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Greiner

(54) **TRUSS AND PURLIN SUPPORT APPARATUS AND A METHOD OF MAKING AND USING SAME WITH BUILDING SUPPORTS AND FLOOR AND ROOF SHEATHING**

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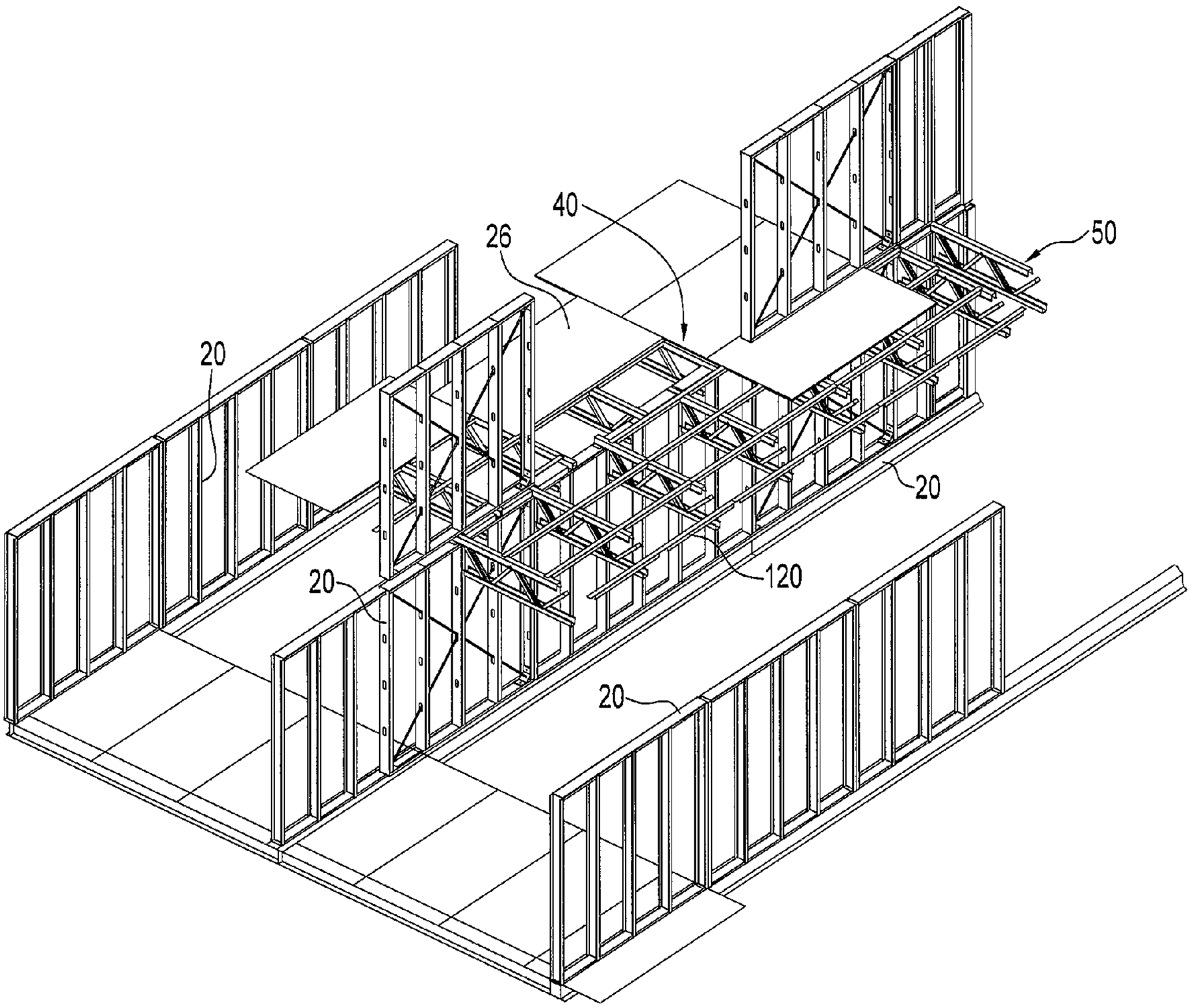
(52) **U.S. Cl.** **52/633**

(57) **ABSTRACT**

A support apparatus is for use with building supports and floor or roof sheathing. The apparatus includes purlins and Pratt-style trusses. Each truss is supported on the building supports. Each truss includes top and bottom chords, and web members extending therebetween. Each purlin extends transversely of the trusses and has notches spaced along an underside thereof. Each notch is saddled over a top chord of one of the trusses, so as to restrict sliding movement of the purlins. The purlins support the floor or roof sheathing thereon. The top chord, the bottom chord, the web members, and the purlin members are constructed from roll-formed light gauge steel material.



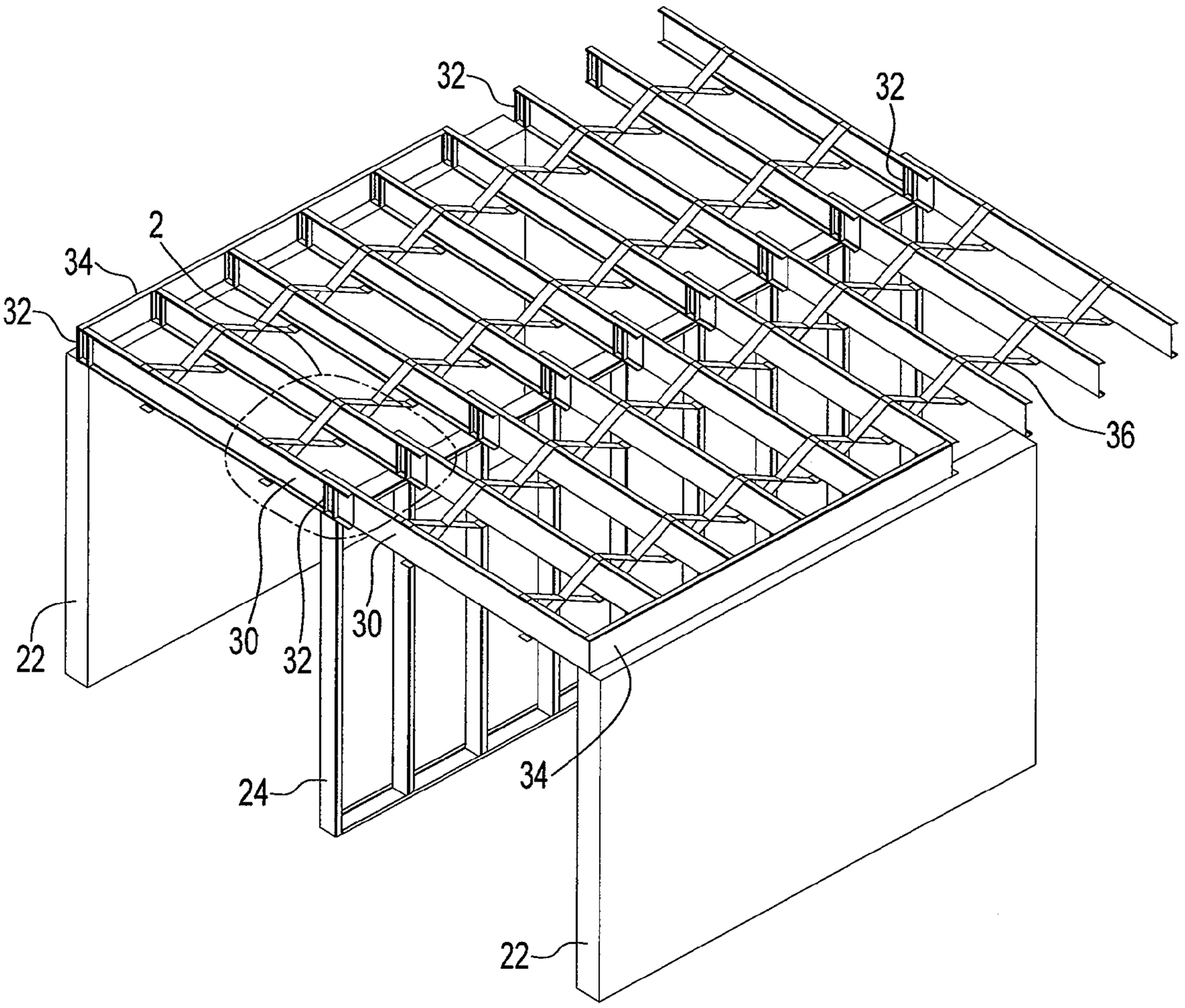


FIG. 1
(Prior ART)

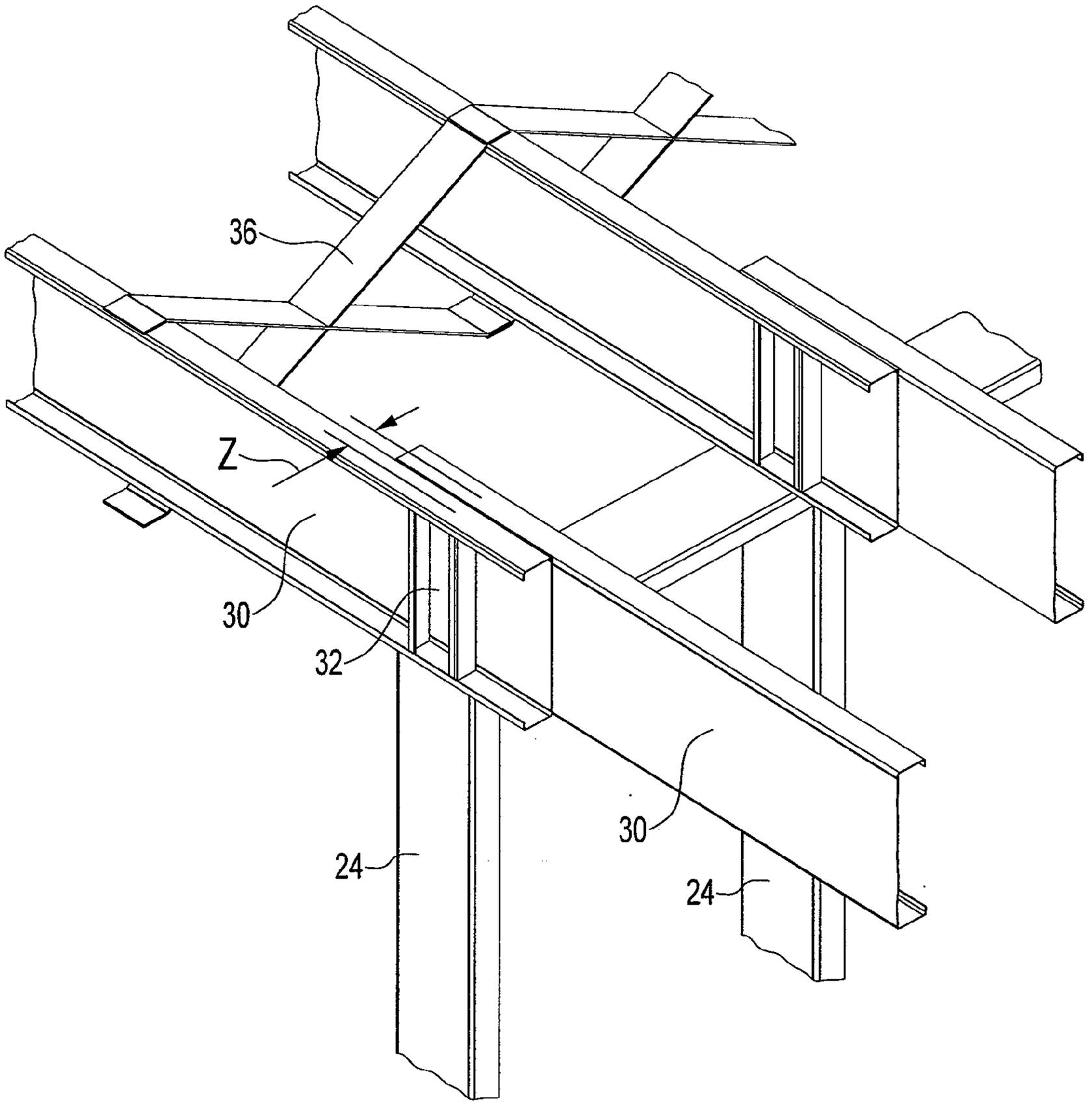


FIG. 2
(Prior ART)

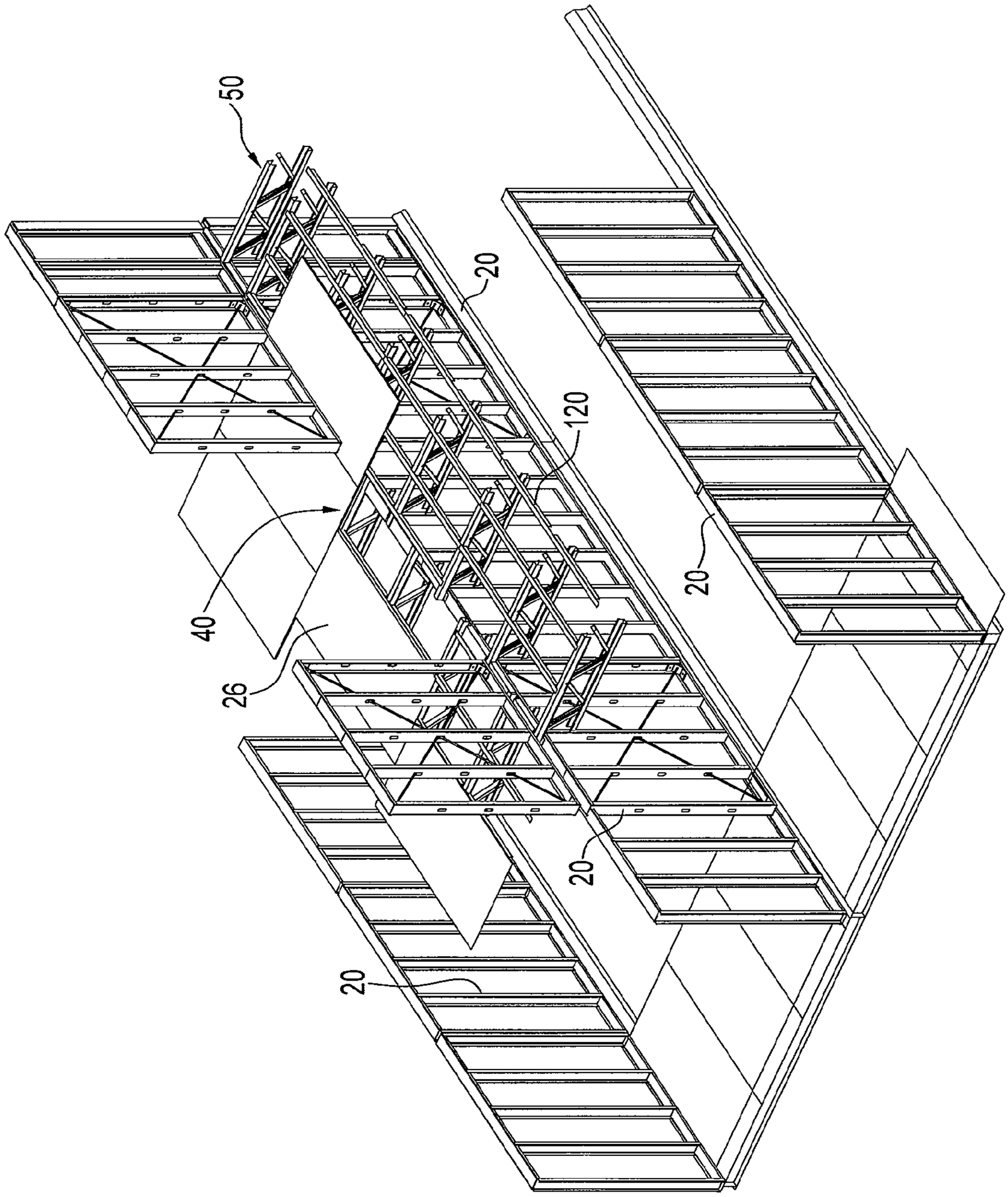


FIG. 3

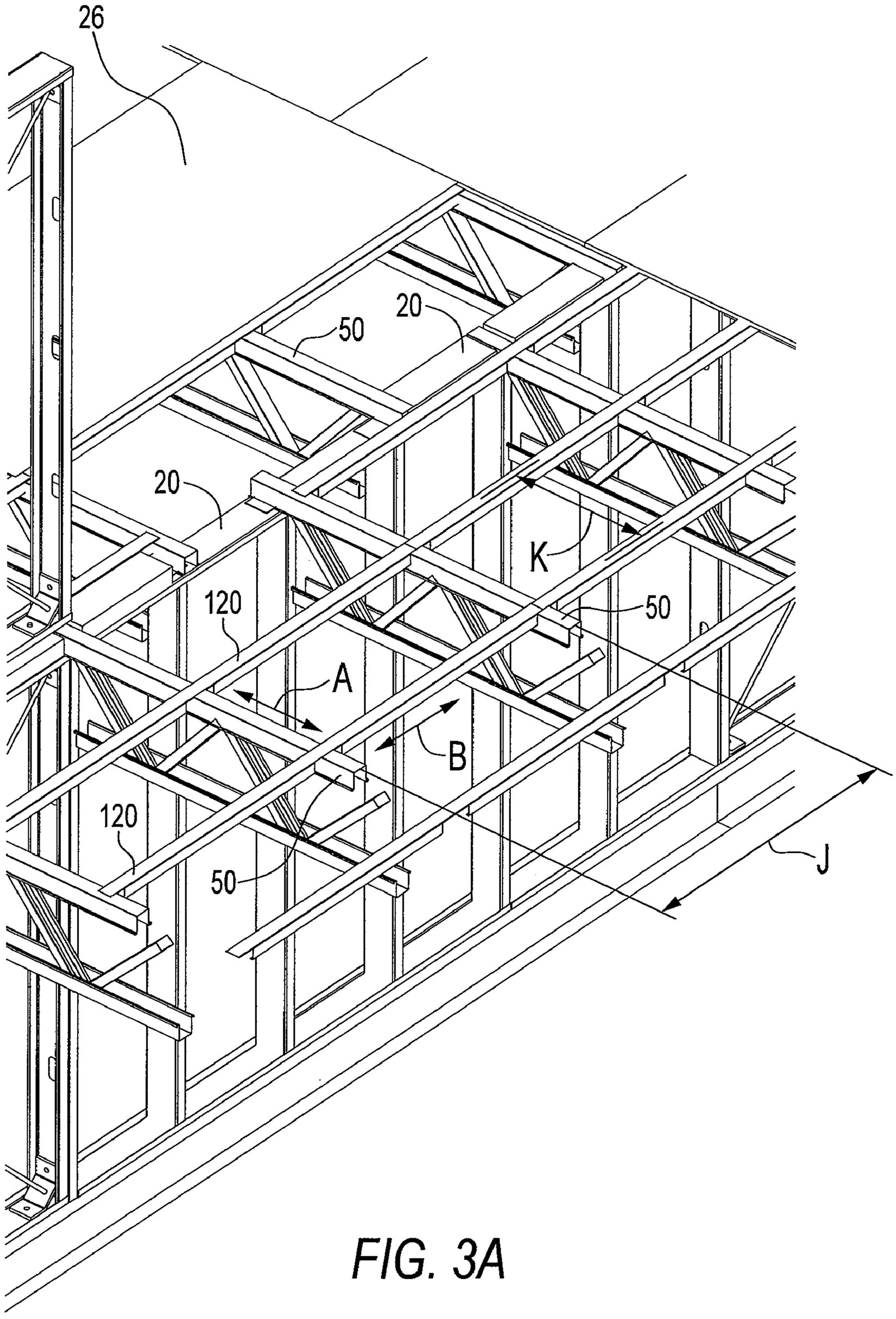


FIG. 3A

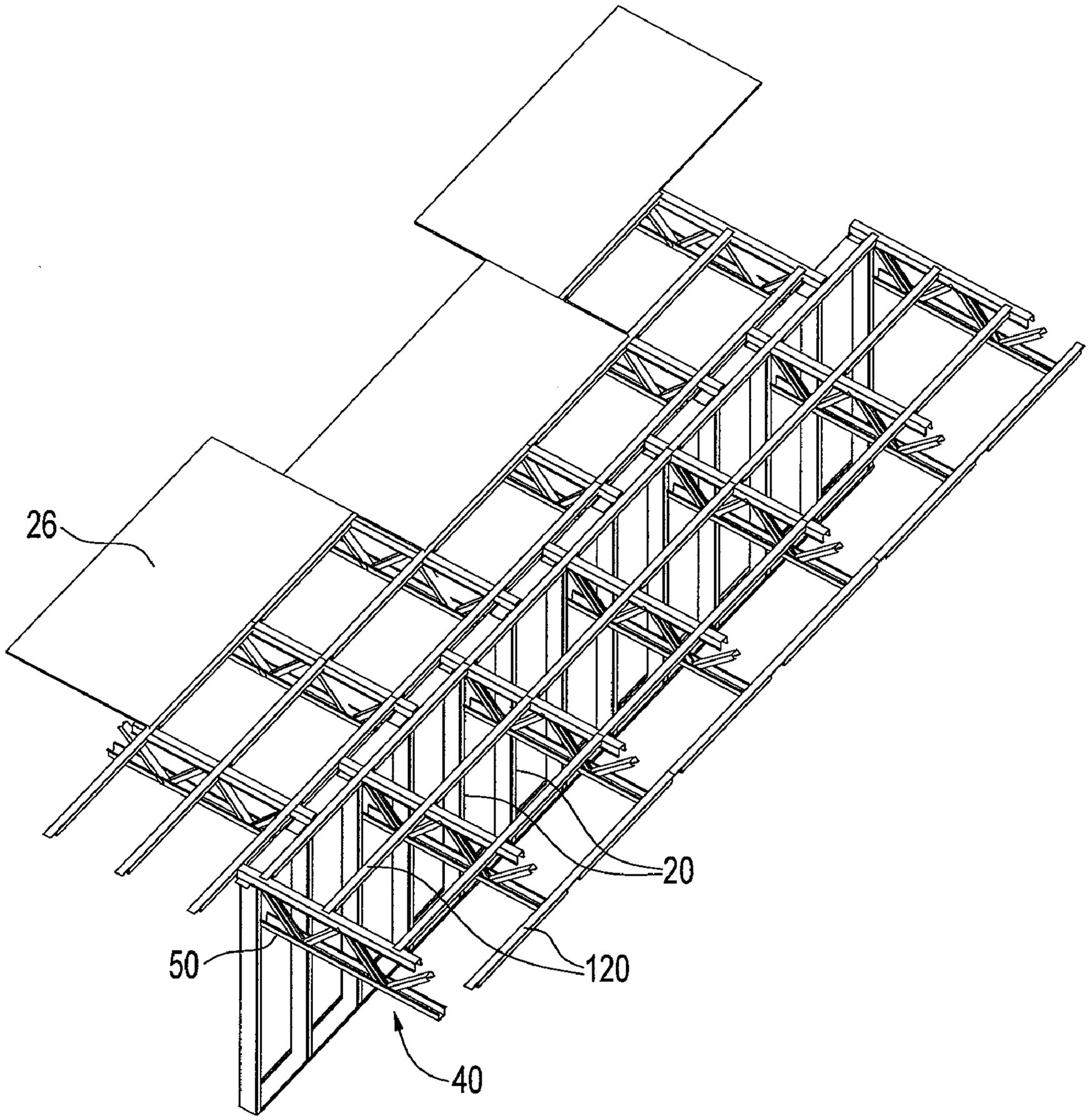


FIG. 4

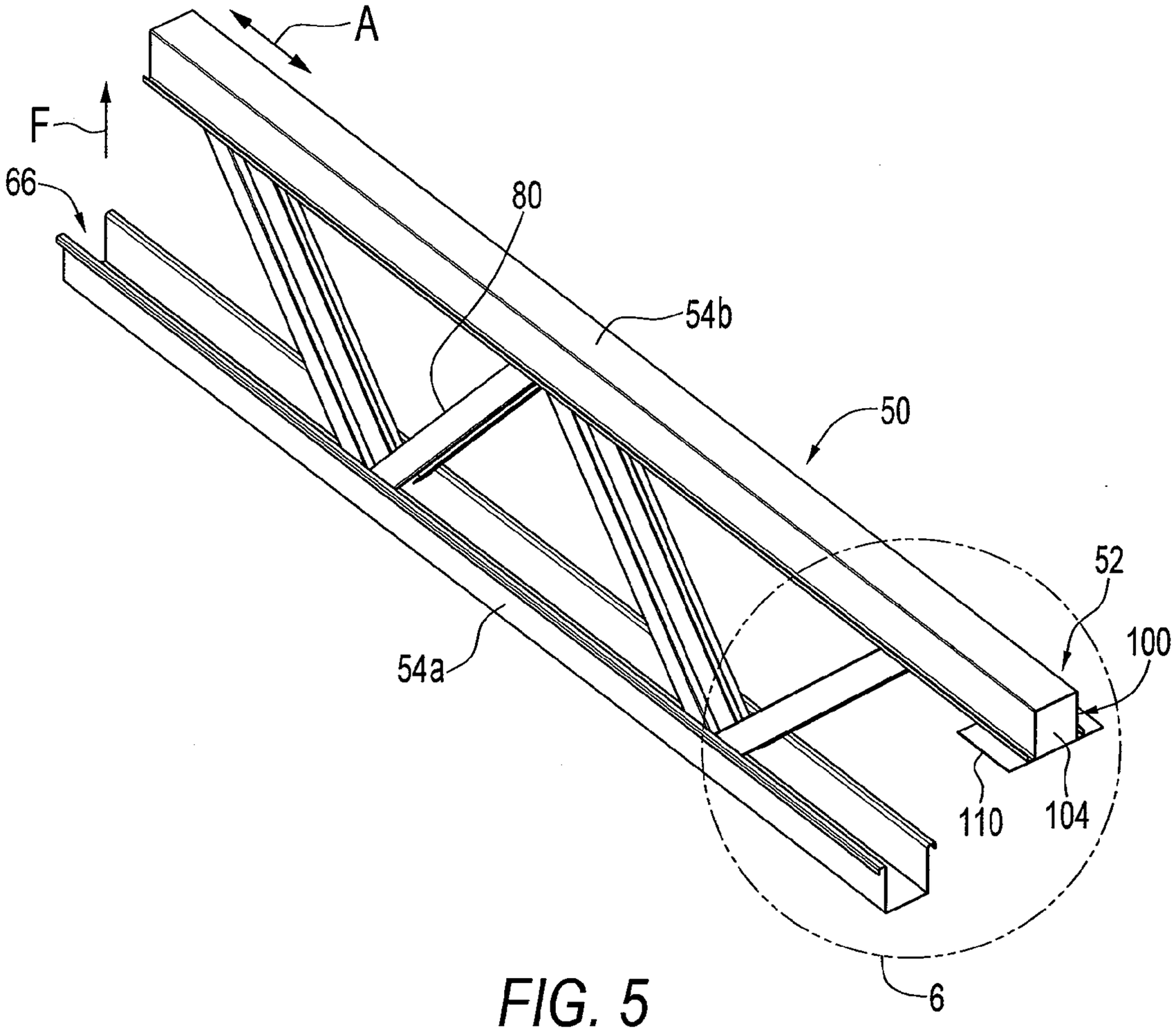


FIG. 5

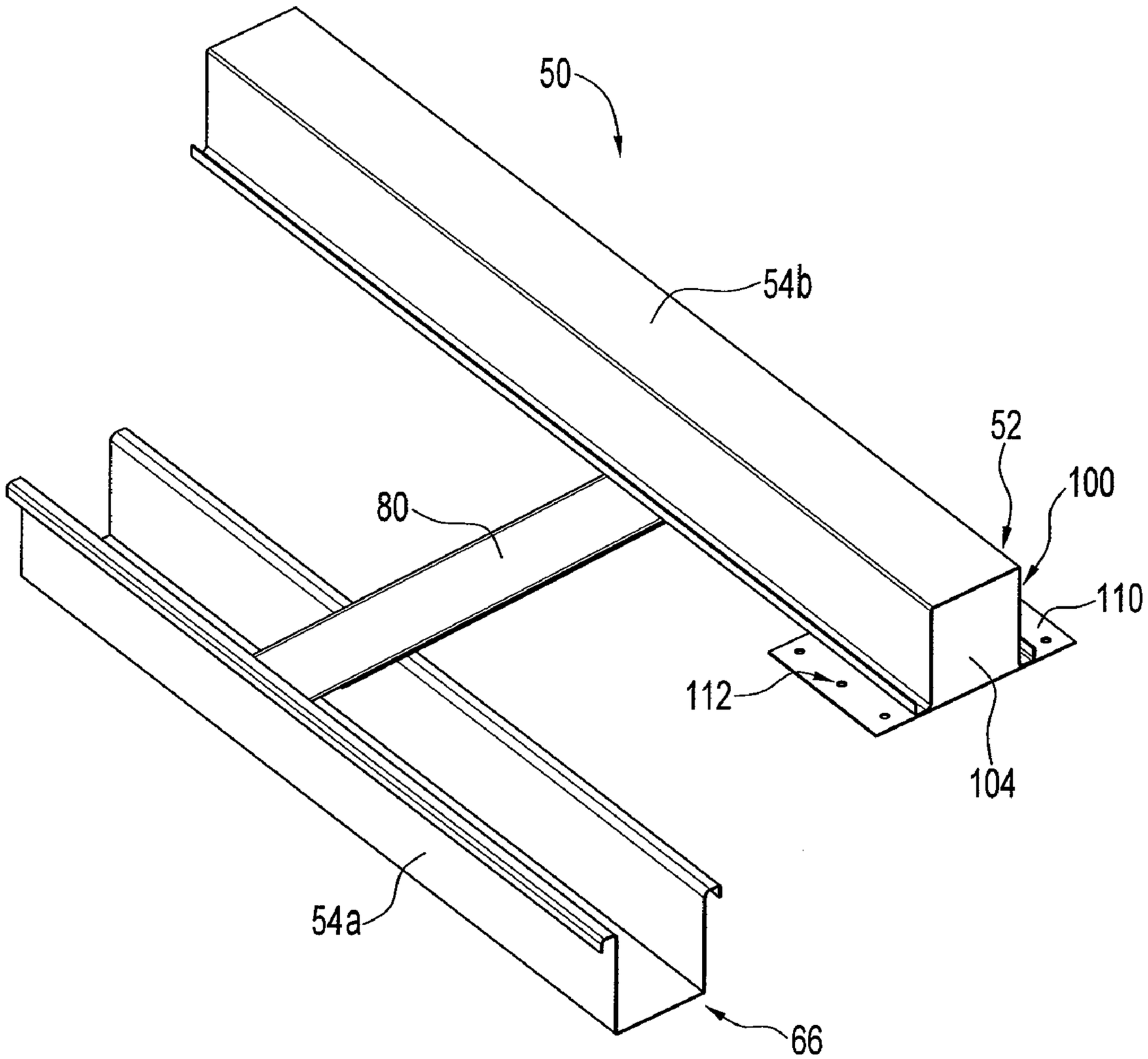


FIG.6

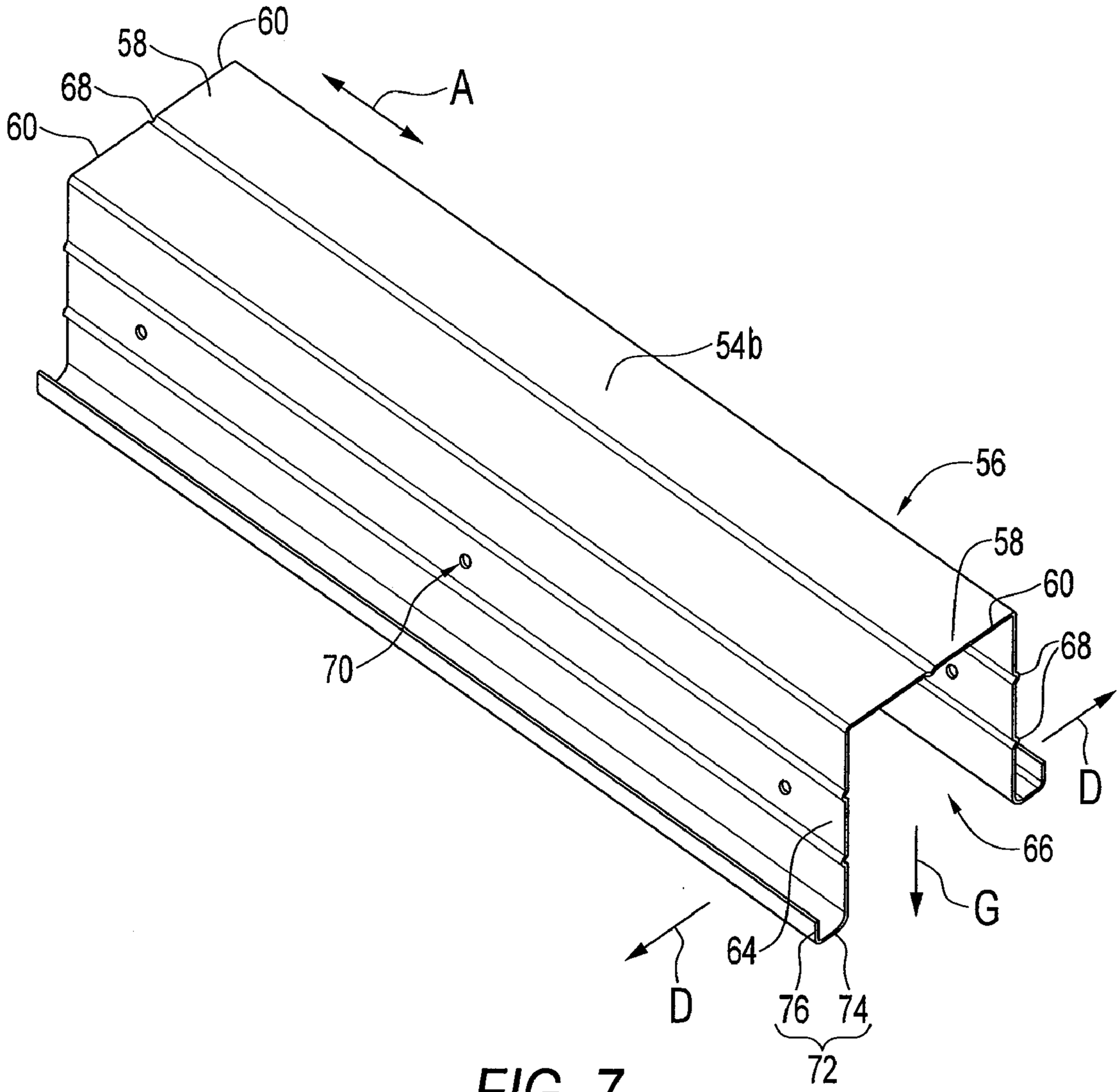


FIG. 7

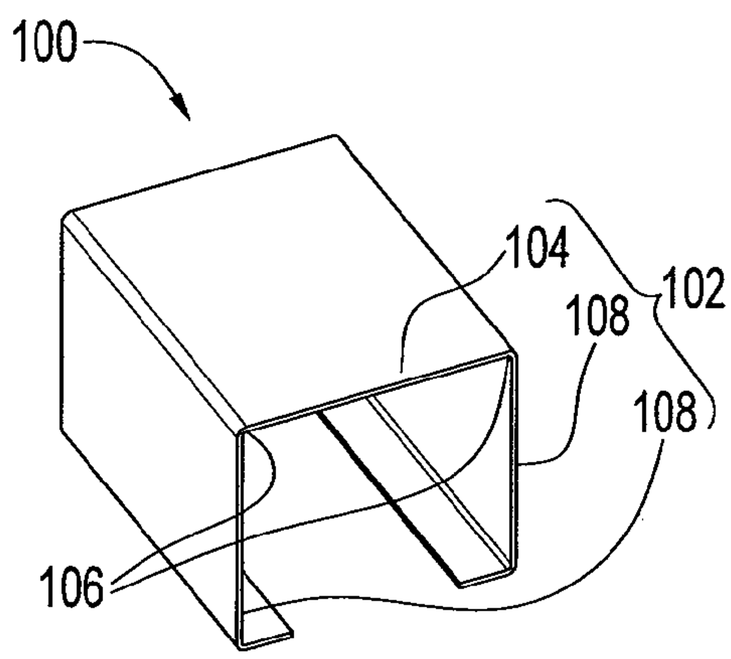


FIG. 8A

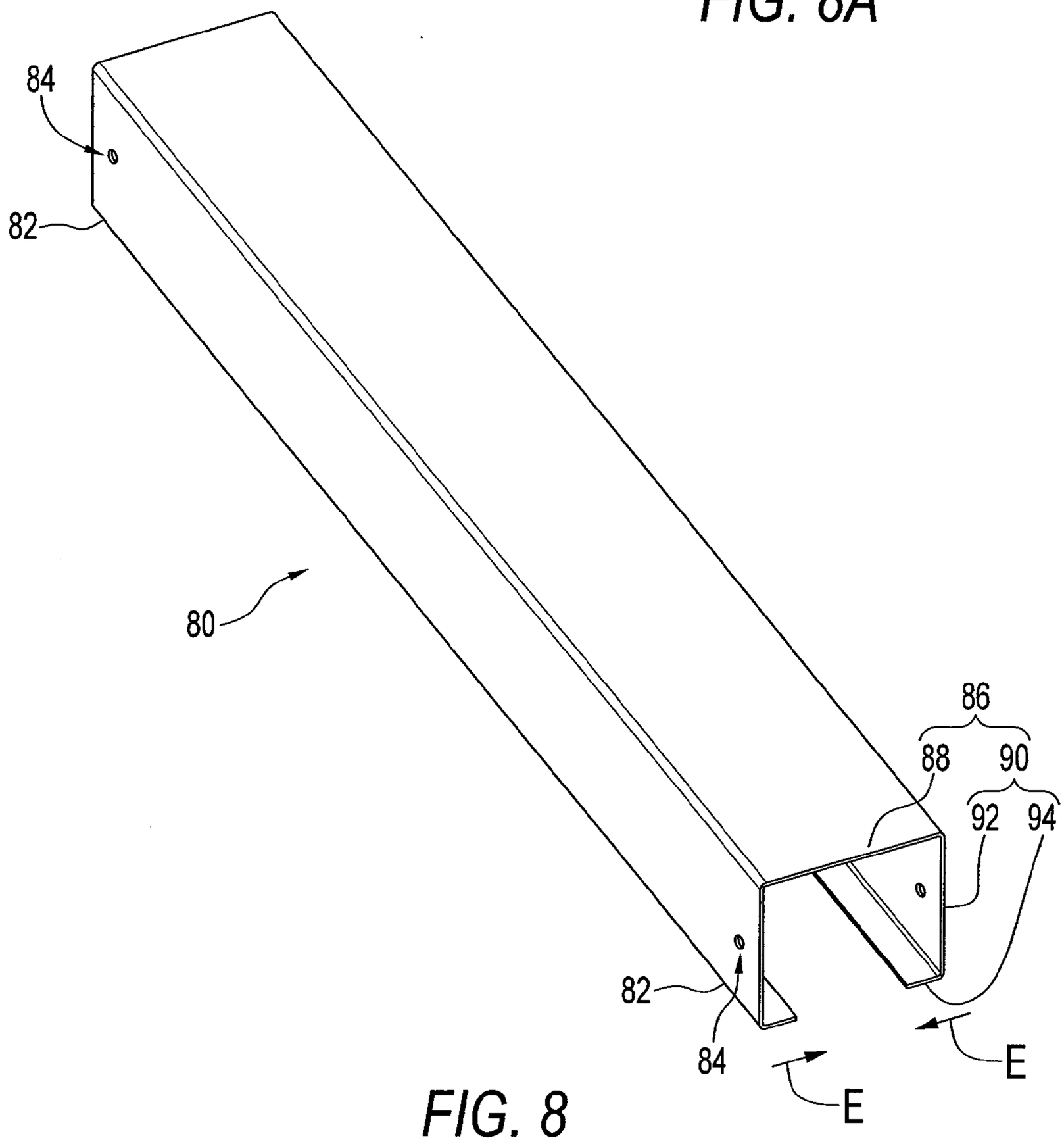


FIG. 8

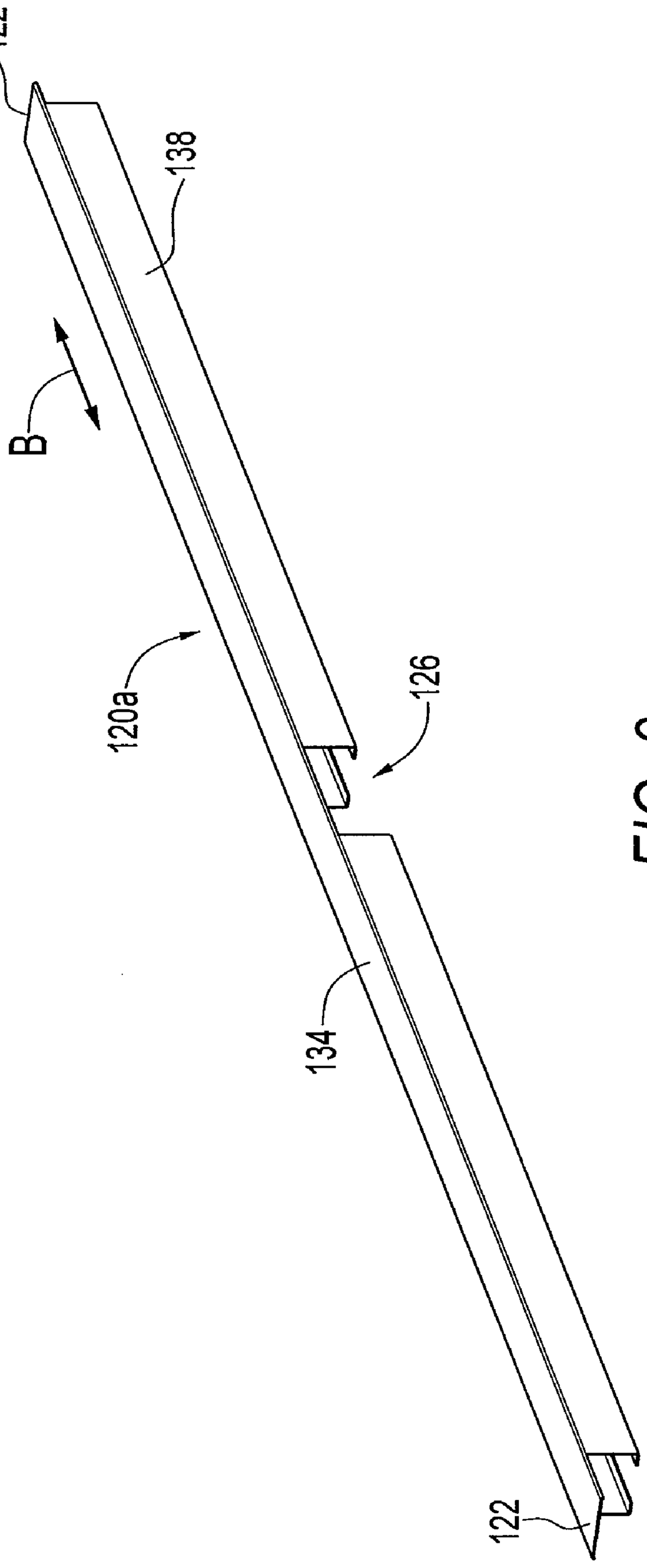


FIG. 9

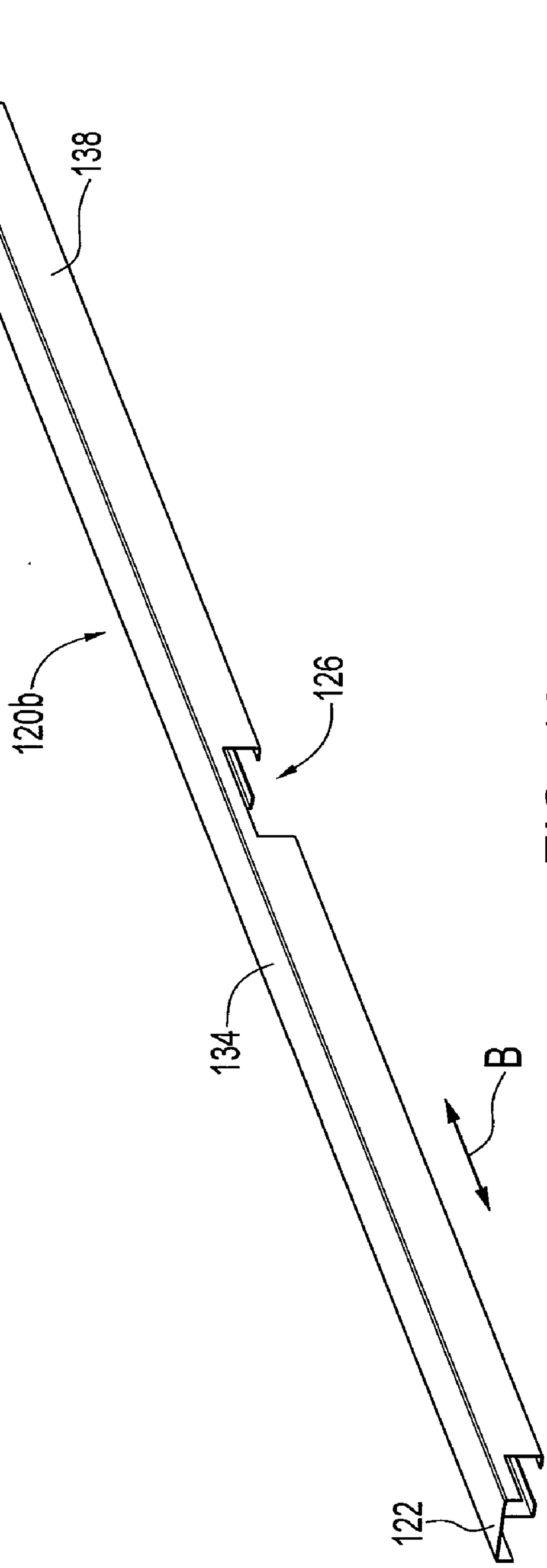


FIG. 10

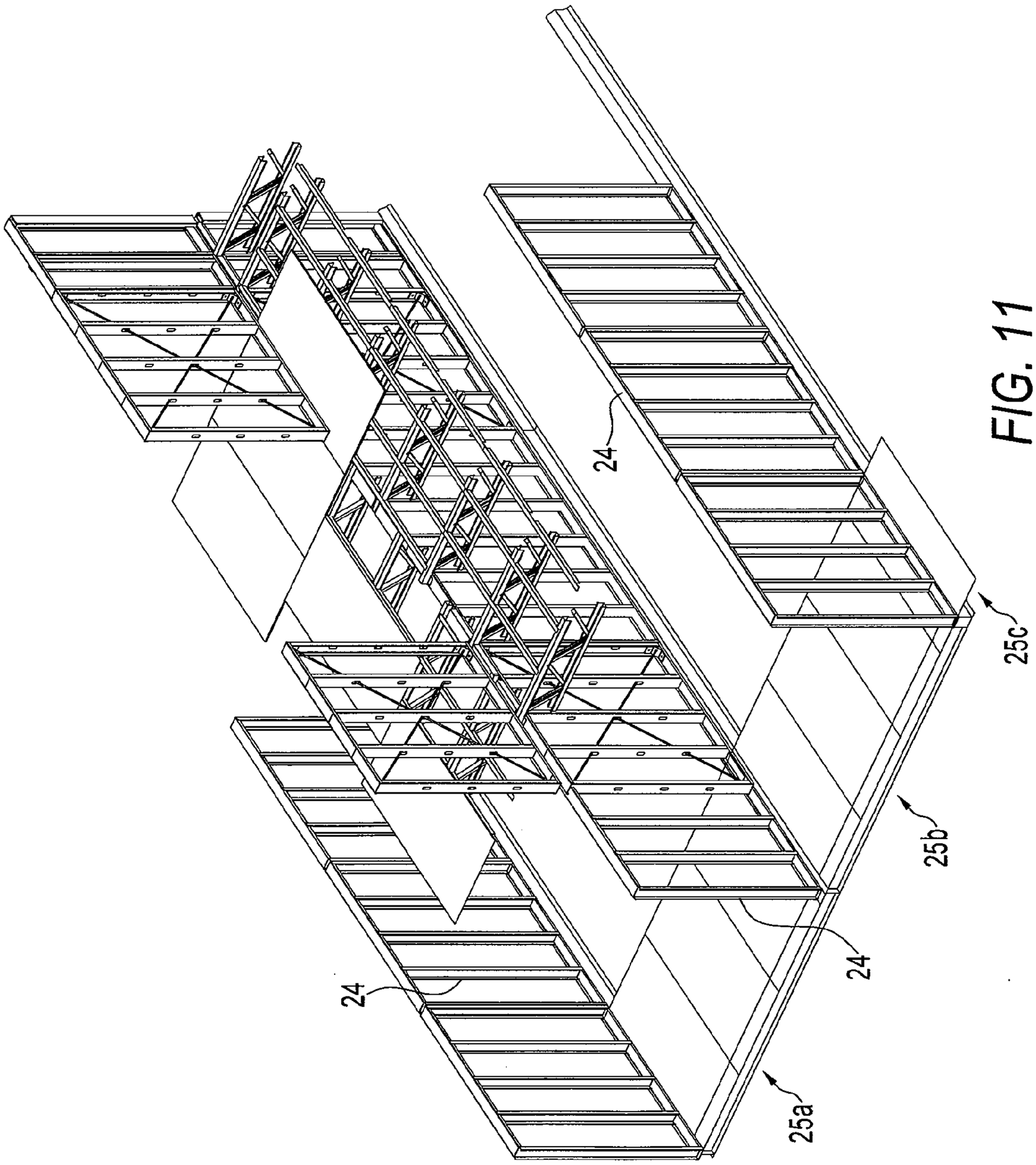


FIG. 11

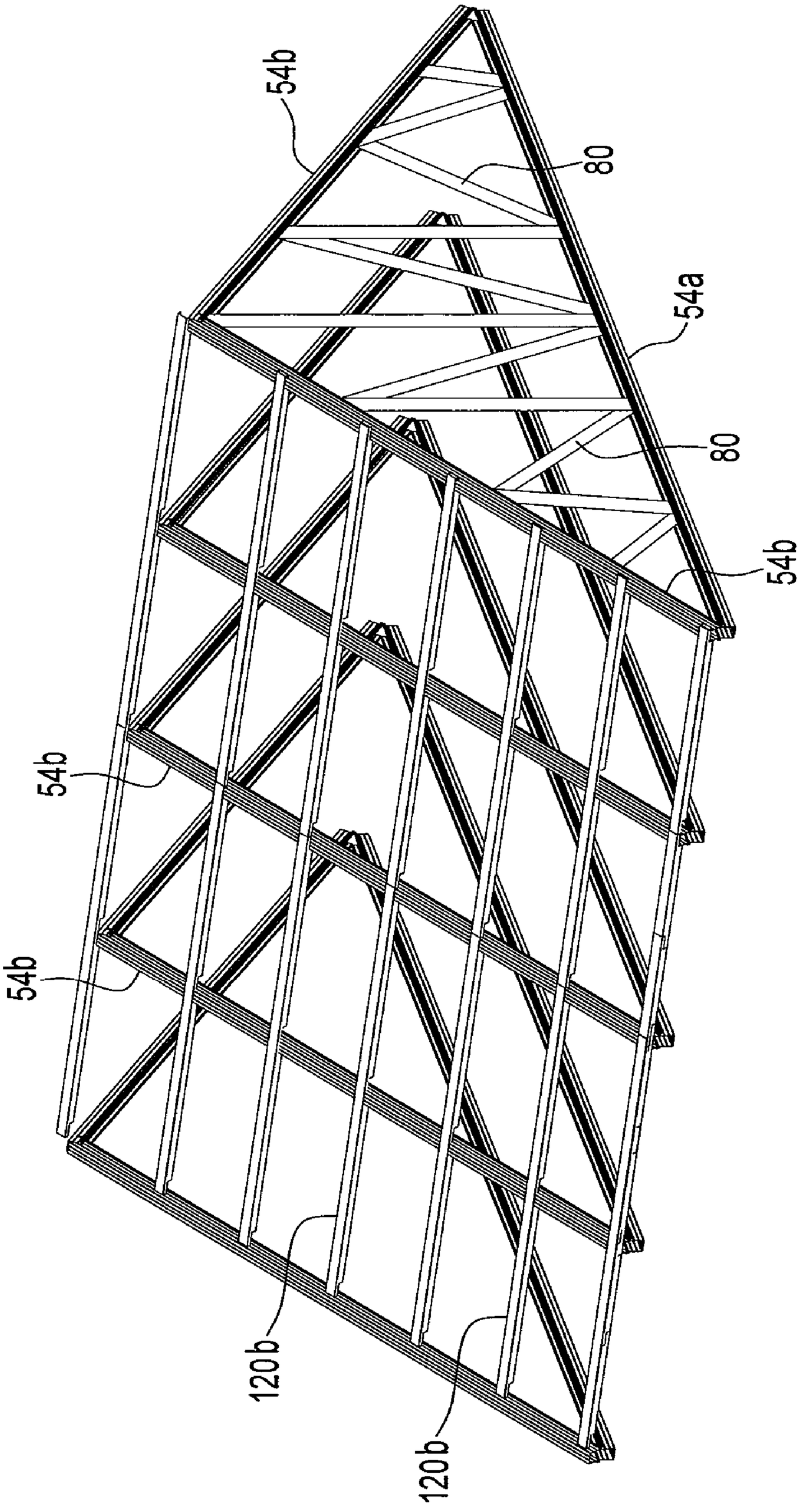


FIG. 12

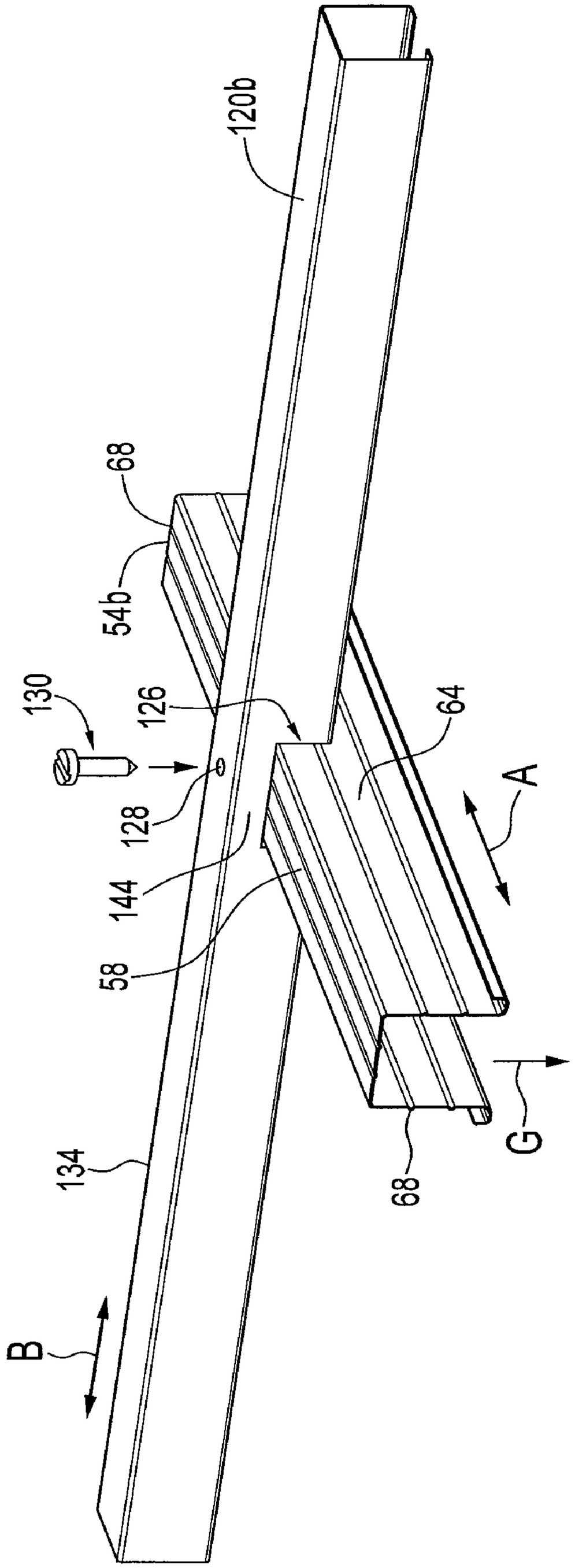


FIG. 13

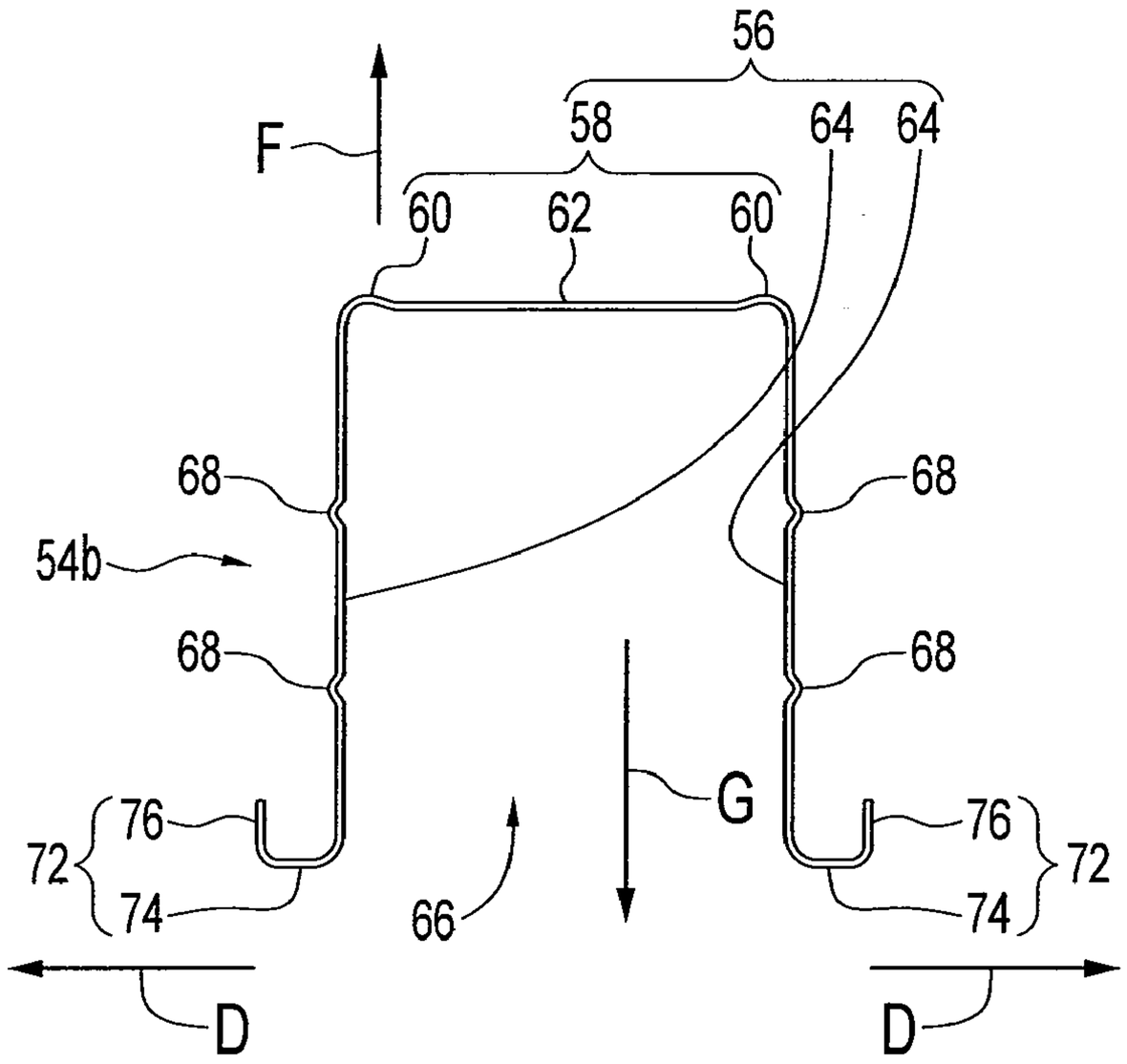

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FIG. 14

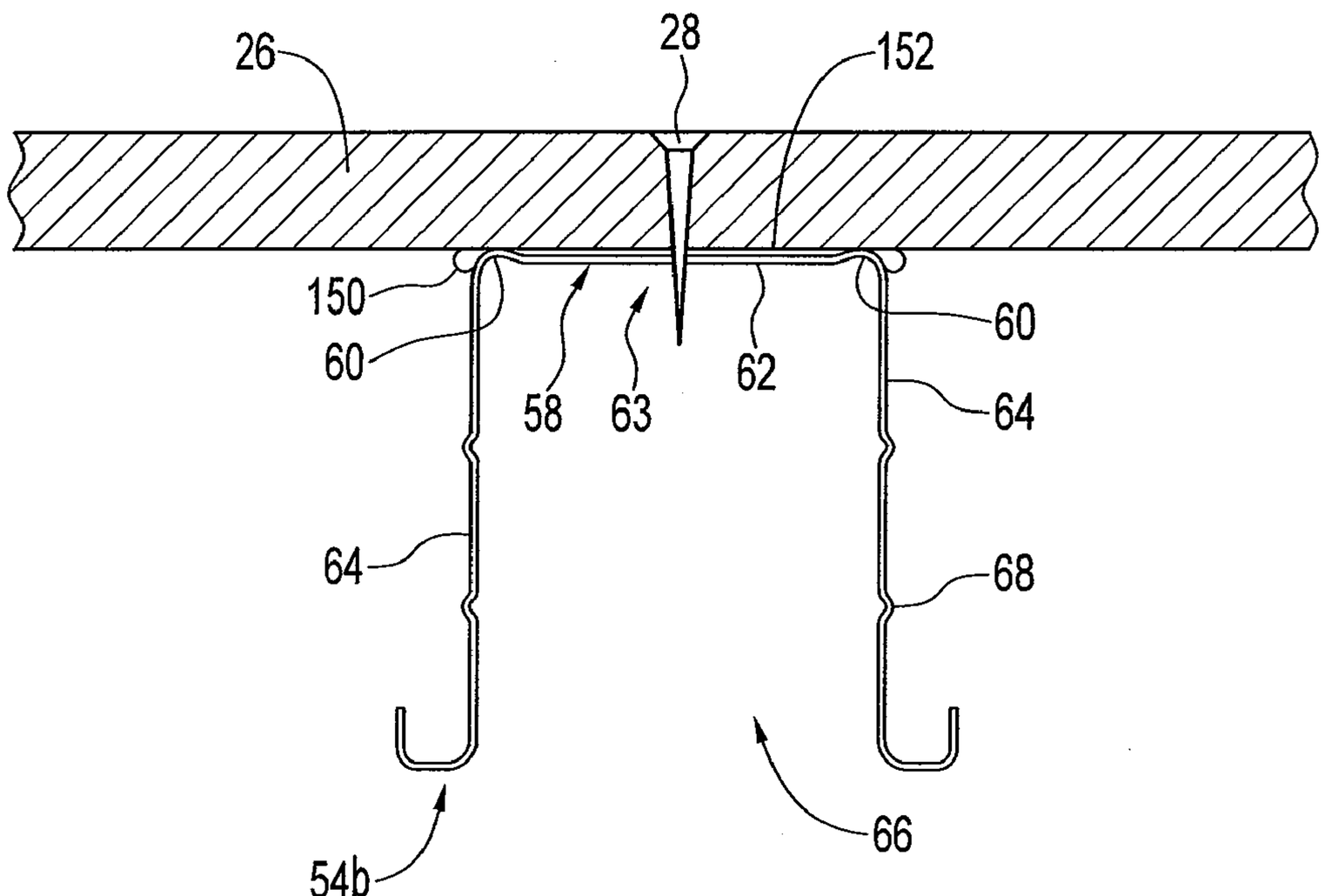
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FIG. 15

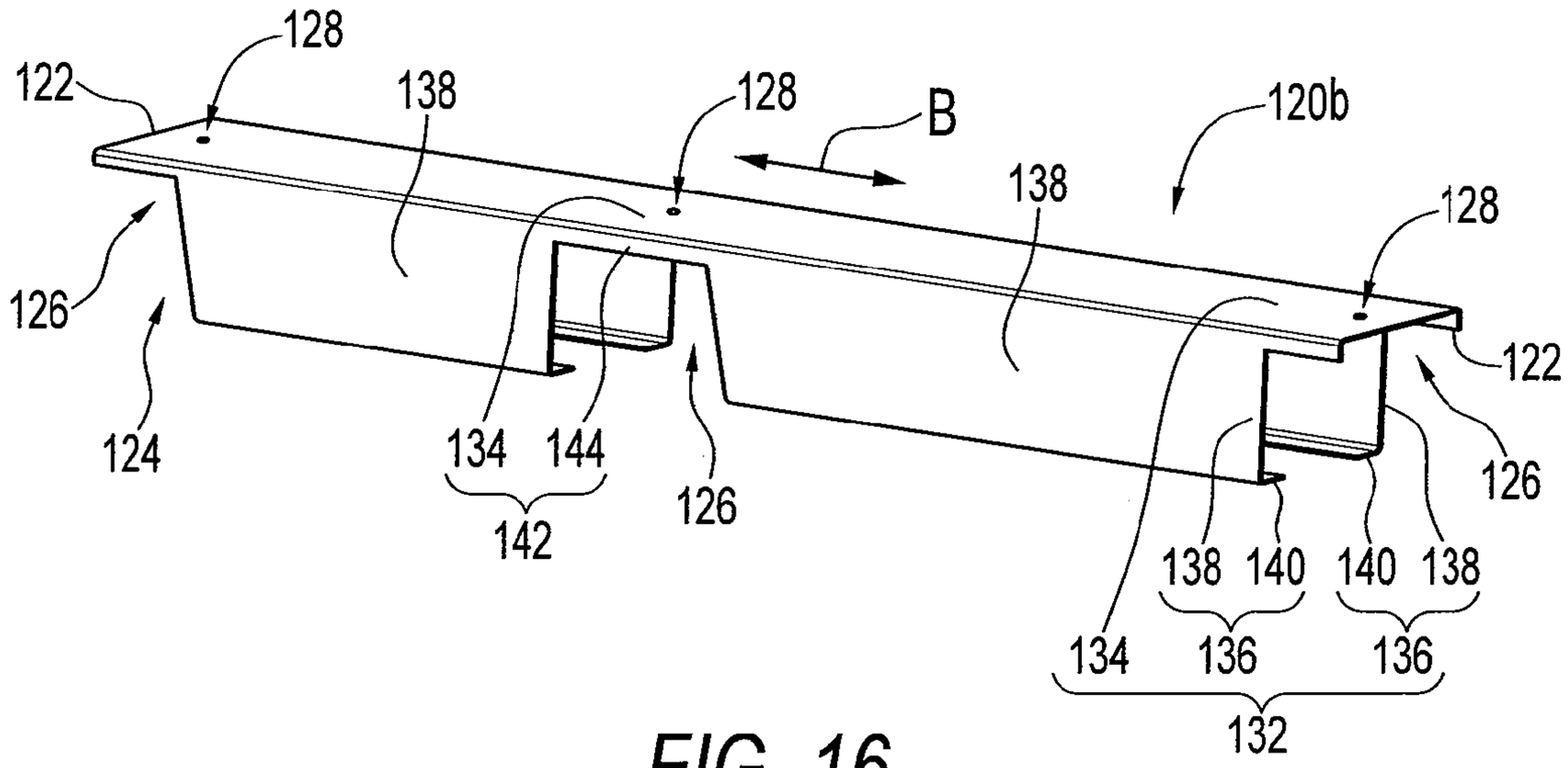
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FIG. 16

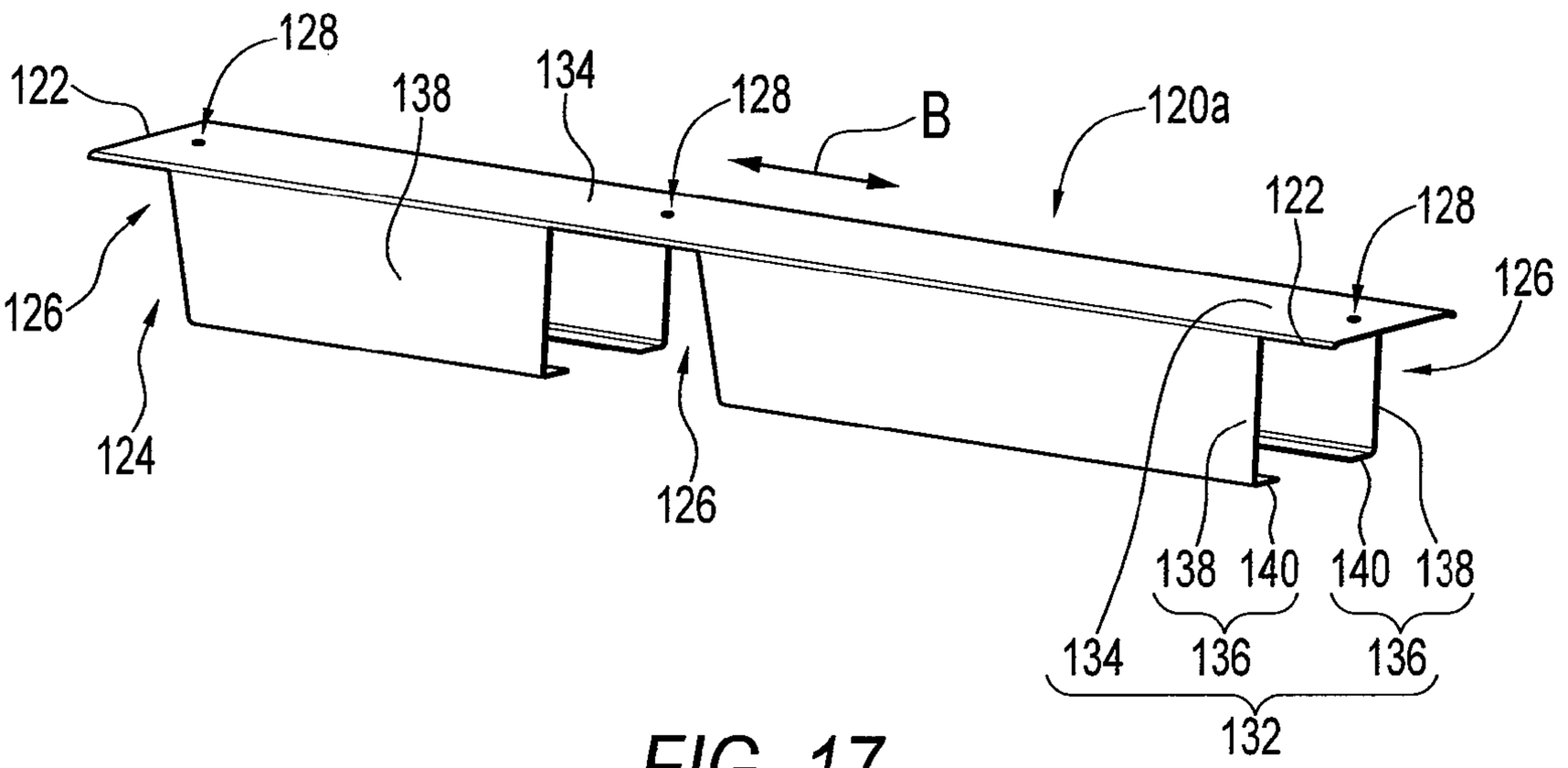
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FIG. 17

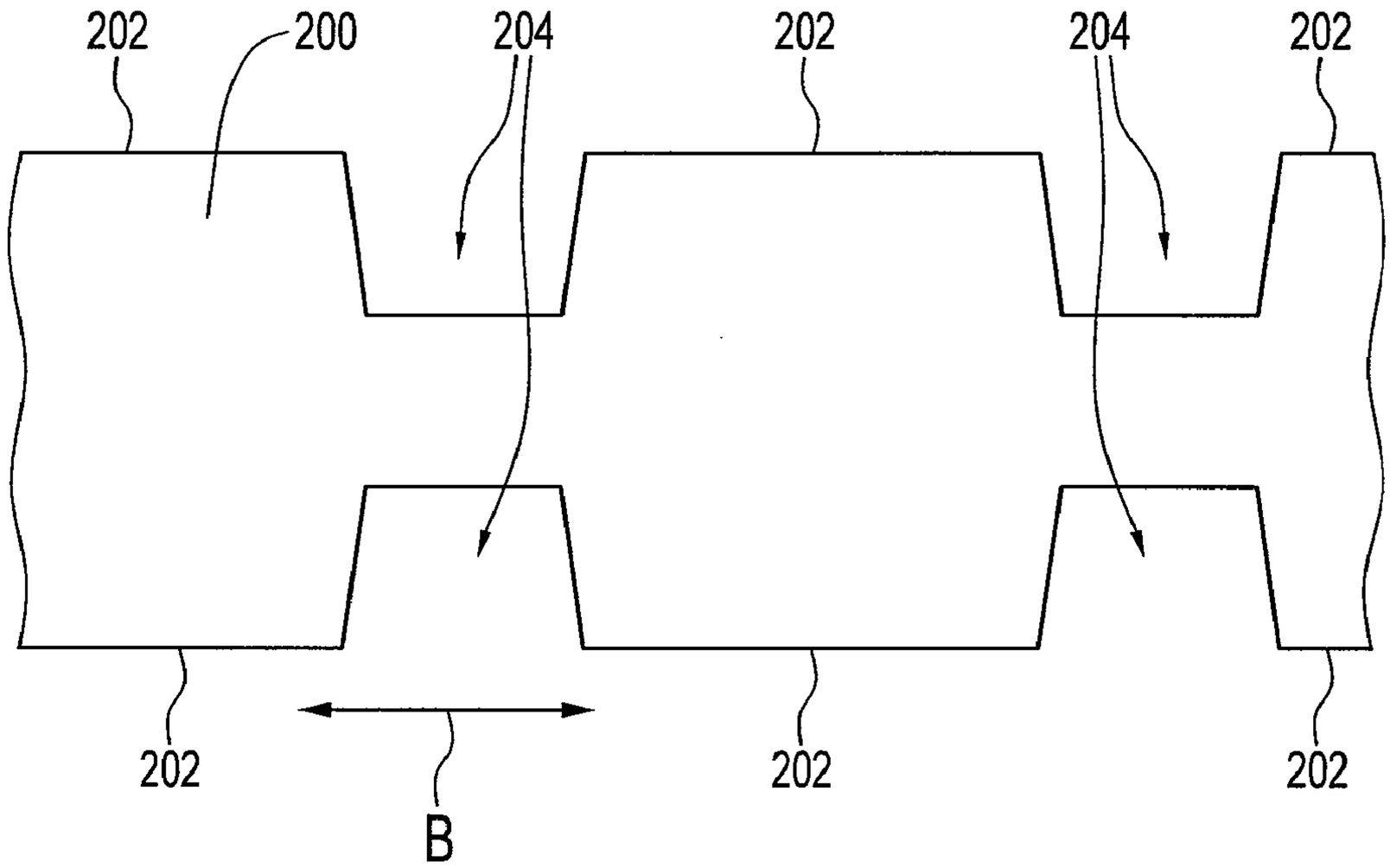
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FIG. 18

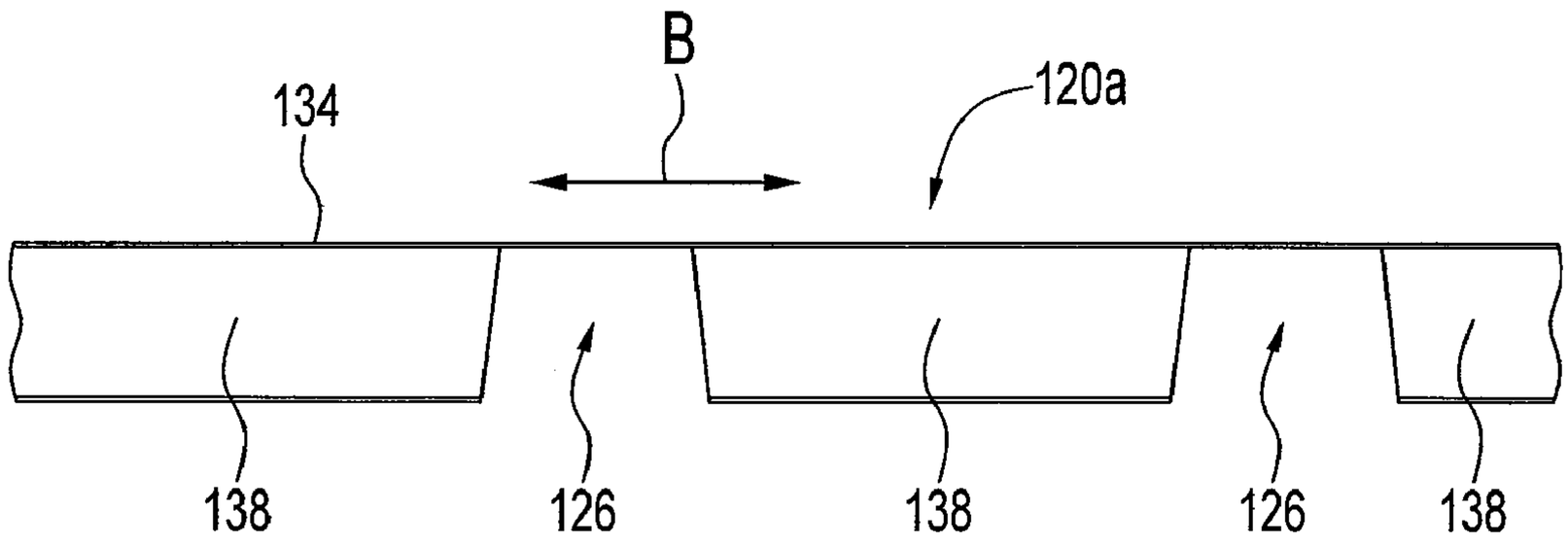
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FIG. 19

TRUSS AND PURLIN SUPPORT APPARATUS AND A METHOD OF MAKING AND USING SAME WITH BUILDING SUPPORTS AND FLOOR AND ROOF SHEATHING

FIELD OF THE INVENTION

[0001] The present invention relates to the field of floor and roof support apparatus and, more particularly, to a truss and purlin support apparatus and a method of making and using same with building supports and floor and roof sheathing.

BACKGROUND OF THE INVENTION

[0002] In the construction industry for buildings, including residential, commercial and institutional and high rise, there is a continuing need to achieve higher economic efficiencies in cost of materials, of fabrication, and of installation labor for floor and roof systems, as well as to achieve improved floor and roof structural efficiency. Though still largely undeveloped, the construction industry may be beginning to consider the use of light gauge steel (hereinafter, alternately referred to as "LGS" and/or "light weight steel") constructions in this regard.

[0003] In the prior art, conventional floor constructions in LGS may heretofore have used "C"-channel floor joists **30**, such as those assembled as illustrated in FIG. **1**. Such prior art LGS floor systems may have included the use of such "C"-channel floor joists **30**, in a back-to-back orientation, in typical depths of 8", 10", 12", and 14", and in typical gauges ranging between 18 gauge and 14 gauge. As illustrated in FIG. **1**, such prior art floor joists **30**, in the aforesaid back-to-back orientation, may heretofore have been supported on external foundation walls **22** and on center load bearing walls **24**. Such prior art installations may often have also required the use of rim joists **34** and "X"-bracings **36**, throughout, to provide a requisite level of stability for the floor, and/or to reduce the likelihood that the prior art joists **30** might fall over under load conditions (not shown). It would be desirable to provide a floor system that does not required the use of such rim joists **34**. In addition, prior art stiffening members **32** may heretofore have been required to reduce the likelihood of web crippling which may arise under concentrated loads (e.g., from wall studs in situations where multiple stories are present). Such prior art floor systems, especially insofar as they may have been constructed of LGS, may have been very time-consuming to construct and cumbersome to install, and often may have been quite costly in terms of material costs.

[0004] In addition, prior art systems that included "C"-channel joists **30** have been subject to the significant problem of providing the requisite level of stability for the "C"-channel joists **30** in their upright position (as shown in FIGS. **1** and **2**). The aforementioned problem may heretofore have been especially acute in situations where the "C"-channel joists **30** may have spanned over three walls (i.e., where the floor system is supported by two exterior foundation walls **22** and by a third center load-bearing wall **24** substantially at the mid-point of the floor). Although the prior art rim joists **34** may have provided some measure of increased stability at the extremities, the "C"-channel joists **30** may not have been sufficiently stable at the at center load bearing wall **24**. As well, certain minimum bearing requirements for floor joists resting on supporting structures, in this case the load bearing wall **24**, may have necessitated the overlap of the prior art "C"-channel joists **30** in the manner best seen in FIG. **2**. That is, it may heretofore have been necessary, as shown in FIG. **2**, to overlap adjacent ones of the "C"-channel joists **30** on top of the supporting structure. The aforementioned problems of collapsing and/or overturning under concentrated loads is one which may have been inherent in such prior art arrangements. As such, in the prior art, it may have been necessary to install expensive "X"-bracing **36** within such prior art floor systems, which (apart from the significant added expense) may heretofore have been particularly difficult to accomplish for LGS constructions.

[0005] Use of prior art floor systems may also have presented additional headaches insofar as an "offset seam" may have been present (as indicated generally by arrows "Z" in FIG. **2**). Floor sheathing that might heretofore have been placed on top of the offset prior art "C"-channel joists **30** often may not have been properly and/or readily aligned therewith. In the result, considerable adjustments may have been necessitated during installation of sheathing over such prior art floor systems and may not have lended itself to a clean construction detail.

[0006] The aforementioned problem with prior art floor systems may have been somewhat more pronounced in low rise hotel constructions where a multitude of units, separated merely by center load bearing walls **24**, may be present adjacent to one another. In such situations, and/or if several floors are constructed on top of each other, prior art "C"-channel joists **30** may have become particularly unstable. Extreme care and "X"-bracing **36** may heretofore have been required to achieve a requisite level of stability, especially when under an applied load of several building stories. Moreover, such uses of prior art systems may not have afforded and/or guaranteed the desired level of sound stability, especially when under an applied load of several building stories.

[0007] It is thus an object of this invention to obviate or mitigate at least one of the above mentioned disadvantages of the prior art.

SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, there is disclosed a truss and purlin support apparatus for use with building support members and a substantially planar substrate sheathing member. The apparatus includes a plurality of Pratt-style elongate truss members and a plurality of purlin members. Each of the truss members has at least two support portions longitudinally spaced from one another. The support portions are adapted to operatively engage and transfer loads to the building support members. Each of the truss members includes an elongate top chord, an elongate bottom chord, and a plurality of web members securely extending between the top chord and the bottom chord. Each of the purlin members extends in a substantially transverse direction relative to the elongate truss members. Each of the purlin members has an underside portion that is shaped to define a plurality of notched portions. The notched portions are spaced from one another in the transverse direction along the underside portion. Each of the notched portions is saddled over a respective top chord of the truss members, so

as to restrict sliding movement of the purlin members in the transverse direction. The purlin members operatively support the substrate sheathing member thereon. The top chord, the bottom chord, the web members, and the purlin members are constructed from roll-formed light gauge steel material.

[0009] According to an aspect of one preferred embodiment of the invention, each of the truss members may preferably, but need not necessarily, have a center of gravity that is operatively located below the support portions.

[0010] According to an aspect of one preferred embodiment of the invention, neighboring ones of the truss members may preferably, but need not necessarily, be spaced by a truss on-center distance in the substantially transverse direction that is selected from the group consisting of about 36 inches and about 48 inches.

[0011] According to an aspect of one preferred embodiment of the invention, neighboring ones of the purlin members may preferably, but need not necessarily, be spaced by a purlin on-center distance in a substantially longitudinal direction that is selected from the group consisting of about 16 inches and about 24 inches.

[0012] According to an aspect of one preferred embodiment of the invention, each top chord and each bottom chord may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "U"-shaped chord portion and two substantially "L"-shaped chord portions. The "U"-shaped chord portion may preferably, but need not necessarily, include two substantially planar chord side portions extending substantially at right angles from opposing ends of a substantially planar central chord base portion. The chord side portions may preferably, but need not necessarily, define a web-receiving aperture therebetween. Each of the "L"-shaped chord portions may preferably, but need not necessarily, include a substantially planar first chord segment and a substantially planar second chord segment. The first chord segment may preferably, but need not necessarily, extend in a substantially outward direction and substantially at right angles from a respective one of the chord side portions. The second chord segment may preferably, but need not necessarily, extend substantially at right angles from the first chord segment. In each of the truss members, the web-receiving aperture of the bottom chord may preferably, but need not necessarily, face in a substantially upward direction and the web-receiving aperture of the top chord may preferably, but need not necessarily, face in a substantially downward direction. Each of the web members may preferably, but need not necessarily, extend into each web-receiving aperture, and securely engage each "U"-shaped chord portion, of the top chord and of the bottom chord.

[0013] According to an aspect of one preferred embodiment of the invention, one or more of the central chord base portion and the chord side portions of each top chord and each bottom chord may preferably, but need not necessarily, be shaped so as to define a stiffening projection substantially along a longitudinal extent thereof, whereby each top chord and each bottom chord may preferably, but need not necessarily, be provided with structural rigidity.

[0014] According to an aspect of one preferred embodiment of the invention, in each top chord and in each bottom chord, the chord side portions may preferably, but need not necessarily, be shaped so as to define a plurality of longitudinally spaced locator apertures therein. Each of the web members may preferably, but need not necessarily, be provided with end portions that are each shaped to define a locator aperture mating portion. Each of the web members may preferably, but need not necessarily, be located within each web-receiving aperture, and securely engage each "U"-shaped chord portion, of the top chord and of the bottom chord. Each locator aperture mating portion may preferably, but need not necessarily, be substantially securely aligned with one of the locator apertures.

[0015] According to an aspect of one preferred embodiment of the invention, each of the truss members may preferably, but need not necessarily, additionally include two support stiffening members, each preferably, but not necessarily, securely engaging the top chord substantially adjacent to a respective one of the support portions. Each of the support stiffening members may preferably, but need not necessarily, be positioned within the web-receiving aperture of the top chord. The support stiffening members may preferably, but need not necessarily, substantially maintain local structural integrity of the support portions preferably, but not necessarily, whilst the support portions operatively transfer the loads to the building support members.

[0016] According to an aspect of one preferred embodiment of the invention, each of the support stiffening members may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "C"-shaped support stiffening portion. The "C"-shaped support stiffening portion may preferably, but need not necessarily, include two substantially planar support side portions extending substantially at right angles from opposing ends of a substantially planar central support base portion. The central support base portion may preferably, but need not necessarily, be positioned substantially vertically within the web-receiving aperture of the top chord.

[0017] According to an aspect of one preferred embodiment of the invention, each of the purlin members may preferably, but need not necessarily, be shaped so as to define, remotely of the notched portions, a substantially "C"-shaped purlin profile that faces in the substantially downward direction.

[0018] According to an aspect of one preferred embodiment of the invention, the "C"-shaped purlin profile may preferably, but need not necessarily, be defined by a substantially planar central purlin base portion and two substantially "L"-shaped purlin portions. Each of the "L"-shaped purlin portions may preferably, but need not necessarily, include a substantially planar first purlin segment and a substantially planar second purlin segment. The first purlin segment may preferably, but need not necessarily, extend substantially at right angles from one respective end of the purlin base portion. The second purlin segment may preferably, but need not necessarily, extend in a substantially inward direction and substantially at right angles from the first purlin segment.

[0019] According to an aspect of one preferred embodiment of the invention, the chord base portion of the top chord may preferably, but need not necessarily, securely engage the purlin base portion adjacent to one of the notched portions. The chord base portion may preferably, but need not necessarily, be substantially flush with the purlin base

portion. The chord base portion may preferably, but need not necessarily, operatively substantially support the substrate sheathing member.

[0020] According to an aspect of one preferred embodiment of the invention, the opposing ends of the central chord base portion of the top chord may preferably, but need not necessarily, define a concave portion therebetween. The concave portion may preferably, but need not necessarily, face in the upward direction. According to this aspect of the invention, the apparatus may preferably, but need not necessarily, be adapted to additionally include a predetermined amount of an adhesive operatively interposed in adhering relation substantially between the concave portion and the substrate sheathing member.

[0021] According to an aspect of one preferred embodiment of the invention, each of the purlin members may preferably, but need not necessarily, be shaped so as to define, substantially adjacent to the notched portions, a substantially "U"-shaped purlin profile that faces in the substantially downward direction. The "U"-shaped purlin profile may preferably, but need not necessarily, include two purlin side portions extending substantially at right angles from opposing ends of the purlin base portion. The first purlin segment may preferably, but need not necessarily, extend beyond the purlin side portions in the downward direction. The purlin side portions may preferably, but need not necessarily, securely engage the chord base portion of the top chord. The purlin side portions may preferably, but need not necessarily, define an up-set portion that extends between each of the notched portions and the purlin base portion. The chord base portion of the top chord may preferably, but need not necessarily, be operatively vertically spaced from the substrate sheathing member.

[0022] According to an aspect of one preferred embodiment of the invention, each of the web members may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "C"-shaped web portion.

[0023] According to an aspect of one preferred embodiment of the invention, the "C"-shaped web portion may preferably, but need not necessarily, include a substantially planar central web base portion and two substantially "L"-shaped web side portions. Each of the web side portions may preferably, but need not necessarily, include a substantially planar first web segment and a substantially planar second web segment. The first web segment may preferably, but need not necessarily, extend substantially at right angles from one respective end of the web base portion. The second web segment may preferably, but need not necessarily, extend in a substantially inward direction and substantially at right angles from the first web segment.

[0024] According to an aspect of one preferred embodiment of the invention, each of the truss members may preferably, but need not necessarily, additionally include two load distribution plates, each securely engaging the top chord. Each of the load distribution plates may preferably, but need not necessarily, be operatively substantially interposed between a respective one of the support portions and one of the building support members. The load distribution plates may preferably, but need not necessarily, operatively transfer the loads to the building support members preferably, but not necessarily, whilst substantially maintaining local structural integrity of the building support members.

[0025] According to an aspect of one preferred embodiment of the invention, each of the load distribution plates may preferably, but need not necessarily, be operatively securely fastened to one of the building support members.

[0026] In accordance with the present invention, there is also disclosed a method of forming a truss and purlin support apparatus for use with building support members. The method includes a chord forming step, a web forming step, and a purlin forming step. In the chord forming step, a plurality of top chords and bottom chords are roll-formed by passing first elongate sheets of light gauge steel material through a series of roll-forming chord tool sets. Passage of the first elongate sheets through each successive one of the chord tool sets progressively forms the top chords and the bottom chords. In the web forming step, a plurality of web members are roll-formed by passing second elongate sheets of light gauge steel material through a series of roll-forming web tool sets. Passage of the second elongate sheets through each successive one of the web tool sets progressively forms the web members. In the purlin forming step, a plurality of purlin members are roll-formed by passing a plurality of third elongate sheets of light gauge steel material through a series of roll-forming purlin tool sets. Passage of the third elongate sheets through each successive one of the purlin tool sets progressively forms the purlin members, such that each of the purlin members has an underside portion that defines a plurality of notched portions that are longitudinally spaced from one another. Each of the web members is adapted to be operatively secured between one of the top chords and one of the bottom chords to form elongate truss members. The truss members are securable on the building support members. The truss members are adapted to be nested and secured within the notched portions of the purlin members. The purlin members operatively extend in a transverse direction relative to the elongate truss members. Each of the purlin members is adapted to operatively support a substantially planar substrate sheathing member thereon.

[0027] According to an aspect of one preferred embodiment of the invention, the method may preferably, but need not necessarily, additionally include a purlin sheet forming step before the purlin forming step. In the purlin sheet forming step, the plurality of the third elongate sheets may preferably, but need not necessarily, be formed with a plurality of opposed notch pairs along longitudinal edges thereof.

[0028] According to an aspect of one preferred embodiment of the invention, in the purlin sheet forming step, neighboring ones of the opposed notch pairs may preferably, but need not necessarily, be spaced by a truss on-center distance that is selected from the group consisting of about 36 inches and about 48 inches.

[0029] According to an aspect of one preferred embodiment of the invention, in the chord forming step, each of the top chords and the bottom chords may preferably, but need not necessarily, be roll-formed so that a chord profile of each of the top chords and the bottom chords defines a substantially "U"-shaped chord portion and two substantially "L"-shaped chord portions. The "U"-shaped chord portion may preferably, but need not necessarily, include two substantially planar chord side portions extending substantially at right angles from opposing ends of a substantially planar central chord base portion. The chord side portions may

preferably, but need not necessarily, define a web-receiving aperture therebetween. Each of the "L"-shaped chord portions may preferably, but need not necessarily, include a substantially planar first chord segment and a substantially planar second chord segment. The first chord segment may preferably, but need not necessarily, extend in a substantially outward direction and substantially at right angles from a respective one of the chord side portions. The second chord segment may preferably, but need not necessarily, extend substantially at right angles from the first chord segment. The web-receiving aperture of each of the bottom chords may preferably, but need not necessarily, operatively face in a substantially upward direction and the web-receiving aperture of each of the top chords may preferably, but need not necessarily, operatively face in a substantially downward direction. Each of the web members may preferably, but need not necessarily, be operatively adapted to extend into each web-receiving aperture, and to be secured to each "U"-shaped chord portion, of each of the top chords and the bottom chords.

[0030] According to an aspect of one preferred embodiment of the invention, in the chord forming step, one or more of the central chord base portion and the chord side portions of each of the top chords and the bottom chords may preferably, but need not necessarily, be roll-formed so as to define a stiffening projection substantially along a longitudinal extent thereof.

[0031] According to an aspect of one preferred embodiment of the invention, in the chord forming step, a plurality of longitudinally spaced locator apertures may preferably, but need not necessarily, be punched in the chord side portions of each of the top chords and the bottom chords. In the web forming step, a locator aperture mating portion may preferably, but need not necessarily, be punched in each end portion of each of the web members. Each locator aperture mating portion may preferably, but need not necessarily, be adapted to be operatively aligned with one of the locator apertures.

[0032] According to an aspect of one preferred embodiment of the invention, the method may preferably, but need not necessarily, additionally include a support stiffener forming step. In the support stiffener forming step, a plurality of support stiffening members may preferably, but need not necessarily, be roll-formed by passing the second elongate sheets through the series of roll-forming web tool sets. Passage of the second elongate sheets through each successive one of the web tool sets may preferably, but need not necessarily, progressively form the support stiffening members, such that a support profile of each of the support stiffening members may preferably, but need not necessarily, define a substantially "C"-shaped support stiffening portion. The "C"-shaped support stiffening portion may preferably, but need not necessarily, include two substantially planar support side portions extending substantially at right angles from opposing ends of a substantially planar central support base portion. The web-receiving aperture of each of the top chords may preferably, but need not necessarily, be adapted to operatively receive two support stiffening members therewithin. Each of the support stiffening members may preferably, but need not necessarily, be substantially adjacent to the support portions. The central support base portion may preferably, but need not necessarily, be positioned substantially vertically.

[0033] According to an aspect of one preferred embodiment of the invention, in the chord forming step, the opposing ends of the central chord base portion of each of the top chords may preferably, but need not necessarily, be roll-formed to define a concave portion therebetween. The concave portion may preferably, but need not necessarily, operatively face in the upward direction. The concave portion may preferably, but need not necessarily, be adapted to operatively receive a predetermined amount of an adhesive.

[0034] According to an aspect of one preferred embodiment of the invention, in the purlin forming step, each of the purlin members may preferably, but need not necessarily, be roll-formed so as to define, remotely of the notched portions, a substantially "C"-shaped purlin profile that faces in the substantially downward direction.

[0035] According to an aspect of one preferred embodiment of the invention, in the purlin forming step, the "C"-shaped purlin profile may preferably, but need not necessarily, be roll-formed to include a substantially planar central purlin base portion and two substantially "L"-shaped purlin portions. Each of the "L"-shaped purlin portions may preferably, but need not necessarily, include a substantially planar first purlin segment and a substantially planar second purlin segment. The first purlin segment may preferably, but need not necessarily, extend substantially at right angles from one respective end of the purlin base portion. The second purlin segment may preferably, but need not necessarily, extend in a substantially inward direction and substantially at right angles from the first purlin segment.

[0036] According to an aspect of one preferred embodiment of the invention, in the purlin forming step, each of the purlin members may preferably, but need not necessarily, be roll-formed so as to define, substantially adjacent to the notched portions, a substantially "U"-shaped purlin profile that faces in the substantially downward direction. The "U"-shaped purlin profile may preferably, but need not necessarily, additionally include two purlin side portions extending substantially at right angles from opposing ends of the purlin base portion. The first purlin segment may preferably, but need not necessarily, extend beyond the purlin side portions in the downward direction. Each of the purlin side portions may preferably, but need not necessarily, define an up-set portion that extends between each of the notched portions and the purlin base portion. The purlin side portions may preferably, but need not necessarily, operatively engage the chord base portion of each of the top chords. The chord base portion of the top chord may preferably, but need not necessarily, be operatively vertically spaced from the substrate sheathing member.

[0037] According to an aspect of one preferred embodiment of the invention, in the web forming step, each of the web members may preferably, but need not necessarily, be roll-formed so that a web profile of each of the web members defines a substantially "C"-shaped web portion.

[0038] According to an aspect of one preferred embodiment of the invention, in the web forming step, the "C"-shaped web portion may preferably, but need not necessarily, be roll-formed to include a substantially planar central web base portion and two substantially "L"-shaped web side portions. Each of the web side portions may preferably, but need not necessarily, include a substantially planar first web segment and a substantially planar second web segment. The

first web segment may preferably, but need not necessarily, extend substantially at right angles from one respective end of the web base portion. The second web segment may preferably, but need not necessarily, extend in a substantially inward direction and substantially at right angles from the first web segment.

[0039] In accordance with the present invention, there is additionally disclosed a method of forming a truss and purlin support apparatus on building support members. The method includes a truss assembling step, a truss supporting step after the truss assembling step, an apparatus assembling step, and a sheathing step after the apparatus assembling step. In the truss assembling step, a plurality of elongate truss members may preferably, but need not necessarily, be assembled, each preferably, but not necessarily, having a plurality of support portions longitudinally spaced from one another, and each preferably, but not necessarily, being assembled by locating and securing a plurality of roll-formed web members between a roll-formed top chord and a roll-formed bottom chord. In the truss supporting step, the support portions of the truss members may preferably, but need not necessarily, be located and secured on the building support members. In the apparatus assembling step, the truss members may preferably, but need not necessarily, be nested and secured within a plurality of notched portions of a plurality of roll-formed purlin members. The purlin members may preferably, but need not necessarily, extend in a transverse direction relative to the elongate truss members, so as to preferably, but not necessarily, restrict sliding movement of the purlin members in the transverse direction. In the sheathing step, a substantially planar substrate sheathing member may preferably, but need not necessarily, be supported on the purlin members.

[0040] According to an aspect of one preferred embodiment of the invention, in the truss supporting step, the centers of gravity of the truss members may preferably, but need not necessarily, be located below the support portions.

[0041] According to an aspect of one preferred embodiment of the invention, in the apparatus assembling step, neighboring ones of the purlin members may preferably, but need not necessarily, be spaced in a substantially longitudinal direction by a purlin on-center distance that is selected from the group consisting of about 16 inches and about 24 inches.

[0042] According to an aspect of one preferred embodiment of the invention, in the truss supporting step, two load distribution plates, securely engaging the top chord, may preferably, but need not necessarily, be substantially securely interposed between the support portions and the building support members.

[0043] According to an aspect of one preferred embodiment of the invention, in the truss supporting step, the load distribution plates may preferably, but need not necessarily, be securely fastened to the building support members.

[0044] According to an aspect of one preferred embodiment of the invention, in the apparatus assembling step, each of the top chords may preferably, but need not necessarily, be substantially flush with each of the purlin members. In the sheathing step, the top chord may preferably, but need not necessarily, substantially support the substrate sheathing member.

[0045] According to an aspect of one preferred embodiment of the invention, the method may preferably, but need not necessarily, additionally include a gluing step, before the sheathing step, of applying a predetermined amount of an adhesive preferably, but not necessarily, to one of the substrate sheathing member and a upward-facing concave portion of the top chord. In the sheathing step, the predetermined amount of the adhesive may preferably, but need not necessarily, be operatively interposed in adhering relation substantially between the concave portion and the substrate sheathing member.

[0046] According to an aspect of one preferred embodiment of the invention, in the apparatus assembling step, up-set portions of the purlin members preferably, but not necessarily, substantially adjacent to the notched portions may preferably, but need not necessarily, engage each the top chord. In the sheathing step, the top chord may preferably, but need not necessarily, be vertically spaced from the substrate sheathing member.

[0047] Other advantages, features and characteristics of the present invention, as well as methods of operation and functions of the related elements of the structure, and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following detailed description and the appended claims with reference to the accompanying drawings, the latter of which are briefly described hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0048] FIG. **1** of the drawings appended hereto is a top perspective view of a prior art floor system;

[0049] FIG. **2** is an enlarged view of encircled area **2** of FIG. **1**;

[0050] FIG. **3** of the drawings is a top perspective view of a floor support apparatus according to the present invention;

[0051] FIG. **3**A is an enlarged top perspective view of a portion of the floor support apparatus of FIG. **3**;

[0052] FIG. **4** of the drawings is a top perspective view of another floor support apparatus according to the present invention;

[0053] FIG. **5** is a top perspective view of a portion of one of the truss members shown in FIG. **3**;

[0054] FIG. **6** is an enlarged view of encircled area **6** of FIG. **5**;

[0055] FIG. **7** is a top perspective view of a portion of one of the top chords shown in FIG. **5**;

[0056] FIG. **8** is a top perspective view of one of the web members shown in FIG. **5**;

[0057] FIG. **8**A is a top perspective view of a support stiffening member shown in FIG. **5**;

[0058] FIG. **9** is a top front perspective view of one of the floor purlin members shown in FIG. **3**;

[0059] FIG. **10** is a top front perspective view of a roof purlin member of a roof support apparatus according to the invention;

[0060] FIG. **11** is a top perspective view of a low rise hotel installation of the floor support apparatus of FIG. **3**;

[0061] FIG. **12** is a top perspective view of a roof support apparatus according to the invention;

[0062] FIG. **13** is a top perspective view of portions of a top chord and a roof purlin member shown in FIG. **12**;

[0063] FIG. **14** of the drawings is a front view of the top chord of FIG. **7**;

[0064] FIG. **15** of the drawings is a front sectional view of the floor sheathing and one of the top chords shown in FIG. **3**;

[0065] FIG. **16** is a top rear perspective view of the roof purlin member of FIG. **10**;

[0066] FIG. **17** is a top rear perspective view of the floor purlin member of FIG. **9**;

[0067] FIG. **18** of the drawings is a top view of a portion of a light gauge steel sheet used in roll-forming the floor purlin member of FIG. **9**; and

[0068] FIG. **19** is a side view of a corresponding portion of a floor purlin member roll-formed from the sheet shown in FIG. **18**;

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0069] A truss and purlin support apparatus **40** according to the invention in shown in FIG. **3** of the drawings in use with building support members **20** and substantially planar substrate sheathing members **26**. The apparatus **40** includes a plurality of Pratt-style elongate truss members **50** and a plurality of purlin members **120**.

[0070] Each of the truss members **50** has at least two support portions **52** longitudinally spaced from one another. The support portions **52** are adapted to operatively engage and transfer loads to the building support members **20**.

[0071] Each of the truss members **50** includes an elongate top chord **54***b*, an elongate bottom chord **54***a*, and a plurality of web members **80** securely extending between the top chord **54***b* and the bottom chord **54***a*. The top chord **54***b*, the bottom chord **54***a*, the web members **80**, and the purlin members **120** are preferably constructed from roll-formed light gauge steel material. Each top chord **54***b* and each bottom chord **54***a* may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "U"-shaped chord portion **56** and two substantially "L"-shaped chord portions **72**.

[0072] The "U"-shaped chord portion **56** may preferably, but need not necessarily, include two substantially planar chord side portions **64** extending substantially at right angles from opposing ends **60** of a substantially planar central chord base portion **58**. The chord side portions **64** may preferably, but need not necessarily, define a web-receiving aperture **66** therebetween.

[0073] One or more of the central chord base portion **58** and the chord side portions **64** of each top chord **54***b* and each bottom chord **54***a* may preferably, but need not necessarily, be shaped so as to define a stiffening projection **68** substantially along a longitudinal extent thereof, whereby each top chord **54***b* and each bottom chord **54***a* may preferably, but need not necessarily, be provided with structural rigidity.

[0074] In each top chord **54***b* and in each bottom chord **54***a*, the chord side portions **64** may preferably, but need not necessarily, be shaped so as to define a plurality of longitudinally spaced locator apertures **70** therein.

[0075] Each of the "L"-shaped chord portions **72** may preferably, but need not necessarily, include a substantially planar first chord segment **74** and a substantially planar second chord segment **76**. The first chord segment **74** may preferably, but need not necessarily, extend in a substantially outward direction "D" and substantially at right angles from a respective one of the chord side portions **64**. The second chord segment **76** may preferably, but need not necessarily, extend substantially at right angles from the first chord segment **74**.

[0076] In each of the truss members **50**, the web-receiving aperture **66** of the bottom chord **54***a* may preferably, but need not necessarily, face in a substantially upward direction "F" and the web-receiving aperture **66** of the top chord **54***b* may preferably, but need not necessarily, face in a substantially downward direction "G". Each of the web members **80** may preferably, but need not necessarily, extend into and be located within each web-receiving aperture **66**, and securely engage each "U"-shaped chord portion **56**, of the top chord **54***b* and of the bottom chord **54***a*.

[0077] As best seen in FIG. **8**, each of the web members **80** may preferably, but need not necessarily, be provided with end portions that are each shaped to define a locator aperture mating portion **84**. Each locator aperture mating portion **84** may preferably, but need not necessarily, be substantially securely aligned with one of the locator apertures **70** by web fasteners (not shown).

[0078] Each of the web members **80** may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "C"-shaped web portion **86**. The "C"-shaped web portion **86** may preferably, but need not necessarily, include a substantially planar central web base portion **88** and two substantially "L"-shaped web side portions **90**. Each of the web side portions **90** may preferably, but need not necessarily, include a substantially planar first web segment **92** and a substantially planar second web segment **94**. The first web segment **92** may preferably, but need not necessarily, extend substantially at right angles from one respective end of the web base portion **88**. The second web segment **94** may preferably, but need not necessarily, extend in a substantially inward direction "E" and substantially at right angles from the first web segment **92**.

[0079] Each of the truss members **50** may preferably, but need not necessarily, have a center of gravity (not shown) that is operatively located below the support portions **52**.

[0080] Each of the truss members **50** may preferably, but need not necessarily, additionally include two support stiffening members **100**, each preferably, but not necessarily, securely engaging the top chord **54***b* substantially adjacent to a respective one of the support portions **52**. Each of the support stiffening members **100** may preferably, but need not necessarily, be positioned within the web-receiving aperture **66** of the top chord **54***b*. The support stiffening members **100** may preferably, but need not necessarily, substantially maintain local structural integrity of the support portions **52** preferably, but not necessarily, whilst the support portions **52** operatively transfer the loads to the building support members **20**.

[0081] Each of the support stiffening members **100** (as best seen in FIG. **8**A) may preferably, but need not necessarily, be shaped, in profile, so as to define a substantially "C"-shaped support stiffening portion **102**. The "C"-shaped support stiffening portion **102** may preferably, but need not necessarily, include two substantially planar support side portions **108** extending substantially at right angles from opposing ends **106** of a substantially planar central support base portion **104**. The central support base portion **104** may preferably, but need not necessarily, be positioned substantially vertically within the web-receiving aperture **66** of the top chord **54***b* (as best seen in FIG. **6**).

[0082] Each of the truss members **50** may preferably, but need not necessarily, additionally include two load distribution plates **110**, each securely engaging the top chord **54***b*. Each of the load distribution plates **110** may preferably, but need not necessarily, be operatively substantially interposed between a respective one of the support portions **52** and one of the building support members **20**. The load distribution plates **110** may preferably, but need not necessarily, operatively transfer the loads to the building support members **20** preferably, but not necessarily, whilst substantially maintaining local structural integrity of the building support members **20**. Each of the load distribution plates **110** may preferably, but need not necessarily, be operatively securely fastened, through fastening apertures **112**, to one of the building support members **20**.

[0083] Each of the purlin members **120** extends in a substantially transverse direction "B" relative to the elongate truss members **50**. Each of the purlin members **120** has an underside portion **124** that is shaped to define a plurality of notched portions **126**. The notched portions **126** may extend to end portions **122** of the purlin members **120**

[0084] The notched portions **126** are spaced from one another in the transverse direction "B" along the underside portion **124**. Each of the notched portions **126** is saddled over a respective top chord **54***b* of the truss members **50**, so as to restrict sliding movement of the purlin members **120** in the transverse direction "B".

[0085] Each of the purlin members **120** may preferably, but need not necessarily, be shaped so as to define, remotely of the notched portions **126**, a substantially "C"-shaped purlin profile **132** that faces in the substantially downward direction "G".

[0086] The "C"-shaped purlin profile **132** may preferably, but need not necessarily, be defined by a substantially planar central purlin base portion **134** and two substantially "L"-shaped purlin portions **136**. Each of the "L"-shaped purlin portions **136** may preferably, but need not necessarily, include a substantially planar first purlin segment **138** and a substantially planar second purlin segment **140**. The first purlin segment **138** may preferably, but need not necessarily, extend substantially at right angles from one respective end of the purlin base portion **134**. The second purlin segment **140** may preferably, but need not necessarily, extend in a substantially inward direction "E" and substantially at right angles from the first purlin segment **138**.

[0087] As best seen in FIG. **3**A, neighboring ones of the truss members **50** may preferably, but need not necessarily, be spaced by a truss on-center distance "J" in the substantially transverse direction "B" that is selected from the group consisting of about 36 inches and about 48 inches. Similarly, neighboring ones of the purlin members **120** may preferably, but need not necessarily, be spaced by a purlin on-center distance "K" in a substantially longitudinal direction "A" that is selected from the group consisting of about 16 inches and about 24 inches.

[0088] The purlin members **120** operatively support the substrate sheathing member **26** thereon.

[0089] In floor systems, the chord base portion **58** of the top chord **54***b* may preferably, but need not necessarily, securely engage the purlin base portion **134** adjacent to one of the notched portions **126**. In such floor systems, the chord base portion **58** may preferably, but need not necessarily, be substantially flush with the purlin base portion **134**. In floor systems, the chord base portion **58** may preferably, but need not necessarily, operatively substantially support the substrate sheathing member **26**.

[0090] As best seen in FIG. **15**, the opposing ends **60** of the central chord base portion **58** of the top chord **54***b* may preferably, but need not necessarily, define a concave portion **62** therebetween. The concave portion **62** may preferably, but need not necessarily, face in the upward direction "F". The apparatus **40** may preferably, but need not necessarily, be adapted to additionally include a predetermined amount **152** of an adhesive **150** operatively interposed in adhering relation substantially between the concave portion **62** and the substrate sheathing member **26**.

[0091] Alternately, and as may be particularly advantageous in the construction of roof systems according to the present invention, each of the purlin members **120** may preferably, but need not necessarily, be shaped so as to define, substantially adjacent to the notched portions **126**, a substantially "U"-shaped purlin profile **142** that faces in the substantially downward direction "G". The "U"-shaped purlin profile **142** may preferably, but need not necessarily, include two purlin side portions **144** extending substantially at right angles from opposing ends of the purlin base portion **134**. The first purlin segment **138** may preferably, but need not necessarily, extend beyond the purlin side portions **144** in the downward direction "G". The purlin side portions **144** may preferably, but need not necessarily, securely engage the chord base portion **58** of the top chord **54***b*. The purlin side portions **144** may preferably, but need not necessarily, define an up-set portion (with the terms "purlin side portion" and "up-set portion" being herein used, mutatis mutandis, substantially interchangeably) that extends between each of the notched portions **126** and the purlin base portion **134**. In roof systems constructed according to the present invention, the chord base portion **58** of the top chord **54***b* may preferably, but need not necessarily, be operatively vertically spaced from the substrate sheathing member **26**.

[0092] The present invention also extends to a method of forming the apparatus **40** which may preferably include a chord forming step, a web forming step, a support stiffener forming step, a purlin sheet forming step, and a purlin forming step.

[0093] In the chord forming step, the top chords **54***b* and the bottom chords **54***a* are roll-formed by passing first elongate sheets (not shown) of light gauge steel material through a series of roll-forming chord tool sets (not shown). Passage of the first elongate sheets through each successive

one of the chord tool sets progressively forms the top chords **54***b* and the bottom chords **54***a*. In the chord forming step, each of the top chords **54***b* and the bottom chords **54***a* may preferably, but need not necessarily, be roll-formed so that a chord profile of each of the top chords **54***b* and the bottom chords **54***a* defines the "U"-shaped chord portion **56** and the two "L"-shaped chord portions **72**. One or more of the central chord base portion **58** and the chord side portions **64** of each of the top chords **54***b* and the bottom chords **54***a* may preferably, but need not necessarily, be roll-formed so as to define a stiffening projection **68** substantially along a longitudinal extent thereof. The locator apertures **70** may preferably, but need not necessarily, be punched in the chord side portions **64** of each of the top chords **54***b* and the bottom chords **54***a*. In the chord forming step, the opposing ends **60** of the central chord base portion **58** of each of the top chords **54***b* may preferably, but need not necessarily, be roll-formed to define the concave portion **62** therebetween.

[**0094**] In the web forming step, the web members **80** are roll-formed by passing second elongate sheets (not shown) of light gauge steel material through a series of roll-forming web tool sets (not shown). Passage of the second elongate sheets through each successive one of the web tool sets progressively forms the web members **80**. In the web forming step, a locator aperture mating portion **84** may preferably, but need not necessarily, be punched in each end portion **82** of each of the web members **80**.

[**0095**] In the support stiffener forming step, the support stiffening members **100** may preferably, but need not necessarily, be roll-formed by passing the second elongate sheets through the series of roll-forming web tool sets. Passage of the second elongate sheets through each successive one of the web tool sets may preferably, but need not necessarily, progressively form the support stiffening members **100**, such that a support profile **102** of each of the support stiffening members **100** may preferably, but need not necessarily, define the substantially "C"-shaped support stiffening portion (with the terms "support profile" and "support stiffening portion" being herein used, mutatis mutandis, substantially interchangeably).

[**0096**] In the purlin sheet forming step, the plurality of third elongate sheets **200** (as shown in FIG. **18**) may preferably, but need not necessarily, be formed with a plurality of opposed notch pairs **204** along longitudinal edges **202** thereof. In the purlin sheet forming step, neighboring ones of the opposed notch pairs **204** may preferably, but need not necessarily, be spaced by a truss on-center distance "J" that is selected from the group consisting of about 36 inches and about 48 inches.

[**0097**] In the purlin forming step, the purlin members **120** are roll-formed by passing the third elongate sheets **200** (as shown in FIG. **18**) of light gauge steel material through a series of roll-forming purlin tool sets (not shown). Passage of the third elongate sheets **200** through each successive one of the purlin tool sets progressively forms the purlin members **120**, such that each of the purlin members **120** has the underside portion **124** that defines the notched portions **126**.

[**0098**] According to this method, each of the web members **80** so formed is adapted to be operatively secured between one of the top chords **54***b* and one of the bottom chords **54***a* to form the elongate truss members **50**. Each of the web members **80** may preferably, but need not necessarily, be operatively adapted to extend into each web-receiving aperture **66**, and to be secured to each "U"-shaped chord portion **56**, of each of the top chords **54***b* and the bottom chords **54***a*. Each locator aperture mating portion **84** may preferably, but need not necessarily, be adapted to be operatively aligned with one of the locator apertures **70** and secured therewith by a web fastener (not shown). The web-receiving aperture **66** of each of the top chords **54***b* may preferably, but need not necessarily, be adapted to operatively receive two support stiffening members **100** therewithin. Each of the support stiffening members **100** may preferably, but need not necessarily, be substantially adjacent to the support portions **52**. The central support base portion **104** may preferably, but need not necessarily, be positioned substantially vertically. The truss members **50** are securable on the building support members **20**. The truss members **50** are adapted to be nested and secured within the notched portions **126** of the purlin members **120**. The purlin members **120** operatively extend in the transverse direction "B" relative to the elongate truss members **50**. Each of the purlin members **120** is adapted to operatively support the sheathing member **26** thereon.

[**0099**] The present invention additionally extends to a method of using the apparatus **40** with the building support members **20**. This method includes a truss assembling step, a truss supporting step after the truss assembling step, an apparatus **40** assembling step, a gluing step, and a sheathing step after the apparatus **40** assembling step.

[**0100**] In the truss assembling step, the truss members **50** may preferably, but need not necessarily, be assembled, each preferably, but not necessarily, having the support portions **52** longitudinally spaced from one another, and each preferably, but not necessarily, being assembled by locating and securing the web members **80** between the top chord **54***b* and the bottom chord **54***a*.

[**0101**] In the truss supporting step, the support portions **52** of the truss members **50** may preferably, but need not necessarily, be located and secured on the building support members **20**. The centers of gravity of the truss members **50** may preferably, but need not necessarily, be located below the support portions **52**. In the truss supporting step, the load distribution plates **110**, securely engaging the top chord **54***b*, may preferably, but need not necessarily, be substantially securely interposed between the support portions **52** and the building support members **20**. The load distribution plates **110** may preferably, but need not necessarily, be securely fastened, through fastening apertures **112**, to the building support members **20**.

[**0102**] In the apparatus **40** assembling step, the truss members **50** may preferably, but need not necessarily, be nested and secured within the notched portions **126** of the purlin members **120**. The purlin members **120** may preferably, but need not necessarily, extend in the transverse direction "B" relative to the elongate truss members **50**, so as to preferably, but not necessarily, restrict sliding movement of the purlin members **120** in the transverse direction "B". Neighboring ones of the purlin members **120** may preferably, but need not necessarily, be spaced in the longitudinal direction "A" by the purlin on-center distance "K" being selected from the group consisting of about 16 inches and about 24 inches.

[0103] In the apparatus **40** assembling step, for floor systems, each of the top chords **54***b* may preferably, but need not necessarily, be substantially flush with each of the purlin members **120**.

[0104] In the apparatus **40** assembling step, for roof systems, the up-set portions **144** of the purlin members **120**—preferably, but not necessarily, substantially adjacent to the notched portions **126**—may preferably, but need not necessarily, engage each top chord **54***b*.

[0105] In the gluing step, for floor systems, the predetermined amount **152** of the adhesive **150** may preferably, but need not necessarily, be applied to one of the substrate sheathing member **26** and a upward-facing concave portion **62** of the top chord **54***b*.

[0106] In the sheathing step, the sheathing member **26** may preferably, but need not necessarily, be supported on the purlin members **120**.

[0107] In the sheathing step, for floor systems, the top chord **54***b* may preferably, but need not necessarily, substantially support the substrate sheathing member **26**. The predetermined amount **152** of the adhesive **150** may preferably, but need not necessarily, be operatively interposed in adhering relation substantially between the concave portion **62** and the substrate sheathing member **26**.

[0108] In the sheathing step, for roof systems, the top chord **54***b* may preferably, but need not necessarily, be vertically spaced from the substrate sheathing member **26**.

[0109] The construction of the truss members **50** according to the present invention is shown in FIG. **3**, and are shown adjacent to the building support members **20**. FIG. **3** shows the truss members **50** in use with the floor system. The truss members **50** have the purlin members **120** saddled on top. The sheathing member **26** (i.e., floor sheathing) is laid on top of the truss members **50** and the purlin members **120**. The truss member **50** is a Pratt-style truss member that is supported on the building support members **20** in a manner that may be best seen in FIGS. **5** and **6**. The truss member **50** includes bottom and top chords **54***a*, **54***b* of substantially the same profile, as well as the web members **80**, which have a "C"-shaped web profile **86**. The apparatus **40** also includes the load distribution plates **110** with predrilled fastening apertures **112**, and support stiffening members **100** which may preferably each take the form of a short up-right piece of webbing having substantially the same profile **102** as the "C"-shaped web profile **86**. All elements may preferably be either of welded construction, and/or be screwed together, and/or be fastened by way of alternate fasteners, such as, for example, insert rivets. The bottom and top chords **54***a*, **54***b* and the web members **80** are provided with the locator apertures **70** and the locator aperture mating portions **84**, respectively, which are used to locate the positions of the web members **80** relative to the top and bottom chords **54***a*, **54***b*.

[0110] The load distribution plates **110** may help to ensure loads are transferred to supporting structures below the building support members **20** without substantial localized distortion, and the support stiffening members **100** may help to prevent the top chord **54***b* from local collapse as a result of point loads.

[0111] The apparatus **40**, including the truss members **50**, is an open-web assembly. The apparatus **40** is shown in a floor configuration in FIGS. **3** and **3**A, where the truss members **50** may preferably be spaced from one another by the truss on-center distance (as indicated generally by arrow "J" in FIG. **3**A) of about 32" or about 48". As may be best appreciated by a person having ordinary skill in the art upon a consideration of FIG. **3**A, the Pratt-style top chord **54***b* has an inherent resistance to toppling and/or falling over under concentrated loads, since its center of gravity (not shown) is below the support portions **52**.

[0112] In floor systems, and as best seen in FIG. **3**A, the truss members **50** according to the present invention may span from the building support member **20** (alternately referred to hereinafter as a "party wall") to the party wall **20** in an alternating sequence upon the building support members **20**. To accommodate this, it may have been generally thought, though it is not essential to the working of the present invention, that each of the truss members **50** may need to carry about twice the normal spans and therefore twice the loads. It may have been traditionally thought, though again not essential to the working of the present invention, that with the installation of ⅝" thick or ¾" thick sheathing members **26**, the maximum distance between sheathing support points thereunder should not exceed about 16" or about 24", respectively. According to the present invention, by positioning the truss members **50** at about double the usual spacing, the wall floor junction and bearing support problems may be overcome. To provide the desired level of comfort concerning whether adequate support is provided for the sheathing member **26** (hereinafter, alternately referred to at the "sub-floor"), the purlin members **120**, having the underside portions **124** with the notched portions **126** spaced therealong, are placed on top of the truss embers **50**, with the top chords **54***b* thereof nesting in the notched portions **126**. These purlin members **120** (hereinafter, alternately referred to as "notched purlins") are shown in detail, inter alia, in FIGS. **9** and **10**.

[0113] Also, though only the top chord **54***b* is shown in detail in FIG. **7**, it should be appreciated that the bottom chord **54***a* may preferably have a substantially identical profile. The top chord **54***b* (e.g., as shown in FIG. **7**) may preferably include, among other things, the two "L"-shaped chord portions **72**, the stiffening projections **68**, and the locator apertures **70** which are used to position the web members **80** within the top and bottom chords **54***a*, **54***b*.

[0114] The notched purlins **120** have the "C"-shaped purlin profile **132** and may preferably be placed structurally in their weakest axis against loads (not shown) to avoid and/or reduce an otherwise tendency to twist. Though not essential to the working of the invention, it is generally thought, that with the notched purlins **120** placed in their weakest axis against the loads, the shear center may run substantially directly inline with the load, such that there may be a reduced tendency for the LGS member to twist. The purlin members **120** according to the invention will preferably be sufficiently rigid to support the sub-floor sheathing **26**. In FIG. **3**A, the notched purlins **120** are shown in position over the truss members **50**, and may preferably be spaced from one another by the purlin on-center distance (as indicated generally by arrow "K") of about 16" or about 24".

[0115] The purlin member **120** which is used in floor systems (i.e., the floor purlin member **120***a* best seen in FIG. **19**) is fastened onto the top chord **54***b* by a purlin fastener

130 extending through a fastening aperture **128** in the purlin base portion **134**. The floor purlin member **120***a* (such as that shown in FIG. **17**) may be substantially flat adjacent the notched portions **126**, contributing substantially little or no structural strength in vertical loadings. This flatness may help to avoid creating a bump over the top chord **54***b*, but may or may not be necessary due to its intended use with features inherent in the sub-floor **26**. The notched purlins **120** provide the necessary support over the otherwise unsupported length "J" of 32" or 48", notwithstanding the flat element directly connecting to the top chord **54***b*.

[**0116**] According to one aspect of the present invention, the truss members **50** may preferably be supported at the support portions **52** that are located either on the top chord **54***b* or substantially adjacent thereto. Such a configuration allows the truss member **50** to "hang" so as to inherently reduce the chances of collapse under load conditions and so as to greatly reduce the secondary installation work that might otherwise be required in order to stabilize the floor system.

[**0117**] By spacing the truss members **50** twice the distance apart from one another, the present invention may provide one or more significant advantages over prior art systems—possibly making it easier to install HVAC (heating and air conditioning) components, as well as electrical and plumbing components. With the truss members being spaced the distance "J" from one another of 48" on-centers (hereinafter, alternately referred to as "OC"), and with wall studs being spaced from one another at about 16" OC, then in comparison to prior systems, two of every three prior floor trusses may not be required.

[**0118**] It may be additionally thought, though it is not essential to the working of the present invention, that the amount of deflection of the floor truss members **50** may be substantially dependent upon the modulus of elasticity for steel, Young's modulus (i.e., with E approximately equal to about 29,500,000 psi), which may be much higher for steel than for wood. The comparatively low modulus of elasticity for wood may mean that a typical 10" wood floor joist may deflect vastly more than one formed from LGS. Various governmental codes and standards may limit the acceptable amount of deflection for the truss member **50** under the load (not shown) to the unsupported spanning length (in inches) divided by 360. As a result, it may not be possible, for example, to provide double spans for most wood applications. As such, the concepts employed, and the functioning and utilities afforded, by the LGS construction of the present invention do not work the same way for, and do not have a historical equivalent in, wood applications.

[**0119**] Various features and capabilities of, and/or advantages afforded by, the present invention—e.g., alternating spacing of the truss members **50** as shown in FIG. **3**A, supporting the truss members **50** by the top chords **54***b* on the building support members **20**, forming the apparatus **40** from open-web truss members **50** and notched purlins **120**—are not present, either on their own or in combination with one another, in the prior art relating to the construction industry, and their use in floor and roof construction may preferably yield considerable cost savings and/or other great advantages over wood floor joist constructions.

[**0120**] A typical low rise hotel installation (e.g., about six building stories) according to the present invention is shown in FIG. **11**, where the walls **24** can be seen to divide the structure into first **25***a*, second **25***b*, and third **25***c* rooms.

[**0121**] One advantage of the apparatus **40**, with the notched purlins **120**, may be that the notched portions **126** may be generally provided at the distance "J" of either 32" or 48" apart. Accordingly, the notched portions **126** may preferably be used as a template for measuring the location and distance between adjacent ones of the floor truss members **50**. As such, in use, one may generally need only to locate a starting point, after which the measuring tape may be no longer required until completion of the unit **25***a*, **25***b*, **25***c*.

[**0122**] The "hat"-shaped design of the bottom and top chords **54***a*, **54***b*, which is best seen FIGS. **7**, **14** and **15**, may be relatively easy to fabricate and/or install. Such "hat"-shaped top chords **54***b* have not previously been used with notched purlins **120**, and such use may results in many benefits.

[**0123**] A further feature of the top chord **54***b*, which may be particularly useful when used in floor systems, is that base portion **58** of the top chord **54***b* includes a concave portion **62** (as best seen in FIGS. **14** and **15**). The concave portion **62** is defined between opposing ends **60** of the base portion **58** and faces in the upward direction (as indicated generally by arrow "F" in FIG. **14**). Through use of the concave portion **62**, a user may control the thickness of the adhesive **150** (e.g., glue) that is applied. Typically, as shown in FIG. **15**, the sub-floor **26** must be glued as well as screwed to the top chord **54***b* by a sheathing fastener **28** extending through a chord base aperture **63** in the chord base portion **58**. The glue **150** may help to reduce squeaking that might otherwise be caused by movement of the sub-flooring **26** and the surface where the bond is applied. The ability to control glue thickness, so that the predetermined amount **152** of the adhesive **150** is applied, helps to increase the chances that a minimum amount of the glue **150** may be applied—i.e., as it might otherwise be squeezed out leaving no glue between the surfaces.

[**0124**] As may be appreciated by persons having ordinary skill in the art upon a consideration of FIG. **15**, the use of the notched purlins **120** may help to provide improved (i.e., reduced) sound transmission characteristics underneath the floor sheathing **26**.

[**0125**] When used in roof systems, the notched purlins **120** (alternately herein referred to as roof purlin members **120***b* when used in such roof systems) as shown in FIGS. **12**, **13** and **16** may preferably include the up-set portion **144**. This feature may allow flow of air between the roof sheathing elements (not shown) and the top chord **54***b* so as to reduce the likelihood that moisture may become trapped.

[**0126**] As shown in FIG. **12**, the roof system includes top chords **54***b*, bottom chords **54***a*, and web members **80**. In prior art roof systems, the truss members may heretofore have been spaced at about 24" OC in order to comply with the maximum allowable unsupported span for a typical plywood or OSB board sheathing material. The top chords **54***b* in a roof system constructed according to the invention, however, may preferably be spaced at 48" OC with notched purlins **120***b* being spaced at 24" OC whilst still providing the desired level of support for the roof sheathing (not shown). Such a construction according to the present inven-

tion may save about ½ of the normal trusses which might otherwise have been installed according to the prior art.

[0127] In FIG. **13**, the roof purlin member **120***b* is shown with the up-set portion **144** being in the approximate order of about ⅞". Though not essential to the working of the present invention, it may be generally believed that such an up-set portion **144** may help to improve air circulation in the roof and to reduce the likelihood of moisture entrapment.

[0128] Various other modifications and alterations may be used in the design and manufacture of the truss and purlin support apparatus and in the method of making and using same with building supports and floor and roof sheathing according to the present invention without departing from the spirit and scope of the invention, which is limited only by the accompanying claims.

I claim:

1. A truss and purlin support apparatus for use with building support members and a substantially planar substrate sheathing member, said apparatus comprising:

a) a plurality of Pratt-style elongate truss members, each having at least two support portions longitudinally spaced from one another, with said support portions adapted to operatively engage and transfer loads to the building support members, with each of said truss members comprising an elongate top chord, an elongate bottom chord, and a plurality of web members securely extending between said top chord and said bottom chord; and

b) a plurality of purlin members, each extending in a substantially transverse direction relative to said elongate truss members, with each of said purlin members having an underside portion that is shaped to define a plurality of notched portions, with said notched portions being spaced from one another in said transverse direction along said underside portion, and with each of said notched portions saddled over a respective top chord of said truss members, so as to restrict sliding movement of said purlin members in said transverse direction; with said purlin members operatively supporting the substrate sheathing member thereon; and

wherein said top chord, said bottom chord, said web members, and said purlin members are constructed from roll-formed light gauge steel material.

2. An apparatus according to claim 1, wherein each of said truss members has a center of gravity that is operatively located below said support portions.

3. An apparatus according to claim 1, wherein neighboring ones of said truss members are spaced by a truss on-center distance in said substantially transverse direction that is selected from the group consisting of about 36 inches and about 48 inches.

4. An apparatus according to claim 3, wherein neighboring ones of said purlin members are spaced by a purlin on-center distance in a substantially longitudinal direction that is selected from the group consisting of about 16 inches and about 24 inches.

5. An apparatus according to claim 1, wherein each said top chord and each said bottom chord is shaped, in profile, so as to define:

a) a substantially "U"-shaped chord portion that includes two substantially planar chord side portions extending substantially at right angles from opposing ends of a substantially planar central chord base portion, with said chord side portions defining a web-receiving aperture therebetween; and

b) two substantially "L"-shaped chord portions, each of said "L"-shaped chord portions including a substantially planar first chord segment that extends in a substantially outward direction and substantially at right angles from a respective one of said chord side portions, and a substantially planar second chord segment that extends substantially at right angles from said first chord segment;

wherein, in each of said truss members, said web-receiving aperture of said bottom chord faces in a substantially upward direction and said web-receiving aperture of said top chord faces in a substantially downward direction, with each of said web members extending into each said web-receiving aperture, and securely engaging each said "U"-shaped chord portion, of said top chord and of said bottom chord.

6. An apparatus according to claim 5, wherein one or more of said central chord base portion and said chord side portions of each said top chord and each said bottom chord is shaped so as to define a stiffening projection substantially along a longitudinal extent thereof, whereby each said top chord and each said bottom chord is provided with structural rigidity.

7. An apparatus according to claim 5, wherein in each said top chord and in each said bottom chord, said chord side portions are shaped so as to define a plurality of longitudinally spaced locator apertures therein, and wherein each of said web members is provided with end portions that are each shaped to define a locator aperture mating portion, whereby each of said web members is located within each said web-receiving aperture, and securely engages each said "U"-shaped chord portion, of said top chord and of said bottom chord, with each said locator aperture mating portion being substantially securely aligned with one of said locator apertures.

8. An apparatus according to claim 5, wherein each of said truss members further comprises two support stiffening members, each securely engaging said top chord substantially adjacent to a respective one of said support portions, with each of said support stiffening members being positioned within said web-receiving aperture of said top chord, whereby said support stiffening members substantially maintain local structural integrity of said support portions whilst said support portions operatively transfer said loads to the building support members.

9. An apparatus according to claim 8, wherein each of said support stiffening members is shaped, in profile, so as to define a substantially "C"-shaped support stiffening portion that includes two substantially planar support side portions extending substantially at right angles from opposing ends of a substantially planar central support base portion, with said central support base portion being positioned substantially vertically within said web-receiving aperture of said top chord.

10. An apparatus according to claim 5, wherein each of said purlin members is shaped so as to define, remotely of said notched portions, a substantially "C"-shaped purlin profile that faces in said substantially downward direction.

11. An apparatus according to claim 10, wherein said "C"-shaped purlin profile is defined by a substantially planar

central purlin base portion and two substantially "L"-shaped purlin portions, with each of said "L"-shaped purlin portions including a substantially planar first purlin segment that extends substantially at right angles from one respective end of said purlin base portion, and a substantially planar second purlin segment that extends in a substantially inward direction and substantially at right angles from said first purlin segment.

12. An apparatus according to claim 11, wherein said chord base portion of said top chord securely engages said purlin base portion adjacent to one of said notched portions, with said chord base portion being substantially flush with said purlin base portion, whereby said chord base portion operatively substantially supports the substrate sheathing member.

13. An apparatus according to claim 12, wherein said opposing ends of said central chord base portion of said top chord define a concave portion therebetween, with said concave portion facing in said upward direction, with said apparatus further comprising a predetermined amount of an adhesive operatively interposed in adhering relation substantially between said concave portion and the substrate sheathing member.

14. An apparatus according to claim 11, wherein each of said purlin members is shaped so as to define, substantially adjacent to said notched portions, a substantially "U"-shaped purlin profile that faces in said substantially downward direction and includes two purlin side portions extending substantially at right angles from opposing ends of said purlin base portion, with said first purlin segment extending beyond said purlin side portions in said downward direction, wherein said purlin side portions securely engage said chord base portion of said top chord, with said purlin side portions defining an up-set portion that extends between each of said notched portions and said purlin base portion, whereby said chord base portion of said top chord is operatively vertically spaced from the substrate sheathing member.

15. An apparatus according to claim 1, wherein each of said web members is shaped, in profile, so as to define a substantially "C"-shaped web portion.

16. An apparatus according to claim 15, wherein said "C"-shaped web portion includes a substantially planar central web base portion and two substantially "L"-shaped web side portions, with each of said web side portions including a substantially planar first web segment that extends substantially at right angles from one respective end of said web base portion, and a substantially planar second web segment that extends in a substantially inward direction and substantially at right angles from said first web segment.

17. An apparatus according to claim 1, wherein each of said truss members further comprises two load distribution plates, each securely engaging said top chord, with each of said load distribution plates being operatively substantially interposed between a respective one of said support portions and one of the building support members, whereby said load distribution plates operatively transfer said loads to the building support members whilst substantially maintaining local structural integrity of the building support members.

18. An apparatus according to claim 17, wherein each of said load distribution plates is operatively securely fastened to one of the building support members.

19. A method of forming a truss and purlin support apparatus for use with building support members, said method comprising the steps of:

a chord forming step of roll-forming a plurality of top chords and bottom chords by passing first elongate sheets of light gauge steel material through a series of roll-forming chord tool sets, with passage of said first elongate sheets through each successive one of the chord tool sets progressively forming said top chords and said bottom chords;

a web forming step of roll-forming a plurality of web members by passing second elongate sheets of light gauge steel material through a series of roll-forming web tool sets, with passage of said second elongate sheets through each successive one of the web tool sets progressively forming said web members; and

a purlin forming step of roll-forming a plurality of purlin members by passing a plurality of third elongate sheets of light gauge steel material through a series of roll-forming purlin tool sets, with passage of said third elongate sheets through each successive one of the purlin tool sets progressively forming said purlin members, such that each of said purlin members has an underside portion that defines a plurality of notched portions that are longitudinally spaced from one another;

wherein each of said web members is adapted to be operatively secured between one of said top chords and one of said bottom chords to form elongate truss members, with said truss members securable on the building support members, wherein said truss members are adapted to be nested and secured within said notched portions of said purlin members, with said purlin members operatively extending in a transverse direction relative to said elongate truss members, and wherein each of said purlin members is adapted to operatively support a substantially planar substrate sheathing member thereon.

20. A method according to claim 19, further comprising a purlin sheet forming step, before said purlin forming step, of forming said plurality of said third elongate sheets with a plurality of opposed notch pairs along longitudinal edges thereof.

21. An apparatus according to claim 20, wherein in said purlin sheet forming step, neighboring ones of said opposed notch pairs are spaced by a truss on-center distance that is selected from the group consisting of about 36 inches and about 48 inches.

22. A method according to claim 19, wherein in said chord forming step, each of said top chords and said bottom chords is roll-formed so that a chord profile of each of said top chords and said bottom chords defines:

a) a substantially "U"-shaped chord portion that includes two substantially planar chord side portions extending substantially at right angles from opposing ends of a substantially planar central chord base portion, with said chord side portions defining a web-receiving aperture therebetween; and

b) two substantially "L"-shaped chord portions, each of said "L"-shaped chord portions including a substantially planar first chord segment that extends in a substantially outward direction and substantially at right angles from a respective one of said chord side portions, and a substantially planar second chord segment that extends substantially at right angles from said first chord segment; and

wherein said web-receiving aperture of each of said bottom chords operatively faces in a substantially upward direction and said web-receiving aperture of each of said top chords operatively faces in a substantially downward direction, with each of said web members being operatively adapted to extend into each said web-receiving aperture, and to be secured to each said "U"-shaped chord portion, of each of said top chords and said bottom chords.

23. A method according to claim 22, wherein in said chord forming step, one or more of said central chord base portion and said chord side portions of each of said top chords and said bottom chords is roll-formed so as to define a stiffening projection substantially along a longitudinal extent thereof.

24. A method according to claim 22, wherein in said chord forming step, a plurality of longitudinally spaced locator apertures are punched in said chord side portions of each of said top chords and said bottom chords; and wherein in said web forming step, a locator aperture mating portion is punched in each end portion of each of said web members, with each said locator aperture mating portion being adapted to be operatively aligned with one of said locator apertures.

25. A method according to claim 22, further comprising a support stiffener forming step of roll-forming a plurality of support stiffening members by passing said second elongate sheets through said series of roll-forming web tool sets, with passage of said second elongate sheets through each successive one of the web tool sets progressively forming said support stiffening members, such that a support profile of each of said support stiffening members defines a substantially "C"-shaped support stiffening portion that includes two substantially planar support side portions extending substantially at right angles from opposing ends of a substantially planar central support base portion; and

wherein said web-receiving aperture of each of said top chords is adapted to operatively receive two support stiffening members therewithin, with each of said support stiffening members being substantially adjacent to said support portions, and with said central support base portion being positioned substantially vertically.

26. A method according to claim 22, wherein in said chord forming step, said opposing ends of said central chord base portion of each of said top chords are roll-formed to define a concave portion therebetween, with said concave portion operatively facing in said upward direction, and with said concave portion adapted to operatively receive a predetermined amount of an adhesive.

27. A method according to claim 22, wherein in said purlin forming step, each of said purlin members is roll-formed so as to define, remotely of said notched portions, a substantially "C"-shaped purlin profile that faces in said substantially downward direction.

28. A method according to claim 27, wherein in said purlin forming step, said "C"-shaped purlin profile is roll-formed to include a substantially planar central purlin base portion and two substantially "L"-shaped purlin portions, with each of said "L"-shaped purlin portions including a substantially planar first purlin segment that extends substantially at right angles from one respective end of said purlin base portion, and a substantially planar second purlin segment that extends in a substantially inward direction and substantially at right angles from said first purlin segment.

29. A method according to claim 28, wherein in said purlin forming step, each of said purlin members is roll-formed so as to define, substantially adjacent to said notched portions, a substantially "U"-shaped purlin profile that faces in said substantially downward direction and includes two purlin side portions extending substantially at right angles from opposing ends of said purlin base portion, with said first purlin segment extending beyond said purlin side portions in said downward direction, with said purlin side portions defining an up-set portion that extends between each of said notched portions and said purlin base portion; and with said purlin side portions operatively engaging said chord base portion of each of said top chords, such that said chord base portion of said top chord is operatively vertically spaced from the substrate sheathing member.

30. A method according to claim 19, wherein in said web forming step, each of said web members is roll-formed so that a web profile of each of said web members defines a substantially "C"-shaped web portion.

31. A method according to claim 30, wherein in said web forming step, said "C"-shaped web portion is roll-formed to include a substantially planar central web base portion and two substantially "L"-shaped web side portions, with each of said web side portions including a substantially planar first web segment that extends substantially at right angles from one respective end of said web base portion, and a substantially planar second web segment that extends in a substantially inward direction and substantially at right angles from said first web segment.

32. A method of forming a truss and purlin support apparatus on building support members, said method comprising the steps of:

a truss assembling step of assembling a plurality of elongate truss members, each having a plurality of support portions longitudinally spaced from one another, and each being assembled by locating and securing a plurality of roll-formed web members between a roll-formed top chord and a roll-formed bottom chord;

a truss supporting step, after said truss assembling step, of locating and securing said support portions of said truss members on the building support members;

an apparatus assembling step of nesting and securing said truss members within a plurality of notched portions of a plurality of roll-formed purlin members, with said purlin members extending in a transverse direction relative to said elongate truss members, so as to restrict sliding movement of said purlin members in said transverse direction; and

a sheathing step, after said apparatus assembling step, of supporting a substantially planar substrate sheathing member on said purlin members.

33. A method according to claim 32, wherein in said truss supporting step, centers of gravity of said truss members are located below said support portions.

34. A method according to claim 32, wherein in said apparatus assembling step, neighboring ones of said purlin members are spaced in a substantially longitudinal direction by a purlin on-center distance that is selected from the group consisting of about 16 inches and about 24 inches.

35. A method according to claim 32, wherein in said truss supporting step, two load distribution plates, securely engaging said top chord, are substantially securely interposed between said support portions and the building support members.

36. A method according to claim 35, wherein in said truss supporting step, said load distribution plates are securely fastened to the building support members.

37. A method according to claim 32, wherein in said apparatus assembling step, each of said top chords is substantially flush with each of said purlin members; and wherein in said sheathing step, said top chord substantially supports the substrate sheathing member.

38. A method according to claim 37, further comprising a gluing step, before said sheathing step, of applying a predetermined amount of an adhesive to one of said substrate sheathing member and a upward-facing concave portion of said top chord; whereby, in said sheathing step, said predetermined amount of said adhesive is operatively interposed in adhering relation substantially between said concave portion and the substrate sheathing member.

39. A method according to claim 32, wherein in said apparatus assembling step, up-set portions of said purlin members substantially adjacent to said notched portions engage each said top chord; and wherein in said sheathing step, said top chord is vertically spaced from the substrate sheathing member.

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