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**Pendley et al.**

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(54) **SUPPORTING A LOAD ON A ROOF**

(2013.01); *E04D 13/031* (2013.01); *E04D 13/0305* (2013.01); *E04D 13/0315* (2013.01)

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(58) **Field of Classification Search**  
CPC .. *E04D 3/364*; *E04D 3/30*; *E04D 3/36*; *E04B 7/20*

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See application file for complete search history.

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **15/884,000**

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(Continued)

(65) **Prior Publication Data**

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Cross-section and pictorial views of SSR-TUF-LITE daylighting panels, 1 sheet.

**Related U.S. Application Data**

(Continued)

(63) Continuation of application No. 14/482,471, filed on Sep. 10, 2014, now abandoned, which is a  
(Continued)

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(51) **Int. Cl.**

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*E04D 3/36* (2006.01)  
*E04D 13/03* (2006.01)  
*E04D 3/367* (2006.01)  
*E04D 3/365* (2006.01)

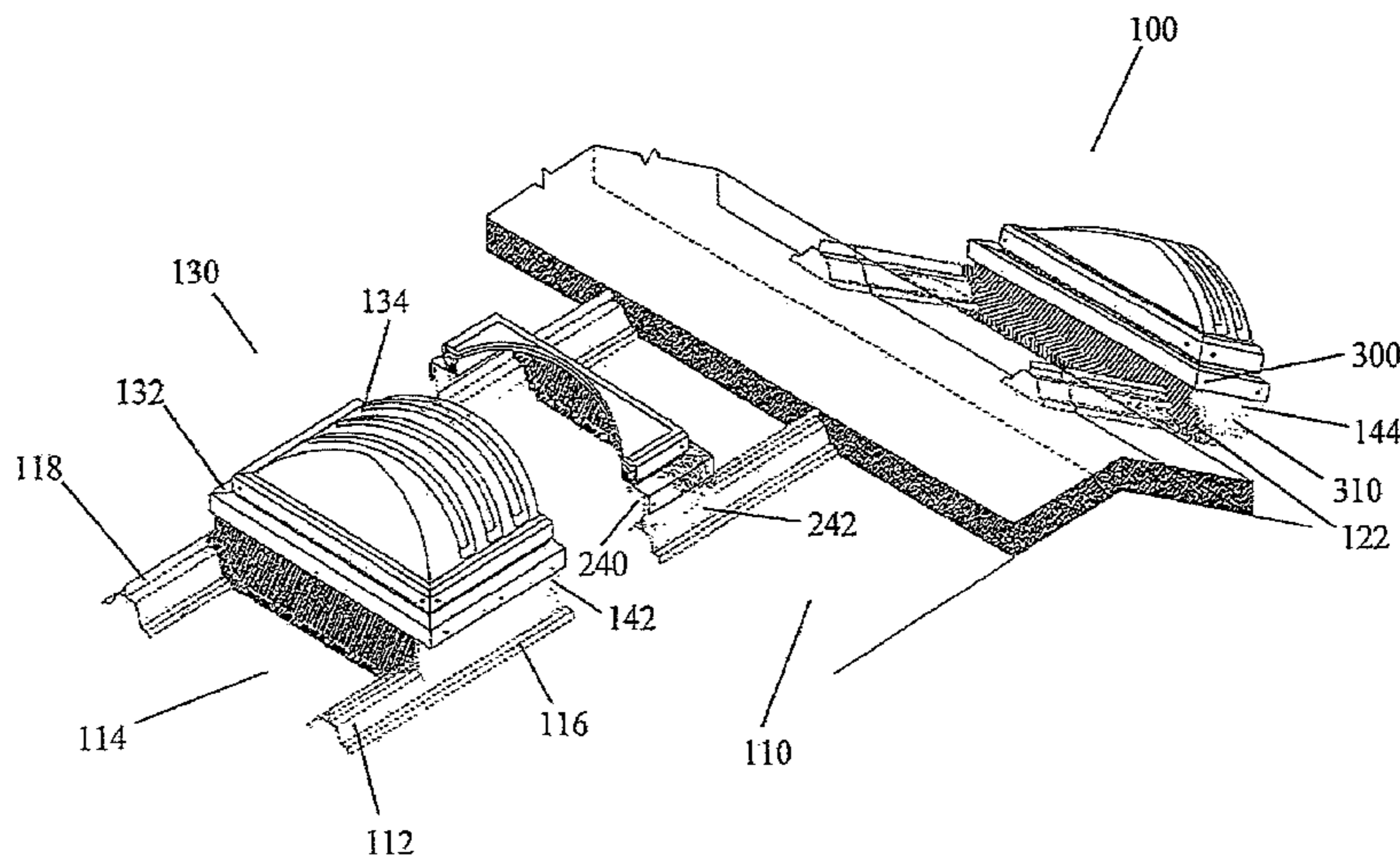
(57) **ABSTRACT**

The invention provides a system for installing a roof penetrating structure to a metal roof, the system comprising: a) a rail and closure structure adapted to be supported by adjacent rib elevations of said roof; b) a skylight adapted to be supported on the rail and closure structure; and c) a support member for sealing a cut away portion of the rib structure to divert water away from the rail and closure structure.

(52) **U.S. Cl.**

CPC ..... *E04D 3/30* (2013.01); *E04D 3/24* (2013.01); *E04D 3/36* (2013.01); *E04D 3/364* (2013.01); *E04D 3/365* (2013.01); *E04D 13/03*

**22 Claims, 18 Drawing Sheets**



**Related U.S. Application Data**

continuation of application No. 13/771,746, filed on Feb. 20, 2013, now Pat. No. 8,833,009, which is a continuation of application No. 12/932,892, filed on Mar. 8, 2011, now Pat. No. 8,438,798, which is a continuation-in-part of application No. 12/572,176, filed on Oct. 1, 2009, now abandoned.

(60) Provisional application No. 61/102,333, filed on Oct. 2, 2008.

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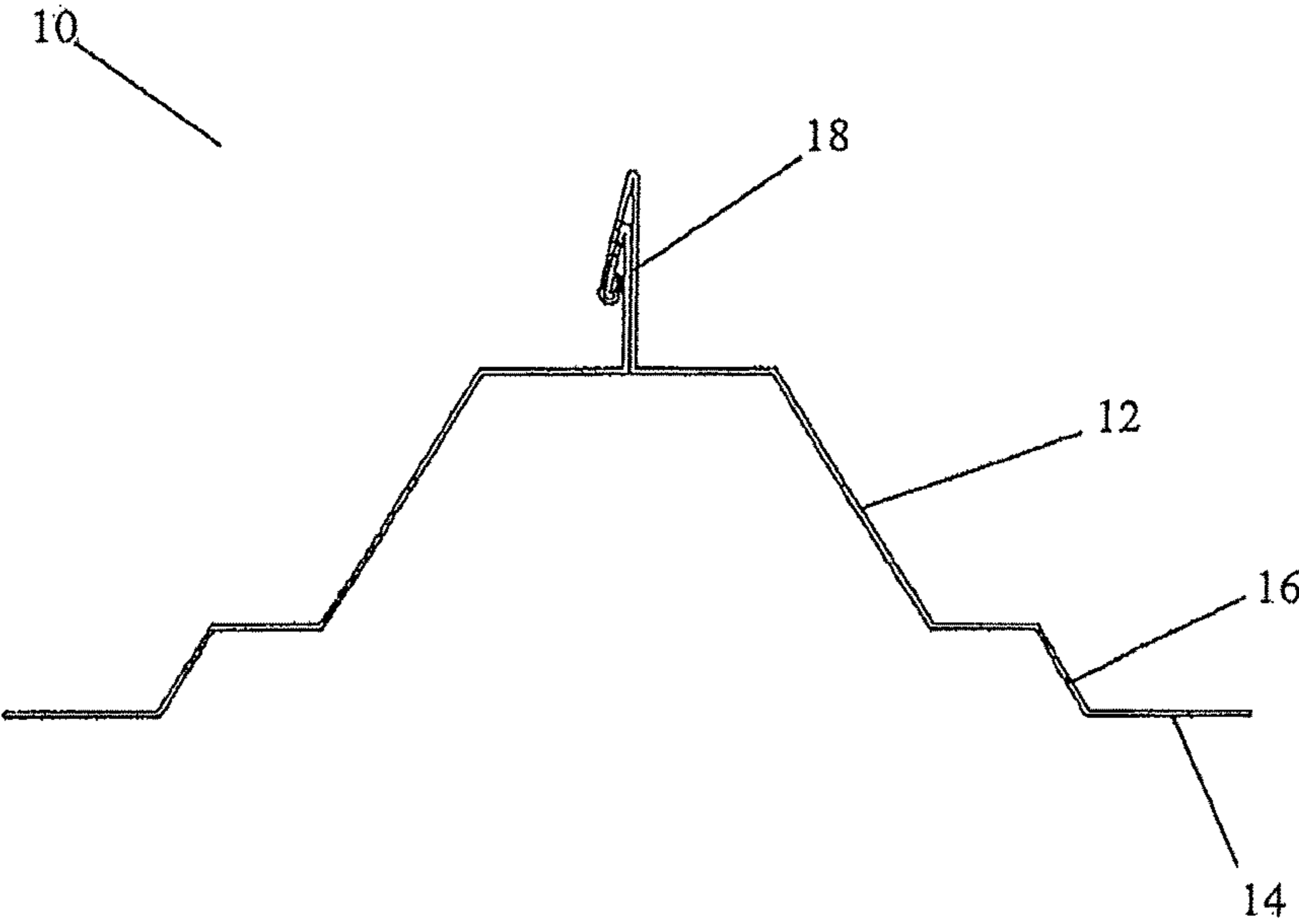


FIGURE 1

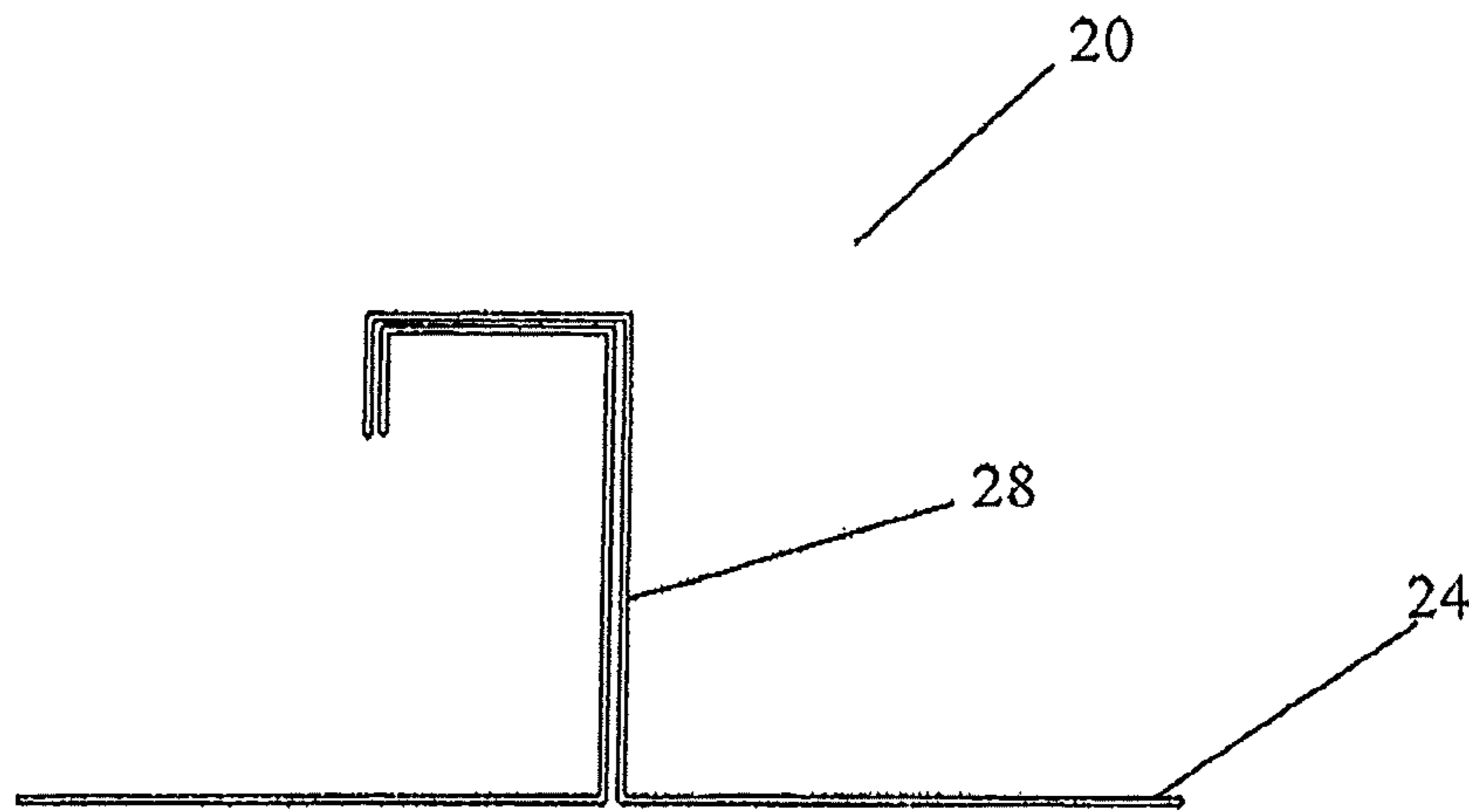


FIGURE 2

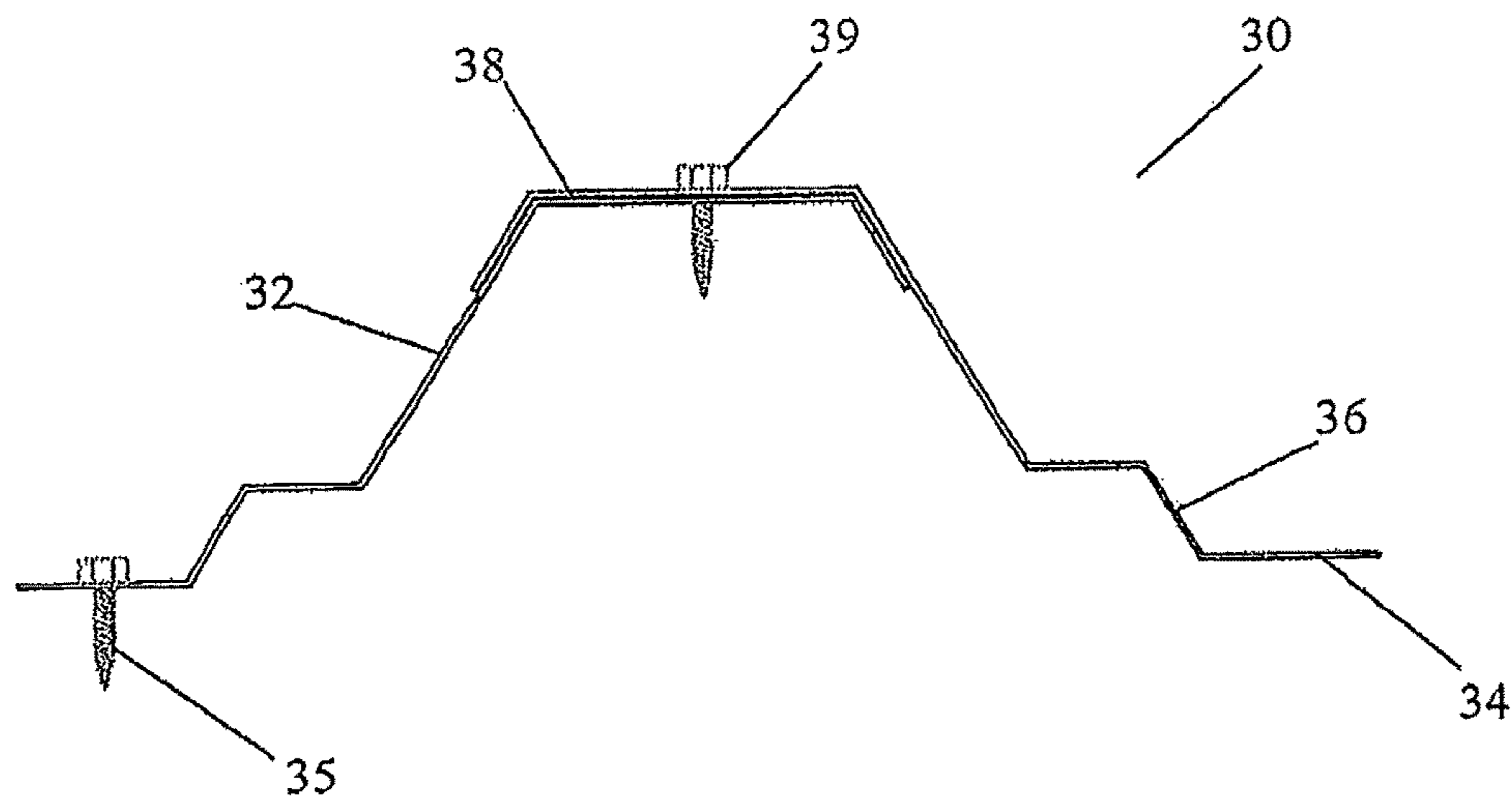


FIGURE 3

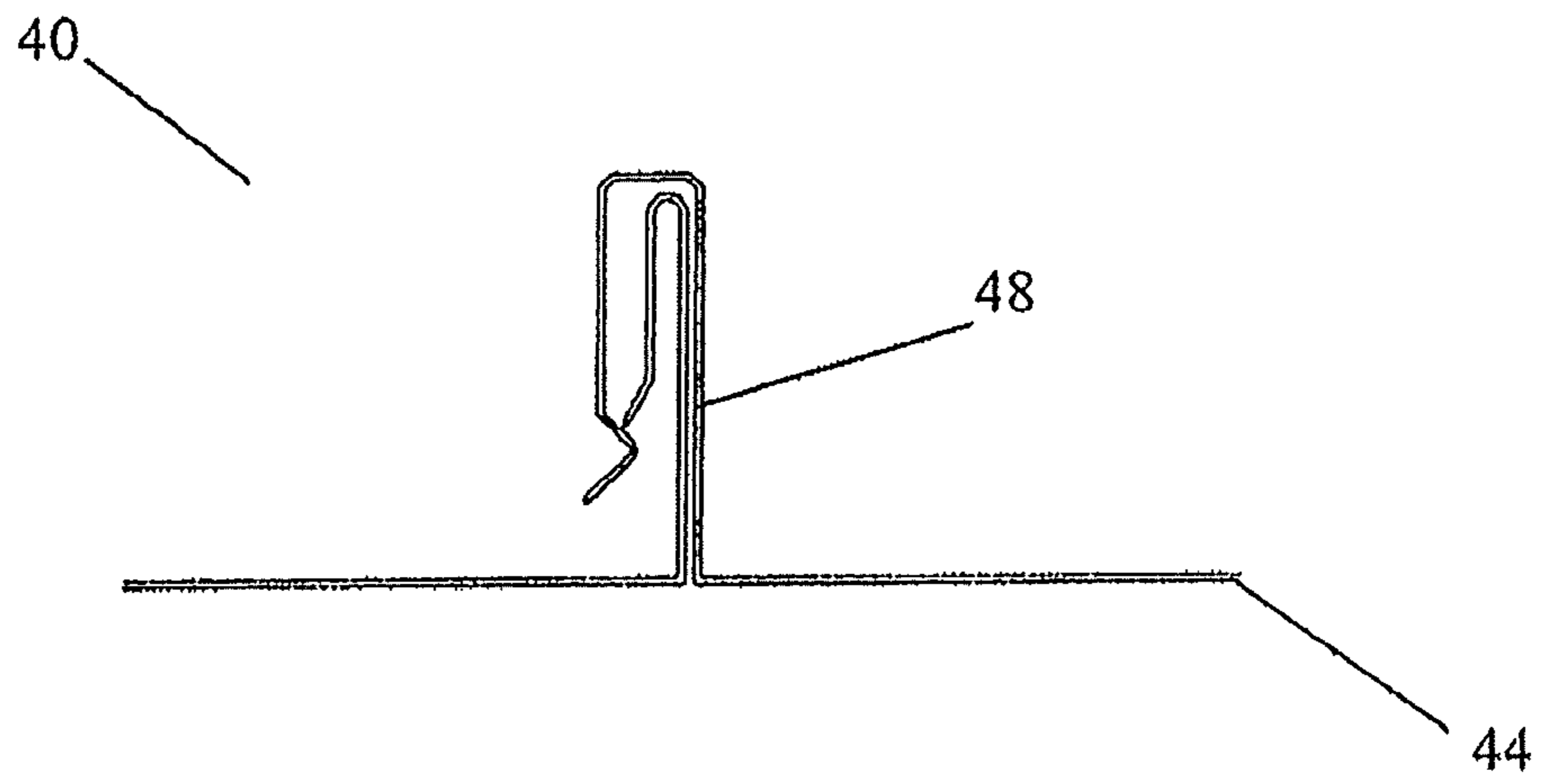


FIGURE 4

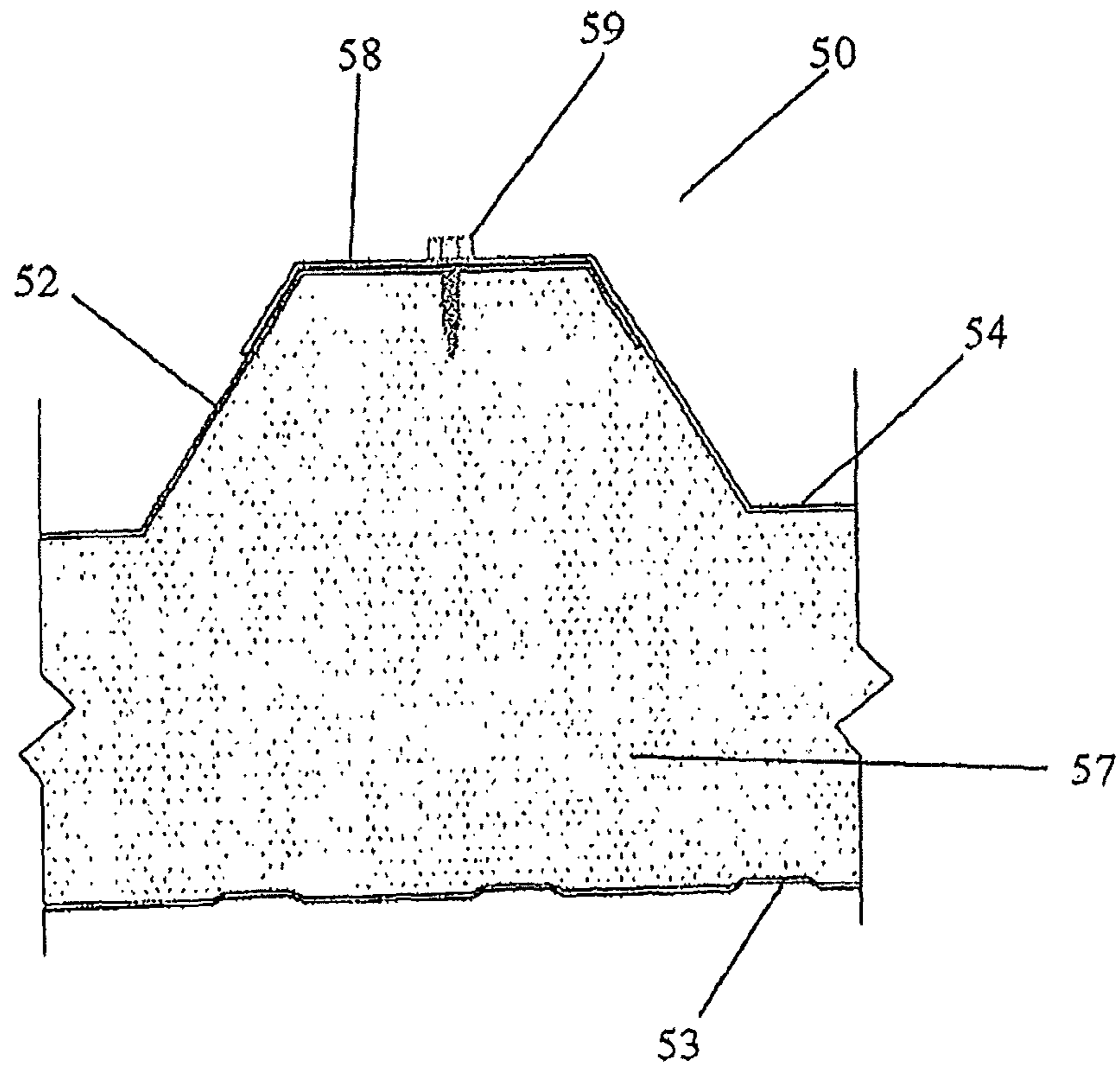


FIGURE 5



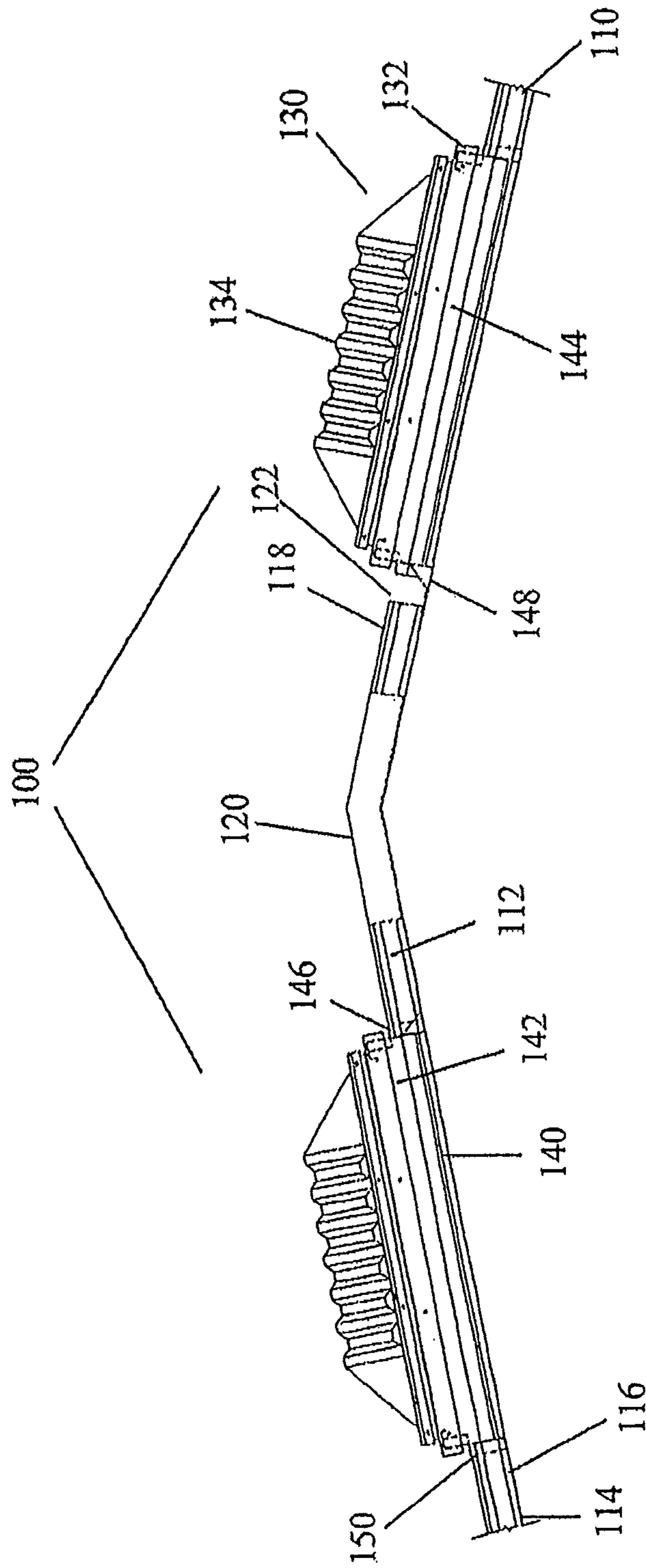


FIGURE 6

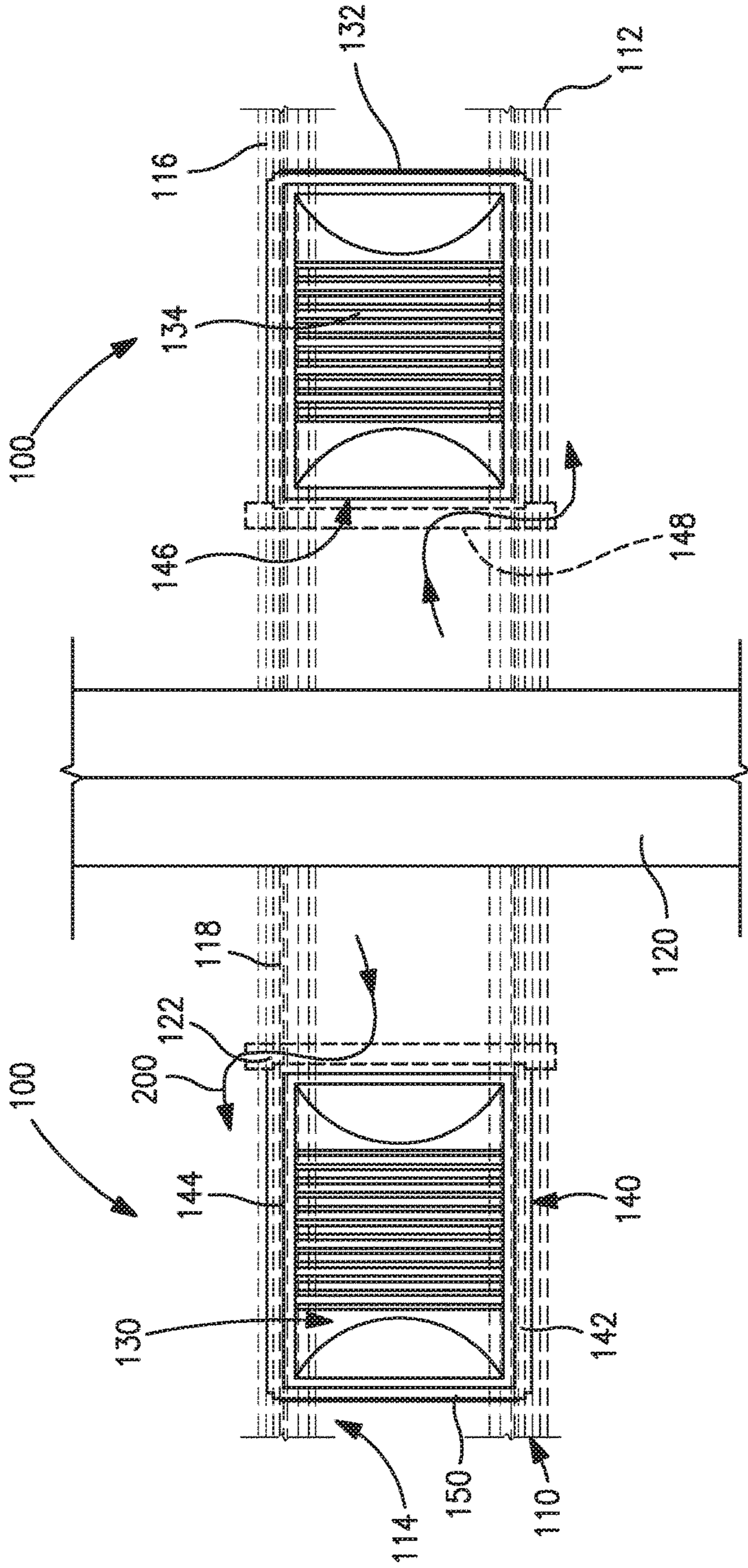


FIG. 7

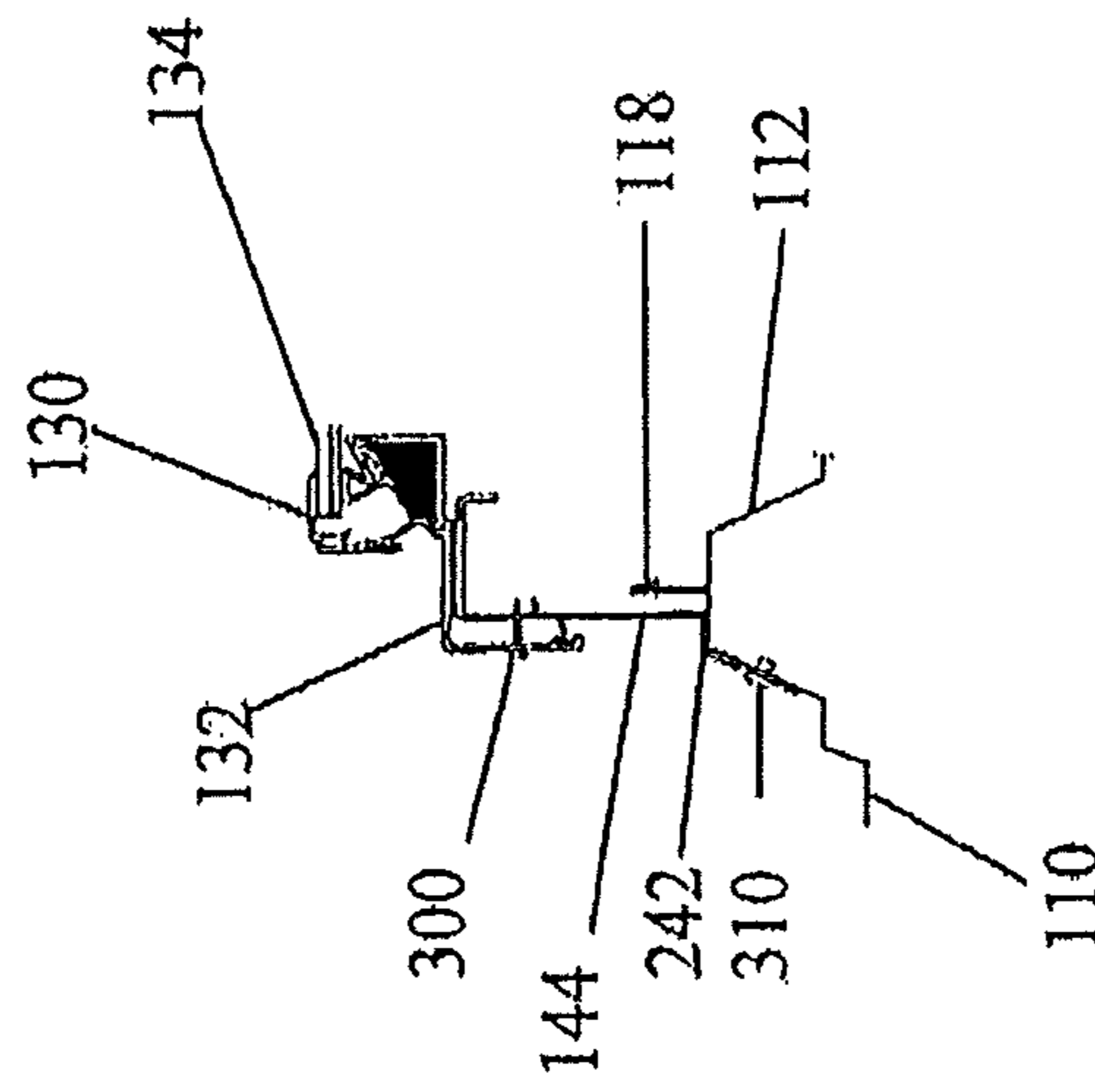
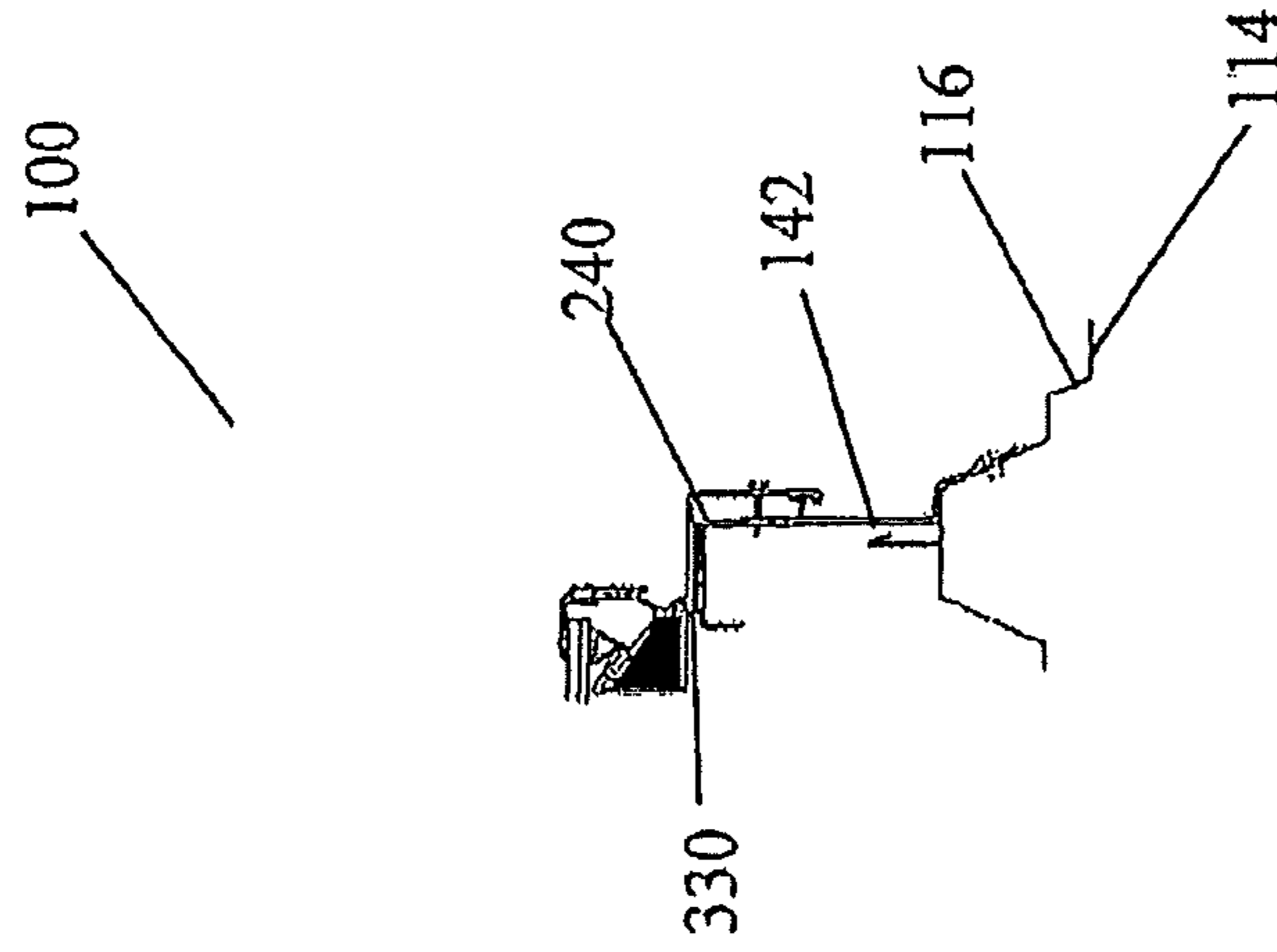


FIGURE 8

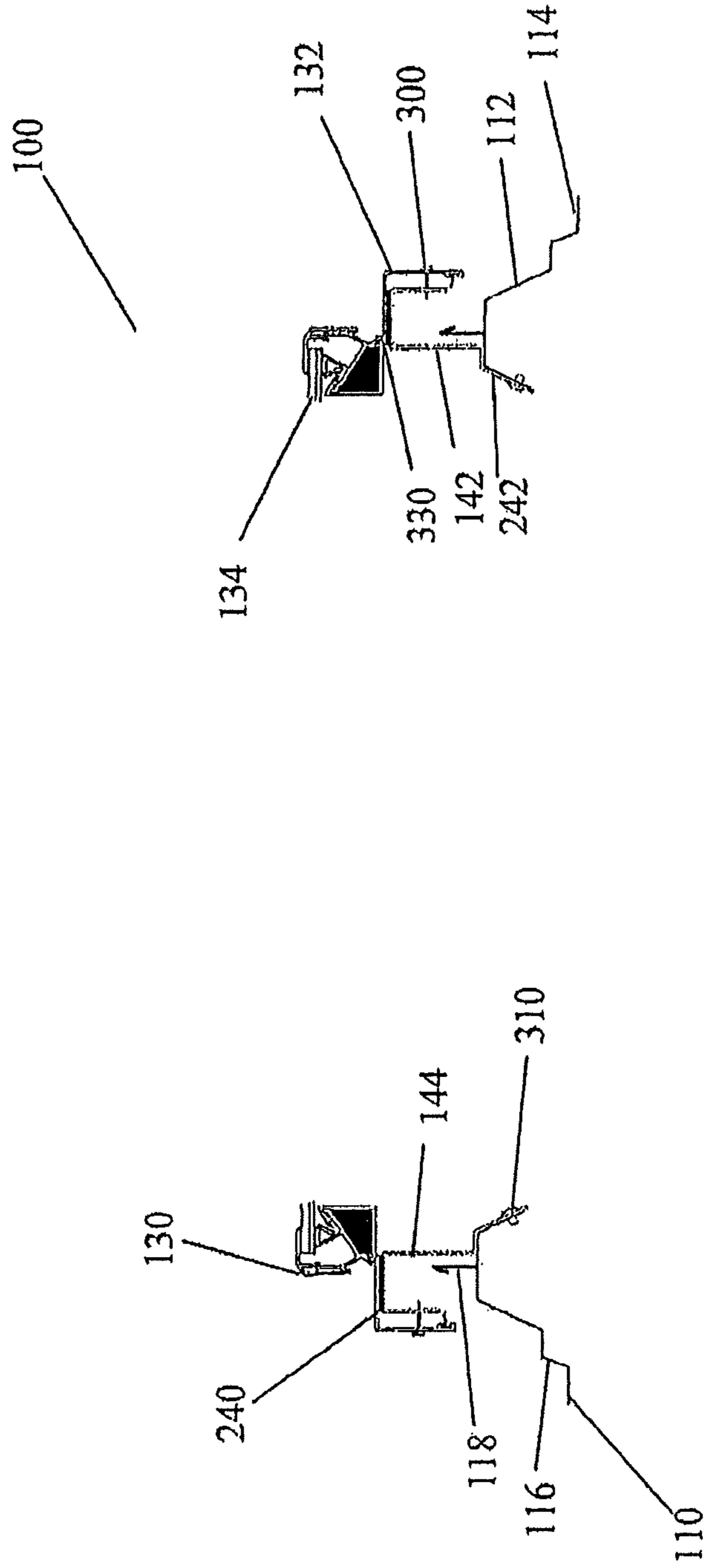


FIGURE 9

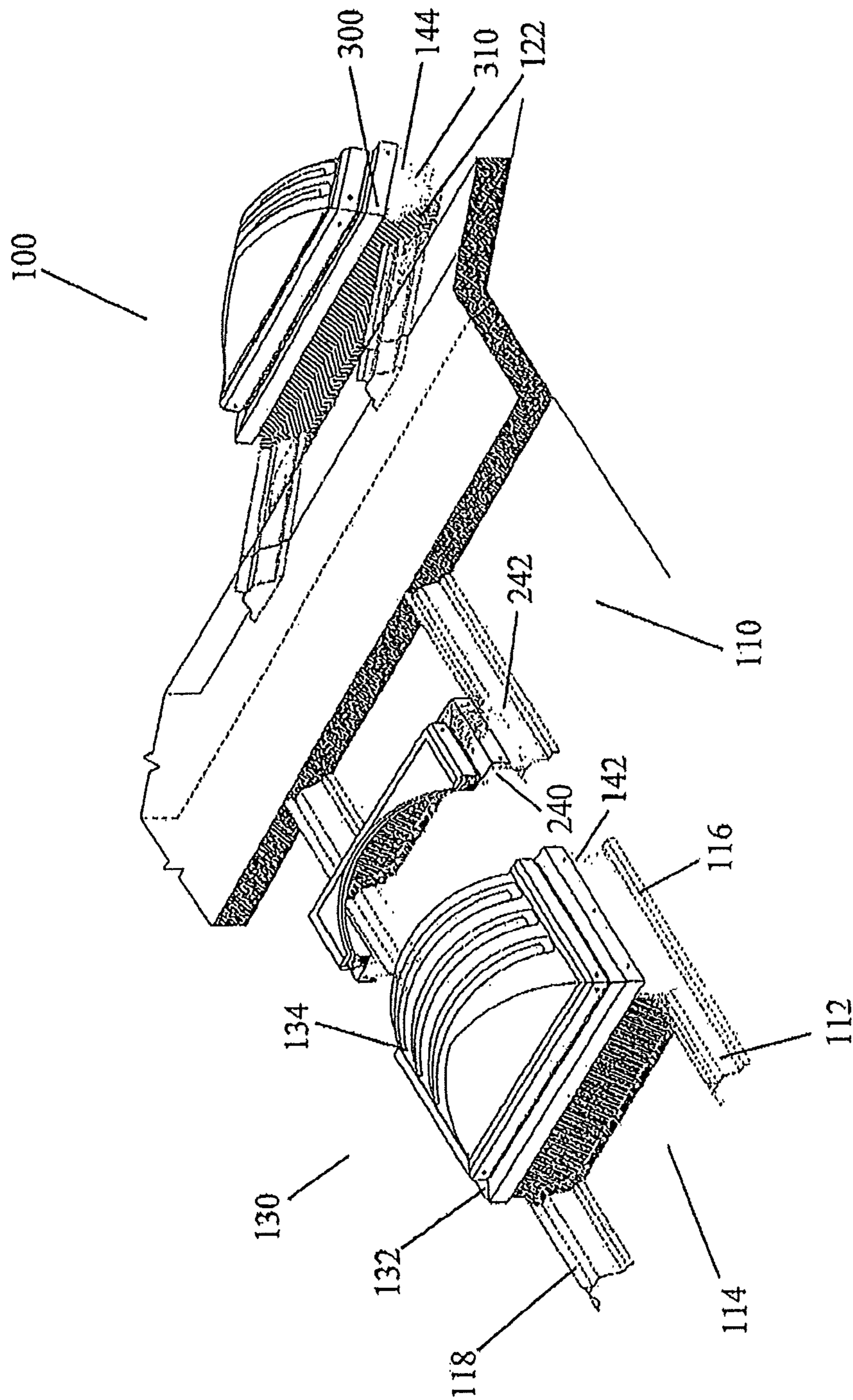


FIGURE 10

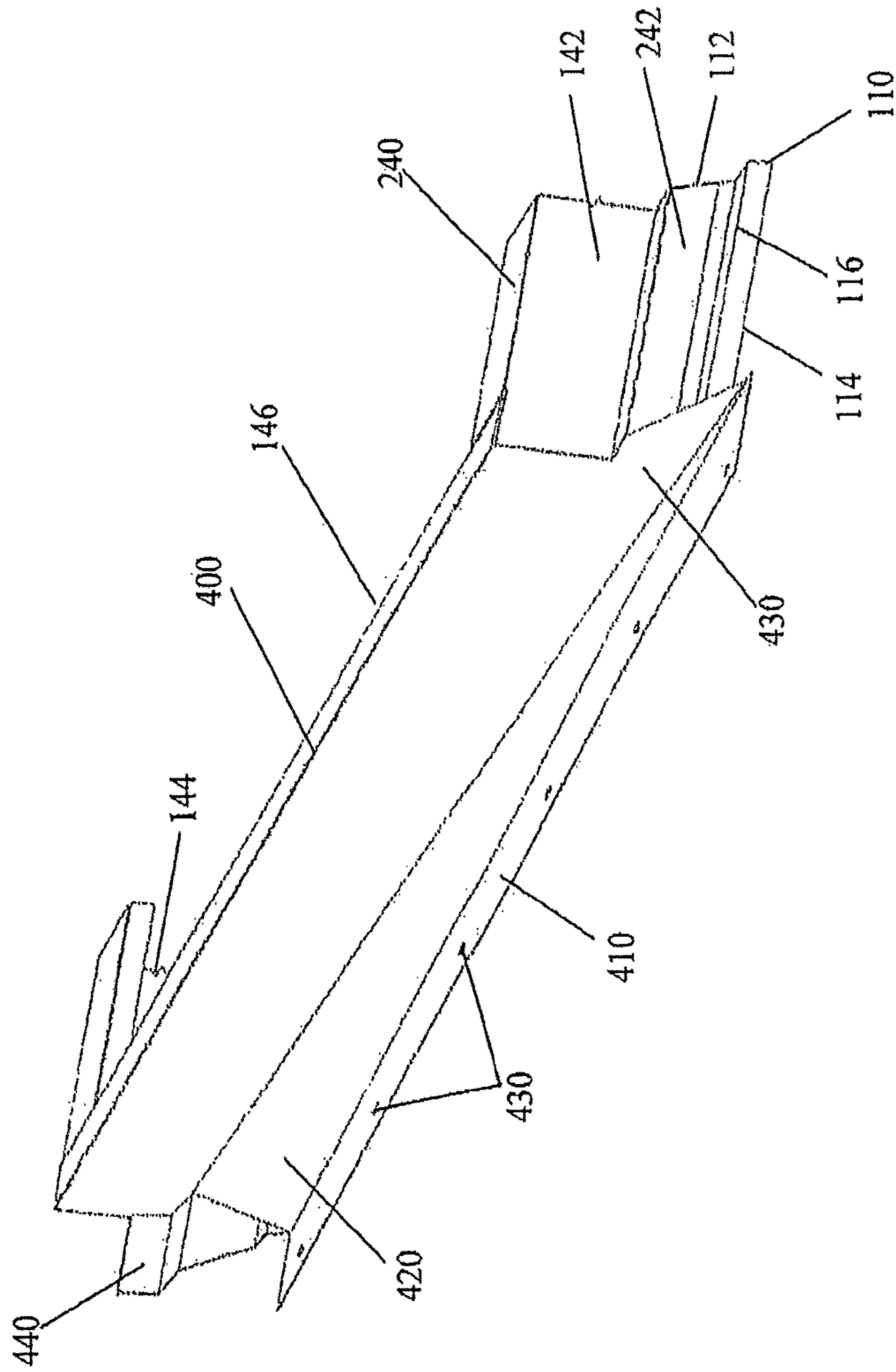


FIGURE 11

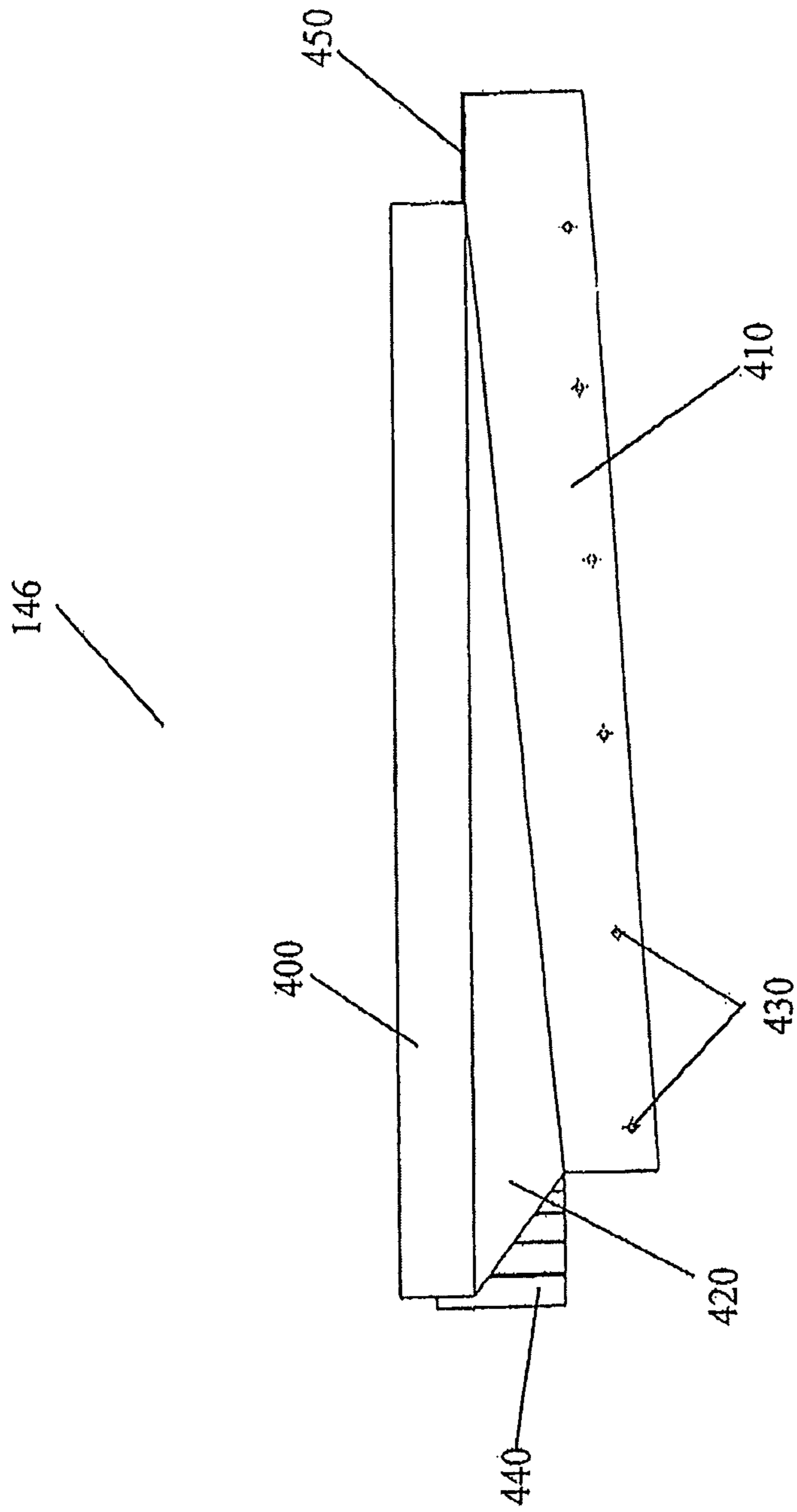


FIGURE 12

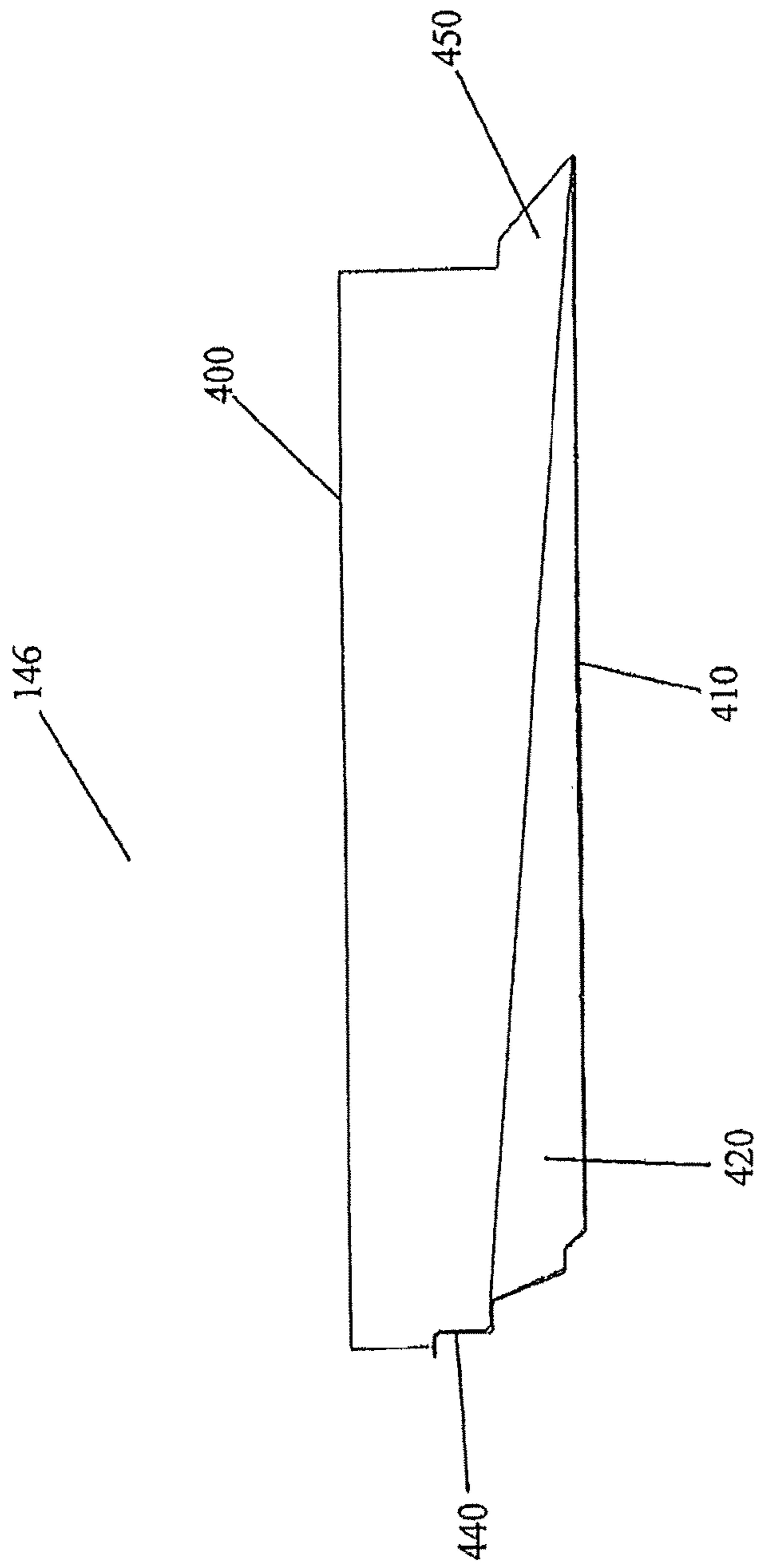


FIGURE 13



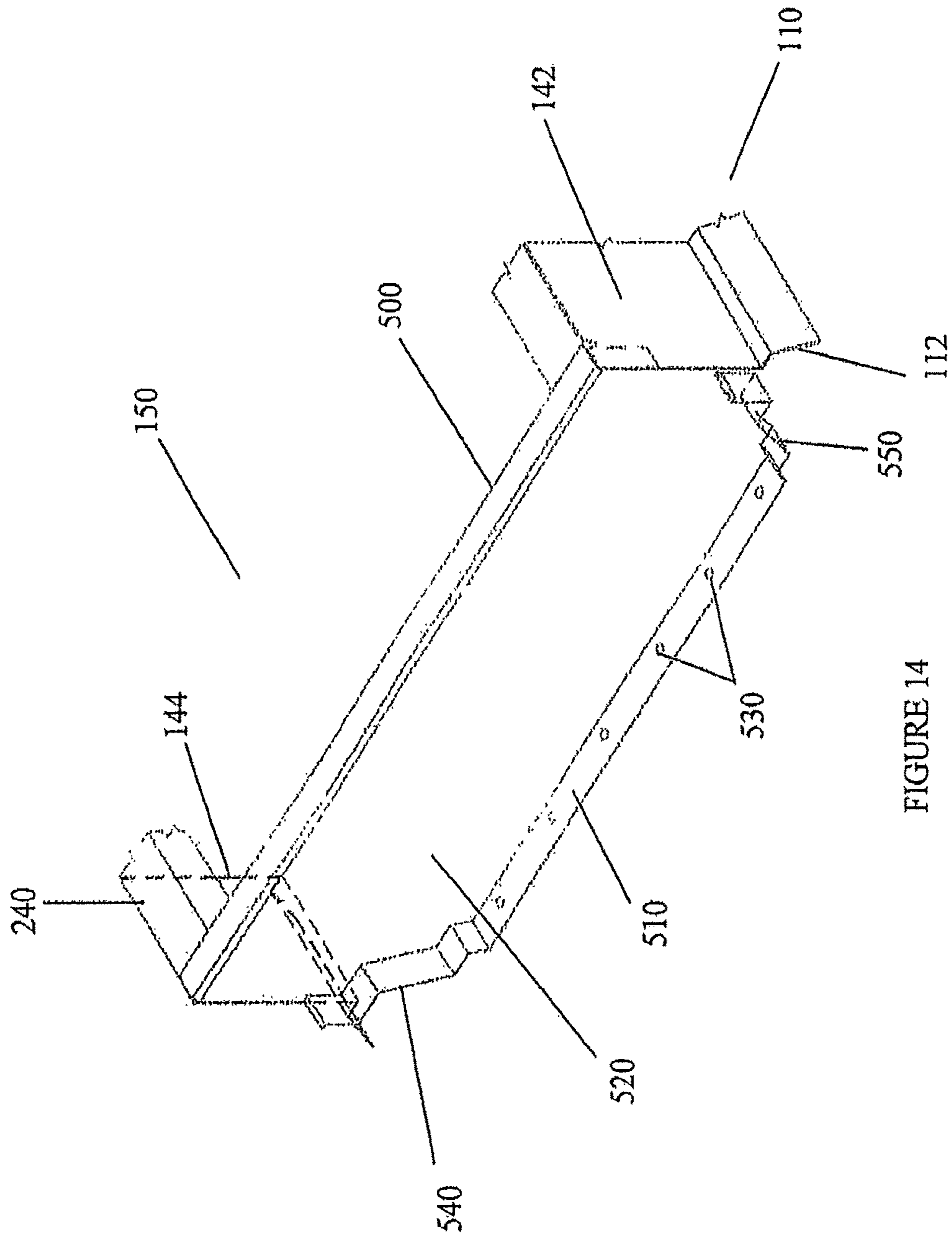


FIGURE 14

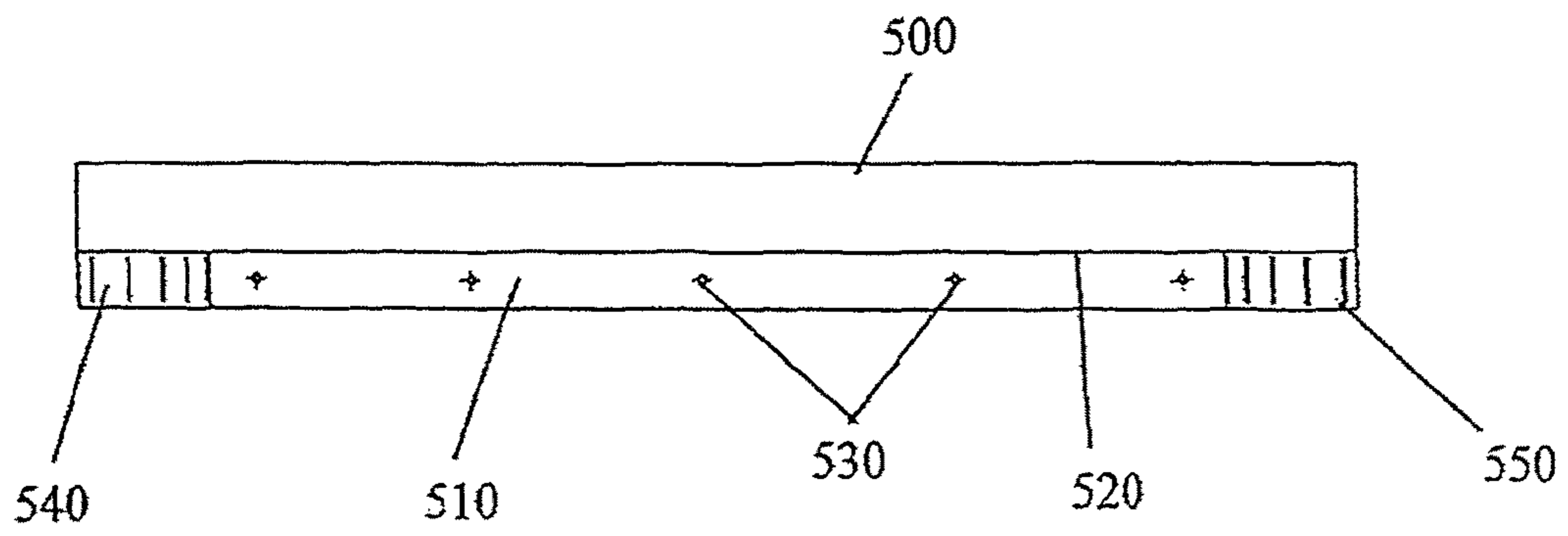


FIGURE 15

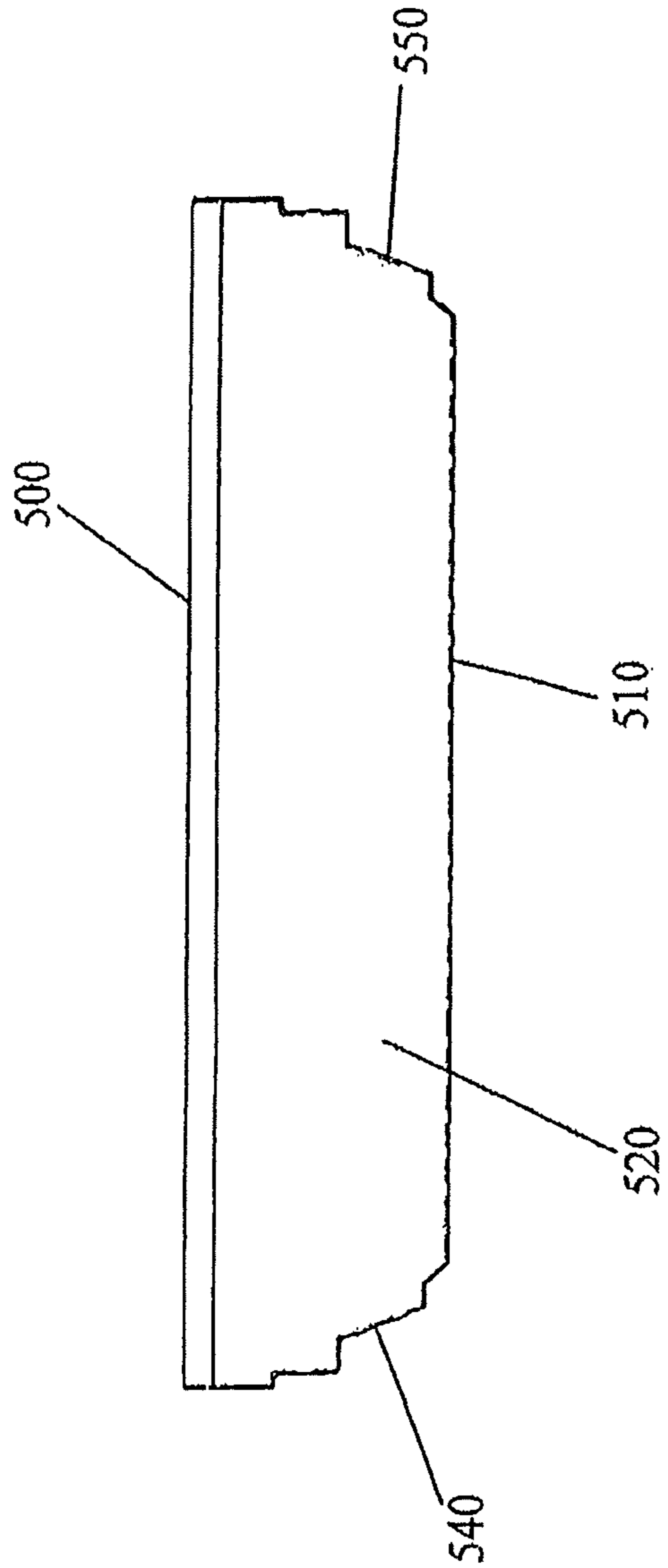


FIGURE 16

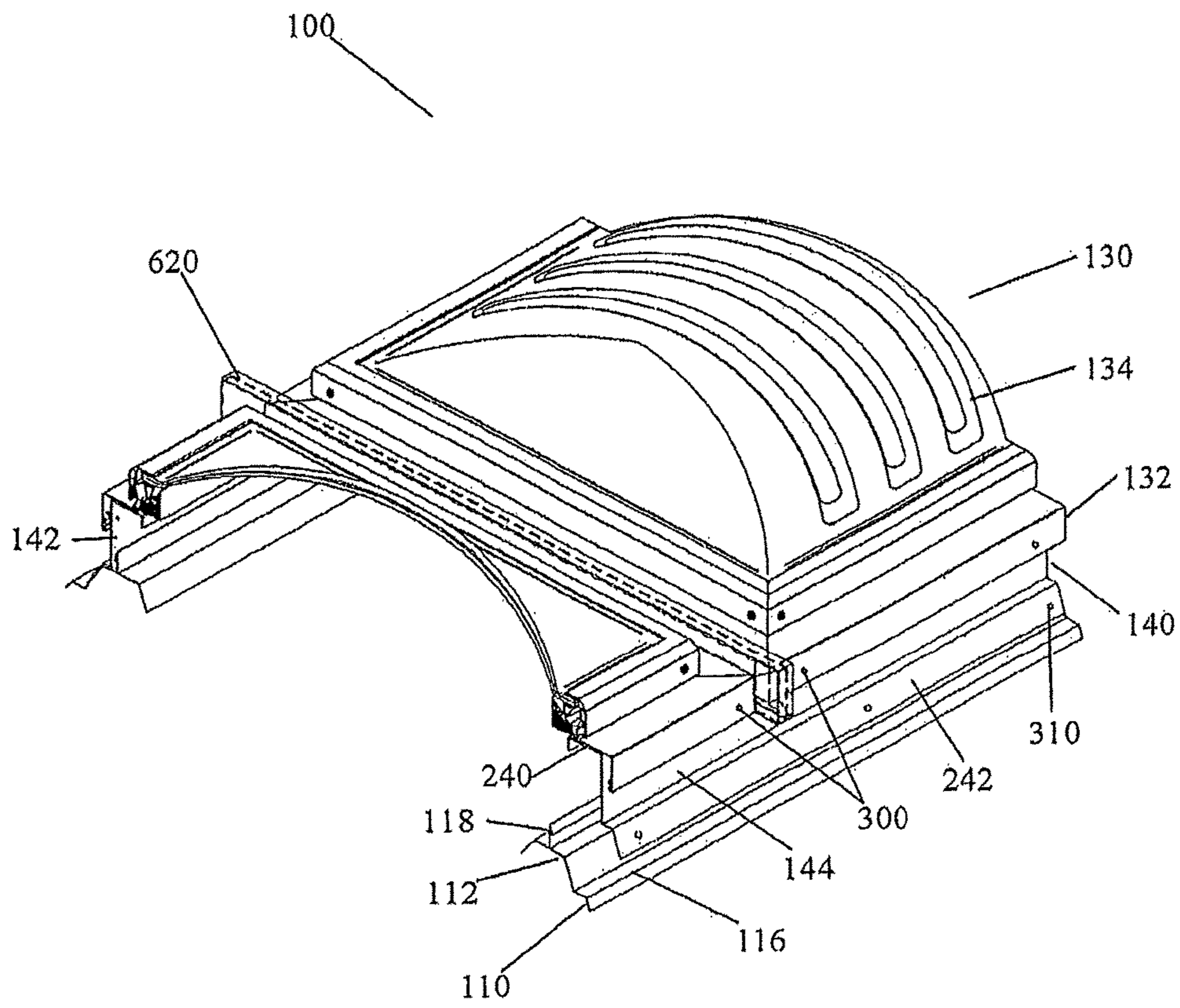


FIGURE 17

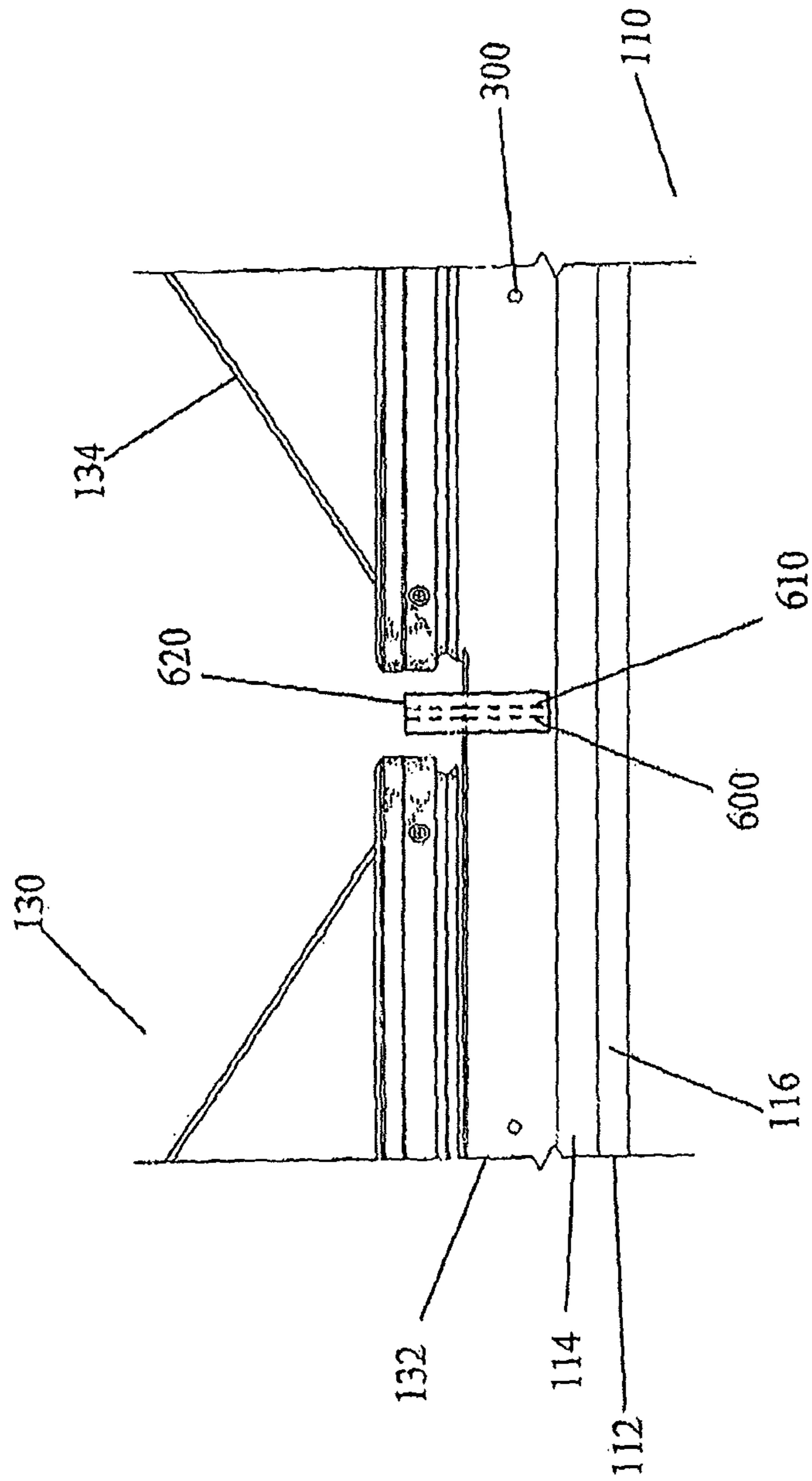


FIGURE 18

**SUPPORTING A LOAD ON A ROOF**

## REFERENCE TO RELATED APPLICATION

This application is a Continuation application, under 5 U.S.C. 120, of Ser. No. 14/482,471, filed Sep. 10, 2014, which is a Continuation of Ser. No. 13/771,746, filed Feb. 20, 2013, now U.S. Pat. No. 8,833,009, which is a Continuation of Ser. No. 12/932,892, filed Mar. 8, 2011, now U.S. Pat. No. 8,438,798, which is a Continuation-In-Part of Ser. 10 No. 12/572,176, filed Oct. 1, 2009, now abandoned, which is a Non-Provisional patent application of U.S. Provisional Patent Application Ser. No. 61/102,333, filed Oct. 2, 2008, the complete disclosure of each of which is incorporated herein, in its entirety.

## BACKGROUND OF THE INVENTION

## Field of the Invention

The field of the invention is skylights systems.

## Description of Related Art

Various systems are known for using curb construction for 25 inserting skylights and smoke vents into roofs.

The most commonly used skylighting systems are those that incorporate translucent or transparent layers in a frame-work that penetrates the roof structure, so as to allow 30 ambient daylight into the building.

In the past roof penetrating installations have required a complex structure beneath the roofing panels in order to support a roof curb to which the skylight was attached. Skylight curbs are generally in the form of a preassembled 35 box structure, that is fixed within a roof cutout. The retrofitting of such curb systems into existing roof structure is problematic.

U.S. Pat. No. 4,296,581, to Heckelsberg, issued Oct. 27, 1981, provides an example of a roofing structure of the type that is constructed of a series of metal panels having flanges 40 that interlock when the panels are laid side by side and which are subsequently tightly seamed together to convert the individual panels into an integrated roof forming membrane. This roof structure is mounted to the purlins with clips that permit the panels to expand or contract in response to 45 temperature and pressure changes, thereby minimizing roof stressing.

U.S. Pat. No. 4,703,596, to Sandow, issued Nov. 3, 1987, and titled "Grid Skylight System", provides a grid skylight support apparatus that includes prefabricated grid row 50 frames, each of which form a number of connected beam supports which define a number of bays. Each bay has a skylight curb formed by upper flanges of the beam supports to receive a preassembled skylight unit. The sides of each grid row frame provide a mating edge that can register with 55 the mating edge of an adjacent grid row frame during assembly. The skylights have peripheral support skirts that register upon each bay and a light-transmitting skylight panel to cover the peripheral support. Cross gutters on each grid row frame, which are positioned between adjacent 60 skylights, extend at an angle toward the mating edge of the grid row frame for carrying rainwater to a main gutter channel formed by field-assembly of the mating edges of two adjacent grid row frames. The main gutter channel includes a pair of longitudinally extending gutter sections, 65 each of which have a main gutter channel surface with a lower elevation than the elevation of the cross flow channel.

Fasteners assemble the grid row frame mating edges together and a continuous seal to prevent rainwater leakage at the mating edges of adjacent grid row frames.

U.S. Pat. No. 4,520,604, to Halsey et al., issued Jun. 4, 5 1985, entitled "Skylight Structure", teaches a curb structure that is dimensioned to be passed through an opening in a roof and then attached in moisture impervious relation to the roof from within a building interior. A skylight assembly including a frame and light transmitting member secured to 10 the frame is dimensioned to be passed through the opening and attached in a sealing engagement to the curb structure from within the building interior for covering the opening. The skylight assembly is then secured to the rafters and headers at an interior location. The frame includes upper and 15 lower clamping jaws and spaced fulcrum links attached to the jaws for clamping the light transmitting member thereto. The lower clamping jaw includes a channel which engages and is interlocked with the curb structure.

Other skylight systems, as contemplated in U.S. Pat. No. 20 4,470,230, by Weinsner, provide a prefabricated skylight support curb that is formed to be a protective packaging for the skylight during shipment and then used as a curb for mounting the skylight on a roof. A prefabricated skylight support curb for supporting a skylight thereover has a 25 bottom flange angled, upright sides, and a top lip round the top of the sides forming an opening through the curb. A skylight is adapted to cover the opening through the skylight support curb when installed, and has a domed portion and an angled portion extending from the dome portion and a drip 30 edge on the curb portion. The skylight curb portion is shaped to fit over a portion of the prefabricated skylight support curb angled upright portion and top lip. The skylight support curb is shaped to nest an accompanying skylight therein having the skylight curb portion adjacent to the interior of 35 the skylight support curb angled upright walls to protect the skylight during shipping and storing.

In another skylight system, as contemplated in U.S. Pat. No. 3,791,088, by Sandow, et al., a prefabricated multiple 40 dome unit or skylights and composite is provided, wherein each multiple dome unit has several domes of transparent or translucent material mounted together on a common frame, and wherein means are provided for assembling a plurality of such dome units into a composite thereof on a building, with the units lapped and interfitted so as to provide a 45 continuous drainage system discharging to the exterior of the units in the composite assembly.

In yet another skylight system, as contemplated in U.S. Pat. No. 4,642,466, by Sanneborn, et al., a flashing frame is described for roof windows to be installed adjacent to each 50 other with edges facing each other in the installed position with a connecting flange of its upper flashing members extending beneath the roofing and, if need be, with its lower flashing members and required intermediary flashing members, obliquely outwardly bent connecting webs and each 55 with a connecting bar with supporting webs which rearwardly engage the connecting webs being adjacent to the width of the installation distance and are obliquely bent inwardly on both sides, and at least one inner projection which engages between the facing corner edges of the 60 connecting webs in the installed position, thus maintaining these corner edges at the installation distance.

In today's world of mandated energy efficiency in all types of buildings the metal building industry needs a more economical and less detrimental way to use skylights and 65 smoke vents to daylight their buildings. To ensure adequate daylighting, however, typical skylight and smoke vent installations require multiple roof penetrations that cut

through and remove plural major elevations in standing seam and other roof panel profiles. These curbs create multiple opportunities for water to enter the interior of the building, due to multiple curb locations and the width of the curbs, as well as the challenge to effectively seal the roof at the high end of such curbs.

The traditional curb constructions and methods of attachment in most cases require a complicated support structure to be installed below the roof panel which can restrict movement associated with the thermal expansion and contraction of the metal roof due to temperature changes and the like.

None of the prior approaches have been able to provide an installation system for multiple skylights that accomplishes all the goals of economy and simplicity of installation and will work equally well for new buildings and as a retrofit in existing buildings.

#### SUMMARY OF THE INVENTION

This invention provides for supporting a load on a roof. In one aspect, the invention provides a curbless construction system for installing two or more adjacent skylights and smoke vents end to end onto the major rib elevation of a building's metal panel roof system. Numerous roof structures include such elevations, sometimes deemed "ribs" or "corrugations", including the standing seam, snap seam and "R" panel roof types. The rail and closure system is fastened to the metal roof panels along the rib structures, so that the system can move with the expansion and contraction of the roof.

The invention utilizes elements of the roof surface structure as an integral part of the skylight support structure. In the preferred embodiment, the system includes a rail and closure assembly adapted to be supported on a major rib elevation a metal roof, typically where the elevation has been cut to accommodate drainage. The balance of the rib is to provide structural support for the rail assemblies.

Also in the preferred embodiment, the skylight/smoke vent system includes a skylight adapted to be supported on the rail and closure assembly, and a bearing plate structure for supporting and sealing the portion of the elevations that have been cut away preventing water accumulation at the surface, thus preventing water egress into the building.

In a further preferred embodiment, the invention provides a skylight system (including smoke vents) where the bearing plate structure cooperates with the rail and closure assembly to close the cut away portion to water egress.

In another preferred embodiment, the invention provides a skylight system where the metal roof is selected from the group of roofs comprising a standing seam roof, an architectural standing roof and a snap seam roof.

In another preferred embodiment, the invention provides a skylight system where the rib has been cut in only one location.

In a further preferred embodiment, the invention provides a skylight system where the standing seam roof has trapezoidal rib elevations.

In still further preferred embodiment, the invention provides a skylight system where the ribs are about 24" to about 30" on center.

In a different preferred embodiment, the invention provides a skylight system where the metal roof is selected from the group of roofs comprising an architectural standing roof and a snap seam roof, and where the vertical rib configurations are about 12" to about 18" on center.

In still further preferred embodiment, the invention provides a skylight system where the metal roof is an exposed fastener roof system.

In one preferred embodiment, the invention provides a skylight system where the rib has been cut in two locations.

In a different preferred embodiment, the invention provides a skylight system having a trapezoidal or rectangular rib elevation 8" to 12" on center.

In another preferred embodiment, the invention provides a skylight system where the exposed fastener roof is of the type having roof panels fastened directly to the roof purlin from the top side of the roof panel.

In a further preferred embodiment, the invention provides a skylight system where the system comprises two or more skylights supported end to end.

In a different preferred embodiment, the invention provides a skylight system (including smoke vents) where each of the skylights are about 10 feet in length.

In one preferred embodiment, the invention provides a skylight system where the rail and closure assembly moves with the rib elevation.

In different preferred embodiment, the invention provides a skylight system further comprising a ridge cap configured to fit over the standing rib elevations at the ridge of the roof.

In a further preferred embodiment, the invention provides a skylight system where a lower closure of the skylight rail and closure assembly extends across the top of the metal roof panel profile.

In one preferred embodiment, the invention provides a skylight system where the closure is configured to match the roof panel surface adjacent rib elevations for sealing.

In a further preferred embodiment, the invention provides a skylight system where the closure is pre-cut to match the roof surface and adjacent rib elevations for sealing.

In a still further preferred embodiment, the invention provides a skylight system where the rail and closure assembly is fastened directly to the rib elevations using screws or rivets.

Where an extension is attached to the upper flange of the rail and closure assembly to effectively raise the height of the skylight or smoke vent to accommodate snow conditions and the like.

In a preferred embodiment, the invention provides a skylight system further comprising a safety security guard attached to the rail assembly.

In a still further preferred embodiment, the invention provides a skylight system where the rail and closure assembly comprises an extended down leg on the inside of the roof cut away segment.

In another preferred embodiment, the invention provides a skylight system where the rail and closure assembly forms a water tight seal with the rib elevation.

In a preferred embodiment, the invention provides a skylight system where a side rail elevation attaches to the interior of the rib elevation.

In a further preferred embodiment, the invention provides a skylight system where the side rail elevation attaches to the anterior of the rib elevation.

In a different preferred embodiment, the invention provides a skylight system where a portion of the adjacent rib elevation is cut away to accommodate drainage along the roof surface.

In a still further preferred embodiment, the invention provides a skylight system where a portion at only one adjacent rib elevation is cut away to accommodate drainage along the roof surface.

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In another preferred embodiment, the invention provides a skylight system where a portion at two or more adjacent rib elevations is cut away to accommodate drainage along the roof surface.

These and other features and advantages of this invention are described in, or are apparent from, the following detailed description of various exemplary embodiments of the apparatus and methods according to this invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention and the attendant features and advantages thereof may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein various figures depict the components and composition of the multiple skylight system.

FIG. 1 is a view showing the roof profile of a metal roof of the type known as the standing seam roof panel.

FIG. 2 is a view showing the roof profile of a metal roof of the type known as an architectural standing seam roof.

FIG. 3 is a view showing the roof profile of a metal roof of the type commonly referred to as a snap seam roof.

FIG. 4 is a view showing the roof profile of a metal roof of the type commonly referred to as an exposed fastener roof panel.

FIG. 5 is a view showing the roof profile of a metal roof of the type commonly known as foam core panel.

FIG. 6 is a side view showing the major components of the system as installed on a metal roof.

FIG. 7 is a top plan view of the installed system, showing the placement of skylights and the direction of water flow over the roof.

FIG. 8 is a cross sectional view showing the connections of the skylight frame to the rail and closures structure, and the latter affixed over the outer surfaces of adjacent rib elevations of the metal roof.

FIG. 9 is a cross sectional view showing an alternative arrangement for the elements shown in FIG. 8, only with the rail and closure structure connecting along the inner faces of adjacent rib elevations.

FIG. 10 is a perspective view partially cut away showing internal structure of the system as installed on the rib elevations of a metal roof.

FIG. 11 is a perspective view of the upper rain pan or diverter of the rail and closure structure.

FIG. 12 is a top view of the upper rain pan or diverter of the rail and closure structure.

FIG. 13 is a front plan view of the upper rain pan or diverter of the rail and closure structure.

FIG. 14 is a perspective view of the lower rain pan or lower closure of the rail and closure structure.

FIG. 15 is a top view of the lower rain pan or lower closure of the rail and closure structure.

FIG. 16 is a front plan view of the lower rain pan or lower closure of the rail and closure structure.

FIG. 17 is a perspective and partially cut away view showing a connection of adjacent skylights of the system.

FIG. 18 shows detail of how the batten connects adjacent skylights and prevents water egress between them.

## DETAILED DESCRIPTION OF THE INVENTION

The products and methods of the present invention provide a skylight rail and closure system for use in installing various roof penetrating structures in metal roofs. For pur-

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poses of simplicity, "roof penetrating structures" and "skylights" will be used interchangeably to mean various forms of roof structures installed for passage of light and/or ventilation to the interior of the building. In the case of roof ventilation, examples include simple ventilation openings, such as for roof fans, and smoke vents, which are used to allow the escape of smoke through the roof during fires.

The number of skylights can vary from one to many structures connecting end to end be from one to as many as the building roof structure will support, limited only by the amount of support provided by the roof surface structure, which is left largely intact during the installation process.

The system utilizes the major rib structure in the roof as the primary support structure and water barrier to fasten the skylight assembly. Typical skylight installations do not allow for continuous runs, but use a curb construction that is typically 2-3 times wider than the present system.

The present skylight system does not require a complex structure underneath the panels or a separate curb construction to support or attach the skylight. The rail and closure assembly is overlaid onto the roof system and allows for thermal expansion and contraction by utilizing the major profiles of the metal roof panel for support. This is accomplished through direct attachment of the rail assembly and a combination of the panel flat and major ribs for support and attachment of the closure assembly.

In reference now to the figures, the system allows the installation of two or more adjacent skylights in an end to end fashion along the major rib structure of a building's metal roof panel profile.

The skylight system may be applied to various types of ribbed roof profiles. FIG. 1 is a view showing the roof profile of a metal roof of the type known as the standing seam roof panel 10. These include the "standing seam" roof, which has trapezoidal major ribs 12 typically 24" to 30" on center. Each panel 10 will also include the panel flat 14, having a shoulder 16 and seamed at adjacent panels forming a standing seam 18, which is folded over and seamed to prevent water from penetrating the roof.

FIG. 2 is a view showing the roof profile of a metal roof of the type known as an architectural standing seam roof, produced of a series of overlapping architectural standing seam panels 20. Each panel 20 comprises a panel flat 24, with an architectural standing seam 28 formed at the interconnecting panels.

FIG. 3 is a view showing the roof profile of a metal roof of the type commonly referred to as an R panel or exposed fastener panel 30, with each panel having a rib 32, panel flat 34. Adjacent R panels are secured to the roof through a structural fastener 35, and at the shoulder 36 which is formed from overlapping regions, or side lap 38, the adjacent panels are secured through a stitch fastener 39. The trapezoidal major ribs of the R panel roof are most typically formed at 8" to 12" on center.

FIG. 4 is a view showing the roof profile of a metal roof of the type commonly referred to as a snap rib seam panel 40. Snap seam panels 40 have a panel flat 44 and a standing seam or snap seam 48 at adjacent panels.

FIG. 5 is a view showing the roof profile of a metal roof of the type commonly known as foam core panel 50, which has a rib 52, a liner panel 53, a panel flat 54 and a foam core 57. Side laps 58 are secured by a stitch fastener 59. This panel is typically installed from the interior of the building.

The system includes a rail and closure assembly adapted to be supported onto the major elevations, seams, rib structures, or other structural elements of such roof profiles, where the standing structure provides the support, and the



skylight is secured through an opening formed in the inter-vening, non-structural roof flat region.

Turning now to FIG. 6, there is shown an exemplified rail and closure assembly 100 adapted for attachment to a standing seam panel roof 110. While the following figures depict such an assembly, it will be understood that the components could easily be adapted, by shaping of the elements, for attachments to any roof system that has a profile with elevations providing a place for structural support.

Looking again to the figures, particularly FIGS. 6 and 7, there is shown such a standing seam panel roof 110 having structural and other elements including a raised rib 112, a panel flat 114, shoulder 116 and standing seam 118. Also depicted are the ridge cap 120 of the roof structure, and a series of cutaway regions, or gaps 122 formed to accommodate the structure, as described more fully as follows.

Shown as part of the system, and exemplified in this case, is a skylight 130, generally comprising a skylight frame 132 and skylight lens 134. While the figures depict a skylight, it will be understood that the system could also be adapted for use with any number of roof penetrating structures, from various types of skylights to smoke vents or other loads or other ventilating structures, which can all be adapted to be supported on the rail and closure assembly system.

Again in reference to FIGS. 6 and 7, the system includes a rail and closure structure 140, generally comprised of side rails 142 and 144, and upper diverter 146 disposed at the rib cutaway section, or gap 122. FIGS. 6 and 7, collectively, show the rail 142 being mounted to the rib by rivets 310 at leading, intermediate, and trailing portions of the length of the rail. At this gap 122, a plate 148 may be located under the gap 122 to prevent water leakage from roof. In assembling the rail and closure structure to a roof, the plate 148 may be sealed and fastened securely to the roof panel supports.

Looking more particularly to FIG. 7 it is shown how the gap 122 in the roof rib 112 allows water flow 200 along the roof surface, over plate 148, and down and away from the roof ridge cap 120.

The rail and closure assembly structure 140 may also include a lower closure 150 to seal the system from the elements.

In reference now to FIG. 8, there is shown a cross section through the skylight 130 region of the rail and closure structures 100, showing the securement of the assembly 100 to the standing seam panel roof 110. FIGS. 6 and 7 illustrate the skylight load length extending in the same direction as the roof ribs 112. FIG. 8 illustrates the skylight load width. FIGS. 6-8 show the skylight load being separate and distinct from the rail and closure structure 140. FIGS. 6 and 7 also show the rails extending substantially the full length of the skylight load. FIG. 8 shows rails 142, 144 contacting respective underlying ones of the ribs and extending upwardly from the underlying ribs, and supporting the skylight load; and the underlying ribs supporting the rails along substantially the full length of the skylight load.

In particular, FIG. 8 depicts the use of the ribs 112 to support the side rails 142 and 144 on opposing sides of panel flat 114. It is seen that each of rail 142, rail 144, and upper diverter 146, has an upper support flange defining an upper bearing surface 240 at a common elevation above the panel flat of a next adjacent roof panel, supported by a generally vertically upstanding web. Rails 142, 144 have lower shoulders 242 supporting the upstanding webs. FIG. 11 shows the upper bearing surfaces of the diverter and the rails at a common elevation.

FIG. 6, in combination with FIG. 8, shows that rails 142 and 144 extend substantially the full length of the overlying skylight load, and that the skylight load is secured to the underlying rails by fasteners 300 spaced along the lengths of the rails. The rails 142 and 144 extend upwardly from and above the ribs in contacting and supporting the load, whereby substantially all of the downwardly-directed force of the load passes downwardly through the rails at the vertically upstanding webs, as elements of the rails, and from the rails downwardly to the underlying ones of the ribs, and from the ribs downwardly to structural support members of the building. Particularly as illustrated in FIG. 7, as supported by FIGS. 6, 8, and 10, all of the downwardly-directed force of the skylight load passes downwardly through respective ones of the roof panels, ultimately through the respective roof panel ribs, along substantially the full length of the load, to underlying elements of the building support structure. As illustrated in FIG. 7, the load extends between the first and second rails across the entire width of the respective panel flat.

The rail shoulder 242 is shaped to fit closely over the outside of the roof rib 112, and FIG. 8, in combination with FIG. 6, shows the rail secured directly to roof rib 112 by a rivet 310. A rail support flange supports the skylight frame 132, where a sealant 330 can be applied to seal against the passage of water or air.

FIG. 9 depicts a variation of the rail and closure assembly 100 shown in FIG. 8, only where the rail shoulder 242 is shaped to fit closely along the inside of the roof rib 112, and is secured to roof rib 112 by rivet 310. As for FIG. 8, the rail bearing surface 240 similarly supports the skylight frame 132, where a sealant 330 can be applied.

It can be seen that the rail and closure structure 140 of the assembly 100 can be produced to fit closely along the contour of the roof 110, and can be so configured to have end portions that match the contour of the ribs 112. The various mating surfaces of the structure 140 and the roof 110 can be sealed in various ways known to the roofing art, including caulking or tape mastic, or various rubber fittings or inserts can be provided be used to seal the open area of the panel roof.

In FIG. 10 a partially cut away perspective view of the rail and closure structure assembly 100 is used to show the support of the rail and closure system by the standing seam panel roof 110, particularly the elevated rib 112 providing the structural support. In FIG. 10, it is seen how the rail and closure system incorporates the structural profile of the upper panels of metal roof structure, the elevations and ribs used in sealing adjacent panels, to provide the support of adjacent skylights. In this fashion, the system adopts various advantages of a standing seam roof.

Most standing seam roofs are seamed using various clip assemblies that allow the roof to float, along the major elevation. Typically, the roof is fixed at eave and allowed to expand and contract over at ridge. Very wide roofs can be fixed at midspan and expand towards both the cave and ridge. The design of the skylight system takes full advantage of the floating features of contemporary roofing structures, and when a skylight is so secured to the elevations, the skylight assemblies themselves are able to draw strength from the structural load bearing capacity of the roof profile.

Shown in FIG. 10 is the panel flat 114, rib 112 and shoulder 116, as well as the standing seam 118. The ridge cap 120 is also shown, as well as the gap in the roof 122.

The skylight 130 is supported on the rail and closure structure 140, as previously described.

The rail and closure structure **140** is secured by its side rails **142** and **144** by a series of fasteners **300** to the skylight frame **132** and to the ribs **112** by a series of rivets **310**.

In application, from each structure **140** a single rib **112** is typically cut away to accommodate drainage at the high end of the system (toward ridge cap **120**). This is an important feature for standing seam, architectural standing seam and snap seam roofs. Two ribs may be cut for roofs having an "R" panel profile.

The retained portions of rib **112** serve as a beam to support the side rails **142** and **144** and maintain a watertight seal along the length of the assembly. Internal portions of the ribs **112** may be removed to allow additional light from the skylight **130**.

A single bearing plate structure **148** is used for sealing the cut away rib. The bearing plate **148** also provides some support to link adjacent rib elevations **112**, and is typically produced of steel or other material sufficient to provide a rigid substructure to the skylight rail and closure structure.

The rail and closure structure **140** is shaped in such a manner that the skylight can be easily fastened directly to the rail portion, with rivets or fasteners such as screws and the like. The rail and closure structure **140** may also be designed to accept a safety security guard before the skylight is installed.

Looking now to FIGS. **11** through **13**, an upper or high end diverter **146** provides closure and diversion of water around the top of the assembly to an adjacent panel flat. Diverter **146** also provides a weather tight seal at the upper end of the assembly, with the plate **148** (not shown). In reference to the side rails **142** and **144** of a standing seam panel roof **110**, the diverter **146** generally fits the profile of the rib **112** at the region of the cut away gap **122**. The side rails **142** and **144** abut the diverter **146** and the height of the diverter **146** closely matches them in height. The upper support flange **400** of the diverter **146** actually acts with upper support flanges **240** of the side rails **142** and **144** to form the bearing surface of the skylight frame.

The diverter **146** lower flange **410** runs along the panel flat **114**. The diverter **146** also has a diversion surface **420** and fastener holes **430** along the lower flange.

At one end is a rib mating surface **440** and at the other a rib sealing plate **450** is formed.

FIGS. **14** through **16** show the low end closure **150** that is used to maintain a weather tight seal at the lower end of the assembly. Shown again in reference to the side rails **142** and **144** of a standing seam panel roof **110**, the closure **150** is adapted to fit the profile of the rib **112**. The side rails **142** and **144** abut the closure **150** and the height of the closure flange matches the in height of flanges **240** of the side rails and the diverter, whereby the rail and support structure defines a plurality of support flanges having bearing surfaces all interfacing with said load at a common elevation above the panel flat of a respective next adjacent roof panel.

Looking to the closure **150**, it is seen to have an upper support flange **500** and a lower flange **510**, as well as a closure web **520**. The lower flange **510** includes fastener holes **530**.

The closure **150** also includes rib mating surfaces **540** and **550** to provide a tight fit along the ribs **112**.

Looking now to FIGS. **17** and **18**, the adaptation of the system for the application of multiple roof penetrating structures is described. A chief aspect of the assembly **100** is the reduction in the number of roof penetrations required to provide daylight to the interior of a structure, as fewer, longer cuts can be made along the roof elevations. These minimized openings can be maintained along a single rib, if

desired, with one continuous opening versus many smaller ones permitting an equal or greater amount of ambient light into the building.

In the case of standing seam roofs the system provides the ability to remove only a portion of the bottom flat of the panel. This maintains the structural integrity of the roof in that multiple sections of major panel elevations are not removed, as is done to accommodate a "typical" curb assembly. Thus, the roof's structural integrity is not compromised to that extent and there are fewer potential areas for water infiltration, in that the skylight panels can be attached very near the ridge of the building and run to the cave requiring water to be diverted only once near the ridge of the roof plane and only across one panel flat.

To the limited extent that cutaways are made to the elevations, these are made small, on the order of a few inches or less, solely for the purpose of allowing drainage past the skylights.

The rail system is designed to install to either the inside or outside of the major rib elevation for any of the aforementioned roof panel profiles.

The rail and closure assembly **100** is particularly useful for continuous runs of skylights end to end. FIG. **17** shows how two adjacent skylights of the rail and closure assembly **100** can be affixed along a standing seam panel roof **110**. Instead of producing the lights with diverters and lower closures, where adjacent lights abut, the rail and curb structures **140** are provided with upper and lower standing rib frames **600** and **610** at adjacent ends of the adjacent structures **140**. A batten **620** is provided to secure the system **100** against the elements.

FIG. **18** is a side elevational view of the batten **620**, showing how it fits over the adjacent upper and lower standing rib frames **600** and **610**.

As only one example, skylights can be produced in units of up to 10 feet long, and connected in this fashion for as long as necessary, as each skylight unit is supported by the primary rib of the profile. The standing rib elevation (the major corrugation) runs longitudinally along the length of the assembly and mates along the entire assembly **100**, regardless of the number of adjacent structures **140**. No water can enter over the top of the rail and closure assembly.

Where it is desired that the skylight starts at the ridge of the roof, a simple flashing can be inserted under the ridge cap.

Where the ridge cap has a configuration to fit the rib elevations (major corrugations) in the roofing panels, a portion of the one rib may be cut out (approximately 2"), allowing the water from the roof panel above to be diverted on to the next panel.

If desired, a simple rail enclosure extension could be used to increase the height or distance between top skylight frame and the roof panel, and can be adapted to simply lay over or attach to the top of the rail and closure assembly. Such an extension could be produced to rest along the upper flange of the rail and closure assembly, to effectively raise the height of the skylight or smoke vent to accommodate different skylight depths or other design features, or to accommodate snow conditions and the like. In this fashion, the rail and closure structure can be produced to a standard height, with varying extensions used to elevate the overall height of the structure for such varied purposes. Various forms for such an extension would be suitable, and the skilled artisan will understand various ways and means of designing and manufacturing these to accomplish the goal of added height to the skylight.

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While this invention has been described in conjunction with the specific embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention, as set forth above, are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of this invention.

What is claimed is:

1. A metal panel roof, said metal panel roof comprising a plurality of elongate metal roof panels arranged side by side, such metal roof panels having lengths and widths, edges of adjacent such metal roof panels meeting at elevated rib structure portions thereof, first and second ones of said rib structure portions being joined to each other to define respective elevated roof panel ribs, having rib lengths, panel flats being disposed between such elevated roof panel ribs, said panel flats having panel flat widths extending between respective ones of said elevated roof panel ribs,

a load being mounted on said roof, a rail and closure structure underlying and supporting said load, said load having a first end and a second end, and a load length between the first end and the second end, and extending in a same direction as the lengths of said elevated roof panel ribs, said rail and closure structure comprising first and second rails, separate and distinct from said load, said rails having rail lengths extending substantially the full length of said load, said rails directly contacting underlying ones of said ribs and extending upwardly from said underlying ribs, said rails supporting said load, said underlying ribs supporting said rails between the first end of said load and the second end of said load,

substantially all downwardly-directed force of said load passing downwardly through said rails, and passing from said rails downwardly to said underlying ones of said ribs.

2. A metal panel roof as in claim 1, a distance between said first and second rails spanning an entirety of a width of a given such panel flat, further comprising end closures at up-slope and down-slope ends of said rail and closure structure, said end closures extending between said first and second rails, said load, in combination with said rail and closure structure comprising a rail and closure assembly, said rail and closure assembly forming a water tight seal with the rib elevation.

3. A metal panel roof as in claim 2, said end closures comprising an upper diverter at the up-slope end of said rail and closure structure and a lower closure at the down-slope end of said rail and closure structure.

4. A metal panel roof as in claim 3, a lower portion of an end panel of said upper diverter defining a downwardly-directed slope extending across the width of the respective panel flat thereby to direct water, flowing by gravity toward said rail and closure structure, laterally across the respective metal roof panel at said upper diverter.

5. A metal panel roof as in claim 1, said load being disposed above respective elevations of the panel flats which are next adjacent said rail and closure structure.

6. A metal panel roof as in claim 1, said load, at a given location along the length of a given said rail, being disposed above a top of the given said rail at the given location.

7. A metal panel roof as in claim 1, said rail and closure structure surrounding an area on said roof and extending, from the underlying roof panels, upwardly to a top of said rail and closure structure, and wherein said rail and closure

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structure spans an entirety of the width of a said panel flat between said first and second rails.

8. A metal panel roof as in claim 1, all downwardly-directed force of said load passing downwardly through respective ones of said roof panels.

9. A metal panel roof as in claim 1, said load passing from said ribs downwardly to structural support members of said building.

10. A metal panel roof as in claim 1, upper bearing surfaces of said rails supporting said load above said ribs.

11. A metal panel roof as in claim 1, substantially all downwardly-directed force of said load passing downwardly through said rails, including along substantially the full length of said load.

12. A metal panel roof, said metal panel roof comprising a plurality of elongate metal roof panels arranged side by side, such metal roof panels having lengths and widths, edges of adjacent such metal roof panels meeting at elevated rib structure portions thereof, ones of said rib structure portions being joined to each other and thereby defining elevated roof panel ribs, having rib lengths, panel flats being disposed between such elevated roof panel ribs, said panel flats having panel flat widths extending between respective ones of said elevated roof panel ribs,

a load being mounted on said roof, said load being supported by a rail and closure structure, said rail and closure structure having a length and a width, and comprising first and second rails, separate and distinct from said load, said rails having lengths extending in same directions as the lengths of said elevated roof panel ribs, said rail and closure structure extending across an entirety of the width of at least one said panel flat, from a first said elevated roof panel rib to a second said elevated roof panel rib, said first rail defining a first side of said rail and closure structure, said second rail defining a second opposing side of said rail and closure structure, said first and second rails being mounted directly to said first and second ribs, said rail and closure structure defining a plurality of support flanges interfacing with said load at a common elevation above the panel flat of a respective next adjacent said first roof panel along the width and the length of said rail and closure structure, said load exerting a downwardly-directed force on said rail and closure structure at said support flanges, said rail and closure structure being disposed between said load and one or more of said roof panels,

substantially all downwardly-directed force of said load passing downwardly through said rails, and passing from said rails downwardly to underlying ones of said ribs.

13. A metal panel roof as in claim 12, said rail and closure structure further comprising an upper diverter at an up-slope end of said rail and closure structure and a lower closure at a down-slope end of said rail and closure structure, said rail and closure structure surrounding an area on said roof and extending, from the underlying roof panels, upwardly to said support flanges, each of said first and second rails, said upper diverter, and said lower closure defining elements of said support flanges, and defining upwardly-facing load bearing surfaces on said support flanges.

14. A metal panel roof as in claim 12, further comprising end closures at up-slope and down-slope ends of said rail and closure structure, said end closures extending between said first and second rails, said load, in combination with said rail and closure structure comprising a rail and closure

assembly, said rail and closure assembly forming a water tight seal with the rib elevations.

15. A metal panel roof as in claim 14, said end closures comprising an upper diverter at the up-slope end of said rail and closure structure and a lower closure at the down-slope 5 end of said rail and closure structure.

16. A metal panel roof as in claim 15, a lower portion of an end panel of said upper diverter defining a downwardly-directed slope extending across the width of the respective panel flat thereby to direct water, flowing by gravity toward 10 said rail and closure structure, laterally across the respective metal roof panel at said upper diverter.

17. A metal panel roof as in claim 12, all of the downwardly-directed force of said load passing downwardly through respective ones of said roof panels. 15

18. A metal panel roof as in claim 12, said load, at a given location along the length of a given said rail, being disposed above a top of the given said rail at the given location.

19. A metal panel roof as in claim 12, said load passing from said ribs downwardly to structural support members of 20 said building.

20. A metal panel roof as in claim 12, all downwardly-directed force of said load passing downwardly through respective ones of said metal roof panels.

21. A metal panel roof as in claim 12, upper bearing 25 surfaces of said rails supporting said load above said ribs.

22. A metal panel roof as in claim 12, substantially all downwardly-directed force of said load passing downwardly through said rails, including along substantially the full 30 length of said load.

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