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AUDIOMETRIC ENCLOSURE

Filed July 22, 1968

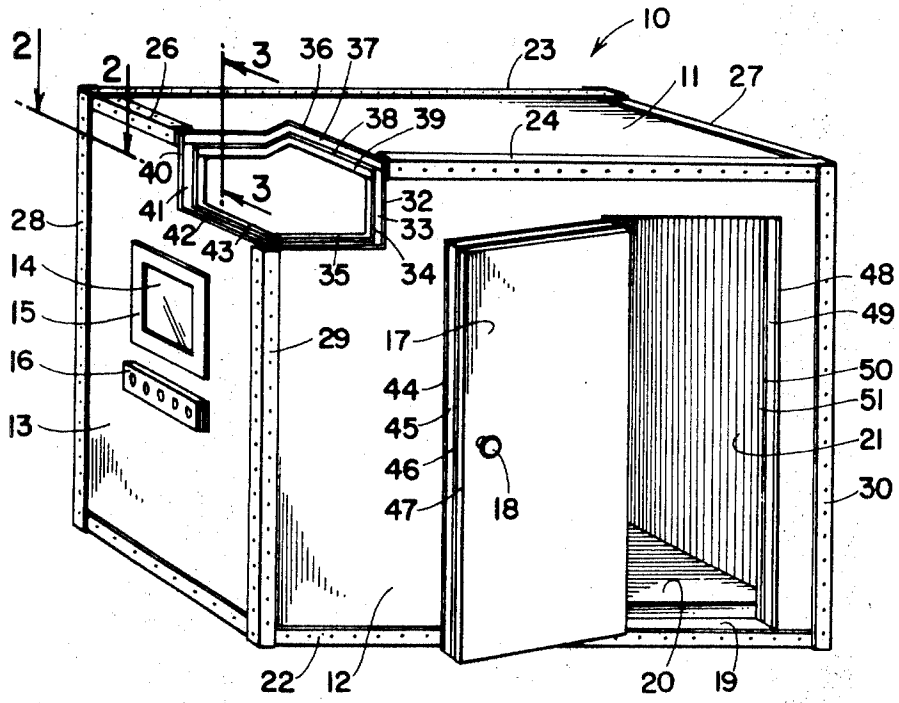


FIG. 1

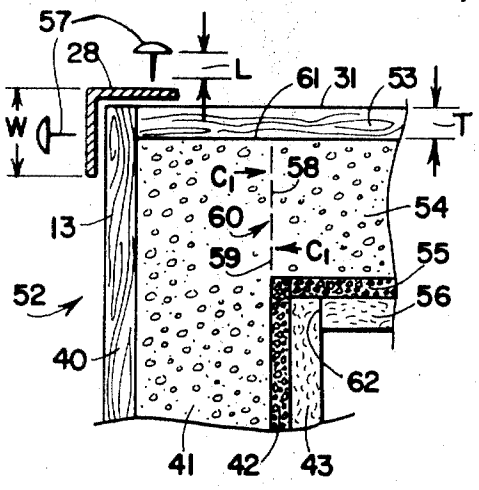


FIG. 2

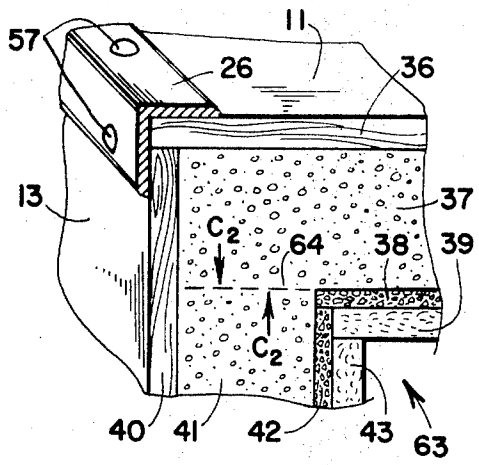


FIG. 3

INVENTOR:
JOHN THOMAS WOODS
BY
Elliott & Pastoriza
ATTORNEYS

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AUDIOMETRIC ENCLOSURE

John Thomas Woods, 513 Howie Court,
Santa Paula, Calif. 93060

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ABSTRACT OF THE DISCLOSURE

An audiometric enclosure includes side wall, roof and floor panels that are secured together so that sounds from external sources can be greatly attenuated to make the enclosure soundproof. Each panel is of sandwich construction including an intermediate layer of sound absorption material such as polyurethane foam. The panels are joined together at corner joints by angle bars and fasteners that do not penetrate through the sound absorption material. By preventing the fasteners from penetrating through the sound absorption material numerous leakage sources through which external sound could otherwise enter the enclosure are eliminated.

This invention relates to soundproof rooms and more specifically to audiometric enclosures.

BACKGROUND OF THE INVENTION

Numerous situations require that noise and lesser sounds be blocked from penetrating enclosures in which particular acoustical environments are to be created or regulated. When sounds such as speech signals originating in adjacent rooms or ambient areas become transmitted into the enclosure then the acoustical environment becomes disrupted making important objectives impossible to attain.

By way of illustration, the enclosure may be an audiometric enclosure for permitting doctors to obtain psychoacoustic, bioacoustic or other medical data from patients, school nurses or supervisors to screen students and hearing aid dealers to accurately diagnose hearing deficiencies of customers. The audiometric enclosure may be a modular room, incorporated as an integral room within a building or may be a mobile testing unit. In all of these situations it is imperative to reduce external sounds to a prescribed low level.

The use of sound absorption building materials and barriers have been employed in conventional audiometric enclosures in order to exclude external sound waves from entering the enclosure. It is known to employ sound absorbing barriers including porous or fibrous materials that serve to dissipate and attenuate sound energy by converting it into thermal energy as a result of the sound waves creating friction upon the cavities defined by the porous or fibrous materials. The materials may be polyurethane or polyvinyl foam or porous rubber. Although barriers constructed of these materials have succeeded in reducing sound transmission and soundproofing the audiometric enclosures these conventional systems often fail to attenuate the sound to a tolerable level.

One reason for this deficiency is that the sidewall, roof

and floor panels that are conventionally joined together to define the enclosure for the audiometric room incorporate fasteners that penetrate at least partially into the corner joints. These fasteners which are ordinarily metallic serve as sound transmitting conduits thereby permitting sound to leak into the enclosure. Merely increasing the thickness or density of the sound absorbing barrier fails to overcome the sound transmission properties of the fasteners. The fasteners and other connection elements often extend entirely through the barriers and panels into the audiometric enclosure to seriously minimize the effectiveness of sound attenuation properties of the sound barriers.

BRIEF SUMMARY OF THE INVENTION

Briefly described, the present invention comprehends an audiometric enclosure whose panels are constructed and assembled together so as to effectively attenuate external sounds that otherwise would be transmitted through the panels into the enclosure. Each corner joint defined by mutually intersecting side wall, roof and floor panels includes a first wall portion including inner and outer layers and an intermediate layer of sound absorption material which may be polyurethane. A second wall panel, angularly aligned relative to the first wall panel, also includes inner and outer layers as well as an intermediate layer of sound absorption material. The panels are joined together by joining means so that an inner side portion of one intermediate layer and an adjacent end portion of the other intermediate layer are forced together to constitute a compression seal for improving sound attenuation.

The joining means may include an angle bar held against adjacent portions of the panels and fastening elements that secure the angle bar to the panels, the elements being shorter than the thicknesses of the panel outer layers. By preventing penetration of the fastening elements through the sound absorption material, even to the slightest depth, numerous sound leakage sources through which external sound could enter the enclosure are effectively eliminated.

In order to allow the panel portions to accurately interfit the combined ends of the first inner, outer and intermediate layers define a stepped configuration and the combined ends of the second inner, outer and intermediate layers constitute a second stepped configuration shaped to snugly fit against the first stepped configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous benefits and unique aspects of the present invention will be fully understood when the following detailed description is studied in conjunction with the drawings, in which:

FIG. 1 is a perspective view of an audiometric enclosure with a corner portion broken away to show how the panels are joined together;

FIG. 2 is a sectional, partially exploded view showing a corner joint taken along line 2—2 of FIG. 1; and

FIG. 3 is an enlarged sectional view taken along line 3—3 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, a soundproof booth or audiometric enclosure **10** is shown that may be used for examining or testing people to obtain information for various purposes. Audiometric enclosure **10** includes a roof panel **11**, front wall panel **12** and side wall panel **13** that intersect at a corner which has been broken away to illustrate various details. Sidewall **13** mounts an observation window **14** that may have double panes of safety glass separated by a vacuum space to assist in isolating sound. The windows are connected only to the wall which they are part of, and have no rigid or through connections with the other walls. Window **14** is surrounded at its outer margins by a frame **15** which may possess a tight, dustproof seal. An audiometer jack panel **16**, secured in a conventional manner to sidewall **13**, includes the usual electrical wires and controls for regulating a patient's hearing equipment (not shown).

Front wall **12** includes a door **17** having a door handle **18** and a step **19** that the patient may use to walk onto floor panel **20**. Another sidewall panel **21** may also include an observation window such as that in sidewall panel **13**. A stringer **22** which may be an angle bar constructed of lightweight metal such as aluminum, assists in joining front wall panel **12** and floor panel **20** together. A pair of top stringers **23** and **24**, beams **25**, **26** and **27** as well as vertical members or columns **28**, **29** and **30** are arranged to assist in holding adjacent panels together. For example, column **28** assists in holding together sidewall panel **13** and a rearwall panel **31**.

Front wall panel **12** is of sandwich construction and includes an outer layer **32** which may be plywood or particle board, an intermediate layer **33** of sound absorption material, an inner layer **34** of untempered masonite and another inner layer **35** constructed of acoustical tile material. In a similar manner, roof panel **11** includes sandwich layers **36**, **37**, **38** and **39** constructed from the same materials used in constructing layers **32**, **33**, **34** and **35**. Also side wall panel **13** has layers **40**, **41**, **42** and **43** that correspond with layers **32**, **33**, **34** and **35** of front wall panel **12**. The sound absorption material is preferably a cellular or foam plastic such as polyurethane foam.

Door **17** includes sandwich layers **44**, **45**, **46** and **47** that correspond with and are designed to mate against door jamb sandwich layers **48**, **49**, **50** and **51**. Layers **45** and **49** are polyurethane foam which, when the door is firmly shut, are pressed together in a compression seal to block external sounds from entering inside audiometric enclosure **10**.

FIG. 2 shows a soundproof corner joint **52** where sidewall panel **13** is joined with rearwall panel **31**. Rearwall panel **31** is of sandwich construction divided into an outer layer **53**, an intermediate layer **54** of polyurethane foam an inner layer **55** and another inner layer **56** of acoustical tile material. Aluminum angle bar **28**, shown spaced from the corner, is positionable against outer layers **40** and **53**. A series of fastening elements **57** such as sheet metal screws are designed to hold angle bar **28** tightly against the corner.

The diverging arms or webs of angle bar **28** have a width W that is equivalent to or exceeds the thicknesses T of outer layers **40** and **53**. The lengths L of fastening elements **57** are shorter than thicknesses T so that they cannot penetrate, even to the slightest depth, into outer layers **40** and **53**. By proportioning the lengths L of fasteners **57** to be shorter than the thicknesses T of outer layers **40** and **53** potential sound leakage paths are eliminated and overall sound attenuation is greatly improved over conventional constructions. As previously mentioned, the corner connections or joints of conventional audiometric enclosures often incorporate fasteners that pass entirely through the panels or walls enabling external sounds to be transmitted inside the audiometric enclosures.

The various angle bars are interconnected so as to press intermediate layer **41** and intermediate layer **54** tightly together. Under this stress an inner side portion **58** of intermediate layer **41** and the end portion **59** of intermediate layer **54** constitute a compression seal at their interface **60**. Compression stresses C_1 constitute the strength of the compression seal. When panels **31** and **13** are aligned in mutual perpendicular relationship, polyurethane foam side portion **58** and polyurethane end portion **59** are arranged in butt joint relationship. The compression seal is characterized by sufficient stress to prevent sound from penetrating into the audiometric enclosure through paths that might otherwise develop along interface **58**.

In order to promote tight and accurate interfitting between the adjacent ends of panels **13** and **31** the ends are fabricated to be of complimentary configuration. Accordingly, the combined ends of the layers of panel **13** have a stepped configuration **61** and the combined ends of the layers of panel **31** also have a stepped configuration **62** shaped to interfit with stepped configuration **61**.

FIG. 3 shows another typical soundproof corner joint **63** defined by the zone of intersection between top panel **11** and side panel **13**. It can be seen that polyurethane foam intermediate sections **41** and **37** are pressed together in compression sealing engagement at interface **64**. The compression stress C_2 is sufficient to block all potential leakage passageways.

OPERATION

Keeping the above construction in mind, it can be understood how many of the previously described disadvantages of prior art audiometric enclosures are overcome or substantially eliminated by the present invention.

After the various layers of the individual panels are glued together by various suitable adhesives the panels may be easily assembled together. In accordance with one of many assembly techniques, the side, front and rear panels are raised to erected positions on the floor panel. Adjacent panel ends of stepped configuration are fit together and then the angle bars and fasteners are assembled to constitute soundproof corner joints. The corner joints are made sufficiently tight so that the polyurethane foam portions of adjacent panels are pressed together to make compression seals. The roof panel is then raised to the proper elevation, and dropped into position and secured to the adjacent panels.

The completed audiometric enclosure is very lightweight and the individual panels can be easily carried by two people to different locations.

From the foregoing it will be evident that the present invention has provided an audiometric enclosure in which all of the various advantages are fully realized.

What is claimed is:

1. An audiometric enclosure having wall, roof and floor panels joined together and partially surrounded by an envelope of sound absorption material that is not interrupted by penetrating fasteners employed to join the panels together, the enclosure comprising:

(a) at least four sidewall panels, one panel of which includes a door;

(b) a roof panel;

(c) a floor panel, the panels being joined together so that the corners defined by intersecting panels each include:

(1) a first wall panel portion including inner and outer layers and an intermediate layer of sound absorption polyurethane foam material whose combined ends define a first stepped configuration;

(2) a second panel portion including inner and outer layers and an intermediate layer of sound absorption polyurethane foam material whose combined ends constitute a second stepped configuration shaped to make a complementary fit with the first stepped configuration; wherein, the panel portions are mutually angularly aligned

so that a flat inner side portion of one intermediate layer is disposed in butt joint relationship against a flat end portion of the other intermediate layer; and

(3) joining means for joining the panel portions and forcing the intermediate layers together to constitute a compression seal for improving sound attenuation; wherein the joining means for each corner includes fastening elements whose lengths are shorter than the thicknesses of the outer layers, and, an angle bar secured to the outer layers by said fastening elements which penetrate only into the outer layers so that sound attenuation through the corner can be improved.

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