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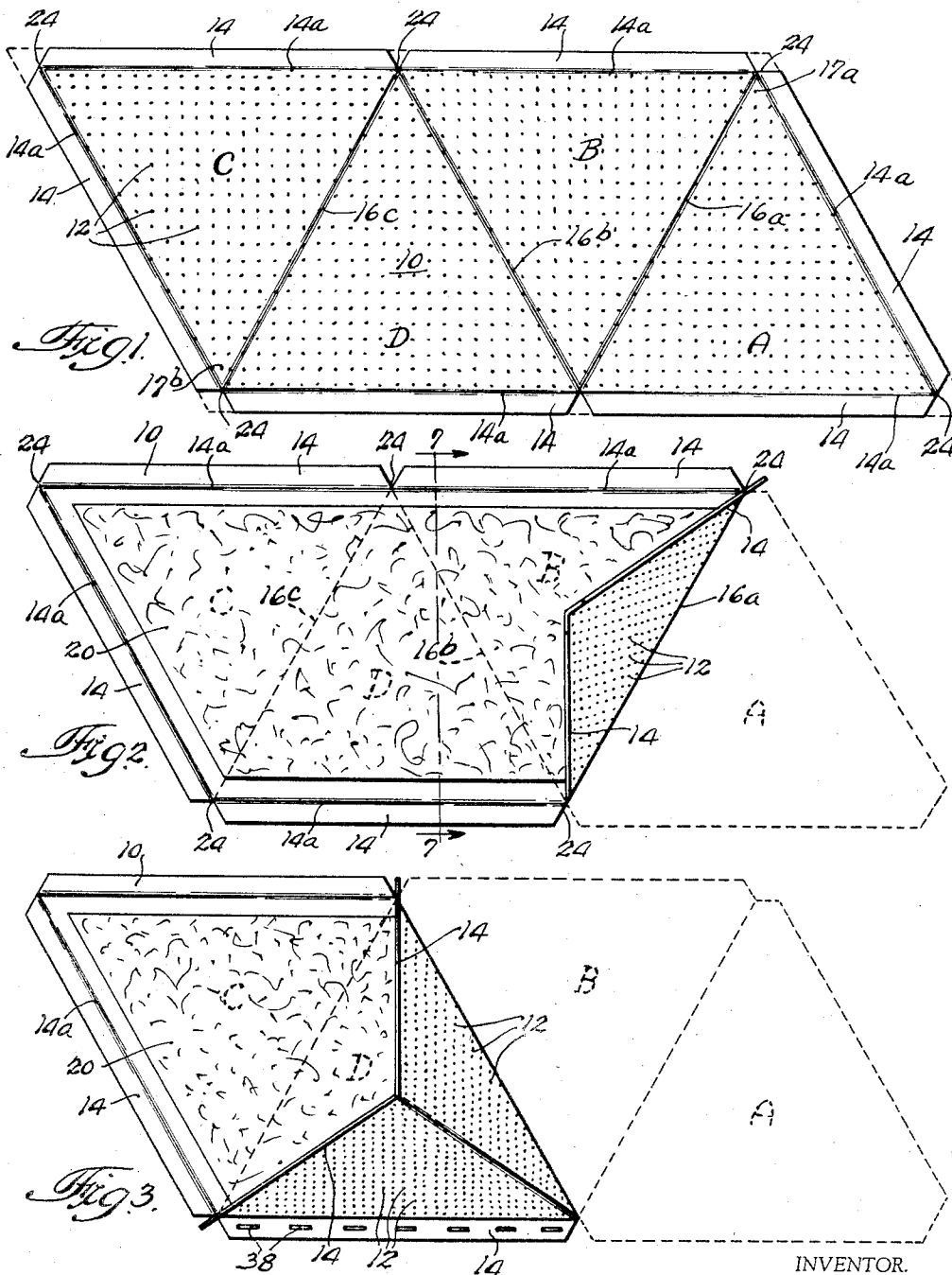
R. M. MUSTOE

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SOUND ABSORBING UNITS AND METHOD OF MAKING SAME

Filed Nov. 1, 1956

2 Sheets-Sheet 1



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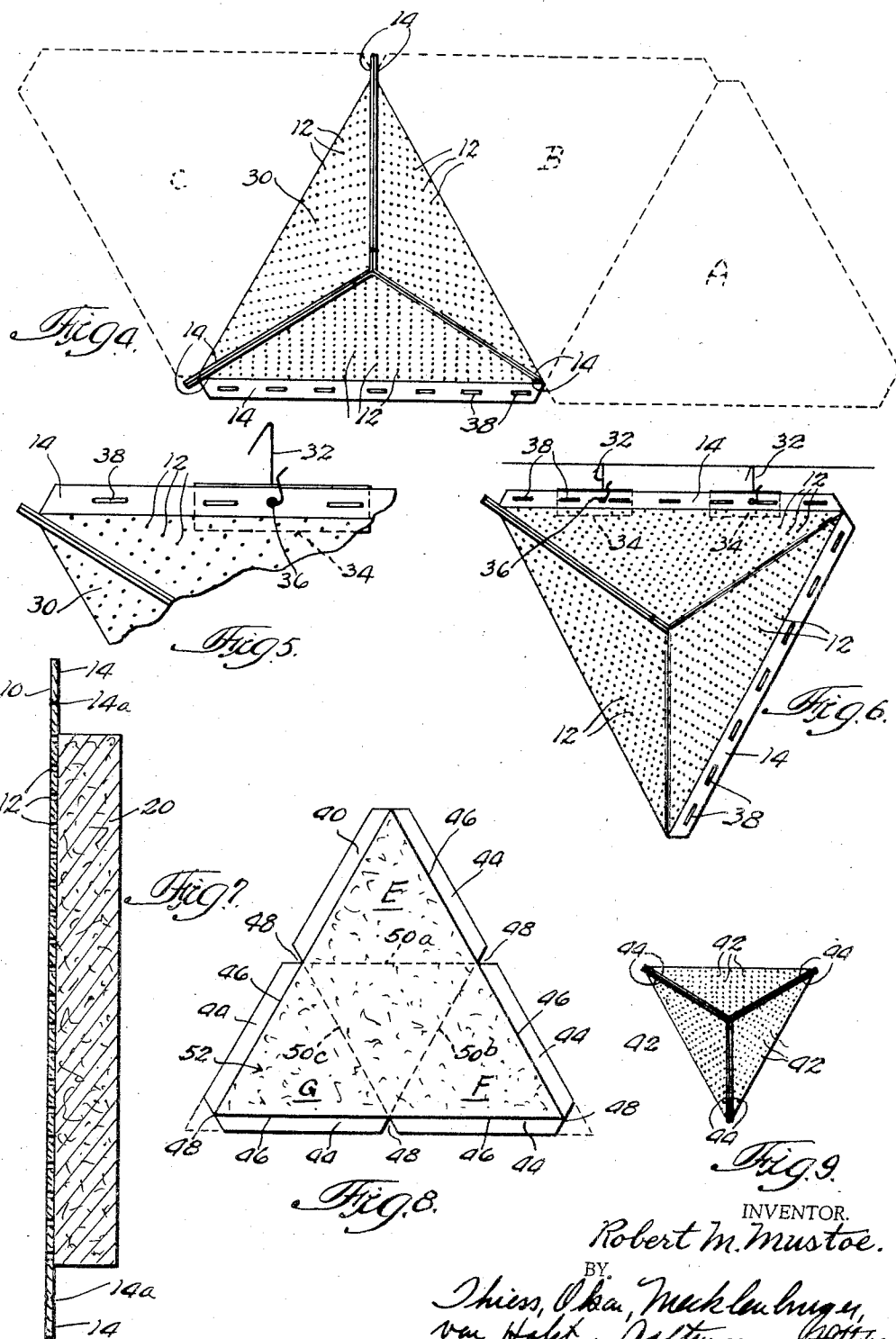
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SOUND ABSORBING UNITS AND METHOD OF MAKING SAME

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11 Claims. (Cl. 181—33)

This invention pertains to space sound absorber units and methods of forming them. More specifically it is directed to methods of assembling the various components into a laminate intended to be formed into a tetrahedral shaped unit quickly and easily under job conditions.

In areas where a high incidence of noise is generated as in machine shops, forges, office areas containing a concentration of office machines and the like, the sound generated is unpleasant, unnecessary and undesirable. The use of sound absorbents on the ceiling or walls adjacent such areas is of value, but a considerable amount of sound is spread laterally about and over the machines, very much to the annoyance of those near by. To overcome this lateral dispersion of sound radiating from a machine and also under some conditions where high ceilings render the use of ceiling surface sound absorbents impractical, sound absorbing units are judiciously suspended from the ceiling within the overhead space and in proximity to the offending noise makers whereby the incident noises are substantially absorbed or reduced to a normal condition.

Space sound absorbers are fully described in literature and in patents such as H. F. Olson Patents 2,502,016; 2,502,018; 2,502,019 and 2,502,020, as well as in G. L. Beers Patent Number 2,502,017 and others. These patents describe variously shaped geometrical figures into which the space sound absorbers can be made. Some of these are folded, others again are stackable, but all are intended to utilize the least amount of space during storage, shipment and until actually applied. When readied for use, these various types of space sound absorbers are either unfolded into the preselected shape or otherwise manipulated to form space sound absorber units. Many of these are in forms of rectangular boxes, cubes, cones, spheres, pyramids and others. All are characterized with large interior cavities in which sound is entrapped and eventually absorbed. However, none can be readily and easily formed into a space sound absorber unit from a single blank or sheet.

It, therefore, is an object of this invention to provide a tetrahedral shaped space sound absorber easily assembled from a single blank.

Another object of this invention is to provide a blank comprising a single integral flat sound pervious sheet which can be readily folded into a tetrahedral shaped space sound absorber.

A further object of this invention is to provide a laminated sound pervious sheetlike construction or blank readily foldable into a tetrahedral shaped spaced sound absorbing unit consisting of a felted fibrous sound absorbent material attached to a sound pervious supporting sheet.

A still further object of this invention is to provide a method for forming blanks of the above-referred-to types which can be readily folded into a tetrahedral shaped space sound absorbent unit.

These and other objects, variations, adaptations, modifications and extensions will become readily apparent to one skilled particularly in this art in view of the description given hereinbelow of the concepts underlying this invention, and the annexed drawings of a preferred embodiment forming a part of this disclosure.

Figure 1 is a plan view of a base sheet.

Figures 2, 3 and 4 are plan views similar to Figure 1 showing successive steps in forming a tetrahedral shaped sound absorbing member from the sheet illustrated in Figure 1 which has sound absorbent material thereon.

Figure 5 is a detailed enlargement showing several means for securing the flaps of the unit together and for supporting it.

Figure 6 shows the completed unit suspended for use.

Figure 7 is a cross-sectional view taken on the line 7—7 of Figure 2.

Figure 8 is a plan view of a modified form of blank which may also be used to form a tetrahedral space sound absorber unit.

Figure 9 is a plan view of a tetrahedral-shaped sound absorbing unit formed from the blank of Figure 8.

The unit illustrated in Figures 1 to 7 comprises a sheet 10 to which a relatively thick mat or layer of sound absorbent material 20 is secured. The sheet 10 is preferably cut from a continuous web of heavy, self-supporting material, such as cardboard, chipboard, or other organic or inorganic materials. Likewise, it can consist of thin gauge metals or have a coating of thin metal, such as aluminum foil and the like. However, it is preferred, for a number of practical reasons, to use thin aluminum sheet material or chipboard having on the exterior surface thereof a covering of aluminum foil. With such material, perforations 12 are formed throughout the entire area of the base sheet 10 so that incident sound waves can penetrate to the interior of the sound absorber member or unit 30 through such perforations to provide for proper sound absorption in accordance with the teaching of said Olson and other patents mentioned hereinabove. The perforations 12 are preferably formed in the web before the sheets 10 are cut therefrom, but may also be formed in the sheets severed from the web. The web from which the sheets are cut may also consist of stiff, porous, sound pervious fabrics, in which case the perforating step may be omitted.

The sound absorbent material 20 which is mounted on the inner face of the sheet 10 preferably consists of glass wool matting or other well known sound absorbing materials, such as mineral wool, cellulosic fibers, hair, asbestos, and the like. This material is preferably felted, for convenience in use, into a mat of desired thickness, such as about one inch, so that it can be easily attached to the base 10 and provide therefor a sound absorbent surface. Animal glue, starch, synthetic resins, or any other suitable adhesive can be used in attaching the sound absorbent material to the interior surface of the base 10. Any other suitable securing means may also be employed for this purpose, such as staples, stitching, etc.

The base sheet 10 is preferably cut askew from a continuous strip of suitable webbing in such manner that the two diagonally facing interior corners of the sheet have 60° angles, and the other two diagonally facing interior corners have 120° angles.

The sheets are severed from the webbing strips in lengths substantially equal to twice the width of the end portions of the sheet. The resulting sheet is also scored or weakened along the lines 16a, 16b, and 16c to form fold lines which, together with the outer edges of the sheet, form similar, generally triangular portions A, B, C, and D.

The line 16a bisects the 120° angle 17a, and line 16c parallel thereto bisects the opposite 120° angle 17b. The

third line 16b connects the inner ends of the lines 16a and 16c and extends substantially parallel to the ends of the sheet 10.

Formed along each of the outer edges of the sheet 10 and the triangular portions A, B, C, and D are narrow flaps 14 delineated from the remainder of the triangular portions by fold lines 14a adjacent and preferably substantially parallel to the outer edges of sheet 10. Notches 24 at the apices of the triangles separate the ends of the various flaps from each other. The portions bounded by the fold lines 16a, 16b, 16c, and 14a are substantially identical equilateral triangles.

The blanks comprising the base sheets 10 with the lines 16a, 16b, 16c, and flaps 14 thereon, and having suitable insulating material 20 secured to the inner face thereof, may be packaged, stored, and shipped flat in compact, convenient bundles ready for formation into the desired tetrahedral shape on the job.

The sound absorbing mat 20 secured to the base sheet 10 has its outer edges spaced inwardly a slight distance from and substantially parallel to the fold lines 14a delineating the marginal flaps 14.

One way of forming a tetrahedral-shaped sound absorbing unit embodying the present invention is to first fold the section A of the sheet 10 along the fold line 16a, as shown in Figure 2. Then sections A and B may be folded upwardly along the fold line 16b (Figure 3), after which section C may be folded upwardly along the line 16c, resulting in a tetrahedral-shaped unit (Figure 4). The contacting edges of the flaps 14 are secured together by any suitable securing means that may be readily applied on the job, such as staples 38, rivets, adhesive, etc.

As the unit in use is preferably suspended from one of the edges formed by the abutting flaps, the intended upper edge is preferably reinforced by means of suitable splines 34 of cardboard, wood, metal, or other material secured to the abutting flaps. Alternatively, the abutting flaps may be made of greater width to permit their being folded over several times to provide the desirable strength and stiffness.

Hooks 32, or any other similar supporting members for suspending the sound absorbing unit, may also be inserted through the upper edge, preferably passing through the splines themselves, as illustrated in Figure 5. If desired, grommets may be inserted within the holes 36 intended to receive the hanger members 32, to strengthen the material about these openings.

The embodiment illustrated in Figures 8 and 9 comprises a base sheet 40 cut from a web of suitable material, such as that from which the base sheet 10 was cut. If this material is not sound pervious, suitable perforations 42, similar to perforations 12, are formed therein to permit entry of sound waves.

The base sheet 40 is cut substantially into the form of an equilateral triangle with narrow flaps 44 along the outer edges and delineated from the triangular portion inwardly thereof by fold lines 46. Notches 48 are formed substantially at the mid-point of the sides of the base sheet 40 and at the apices thereof to produce two separate flaps along each side of the base sheet. Fold lines 50a, 50b, and 50c join the mid-points of the fold lines 46, thereby defining four equal equilateral triangles E, F, G, and H. A mat 52 of suitable sound absorbing material in substantially the shape of an equilateral triangle is secured to the base sheet 40 with the outer edges thereof spaced a small distance inwardly from the fold lines 46. The sound absorbing material employed is of the same type as that previously described in connection with the mat 20. The blank thus formed may be readily shaped to produce the desired tetrahedral space sound absorbing member.

To produce such sound absorbing member it is only necessary to bend the triangular portions E, F, and G of the blank which lie outwardly of the fold lines 50a,

50b, and 50c, respectively, upwardly and inwardly to bring the apices of these triangles together. Thereafter the abutting flaps 44 are secured together by any suitable means, such as staples, rivets, adhesives, etc.

As in the tetrahedral space sound absorber previously described, the unit is intended to be suspended with one of the edges formed by the abutting flaps uppermost. In order to strengthen this edge, reinforcing splines or other suitable reinforcing means may be employed. Also, if desired, openings may be formed in this edge, and the material about these openings reinforced with grommets in which hooks or other supporting members may be inserted to hold the sound absorber in position.

Although various embodiments of the present invention have been described herein, it will be obvious to those skilled in the art that many variations are possible, and it is intended, therefore, to be limited only by the prior art and the appended claims.

I claim:

1. A blank for being readily bent and assembled into a tetrahedral-shaped space sound absorber which comprises a parallelogram-shaped sheet having diagonally opposed corner angles of 60 and 120 degrees, said sheet having fold lines along the bisectors of the said 120 degree angles and an additional fold line joining the inner ends of the said first fold lines and substantially parallel to the ends of said sheet, and long narrow flaps on the outer sides of said sheet extending substantially the full length of each of said sides for securing the blank in assembled shape, said flaps on opposite sides of said blank having their outer edges substantially parallel.

2. The blank of claim 1 in which the sheet has a mat of sound absorbent material on the inner face thereof.

3. The blank of claim 2 in which the sheet has perforations substantially throughout.

4. The method of forming tetrahedral space sound absorbers which comprises severing an elongated web of predetermined width along lines at an angle of substantially 60° to the longitudinal axis of said web to form a plurality of similar integral sheets of substantially the full width of said web which may be divided into four substantially equal equilateral triangular portions with narrow substantially straight securing flaps along the outer edges of said portions and constituting substantially the entire material of said web between the lines of severance, each of said sheets having at least two sides thereof substantially twice the length of one side of said triangular portions, forming fold lines in each of said sheets delineating said triangular portions and dividing said flaps therefrom with at least one of said fold lines substantially bisecting said two last mentioned sides inwardly of said flaps, applying to one side of each of said sheets a layer of generally flexible sound absorbing material, folding each of said sheets along said fold lines and forcing the outer edges of each of said triangular portions adjacent the outer edges of said other triangular portions, and securing said flaps to connect the free edges of said triangular portions.

5. The method of claim 4 in which the integral sheet is cut from a web of sound pervious material having openings therethrough.

6. The method of claim 4 in which perforations are formed in the integral sheet.

7. The method of forming blanks which may be readily bent and assembled into tetrahedral space sound absorbers, which comprises severing an elongated web of predetermined width along lines at an angle of substantially 60° to the longitudinal axis of said web to form a plurality of similar integral sheets of substantially the full width of said web which may be divided into four substantially equal equilateral triangular portions with narrow substantially straight flaps along the outer edges of said portions and constituting substantially the entire material of said web between the lines of severance, each of said sheets having at least two sides thereof

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substantially twice the length of one side of said triangular portions, and forming fold lines in each of said sheets delineating said triangular portions and dividing said flaps therefrom with at least one of said fold lines substantially bisecting said two last mentioned sides inwardly of said flaps.

8. The method of claim 7 with the additional step of cutting out portions of the outer edges of said sheet at the corners and adjacent the ends of said fold lines.

9. The method of claim 7 with the additional step of securing to the inner surfaces of said sheets mats of sound absorbing material.

10. The method of forming blanks which may be readily bent and assembled into tetrahedral space sound absorbers, which comprises severing an elongated web of predetermined width along substantially parallel lines at an angle of substantially 60° to the longitudinal axis of said web and spaced apart a distance equal to substantially twice the length of the severed ends of said web to form a plurality of similar parallelogram-shaped sheets of substantially the full width of said web having angles of 60° and 120° which may be divided into four substantially equal equilateral triangular portions with narrow substantially straight securing flaps along the outer edges of said portions and constituting substantially the entire material of said web between the lines of severance, forming fold lines in each of said sheets delineating said triangular portions and dividing said flaps therefrom with one of said fold lines substantially bisecting the flap fold lines along the two long sides of said sheet and other fold lines substantially bisecting the 120° angles, cutting out portions at the corners of said sheet and at substantially the midpoints of the long sides thereof, and applying to one side of said sheet a layer of generally flexible sound absorbing material.

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11. The method of forming blanks which may be readily bent and assembled into tetrahedral space sound absorbers, which comprises severing an elongated web of predetermined width along zig-zag lines between opposite sides of said web at an angle of substantially 60° to the longitudinal axis thereof to form a plurality of alternately arranged similar integral sheets in the form of equilateral triangles of substantially the full width of said web which may be divided into four substantially equal equilateral triangular portions with narrow substantially straight securing flaps along the outer edges of said portions and constituting substantially the entire material of said web between the lines of severance, forming fold lines in each of said sheets delineating said triangular portions and dividing said flaps therefrom with three of said fold lines connecting substantially the midpoints of the sides of said sheets inwardly of said flaps, cutting out portions at the corners of the sheet and at substantially the midpoints of the sides thereof, and applying to one side of said sheet a layer of generally flexible sound absorbing material.

References Cited in the file of this patent

UNITED STATES PATENTS

204,441	Marshall	June 4, 1878
628,465	Horning	July 11, 1899
720,864	Walter	Feb. 17, 1903
781,082	Morris	Jan. 31, 1905
2,502,016	Olson	Mar. 28, 1950

FOREIGN PATENTS

758,968	France	Nov. 7, 1933
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