of sound absorbing or acoustical correction material since such generally are opaque and are ordinarily applied to the ceiling of the room in which they are installed, and since it was assumed that a translucent ceiling construction had already been installed, there is no place for the installation of a sound absorbing ceiling. In view of this situation there has been developed the invention hereof, which integrates the illuminating effect achieved by the use of a translucent ceiling construction and also incorporates the feature of sound absorption or acoustical correction, so that using a single product it is possible to install a ceiling which, at the same time, serves to provide over-all translucent illumination together with the desired acoustical correction.

Briefly described, the invention hereof constitutes units or elements made up of a more or less translucent or transparent sheet material and as a combination of such material in plane sheets and corrugated sheets composited in a novel manner. The construction is such that there are provided units or elements which may be installed, as such, and which have both the property of light transmission and of acoustical correction.

These composite units or elements just above referred to are light in weight, being comprised of relatively lightweight sheet material and preferably the material of which they are fabricated is of relatively fire-resistant material, such as sheets of vinyl acetate, cellulose acetate, and other similarly relatively incombustible transparent or translucent sheet materials. Of course, it is to be understood that the units may be equally as well constructed of other relatively transparent or translucent materials, but that those which have a relatively high degree of flame resistance are preferred.

In the construction of the combination light-transmitting and acoustical correction units, the composite structure, as will be hereinafter more fully explained, takes advantage of the phenomena of various types of sound absorption to achieve a relatively high over-all level of absorption of sound as usually present in stores, restaurants, offices, and the like, and through the utilization of such novel constructions has a high level of sound absorption comparable to that of the presently used opaque and much heavier sound absorbing products.

The elements or units constituting the invention have a very high ratio of stiffness to weight whereby relatively wide panels can be mounted in a suspension system with relatively wide spacing of the suspending members, with the result that installation costs are considerably reduced.

It will be understood, of course, that where the function of light-transmission is not of importance, the panels may be constructed of materials other than transparent or translucent plastics, or the equivalent, and may be comprised of paper or paper-like materials which may be stiffened and strengthened by suitable treatments, as by the use of synthetic resins either saturated into the paper or as coatings thereon, and that such paper-like materials may be fireproofed to a greater or lesser degree by suitable incorporation therein of known fireproofing ingredients, such as by incorporating an admixture of boric acid and borax, various borates, phosphates, tungstates, or combinations thereof, or other fireproofing compositions of which many examples exist in the fireproofing art.

The principal object of the inventions hereof is that of the provision of a wall structure, usually a ceiling, which provides for both the transmission of light and sound absorption or acoustical correction. A further object of the inventions hereof is that of providing such units or elements which are relatively light in weight, the stiffness of which is high relative to the weight thereof. Still further objects of the inventions hereof are those of providing a construction and elements thereof, as above referred to, in connection with which, such are of relatively low cost, high efficiency, and particularly are economical from the standpoint of application or erection.

The inventions hereof are illustrated in the accompanying drawings wherein

Fig. 1 is an illustration of application of the units or elements hereof, several modifications being illustrated;

Fig. 1*a* is a detail illustrating a modified unit mounting construction;

Fig. 1*b* is a detail illustrating a still further modification of unit mounting construction;

Fig. 2 is a perspective with parts broken away illustrating a unit or element;

Fig. 3 is a perspective view of one type of member for mounting the units or elements;

Fig. 4 is a diagrammatic illustration of the over-all construction of a suspended ceiling comprised of the units or elements hereof; and

Fig. 5 is an end view of a form of runner member for suspending the elements or units hereof.

Fig. 6 is a perspective view illustrating details of construction of the unit on a scale somewhat larger than that of Fig. 2.

The embodiments of the inventions hereof are susceptible to very considerable variation depending upon particular circumstances of use, and for this reason some of these various embodiments will be pointed out to convey at least some idea of the versatility of the resulting product.

These units, as clearly indicated in the drawings, may be applied directly against or to a solid backing or ceiling structure, or they may be suspended as a false ceiling spaced from the structural ceiling. It will be evident, of course, that in the first instance the stiffness of the units is relatively immaterial, whereas on the other hand when the units comprise a suspended ceiling construction, their stiffness is of some or may be of very considerable importance.

It will also be understood that where the units are applied directly to a structural ceiling their weight probably will not be of importance, whereas, on the other hand, when the units are erected on supporting runners or the like as a suspended ceiling, the matter of the weight of the units becomes of importance. The weight to stiffness is of extreme importance since with increased stiffness the span of the units or spacing of the supporting runners or the like may be increased but, of course, the point of economic balance as to materials employed, weight of the unit and distance-spanned will be determinative.

It will be readily apparent that the units will preferably be comprised of different materials depending upon the particular use to which the units are to be put. Where the units are to be applied directly against a structural ceiling, or against a solid false ceiling, transparency or translucency becomes of no moment. In such case, both from the aspects of economics and of requirements, the units would preferably be comprised of relatively opaque materials, as, for example, constructed of suitable paper. Units to be installed as suspended ceilings and having the lighting source provided in the space between the structural ceiling and the suspended ceiling, will be comprised preferably of suitable transparent or translucent sheet materials, as, for example, sheets of synthetic resins such as vinyl chloride acetate plastic sheets, either clear and transparent, or with suitable integral coloring, as clear or translucent sheeting. Also other sheet-form materials may be used depending, as pointed out, largely upon the conditions under which the units are to be used, other of which materials, by way of example, may be paper-like sheets of natural or synthetic fibers suitably bonded with salts or resin materials, such as more or less covered in the article, "Physical Properties of Papers from Synthetic Fibers," appearing in Tappi for May 1955, pages 257–261. Paper or fabric sheets employed may be suitably stiffened by the treatment thereof with synthetic resins, or other suitable stiffening materials, although stiffening through the incorporation of synthetic resins is apparently the form which is most desirable in many respects. Also in some instances the units might be comprised of suitable metal foils or paper-backed foils, or, in fact, depending upon circumstances, the units may be comprised of substantially any relatively thin sheet-form material which of itself has some stiffness or has been stiffened by the incorporation of suitable stiffening materials well known in connection with the use of cloth, paper and the like. In instances it may be desirable to manufacture units of various combinations of the various materials, which have just previously been referred to, or additionally of such sheet-form materials as cellophane, cellulose acetate, and numerous other sheet materials available on the market but which have not herein been referred to.

In connection with the various materials above referred to as suitable for the manufacture of the units hereof, various of these, depending upon the circumstances of the use of the resulting units, would not be suitable without further treatment, as, for example, in the case of

combustible sheet materials, in connection with their practical use, and due to building restrictions or insurance penalties or the like, it will be necessary in connection with the use thereof, that they be suitably treated to render them fire-resistant or fire-proof, such as the treatment of a paper sheet to incorporate therein borates, or phosphate, or urea formaldehyde resin and an ammonium phosphate or other suitable or known fire-resistant or fire retarding composition, many of which are well known and are commonly employed and numerous of which are disclosed, for example, in the book, "Flameproofing of Textile Fabrics," by Robert W. Little, published by Reinhold Publishing Corporation, 1947.

In the serveral preceding paragraphs there have been generally discussed the various sheet materials which may be utilized according to circumstances in the manufacture of the units embodying the features of the inventions hereof, and it is to be understood that such constitutes merely a general discussion of the subject and that suitable selection will be made among the available sheet materials depending upon the physical requirements with respect to the units to be manufactured, and which will be largely determined according to the conditions of use and as dictated or required by the designer, the applicable fire code provisions, insurance ratings and the like, and it is contemplated as within the province of those skilled in the art involved that suitable selection of materials from all those available on the market will be made.

In the specific description of the drawings, as representing an exemplification of the inventions hereof, such description will be relatively specific with respect to materials and constructions, but it is to be understood as contemplated that the designer of the units will take into account the requirements with respect thereto and the materials available on the market, and that he will make suitable selection and specify the combination thereof desirable or required for the manufacture of the units for any particular conditions applying to the use thereof. The general description of the inventions hereof follows:

In the drawings the constructions illustrated in Fig. 1 are those wherein the sound absorbing units hereof are mounted directly to a ceiling or wall surface. As illustrated, the members **10** may represent floor joists or the like to which are suitably secured, as by nailing, supporting sheet material **11** which may be any suitable sheet-form material, for example, plywood, hardboard, asbestos-cement sheets, gypsum board or the like, or such, alternatively, may be considered as representing a plastered ceiling of any usual construction. Members **10** and **11** are merely representative of a building construction providing a supported surface to which the sound absorbing elements hereof may be suitably attached or secured. In the showing of the left hand portion of Fig. 1 the units or elements **12** are illustrated as secured to the wall surface **11** by any suitable adhesive, there being many of these on the market particularly formulated for use in applying tile or panel-form units, such being well known and the use thereof understood by those skilled in the art.

In the right hand portion of Fig. 1 there is illustrated the direct application of units **12** hereof to the surface of wall **11**, mounted thereto by means of clips or members **14**, which are secured to the wall **11** by nails, screws or the like **15**, which are applied through openings **17** provided in the base of the clip members **14**.

In Fig. 3 there is illustrated clip member **14** shown in detail as comprising sheet material, which may be a metal sheet or synthetic resin sheet, which at one end is split and folded at right angles, as is clearly evident, to form attaching base portions **16** provided with holes or perforations **17** through which may be entered nails, screws or the like for securing the clip member **14** to a supporting element. The sheet comprising clip **14** is

further suitably punched or slit, and there are turned out at right angles to the plane of the sheet penetrating points or prongs **18** to penetrate the edges of units **12** when pressed thereagainst and to constitute supports to secure such units **12** in place.

In Fig. 5 there is illustrated a support or rail member particularly adapted for use in connection with a suspended ceiling comprised of the units hereof and which has a flat or sheet-form runner member **20** formed at its lower edge with a suitable bead **21** serving principally as a decorative element, but which also aids in providing stiffness of runner member **20**. At suitable positions along the length of runner member **20** the sheet material is slit or punched to provide supporting members through bending such punched parts outwardly from the plane of the runner at right angles thereto and then upwardly at right angles thereto parallel to the plane of the runner member, such supporting members identified by numeral **22**. These supporting members **22** are designed to enter into keyhole slots or the like **30** provided in the side edges of units **12**, and it will be readily understood that the upstanding portion of such a supporting member **22** will be positioned behind the side or edge member of a unit **12**, and that the unit mounted to the runner member **20** will thus be held in position and will be supported on the out-turned portion of the supporting member **22**.

In Fig. 4 there is schematically illustrated an assembled suspension ceiling construction comprising suitably suspended units **12** serving as a transparent or translucent ceiling, with the light source between the structural ceiling and the suspended ceiling. In this illustration the structural ceiling is identified by numeral **24**, supporting runner members are supported from the structure by hangers **25**, and the light source **26** is suitably mounted to the structure as, for example, by hangers **27**. Further in this diagrammatic or schematic illustration of an installation incorporating the inventions hereof, there is shown the use of suitable sound absorbing pads, by way of example, of resin bonded glass fiber or of suitable felt, perforated fiberboard or the like, which sound absorbing material is generally identified by numeral **28**. It is to be understood that the example illustrated in Fig. 4 is purely a schematic representation and that the actual constructions involved in any installation will be dictated by the specific requirements thereof, and it is contemplated that the inventions hereof may, by those skilled in the art, be incorporated into an almost endless variety of specific constructions.

Illustrating a variation of the detail mounting for the units **12** hereof, Fig. 1*a* illustrates the units **12** as mounted to a suitably suspended inverted T-form runner in which instance, it will be understood, the units **12** will be supported at their edges by the flanges of such T runners which are identified by numeral **31**. The form of mounting illustrated in Fig. 1*b* is substantially runner member **20** but having upwardly inclined strike-outs or prongs **32** provided, suitably positioned, to enter into keyhole slots **30** in the side of a unit **12**, whereby the two elements, prongs **32** and head member **33**, together constitute a support for a suspended unit **12** and also serve, by way of prong **32**, to stabilize the installation and hold the side of unit **12** close against the runner member. These various modifications, particularly with reference to the support or mounting of units **12**, constitute merely particular forms of support illustrative of the requirements, and it is contemplated that the designer will, in the design of a particular installation, utilize the teachings thereof in providing suitable support for elements **12**.

The unit **12** as illustrated in Fig. 2 is an assemblage which may be said to be of tile-form but which, depending primarily on the materials of which it is comprised, the particular requirements of the installation to be provided and various requirements as to building codes, insurance codes and the like, and based on economic considerations, may be anywhere from about 12 inches by 12 inches to four feet by eight feet in dimensions. These units **12** will also be of different thicknesses depending on the basis on which they are designed, and controlled primarily by the stiffness required for their span, that is, the distance between supports provided at their edges, and upon the sound absorbing and/or lighting requirements of the specific installation.

The principles involved in the construction of units **12**, however, are applicable to units of various sizes and thicknesses, and by way of example there has been illustrated the specific unit of Fig. 2, which is a somewhat complex unit designed to span a relatively wide distance between edge-supporting runners and to provide a relatively high degree of sound absorption.

Unit **12**, as illustrated, is assumed to be comprised of a vinyl chloride acetate plastic sheet product incorporating suitable filler to provide translucency rather than transparency, a sheet-form material readily available commerically.

The unit **12** as illustrated is comprised of what might be referred to as "three layers" each comprising a plane face sheet and a cellular backing sheet secured together, with three of such secured one to the other in stacked relation to comprise the base structure to which plain edge sheets and a back sheet may be applied to constitute a complete unit. The unit of the drawing, as illustrated in Fig. 2, comprises a face sheet **40** which is a composite sheet which will be described in greater detail in connection with the description of Fig. 6 of the drawing, and which, as will be seen, comprises two sheets, one of which, the actual facing sheet **41**, is relatively thick, whereas the other sheet **42** composited therewith is approximately a tissue sheet. The composite facing sheet **40** is mounted to a cellular core portion **43** produced by well known procedures. The particular core material **43** illustrated is made by line-gluing suitable sheets so that every other sheet is adhered along the line intermediate the adjacent glue lines of the sheets adhered to each side thereof. Such structure, after the glue has set, is expanded at right angles to the sheets of which it is composited to form a cellular column from which may be sliced or cut suitable core portions **43**, as illustrated. The composite facing **40** is suitably secured to one plane surface of core portion **43** by suitable resin adhesive preferably, of course, a clear adhesive, or by welding or the like.

There is then mounted to the back surface of the composite just described a second composite which is generally similar and comprises a face sheet **40*a***, which may be of the same construction as face sheet **40**, as described, or may be a single sheet which is naturally very finely porous or has been caused to have substantially uniformly-distributed porosity, and in either case having a porosity approximately that of the average good grade filter paper or tea bag paper. Facing sheet **40*a*** is the surfacing sheet for a core portion **43*a***, which is generally similar to previously described core portion **43**. These two assemblages which have just been described, of course, are suitably secured one to the other by suitable resin adhesive or by welding, or other suitable procedure. To the back plane surface of the assemblages just described there is mounted a third assemblage which comprises a face sheet **40*b***, which may be of the same composite structure as face sheet **40** or only a thin and finely porous sheet such as sheet **42**, and to this is mounted a core portion **43*b*** which is similar to the cores **43** and **43*a***, previously described.

It is to be understood that the three assemblages which have been described are secured together in stacked relation, suitably secured together as by cementing, welding, or the like, and that there may be similarly secured to the side edges thereof plain flat sheets **44** and, if desired, a plain back sheet **45**, whereby the entire assemblage con-

stitutes a rectangular box-like structure with plane surfaces, one of which is provided with openings or perforations 46. Back sheet 45, however, may in certain circumstances comprise a composite similar to facing 40.

In accordance with the foregoing general description of the inventions hereof, it is to be understood, of course, that while the unit 12, as just described, has been described as comprised of a vinyl chloride acetate plastic sheet, that in accordance with the general description and depending on circumstances, as were set out, the unit may be comprised of substantially any sheet material having generally the characteristics of a fairly stiff paper, it being understood, however, that face 40 will be thicker than the other sheets entering into the construction and which, preferably, will be of a thickness of at least one-eighth inch.

In the illustration of the unit, the exposed face of the unit as installed is shown as uppermost, that is, the unit is upside down as compared with a unit as ordinarily installed, so that the surface which is ordinarily seen when installed is the surface which is uppermost in the illustration. The unit constructed as described will, it is evident, be quite light in comparison with most of the sound absorbing products available on the market, and it should be readily apparent that due to its construction, the spacing of the facing surfaces by cellular core material, the composite material will be one which is quite stiff in cross-bending resistance or flexure, and that the resulting unit will be of a high ratio of transverse strength to weight.

The unit face 40 which has been described as comprising a combination of a relatively thick base sheet and a thin under sheet, identified as sheets 41 and 42, respectively, are adhered by suitable adhesive, cement or by heat-sealing or welding, which is well understood, but particular attention is directed to the fact that in securing these sheets 41 and 42 together, such parts of sheet 42 as lie under the holes or perforations 46 in face sheet 41 must be taut, and that the porous structure of the sheet must be retained. If sheets 41 and 42 are secured together by some type of adhesive, it is believed that it will be obvious that adhesive should be applied to back of sheet 41 and not to the face of sheet 42, since by such procedure the sheets may be plied without the porosity of sheet 42 in those areas behind perforations 46 being blocked or choked with the adhesive.

As previously referred to, the face sheet 41 is preferably of material of at least one-eighth inch thick, or preferably thicker. Sheet 42 is relatively thin and should comprise substantially a tissue or foil sheet which will be, preferably, about .003 thick, although if the requisite porosity is provided the actual thickness of the sheet is not at all critical. The cellular core material, whether of the form as illustrated in Fig. 2 or of other form such as illustrated in Fig. 6, which latter is a common form of built-up corrugated material, is comprised of sheets preferably of a thickness of from about .005 to 0.01 inch, but it is to be understood that the requisite thickness of the sheets is merely that which, with the particular material, will provide a substantial core, since primarily these cores are merely spacers. The sheet covering the edges and back of the unit are merely of such thickness as will serve to comprise the entire unit, a substantial and handleable box-form structure, and these sheets accordingly may be of such thickness as will produce the desired structural result.

In the foregoing the sound absorbing unit 12 has been described as a unit for conventional ceiling or wall application in that the sides and rear surface thereof have been described as closed or completed by the suitable attachment of an ordinary sheet of paper, cardboard, plaster sheet, or the like, the only requirement being that such shall be of sufficient stiffness and rigidity to constitute the complete unit 12 suitable for use and attachment as hereinbefore described in detail. It is readily evident, however, that the base unit may be utilized as an acoustic baffle or acoustic sink, in which case there would be applied to the back surface a cover sheet the same as that applied to the front face and comprising the perforated face sheet 41 composited with porous sheet 42. Also, and particularly when such unit is to be used as an acoustic sink, where in general all faces of the unit will be exposed, then for such use if desired, and as of some advantage, the core portion of the unit may have applied to all faces, that is, front, back and side edges, the composite facing 40 comprising the combination of perforated sheet 41 and porous sheet 42.

The construction of the sound absorbing element hereof as described is such that it will provide a relatively broad and uniform absorption of sound ordinarily encountered in typical sound absorbing installations, where by far the major frequencies to be absorbed lie between the frequencies of about 100 to about 12,000 cycles, and over which range the absorption of sound by the unit described is relatively uniform.

In an exemplification of the unit described, the respective core portions 43 and 43*b* are each about one inch thick and core portion 43*a* about two inches thick. The cells of the core portion have a cross sectional area of about one square inch, and the composite facing 40 is that previously herein described as a face sheet 41 about one-eighth inch in thickness with about 758 perforations of .02735 square inch each, and porous sheet 42 mounted thereto and having a porosity of between about 90 to 200 cubic feet per minute. The porosity of sheet 42 as referred to is determined by standard procedure—which, briefly, is the determination of the cubic feet of air passing through one square foot of the sheet, per minute, at 0.5 inch water pressure.

It is to be understood, of course, that the various dimensions and so on just above given are those of the exemplification of the invention as illustrated, and that the dimensions as stated are susceptible of variation in designing a unit, and that within reasonable limits a variation of these various dimensions will not greatly affect the high and relatively uniform absorption which is obtained in the use of the described sound absorbing unit. For example, it is understood, of course, that if the unit is to span a relatively narrow space between supports, core 13 may be of lesser height or, on the other hand, if the span is greater, the unit may be stiffened by increasing the height of this core. Alternatively, the same effect as regards stiffness of the unit will be obtained by some suitable variation of the height of core 43 or 43*b*. Also the particular construction of the core may be varied and instead of using a core of the construction of that identified by numeral 43, the core construction may be as shown at 43*a* of Fig. 6, where there is shown a core built up of more or less conventional corrugated construction with alternate flat sheets. Also the thickness of the facing 40 may be varied within reasonable limits without unduly affecting the over-all results, and this may range in thickness from, say, about one-sixteenth inch or even less to about one-half inch, and also perforations 46 in face sheet 40 may be varied both in size, spacing and position, reasonable limits of variations being from approximately one-eighth inch to one-half inch in diameter with spacing of approximately three-eighths inch to one-half inch for the smaller perforations, and approximately one-half inch to one inch for the larger perforations.

It is also to be understood that while perforations 46 have been described and illustrated as circular, that such may be of other shape having equivalent area, as, for example, they may be square or oval or the like. The porous sheet mounted to the back of the face sheet will in general be of a thickness of about .003 but may range from about .002 to about .005 so long as the sheet provides the requisite porosity, which may be either the natural porosity between fibers of a fiber sheet or provided

in a continuous and otherwise imperforate sheet such as a foil, by suitable, extremely small perforations, as by electric spark perforating or the like. The porosity of the sheet 45 may vary between the limits of from about 90 to 200 cubic feet per minute but with a porosity of around 120 to 150 cubic feet per minute being that which is preferable.

It will be understood, of course, that the unit 12, as heretofore described, is but an exemplification of the inventions hereof, and that utilizing the teachings hereof, those skilled in the art of sound absorption may readily utilize sheet materials other than those herein particularly referred to in constructing such units, and that still utilizing the inventions hereof they may depart from the various respective figures herein referred to with reference to dimensions and the like, especially so where there is a particular noise condition to be corrected, as, for example, in an office in which there are machines operating which cause a particularly high sound level within some relatively narrow range of frequencies. In such case the various absorbing elements of the unit should be designed to provide for peak absorption in such range of frequencies of high intensity, so that the unit may be most efficient within the range of such limited high level of sound.

The inventions hereof having been illustrated and described in detail, I claim:

1. A sound absorbing unit comprising a sheet-form cellular core portion in which the cells extend normal to a face surface and through the thickness thereof, a sound porous sheet adhered to a face surface of the cellular core portion, said sound porous sheet having air permeability of between 90 and 200 cubic feet per minute at 0.5" hydrostatic pressure, and a facing sheet adhered to said sound porous sheet, about 5 to 15% of said facing sheet comprising substantially regularly dispersed perforations of about 0.01 to 0.05 square inch area, each, extending through the thickness of said facing sheet.

2. A composite sound absorber comprising serially composited, a perforated facing sheet, approximately 5 to 15% of the area thereof comprising dispersed perforations each of area about 0.01 to 0.05 square inches and extending through the facing sheet, an air-pervious sheet of air porosity of between about 90 to 200 cubic feet per minute at 0.5" hydrostatic pressure, a cellular core sheet of substantially uniform cellularity, the cells extending through the thickness of the core sheet, the such cellular core comprised of composited deformed sheets, a second air-pervious sheet substantially similar to the previously said air-pervious sheet and a second cellular core sheet of substantially the construction of the first said cellular core sheet but of at least twice the thickness thereof.

3. A composite sound absorber comprising serially composited, a perforated facing sheet, approximately 5 to 15% of the area thereof comprising dispersed perforations each of area about 0.01 to 0.05 square inch and extending through the facing sheet, an air-pervious sheet of air porosity of between about 90 to 200 cubic feet per minute at 0.5" hydrostatic pressure, a cellular core sheet of substantially uniform cellularity, the cells of cross sectional area of about one square inch each and extending through the thickness of the core sheet, the such cellular core comprised of composited deformed sheets of thickness of between about 0.005 to 0.01 inch, a second air-pervious sheet substantially similar to the previously said air-pervious sheet and a second cellular core sheet of substantially the construction of the first said cellular core sheet but of at least twice the thickness thereof.

4. A sound absorbing and translucent structural element comprised of composited elements, a core portion and a facing portion, the core portion formed of strips of light transmitting sheet material, such strips deformed across the width thereof and adhered along spaced lines

forming a cellular construction in which the cells extend through the thickness of the core portion and a composite facing secured to said core portion, said composite facing comprising a light transmitting, air-porous sheet and a perforated light transmitting perforated sheet, the perforations in said perforated sheet substantially uniformly dispersed and of cross sectional area of about 0.01 inch to 0.05 inch each and comprising about 5 to 15% of the sheet area.

5. A light transmitting sound absorbing unit comprised of light transmitting sheet materials secured in assembled relation, the core thereof a cellular sheet of adhered strips on edge, the cells thereof extending through the thickness of the sheet and adhered to a face thereof and to one another, an air-porous sheet and a perforated sheet, the perforations thereof substantially uniformly distributed and comprising about 5 to 15% of the sheet area.

6. A light transmitting sound absorbing unit comprised of light transmitting sheet materials secured in assembled relation, the core thereof a cellular sheet of adhered strips on edge, the cells thereof extending through the thickness of the sheet, an air-porous sheet secured to a face surface thereof and secured thereto a second core of similar construction, and secured to the other face surface thereof a composite facing, an element of which is air-porous and secured to a perforated sheet, the perforations thereof substantially uniformly distributed of about 0.01 to 0.05 square inch area each and totalling about 5 to 15% of the sheet area.

7. In a building structure, an illuminating and sound absorbing ceiling construction comprising a plurality of wall forming elements, suspending means mounting such elements in assembled relation as a ceiling spaced from the building structure, a source of illumination disposed between the building structure and such suspended ceiling, the elements forming such suspended ceiling comprising assembled elements, the face thereof a light transmitting composite of a perforated sheet together with an imperforate air-porous sheet, the perforations in the perforated sheet substantially uniformly distributed and the imperforate air-porous sheet secured to the perforated sheet along the periphery of the perforations, and mounted and secured to such composite sheet a light transmitting cellular structure, the cells of which are normal to the composite face sheet.

8. A composite sound absorbing element comprising in combination a cellular core constituted of juxtaposed tubular elements each defined by walls extending continuously through the thickness of the cellular core portion and defining cells extending continuously through the thickness of the core and substantially normal to the face surface thereof, and secured to a face surface of the core portion a sound porous sheet having air permeability of between 90 and 200 cubic feet per minute at 0.5" hydrostatic pressure, the sound porous sheet adhered to the ends of the walls forming the cells of the core whereby the sound porous sheet constitutes a connected system of contiguous air and sound porous diaphragms.

9. A composite sound absorbing element comprising in combination a cellular core constituted of composited corrugated sheets comprising walls forming juxtaposed tubular elements, the walls thereof extending continuously through the thickness of the core portion and defining cells extending continuously through the thickness of the core and at one face of the core air and sound porous diaphragmatic elements extending transversely of the ends of each of the cells formed by the cell walls extending through the thickness of the core, and each of the diaphragmatic elements secured to the ends of the wall circumscribing the cell over which such diaphragmatic element extends.

10. A composite sound absorbing assembly comprising, serially composited, a perforated sheet, an imperforate air and sound porous sheet, the perforations of the perforated

sheet substantially uniformly distributed over the area of sheet, and the imperforate air porous sheet secured to the perforated sheet along the peripheries of the perforations and mounted and secured to the composited perforated and imperforate sheet, a cellular structure constituted of juxtaposed tubular elements each extending through the thickness of the cellular structure and having the end thereof mounted to the composited sheets in continuous contact with a face of the imperforate air and sound porous sheet.

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Notice of Adverse Decision in Interference

In Interference No. 91,434 involving Patent No. 2,870,857, E. E. Goldstein, Translucent acoustical correction ceiling construction, final judgment adverse to the patentee was rendered Oct. 2, 1962, as to claims 1, 4, 5, 7, 8, 9 and 10.

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