April 27, 1954 V. JACOBSON 2,676,678

WALL AND WALL ELEMENT

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FIG. 1

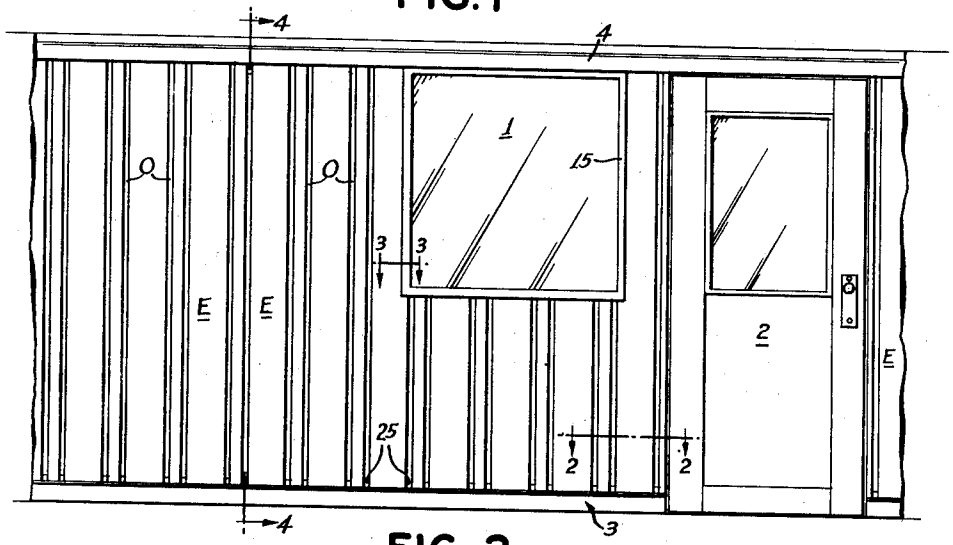


FIG. 2

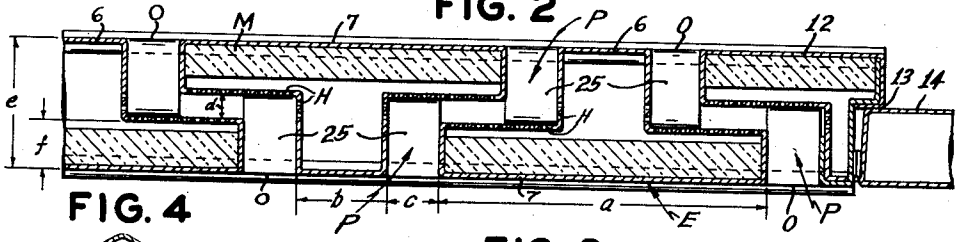


FIG. 4

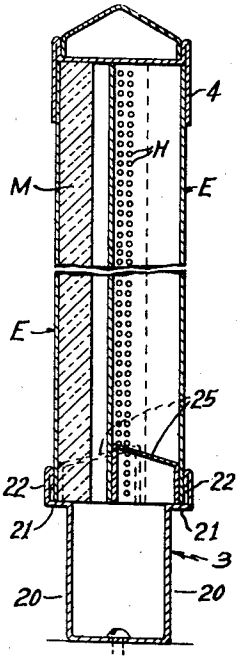


FIG. 3

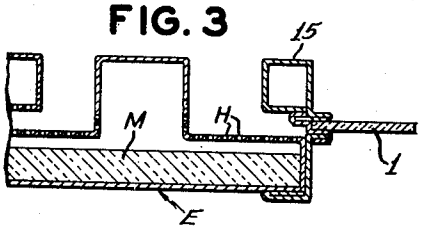


FIG. 5

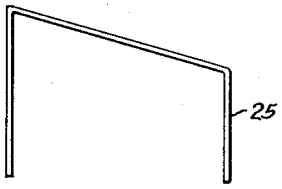
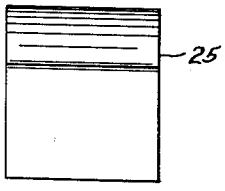


FIG. 6



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FIG. 7

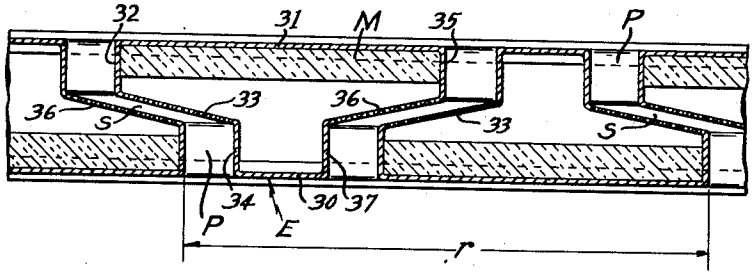


FIG. 8

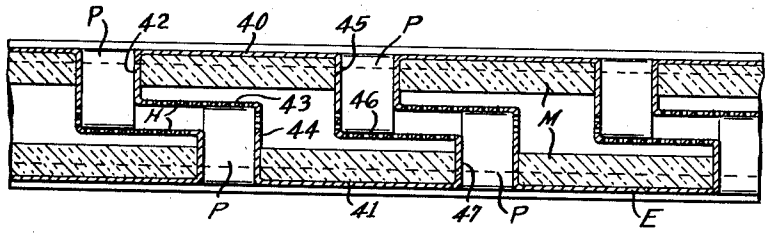
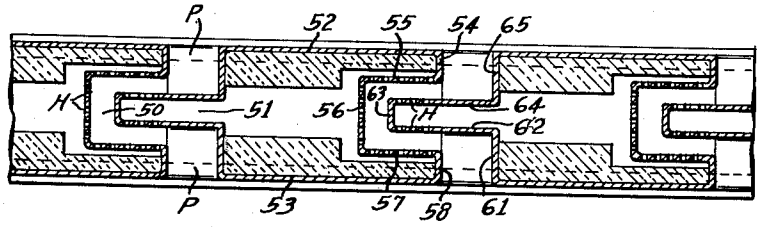


FIG. 9



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UNITED STATES PATENT OFFICE

2,676,678

WALL AND WALL ELEMENT

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Application January 19, 1951, Serial No. 206,750

11 Claims. (Cl. 189—34)

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This invention relates to walls or partitions for buildings and has for its object the provision of an improved wall and improved members for forming the wall. The invention is concerned with both interior and exterior walls or partitions such as for homes, offices and factories, and provides wall members and walls of simple construction which have good acoustic and ventilating characteristics.

The wall of my invention has a plurality of spaced upright tortuous passages extending completely through the wall. The passages have narrow upright openings on the opposite sides and are within passage-forming members shaped to provide a tortuous path for sound waves but which offer little resistance to the passage of air. By a tortuous passage, I mean a passage which is so curved or bent by the confining surfaces or walls thereof that neither light nor sound can pass straight through from opening to opening. The surfaces of the passages are so shaped that the sound waves impinge thereon and are reduced in intensity in going through the passages. The wall members are made of such materials and are so constructed that an effective part of the sound energy is absorbed on impingement with the result that the sound level is very materially reduced.

The invention provides individual wall-forming elements of simple construction which can be erected in spaced relation, thereby forming a wall having spaced wall sections and the intervening tortuous passages. In a particularly advantageous embodiment of the invention, I provide wall elements formed of sheet metal bent to enclose a hollow interior containing a sound absorbing material which have an angularly disposed cross-section and which are relatively long, preferably extending the height of the wall. When these elements are suitably spaced apart, there is formed a wall having alternate similar wall sections with intervening tortuous passages. The entire wall permits a relatively free passage of air for ventilating, heating or cooling but which does not permit visibility or the uninterrupted passage of sound. In short, the invention forms rooms having privacy of both sight and sound with a free passage of air.

In an example of a preferred construction, I form the elements of sheet metal bent to form an enclosed hollow cell of T cross-section of any desired length and having a sound-absorbing material inside. Those surfaces which define the passages on which the sound waves impinge are preferably perforated to permit absorption of an

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appreciable part of the sound with a resulting diminution of the sound from surface to surface as it passes through the tortuous passages. The wall elements are so shaped that the surface embracing the top of the T lies in one wall surface and the surface embracing the bottom of the T lies in the opposite wall surface and is much narrower than the surface of the top. The wall members of T cross-section are erected in reversed side relation forming a wall having identical opposite surfaces, each comprising alternate wide and narrow surfaces and intervening narrow openings. By an appropriate selection of colors for the surfaces and the background surfaces in the passages, a very pleasing effect is attained.

These and other objects of the invention will be better understood after considering the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a side elevation of a wall embodying the invention;

Fig. 2 is an enlarged sectional view at 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view at 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view at 4—4 of Fig. 1;

Figs. 5 and 6 are side and end views, respectively, of bottom closures for the wall elements, and

Figs. 7, 8 and 9 are horizontal cross-sectional views of modified forms of wall elements and walls.

Fig. 1 illustrates an embodiment of the invention in which the wall includes a window 1 and a door 2. The wall elements E are of such length that they extend from the base member 3 which is attached to the floor to the cornice 4. However, the wall elements may be of any suitable length and may be cut to fit a particular situation, as where a window or door is installed.

As best shown in Fig. 2, the individual wall elements are formed of sheet metal, preferably a metal of such stiffness or rigidity with respect to the dimensions that there is a minimum of vibration; for example when the maximum width of the element is about 7½ inches, 20 gage steel is satisfactory. The sheet metal is bent to form a structure having the cross-sectional area of a T and is connected along the contacting edges at any suitable place to form an enclosed cell which is conveniently left open at the top and bottom. The base 6 of the T is a relatively narrow flat surface which forms part of the wall surface on one side of the wall. The top 7 of

the T is a relatively wider flat surface forming a part of the wall surface on the opposite side. As best illustrated in Figs. 1 and 4, the wall elements are supported below in the base member **3** and at the top in the cornice **4** and are not otherwise connected or supported. They are mounted in such spaced relation as to form between adjacent elements the tortuous passages P, each of which has an elongated rectangular and relatively narrow opening O in each side of the wall. It will be apparent from Fig. 2 that the tortuous passages do not present a straight line passage for either sound or light but that they offer relatively no obstruction to the free passage of air for ventilating, heating, and cooling purposes. Sound waves passing into the passage P from either opening must strike the flat sound-absorbing surfaces defining the passages, and will be reduced in intensity before eventually passing through to the opening on the opposite side. In order to minimize the amount of reflected sound energy which impinges upon these surfaces, I provide a multiplicity of small holes H in the surfaces through which a substantial portion of the sound energy passes and is prevented from being deflected. The sound energy accordingly diminishes in passing through the tortuous passages and only an unobjectionably small amount of sound passes through. The sound passing through may be of such a low level that it can easily be confused with other sounds on the opposite side of the wall and thus rendered inaudible or unobjectionable. In order to increase more effectively the absorption of the sound in the passages and its dissipation within the elements, I provide inside of each enclosed cellular space of the wall elements any suitable porous or fibrous sound-absorbing medium M such as spun glass, rock wool, or fibrous sheet material.

In one embodiment of the wall illustrated in Figs. 1 to 4, the following dimensions in inches for each wall element may be used: *a*—7½; *b*—2⅛; *c*—$1\frac{3}{16}$; *d*—½; *e*—3; and *f*—1¼.

In order to facilitate the erection of a complete wall with doors and windows, I may provide specially shaped wall elements **12** formed to provide a door jamb **13** for the door **14**. I may also attach to one edge portion of the wall element a window casing and trim **15** shaped to receive a window **1**. Any suitable or convenient means for installing the windows or doors may, of course, be used.

As shown in Fig. 4, the base **3** is inset to provide a kick-space **20** on each side of the wall and lateral flanges **21** on which the wall elements rest and are secured within the upturned ends **22**. In order to close the bottom portions of the passages where the elements E rest on the base **3**, the closures **25** (Figs. 5 and 6) are inserted as best shown in Fig. 4.

The modification shown in Fig. 7 comprises wall elements E having T-shaped cross-sections with bottoms **30**, tops **31**, and interior passage-forming sides **32, 33, 34** and **35, 36, 37**. The side portions **33** and **36** are sloped as shown and in the erected wall the adjacent sloped portions are in parallel spaced relation forming a part of the passages P. One of the important features of the construction of Fig. 7 is that the spaces S between the sloping sides **33** and **36** can be widened or narrowed by suitably shifting the elements by setting them wider apart or closer together. In other words the passages S are internal throats of variable widths. In a repeating width as measured, say, the distance *r*, for example 12 inches, the maximum width of space S is 15% of *r*. Any desired narrower width may be employed. The surfaces **33** and **36** are provided with a multiplicity of small holes for the entrance of sound and the interior is provided with a layer of fibrous sound-absorbing material M. While the elements of Figs. 1 to 4 may be spaced varying distances apart to change the width of openings O, the interior portion of the passage P does not vary in width.

The modification shown in Fig. 8 comprises elements E which have what I call a Z cross-sectional shape. These elements are formed of sheet metal, say 20 gage steel. The surfaces **40** and **41** form the wall surfaces and the surfaces **42, 43** and **44** of one side and the surfaces **45, 46** and **47** of the opposite side form the passages P. The surfaces **43** to **46** are preferably provided with a multiplicity of small holes H for the absorption of sound. The hollow cellular interior of the members is provided with sound-absorbing material M.

The modification shown in Fig. 9 comprises elements E which in cross-section resemble the so-called tongue-and-groove lumber. The elements of this invention, however, are cellular being formed of sheet metal and the grooves **50** are materially wider than the tongues **51**. The surfaces **52** and **53** form the wall surfaces on opposite sides of the wall. Surfaces **54, 55, 56, 57** and **58** form the end comprising the groove and are provided with a multiplicity of small holes H for the absorption of sound. The surfaces **61, 62, 63, 64** and **65** form the end comprising the tongue and surfaces **62, 64** are preferably provided with a multiplicity of small holes H for the absorption of sound. It will be apparent from the drawing that by spacing the elements a suitable distance apart, say, from 1 to 1½ inches, that the tortuous passages P are formed therebetween. In order to absorb the sound which enters the small holes H, the hollow interiors of the elements are provided with sound-absorbing material M such as rock wool, spun glass, or fibrous sheet material.

The walls of the invention are preferably so proportioned that the widths of the passages P do not exceed about 15% of the repeating widths of the elements in the wall. It will be apparent, therefore, that the openings of the tortuous passages comprise but a minor proportion of the wall surface.

The improved wall elements and walls of my invention have general building utility as in forming the interior walls or partitions of offices, schools, hospitals, factories, and the like. They may also be used for the exterior walls of dwellings, especially for erection in the warm or tropical regions and to this end the openings to the tortuous passages may be provided with shutter closures, screens, or both. When the elements are constructed of aluminum, for example, there is an effective reflection of heat and a very durable building of low initial and maintenance costs can be provided which gives a combination of privacy and ventilation not heretofore attainable.

I claim:

1. A metal wall element of relatively great length but small cross-sectional dimensions, the longitudinally extending sides enclosing a space therebetween, two diametrically opposite sides of said element forming the surfaces of a wall constructed of said elements, the other diametrically opposite sides being discontinuous and offset, said

other opposite sides having a multiplicity of small holes for the entrance of sound, and a sound-absorbing material in the space inside the element underlying said holes.

2. A wall element according to claim 1 having a cross-section in the form of a T.

3. A wall element according to claim 1 having a cross-section in the form of a Z.

4. A wall element according to claim 1 having two flat opposite sides, one side having a projecting hollow tongue and the opposite side a groove.

5. A hollow metal wall element in the form of a T in cross-section and of indefinite length but appreciably longer than any cross-sectional dimension, two diametrically opposite sides of said element being flat for forming the surfaces of a wall constructed of said elements, the other diametrically opposite sides of said element being discontinuous and offset, a multiplicity of holes in the offset portions to absorb sound impinging thereon, and sound absorbing material in the element positioned to receive sound passing through the holes.

6. A ventilating acoustic wall comprising on each side a plurality of upright relatively narrow and relatively wide wall surfaces in alternate arrangement and spaced apart to form therebetween narrow upright openings, and tortuous passages extending through the wall from the openings on one side to the openings on the other side, the surfaces in the passages on which sound waves impinge being perforated and sound absorbing material adjacent the perforations, said passages permitting the free passage of air but effectively reducing the passage of sound.

7. A wall having a plurality of spaced upright tortuous passages with openings on opposite sides of the wall shaped to prevent the straight line passage therethrough of light and sound, said passages being Z-shaped in horizontal section and having surfaces on which sound waves impinge and are deflected in part to other impinging surfaces, said surfaces in the Z-shaped passages having a multiplicity of holes for receiving and absorbing a part of the sound, and narrow upright wall surfaces on each side of the wall between the openings.

8. A ventilating acoustic wall comprising on each side a plurality of upright relatively narrow wall-forming surfaces spaced apart to form therebetween narrow upright openings on each side, tortuous passages extending through the wall from the openings on one side to the openings on the other side and over substantially the entire height of the wall, and sound-absorbing means in the passages and comprising perforated surfaces overlying sound absorbing material, said passages permitting the free passage of air but preventing the straight line passage of light and effectively reducing the passage of sound.

9. A wall element formed of sheet metal and angularly bent and connected along its abutting longitudinal edges to form a hollow interior and diametrically opposite flat wall-forming sides and two other diametrically opposite sides angularly disposed with respect to the wall-forming sides, said latter sides being angularly shaped to provide angularly disposed side portions having a multiplicity of small holes for the absorption of sound, and a sound-absorbing material in the hollow interior underlying the said holes.

10. A wall element according to claim 9 having a cross-section in the form of a T and one of said angularly disposed side portions on each side of the element being sloped so that when placed adjacent a similar sloping side portion of another element there is formed a tortuous passage of variable width.

11. A ventilating acoustic wall according to claim 8 in which the maximum width at the smallest dimension of the tortuous passages is 15% of the width of the repeating units of the wall.

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