Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

[0001] The present invention relates to a shearwall for opposing lateral forces on building walls, and in particular to a prefabricated shearwall including a central diaphragm having a corrugated or non-planar cross section to improve the ability of the shearwall to withstand lateral forces such as those generated in earthquakes, high winds, floods and snow loads. Shearwalls were developed to counteract the potentially devastating effects of natural phenomena such as seismic activity, high winds, floods and snow loads on the structural integrity of light-framed constructions. Prior to shearwalls and lateral bracing systems, lateral forces generated during these natural phenomena often caused the top portion of a wall to move laterally with respect to the bottom portion of the wall, which movement could result in structural failure of the wall and, in some instances, collapse of the building. Shearwalls within wall sections of light-framed constructions provide lateral stability and allow the lateral forces in the wall sections to be transmitted through the shearwalls between the upper portions of the wall and the floor diaphragm or foundation of the building where they are dissipated without structural effect on the wall or building.

[0002] In constructions such as residences and small buildings, a lateral bracing system typically includes vertical studs spaced from each other and affixed to horizontal top and bottom plates. The bottom plate is typically anchored to the floor diaphragm or foundation. The bracing system typically further includes sheathing affixed to the studs, upper plate and/or lower plate to increase structural response to lateral forces. The sheathing used is generally oriented strand board (OSB) or plywood, but fiberboard, particleboard and drywall (gypsum board) are also used. Alternatively or additionally, light-frame construction wall sections may include prefabricated shearwall sections, which can be positioned between the vertical studs and affixed to the studs and the top and bottom connecting plates. The sheathing or prefabricated panels can also be placed adjacent door and window frames to improve the response to lateral forces at these locations.

[0003] A conventional prefabricated shearwall 20 is shown in the perspective and cross-sectional views in Figs. 1 and 2. The shearwall includes an interior diaphragm 22 formed of thin gauge sheet steel which is affixed to an exterior wooden frame 24. The diaphragm is conventionally planar with the edges along the length of the diaphragm being formed to respective lips 26 and 28. The lips 26, 28 allow the diaphragm to be affixed to the wooden frame. While a prefabricated shearwall of the construction shown in Figs. 1 and 2 provides lateral force response and resistance, it has limitations with respect to its lateral load bearing capabilities. There is, therefore, a need for an improved shearwall capable of withstanding greater lateral loads.

[0004] In an aspect of the present invention, there is provided a shearwall as claimed in claim 1. It is an advantage of the present invention to provide a shearwall having improved lateral load bearing characteristics relative to similarly sized shearwalls. It is another advantage of the present invention to provide a shearwall having improved lateral load bearing characteristics without adding to the size or materials used relative to conventional shearwalls.

[0005] In order to distribute the significant compressive forces exerted by the shearwall over a large surface area on the underlying support surface, the shearwall further includes a flat sill plate affixed to the bottom edge of the central diaphragm. The sill plate has a footprint at least equal to that of the central diaphragm. The chords further improve the resistance of the shearwall to lateral forces.

[0006] The shearwall also includes a pair of reinforcing chords affixed to the end sections of the central diaphragm. The chords may be formed of 2 inch (5 cm) x 4 inch (10 cm) wooden studs having a height equal to that of the central diaphragm. The chords further improve the resistance of the shearwall to lateral forces.

[0007] While a preferred embodiment of the invention includes a central diaphragm with a corrugation having a constant size and shape from the top edge to the bottom edge, the corrugation may be formed so that it is larger at the bottom edge of the central diaphragm and slopes inward to become smaller toward the top edge of the
central diaphragm (or visa-versa). This results in a shear-wall providing even greater lateral force resistance, as the sloped lines defined by the bends at the intersection between the various diaphragm sections have lateral components that exhibit increased resistance to movement in the lateral direction.

[0016] The present invention will now be described with reference to the drawings in which:

FIGURE 1 is a perspective view of a prefabricated shearwall panel according to the prior art;

FIGURE 2 is a cross-sectional view through line 2-2 of Fig. 1 showing the prefabricated shearwall panel according to the prior art;

FIGURE 3 is a perspective view of a prefabricated shearwall according to an embodiment of the present invention;

FIGURE 4 is a cross-sectional view through line 4-4 of Fig. 3 showing the prefabricated shearwall according to an embodiment of the present invention;

FIGURE 5 is an exploded perspective view of the prefabricated shearwall according to an embodiment of the present invention;

FIGURE 6 is a perspective view of a shearwall according to an embodiment of the present invention mounted to an underlying support surface such as a building foundation;

FIGURE 7 is a front view of a shearwall according to an alternative embodiment of the present invention where the size and shape of the corrugation changes from the top edge to the bottom edge of the shearwall;

FIGURE 8 is a cross-sectional view through line 8-8 of Fig. 7;

FIGURE 9 is a cross-sectional view through line 9-9 of Fig. 7;

FIGURE 10 is a cross-sectional view through line 10-10 of Fig. 7;

FIGURE 11 is a front view of a shearwall according to a further alternative embodiment of the present invention similar but inverted with respect to Fig. 7;

FIGURE 12 is a front view of a shearwall according to a further alternative embodiment of the present invention where the size and shape of the shearwall changes from the top edge to the bottom edge of the shearwall;

FIGURE 13 is a front view of a shearwall according to a further alternative embodiment of the present invention where the size and shape of the corrugation changes from the top edge to the bottom edge of the shearwall;

FIGURE 14 is a cross-sectional view through line 14-14 of Fig. 13;

FIGURE 15 is a cross-sectional view through line 15-15 of Fig. 13;

FIGURE 16 is a cross-sectional view through line 16-16 of Fig. 13;

FIGURE 17 is a front view of a shearwall according to a further alternative embodiment of the present invention where the shearwall has cutout sections in the surface of the central diaphragm;

FIGURE 18 is a cross-sectional view through line 18-18 of Fig. 17;

FIGURE 19 is a cross-sectional view through line 19-19 of Fig. 17;

FIGURES 20 through 24 are cross-sectional views of alternative embodiments of the central diaphragm which may be used in the present invention;

FIGURE 25 is a cross-sectional view from the same perspective as Figs. 20 through 24, further including an embossment;

FIGURE 26 is a side view of an embossment shown in Fig. 25;

FIGURE 27 is a cross-sectional view from the same perspective as Figs. 20 through 24, further including an inwardly facing stiffening lip;

FIGURE 28 is a cross-sectional view from the same perspective as Figs. 20 through 24, further including an outwardly facing stiffening lip;

FIGURES 29 and 30 are cross-sectional views of a further alternative embodiment of the present invention; and

FIGURE 31 is a front view of the embodiment of the present invention shown in Figs. 29 or 30.

[0017] The present invention will now be described with reference to Figs. 3 through 31, which in embodiments relate to a prefabricated shearwall panel including a central diaphragm having a non-planar cross-section to improve the lateral load bearing characteristics of the panel. It is understood that the present invention may be
embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather these embodiments are provided so that this disclosure will be thorough and complete and will fully convey the invention to those skilled in the art. Indeed, the invention is intended to cover alternatives, modifications and equivalents of these embodiments, which are included within the scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be clear to those of ordinary skill in the art that the present invention may be practiced without such specific details.

Referring now to Figs. 3 through 4, there is shown a prefabricated shearwall 100 according to an embodiment of the present invention. The shearwall 100 includes a central diaphragm 102 having a height, width, and depth, each perpendicular to each other and denoted as h, w and d, respectively, in Fig. 4. In embodiments of the present invention, the central diaphragm 102 includes a top edge 101 and a bottom edge 103 generally defining the height of the central diaphragm, and a pair of end sections 104 and 106 generally defining the width of the central diaphragm. The diaphragm 102 further includes a corrugation 108 defined by rear planar sections 110 and 112, angled sections 114 and 116, and front planar section 118. While the corrugation 108 is shown comprised of planar sections joined at angles with respect to each other, it is understood that the corrugation 108 may have different configurations in alternative embodiments. As used herein, a corrugation may be any ridge, groove or angle formed in central diaphragm 102 extending in the height direction at least partially between the top edge 101 and the bottom edge 103. The ridge, groove or angle lies in between the end sections 104, 106 in a plane different from that of an adjacent section which also extends in the height direction between the top and bottom edges 101, 103 in between the end sections 104, 106.

Some alternative embodiments of the central diaphragm are shown in Figs. 7 through 28 and discussed hereinafter. In addition to adding increased resistance to compressive loads (i.e., those parallel to the diaphragm height), the corrugation 108 increases the cross-sectional area and its ability to withstand lateral forces (i.e., those parallel to the diaphragm width). Moreover, the corrugation 108 provides increased ductility to the shearwall in the lateral direction.

In embodiments of the present invention, the central diaphragm may have an overall height of 93½ inches (237 cm), an overall width of 12 inches (30 cm), and a depth of 2½ inches (6 cm). It is understood that each of these dimensions may be varied in alternative embodiments, both proportionately and disproportionately with respect to each other. For example, in one alternative embodiment, the central diaphragm may have an overall width of 18 inches (46 cm). Each of the sections 104, 106 and 110 through 118 is preferably the same height. In embodiments where the overall width is 12 inches, end sections 104 and 106 may each be 2½ inches (6 cm) wide, rear planar sections 110 and 112 may each be 3 inches (8 cm) wide, the angled sections 114 and 116 may each be 4½ inches (11 cm) wide, and the front planar section 118 may be 1½ inches (4 cm) wide. It is understood that each of these dimensions for the sections 104, 106 and 110 through 114 may vary in alternative embodiments, both proportionately and disproportionately with respect to each other. In embodiments of the present invention, the central diaphragm 102 may be formed of 7-gauge sheet steel (0.1875 inches (0.5 cm)). Other gauges, such as for example 10-gauge sheet steel (0.4 cm), and other materials of comparable strength and rigidity may be used in alternative embodiments. One such alternative material may be expanded metal.

In a preferred embodiment, the rear planar sections 110, 112 may be coplanar with a back edge of the diaphragm 102 and front planar section 118 may be coplanar with a front edge of the diaphragm 102 so that the corrugation 108 traverses the entire depth of the central diaphragm. As explained in greater detail below, the corrugation 108 need not traverse the entire depth of the central diaphragm in alternative embodiments.

Referring now to Figs. 5 and 6, when installed into a wall, the top and bottom edges 101 and 103 of the central diaphragm lie within U-shaped channels 119 and 121, respectively. In embodiments of the invention, both U-shaped channels may be formed of ¼ inch (0.6 cm) steel plate bent into a U shape. Each channel 119, 121 may be as long as the central diaphragm is wide. The uppermost surface of channel 119 and the lowermost surface of channel 121 shown in Fig. 5 may be 3 inches wide. The front and back edges of the channels may extend a few inches over the top and bottom of the central diaphragm, and the front and back edges may include scallops to facilitate fastening of the bolts securing the central diaphragm to the top plate and underlying surface as explained hereinafter. The channels 119 and 121 may be affixed in their respective positions on the central diaphragm by welding, bolting, gluing and other known affixation methods. As used here, gluing refers to the application of any of one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the channels 119/121 and central diaphragm which cause the channels and central diaphragm to stick to each other. The U-shaped channels 119, 121 may be omitted in alternative embodiments, in which case the top and bottom edges of the central diaphragm may attach directly to the top and bottom plates of the wall.

In embodiments of the present invention, the shearwall 100 may further include a pair of reinforcing chords 120 and 122 affixed to the end sections 104 and 106, respectively. The chords may be formed of wood, such as for example sawn lumber from lumber groups including spruce-pine-fir, Douglas fir-larch, hem-fir and southern pine. The chords 120, 122 may alternatively be
formed of engineered lumber, such as glulam and wood composites. Other types of wood are contemplated. The chords may have a height equal to that of the central diaphragm 102 and channels 119 and 121 together, and may be 4 inches (10 cm) wide by 2 inches (5 cm) deep. Various affixing mechanisms may be used to affix the chords to the central diaphragm, such as for example a plurality of ¼ inch (0.6 cm) x 1½ inch (4 cm) Simpson Strong-Drive® screws. Other types of screws and affixation methods are contemplated, such as for example gluing. As used in this regard, gluing refers to the application of any of one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the chords and central diaphragm which cause the chords and central diaphragm to stick to each other. In embodiments employing screws, the screws may be provided in each chord along a single column and spaced apart 6 to 12 inches (15 to 31 cm) from each other. It is understood that the screws may be provided in more than one column, or not aligned in a column, down the length of the chords 120, 122, and may be spaced apart more or less than 6 to 12 inches (15 to 31 cm) in alternative embodiments.

0024 Affixation of the chords to the central diaphragm as described above further improves the resistance of shearwall 100 to lateral forces. While a single chord is shown on each side of the central diaphragm, it is understood that more than one chord may be provided at each end. For example, 2 to 4 (or more) such chords may be affixed together and mounted to each side of the central diaphragm. It is also understood that chords of less than 2 inches (5 cm) deep and 4 inches (10 cm) wide may be used in alternative embodiments. Sheathing (not shown) may be affixed over the front and back surface of the central diaphragm and chords, and affixed to the chords by a variety of affixing mechanisms including Simpson Strong-Drive® screws and gluing. It is further understood that the chords 120, 122 may be omitted in alternative embodiments.

0025 Shearwall 100 further includes a sill plate 124 affixed to the bottom of the central diaphragm. This allows shearwall 100 to have a lower load bearing surface with a sufficient surface area to allow distribution of the shearwall compressive forces over a sufficiently large area on the underlying floor diaphragm or foundation. If the compressive forces from the shearwall are concentrated, for example in a situation where the bottom plate is small or is shaped with channels so that only a portion of the bottom plate lies in contact with the underlying support surface, the resulting compressive forces can damage or cause failure in the underlying support surface.

0026 Accordingly, sill plate 124 is provided as a flat plate with a relatively large surface area. The plate 124 has a length which is preferably equal to that of the central diaphragm and the chords 120 and 122 together, and a width that is equal to the width of the chords 120 and 122. This width dimension is greater than the width of the U-shaped channel 121 in embodiments of the present invention. In such embodiments, this provides a sill plate which is 16 inches (41 cm) long and 4 inches (10 cm) wide. It is understood that the length and/or width of plate 124 may be larger in alternative embodiments. For example, in embodiments of the invention not including chords 120, 122 and/or channel 121, the footprint of the sill plate may be the same size as the footprint of the central diaphragm.

0027 Sill plate is also rigid enough to allow even distribution of any localized compressive forces from the shearwall 100. In one embodiment of the present invention, the sill plate 124 is formed of ½ inch (1.3 cm) thick steel. In embodiments of the invention, sill plate 124 may be affixed to channel 121 by affixation methods such as welding, bolting or gluing. As used in this regard, gluing refers to the application of any of one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the sill plate 124 and channel 121 which cause the sill plate and channel to stick to each other. The rigidity of the sill plate 124 as well as the rigid affixation of the sill plate 124 to the channel 121 further prevents buckling of the shearwall under laterally applied loads. It is understood that sill plate 124 may have thicknesses other than ½ inch (1.3 cm) in alternative embodiments.

0028 It is a further feature of the sill plate 124 to underlie the chords 120, 122, thereby preventing their contact with the underlying support surface. In embodiments of the present invention where shearwall 100 is mounted on a foundation, the sill plate 124 isolates the chords from wetness and moisture from the foundation which may otherwise weaken and erode the chords. The provision of the sill plate 124 under the chords also allows the compressive forces exerted specifically by the chords to be evenly distributed over the sill plate and onto the underlying support surface as described above.

0029 Referring now specifically to Fig. 6, there is shown a perspective view of the shearwall 100 mounted on an underlying support surface 150. In the embodiment shown, underlying support surface 150 comprises a concrete building foundation, but it is understood that underlying support surface 150 may be any surface on which a conventional shearwall may be located, including for example a floor diaphragm on the building foundation or a floor diaphragm on a top plate of a lower floor. The shearwall is fastened to the underlying support surface 150 by means of anchors 152 (partially shown in Fig. 6) protruding up through aligned holes formed in the sill plate 124, channel 121 and the bottom of the central diaphragm 102. The bolts are then fastened over threaded ends of anchors 152 to anchor the shearwall to the underlying support surface. It is understood that shearwall 100 may be anchored to the underlying support surface by other anchoring mechanisms in alternative embodiments, such as for example by strap anchors, mudsill anchors, retrofit bolts, foundation plate holdowns, straps, ties, nails, screws, framing anchors, ties, plates, straps or a combination thereof. The shearwall may alternatively
or additionally be fastened to the underlying support surface 150 by gluing, which in this context refers to the application of any one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the shearwall and underlying surface which cause the shearwall and underlying surface to stick to each other.

Shearwall 100 may similarly include openings in the top edge of the central diaphragm 102 and channel 119 for affixation to a top plate of a wall as by welding, bolts and/or other anchoring mechanisms described above. The central diaphragm 102, channel 119 and top plate may additionally or alternatively be affixed to each other as by gluing, which refers to the application of any of one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the central diaphragm 102, channel 119 and/or top plate which cause the central diaphragm, channel and/or top plate to stick to each other. As also indicated above, shearwall 100 is prefabricated so that it may be easily located within a wall in any desired location simply by affixing the shearwall to the underlying support surface and top plate. The shearwall may be installed initially during construction of a building, or retrofit after completion of construction.

Shearwall 100 including corrugated central diaphragm 102 is capable of withstanding greater lateral loads in comparison to conventional shearwalls. Moreover, the corrugation(s) improve the ductility of the shearwall in the lateral direction.

Up to this point, the corrugation 108 has been disclosed as having constant dimensions between the top edge 101 and the bottom edge 103. That is, the intersection between the rear planar section 110 and angled section 114, and the intersection between the rear planar section 112 and angled section 116, form lines that extend vertically between the top and bottom edges parallel to each other. Similarly, the intersections between the angled sections 114, 116 and the front planar section 118 form lines that extend vertically between the top and bottom edges parallel to each other.

In an alternative embodiment of the present invention shown in Figs. 17 though 19, the central diaphragm may include apertures 260 provided through the surface of the diaphragm. The apertures may be various shapes and sizes in alternative embodiments, and may be formed in the diaphragm before or after the corrugation is formed. The shapes may be oval, oblong, circular, quadrilateral, polygon or irregular from the front view in alternative embodiments. The size may also vary such that the aperture 260 extends as far out as the rear planar surfaces 210, 212 (as shown in Fig. 17), out as far as the angled sections 214, 216, or be provided only through the front planar section 218. Moreover, while three such apertures 260 are shown in Fig. 17, the number of apertures 260 may be less than or greater than three in after-native embodiments. The apertures can be used to reduce the overall strength of the central diaphragm in such a way so that the shearwall 100 yields under lateral loads before an underlying support structure such as the foundation.

Up to this point, embodiments of the present invention have been shown as including a central dia-
Fig. 28. The stiffening lips 280 may be provided to add additional strength to the diaphragm 102, and may be used in any of the embodiments shown in Figs. 7 through 26.

[0043] Figs. 29 through 31 illustrate a further alternative embodiment of the present invention. According to this embodiment, the central diaphragm 102 may be comprised of separate end members 402 and 404, and a separate central section 406. Each end member may include end sections 406, rear planar sections 408 and angled sections 410 similar to the end sections, rear planar sections and angled sections described above with respect to other embodiments. The end members may optionally have a portion of a front planar section 412 similar to a portion of the front planar section described above with respect to other embodiments. The central section may be affixed by welding, bolting, gluing or other known affixation methods. As used here, gluing refers to the application of any of one or more known compounds (including adhesives and epoxies) to at least portions of the interface between the central section and angled sections 410 which cause the central section and angled sections to stick to each other.

[0044] As an alternative to a single unitary piece of material that extends the length of the diaphragm, the central section 406 may be comprised of more than one piece as shown in Fig. 31. In such an embodiment, the central section may include a section 406a at a top of the diaphragm and a section 406b at a bottom of the diaphragm. Though not critical to the present invention, the section 406a may extend down 12 inches (30 cm) from the top of the diaphragm and the section 406b may extend up 36 inches (21 cm) from the bottom of the diaphragm. It is understood that the lengths of sections 406a and 406b may vary in alternative embodiments, both proportionately and disproportionately to each other. As above, the central sections may be affixed by welding, bolting, gluing or other known affixation methods.

[0045] The embodiment shown in Figs. 29 through 31 allows the overall width of the shearwall 100 to be easily provided to different widths in the field simply by using a central section of differing widths. A shorter width central section (Fig. 29) will provide one overall width, while a larger width central section (Fig. 30) will provide another overall width. Thus, a shearwall 100 of the precisely needed width may be easily and quickly formed. The embodiment shown in Figs. 29-31 may be used in conjunction with the embodiments disclosed above with respect to Figs. 7 through 28.

[0046] Although the invention has been described in detail herein, it should be understood that the invention is not limited to the embodiments herein disclosed. Various changes, substitutions and modifications may be made thereto by those skilled in the art without departing
from the scope of the invention as described and defined by the appended claims.

**Claims**

1. A shearwall (100), comprising a central diaphragm (102) having a height (h), width (w) and depth (d), each being perpendicular to each other, and a corrugation extending in the direction of said height (h) of said central diaphragm (102); **characterised in that** said shearwall further comprises:

   - first and second chords (120, 122) affixed to said central diaphragm (102) at opposed edges of said central diaphragm (102) and extending in the direction of said height (h) of said central diaphragm (102); and
   - a sill plate (124) affixed to a bottom of the shearwall (100), said sill plate (124) having a footprint at least as large as said central diaphragm (102) and said first and second chords (120, 122) together;

   and **in that** at least two of the central diaphragm (102), the first chord (120), the second chord (122) and sill plate (124) are affixed to each other by at least one of welding, bolting, screwing and gluing.

2. A shearwall (100) as recited in claim 1, wherein said first and second chords (120, 122) are each formed of 2 inch (5 cm) x 4 inch (10 cm) wood.

3. A shearwall (100) as recited in claim 1, the sill plate (124) affixed at the bottom edge (103) of said central diaphragm (102) and having a footprint at least as large as the combined footprint of said central diaphragm (102) and said first and second chords (120, 122) together.

4. A shearwall (100) as recited in claim 1, wherein said central diaphragm (102) is formed of 7-gauge steel (0.5 cm).

5. A shearwall (100) as recited in claim 1, said corrugation being defined by a pair of angled sections (114, 116) extending along said height dimension (h) from a first plane at a back edge of the central diaphragm (102) and angling inward toward each other, said angled sections (114, 116) terminating in a second plane at a front edge of the central diaphragm (102), and said corrugation further being defined by a front planar section (118) in said second plane and extending between said pair of angled sections (114, 116).

6. A shearwall (100) as recited in claim 1, said corrugation extending from the top edge (101) to the bottom edge (103) of said central diaphragm (102).

7. A shearwall (100) as recited in claim 1, said corrugation extending from the bottom edge (103) of said central diaphragm (102) and terminating at a position between said bottom edge (103) and the top edge (101) of said central diaphragm (102).

8. A shearwall (100) as recited in claim 1, said central diaphragm (102) including at least one aperture (260).

9. A shearwall (100) as recited in claim 1, said central diaphragm (102) including at least one embossment (270).

10. A shearwall (100) as recited in claim 1, said central diaphragm (102) including at least one stiffening lip (280).

11. A shearwall (100) as recited in claim 1, further comprising a channel in which said central diaphragm (102) resides.

12. A shearwall (100) as recited in claim 11, said sill plate (124) having a width greater than that of said channel.

13. A shearwall (100) as recited in claim 11, said sill plate (124) being formed of 1/2 inch (1.3 cm) thick steel.

14. A shearwall (100) as recited in claim 11, said channel is affixed to the central diaphragm (102) by at least one of welding, bolting, screwing and gluing.

**Patentansprüche**

1. Scherwand (100), die Folgendes umfasst:

   - eine mittlere Membran (102) mit einer Höhe (h), einer Breite (w) und einer Tiefe (d), die jeweils senkrecht zueinander sind, und einer in Richtung der Höhe (h) der mittleren Membran (102) verlaufenden Wellung;
   - dadurch gekennzeichnet, dass die Scherwand weiterhin Folgendes umfasst:

   - eine erste und eine zweite Sehne (120, 122), die an der mittleren Membran (102) an einander gegenüberliegenden Rändern der mittleren Membran (102) befestigt sind und sich in Richtung der Höhe (h) der mittleren Membran (102) erstrecken; und eine Grundschwelle (124), die an einem unteren Ende der Scherwand (100) befestigt ist, wo-
bei die Grundschwelle (124) eine Grundfläche aufweist, die mindestens so groß ist wie die mittlere Membran (102) und die erste und die zweite Sehne (120, 122) zusammen; und dass mindestens zwei der mittleren Membran (102), der ersten Sehne (120), der zweiten Sehne (122) und der Grundschwelle (124) durch Verschweifen und/oder Verbolzen und/oder Verschrauben und/oder Verkleben aneinander befestigt sind.

2. Scherwand (100) nach Anspruch 1, wobei die erste und die zweite Sehne (120, 122) jeweils aus 2 Zoll (5 cm) x 4 Zoll (10 cm) -Holz hergestellt sind.

3. Scherwand (100) nach Anspruch 1, wobei die Grundschwelle (124) an dem unteren Rand (103) der mittleren Membran (102) befestigt ist und eine Grundfläche aufweist, die mindestens so groß ist wie die kombinierte Grundfläche der mittleren Membran (102) und der ersten und der zweiten Sehne (120, 122) zusammen.

4. Scherwand (100) nach Anspruch 1, wobei die mittlere Membran (102) aus 7er Stahl (0,5 cm) hergestellt ist.

5. Scherwand (100) nach Anspruch 1, wobei die Wellung durch ein Paar abgewinkelter Abschnitte (114, 116) definiert wird, die sich entlang der Höhenmessung (h) von einer ersten Ebene an einem Hinterrand der mittleren Membran (102) erstrecken und nach innen zueinander abgewinkelt sind, wobei die abgewinkelten Abschnitte (114, 116) in einer zweiten Ebene an einem Vorderrand der mittleren Membran (102) enden, und wobei die Wellung weiterhin durch einen vorderen planaren Abschnitt (118) in der zweiten Ebene definiert wird, der sich zwischen dem Paar abgewinkelster Abschnitte (114, 116) erstreckt.

6. Scherwand (100) nach Anspruch 1, wobei sich die Wellung von dem oberen Rand (101) zu dem unteren Rand (103) der mittleren Membran (102) erstreckt.

7. Scherwand (100) nach Anspruch 1, wobei sich die Wellung von dem unteren Rand (103) der mittleren Membran (102) erstreckt und an einer Stelle zwischen dem unteren Rand (103) und dem oberen Rand (101) der mittleren Membran (102) endet.

8. Scherwand (100) nach Anspruch 1, wobei die mittlere Membran (102) mindestens eine Öffnung (260) enthält.

9. Scherwand (100) nach Anspruch 1, wobei die mittlere Membran (102) mindestens eine Prägung (270) enthält.

10. Scherwand (100) nach Anspruch 1, wobei die mittlere Membran (102) mindestens eine Versteifungslippe (280) enthält.

11. Scherwand (100) nach Anspruch 1, die weiterhin einen Kanal umfasst, in dem die mittlere Membran (102) liegt.

12. Scherwand (100) nach Anspruch 11, wobei die Grundschwelle (124) eine Breite aufweist, die größer ist als die des Kanals.

13. Scherwand (100) nach Anspruch 11, wobei die Grundschwelle (124) aus 1/2 Zoll (1,3 cm) dickem Stahl hergestellt ist.

14. Scherwand (100) nach Anspruch 11, wobei der Kanal durch Verschweißen und/oder Verbolzen und/oder verschrauben und/oder Verkleben an der mittleren Membran (102) befestigt ist.

Revendications

1. Mur de contreventement (100), comprenant :

un diaphragme central (102) ayant une hauteur (h), une largeur (w) et une profondeur (d), chacune étant perpendiculaire aux autres, et une ondulation s’étendant dans la direction de ladite hauteur (h) dudit diaphragme central (102) ;

2. Mur de contreventement (100) selon la revendication 1, dans lequel lesdites première et deuxième cordes (120, 122) fixées audit diaphragme central (102) à des bords opposés dudit diaphragme central (102) et s’étendant dans la direction de ladite hauteur (h) dudit diaphragme central (102) ; et une longrine (124) fixée à une base du mur de contreventement (100), ladite longrine (124) ayant une empreinte au moins aussi grande que ledit diaphragme central (102) et lesdites première et deuxième cordes (120, 122) ensemble ; et en ce qu’au moins deux du diaphragme centrale (102), de la première corde (120), de la deuxième corde (122) et de la longrine (124) sont fixées l’un ou l’une à l’autre par soudage, boulonnage, vissage et/ou collage.
cordes (120, 122) sont chacune formées de bois de dimension 2 pouces (5 cm) x 4 pouces (10 cm).

3. Mur de contreventement (100) selon la revendication 1, dans lequel la longrine (124) est fixée au bord inférieur (103) dudit diaphragme central (102) et a une empreinte au moins aussi grande que l’empreinte combinée dudit diaphragme central (102) et desdites première et deuxième cordes (120, 122) ensemble.

4. Mur de contreventement (100) selon la revendication 1, dans lequel ledit diaphragme central (102) est formé d’acier de calibre 7 (0,5 cm).

5. Mur de contreventement (100) selon la revendication 1, dans lequel ledit diaphragme central (102) est formé d’acier de calibre 7 (0,5 cm).

6. Mur de contreventement (100) selon la revendication 1, dans lequel ledit diaphragme central (102) comporte au moins une ouverture (260).

7. Mur de contreventement (100) selon la revendication 1, dans lequel ledit diaphragme central (102) comporte au moins un bossage (270).

8. Mur de contreventement (100) selon la revendication 1, dans lequel ledit diaphragme central (102) comporte au moins une lèvre de rigidification (280).

9. Mur de contreventement (100) selon la revendication 1, comprenant en outre un canal dans lequel est disposé ledit diaphragme central (102).

10. Mur de contreventement (100) selon la revendication 1, dans lequel la longrine (124) a une largeur supérieure à celle dudit canal.

11. Mur de contreventement (100) selon la revendication 1, dans lequel ledite longrine (124) est formée d’acier de 1/2 pouce (1,3 cm) d’épaisseur.

12. Mur de contreventement (100) selon la revendication 11, dans lequel ledite longrine (124) est fixée au diaphragme central (102) par soudage, boulonnage, vissage et/ou collage.
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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