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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 August 2012 (30.08.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/114100 A2

(51) International Patent Classification:
B65F 1/02 (2006.01)

(21) International Application Number:
PCT/GB2012/050391

(22) International Filing Date:
22 February 2012 (22.02.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1103102.8 23 February 2011 (23.02.2011) GB

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(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, 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, IS, JP, KE, KG, KM, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, MD, 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, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

WO 2012/114100 A2

(54) Title: APPARATUS

(57) Abstract: Apparatus for use in a bomb resistant bin comprising first and second sheet components each formed with a hole and a third sheet component provided with a corresponding tab is disclosed. Each of the first and second components has an inner surface and an outer surface on the opposing side. The inner surfaces of the first and second components are located against each other, wherein the third component is located against the outer surface of the first component and the tab is received in the holes of the first and second components such that the tab protrudes at least to the outer surface of the second component. The tab is secured to the outer surface of the second component so that the first and second sheet components are joined in a layered fashion adding structural integrity to the device.

Apparatus

Field

The present invention relates to apparatus and in particular, although not exclusively, to apparatus for use in a bomb resistant bin.

Background

Refuse bins are typically provided in public places in town and city centres. However, security concerns have resulted in the removal of refuse bins from some public areas causing inconvenience to the public and an increase in cost for those charged with litter clearance.

Bomb resistant bins with the ability to contain explosions are known. The design of such bins is challenging because of the usually conflicting requirements of effectiveness of blast-resistance and cost of manufacture, ease of emptying, ease of use by the public, ease of installation and later removal.

Summary

According to the present invention, there is provided apparatus comprising first and second sheet components each formed with a hole and a third sheet component provided with a corresponding tab, each of the first and second components having an inner surface and an outer surface on the opposing side, the inner surfaces of the first and second components being located against each other, wherein the third component is located against the outer surface of the first component and the tab is received in the holes of the first and second components such that the tab protrudes at least to the outer surface of the second component, and wherein the tab is secured to the outer surface of the second component.

This 'tab and hole' configuration allows for the centre of the first and the second components to be joined in a layered fashion, which adds structural integrity to the device. Moreover, the third component may provide improved resistance to

bending across the planes of the first and second components. In addition to the tab and hole configuration, fillet welding may be performed along the edges of two components so as to further increase the strength of the device.

Preferably, the tab is welded to the outer surface of the second component.

In one embodiment, the first and the second component are of similar shape and thickness. This creates a double thickness adding strength to the structure.

Conveniently, the first and the second components lie in parallel planes and the tab lie in a plane perpendicular to the planes of the first and second components. The tab extending through the holes of the first and the second components prevent any movement of the components relative to one another in a direction parallel to their planes. The fact that the third component is located against the first component and the tab is joined to the outer surface of the second component prevents the first and the second component to move away from each other in a direction parallel to the plane of the tab.

The tab may protrude past the outer surface of the second component.

Conveniently, the tab protrudes by an amount that is such as to cause the tab to be levelled with said outer surface of the second component when the tab is welded to the outer surface of the second component. This can allow the outer surface of the second component to be provided with a relatively smooth surface, assisting alignment or engagement with another part.

In one embodiment, the third component includes multiple tabs each of which extends through holes in the first and second components at least to be level with the outer surface of the second component and each of which is secured to the outer surface of the second component.

In an alternative embodiment, the apparatus comprises a fourth sheet component joined against the third components, the fourth component having one or more tabs each of which extends through holes in the first and second components at least to be level with the outer surface of the second component and each of which is secured to the outer surface of the second component. This provides further reinforcement, to complement the third component, and also provides further securing of the first and second components against one another.

The holes in the first and second components that receive tabs of the third component may be disposed at different locations along the length of the third and fourth components to the holes that receive tabs of the fourth component.

Brief Description of the Drawings

Embodiments of the present invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a blast resistant container embodying the present invention;

Figure 2 shows a perspective view of an inner side of a door of the container;

Figure 3 shows a perspective view of an inner side of the door of the container without a cover;

Figure 4 shows a front view of an outer side of the door shown in Figures 2 and 3;

Figure 5 shows a perspective view of a paper gate fitted to the door;

Figure 6 shows a perspective view of an upper locking plate with locking hooks;

Figure 7 shows a perspective view of a lower locking plate with locking hooks;

Figure 8 shows a perspective view of a part of either of the locking plates and showing a second layer;

Figure 9 shows a perspective view the same as Figure 8 but with a reinforcing component in place;

Figure 10 shows a perspective view of part of the reinforcing component shown in Figure 9;

Figure 11 shows a perspective view of a cover fitted to an inner side of the door; and

Figure 12 shows a perspective view of the container without the door.

Detailed Description

Referring now to the drawings, there is shown in Figure 1 a blast resistant container 1 configured to absorb and upwardly direct forces of an explosion originating inside the container 1.

The container 1 comprises a door 2, a rear wall 3, a left and a right side wall 4, 5 and a base 6 (shown Figure 12) defining a space for holding refuse. The rear wall 3, the left and the right side walls 4, 5 are integrally formed, for example, it may be formed of a metal sheet. The door 2 is removably attachable to edges formed at the front of the two side walls 4, 5 so as to provide access to the space provided within the container 1. The door 2 is hinged so that is can be swung open and closed. The hinge axis is vertical, and there is no vertical change in the centre of gravity of the door as it hinges.

The base 6 is formed with a plurality of holes (not shown) for receiving fastening means such as bolts so that the container 1 can be secured to the ground upon which it stands. At an opposite end to the base 6, an aperture 8 is formed for directing or channelling a blast from an explosion in a direction away from the base 6 and generally vertically. The longitudinal axis of the container 1 is generally vertical in use.

Referring now to Figures 2 to 5, the door 2 comprises a front panel 20 preferably made out of a metal sheet. The door 2 of the container is provided with a refuse aperture 9 through which a user disposes of their waste so that the waste is received and contained in the space of the container 1. A refuse aperture panel 21 is fitted on the inner surface of the front panel 20 covering the aperture 9. The refuse aperture panel 21 is removably attachable to the refuse aperture 9 and when it is attached to the front panel 20 a user is prevented from

disposing of their waste through the aperture 9. This may be necessary in order to put the container temporarily out of use as a bin, in particular during high security alerts when there is an imminent threat. In an alternative embodiment, the refuse aperture panel 21 may be formed with a variety of holes so that the size of the waste received in the space of the container 1 can be controlled.

The door 2 is removably attached to the container 1 by cooperating means. The cooperating means of the door 2 includes locking hooks 28 attached to locking plates 25, 26 which are movable in a direction parallel to the longitudinal axis of the container 1. The locking hooks 28 may also be termed locking pins. The locking plates 25, 26 may also be termed locking pin mechanisms. The locking hooks 28 engage with corresponding cooperating elements, which can be termed locking channels 50. The cooperating means enable the door 2 to be secured to the left and right side walls 4, 5 of the container 1 such that it is retained in its position in the event of an explosion within the container. Additionally, the cooperating means allow for the door 2 to be opened such as to allow access to the interior of the container 1, in particular when the container is used for refuse and needs emptying or cleaning.

The locking plates 25, 26 comprise an upper 25 locking plate and a lower locking plate 26 which are shown in Figures 6 and 7, respectively, and in situ in Figure 3. Both plates 25, 26 have a rectangular profile and are formed of a respective metal sheet. Centrally positioned apertures 27 of the plates 25, 26 have been cut out. This reduces the weight of the plates 25, 26 as well as the quantity of material required without significantly reducing strength where high strength is most needed. At approximately each corner of each of the plates 25, 26, the locking hooks 28 are formed. The locking hooks 28 each have a longitudinal axis that extends perpendicular to a line connecting opposite locking hooks. The axes of the locking hooks is vertical in use.

An end of an arm 29 is attached to the lower locking plate 26. At an opposite end of the arm 29, a rack 30 having teeth 31 is formed. The arm 29 and the rack

30 extend parallel to the locking hooks 28, so vertically in use. The upper locking plate 25 is also formed with a rack 30 having teeth 31. When the upper and lower locking plates 25, 26 are in the position shown in Figure 3, the rack 30 on the arm 29 extending from the lower locking plate 26 is parallel to the rack 30 formed on the upper locking plate 25. Furthermore, the teeth 31 of the racks 30 are opposing one another. A pinion 32 is located between the racks 30 and is rotatable about a central axis. The pinion 30 engages with the teeth 31 of the racks 30 such that rotation of the pinion causes the racks 30 to move up and down respectively. This causes the plates 25, 26 to be moved in a direction parallel to the longitudinal axis of the container 1. The plates 25, 26 have generally the same configuration, and approximately the same weight. The rack and pinion arrangement results in the plate 25 moving upwards by the same amount as the other plate 26 is moved downwards. Because the plates 25, 26 have about the same weight, the force required to move the plates 25, 26 to activate locking or unlocking is relatively low. Moreover the force required is approximately the same for both the locking and unlocking movements.

The pinion 30 is further formed with holes (not shown) for receiving a corresponding key (not shown) so that the pinion can be rotated so as to lock and unlock the door 2. As shown in Figure 1, a hole 80 is formed in the door 2 exposing the holes in the pinion such that they can be accessed with a corresponding key 81.

The locking hooks 28 of each locking plate 25, 26 face the same direction and lie in the plane of the locking plates 25, 26. However, the locking hooks 28 of the upper locking plate 25 face the opposite direction to the locking hooks 28 of the lower locking plate 26, as is best seen in Figure 3. When the locking hooks 28 engage with the cooperating elements of the container 1 such that the door 2 is secured to said container 1, movement of the door in a bilateral direction parallel to the longitudinal axis of the container is restricted. This increases the blast resistance of the door 2 in contrast to a container wherein the hooks are configured to face the same direction. If the hooks were to face the same

direction, movement of a door due to an explosion might only be restricted in a unilateral direction parallel to the longitudinal axis of the container.

Outer portions of the locking plates 25, 26 and the corresponding locking hooks 28 extending therefrom are provided with a second layer 33, as is best seen in Figure 8. Although it is not shown in Figure 8, it should be understood that a second layer 33 is formed on both locking plates 25, 26. As such, each of the locking hooks 28 includes two layers of sheet metal. However, much of the locking plates 25, 26 is formed of only single thickness sheet steel. The second layers 33 lie in a plane parallel to the locking plates 25, 26 and are formed with holes 24. The second layers 33 are secured to the main sheet of the locking plates 25, 26 by fillet welds where the edges of the holes 24 meet the adjacent surface of the main sheet of the locking plates 25, 26. Additionally or alternatively, the second layers 33 are secured to the main sheet of the locking plates 25, 26 in part by fillet welds at the step formed where the second layers 33 end and the main sheet continues. This is achieved also by the way in which reinforcing members are secured, as is described below.

As can be seen best in Figure 9, each outer portion of the locking plates 25, 26 is also reinforced with a reinforcing member 34. The reinforcing members 34 each lie in a plane perpendicular to the locking plates 25, 26 thereby adding additional strength in yet another direction. The reinforcing members 34 of each plate 25, 26 also extend over the tips of the locking hooks 28. This provides further strength to the hooks 28 and facilitates self-guiding of the locking hooks 28 into the cooperating elements. The corners 35 of the locking hooks 28 are tapered, and the tapering may be rounded. This further eases the guiding of the hooks 28 into the cooperating elements of the container.

The second layers 33 and the reinforcing members 34 are joined to the locking plates 25, 26 by means of welding tabs received through holes. In particular, holes 34b are formed in the second layers 33 at locations corresponding to holes in the locking plates 25, 26 as seen in Figure 8. The reinforcing members 34

are formed with tabs 34a, that are best seen in Figure 10. The tabs 34a have a rectangular cross-section, one dimension of which is equal to the thickness of the metal sheet constituting the reinforcing members 34. The other dimension may be larger, for instance up to 150% of the sheet thickness. In this example, the sheet thickness is 6mm and the other dimension of the cross-section of the tabs is 8mm.

The tabs 34a are inserted into the holes 34b of corresponding dimensions. The holes 34b may be a small amount larger than the exterior dimensions of the tabs 34a, for instance. The tabs 34a protrude by a small distance, in this example approximately 1 millimetre, past the opposite side of the locking plates 25, 26. The 1 millimetre protrusions of the tabs 34a are thereafter welded to the locking plates 25, 26. The weld may be a weld material-free weld. Advantageously, the 1 millimetre protrusions are generally levelled with the surface of the locking plates 25, 26 during the welding. Additional fillet welding is performed for some of the junction between the reinforcing members 34 and the second layer 33, and for some of the junction between the reinforcing members 34 and the locking plates 25, 26.

The locking plates 25, 26 and the second layer are preferably formed of metal sheet. In this way, the downsides of using machined, cast etc metal can be avoided. The metal sheet may be cut into shape by laser cutting. The metal sheet may be a high carbon steel, such as a high carbon hardened steel sold under the name Domex ™.

Although in the present embodiment, the second layers 33 are secured to each locking plate 25, 26 by fillet welds at some of the junctions of the edges of the second layers 33 and the edges of respective locking plate 25, 26, it shall be understood that in an alternative embodiment the second layers 33 may be secured to each locking plate 25, 26 by the use of the hole and tab configuration only, which is achieved by using a third component formed with tabs which in this case is the reinforcing member 34.

The tab and hole configuration as described above allows for the centre of each locking plate 25, 26 and respective second layers 33 to be joined in a layered fashion so as to provide a double thickness, which adds structural integrity to the locking plates 25, 26 and their locking hooks 28. In the present invention, the reinforcing component 34 secures each second layer 33 to respective locking plate and also provides improved resistance to bending across the planes of the locking plates 25, 26 and the second layers 33. In particular, this is achieved as the plane of the reinforcing component 34 is perpendicular to the planes of the locking plates 25, 26 and the second layers 33.

Furthermore, the tab of the reinforcing component 34 extending through the holes 34b of the locking plates 25, 26 and the second layers 33 prevent any movement of the locking plates and the second layer relative to one another in a direction parallel to their planes. The fact that the reinforcing component 34 is located against each second layer 33 and the tab is joined to the outer surface of each locking plate 25, 26 prevents the second layers 33 to move away from respective locking plates in a direction parallel to the plane of the tab.

The tab and hole configuration is not limited to a container 1 as described with reference to the accompanying Figures. It is envisaged that it can be applied to any apparatus comprising a first and a second sheet component that are to be secured to one another in a layered fashion by the use of a third component. For such a device, the first and second components would each be formed with at least one hole and by using a third sheet component provided with a corresponding tab, the first and second components can be secured to one another by the third component locating against an outer surface of the first component and the tab being received in the holes of the first and second components such that the tab protrudes at least to an outer surface of the second component. The tab would then be secured to the outer surface of the second component by welding as described with reference to the accompanying Figures.

It shall also be understood that it is optional as to whether the third component provides a function in addition to securing the first component to the second component of a device.

Referring now to Figures 12, the cooperating means on the container 1 comprises two locking channel structures 50 which are fixedly attached to the inside of the container 1 adjacent to the free edges of the left and right side walls 4, 5. Each locking channel structure 50 is defined in part by one of first and second elongate components 51, 52 and defines respective locking channels for receiving locking pins 28.

The container 1 absorbs and upwardly directs forces of an explosion originating inside the container 1 by the container being structurally sound and strong due to the two side walls 4, 5 and the rear wall 3 being integrally formed and the door 2 being securely attached to the container 1. In the event of an explosion within the container, forces are exerted outwards on the three walls 3, 4, 5 and the door 2 of the container. The container 1 remains in its position as it is secured to the ground upon which it stands. The three walls 3, 4, 5 can withstand forces of great magnitude as they are formed out of a single sheet of metal. The door 2, being in a locked position, remains secured to the container 1 due the locking hooks 28 of each locking plate 25, 26 facing opposite directions such that the door is restricted to move in a bilateral direction parallel to the longitudinal axis of the container. Additionally, although the locking plates are formed out of sheets of material which provides strength to the locking mechanism of the door, the strength of the locking plates 25, 26 are further enhanced by the second layers 33 which are secured to the locking plates 25, 26 by the reinforcing components 34. The reinforcing components also provide additional strength to the locking hooks 28 by lying in a plane perpendicular to the planes of the locking plates 25, 26, locking hooks 28 and the second layers 33, thereby enhancing the strength of the locking mechanism and the door itself. Furthermore, the fact that the locking hooks 28 and the locking plates lie

in a plane perpendicular to the left and right side walls 4, 5, means that the locking hooks and the locking plates resist forces exerted in a general perpendicular direction on the inner surfaces of the side walls 4, 5, thereby retaining the side walls 4, 5 in their position.

Although embodiments of the invention have been shown and described, it will be appreciated by those skilled in the art that variations may be made to the above exemplary embodiments that lie within the scope of the invention, as defined by the following claims.

Claims

1. Apparatus comprising first and second sheet components each formed with a hole and a third sheet component provided with a corresponding tab, each of the first and second components having an inner surface and an outer surface on the opposing side, the inner surfaces of the first and second components being located against each other, wherein the third component is located against the outer surface of the first component and the tab is received in the holes of the first and second components such that the tab protrudes at least to the outer surface of the second component, and wherein the tab is secured to the outer surface of the second component.

2. Apparatus according to claim 1, wherein the tab is welded to the outer surface of the second component.

3. Apparatus according to any preceding claim, wherein the first and the second component are of similar shape and thickness.

4. Apparatus according to any preceding claim, wherein the first and the second components lie in parallel planes and the tab lie in a plane perpendicular to the planes of the first and second components.

5. Apparatus according to any preceding claim, wherein the tab protrudes past the outer surface of the second component.

6. Apparatus according to claim 5, wherein the tab protrudes by an amount that is such as to cause the tab to be levelled with said outer surface of the second component when the tab is welded to the outer surface of the second component.

7. Apparatus as claimed in any preceding claim, wherein the third component includes multiple tabs each of which extends through holes in the

first and second components at least to be level with the outer surface of the second component and each of which is secured to the outer surface of the second component.

8. Apparatus as claimed in any preceding claim comprising a fourth sheet component joined against the third components, the fourth component having one or more tabs each of which extends through holes in the first and second components at least to be level with the outer surface of the second component and each of which is secured to the outer surface of the second component.

9 Apparatus as claimed in claim 8, wherein holes in the first and second components that receive tabs of the third component are disposed at different locations along the length of the third and fourth components to the holes that receive tabs of the fourth component.

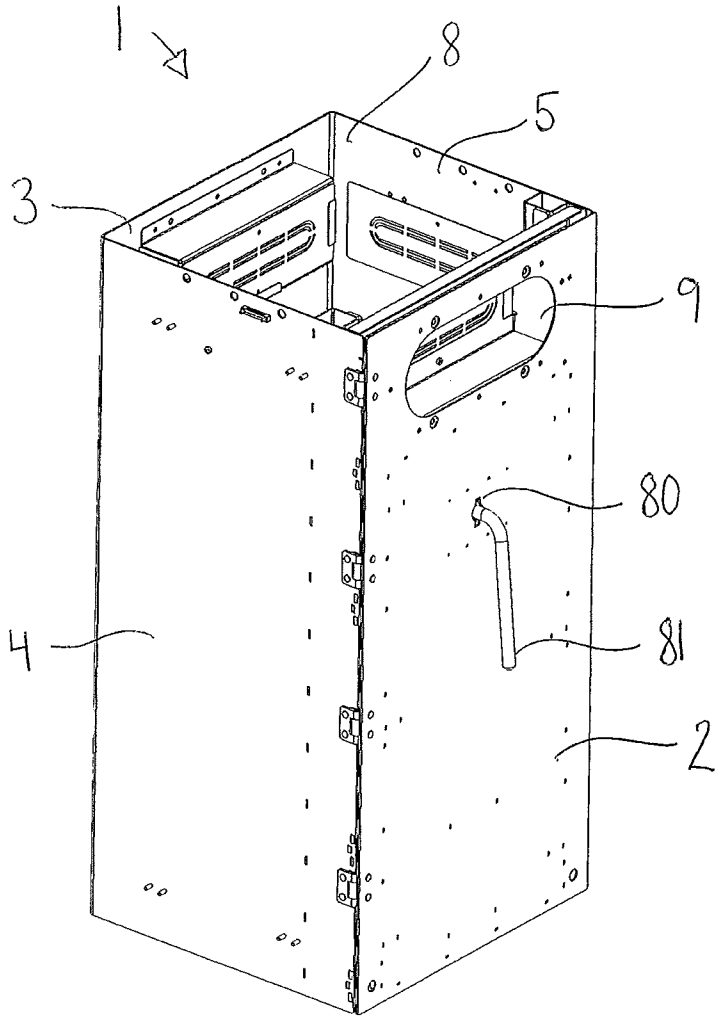

FIGURE 1

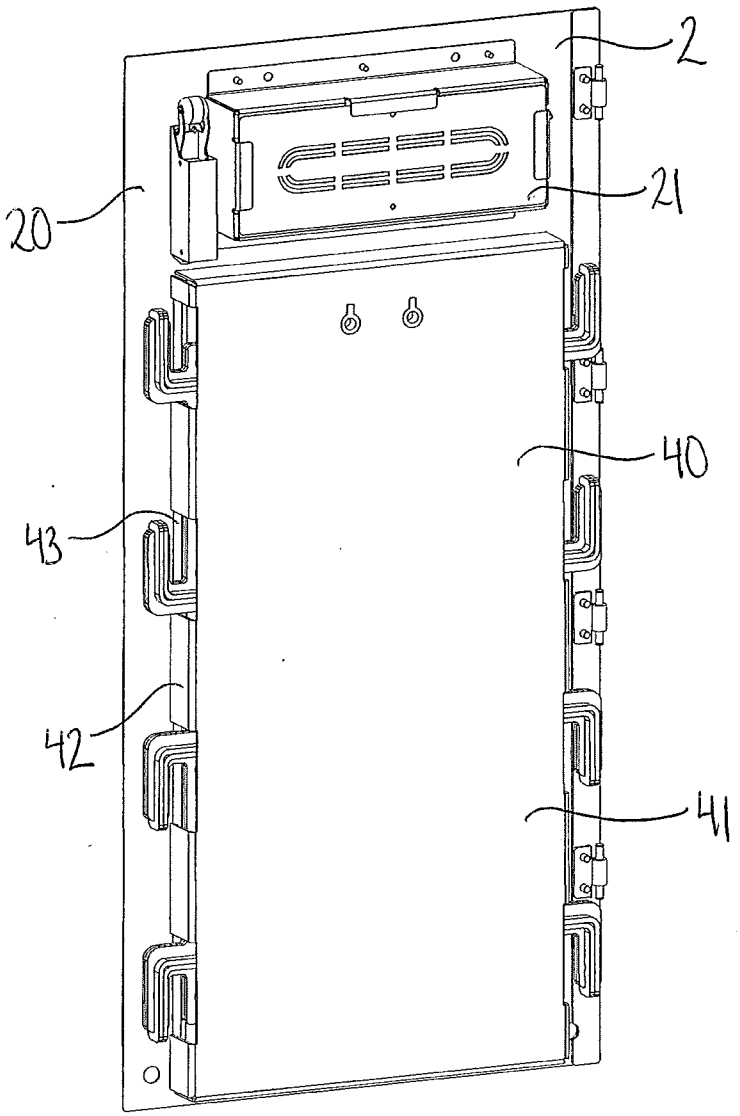

FIGURE 2

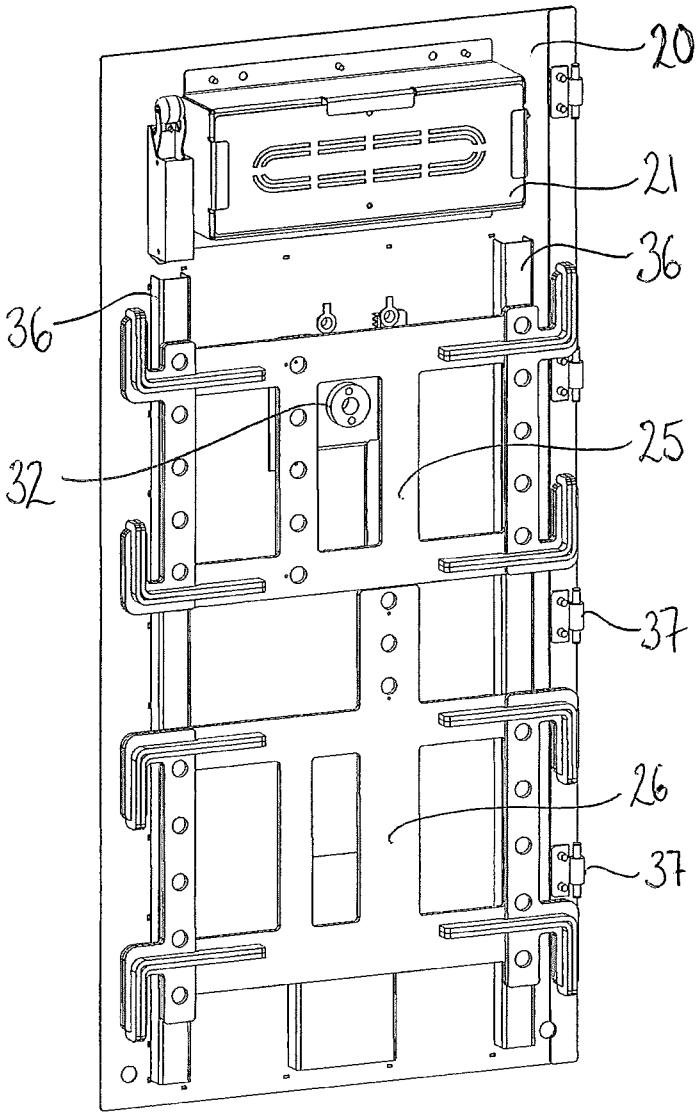

FIGURE 3

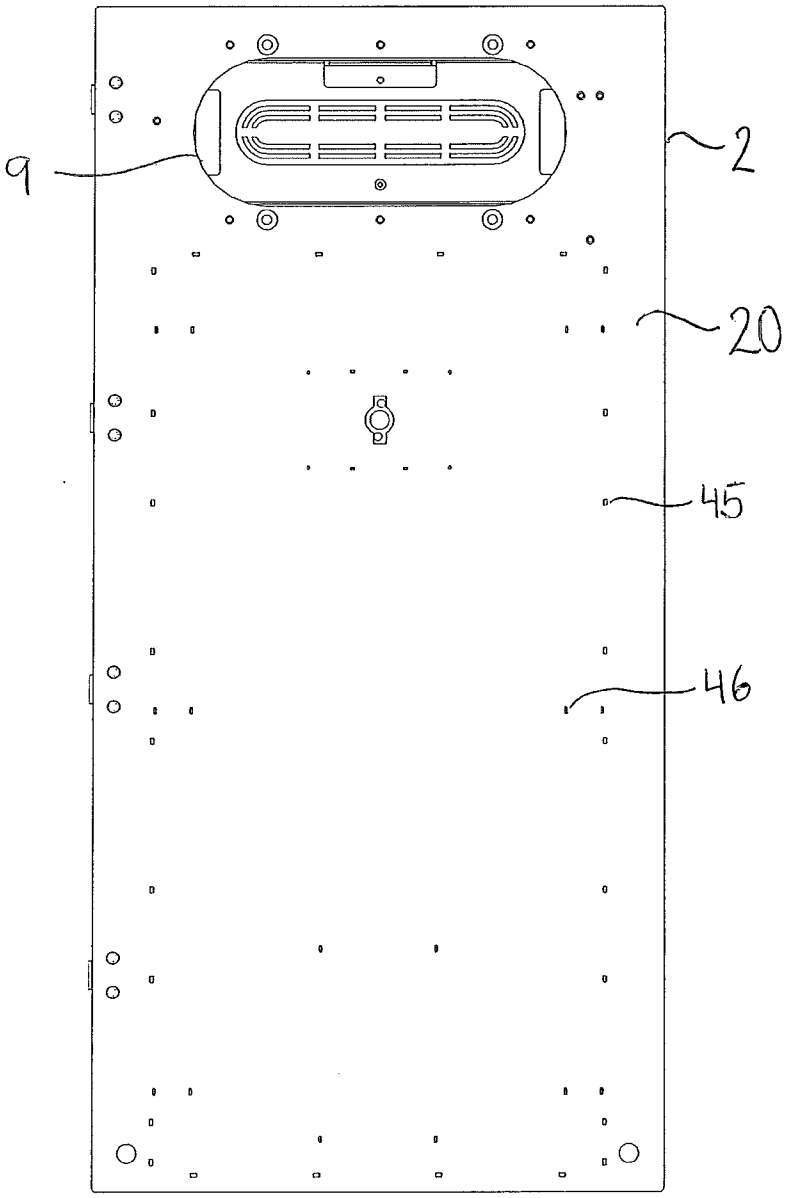

FIGURE 4

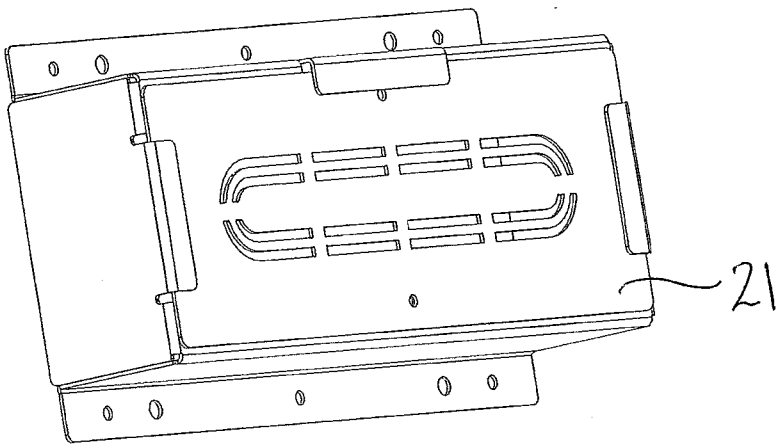

FIGURE 5

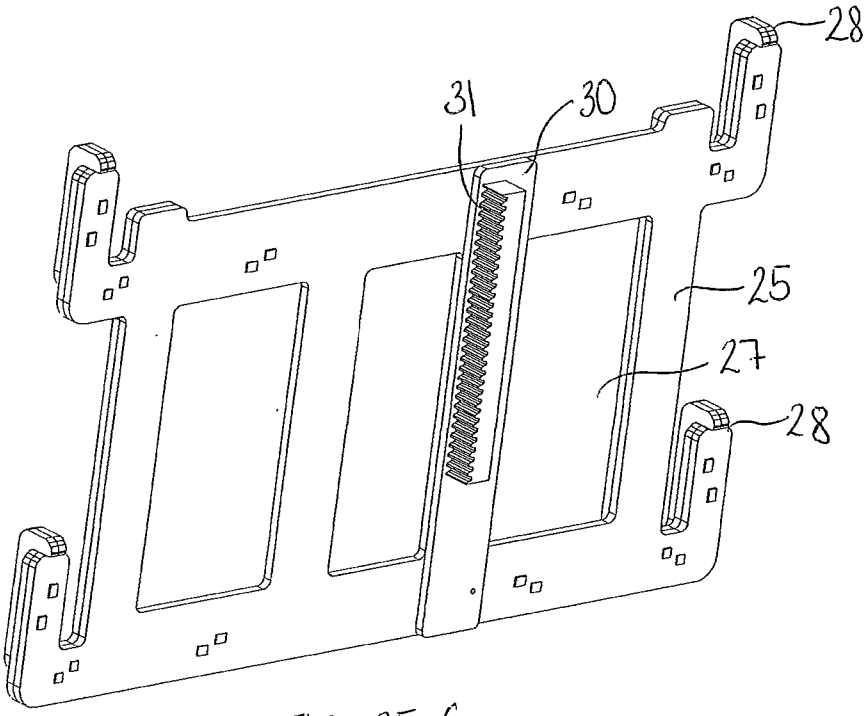

FIGURE 6

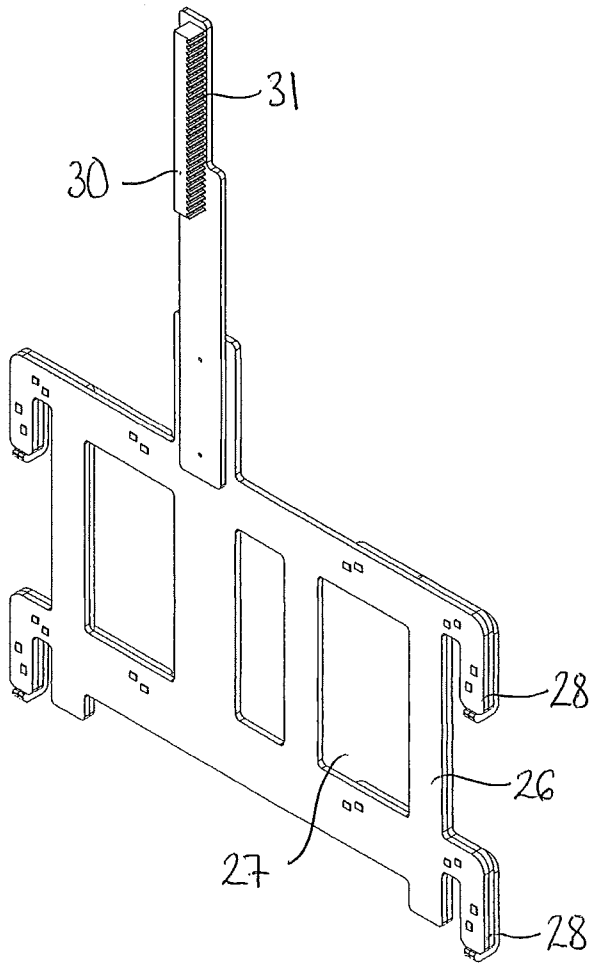

FIGURE 7

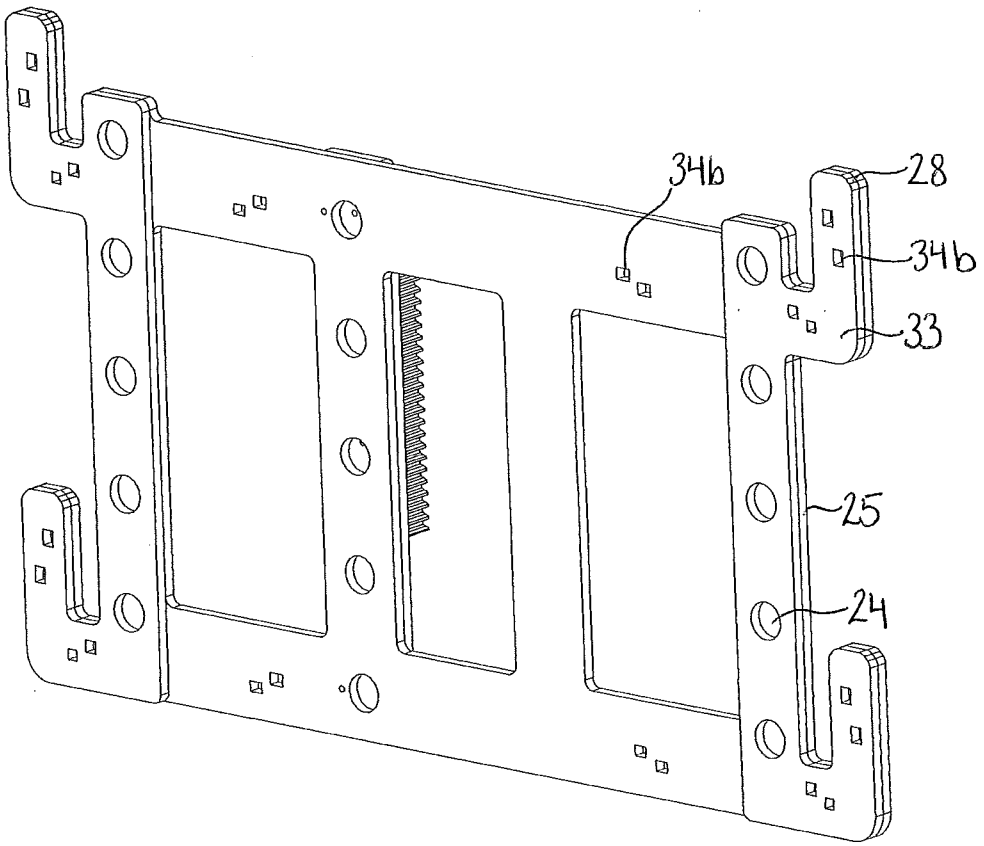

FIGURE 8

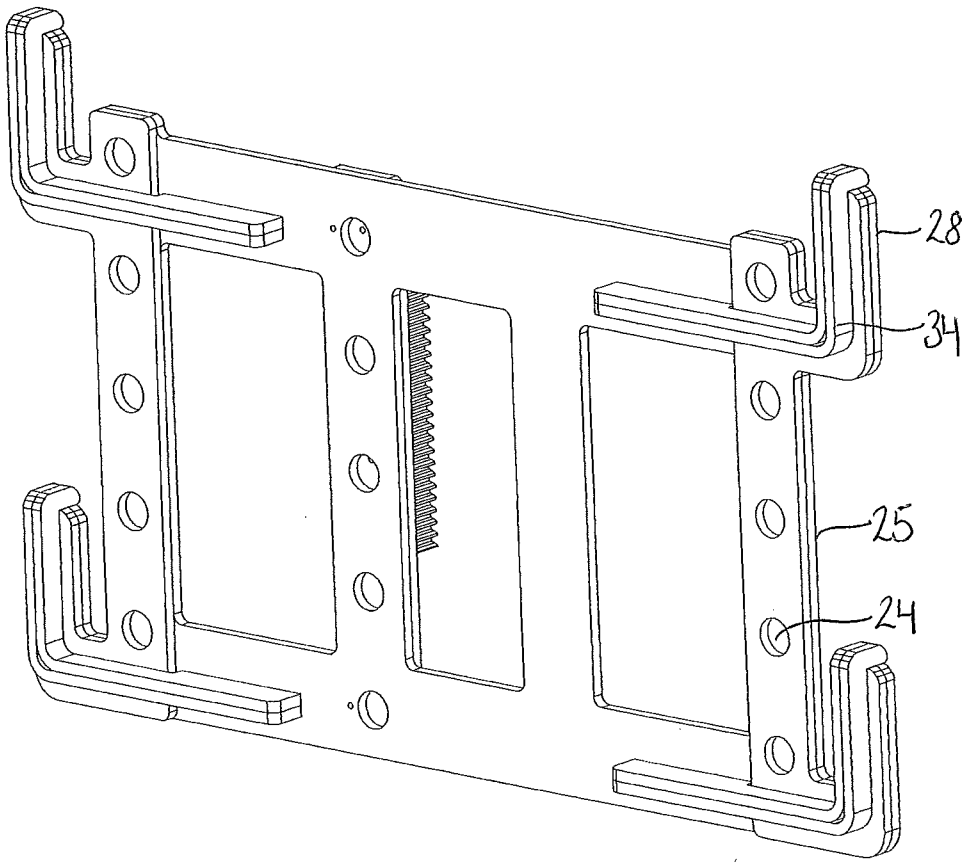

FIGURE 9

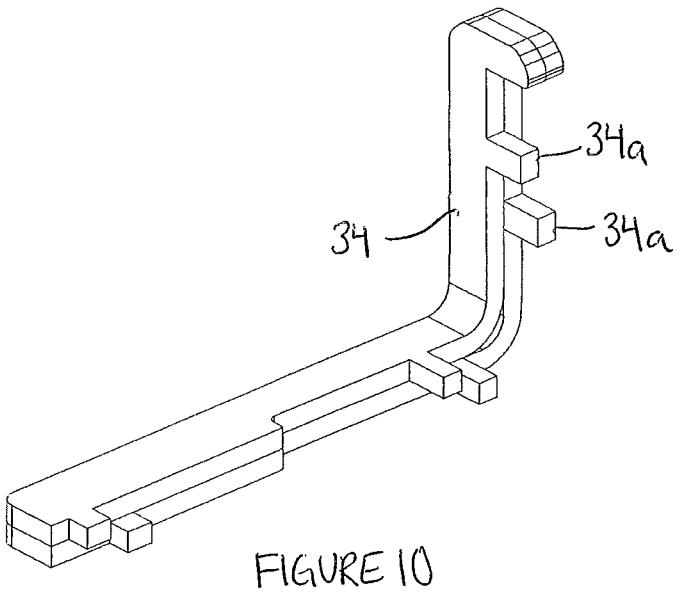

FIGURE 10

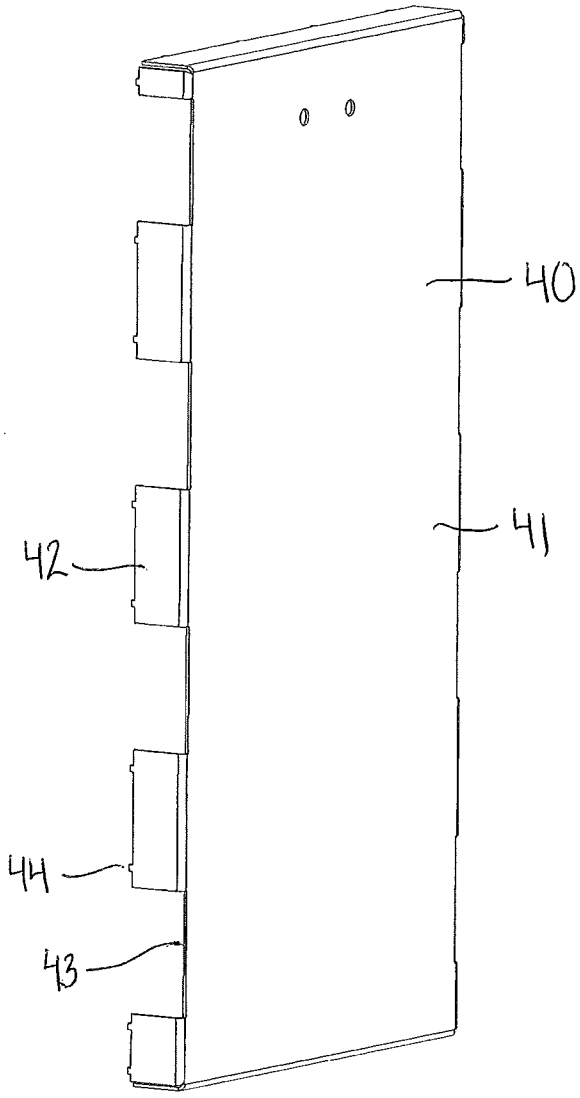

FIGURE 11

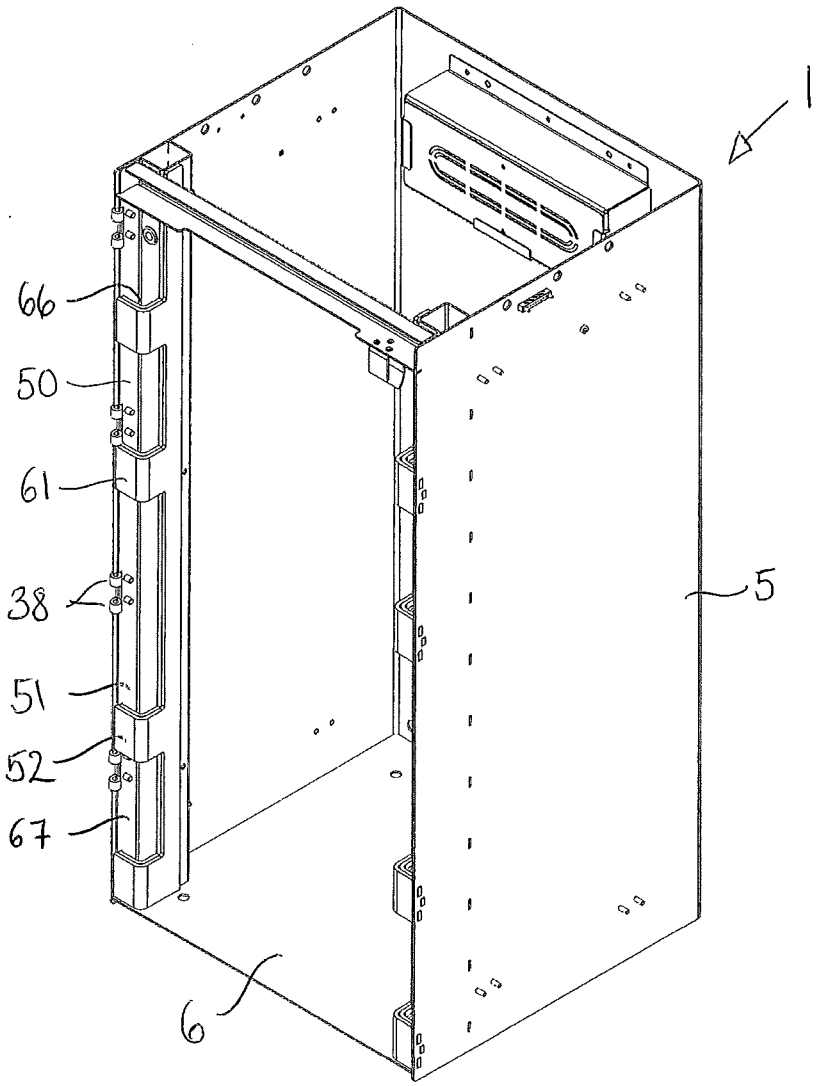

FIGURE 12