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(54) **ENHANCED FASTENER PATTERN FOR IMPROVED SHEAR CAPACITY IN WALLS**

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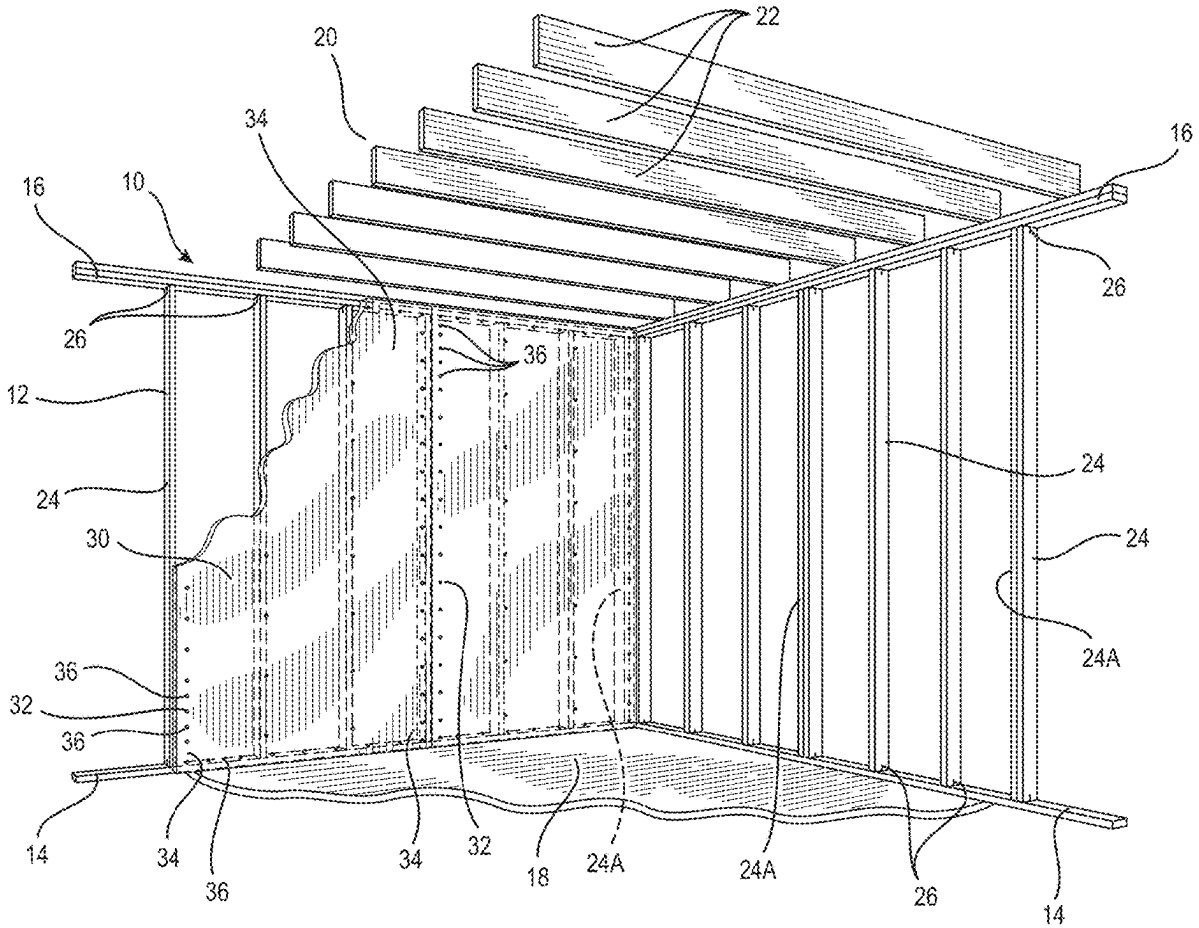
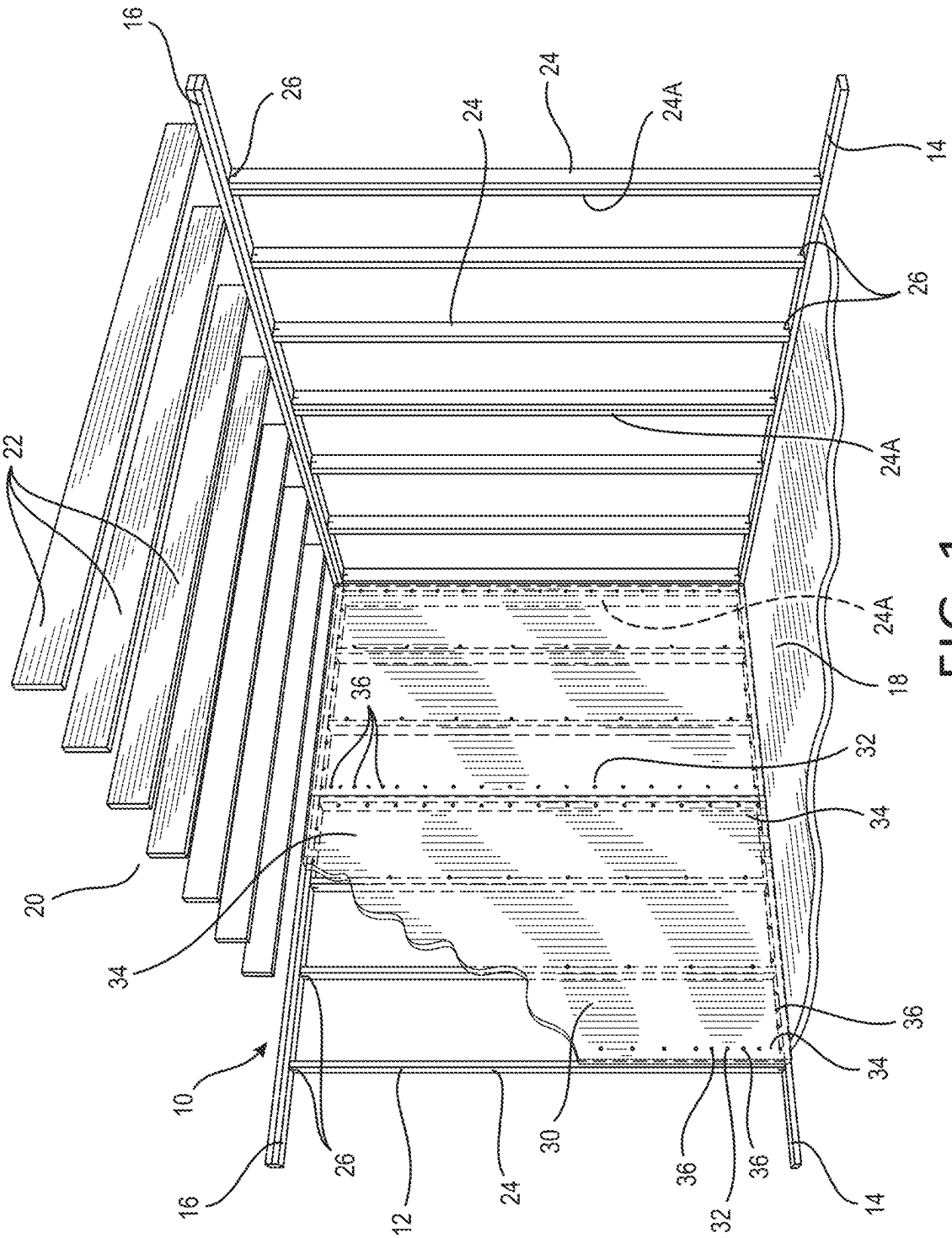
(57) **ABSTRACT**

A wall framing system is provided, including a frame including upper and lower horizontal members attached to each other by a plurality of horizontally-spaced vertical studs forming a frame, at least one wall panel secured to the frame, the panel having at least one corner, a plurality of fasteners securing each panel to the frame. The fasteners have a prescribed spacing. A denser pattern of the fasteners, narrower than said prescribed spacing, is applied at each corner than on other portions of the panel.




16
26
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14

FIG. 1

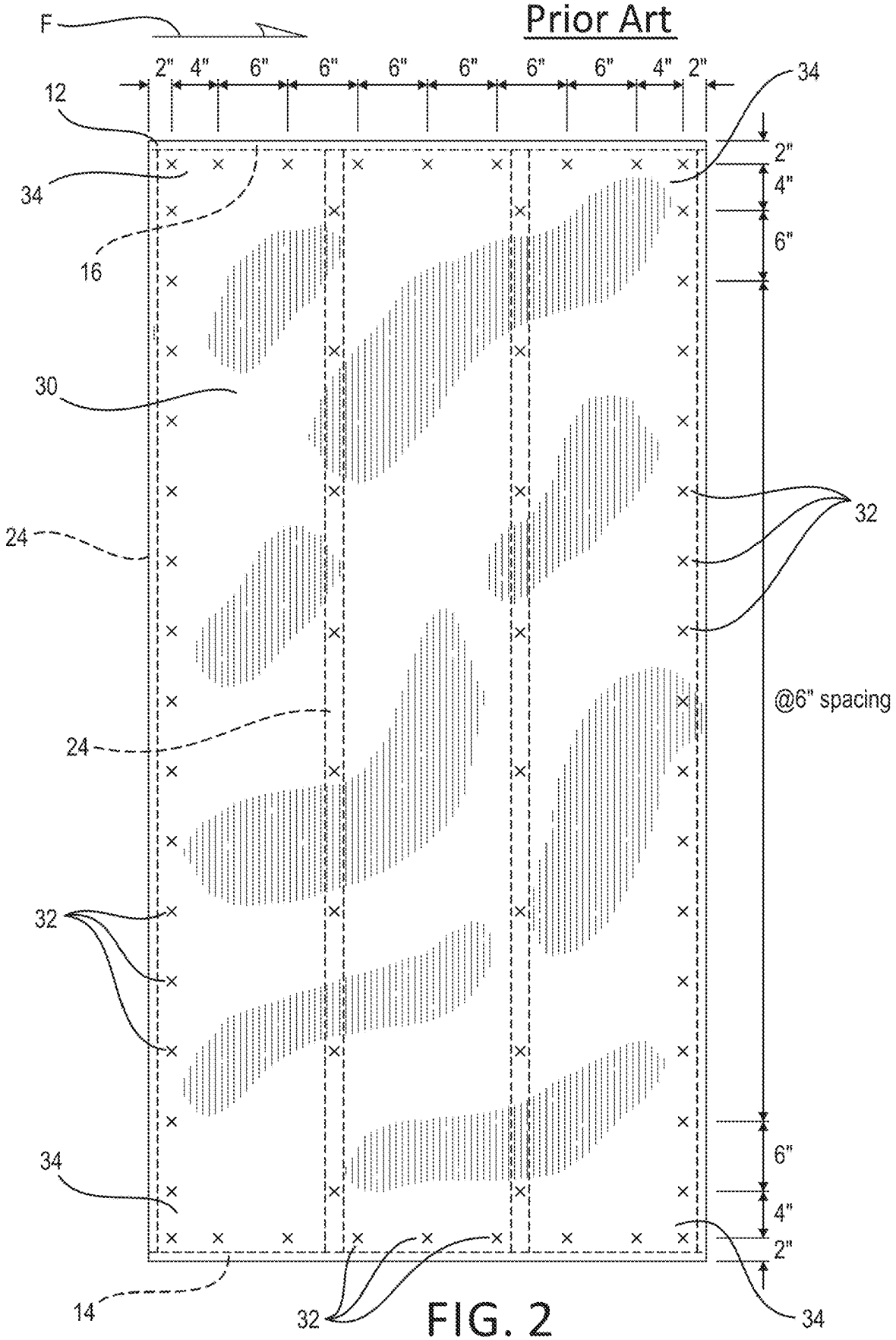
Prior Art
F
2" 4" 6" 6" 6" 6" 6" 6" 4" 2"
12
34
34
16
30
24
24
32
32
34
14
32
34
2"
4"
6"
@6" spacing
6"
4"
2"

FIG. 2

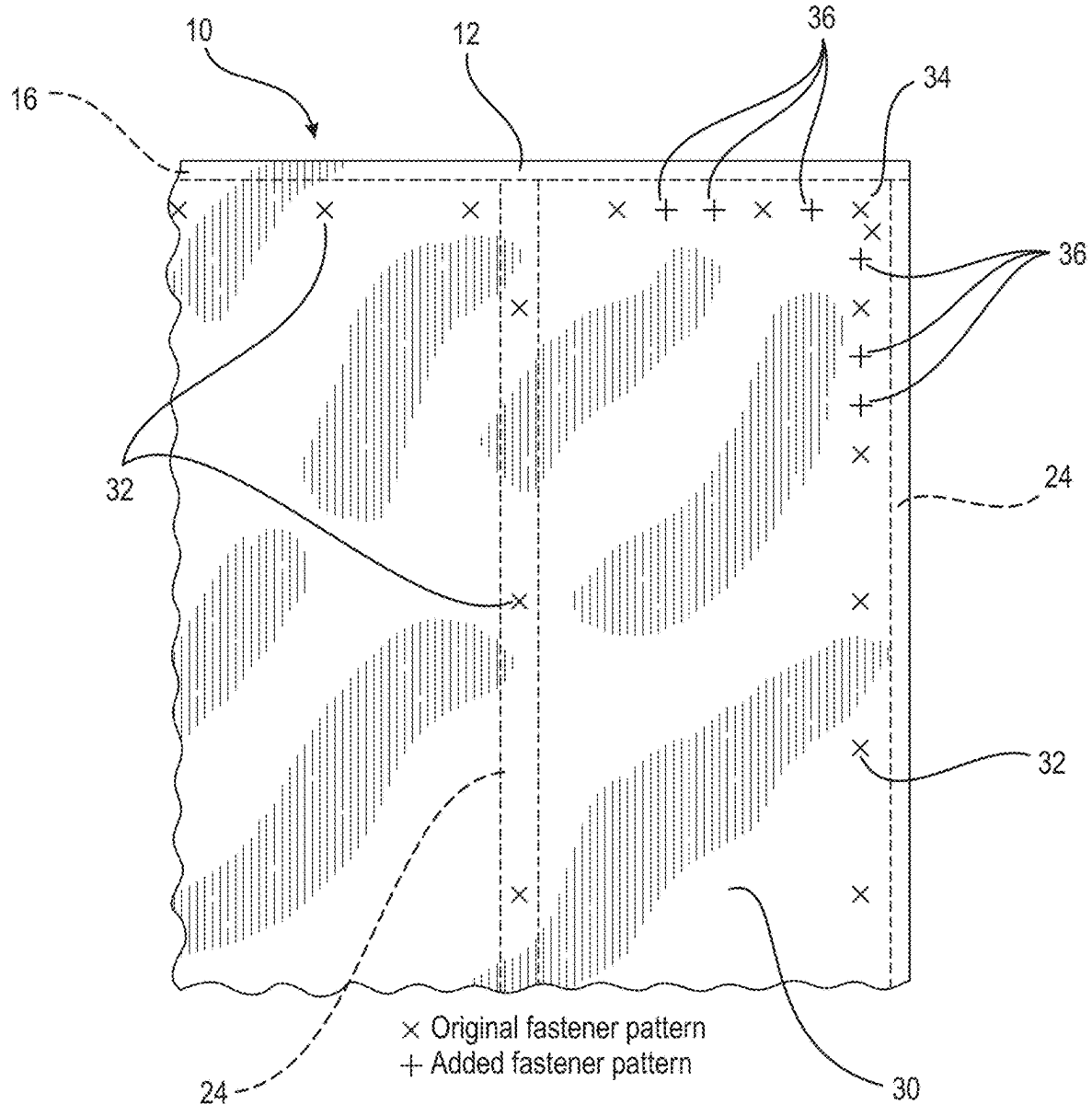
10
12
36
34
16
36
32
24
32
× Original fastener pattern
+ Added fastener pattern
24
30

FIG. 3

ENHANCED FASTENER PATTERN FOR IMPROVED SHEAR CAPACITY IN WALLS

RELATED APPLICATION

[0001] This application is a Non-Provisional of, and claims 35 U.S.C. 119 priority from, U.S. Provisional Patent application Ser. No. 63/551,781 filed Feb. 9, 2024, the entire contents of which are incorporated by reference herein.

BACKGROUND

[0002] The present invention relates generally to the construction of walls used in commercial and residential construction, both exterior and interior, and to an improved wall configuration that resists shear forces.

[0003] Current building techniques include structures for addressing shear forces or lateral forces exerted on a wall, such as by winds on exterior walls, or structural or environmental forces acting on interior walls. For example, walls defining interior hallways in hotels can be subject to enhanced shear forces. Conventional building techniques include lateral restraints for noncombustible construction (featuring metal framing members) such as X-K-bracing or cross-strapping. In residential construction, where combustible materials are more common, plywood or OSB panels are secured to framing members for enhancing resistance to shear forces. These measures significantly add to construction costs, including additional materials as well as installation labor.

[0004] As such, there is a need for an improved more economical approach for constructing walls for resisting shear forces

SUMMARY

[0005] The above-listed need is met or exceeded by the present enhanced fastener pattern for improved shear capacity in walls. The present structure provides an inexpensive way to significantly improve shearwall capacity without increasing steel frame support gauge, panel size or thickness, OSB or other plywood support panels, or without increasing the number of rows of fasteners.

[0006] It has been found that by adding the number of fasteners, preferably screws, especially in the corner region of the wall panel, significantly adds to shear force resistance. Test results have shown that shear failure of walls, both exterior and interior, is most common at the corners of the panel where it is attached to the frame. An enhanced screw pattern is provided for increasing shear capacity in walls using paneled shearwalls fastened to a wood or steel support frame. Shear force capacity is significantly increased when the fasteners are spaced preferably at 2 inches (5 cm) apart between adjacent fasteners. Most preferably, the more tightly spaced fasteners are located in the corner regions of the panels. While present test results use structural cement panels, sold by United States Gypsum Company under the trademark STRUCTO-CRETE® panel in wall applications for shearwalls, it is contemplated that favorable results are also achieved in securing traditional wallboard panels.

[0007] More specifically, a wall framing system is provided, including a frame including upper and lower horizontal members attached to each other by a plurality of horizontally-spaced vertical studs forming a frame, at least one wall panel secured to the frame, the panel having at least one corner, a plurality of fasteners securing each panel to the frame. The fasteners have a prescribed spacing. A denser pattern of the fasteners, narrower than the prescribed spacing, is applied at each corner than on other portions of the panel.

[0008] In an embodiment, the fasteners at each said corner have a 2 inch (5 cm) spacing. It is preferred that the fasteners include 12 screws at each corner having a 2 inch (5 cm) spacing.

[0009] In another embodiment, upon assembly, the wall system includes a single thickness of the panels and the studs are single ended, or of single thickness throughout the frame, and the wall system has a shear capacity of 3,137 lb. This shear capacity is at least 10% stronger than walls having conventional fastener spacing.

[0010] In an embodiment, upon assembly, the wall system includes a single thickness of the panels and the studs are double ended or installed at double thickness at ends of the frame. The wall system in this embodiment has a shear capacity of at least 5,000 lb. Upon placement of the denser fastener spacing at panel corners, the shear capacity increases at least 40% from walls having conventional fastener spacing.

[0011] In an embodiment, the fasteners have a first spacing along vertical and horizontal edges of the at least one panel and a second, denser spacing at the at least one corner. In an embodiment, the first spacing is one of 4 inches (10 cm) and 6 inches (15 cm), and the second spacing is 2 inches (5 cm).

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a front view of a wall system incorporating the present fastener arrangement;

[0013] FIG. **2** is a front view of a conventional wall system depicting the standard fastener pattern; and

[0014] FIG. **3** is a fragmentary view of the present wall system showing the present fastener pattern.

DETAILED DESCRIPTION

[0015] Referring now to FIG. **1**, the present wall system is generally designated **10**, and includes a frame **12** including at least one lower horizontal member **14**, also referred to as a footer, at least one upper horizontal member **16**, also referred to as a header. In conventional construction, the lower horizontal members **14** are secured to a floor **18**, and the upper horizontal members **16** are secured to a ceiling **20**, here shown as a plurality of joists **22**. The lower and upper horizontal members **14**, **16** are attached to each other by a plurality of horizontally-spaced vertical studs **24**.

[0016] It is contemplated that the frame members **14**, **16** and **24** are either wood or metal, the latter being one of a variety of gauges of metal, and typically being formed in a "C" or "U"-shaped horizontal cross-section. The frame members **14**, **16** and **24** are secured together with frame fasteners **26**, preferably screws or nails. A frame **12** with all of the vertical studs **24** at a single thickness is referred to as a "single end" frame. In some cases, to increase structural integrity of the frame, vertical studs **24**A on the ends of each frame segment are double-thickness, being so-called "double end" frames.

[0017] Another part of the wall system **10** is at least one panel **30** secured to the frame **12** with a plurality of panel fasteners **32**. When the wall system **10** is configured for interior use, the panels **30** are mainly gypsum wallboard. However, in some interior applications, more durable struc-

tural cement panels are employed, such as panels sold by United States Gypsum Company under the trademark STRUCTO-CRETE® panel. When the wall system **10** is configured for exterior or high moisture use (showers, bathrooms), the panels **30** are made of more durable structural cement panels, sold by United States Gypsum Company under the trademark STRUCTO-CRETE® panel, moisture-resistant "green board" or the like. Regardless of the construction of the panel **30**, each panel is rectangular in shape and has a plurality of, preferably four corners **34**.

[0018] As seen in FIGS. **1** and **2**, the panel fasteners **32** (represented schematically by "x" in FIG. **2**) are distributed about the panel **30** wherever the panel engages a portion of the frame **12**. As such, the panel fasteners **32** are distributed vertically to secure the panel **30** to the vertical studs **24**, and also horizontally to secure the panel **30** to the lower horizontal member **14** and the upper horizontal member **16**. A standard or prescribed spacing of such panel fasteners **32** is between 4 to 6 inches (10-15 cm) around a perimeter of the panel **30**, and 12" (30 cm) in a field or interior of the panel.

[0019] In strength tests of wall systems, preferably according to ASTM E72, a shear force 'F' (FIG. **2**) is applied transversely to the frame, preferably 20 gauge steel or greater, and a 4 ft×8 ft (1.2192×2.438 meters) panel, or parallel to the length of the lower and upper horizontal members **14**, **16**. Basically, a racking force is applied to the wall systems until they fracture. Such fracturing usually involves the crushing and collapsing of vertical frame members **24**, and the destruction of the panel at the corner **34**.

[0020] Referring now to FIG. **3**, it has been found that by decreasing a spacing of the panel fasteners **32** in the region of the corners **34**, and thus increasing the number of panel fasteners **32**, has significantly increased resistance of the wall system **10** to an applied shear force 'F' (FIG. **2**). In FIG. **3**, the standard spacing of the panel fasteners **32** is represented by "x"s. Additional fasteners **36** are represented by "+". Taken together, the spacing of the panel fasters **32**, **36** in the corners **34** is preferably 2 inches (5 cm). However, it will be understood that the specific spacing may vary to suit the application. Thus, in the present wall system **10**, the spacing of the fasteners **32**, **36**, is such that there are 12 fasteners around the corner **34** having the above-described 2 inch (5 cm) spacing. The result is a denser pattern of panel fasteners **32**, **36** than in other regions of the panel **30**.

[0021] In one embodiment, the wall system **10** includes a single thickness of the panels **30** the studs **24** are single ended, and has the above-described denser fastener spacing of 2 inches (5 cm) at all of the corners **34**. The frame **12** is 20 gauge steel with studs 12 inches (30.48 cm) on center. Pursuant to ASTM E72, the wall system **10** has a shear capacity of 3,137 lb. (1422.919 kg), which is at least 10% stronger than walls having conventional fastener spacing, having a shear capacity of 2,841 lb (1288.656 kg).

[0022] In another embodiment, the wall system **10** includes a single thickness of the panels **30** and the studs **24** are double ended or double thickness at the ends of the 20 gauge steel frame accommodating each panel. The studs are 12 inches (30.48 cm) on center. Also, the wall system **10** has the above-described denser fastener spacing of 2 inches (5 cm) at each of the corners **34**. Pursuant to ASTM E72, the wall system as constructed has a shear capacity of at least 5,000 lb. (2267.962 kg), compared to a wall system constructed similarly with standard fastener spacing has a shear capacity of 3,492 lb. (1583.945 kg). In other words, the shear capacity increases at least 40% from walls having conventional fastener spacing. Similar increases in capacity for added corner fasteners also to be noted when using 16 ga. and 14 ga. steel frames.

[0023] Thus, tests of the present wall system **10** reveal that the addition of a few extra fasteners at a cost of about $2.50 per panel **30** increases shearwall capacity from 110 to 145% depending on exact configuration and steel framing used.

[0024] While a particular embodiment of the present enhanced fastener pattern for improved wall shear capacity has been described herein, it will be appreciated by those skilled in the art that changes and modifications may be made thereto without departing from the invention in its broader aspects and as set forth in the following claims.

1. A wall framing system, including:

a frame including upper and lower horizontal members attached to each other by a plurality of horizontally-spaced vertical studs forming a frame;

at least one wall panel secured to said frame, said panel having at least one corner;

a plurality of fasteners securing each said at least one panel to said frame, said fasteners having a prescribed spacing; and

a denser pattern of said fasteners, narrower than said prescribed spacing, being applied at each said corner than on other portions of the panel.

2. The wall framing system of claim **1**, wherein said fasteners at each said corner have a 2 inch (5 cm) spacing.

3. The wall framing system of claim **1**, wherein said fasteners include 12 screws at each corner having a 2 inch (5 cm) spacing.

4. The wall framing system of claim **1**, wherein upon assembly, said wall system includes a single thickness of said panels and said studs are single ended, said wall system has a shear capacity of 3,137 lb., which is at least 10% stronger than walls having conventional fastener spacing.

5. The wall framing system of claim **1**, wherein upon assembly, said wall system includes a single thickness of said panels and said studs are double ended, said wall system has a shear capacity of at least 5,000 lb.

6. The wall framing system of claim **5**, wherein upon placement of said denser fastener spacing at panel corners, said shear capacity increases at least 40% from walls having conventional fastener spacing.

7. The wall framing system of claim **1**, wherein said fasteners have a first spacing along vertical and horizontal edges of said at least one panel and a second, denser spacing at said at least one corner.

8. The wall framing system of claim **7**, wherein said first spacing is one of 4inches and 6 inches, and said second spacing is 2 inches.

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