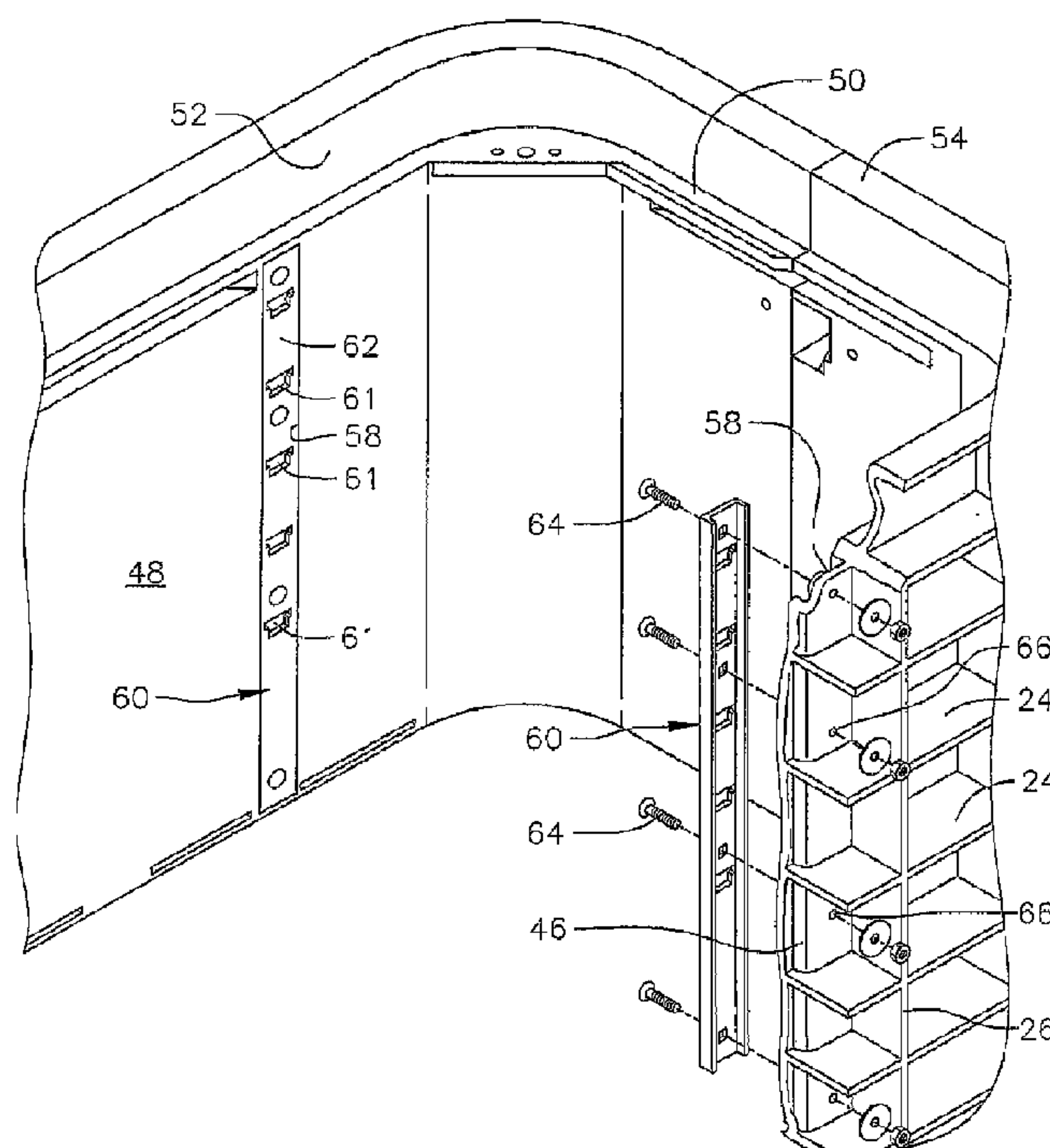




(86) Date de dépôt PCT/PCT Filing Date: 2013/10/28
(87) Date publication PCT/PCT Publication Date: 2014/05/08
(45) Date de délivrance/Issue Date: 2016/11/29
(85) Entrée phase nationale/National Entry: 2015/04/21
(86) N° demande PCT/PCT Application No.: US 2013/067148
(87) N° publication PCT/PCT Publication No.: 2014/070685
(30) Priorités/Priorities: 2012/10/30 (US61/720,297);
2013/03/14 (US13/830,670)

(51) Cl.Int./Int.Cl. *H02G 3/18* (2006.01),
G02B 6/44 (2006.01), *H02G 9/10* (2006.01)
(72) Inventeur/Inventor:
BURKE, EDWARD J., US
(73) Propriétaire/Owner:
CHANNELL COMMERCIAL CORPORATION, US
(74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : ENCEINTE A USAGE GENERAL DE NIVEAU DE BASE RENFORCEE
(54) Title: ENHANCED STRENGTH GRADE LEVEL UTILITIES ENCLOSURE



(57) Abrégé/Abstract:

An enhanced strength grade level utility enclosure comprises a vertical wall structure having an upright inner wall panel (46) extending from an upper edge to a bottom edge of the structure. The inner wall panel (46) has an inside face spanning the enclosure's interior. One or more narrow, vertically extending slotted regions (58) are recessed in the inside face of the wall panel. Upright rigid support bars (60), optionally adapted for use as cable racks, are positioned in and rigidly affixed to separate slotted regions on the wall panel. The support bars (60) provide a continuous means of rigid vertical support from the upper edge down to the bottom edge of the enclosure's wall structure. The recessed support bars, in combination with the vertical wall structure, provide enhanced wall strength in excess of industrial vertical side wall and center load test standards.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau(43) International Publication Date
8 May 2014 (08.05.2014)(10) International Publication Number
WO 2014/070685 A1

(51) International Patent Classification:

H02G 3/18 (2006.01) *G02B 6/44* (2006.01)
H02G 9/10 (2006.01)

(21) International Application Number:

PCT/US2013/067148

(22) International Filing Date:

28 October 2013 (28.10.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/720,297 30 October 2012 (30.10.2012) US
13/830,670 14 March 2013 (14.03.2013) US

(71) Applicant: **CHANNELL COMMERCIAL CORPORATION** [US/US]; 26040 Ynez Road, Temecula, California 92589 (US).

(72) Inventor: **BURKE, Edward, J.**; 26040 Ynez Road, Temecula, California 92589 (US).

(74) Agent: **MAXWELL, Walter, G.**; Christie, Parker & Hale, LLP, P.O. Box 29001, Glendale, California 91209-9001 (US).

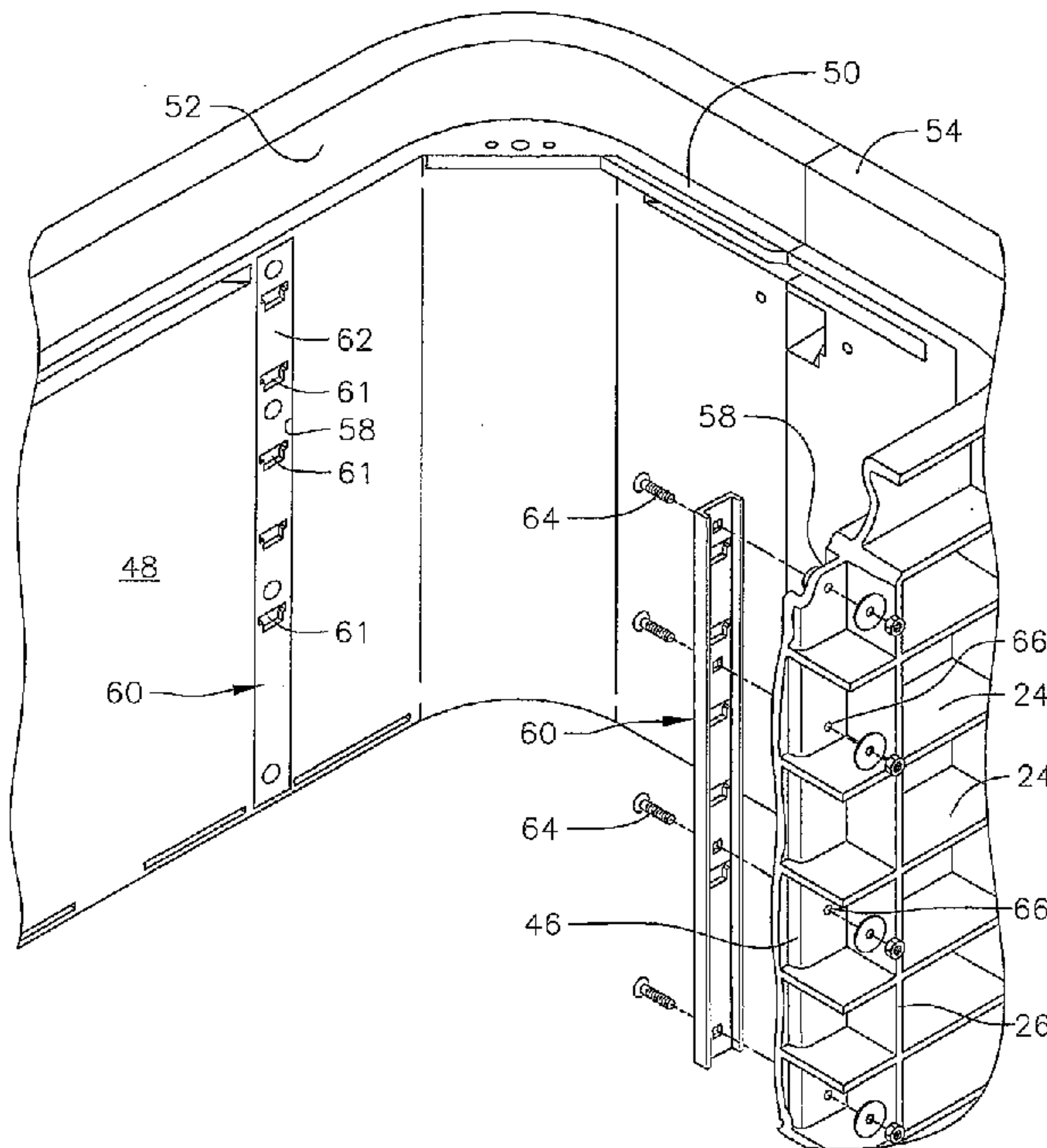
(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: ENHANCED STRENGTH GRADE GRADE LEVEL UTILITIES ENCLOSURE

FIG. 3



(57) Abstract: An enhanced strength grade level utility enclosure comprises a vertical wall structure having an upright inner wall panel (46) extending from an upper edge to a bottom edge of the structure. The inner wall panel (46) has an inside face spanning the enclosure's interior. One or more narrow, vertically extending slotted regions (58) are recessed in the inside face of the wall panel. Upright rigid support bars (60), optionally adapted for use as cable racks, are positioned in and rigidly affixed to separate slotted regions on the wall panel. The support bars (60) provide a continuous means of rigid vertical support from the upper edge down to the bottom edge of the enclosure's wall structure. The recessed support bars, in combination with the vertical wall structure, provide enhanced wall strength in excess of industrial vertical side wall and center load test standards.

WO 2014/070685 A1



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, **Published:**
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, — *with international search report (Art. 21(3))*
GW, KM, ML, MR, NE, SN, TD, TG).

1 **ENHANCED STRENGTH GRADE LEVEL UTILITIES ENCLOSURE**

FIELD OF THE INVENTION

5 **[0001]** This invention relates to enclosures for underground utility lines, and more particularly, to an underground utility enclosure having improved load capacity.

BACKGROUND

10 **[0002]** Underground utility equipment enclosures include the so-called grade level vaults, splice boxes, pull boxes, and the like, for various applications requiring access to an underground service. These may include electrical, gas, water, telephone, fiber optics and cable TV installations, for example.

15 **[0003]** Grade level enclosures are commonly subjected to different kinds of structural loads during use. Generally speaking, prior art enclosures and their cover plates are made from reinforced concrete, fiberglass, or polymer concrete composite materials for added load strength, to withstand the compression forces during use.

20 **[0004]** Grade level enclosures, particularly those used for telecommunications equipment, are adapted to facilitate use with different types of internal equipment. They may include splice cases, fiber optic cables, electrical wires, and the like, supported in the enclosure by metal cable racks fastened to upper portions of the enclosure's inside walls.

25 **[0005]** Industry standards have been developed for conformance tests and requirements for the structural integrity of such grade level enclosures. One standard commonly used for underground enclosures is known as ANSI/SCTE 77-2010. This set of standards for underground enclosure integrity has Tier designations that relate to various load ratings to ensure proper performance for different types of underground enclosures. The objective of these standards is to ensure long product service life, minimized maintenance, and reduced product liability for those who design, develop, and market them.

30 **[0006]** In one example, the ANSI Tier designations relate to the normal design load x 1000 lbs. For instance, Tier 15 = 15 x 1000 lbs = 15,000 lbs. These ANSI Tier loadings have a corresponding test load which is 50% greater than the design load. For example, the test load for Tier 15 = 15,000 lbs x 1.5 = 22,500 lbs. (Tier 15 [15,000 lb. design load, 22,500 lb. test load] is applicable to driveways, parking lots and off-road applications subject to occasional non-deliberate heavy vehicular traffic.)

35 **[0007]** The ANSI/SCTE 77-2010 performance specification includes a three-position structural test simulating wheels rolling over an enclosure where loads are imparted laterally and vertically onto the side wall of the enclosure and vertically onto its cover. The related structural integrity tests comprise:

[0008] (1). Position one -- a lateral side wall test -- a test of the area that must withstand soil forces as vehicles approach.

[0009] (2).Position two - - a vertical side wall test - - a test of load applied directly downward onto the vertical side wall.

[0010] (3).Position three - - a cover test - - a test showing how an enclosure responds to a load applied directly to the center of the cover.

5 **[0011]** The present invention provides an enhanced strength grade level utilities enclosure that can be made from lighter weight polymeric materials. In one embodiment, the enclosure's design provides enhanced structural loading capacity in excess of ANSI Tier 15 vertical side wall load and center cover vertical load requirements.

10 **[0012]** The ANSI Tier 15 test standards are one example of various industry test standards for grade level enclosures for which the present invention provides enhanced load capacities. Structural improvements, in particular, are demonstrated for enclosures' vertical side wall load capacities; and these improvements would result for different types of enclosures each having their own separate vertical side wall load capacity requirements.

SUMMARY OF THE INVENTION

15 **[0013]** Briefly, one embodiment of this invention provides an enhanced strength grade level utility enclosure for underground utilities connections, comprising: a substantially vertical wall structure extending continuously around an open interior region within the wall structure, the wall structure made of a molded polymeric material; the vertical wall structure having an upper edge extending around an opening to the interior of the enclosure and a
20 bottom edge on which the enclosure is supported; a removable cover plate adapted for mounting to the opening in the grade level enclosure to close off at least a portion of the interior region from the environment, the cover plate adapted to engage at least a portion of the enclosure's upper edge structure; the vertical wall structure including an upright inner wall panel extending from the upper edge to the bottom edge of the vertical wall structure, the
25 inner wall panel having an upright inside face spanning the interior of the enclosure; the inside face of the inner wall panel having left and right sides opposing one another; one or more narrow, vertical slotted regions recessed in the inside face of the inner wall panel on the left side and on the right side of the enclosure extending from the upper edge to the bottom edge of the inner wall panel; and an upright rigid support bar adapted for use as a cable rack

positioned in at least one slotted region on each side of the wall structure's inside face; the support bars having a flat continuous face flush with the inside face of the inner wall panel defining a cavity within the slotted region behind the flat continuous face, the support bars providing substantially continuous rigid vertical support extending from the upper edge to the bottom edge of the enclosure's vertical wall structure.

[0013a] The recessed support bars in combination with the vertical wall structure provide enhanced wall load strength sufficient for exceeding vertical side wall load test standards, among other test standards, for grade level enclosures.

[0013b] In another embodiment, there is provided an enhanced strength grade level utility enclosure for underground utilities connections, comprising: a substantially vertical wall structure extending continuously around an open interior region within the wall structure, the wall structure having an open bottom and made of a molded polymeric material; the vertical wall structure having an upper edge extending around an opening to the interior of the enclosure and a bottom edge on which the enclosure is supported; the vertical wall structure including an upright inner wall panel extending from the upper edge to the bottom edge of the vertical wall structure, the inner wall panel having an upright inside face spanning the interior of the enclosure; the inside face of the inner wall panel having left and right sides opposing one another; longitudinally spaced apart, vertical slotted regions recessed in the inside face of the inner wall panel on the left side and on the right side of the enclosure extending from the upper edge to the bottom edge of the inner wall panel; and an upright rigid support bar adapted for positioning in separate vertical slotted regions on each side of the wall structure's inside face; in which positioning of the support bars in the vertical slotted regions having a flat continuous face flush with the inside face of the inner wall panel defining a cavity within the vertical slotted regions behind the flat continuous face, the support bars provide substantially continuous rigid vertical support extending from the upper edge to the bottom edge of the enclosure's vertical wall structure

[0014] These and other aspects of the invention will be more fully understood by referring to the following detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a perspective view showing one embodiment of an enhanced strength grade level utilities enclosure according to principles of this invention.

5 **[0016]** Fig. 1A is a perspective view showing another embodiment of the utilities enclosure.

[0017] Fig. 2 is an enlarged fragmentary perspective view showing the construction of a prior art grade level utilities enclosure.

1 [0018] Fig. 3 is an enlarged fragmentary perspective view showing the detailed construction of the enhanced strength grade level utilities enclosure according to principles of this invention.

5 [0019] Fig. 4 is a front elevational view, partly in cross section, showing an inside wall of the enhanced strength enclosure.

[0020] Fig. 5 is a cross sectional view taken on line 5-5 of Fig. 4.

[0021] Fig. 6 is a cross sectional view taken on line 6-6 of Fig. 4

[0022] Fig. 7 is a schematic perspective view showing a test set up for a side wall load test according to ANSI/SCTE 77-2010 Tier 15.

10 [0023] Fig. 8 is a schematic perspective view showing a test set up for a Tier 15 center load test.

[0024] Fig. 9 shows comparative deflection curves for tests conducted on the present invention.

15 [0025] Fig. 10 shows comparative deflection curves for tests conducted on a modified utilities enclosure.

[0026] Fig. 11 shows comparative deflection curves for tests conducted on a prior art utilities enclosure.

DETAILED DESCRIPTION

20 [0027] Fig. 1 illustrates one embodiment of a grade level underground utilities enclosure 10 according to principles of this invention. The enclosure includes a pair of long parallel side walls 12 and a pair of shorter endwalls 14 forming a generally rectangular structure having a hollow interior. The grade level enclosure has an open bottom. An open top of the enclosure receives a flat top cover plate or panel 16. The enclosure is made of hard molded plastic such as high density polyethylene and is molded in halves, split along its longitudinal center axis into two parts, forming a seam 18 at each end. The two halves are rigidly fastened together along the seams at each end by fasteners at 20 extending through upright flanges 22 which face each other along each seam. The enclosure also has a molded integrally formed grid structure facing outwardly along each side wall. The configuration of the grid structure can be in various forms. The illustrated grid structure has an I-beam configuration formed by long horizontal flanges 24 and vertical upright flanges 26, forming an essentially rectangular array. The horizontal flanges wrap around the ends of the enclosure at 28. This construction of the enclosure provides good compressive strength to resist vertical loads on the side walls of the enclosure. Other configurations can include diagonally extending or diamond pattern molded flanges, for example.

35 [0028] The Appendix to the present application shows features, including dimensions, of one embodiment of the enclosure. Fig. 1A shows the same embodiment, with a top cover plate 30 opened to reveal the interior of the enclosure, described in more detail below. This

embodiment also illustrates use of a polymer composite ring 32 positioned on a top edge of the enclosure's vertical side wall structure. In this embodiment the cover plate 30 rests on the polymer composite ring during use. This embodiment also illustrates use of the cover plate 30 made of a polymer concrete material. The body of the enclosure is made from a non-metal, non-concrete, molded thermoplastic polymeric material such as high density polyethylene. Other thermoplastic materials comprised of polyolefin materials in general also can be used.

[0029] Figs. 2 and 3 illustrate a comparison between the present invention (Fig. 3) and a prior art grade level utilities enclosure (Fig. 2).

[0030] The Fig. 2 illustration shows the prior art enclosure 34 having a vertical wall structure with a flat inside vertical wall surface 35. This embodiment shows narrow elongated recessed slots 36 extending parallel to the top edge of the box. These slots are formed below an inside peripheral rim 38 which extends around and somewhat below a top edge 39 of the enclosure. The slots can be used for interlocking with a cover plate locking device when a cover plate is positioned atop the enclosure. This prior art embodiment also shows a typical prior art use of a narrow, elongated metal cable rack 40 affixed to the flat inside wall surface 35 of the enclosure. The cable rack, as is well known in the art, includes a series of vertically spaced apart stepped connectors 42 for use in attaching various types of equipment used in the interior of the enclosure. The top and bottom of the cable rack are affixed to the side wall of the enclosure by suitable fasteners 44.

[0031] The enclosure of this invention, as shown in Fig. 1A, includes two cable racks 60 on each side, described below, and a hanger bar 33 that provides an organizer feature for internal equipment. The hanger bar is attached to the enclosure at its ends without fasteners.

[0032] Fig. 3 illustrates a more detailed construction of the underground enclosure 10 which is open at its top and reveals the interior of the enclosure. The vertical wall structure of the enclosure is formed by having integrally molded a vertical inner wall panel 46 with the exterior grid structure (formed by the horizontal and vertical flanges 24 and 26). The vertical inner wall has a flat inside surface 48 that extends continuously around and faces toward the open interior of the enclosure.

[0033] The Fig. 3 illustration also shows a narrow horizontal annular rim 50 that extends around the upper inside portion of the enclosure. The rim extends inwardly around and below a short vertical wall 52 that spans an upper portion of the enclosure. An annular outer flange 54 above the shortened wall 52 forms the top edge of the enclosure.

[0034] According to the present invention, the vertical wall structure's load strength is enhanced by a system of substantially vertically extending rigid support bars inserted into corresponding narrow, elongated recessed regions or pockets 58 molded into the otherwise flat inside surface 48 of the vertical inside wall panel 46. The rigid support bars are preferably formed as cable racks 60 adapted for supporting various types of internal

1 equipment used in the enclosure, via a stepped series of vertically spaced apart connectors 61
on the base of each cable rack. Each cable rack is generally U-shaped or channel-shaped in
cross sectional configuration, having a flat base 62 flush with the enclosure's inside surface
48 when the bar is positioned in the recessed slotted region. The side walls of the channel-
5 shaped cable racks rigidly engage the bottoms of the recessed pockets 58 in which they are
positioned. The cable rack is rigidly affixed to the recessed regions by a series of vertically
spaced apart fasteners 64 (and corresponding threaded nuts and washers) screwed into
corresponding holes 66 in the wall of the enclosure. The cable racks are preferably made
10 from galvanized steel or stainless steel, although they can be made from hard plastic or
fiberglass. In one embodiment the metal cable racks have a depth of about 9/16 inch, a width
of about 1½ inches, and a thickness of about ⅛ inch.

[0035] Figs. 4 to 6 illustrate in more detail the structural configuration of the enhanced
strength enclosure provided by the invention. Preferably, two cable racks 60 are positioned
on each longitudinal side wall of the enclosure, although more cable racks could be
15 positioned on each side of the enclosure. Fig. 4 shows a pair of longitudinally spaced apart
cable racks 60 rigidly secured to corresponding slotted recessed regions 58 on one side of the
enclosure. There are two cable racks similarly positioned on the opposite side wall of the
enclosure. Similar cable racks, or other means of rigid vertical support can be affixed to
similar recessed regions or pockets in the end walls of the enclosure.

20 [0036] In use, the cable racks 60 provide a substantially continuous means of rigid
vertical support extending from the top to the bottom of the enclosure's outer wall. The wall
of the enclosure has an annular bottom edge 68 on which the enclosure is supported when the
enclosure rests on the ground. The bottom edge is formed as an inverted T-shaped structure,
integral with the side wall structure of the enclosure. The bottom edge has an integrally
25 formed inner lip 67 facing the interior of the enclosure, near its bottom. The bottom edges of
the cable racks 60 rest on the flanged inner lip 67 of the enclosure side wall. The top edges
of the cable racks are engaged with a bottom edge of the annular upper rim 50 that faces the
interior of the enclosure. When the cover plate 16 is positioned in the top of the enclosure an
annular lower rim 70 of the cover plate rests on the annular rim 50, and a downward force on
30 the cover plate is resisted by the substantially vertically-positioned enclosure side walls
reinforced by the substantially vertically-positioned rigid cable racks 60.

[0037] The grade level enclosure of this invention was tested for its load integrity
according to standards used for such enclosures in the telecommunications industry.

[0038] These test standards can vary as to load levels, resistance to deflection, and other
35 test parameters. Such test standards also can vary between U.S. and European, for example.
One set of these test standards used for testing load integrity of the invention is identified as
the ANSI/SCTE 77 2010 Specification for Underground Enclosure Integrity, incorporated
herein by this reference. The enclosure under test consisted of the enclosure illustrated in

1 Figs. 1 and 3-6. The vertical load capacity of this test unit was compared with the same
enclosure, but with the four cable racks removed from the recessed slotted regions of the
enclosure. The ANSI Tier 15 test methods were used, as one example, to determine the
enclosure's vertical load capacity in both instances: The vertical load capacity of the
5 enclosure was tested for side wall load capacity and center load body deflection, using
vertical side wall test and cover plate test methods for ANSI Tier 15.

[0039] Fig. 7 illustrates the test set up used for the Tier 15 vertical side wall test. This
test shows the load plate 80 and load ram 82 positioned over and applying a downward load
to the vertical side wall 46 of the enclosure 10. This view also shows a dial indicator 84 of a
10 sensor for measuring deflection. In this test, deflection measuring devices are positioned to
indicate vertical and lateral deflection wherever maximum deflection occurs. Design load is
cycled 10 times, followed by applying the test load.

[0040] Fig. 8 illustrates the test set up used for the Tier 15 cover plate center load test. In
this test set up the load plate 80 applies a downward force to the cover plate 16.

15 [0041] Tier 15 test results are shown in the following example and are illustrated
comparatively by the deflection curves shown in Figs. 9, 10 and 11.

[0042] **Example**

20 **1. Purpose**

Test the strength of the modified enclosure of this invention with the metal cable
rack inserts and compare those test results with a modified vault without the metal cable rack
inserts.

25 Compare those test results with similar tests conducted on a non-modified prior art
enclosure as shown in Fig. 2.

2. Test Material

- 30
- Dake mechanical test frame (Frame, 50K load cell)
 - Aerospace digital indicator gauge
 - Omega Model DP41-B digital read out
 - 10 in (254mm) x 10 in (254mm) x 1 in (25mm) thick steel loading plate
 - 35 backed with ½ in (13mm) thick rubber, per SCTE 77 Tier 15
 - One sample with two metal cable racks installed in each long side (four racks
total) or three per side (6 racks total) for the non-modified prior art vault
 - One sample without racks installed

3. Test Procedure

Center load Test

1. Attach 10 in x 10 in (254 mm x 254 mm) loading plate to Dake test frame
2. Place the enclosure on test frame
3. Place standard L-bolt PC lid in the enclosure
4. Locate and align center of lid with center of loading plates. See Fig. 8
5. Attach indicator gauge to test frame and located in on the top surface of the enclosure in the middle of the long side
6. Turn on hydraulics
7. Apply load of 15000 lbs and take displacement reading
8. Remove load and take permanent displacement reading
9. Repeat Steps 7 and 8 for a total of 10 cycles
10. Apply proof load of 22,500 lbs and hold for 30 seconds
11. Release the load and visually inspect sample for any cracks, collapse, or other structural failures

Side wall load Test

1. Move load plate so that it is attached using the side wall configuration
2. Locate and align the test plate center with the middle of the long side of the lid and where the lid and vault come together on the side. See Fig. 7
3. Attach indicator gauge to test frame and located in on the top surface of the enclosure as close to the middle of the long side
4. Repeat Steps 6 to 11 above
5. If vault has not failed then take it to failure using the side wall load test

4. Observations

- All three vault configurations tested very well during the center load test. After the center load test there were no observed effects on either vault.
- The big difference between the two modified configurations was when the

1 side wall load test was performed. When the vault with the racks installed was loaded there were no observable effects. One could not tell load was being applied. When the vault without racks was loaded it started to collapse while holding the proof load of 22,500 lbs.

- 5 • During the side wall load test the non-modified prior art vault passed Tier 15 test with slight deformation observed. The vault was taken to failure, which occurred at 24,000 lbs when a crack was observed at the intersection of the rib pattern.
- 10 • Because the vault with racks did not fail during the Tier 15 test, it was taken to failure which still did not happen because the PC (polymer concrete) lid broke at 32,000 lbs.

5. Conclusions

15 The vault of this invention withstands the 22,500 lbs test load requirement of Tier 15, and produces a minimum vertical side wall load capacity in excess of 25,000 lbs. The vertical side load capacity is enhanced sufficiently to also meet load capacity standards in excess of at least 30,000 lbs. Side load stiffness k is in excess of 100,000 lbs/in and center load stiffness k is in excess of 150,000 lbs/in. The side load stiffness k is sufficiently enhanced to meet
20 standards in excess of at least 80,000 lbs/in.

More specifically, according to the comparative test results, vertical side wall load capacity, measured as a function of side wall deflection, met Tier 15 requirements with a vault body composition comprised of a non-metal, non-concrete, non-fiberglass thermoplastic material.
25 The vault with racks had a stiffness of $k = 189731$ lbs/in and $k = 124342$ lbs/in for the center load and side wall load tests, respectively. The vault without racks had a stiffness of $k = 96985$ lbs/in and $k = 59535$ lbs/in for the center load and side wall load tests respectively. The vault with racks was stiffer by 96% and 109% on the center load and side wall load tests, respectively. The prior art non-modified vault with cable racks had a stiffness $k = 134,477$
30 lbs/in and $k = 76,076$ lbs/in for the center and side wall load tests. The present invention's vault with cable racks was stiffer by 41% and 63% on the center load and side wall load tests, respectively, than the prior art non-modified vault.

Test Results:

Sample Description						$\delta_{\max} = 0.5''$
Vault with Cable Racks and Rack Pockets, Standard Drop in Lid						$\delta_{\text{set}} = \text{NA}$
LOAD CYCLE	Load Applied (lbs)	Deflection (inch)	Body Center Load Permanent	Side wall Load Body	Permanent Side wall Load	
10%	1500	0.030		0.039		
20%	3000	0.042		0.059		
30%	4500	0.050		0.076		
40%	6000	0.059		0.087		
50%	7500	0.066		0.094		
60%	9000	0.074		0.104		
70%	10500	0.081		0.114		
80%	12000	0.088		0.127		
90%	13500	0.096		0.140		
Cycle 1	15000	0.103	0.020	0.156	0.026	
Cycle 2	15000	0.103	0.020	0.154	0.029	
Cycle 3	15000	0.103	0.020	0.153	0.030	
Cycle 4	15000	0.103	0.020	0.154	0.033	
Cycle 5	15000	0.103	0.021	0.154	0.035	
Cycle 6	15000	0.104	0.021	0.156	0.034	
Cycle 7	15000	0.104	0.021	0.158	0.034	
Cycle 8	15000	0.103	0.022	0.157	0.033	
Cycle 9	15000	0.105	0.022	0.157	0.038	
Cycle 10	15000	0.104	0.022	0.157	0.036	
Final Cover Load	22500	0.143		0.235		
Failure Load	32000 lbs (PC Lid failed, not the vault)					

Sample Description						$\delta_{\max} = 0.5''$
Vault with Rack Pockets, but without Racks, Standard Drop in Lid						$\delta_{\text{set}} = \text{NA}$
LOAD CYCLE	Load Applied (lbs)	(inch) Deflection Body	Center Load Permanent	Side wall Load Body	Side wall Load Permanent	
10%	1500	0.032		0.043		
20%	3000	0.051		0.070		
30%	4500	0.065		0.091		
40%	6000	0.080		0.112		
50%	7500	0.094		0.131		
60%	9000	0.109		0.155		
70%	10500	0.125		0.182		
80%	12000	0.141		0.210		
90%	13500	0.157		0.238		
Cycle 1	15000	0.174	0.041	0.278	0.062	
Cycle 2	15000	0.167	0.041	0.266	0.072	
Cycle 3	15000	0.172	0.041	0.265	0.074	
Cycle 4	15000	0.168	0.043	0.267	0.072	
Cycle 5	15000	0.171	0.043	0.266	0.072	
Cycle 6	15000	0.172	0.046	0.267	0.076	
Cycle 7	15000	0.168	0.045	0.270	0.079	
Cycle 8	15000	0.171	0.046	0.272	0.079	
Cycle 9	15000	0.173	0.047	0.273	0.081	
Cycle 10	15000	0.169	0.045	0.272	0.083	
Final Cover Load	22500	0.279	0.075	0.455	0.137	
Failure Load	22500 lbs					

<u>Sample Description</u>		Prior Art Vault w/o Molded in Rack Slots. Vault Fitted with Three Racks per Side. Standard Lid				δ max =0.5"
						δ set = NA
LOAD CYCLE	Load Applied (lbs)	Body Deflection (inch)	Center Load Permanent	Side wall Load Body	Side wall Load Permanent	
10%	1500	0.041		0.039		
20%	3000	0.053		0.058		
30%	4500	0.065		0.075		
40%	6000	0.076		0.092		
50%	7500	0.086		0.109		
60%	9000	0.097		0.128		
70%	10500	0.109		0.148		
80%	12000	0.120		0.170		
90%	13500	0.131		0.197		
Cycle 1	15000	0.142	0.021	0.217	0.038	
Cycle 2	15000	0.137	0.020	0.203	0.033	
Cycle 3	15000	0.135	0.020	0.206	0.033	
Cycle 4	15000	0.135	0.020	0.201	0.032	
Cycle 5	15000	0.134	0.020	0.197	0.030	
Cycle 6	15000	0.134	0.020	0.208	0.036	
Cycle 7	15000	0.136	0.022	0.203	0.035	
Cycle 8	15000	0.135	0.022	0.202	0.035	
Cycle 9	15000	0.136	0.022	0.203	0.035	
Cycle 10	15000	0.133	0.021	0.206	0.037	
Final Cover Load	22500	0.185	0.048	0.335	0.108	
Failure Load	24000 lbs					

[0043] The tests conducted on the present invention have demonstrated improvements in vertical side load capacity, as one example, for molded polymeric grade level enclosures, or other non-metal structures, such as fiberglass. The ANSI Tier 15 test results are also one example demonstrating the improvements in vertical side wall load capacity. Other test standards also can be used to measure the level of improvements provided by the invention.

1 As one example, similar comparative tests conducted on similar structures, but having
different vertical side wall requirements, would see an improvement in load capacities when
utilizing the structural combination of this invention.

5

10

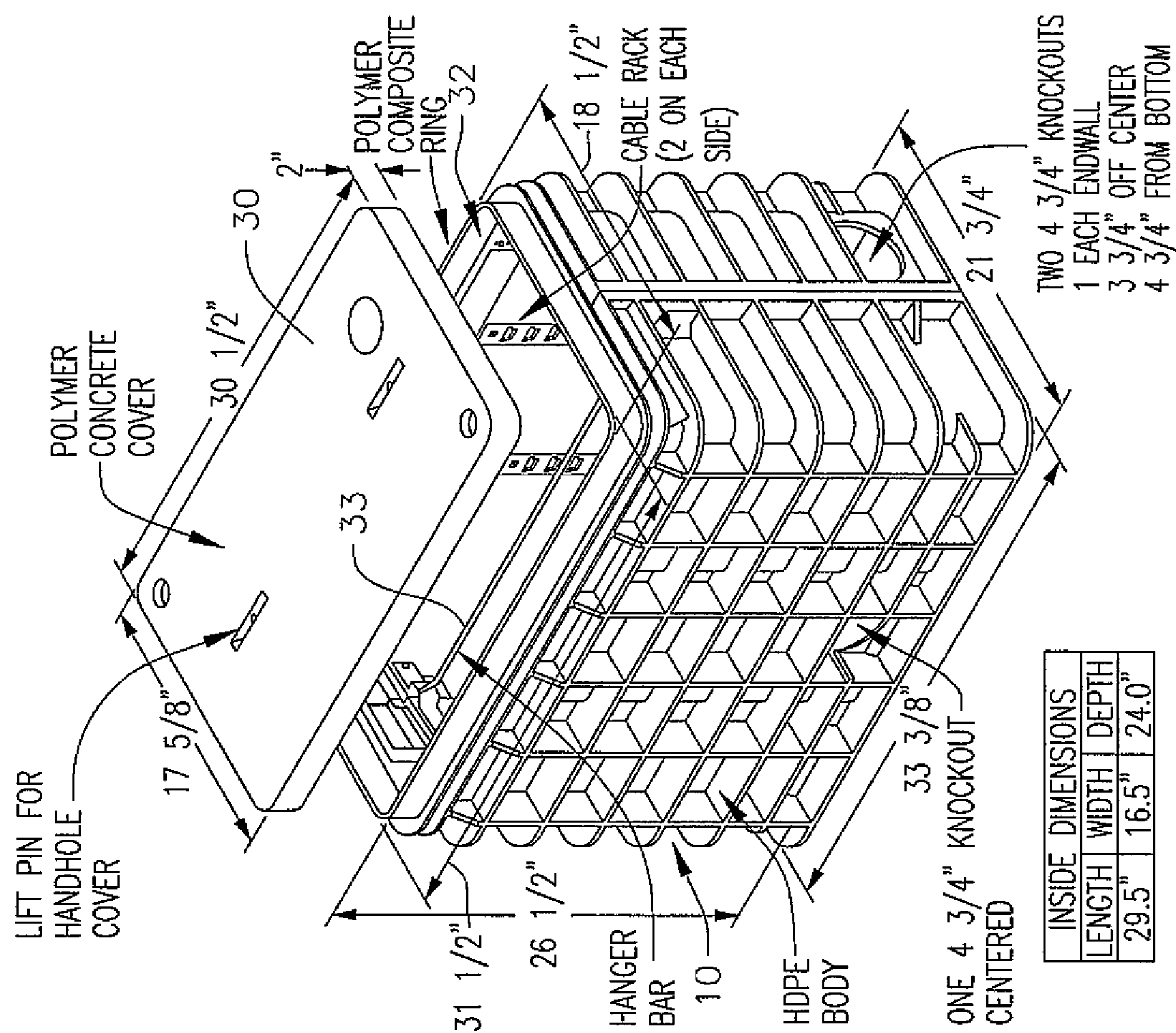
15

20

25

30

35



APPENDIX

FEATURES:

- *17X30X26 INCHES (OPEN FLOOR)W/COMPOSITE RING
- *HDPE BODY-POLYMER CONCRETE COVER/COMPOSITE FRAME-LOAD RATED TIER 15 (ANSI/SCRE 77 2010)
- *2 COVER LOCKING BOLTS, 9/16 STAINLESS STEEL HEX HEAD BOLTS 3.5"X3/8" THREAD BOLTS WITH WASHERS
- *2 BOX SELF-CENTERING STAINLESS STEEL CORROSION RESISTANT NUTS
- *3 CONDUIT HOLES, 1 ON EACH AND 1 ON ONE SIDEWALL (4.75 INCH KO)
- *4 HOT DIPPED GALVANIZED CABLE RACK SUPPORTS, 2 ON EACH SIDE (APPROX.48 INCHES TOTAL OF GALVANIZED METAL MATERIAL, RACK HARDWARE BOLTS ARE ALSO TO BE STAINLESS STEEL)
- *1 STAINLESS STEEL BAR FOR SUPPORTING SPLICE CLOSURE
- *MINIMUM OF 2 LIFTING SLOTS IN COVER EQUIPPED WITH STAINLESS STEEL PINS (SLOTS APPROXIMATELY 3/4"X2")

WEIGHT AND SHIPPING:

- *COVER WEIGHT: 46LBS
- *BOX WEIGHT: 53.2 LBS
- *ASSEMBLY WEIGHT: 99 LBS

LOAD RATINGS:

ANSI/SCTE TIER 15

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An enhanced strength grade level utility enclosure for underground utilities connections, comprising:

a substantially vertical wall structure extending continuously around an open interior region within the wall structure, the wall structure made of a molded polymeric material;

the vertical wall structure having an upper edge extending around an opening to the interior of the enclosure and a bottom edge on which the enclosure is supported;

a removable cover plate adapted for mounting to the opening in the grade level enclosure to close off at least a portion of the interior region from the environment, the cover plate adapted to engage at least a portion of the enclosure's upper edge structure;

the vertical wall structure including an upright inner wall panel extending from the upper edge to the bottom edge of the vertical wall structure, the inner wall panel having an upright inside face spanning the interior of the enclosure;

the inside face of the inner wall panel having left and right sides opposing one another;

one or more narrow, vertical slotted regions recessed in the inside face of the inner wall panel on the left side and on the right side of the enclosure extending from the upper edge to the bottom edge of the inner wall panel; and

an upright rigid support bar adapted for use as a cable rack positioned in at least one slotted region on each side of the wall structure's inside face;

the support bars having a flat continuous face flush with the inside face of the inner wall panel defining a cavity within the slotted region behind the flat continuous face, the support bars providing substantially continuous rigid vertical support extending from the upper edge to the bottom edge of the enclosure's vertical wall structure.

2. Apparatus according to claim 1 in which the recessed support bars provide enhanced wall strength for the vertical wall structure sufficient for meeting ANSI/SCTE 77-2010 Tier 15 vertical side wall load test standards.

3. Apparatus according to claim 1 or 2 including a vertically and horizontally extending exterior supporting grid structure made of a molded polymeric material integrally molded to the inside face of the vertical wall structure, the grid structure comprising horizontally spaced apart vertical ribs extending continuously from a lower to an upper portion of the vertical wall structure, and vertically spaced apart horizontal ribs extending continuously around the vertical wall structure; and in which the inner wall panel is molded to the grid structure.

4. Apparatus according to claim 1, 2 or 3 in which the recessed support bars provide enhanced wall strength sufficient for meeting the ANSI Tier 15 vertical side wall load and center cover load test standards.

5. Apparatus according to any one of claims 1 to 4 in which the vertical wall structure is made from at least one of (a)-(c): (a) high density polyethylene; (b) a thermoplastic material; (c) a polyolefin material.

6. Apparatus according to any one of claims 1 to 5 in which the cover plate is made from a polymer/concrete material.

7. Apparatus according to any one of claims 1 to 6 in which the rigid support bar has a U-shaped cross sectional configuration with the flat continuous face of the bar facing toward the interior of the enclosure, including spaced apart fasteners rigidly affixing each support bar through the cavity to the recessed slotted region, and in which the support bars include stepped connectors extending through the flat continuous face for attachment to equipment disposed within the interior of the enclosure.

8. Apparatus according to any one of claims 1 to 7 including underground telecommunications equipment attached to vertically spaced apart connectors on the support bar.

9. Apparatus according to any one of claims 1 to 8 in which the vertical side wall load capacity is in excess of 25,000 lbs.

10. Apparatus according to any one of claims 1 to 9 in which the wall structure of the enclosure body comprises a substantially non-metal, non-concrete, non-fiberglass thermoplastic material.

11. An enhanced strength grade level utility enclosure for underground utilities connections, comprising:

- a substantially vertical wall structure extending continuously around an open interior region within the wall structure, the wall structure having an open bottom and made of a molded polymeric material;

- the vertical wall structure having an upper edge extending around an opening to the interior of the enclosure and a bottom edge on which the enclosure is supported;

- the vertical wall structure including an upright inner wall panel extending from the upper edge to the bottom edge of the vertical wall structure, the inner wall panel having an upright inside face spanning the interior of the enclosure;

- the inside face of the inner wall panel having left and right sides opposing one another;

- longitudinally spaced apart, vertical slotted regions recessed in the inside face of the inner wall panel on the left side and on the right side of the enclosure extending from the upper edge to the bottom edge of the inner wall panel; and

- an upright rigid support bar adapted for positioning in separate vertical slotted regions on each side of the wall structure's inside face;

- in which positioning of the support bars in the vertical slotted regions having a flat continuous face flush with the inside face of the inner wall panel defining a cavity within the vertical slotted regions behind the flat continuous face, the support bars provide substantially continuous rigid vertical support extending from the upper edge to the bottom edge of the enclosure's vertical wall structure.

12. Apparatus according to claim 11 in which the recessed support bars provide enhanced wall strength for the vertical wall structure sufficient for meeting ANSI/SCTE 77-2010 Tier 15 vertical side wall load test standards with a side load stiffness in excess of 100,000 lbs/in.

13. Apparatus according to claim 11 or 12 including a vertically and horizontally extending exterior supporting grid structure made of a molded polymeric material integrally molded to the inside face of the vertical wall structure, the grid structure comprising horizontally spaced apart vertical ribs extending continuously from a lower to an upper portion of the vertical wall structure, and vertically spaced apart horizontal ribs extending continuously around the vertical wall structure; and in which the inner wall panel is molded to the grid structure.

14. Apparatus according to any one of claims 11 to 13 in which the recessed support bars provide enhanced wall strength with a side load stiffness in excess of 100,000 lbs/in.

15. Apparatus according to any one of claims 11 to 14 in which the enclosure includes at least two of the rigid support bars on each side of the enclosure.

16. Apparatus according to any one of claims 11 to 15 in which the vertical wall structure of the enclosure is made from at least one of (a)-(c): (a) high density polyethylene; (b) a thermoplastic material; (c) a polyolefin material.

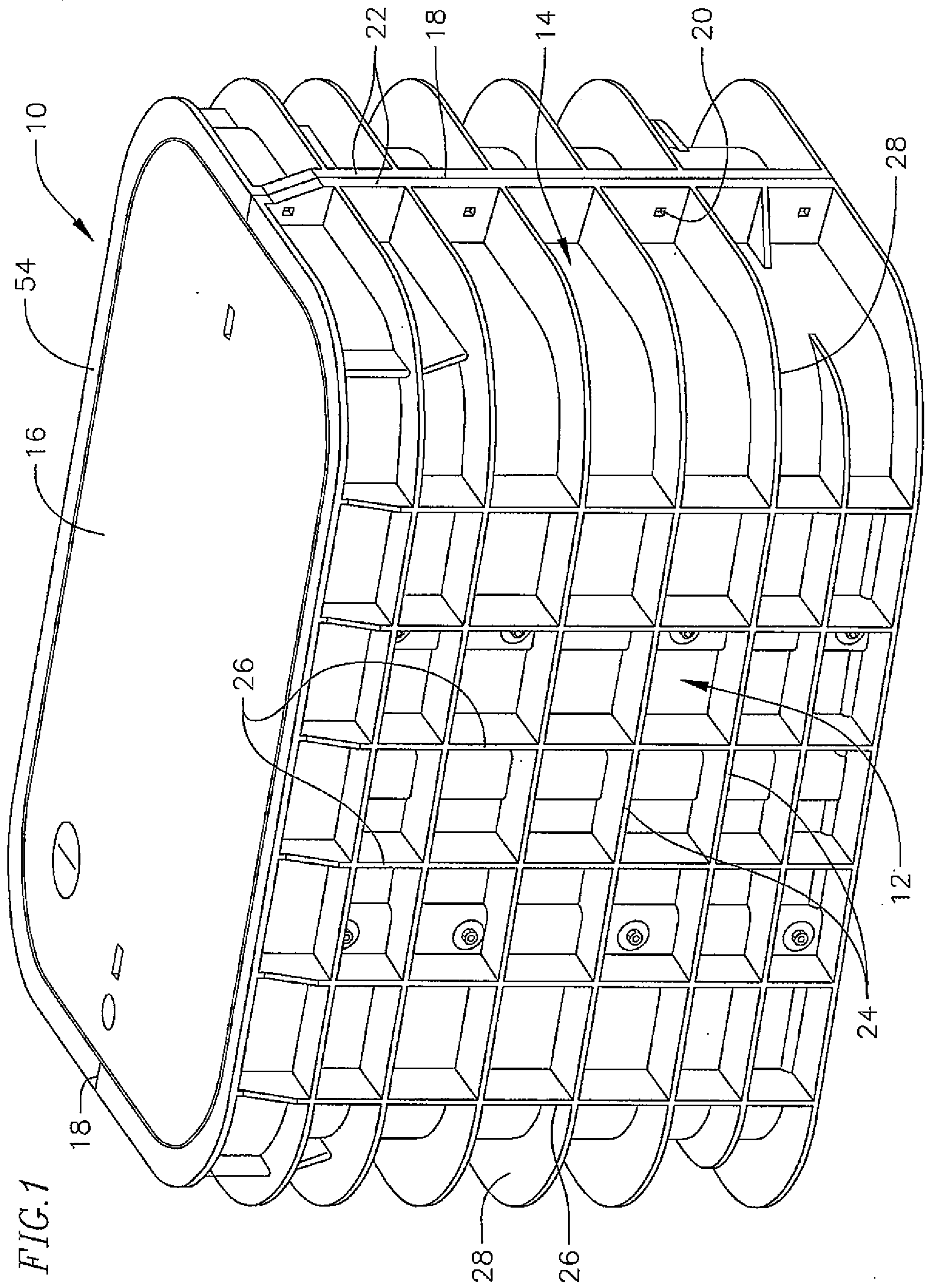
17. Apparatus according to any one of claims 11 to 16 in which the rigid support bar has a U-shaped cross sectional configuration with the flat continuous face of the bar facing toward the interior of the enclosure, including fasteners adapted for rigidly affixing the support bars through the cavity to the recessed slotted regions.

18. Apparatus according to claim 17 in which the support bars comprise cable racks having stepped connectors extending through the flat continuous face for attachment to equipment disposed within the interior of the enclosure.

19. Apparatus according to any one of claims 11 to 18 in which the vertical side wall load capacity is in excess of 25,000 lbs.

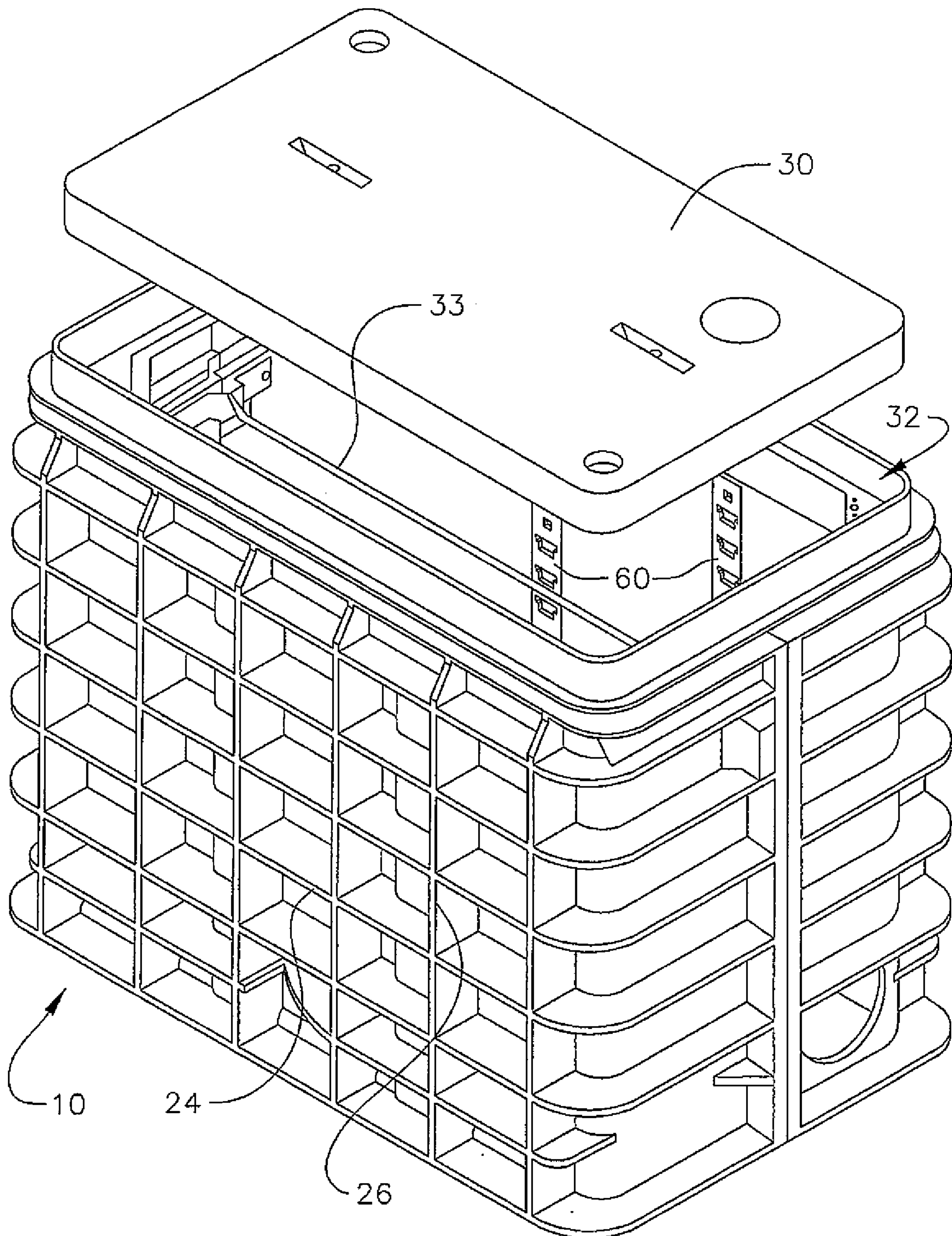
20. Apparatus according to any one of claims 11 to 19 in which the enclosure's center load body deflection meets the ANSI Tier 15 test requirements.

1 / 10



2 / 10

FIG. 1A



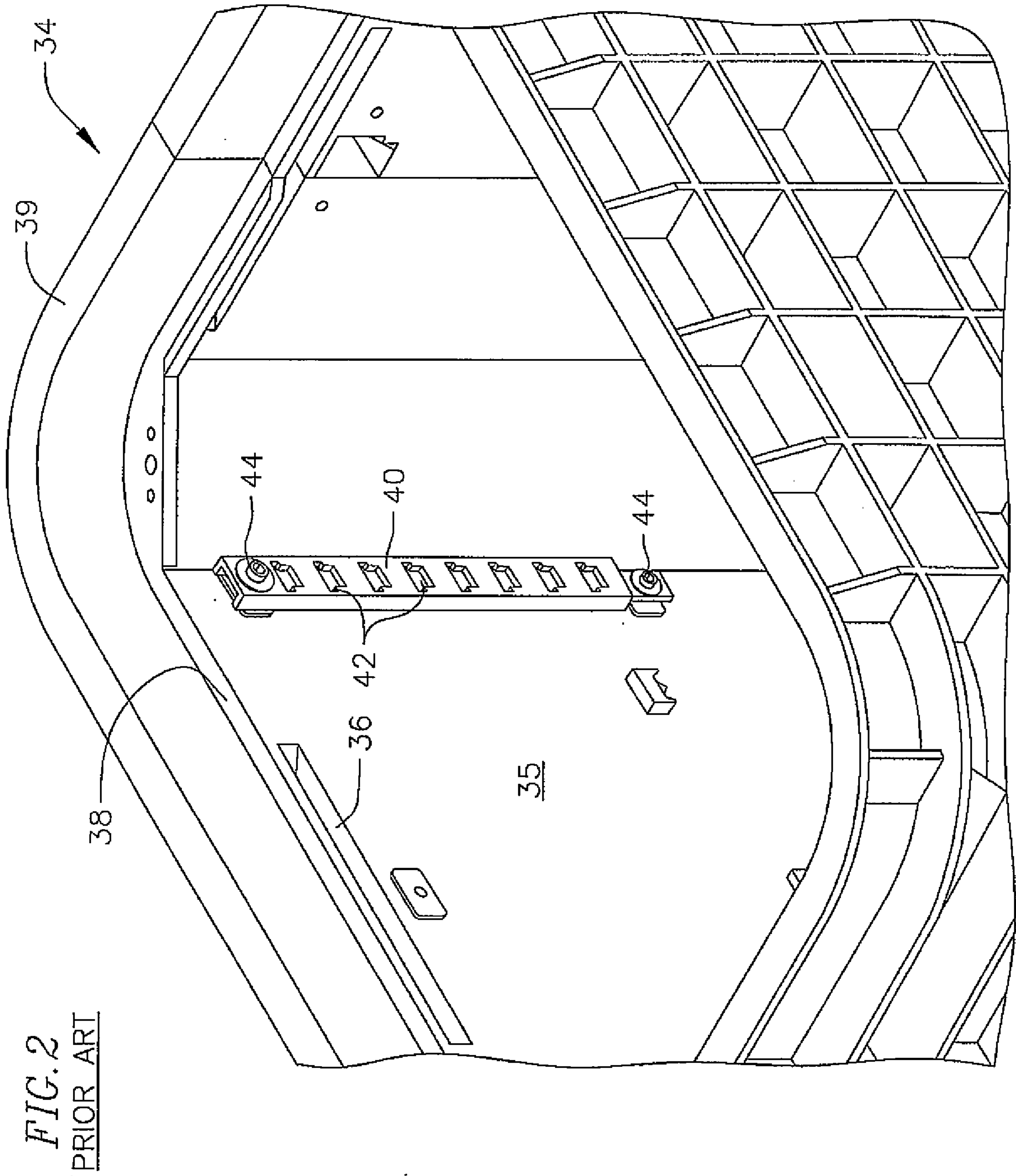
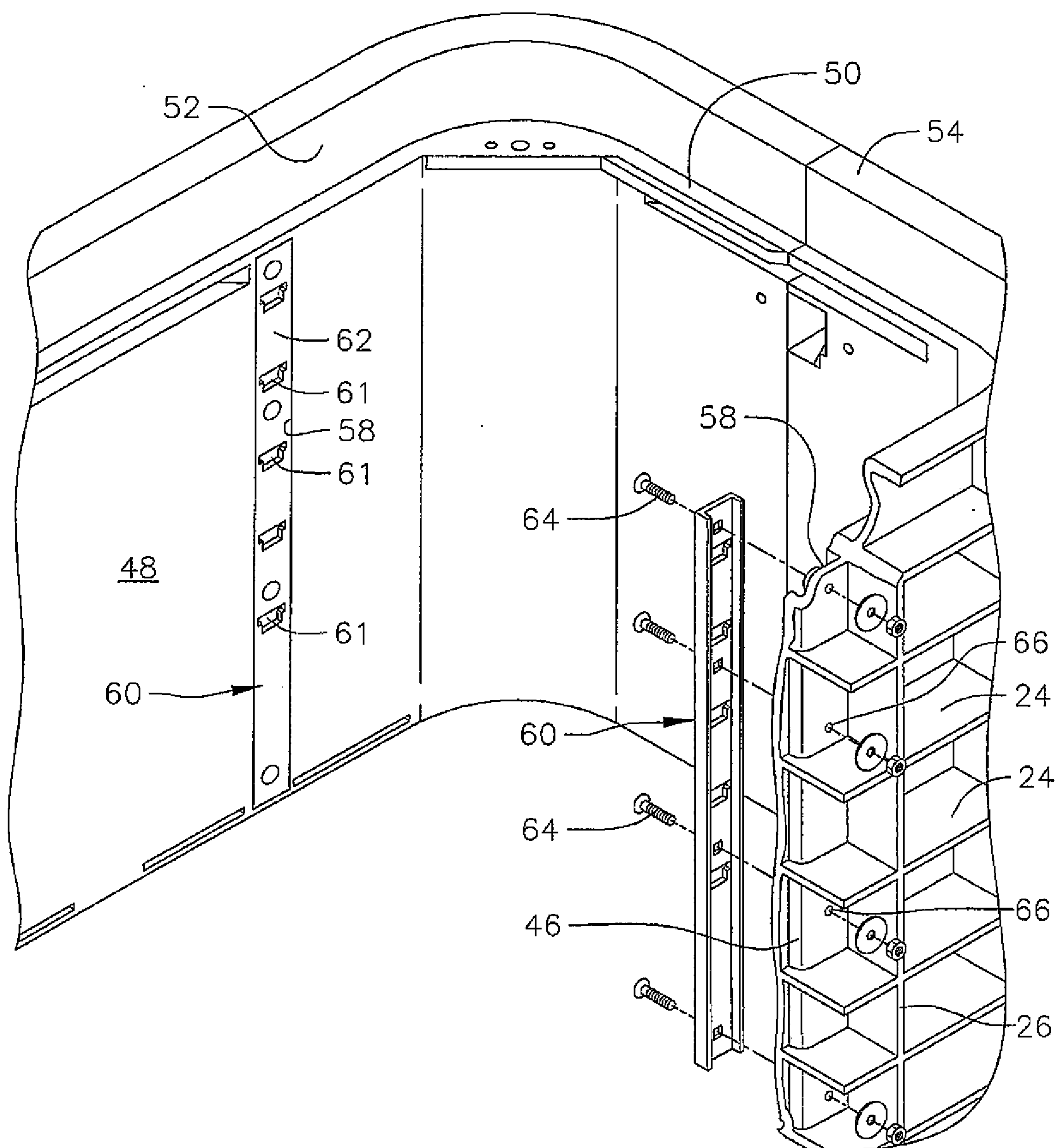
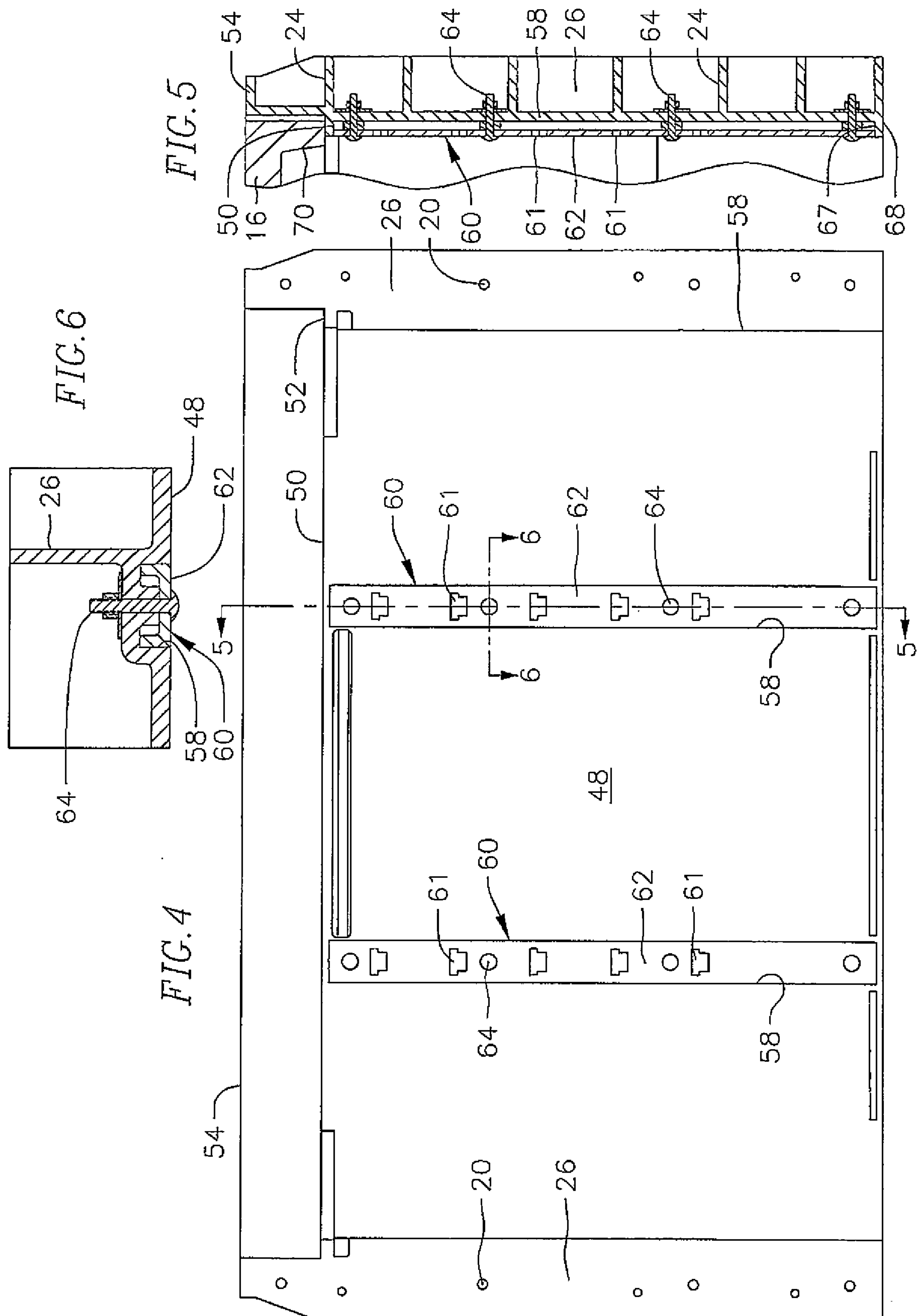


FIG. 3

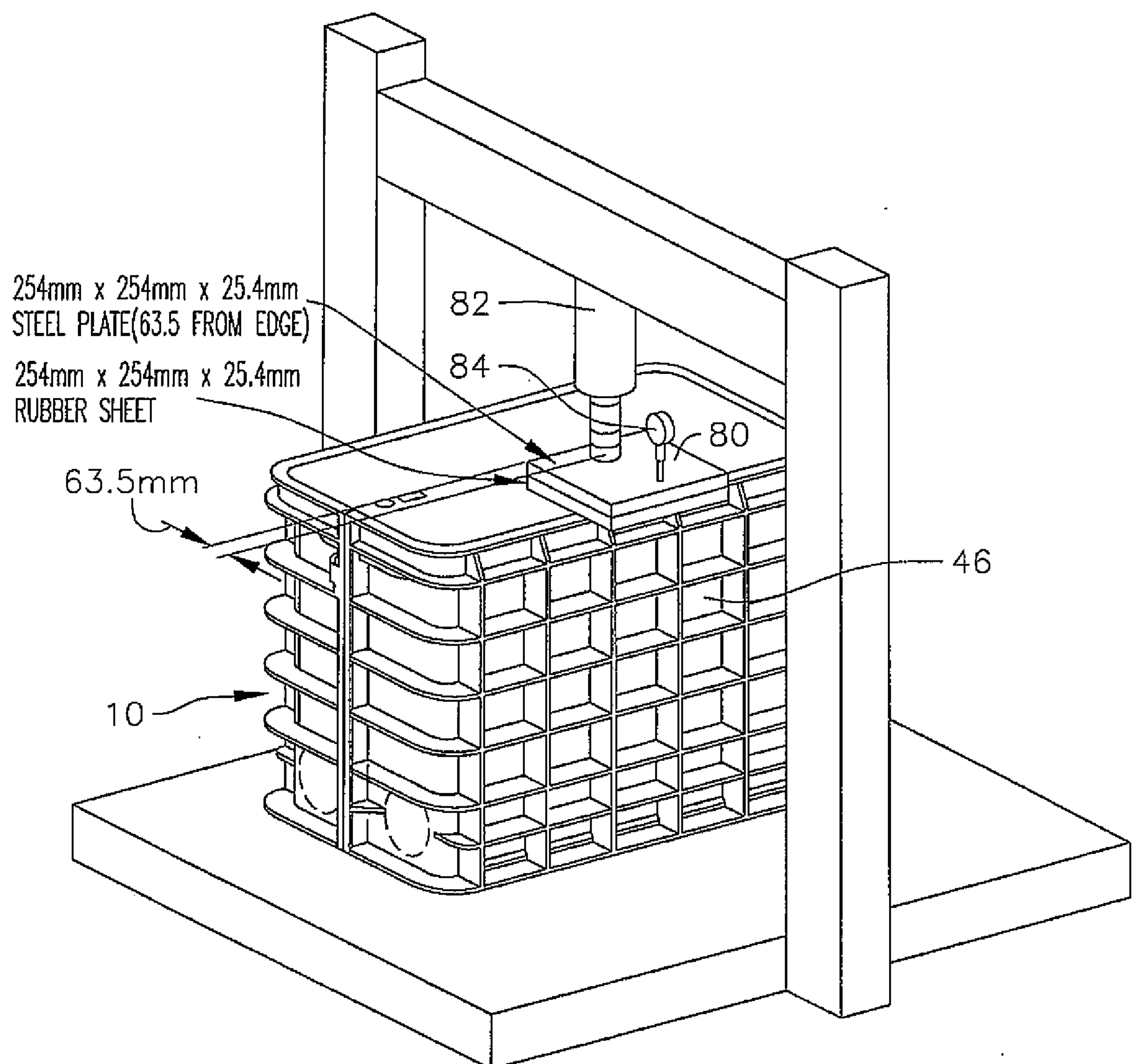


5 / 10



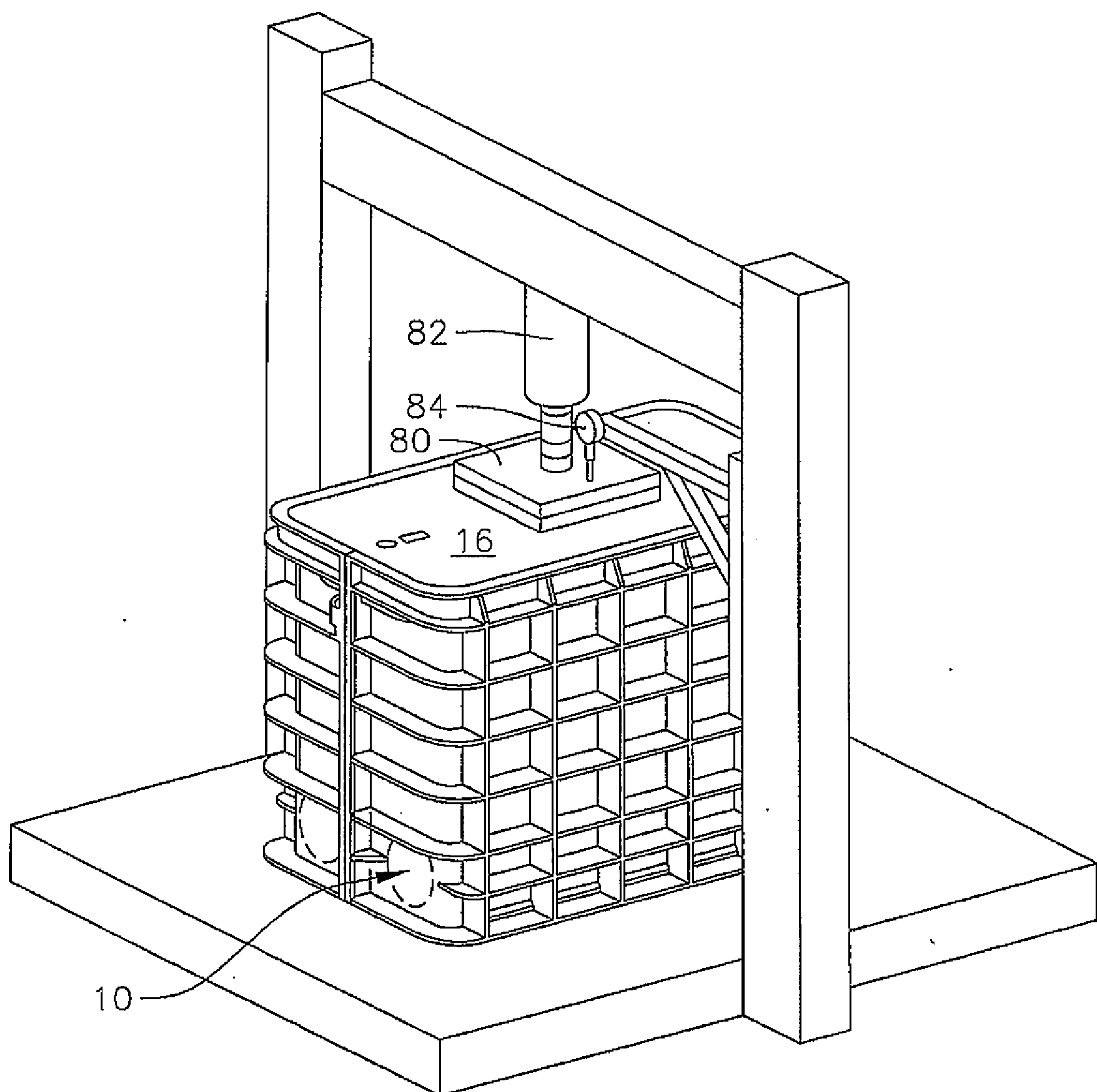
6 / 10

FIG. 7

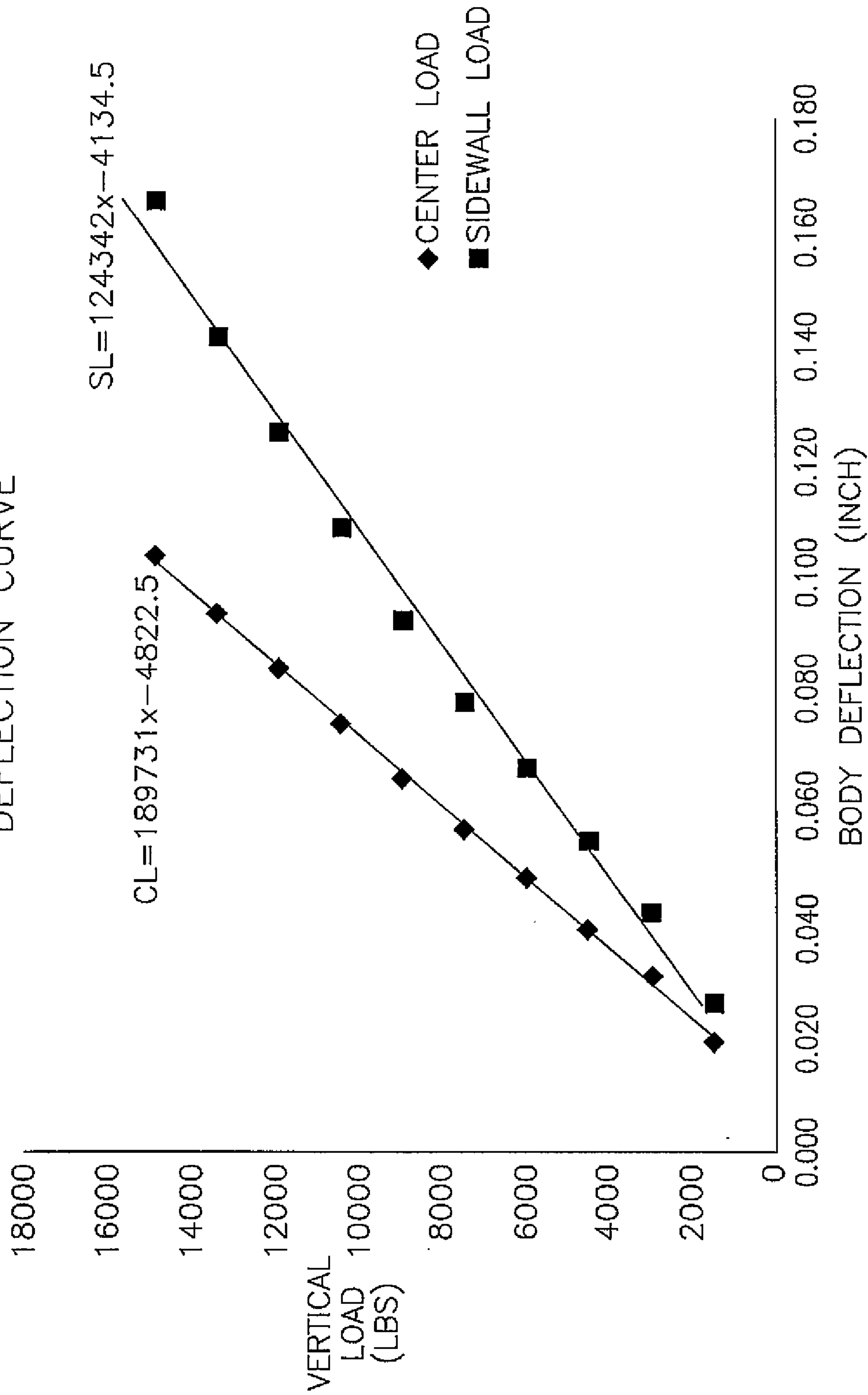


7 / 10

FIG. 8

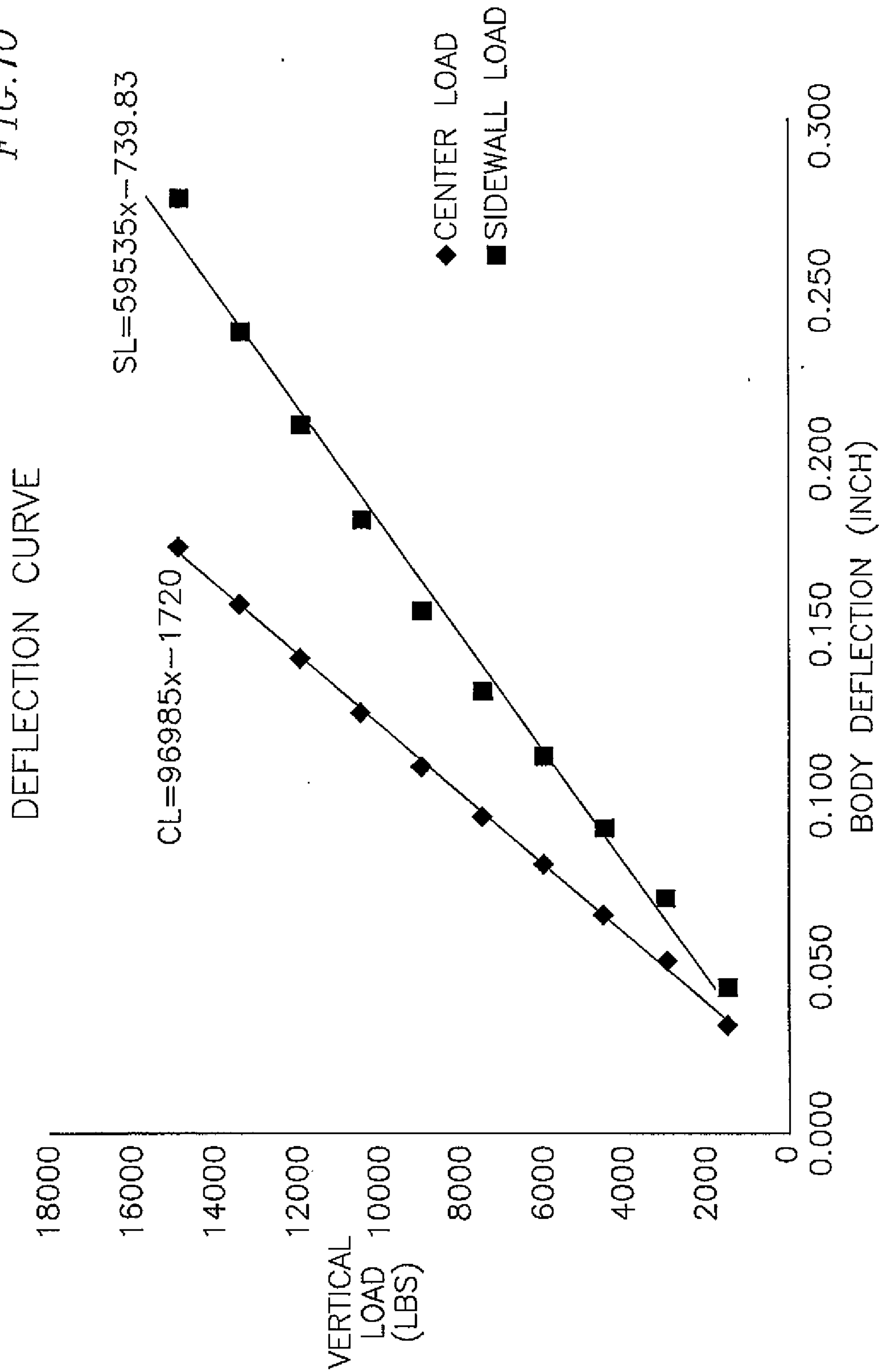


DEFLECTION CURVE



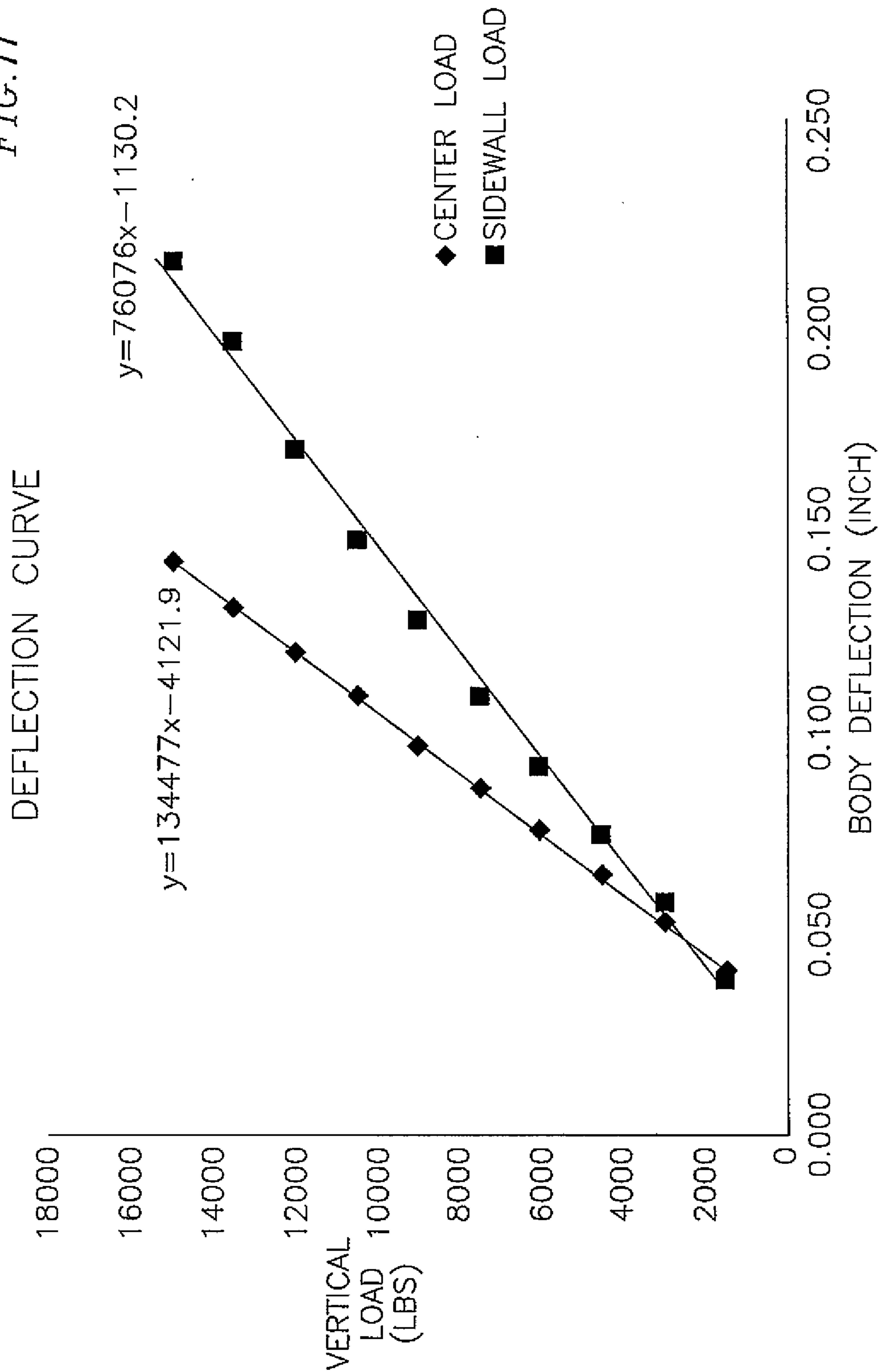
GRAPH SHOWS THE STIFFNESS (k) OF THE VAULT FOR TWO LOAD LOCATIONS.
FOR THE CENTER LOAD $k=189731$ LBS/IN AND FOR THE SIDEWALL LOAD $k=124342$ LBS/IN.

FIG.10



GRAPH SHOWS THE STIFFNESS (k) OF THE VAULT FOR TWO LOAD LOCATIONS.
FOR THE CENTER LOAD $k=96985$ LBS/IN AND FOR THE SIDEWALL LOAD $k=59535$ LBS/IN.

FIG. 11



GRAPH SHOWS THE STIFFNESS (k) OF THE VAULT FOR TWO LOAD LOCATIONS.
FOR THE CENTER LOAD $k=13447$ LBS/IN AND FOR THE SIDEWALL LOAD $k=76076$ LBS/IN.

