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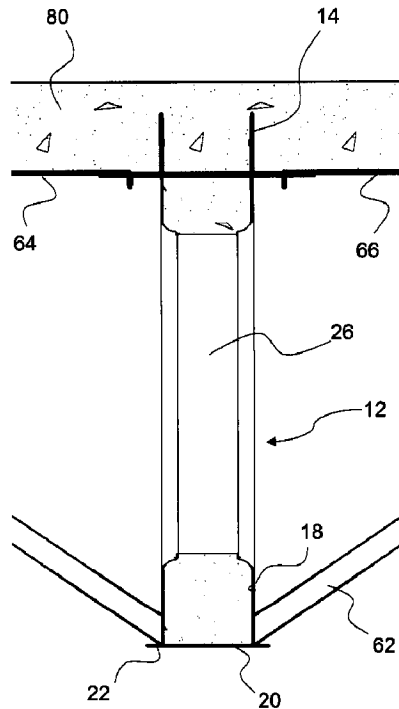
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(54) Titre : POUTRELLE EN ACIER POUVANT ETRE REMPLIE DE BETON

(54) Title: CONCRETE FILLABLE STEEL JOIST



(57) **Abrégé/Abstract:**

A concrete fillable steel joist includes a generally U-shaped member, a top chord, and a pair of end plates. The generally U-shaped member having spaced apart webs and a bottom chord. The top chord is operably attached to the U-shaped member. The top

(57) **Abrégé(suite)/Abstract(continued):**

chord has a plurality of spaced apart top chord holes. The pair of end plates are operably attached at opposed ends of U-shaped member. The U-shaped member, the top chord and the pair of end plates form a volume that is fillable with concrete. A concrete fillable steel joist system includes a plurality of spaced apart concrete fillable steel joist, metal decking, and bridging members. The metal decking is operably attached between the spaced apart steel joists. The bridging members are operably attached between the metal decking and the U-shaped member. The concrete fillable steel joist and the metal decking are configured to receive concrete.

ABSTRACT OF THE DISCLOSURE

A concrete fillable steel joist includes a generally U-shaped member, a top chord, and a pair of end plates. The generally U-shaped member having spaced apart webs and a bottom chord. The top chord is operably attached to the U-shaped member. The top chord has a plurality of spaced apart top chord holes. The pair of end plates are operably attached at opposed ends of U-shaped member. The U-shaped member, the top chord and the pair of end plates form a volume that is fillable with concrete. A concrete fillable steel joist system includes a plurality of spaced apart concrete fillable steel joist, metal decking, and bridging members. The metal decking is operably attached between the spaced apart steel joists. The bridging members are operably attached between the metal decking and the U-shaped member. The concrete fillable steel joist and the metal decking are configured to receive concrete.

CONCRETE FILLABLE STEEL JOIST

FIELD OF THE DISCLOSURE

This disclosure relates to steel joists and in particular steel joists that are fillable with concrete and a concrete fillable steel joist system.

BACKGROUND

For spanning multi residential structures, non-combustible concrete floors provide excellent fire ratings and a solid feeling for the occupants. Composite steel / concrete joist systems have been around since the 1970's, they have proven to be an excellent means for providing cost effective floor systems for buildings.

Composite joists can be supplied with open webs or utility holes for running mechanical/ electrical equipment in the floor plenum. Joists are typically cambered and therefor do not need to be shored for the concrete pour. Joists require gypsum to be placed on the underside to provide 1 hour and greater fire ratings.

Another type of floor system that is good for the multi residential spans are composite deep metal decking filled with concrete. Composite metal deck systems typically do not need gypsum on the underside to achieve fire ratings. Unfortunately, deep deck systems need to be shored when the concrete is being poured. Deep decks do not have utility holes to allow passing mechanical / electrical systems through them.

Accordingly, it would be advantageous to provide a concrete

fillable steel joist and a system using same.

SUMMARY

The present disclosure relates to steel joists that are fillable with concrete. A concrete fillable steel joist comprises: a generally U-shaped member having spaced apart webs and a bottom chord; a top chord operably attached to the U-shaped member, the top chord having a plurality of spaced apart top chord holes; and a pair of end plates operably attached at opposed ends of the U-shaped member; whereby the U-shaped member, the top chord and the pair of end plates form a volume that is fillable with concrete.

The concrete fillable steel joist may include a pair of joist support struts attached to opposed ends of the top chord and extending outwardly from the U-shaped member.

The joist support struts may include a pair of joist shoes attached at a distal end thereof.

The concrete fillable steel joist may include a pair of joist diagonal members on either side of the U-shaped member, the joist diagonal members being operably attached to the U-shaped member and the joist support strut and wherein a pair of the joist diagonal members are operably attached at opposed ends of the U-shaped member.

Each of the end plates of the pair of end plates may have a generally vertical portion and an angled portion and the angled portion is generally in registration with the pair of joist diagonal members.

Each of the joist support struts of the pair of joist support struts may have a plurality of spaced apart strut holes.

The top chord may have two elongate channels formed therein for receiving the spaced apart webs of the U-shaped member.

The top chord may further include a pair of side tabs, wherein one side tab of the pair of side tabs extends outwardly from each of the elongate channels.

The side tabs may include a plurality of spaced apart tab holes.

The U-shaped member may include a plurality of utility holes and wherein each utility hole has a rim that is operably attached to the spaced apart webs around the utility hole.

The U-shaped member may further include a pair of bottom chord tabs extending outwardly from the bottom chord on either side of the spaced apart webs.

The concrete fillable steel joist may be cambered.

A concrete fillable steel joist system is also disclosed. The concrete fillable steel joist system comprises: a plurality of spaced apart concrete fillable steel joists as disclosed above; metal decking operably attached between the spaced apart concrete fillable steel joists; and bridging members extending operably attached between the metal decking and the U-shaped members of the concrete fillable steel joists; whereby the concrete fillable steel joist and the metal decking is configured to receive concrete.

The metal decking may include a first deck portion and a second

deck portion operably connected to each other.

The first deck portion and the second deck portion may have and overlapping joint.

The concrete fillable steel joist system may include bridging members that extend between the bottom chords of the U-shaped members to the overlapping joint.

The top chord may include a pair of side tabs and a plurality of tab holes formed therein and the decking includes a plurality of decking tabs extending downwardly therefrom and the tab holes are configured to receive the decking tabs.

Further features will be described or will become apparent in the course of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments will now be described by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of a plurality of spaced apart concrete fillable steel joists;

FIG. 2 is a perspective view similar to that shown in **FIG. 1** of a plurality of spaced apart concrete fillable steel joists but also including metal decking between the spaced apart concrete fillable steel joists;

FIG. 3 is a cross sectional view of a concrete fillable steel joist of **FIG. 1**;

FIG. 4 is a cross sectional view similar to that of **FIG. 3** showing a concrete fillable steel joist but showing it filled with concrete;

FIG. 5 is a cross sectional view similar to that of **FIG. 4** but the section is through a utility hole;

FIG. 6 is an enlarged cross sectional view of a top chord of a concrete fillable steel joist of **FIG. 1**;

FIG. 7 is an enlarged perspective view of the top chord of the concrete fillable steel joist shown in **FIG. 6**;

FIG. 8 is a side view of a concrete fillable steel joist system including two spaced apart concrete fillable steel joists, metal decking and bridging;

FIG. 9 is an enlarged side view of the concrete fillable steel joist system of **FIG. 8** showing the top chord of a concrete fillable steel joist and the metal decking;

FIG. 10 is an enlarged side view of the concrete fillable steel joist system of **FIG. 8** showing the connection between the metal decking;

FIG. 11 is an enlarged side view of the concrete fillable steel joist system of **FIG. 8** showing the connection between a concrete fillable steel joist and the bridging connections;

FIG. 12 is an enlarged perspective view of one end of the concrete fillable steel joist of **FIG. 1**;

FIG. 13 is a blown apart perspective view of one end of the concrete fillable steel joist shown in **FIG.12**;

FIG. 14 is an enlarged perspective view of a rim for use in the concrete fillable steel joist of **FIG. 1**;

FIG. 15 is a blown apart perspective view of a concrete fillable steel joist system;

FIG. 16 is a blown apart end view of the concrete fillable steel joist system of **FIG. 15**;

FIG. 17 is an enlarged perspective view of the underside of the concrete fillable steel joist system of **FIGS. 15** and **16**;

FIG. 18 is an enlarged view of **FIG. 16** showing decking tabs pushed through the top chord of the concrete fillable steel joist; and

FIG. 19 is an enlarged view of **FIG. 17** showing the bridging support and metal decking between adjacent concrete fillable steel joists.

DETAILED DESCRIPTION

Referring to **FIG. 1**, a concrete fillable steel joist is shown generally at **10**. The concrete fillable steel joist **10** includes a generally U-shaped member **12**, a top chord **14**, and a pair of end plates **16**. All of the elements of the concrete fillable joist **10** may be made from cold rolled steel.

The generally U-shaped member **12** as best seen in **FIGS. 3, 4, 5 and 13** has spaced apart webs **18** and a bottom chord **20**. A pair of bottom chord tabs **22** extend outwardly from the bottom chord **20** on either side of the spaced apart webs **18**. The U-shaped member includes a plurality of utility holes **24**. Each utility hole **24** has a rim **26** that is operably attached to the spaced

apart webs **18** around the utility hole **24**. The rim **26** is shown in **FIG. 14**. The rim **26** has a splice **28**. The rim **26** around the utility hole **24** of the U-shaped member **12** is operably attached to the webs **18** so that when the concrete fillable joist **10** is filled with concrete, concrete will not be able to flow out of the concrete fillable joist **10** through the utility holes **24**.

The top chord **14** is operably attached to the U-shaped member **12**. The top chord **14** has a plurality of spaced apart top chord holes **30** as best seen in **FIG. 7**. The top chord **14** has two elongate channels **32** formed therein for receiving the webs **18** of the U-shaped member **12**. The top chord **14** includes a pair of side tabs **34** extending outwardly from the elongate channels **32**. The side tabs **34** include a plurality of spaced apart tab holes **36**. The elongate channels **32** are clinched **38** to the web **18** of the U-shaped member **12**. It will be appreciated by those skilled in the art that the top chord could be attached to the U-shaped member in a number of different ways for example riveting, welding or clinching as shown herein.

Referring to **FIGS. 12 and 13**, the concrete fillable joist **10** has a pair of end plates **16** operably attached at opposed ends of U-shaped member **12**. A pair of joist support struts **40** are attached to opposed ends of the top chord **14** and extending outwardly from the U-shaped member **12**. A pair of joist shoes **42** are attached to each of the joist support struts **40** at a distal end thereof. A pair of joist diagonal members **44** are attached on either side of the U-shaped member **12** and are operably attached to the U-shaped member **12** and the joist support strut **14**. A pair of the joist diagonal members **44** are operably

attached at opposed ends of the U-shaped member **12**. The end plates **16** have a generally vertical portion **48** and an angled portion **50**. The angled portion **50** is generally in registration with the pair of joist diagonal members **44**. The joist support strut **40** has a plurality of spaced apart strut holes **52**.

The concrete fillable steel joists **10** are for use in a concrete fillable steel joist system. The concrete fillable steel joist system includes a plurality of spaced apart concrete fillable steel joists **10**, metal decking **60** and bridging members **62** as best seen in **FIGS. 2, 15 and 16**. The metal decking **60** is operably attached to the spaced apart concrete fillable joists **10**. The metal decking **60** includes a first and second metal deck portions **64, 66** which are operably connected to each other. One of the first and second metal deck portions **64, 66** is attached to one side to the concrete fillable steel joist **10** and the other of the first and second metal deck portions **64, 66** is attached to the other side to the other of the concrete fillable steel joist **10**. The first and second metal deck portions **64, 66** of two distinct concrete fillable steel joists **10** are operably connected together with an overlapping joint **68** as best seen in **FIG. 10**. A plurality of decking tabs **70** extend downwardly from the first and second decking portions **64, 66**. The tab holes **36** on the tabs **24** of the top chord **14** are configured to receive the decking tabs **70** therethrough.

The bridging members **62** are operably attached between the metal decking **60** and the U-shaped member **12** of the concrete fillable steel joist **10**. The bridging members **62** extend between the bottom chord of the U-shaped member **12** to the overlapping joint **68**. The bridging members **62** have bridging

tabs **72** that extend upwardly. The bridging tabs **72** engage holes formed in the first and second metal deck portions **64, 66** in the overlapping joint zone **68**.

In use, elements of the concrete fillable steel joist **10** in combination with the metal decking **60** provide a stay in place forming system that is fillable with concrete **80**. Prior to filling the concrete fillable steel joist **10** with concrete the concrete fillable steel joist **10** is cambered. During fabrication the concrete fillable steel joist **10** is cambered so that the concrete fillable steel joist system is not required to be shored up to support the system during the concrete pour.

It will be appreciated by those skilled in the art that the concrete fillable steel joists **10** may be constructed off site. When the concrete fillable joists **10** are brought on to the construction site, the first and second metal deck portion **64, 66** is hooked onto each of the concrete fillable joists **10** and the bridging members are engaged. Once the element of the concrete fillable steel joist system is in place concrete may then be poured. As can be seen in **FIGS. 4 and 5** the concrete fillable steel joist **10** and metal decking **60** and concrete **80** all work together. The utility holes **24** with the rims **26** effectively lock the steel web **18** of the joist in with the concrete **80** and the top chord holes **30** and clinching **38** effectively lock in with the concrete so that all elements work in composite action.

Generally speaking, the systems described herein are directed to concrete fillable steel joists. Various embodiments and aspects of the disclosure are described in the detailed description. The description and drawings are illustrative of the disclosure and are not to be construed as limiting the disclosure.

Numerous specific details are described to provide a thorough understanding of various embodiments of the present disclosure. However, in certain instances, well-known or conventional details are not described in order to provide a concise discussion of embodiments of the present disclosure.

As used herein, the terms, “comprises” and “comprising” are to be construed as being inclusive and open ended, and not exclusive. Specifically, when used in the specification and claims, the terms, “comprises” and “comprising” and variations thereof mean the specified features, steps or components are included. These terms are not to be interpreted to exclude the presence of other features, steps or components.

As used herein the “operably connected” or “operably attached” means that the two elements are connected or attached either directly or indirectly. Accordingly the items need not be directly connected or attached but may have other items connected or attached therebetween.

WHAT IS CLAIMED IS:

1. A concrete fillable steel joist comprising:
a generally U-shaped member having spaced apart webs and a bottom chord;
a top chord operably attached to the U-shaped member, the top chord having a plurality of spaced apart top chord holes; and
a pair of end plates operably attached at opposed ends of the U-shaped member;
whereby the U-shaped member, the top chord and the pair of end plates form a volume that is fillable with concrete.
2. The concrete fillable steel joist as claimed in claim 1 further including a pair of joist support struts attached to opposed ends of the top chord and extending outwardly from the U-shaped member.
3. The concrete fillable steel joist as claimed in claim 2 further including a pair of joist shoes attached to each of the joist support struts at a distal end thereof.
4. The concrete fillable steel joist as claimed in claim 3 further including a pair of joist diagonal members on either side of the U-shaped member, the joist diagonal members being operably attached to the U-shaped member and the joist support strut and wherein a pair of the joist diagonal members are operably

attached at opposed ends of the U-shaped member.

5. The concrete fillable steel joist as claimed in claim 4 wherein each of the end plates of the pair of end plates have a generally vertical portion and an angled portion and the angled portion is generally in registration with the pair of joist diagonal members.

6. The concrete fillable steel joist as claimed in any one of claims 2 to 5 wherein each of the joist support struts of the pair of joist support struts has a plurality of spaced apart strut holes.

7. The concrete fillable steel joist as claimed in any one of claims 1 to 6 wherein the top chord has two elongate channels formed therein for receiving the spaced apart webs of the U-shaped member.

8. The concrete fillable steel joist as claimed in claim 7 wherein the top chord further includes a pair of side tabs, wherein one side tab of the pair of side tabs extends outwardly from each of the elongate channels.

9. The concrete fillable steel joist as claimed in claim 8 wherein the side tabs include a plurality of spaced apart tab holes.

10. The concrete fillable steel joist as claimed in any one of claims 1 to 9 wherein the U-shaped member includes a plurality of utility holes and wherein each utility hole has a rim that is operably attached to the spaced apart webs around the utility hole.

11. The concrete fillable steel joist as claimed in any one of claims 1 to 10 wherein the U-shaped member further includes a pair of bottom chord tabs extending outwardly from the bottom chord on either side of the spaced apart webs.
12. The concrete fillable steel joist as claimed in any one of claims 1 to 11 wherein the concrete fillable steel joist is cambered.
13. A concrete fillable steel joist system comprising:
a plurality of spaced apart concrete fillable steel joists as claimed in any one of claims 1 to 11;
metal decking operably attached between the spaced apart concrete fillable steel joists; and
bridging members extending operably attached between the metal decking and the U-shaped members of the concrete fillable steel joists;
whereby the concrete fillable steel joist and the metal decking is configured to receive concrete.
14. The concrete fillable steel joist system as claimed in claim 13 wherein metal decking includes a first deck portion and a second deck portion operably connected to each other.
15. The concrete fillable steel joist system as claimed in claim 14 wherein the first deck portion and the second deck portion have an overlapping joint.

16. The concrete fillable steel joist system as claimed in claim 15 wherein bridging members extend between the bottom chords of the U-shaped members to the overlapping joint.

17. The concrete fillable steel joist system as claimed in any one of claims 13 to 16 wherein the top chord includes a pair of side tabs and a plurality of tab holes formed therein and the decking includes a plurality of decking tabs extending downwardly therefrom and the tab holes are configured to receive the decking tabs.

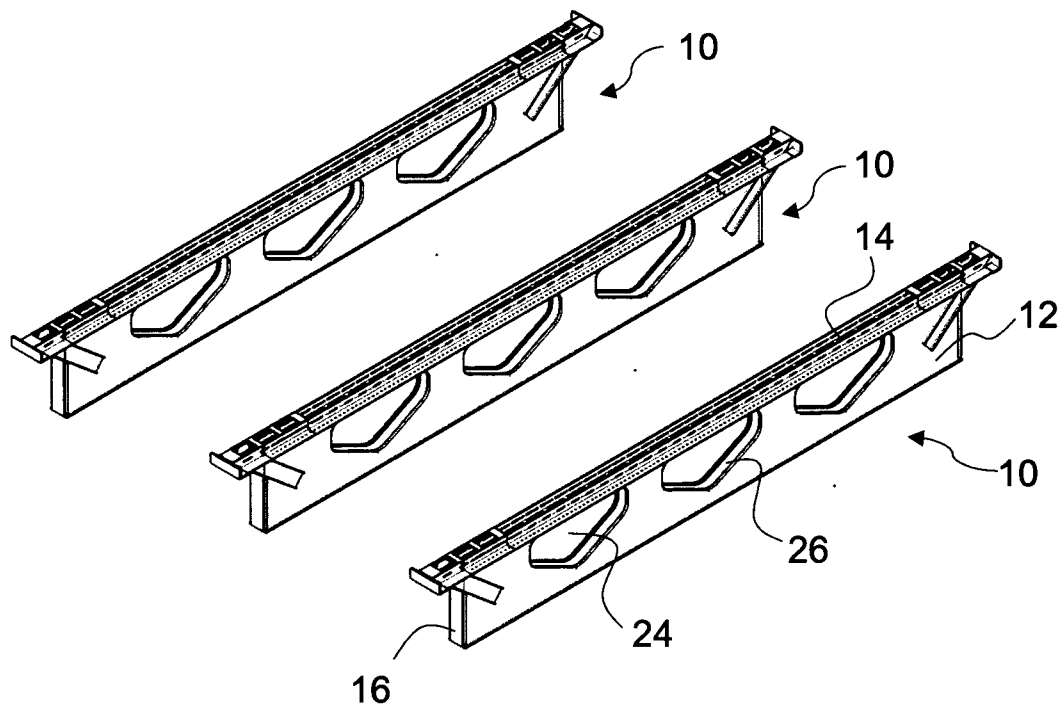


FIG. 1

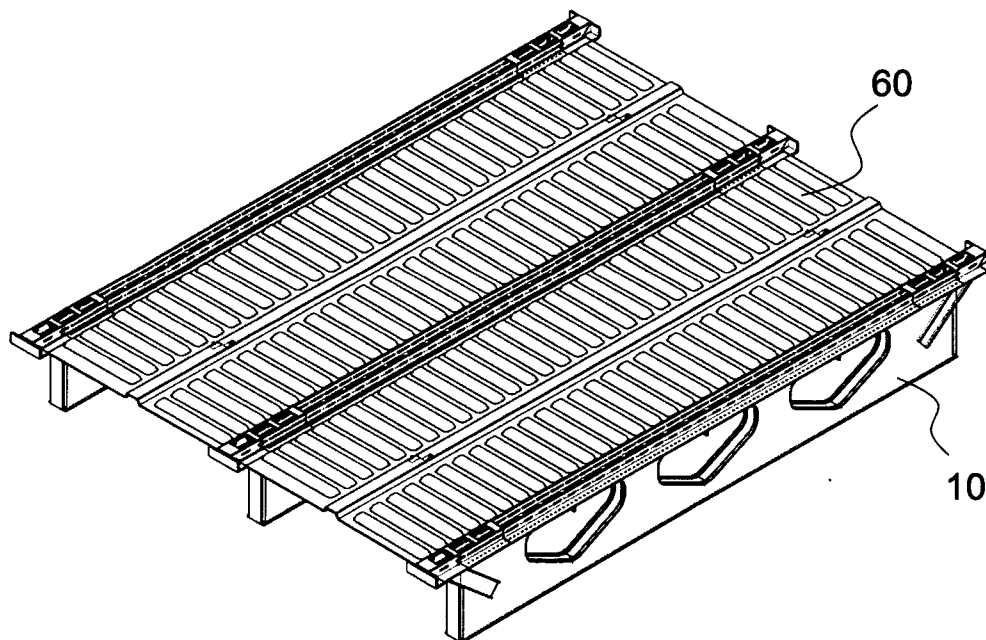


FIG. 2

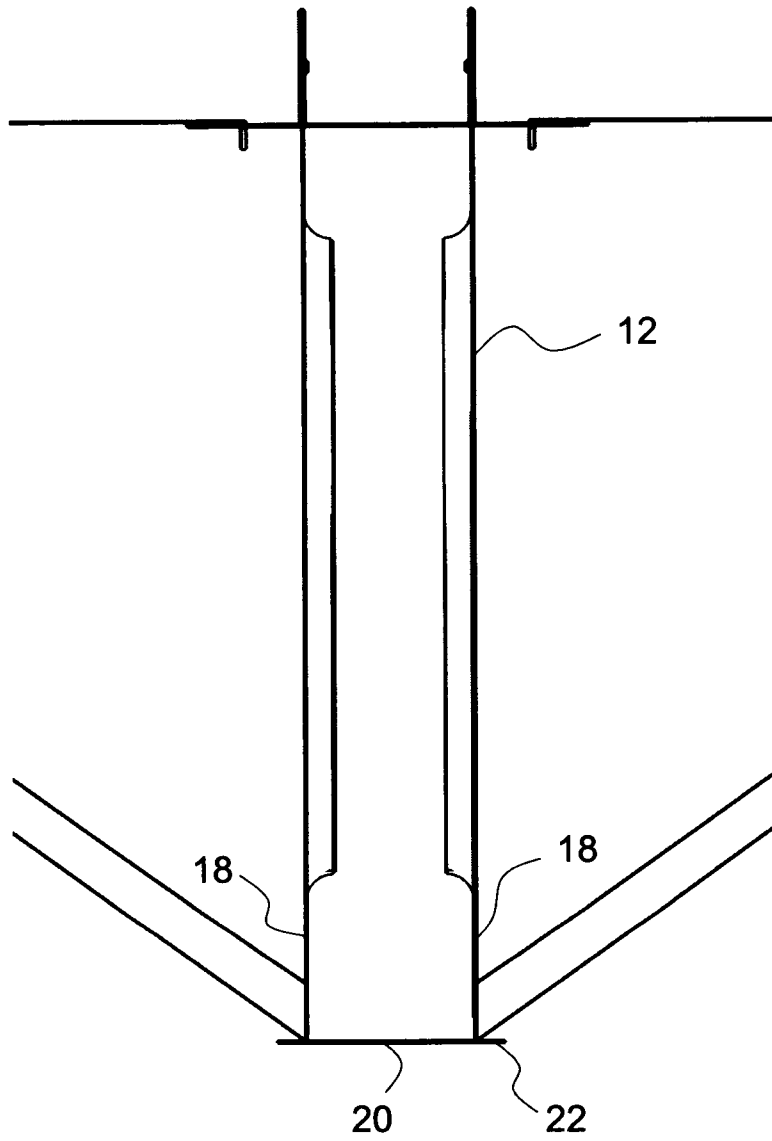


FIG. 3

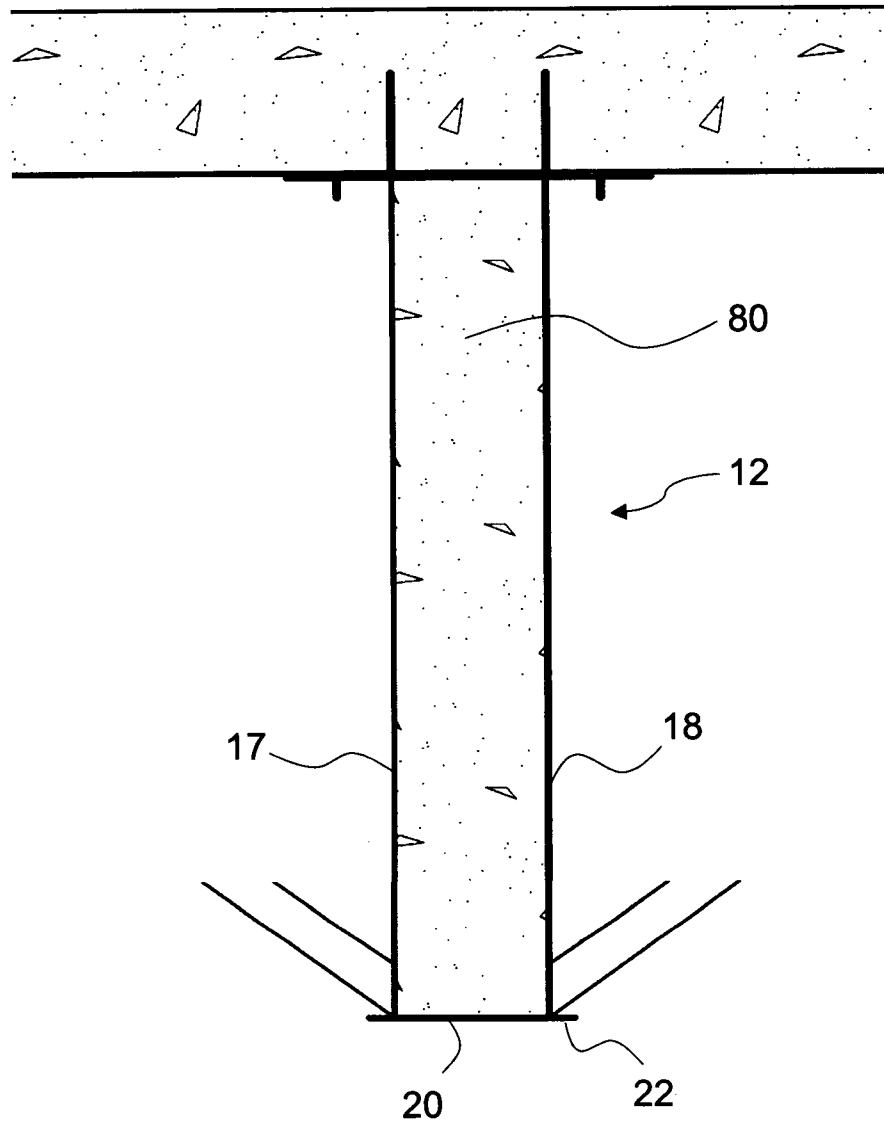


FIG. 4

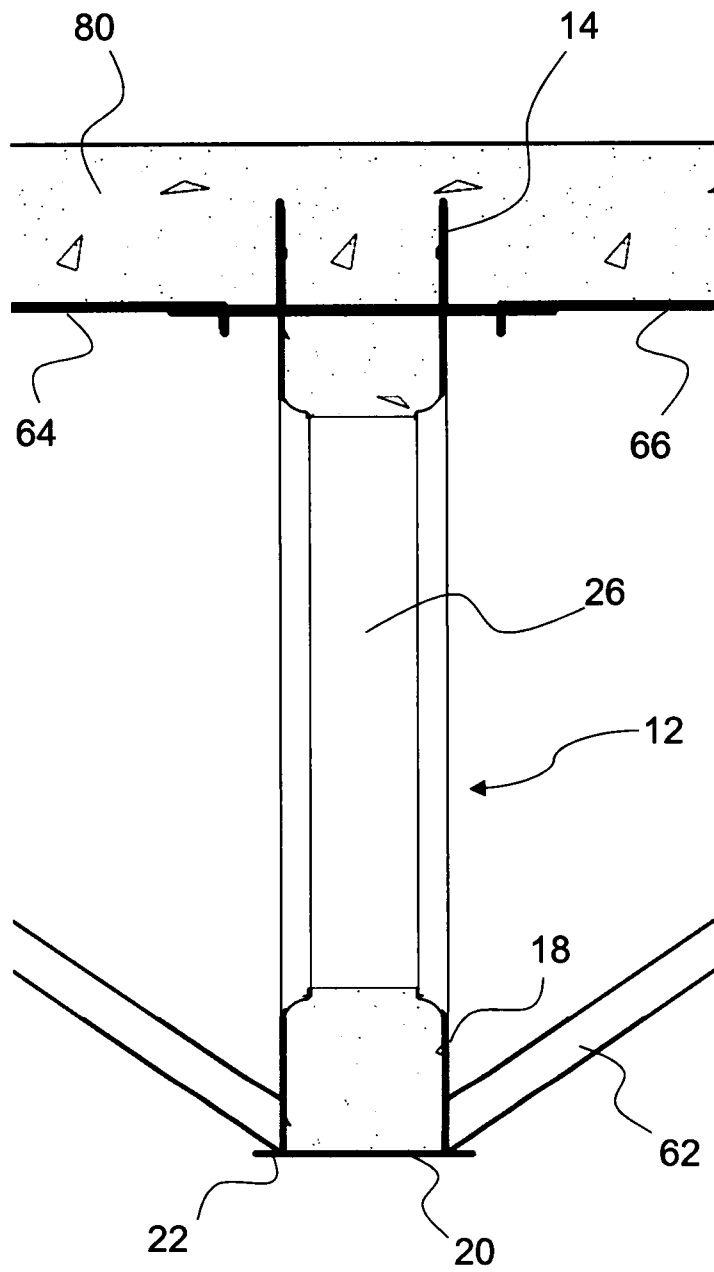


FIG. 5

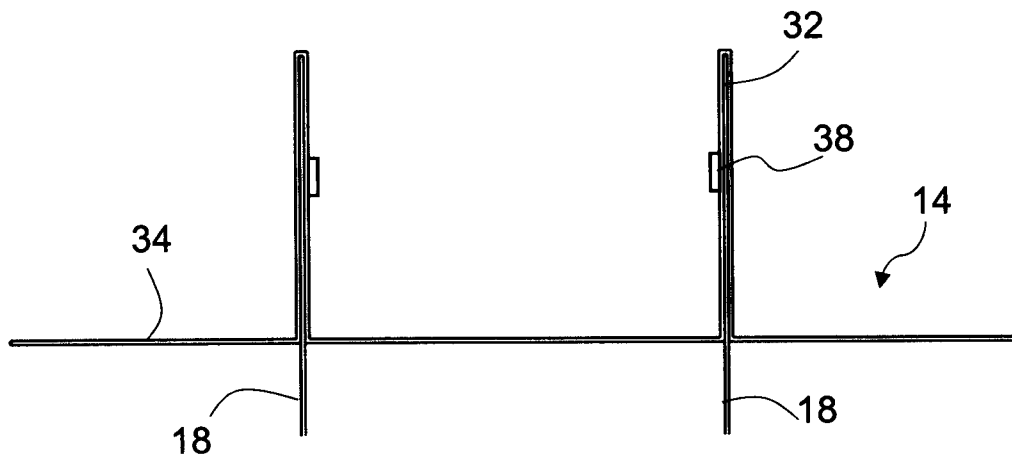


FIG. 6

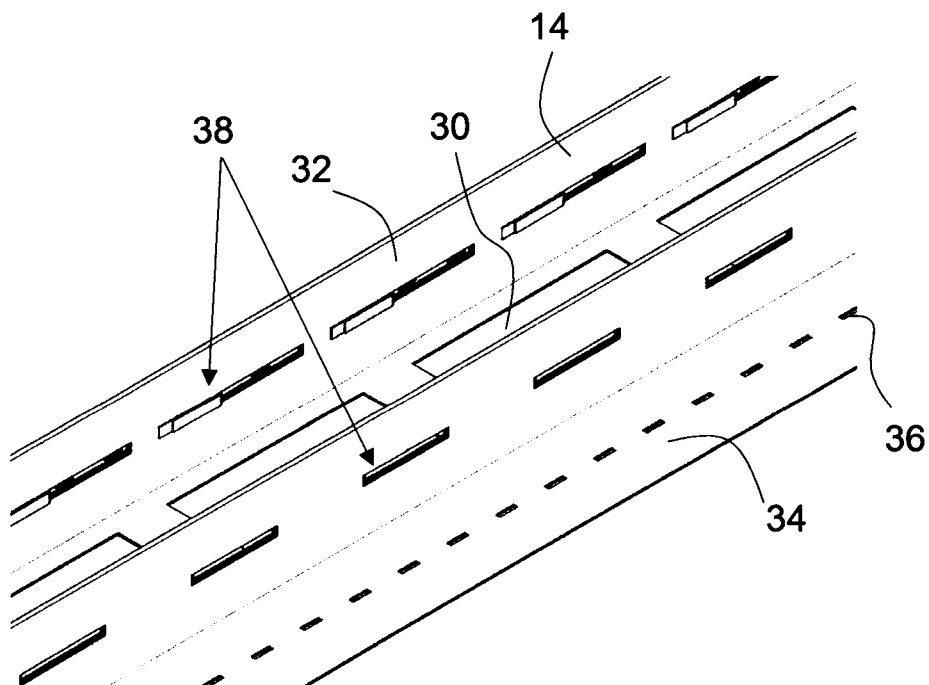


FIG. 7

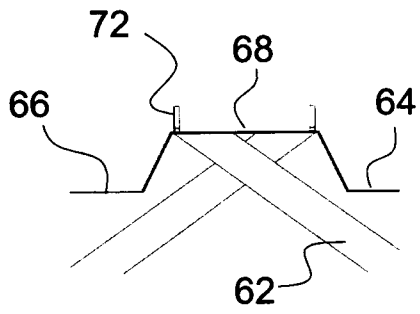


FIG. 10

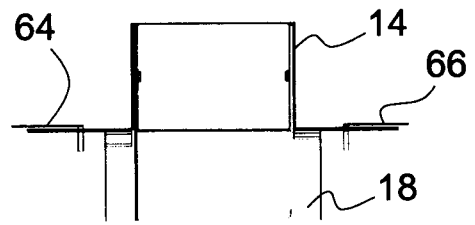


FIG. 9

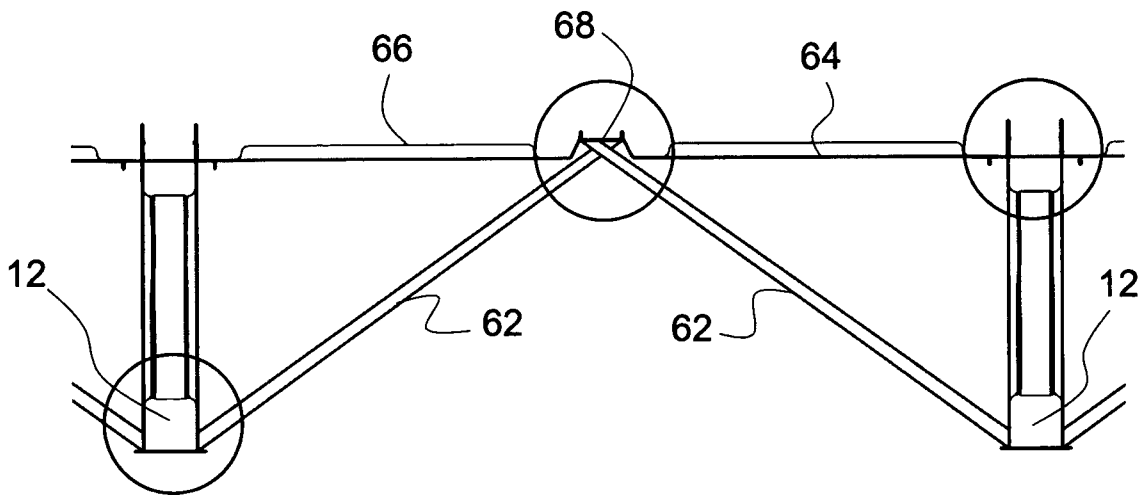


FIG. 8

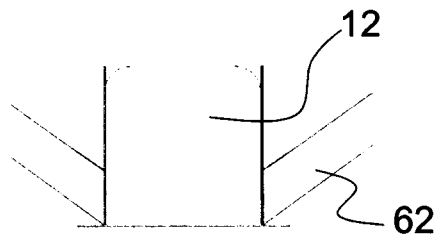


FIG. 11

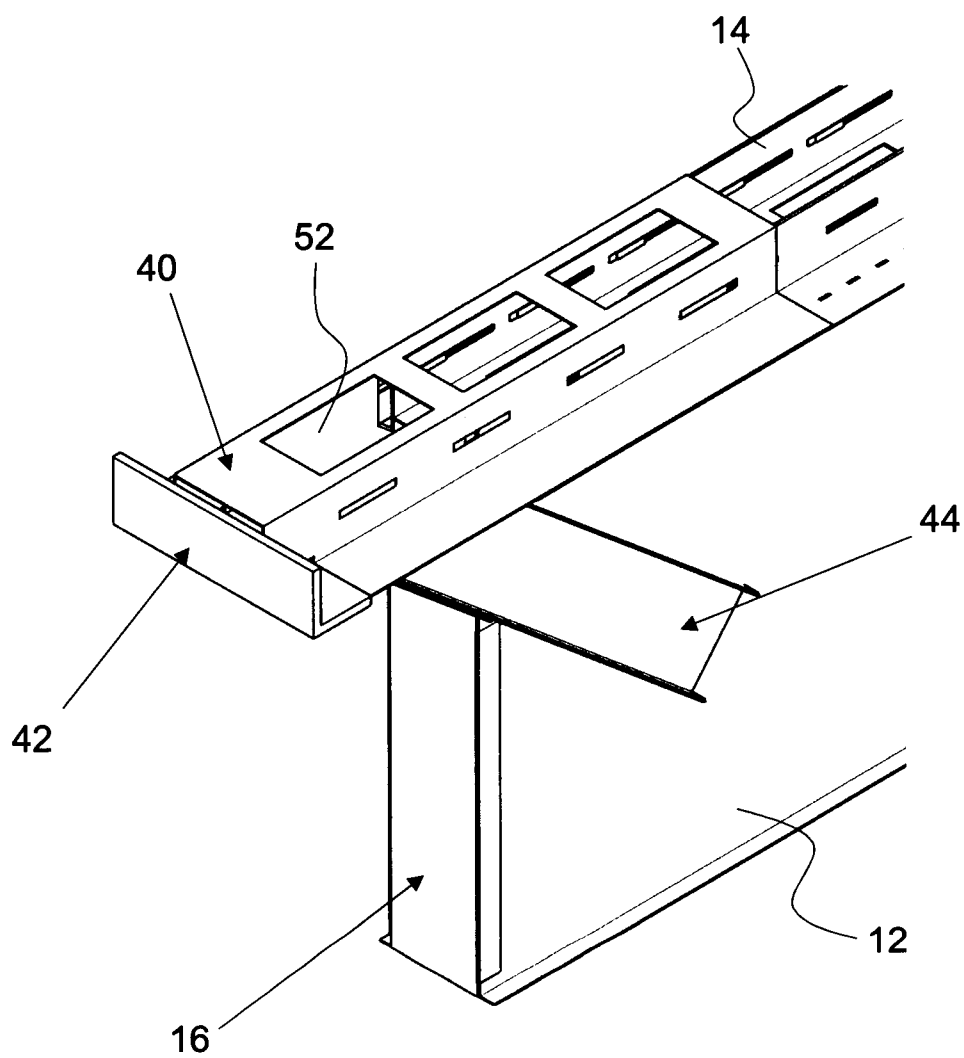


FIG. 12

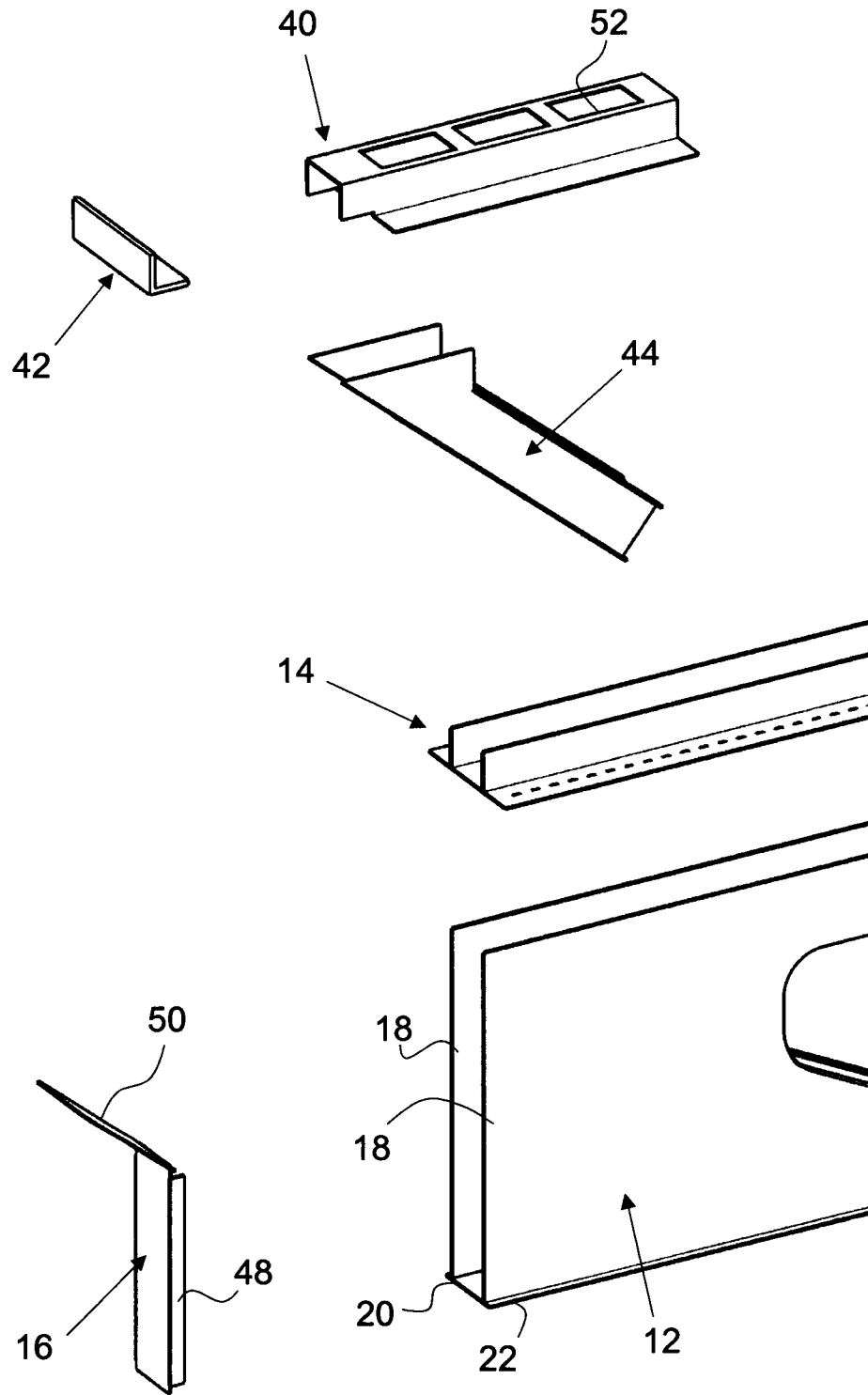


FIG. 13

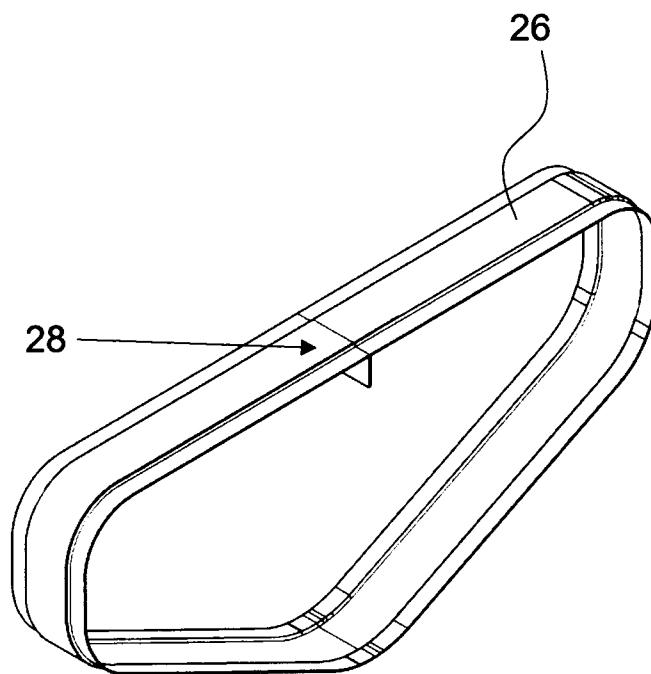
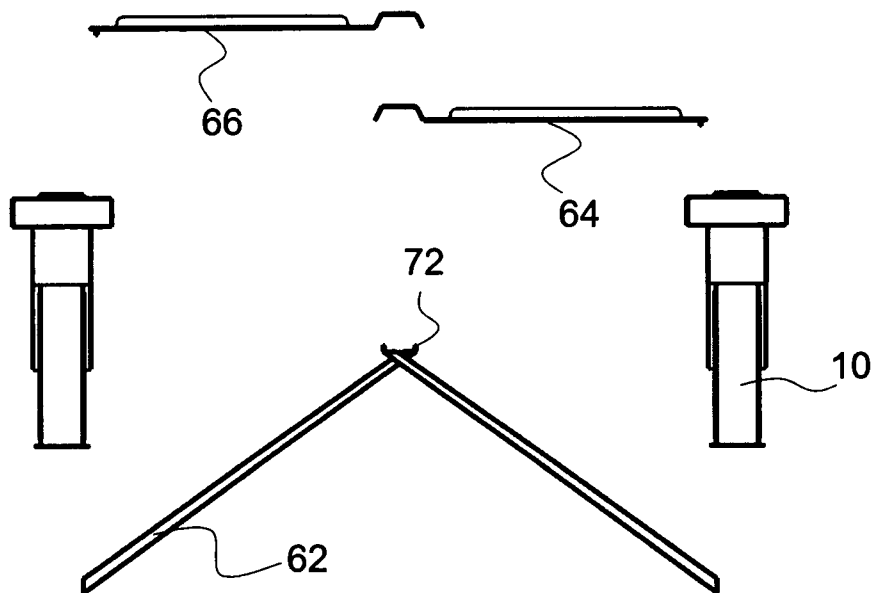
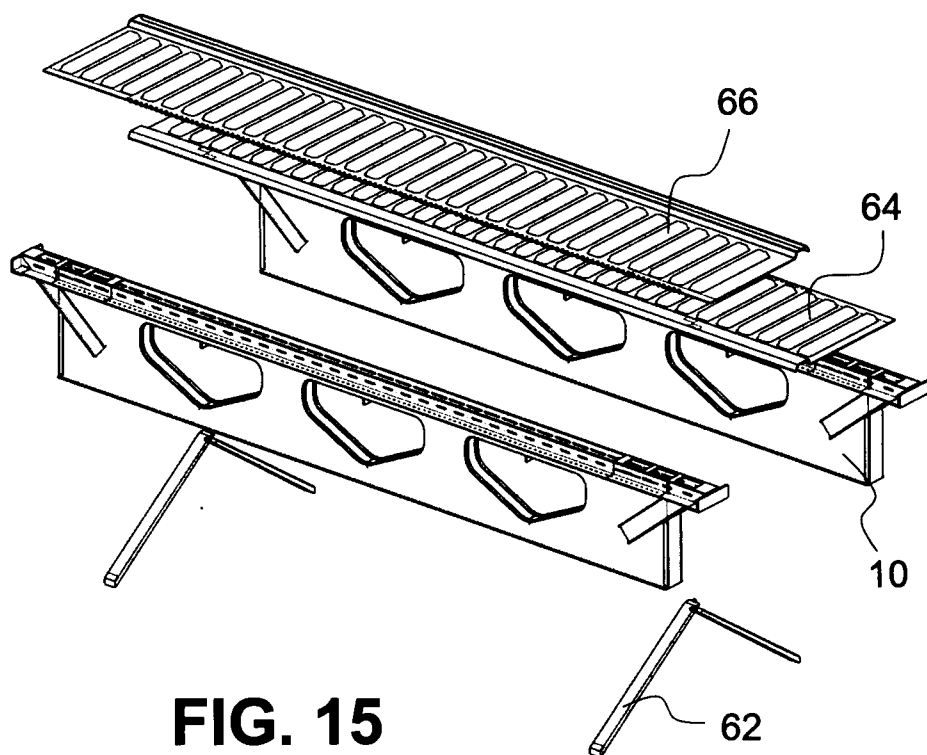


FIG. 14



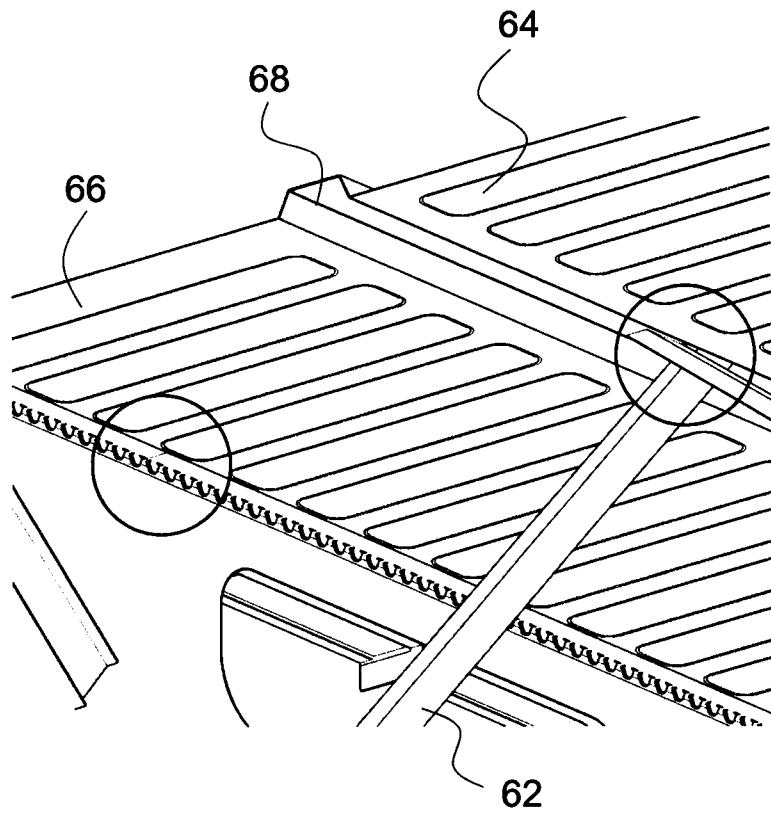


FIG. 17

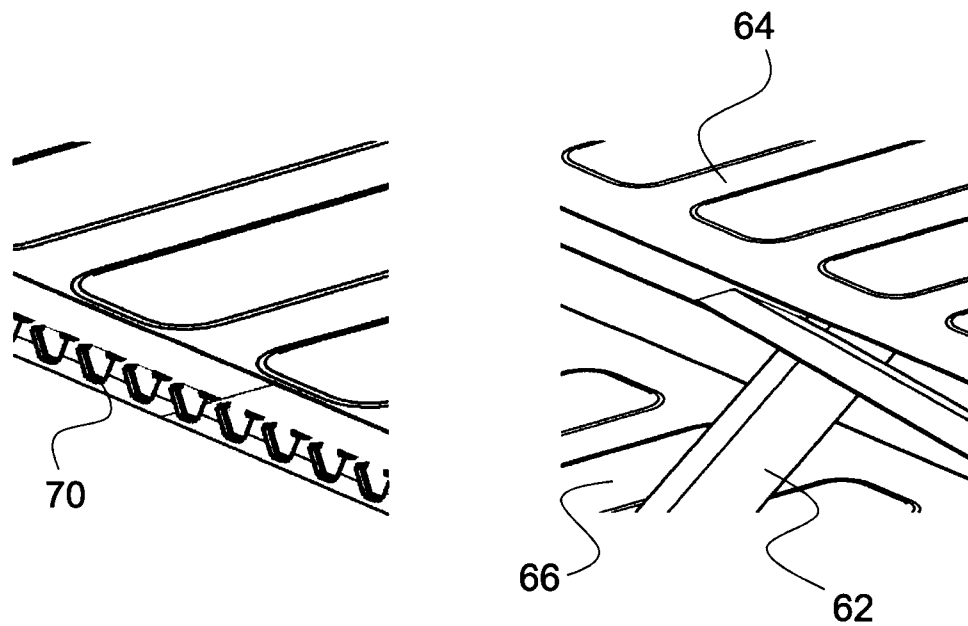


FIG. 18

FIG. 19

