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SOUND CONTROL WALL CONSTRUCTION

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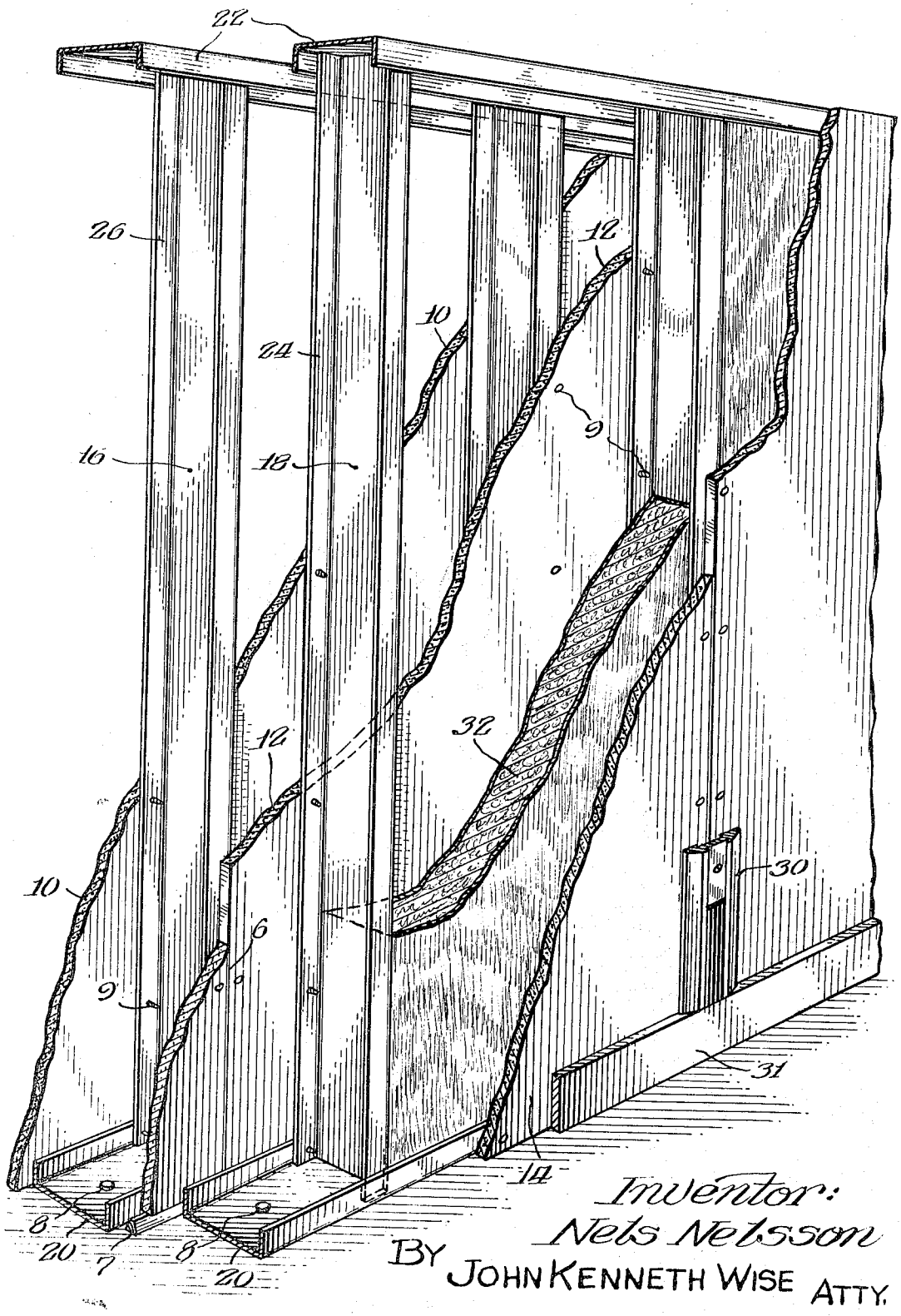

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SOUND CONTROL WALL CONSTRUCTION

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This invention relates to a hollow wall construction and more particularly to a lightweight wall construction which has superior sound control properties, especially with respect to sound transmission.

In the modern apartment house, office building, hotel and other buildings of this nature, sound insulation is becoming increasingly significant and this consideration is often difficult to satisfy simultaneously with other important requirements. The rising costs of construction have brought about a tendency to make nonload-bearing walls as thin and light as possible to save space and to reduce the strength requirements of the supporting structure. The problem is to build a wall which will have maximum opacity to sound with a minimum weight, a reasonable cost of construction and present a surface which will satisfy the practical and esthetic requirements of the building occupants.

The need for sound isolation is especially important in the construction of partitions designed for use as party walls, that is, walls separating occupancies in apartments, offices, motels and hospitals. In order for these partitions to be practical, the design must also provide a means of installing electrical outlets, plumbing, medicine cabinets and the like without destroying the sound isolation provided. In conventional wall construction, such service installations result in a ready path or short circuit for sound to pass through the partition with a consequent objectionable destruction of sound privacy in adjoining rooms.

Previously, sound isolation has been achieved by double wall partitions through costly and weighty modifications in the wall, as by increasing its mass or by acoustically isolating the walls one from the other. In one relatively expensive wall construction, for instance, the spaced apart walls are isolated one from the other by means of resilient clips attached to the support members. In other modifications to increase the mass of the partition, layers of building board are laminated together to form a heavy double or triple layer of laminated building boards for one side of a wall construction.

It is an object of this invention, therefore, to provide a wall or partition construction of relatively low weight which possesses adequate structural strength and is able to provide a high degree of sound insulation. It is a further object of this invention to provide a partition construction having desirable acoustical properties without the usual accompanying loss in structural rigidity.

Another object of this invention is to provide a wall or partition construction utilizing conventional materials wherein an exceptional degree of sound isolation is provided. It is a further object of this invention to provide a relatively fool-proof construction wherein the high degree of acoustical isolation provided is not destroyed by common installation of electrical outlets, plumbing, medicine cabinets and such within the wall construction.

These and other objects of the invention are obtained by the provision of a partition comprising three layers of wallboard in which a rigid septum board is positioned between two spaced apart parallel rows of vertical support members with the members in one parallel row offset from the members in the other row, in combination with two rigid face boards secured to the vertical support members, this forming one composite structure.

The vertical support members may be light gauge steel channels or box studs, wood, laminated gypsum board or other stud materials well known in the industry but a light gauge steel channel is preferred. By securing the septum member to the studs, improved structural versatility can be achieved with very little change in acoustic efficiency. The acoustical properties of the partition are further enhanced if the cavities between the studs are filled with a sound absorbing material such as mineral wool batts, cellular insulation, and foamed plastic.

Referring now to the drawing, a hollow partition of drywall construction is shown having three layers of spaced apart building boards **10**, **12** and **14**, respectively, secured to and spaced apart by two parallel rows of vertically extending support members **16** and **18**, respectively. The vertical support members **16** and **18** are, for example, conventional channel shaped metal studs secured in the usual manner to floor runners **20** and ceiling runners **22**. The studs of one row are located intermediate and are desirably spaced equidistant between the studs of the other parallel row.

In a preferred embodiment of our invention, the septum member **12** is a sheet of gypsum wallboard but other rigid materials such as mineral fiber sound deadening board and wood fiber acoustical board may be used. The septum member is secured to both rows of studs by adhesive means or with mechanical fasteners **9**, preferably metallic rotary type screw fasteners, such as are more particularly described in U.S. Patent No. 3,056,234, the fasteners engaging the inner flanges **24** and **26** of the studs. For optimum properties joints **6** in the septum member should be sealed with a bead of non-setting filler material or caulking compound **7** and this material should also be used to seal the septum to the ceiling and floor. It is preferred that the joints **6** be vertical and fall on a stud but the boards may be run horizontally and the seams caulked.

The face members **10** and **14** are preferably paper covered gypsum wallboard but other materials of similar physical properties may likewise be used. The surface joints may be finished with tape and joint compound according to procedures well known in the art but slightly superior acoustical performance has resulted when the joints were finished with the use of a batten strip **30**. The partition may be finished at the floor line with a conventional base **31**. Higher transmission loss ratings have been achieved when, in erecting the face layers of wallboard, the screw fasteners are used only at the margins of the board and the intermediate studs are attached to the board with a contact adhesive.

While the partition just described will give acoustical performance far superior to that heretofore known, this can be increased further by fillng the space between the studs with a sound absorbing material **32** such as mineral fiber batts, acoustical wool, etc. It also has been discovered that the acoustical performance of the partition can be measurably increased if the face layers **10** and **14** have an outer surface of plastic film. An adhesively attached layer of polyvinyl chloride 0.008" thick has been found very suitable but other thicknesses and films of other materials such as polyethylene, polypropylene, polyesters, etc., may be used.

To assemble the foregoing partition, a first row of floor and ceiling metal runners is installed, secured with suitable fasteners **8** to the floor and ceiling and then the vertical supporting members **24** are attached to the floor and ceiling runner at a spacing of about 24" center to center. The septum member is cut to approximately ceiling height, with the board disposed with its longitudinal dimension parallel to the vertical support members. The longitudinal edges of the building board are positioned so that they are located approximately at the center of the supporting member flanges **24**. In this manner, the building boards forming the center or septum wall abut each

other approximately at the center of the flanges. After securing the building boards to the first row of stud flanges, it is preferable to seal all of the perimeter joints, that is, the joints between adjoining or abutting wallboards and between the wallboard and the floor, ceiling and intersection with other walls to eliminate potential sound leaks using a non-hardening caulking compound, such as Press-Tite caulking, manufactured by the Presstite Engineering Company, St. Louis, Missouri, or drywall adhesive DWA–14, manufactured by United States Gypsum Company.

The second row of floor and ceiling runners and the second row of vertical studding are then installed in a similar manner to the installation of the first row of support members, but with the vertical support members in the second row approximately centered laterally between two adjoining support members in the first row.

After installation of the second row of support members, the septum layer of building boards is secured to the second row of support members by adhesive or with mechanical fasteners, such as 1" drywall screws spaced about twenty four inches center to center. Thus the septum board is securely fastened to both rows of support members on their inner flanges **24** and **26**, respectively, for maximum structural utility.

Ceiling height gypsum wallboards are then securely fastened to the exterior portions of the two rows of supporting members with the longitudinal edges of the wallboard positioned at about the vertical center of the stud flanges. Conventional fastener and finishing means may be used with respect to the face layers of the partition. In the preferred construction, the exterior walls are solid since greater sound isolation is thus provided by three solid spaced apart layers joined together by two offset rows of vertical support members offset one from the other horizontally. By "offset rows" of support members it is meant that the vertical support members in one row are positioned approximately median the support members in the other row, that is, the entire one row of support members is offset from the other row.

In addition to the construction illustrated, many modifications may be made and are contemplated here by applicants, such as forming the face layers on one or both sides of plain or perforated plaster base or metal lath and then providing a finished wall surface by plastering thereover. The exceptionally high sound isolation result achieved by applicant's construction is illustrated by the following Table A which presents the sound transmission resistance results of various triple wall partitions representative of applicant's invention in comparison to other constructions when determined and reported according to ASTM method E–90–61–T.

As will be noted, constructions (1), (2) and (3) in Table A relate particularly to the partition of this invention. Applicant used 1" rotary-type screw fasteners to secure the septum wall layer of one half inch thick gypsum wallboard to both rows of studs and also fastened the exterior layers of gypsum wallboard to the exterior portions of the studs by driving rotary-type screw fasteners through vertical aluminum batten strips along the longitudinal joint of the exterior wallboards, using contact type adhesive to secure the wallboard to intermediate studs.

It is to be particularly noted that the sound transmission class ratings of 53 to 56 achieved with partition assemblies (1), (2) and (3) are exceptionally high. Class ratings of about 55 have been reported to be near the practical limit for at about this value flanking paths of sound transmission become significant. This means that the amount of sound transmitted through the floors, ceilings, ducts, windows, etc., is large enough that a further reduction in the amount transmitted through the walls is of no consequence.

These high class ratings are even more surprising because of the relatively simple construction involved, and especially in view of the very light weight which was between 7 and 8 pounds per square foot. The next lightest

partition was the 2" solid partition of gypsum board (4) and this weighed over 10½ pounds per square foot and had a far poorer sound transmission rating. The other constructions, (5) to (7), all weighed over 11 pounds per square foot. Thus not only does the partition of this invention yield exceptionally good sound transmission loss results, but such results are obtained at a saving in unit weight, which may result in highly desirable savings in structural steel in a building.

TABLE A

Sound transmission rating of partitions

	Sound transmission class
(1) Preferred partition assembly of three spaced apart layers of half inch gypsum wallboard (1½ inches total) secured to 2 parallel offset rows of vertical metallic 2½ inch drywall studs with a two inch thick blanket of sound attenuating mineral wool between the septum layer and both face layers	54
(2) Partition assembly of same construction as (1) except vinyl coated gypsum wallboard used for exterior layers	56
(3) Partition assembly of same construction as (2) except mineral wool used between septum layer and one exterior layer only	53
(4) A two-inch solid partition of a one-inch thick gypsum board laminated on both sides to a layer of one-half inch gypsum board supported by metal floor and ceiling runners	34
(5) A hollow double wall partition of two walls each having a one-inch thick gypsum board laminated to an outer layer of one-half inch gypsum board, the walls separated by a 1" air space, supported by metal floor and ceiling runners	42
(6) A hollow double wall partition of 2 spaced apart walls of ⅝" gypsum wallboard secured to 3⅝" wide metal studs	39
(7) Same as (6) except each wall having 2 layers of ⅝" gypsum wallboard laminated together	46

From the above results shown in Table A it is apparent that the partition construction of this invention produces an exceptionally high and unexpected degree of sound isolation, and does so at no sacrifice in weight, cost or complexity. Various modifications of this structure will, of course, occur to those skilled in the art. For example, wood or laminated gypsum studs may be substituted for the metal channel studs previously described and the face layers may be comprised of gypsum wallboards laid horizontally, the horizontal joint between boards in such construction being sealed either by tape and sealing compound or by a horizontal batten strip.

While I have shown several embodiments of my invention above, I do not wish to be limited thereto, since many modifications of my invention may be made, and it is, therefore, contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. A sound control partition comprising, in combination, first and second parallel rows of studs, the studs of said first row being intermediate the studs of said second row, said rows being offset by a distance equal to the thickness of a septum member, a rigid planar septum member between said rows of studs, securing means attaching said septum member to the studs in each of the two rows, said securing means attaching said septum to a stud in said first row being laterally spaced from said securing means attaching said septum member to a stud in said second row, and first and second outer surface defining layers attached to said first and second rows of studs respectively and parallel to said septum member.

2. The partition of claim 1 wherein the septum mem-

ber comprises ceiling height boards of set calcined gypsum arranged with the longitudinal edges in side by side relationship and a resilient grout sealing the joints between adjoining boards.

3. The partition of claim 1 wherein the septum member and the outer surface defining layers are gypsum board about one-half inch thick and the partition weighs less than about eight pounds per square foot.

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