United States Patent [19]

Menge

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[45] **Apr. 8, 1975**

[54] **METAL SUPPORT FOR WOOD STRUCTURAL ELEMENTS**

[75] Inventor: **Donald C. Menge**, Warren, Mich.

[73] Assignee: **Troy Steel Corporation**, Troy, Mich.

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[21] Appl. No.: **376,552**

[52] **U.S. Cl.** **52/669**; 52/657; 52/696; 52/751

[51] **Int. Cl.** **E04b 2/70**; E04c 3/292

[58] **Field of Search** ..... 52/368-377, 52/348-350, 650, 657, 664, 667, 669, 753 D, 753 Y, 751, 753 C, 693, 696, 643; 85/85

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Primary Examiner—Henry C. Sutherland

Attorney, Agent, or Firm—Hauke, Gifford, Patalidis & Dumont

[57] **ABSTRACT**

Deflection under load of flooring and roofing used in the construction of buildings and bridges; racking of side walls by wind pressure; racking of prefabricated structural units during shipping and handling; and the like is minimized by providing additional support for such structures such as by joining parallel wooden trusses or joists with a metal support strip inserted into transversely extending channels in the trusses or joists. The metal support strip is generally T-shaped with a narrow, generally U-shaped portion forming the base leg of the T. The strip is fastened, and the U-shaped portion spread outwardly, by driving a nail downwardly inside the U-shaped portion, through the bottom of the strip and into the joist or truss.

9 Claims, 14 Drawing Figures

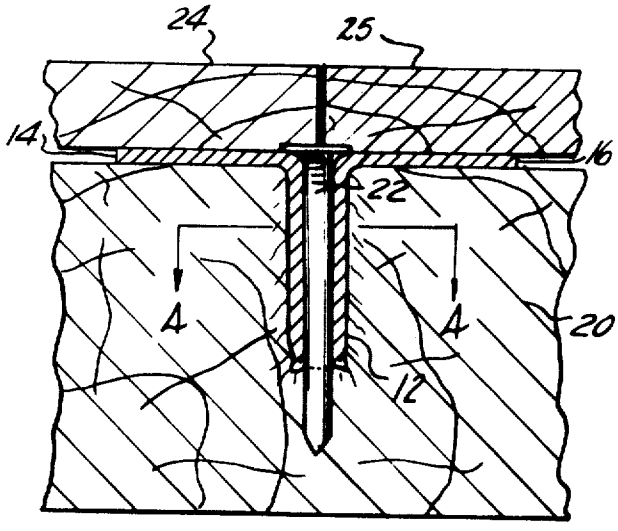
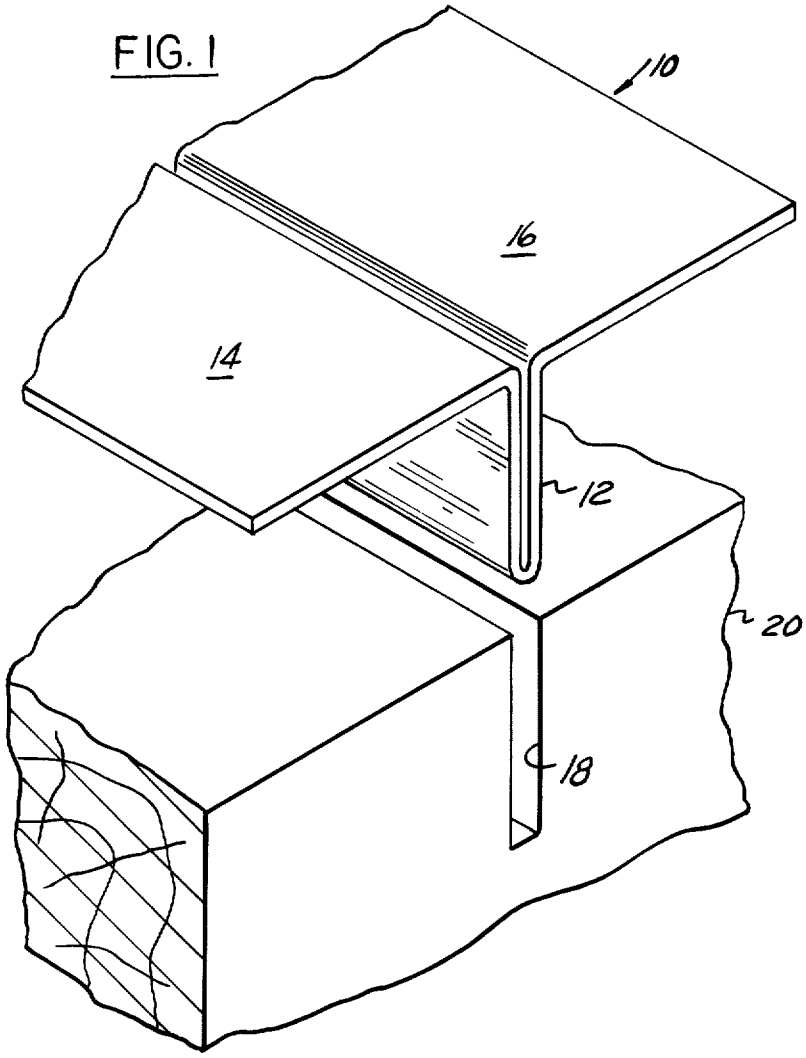


FIG. 1



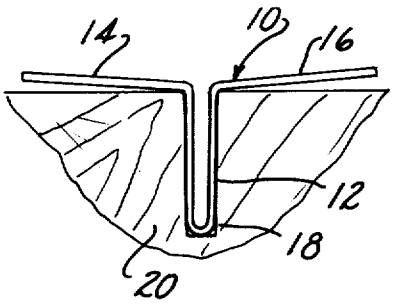


FIG. 2

FIG. 5

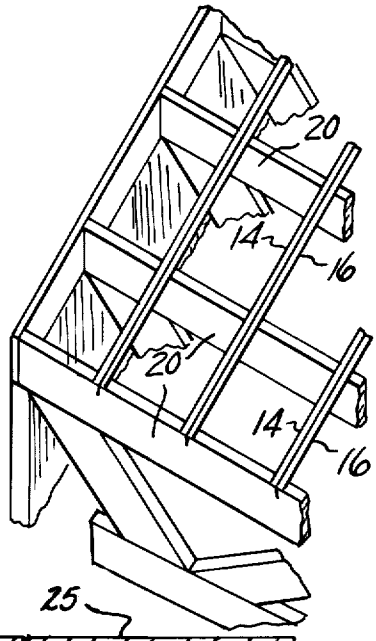
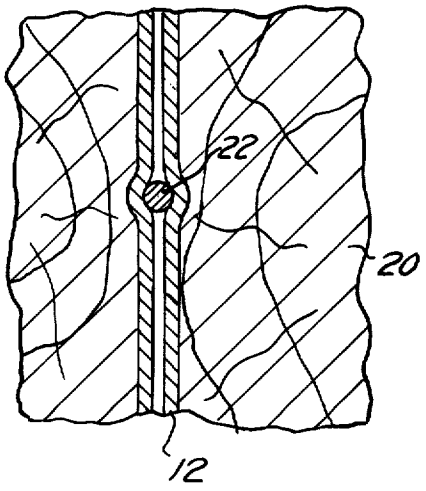


FIG. 4



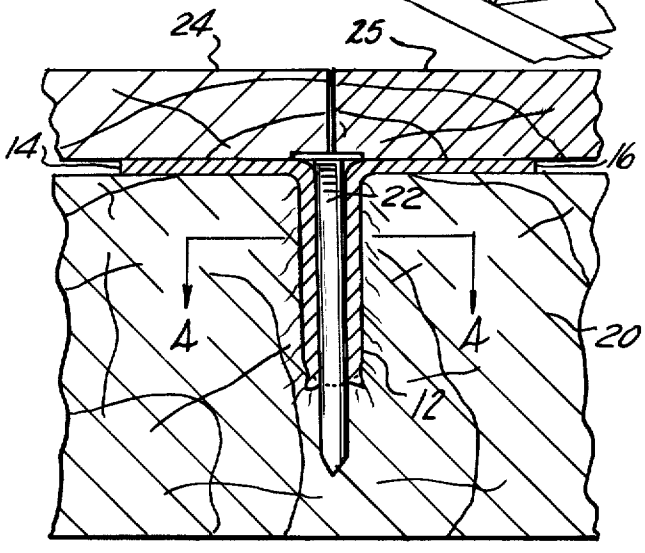


FIG. 3

FIG-6

1/2" Plywood Group I Underlayment

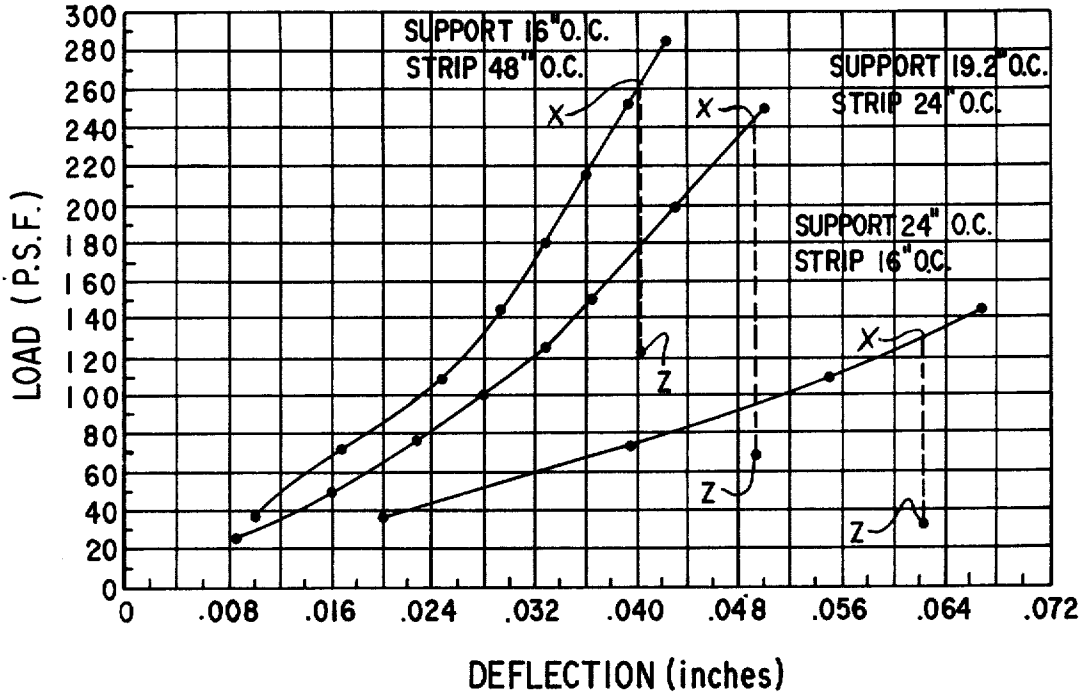
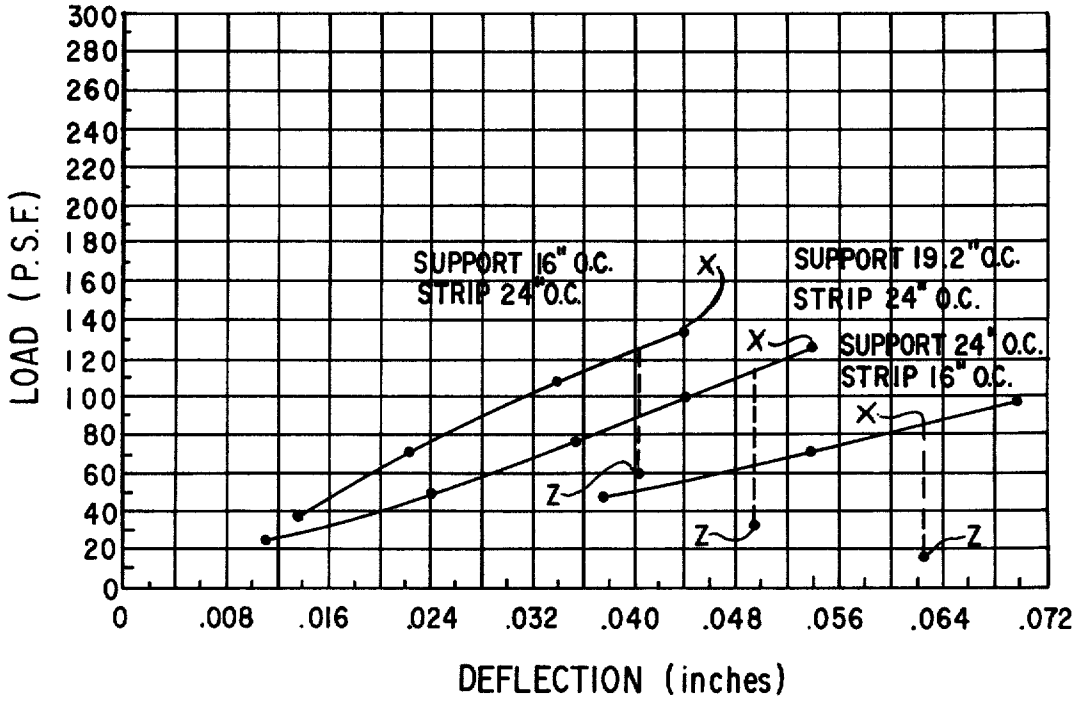


FIG-7

3/8" Plywood Sheathing



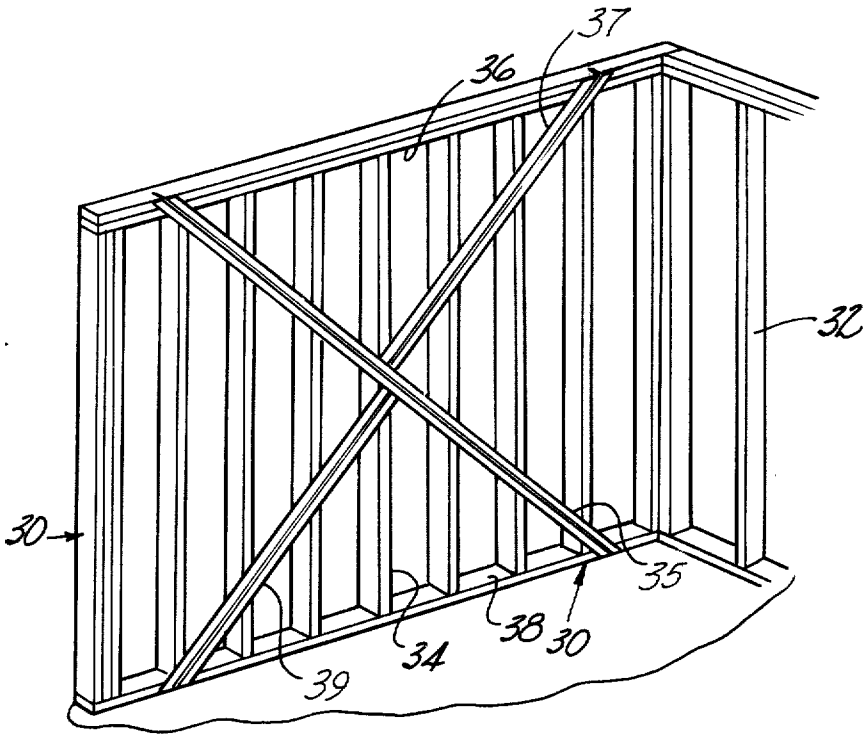


FIG-8

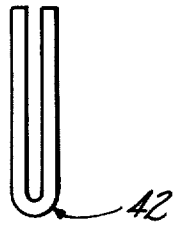


FIG-9

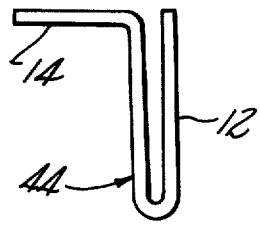


FIG-10

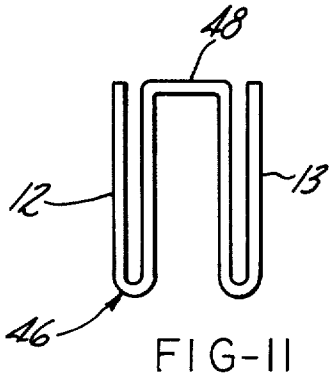


FIG-11

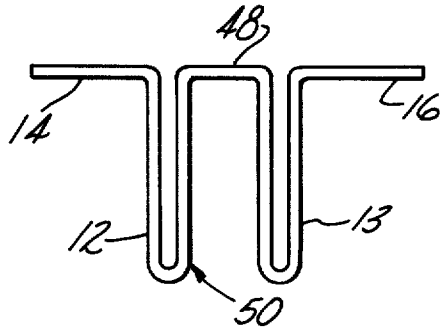


FIG-12

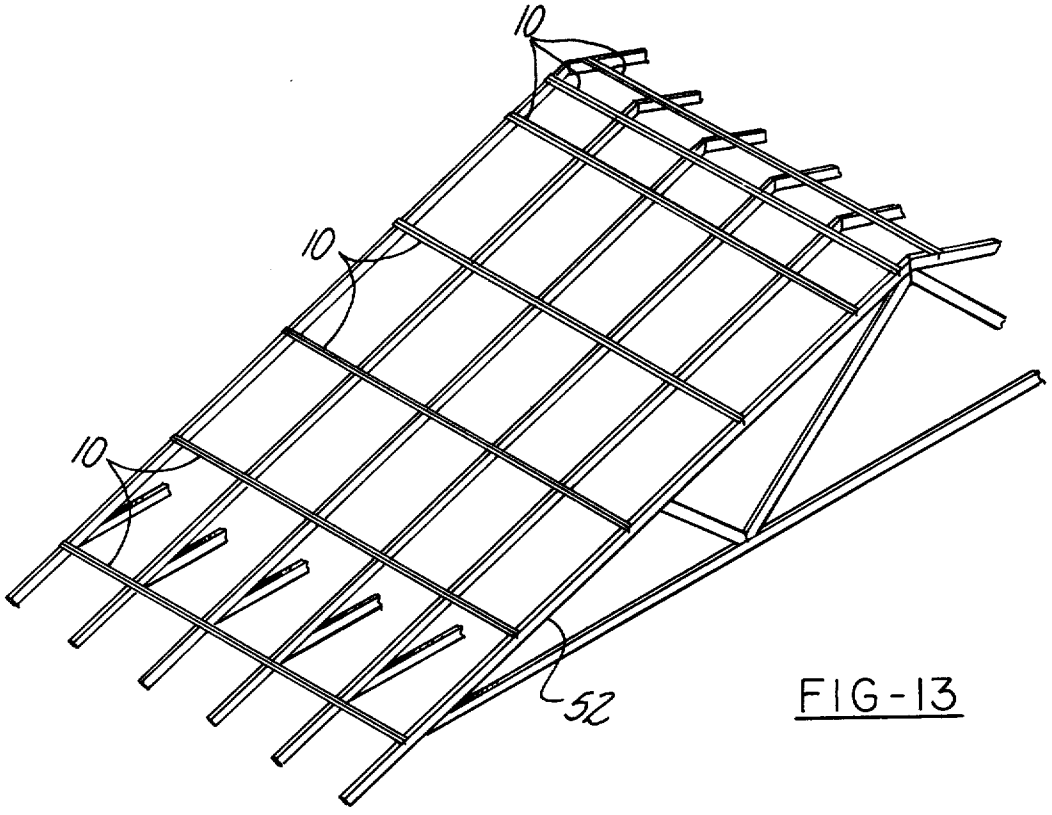


FIG-13

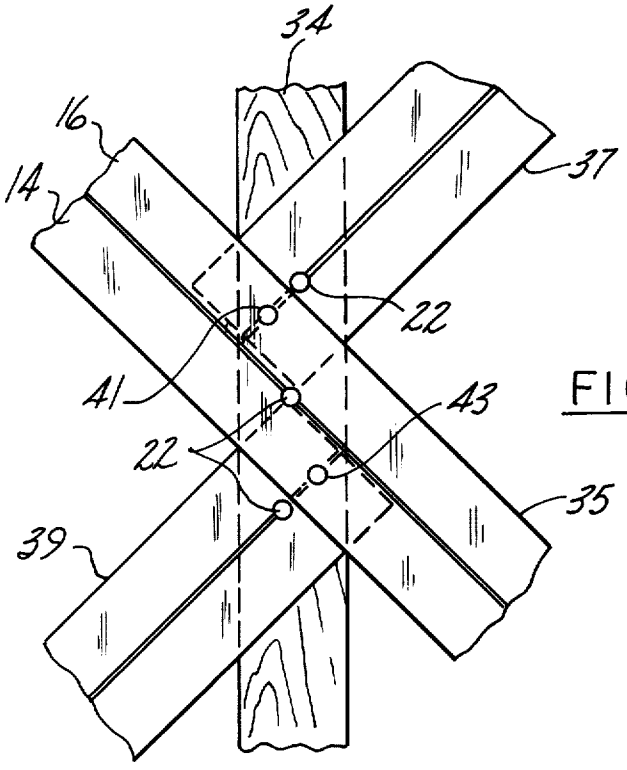


FIG-14

METAL SUPPORT FOR WOOD STRUCTURAL ELEMENTS

BACKGROUND OF THE INVENTION

The invention lies in the art of constructing buildings, bridges and the like wherein wooden trusses or joists are used to support flooring or other heavy structural elements. More specifically, the invention involves a structure which resists the tendency of parallel joists, or chords of trusses to rack under load and which increases the load carrying capacity of structural elements by increased support for such elements. The invention is here describes as applied to trusses supporting a floor and to wall joists under stress by wind, but it will be apparent that the invention can be used where any horizontal or vertical joist or truss supports heavy structural elements or resists forces such as the force of the wind. Therefore, the words "joist" and "truss" (or a chord of a truss) are interchangeable as used herein and the word "truss" will be used to mean any such structure.

An important property of a truss is strength and rigidity whereby it is able to prevent or minimize deflection of a floor which it supports. It is therefore important to provide, where possible, additional structural elements which impart added strength and rigidity to a floor to prevent or minimize deflection. In this connection the type of flooring laid on a truss is itself a factor in such rigidity. By way of example, plywood flooring over trusses with standard spacing, for allowable deflections, requires three-fourths inch tongue and groove plywood or requires three-fourths inch square edge plywood with blocking. It can be appreciated that considerable economic advantage would be derived if the same structure required only one-half inch square edged plywood, neither tongue and grooved nor blocked. This advantage would be gained partly because the smaller size plywood is cheaper, partly because tongue and grooving as well as blocking are expensive operations, partly because tongue and groove plywood is easily damaged from handling, and partly because lumber dealers need not maintain large stocks of more expensive flooring. This advantage is gained with the present invention.

Similarly, it is important that truss structures, when used in walls, prevent or minimize such distortions as racking wherein a rectangular construction unit, such as a side of a building, becomes a rhomboid under stress. In the case of wall structure, it can be appreciated that considerable economic advantage can be gained in applying satisfactory bracing if the builder can replace expensive "corner" plywood with regular sheathing, if the time consuming special nailing required with "corner" plywood can be avoided, and if the relatively expensive countersunk wood bracing can be eliminated. These advantages are gained with the present invention.

SUMMARY OF THE INVENTION

In the present invention, and where the structure is a floor, for example, spaced parallel narrow channels are cut transversely into the top surface of each of a plurality of parallel trusses. For example, a sawcut about one-half or three-eighths inch deep is typical of such a channel. In the case of floors the channels are usually made perpendicular to the longitudinal axis of the truss and, in the case of walls, are usually made at

an angle of 45 degrees to said axis. However, the angle which the transverse channel forms with the truss will depend on the specific truss structure involved and the forces tending to deflect or distort it. A metal support strip, preferably generally T-shaped in cross section and having a narrow, generally U-shaped base leg portion and upper flange portions, is inserted into aligned channels of the parallel trusses in a manner such that the U-shaped portion fits snugly into each channel and the top flange portions of the T initially lie against or in part engage the top surfaces of the trusses. The support strip is fastened, and the U-shaped portion is spread outwardly against the sides of each channel, for example, by driving a nail downwardly inside the U-shaped portion, through the bottom of the support strip, and into the truss.

The metal support strip can take a variety of forms in addition to the preferred form. For example, it can consist solely of the U-shaped base leg (the plywood resting on the upper edges of the U), it can have a single flange extending outwardly from the leg, the flange can take the form of a web joining two such legs, there can be two legs joined by a web with oppositely disposed single flanges extending outwardly from each leg, and the like. In the context of the metal support strip of the invention a web joining two U-shaped leg portions is considered equivalent to a flange extending from both of said legs.

Where the structure involved is a wall, for example, aligned narrow channels are cut transversely, preferably at an angle of 45°, in a row of trusses and in the stringers which join the ends of the trusses. The metal support strip is then positioned snugly into the aligned channels and secured as described above. The secured support strip functions in the manner of a very taut steel cable.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a portion of the metal support strip and truss channel of the invention as they appear before the base leg portion of the strip is inserted into the channel;

FIG. 2 is a cross-sectional view of a preferred metal strip of the invention as initially inserted into a truss channel;

FIG. 3 is a cross-sectional view of the metal strip of the invention nailed in place in a truss channel, with an overlying floor.

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a perspective view of a portion of a supporting structure for a floor showing the metal support strip of the invention positioned transversely to wooden trusses;

FIG. 6 is a graph of weight load versus the deflection of a floor constructed using the present invention;

FIG. 7 is a second graph of weight load versus the deflection of a floor constructed using the present invention;

FIG. 8 is a perspective view of a wall braced in accordance with the principles of the invention;

FIGS. 9–12 are diagrammatic views showing various configurations of the support strip of the invention;

FIG. 13 is a fragmentary view, in perspective, of a prefabricated truss structure for supporting a roof; and

FIG. 14 is a plan view, in more detail, of the intersection of the support strips shown in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A generally T-shaped metal strip **10,** having a narrow generally U-shaped base leg portion **12** and upper flange portions **14, 16,** is formed to fit snugly into narrow channels, or sawcuts **18,** each such channel extending transversely across the surface of each of a plurality of parallel upper chords of trusses **20.**

Nails, such as at **22** in FIG. **3,** are driven into the inside of the U-portion of the metal strip **10,** through the bottom of said U-portion, and into the truss **20.** Flooring, such as plywood flooring numbers **24** and **25,** are laid over the grid formed by parallel trusses **20** and the spaced parallel support strips **10** lying perpendicular to said trusses.

The channel **18** can be made in any suitable manner, but a transverse cut, or kerf, with a saw has proven quite efficient. The metal strip **10,** by way of example, can be about **2** inches in width, about one-half inch deep, and formed from about **16** to **20** gauge steel. Again by way of example, the outside width of the U-portion can be about one-eighth inch. It is not necessary that the metal strip **10** be in the form of a perfect T. Rather advantage is gained in the form of more positive contact between the flooring and the metal strips if the flanges forming the upper part of the T form a dihedral angle slightly greater than 90°, preferably one or several degrees greater than 90°, with the bottom portion of the T, as indicated in FIG. **2.**

FIGS. **6** and **7** shows graphs of weight load on a section of flooring versus the deflection of a plywood floor. In FIG. **6** the flooring is a one-half inch plywood, Group 1 underlayment, and in FIG. 7 the flooring is a three-eighths inch plywood sheathing. In both cases the plywood was square edged (not tongue and grooved) and was not blocked. Rather, the plywood **24, 25** rested directly on the flanges **14, 16** of the metal support strips (as shown in FIG. **3**). The metal support strips used in the reported tests were 2 ⅛ inch wide, one-half inch deep, one-eighth inch across the bottom portion, and were made from **20** gauge galvanized steel.

The curves of FIG. **6** represent a 16 inch, 19.2 inch and a 24 inch spacing, respectively, of the trusses (labeled "support") and a 48 inch, 24 inch, and 16 inch spacing, respectively, of the metal support strip (labeled "strip"). The points marked X on each curve represent the weight load which effects the highest allowable deflection, the latter being 1/360 of the span between the trusses. The points marked Z represent control points; that is, the weight load which effects the highest allowable deflection in the absence of the support strip. The dotted line joining a point X and a point Z represents the increment gain of weight load for the particular maximum deflection involved.

The three floor constructions noted in FIG. **6,** using one-half inch Group 1 underlayment are recommended for use in residential and commercial sub-flooring. The Group 1 plywood provides a smooth surface to accept tile or carpeting.

Thus, in FIG. **6,** referring to the curve representing a floor wherein the trusses are 16 inches between centers and the support strips are 48 inches between centers the floor supports a weight of about 260 pounds per square foot (point X) at the allowable deflection. In the absence of the support strip a load of about 120 PSF effects the maximum allowable deflection (point Z).

Similarly, referring to the curve representing a floor wherein the trusses are 19.2 inches between centers and the support strips 24 inches between centers, the floor supports a weight of about 240 pounds PSF at the allowable deflection as compared to about 70 PSF in the absence of the strip. Similarly, referring to the curve representing a floor wherein the trusses are 24 inches netween centers and the support strips are 16 inches between centers, the floor supports a weight of about 130 PSF at the allowable deflection as compared to about 30 PSF in the absence of the strip.

The floor constructions noted in FIG. **7,** using three-eighths inch square edge plywood sheathing, are recommended for working floors that will later support 1 ⅝ inch lightweight concrete.

Thus, in FIG. **7,** referring to the curve representing a floor wherein the trusses are 16 inches between centers and the support strips 24 inches between centers, the floor support a weight of about 128 PSF at the allowable deflection as compared to about 60 PSF in the absence of the strip. Similarly, referring to the curve representing a floor wherein the trusses are 19.2 inches between centers and the support strips are 24 inches between centers, the floor supports a weight of about 116 PSF at the allowable deflection as compared to about 35 PSF in the absence of the strip.

The final curve of FIG. **7,** which represents a floor wherein the trusses are 24 inches between centers and the strips 12 inches between centers, illustrates the case where a weight of less than 100 PSF (in this case about 85 PSF) effects the highest allowable deflection. This latter arrangement, however, is considered satisfactory for a floor which is to support lightweight concrete with reinforcing mesh or an additional underlayment of one-fourth inch plywood to accept carpeting or tile. In the absence of the strip, however, about 16 PSF effects the maximum allowable deflection as compared to about 85 PSF with the strip.

Referring to FIG. **8,** a wall indicated generally at **30** is shown as perpendicular to a second wall **32.** Wall **30** is constructed of a group of parallel joists, such as joist **34,** secured to stringers **36** and **38.** Strips **35, 37** and **39** inserted into aligned channels (not shown) in joists **34** and in stringers **36** and **38.** Nails, such as nail **22,** are driven into the inside of the U-portion of the strips **35,** 37, and **39** in the same manner as illustrated in FIGS. **3** and **4.** Wall **30,** constructed as shown, is not only rigid but serves to prevent racking of wall **32** by wind pressure.

As shown in FIG. **14** a preferred manner of intersecting the support strips **35, 37** and **39** invovles terminating the strip **37** and **39** at the base portion of strip **35** and positioning a portion of each of the former between strip **35** and joist **34.** Nails **22** are driven through the base portions of the respective strips in the manner illustrated in FIG. **3.** Nail **41** is driven through flange **16** of strip **35** as well as through strip **37.** Similarly, nail **43** is driven through flange **14** of strip **35** as well as through strip **39.**

Although FIGS. **8** and **14** illustrate intersecting support strips **35, 37** and **39;** it will be apparent that only one strip, such as strip **35,** can be used where the strength requirements are not so severe.

Referring to FIGS. **9–12,** a strip **42** consists of a U-shaped portion without flanges; a strip **44** consists of a

U-shaped portion **12** having one flange **14** extending outwardly perpendicularly from the portion **12**; a strip **46** consists of two U-shaped portions **12** and **13** joined by the web (or flange) **48**; and a strip **50** consists of two U-shaped portions **12** and **13**, two flanges **14** and **16**, and a web portion **48**.

Referring to FIG. **13** a bank of six individual trusses, such as truss **52**, are prefabricated by joining them by means of the support strip **10** of the invention in the same manner as illustrated in FIGS. **2–5**, inclusive.

Walls **30** and **32**, constructed as described above (FIG. **8**) can be covered with regular sheathing. The relative expensive "corner" plywood is not required. Further, the special nailing required with the use of corner plywood can be eliminated. In addition to these advantages installation of the support strip of the invention is less costly than comparable wood bracing.

Use of the support strip of the invention in the top chord of a roof truss (FIG. **13**) provides a strong resistance to racking where, for example, the trusses are placed in banks of four, six, etc. The strip can support the long edge of the roof plywood and eliminate the need for plywood clips as well as any bracing, including the usual expensive temporary bracing which is both costly to install and costly to remove. An added advantage to this use in roof trusses is that the roof trusses can be pre-assembled in, for example, banks of four or six with the necessary plywood attached. This step minimizes damage to the truss in handling as by a crane, for example, when a prefabricated section is lifted from the ground to a second floor or to a roof.

Where the support strip of the invention is to be used in a prefabricated roof, for example, nail-receiving holes can be put through the U-shaped portion, said holes being spaced the same distance as successive trusses. The presence of such holes makes location of the center line of the truss, for purposes of nailing, very simple and much more accurate, and avoids a substantial expenditure of a carpenter's time on the job.

It will be apparent to one skilled in the art to which the invention pertains that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a wooden truss structure or the like for supporting structural elements the improvement which comprises:

a. a plurality of spaced wooden truss elements;

b. a narrow transversely extending channel in each said truss element, said channels being aligned in a manner to receive a straight metal strip inserted therein;

c. a metal support strip comprising a portion generally U-shaped in cross section, said U-shaped portion being positioned snugly in said channels; and

d. nail means extending downwardly inside said U-shaped portion, through the bottom of said U-shaped portion and into the wood defining each said channel in a manner to fasten said strip in each said channel and to effect the spreading of the sides of said U-shaped portion tightly against the sides of said channel.

2. The structure according to claim **1** and additionally comprising a flange extending outwardly approximately perpendicularly from the top of said U-portion, said flange lying against the surface of said truss.

3. The structure according to claim **2** wherein said strip comprises two such flanges to form a strip which is generally T-shaped in cross section.

4. The structure according to claim **2** comprising two such channels and wherein said strip comprises two such portions joined by said flange, each said channel snugly containing one of said portions.

5. The structure according to claim **3** comprising two such channels and wherein said strip comprises two said T-shaped sections having a common flange, each said channel snugly containing one of said portions.

6. The structure according to claim **3** wherein a plurality of such truss elements and a plurality of such strips form a grid and wherein there are in each of said truss elements a plurality of said channels and there are a corresponding plurality of said strips, said truss elements being substantially parallel to each other and said strips being substantially parallel to each other and perpendicular to said truss elements.

7. A floor comprising:

a. a plurality of spaced parallel trusses or the like;

b. a plurality of spaced parallel narrow channels extending transversely across the surface of each of said trusses;

c. a plurality of spaced parallel metal support strips positioned perpendicular to said trusses to form a grid therewith, each said strip being a unitary element generally T-shaped in cross section and having a generally U-shaped base leg portion and upper flange portions; said U-shaped portion positioned snugly in aligned channels in said parallel trusses and said flange portions lying against truss surfaces;

d. nail means extending downwardly inside said U-shaped portion, through the bottom of said U-shaped portion and into the wood defining each said channel in a manner to fasten said strip in each said channel and to effect the spreading of the sides of said U-shaped portions against the respective sides of said channels;

e. plywood panels secured to said trusses and resting on said flange portions.

8. A wall comprising:

a. a plurality of spaced parallel trusses or the like;

b. a plurality of aligned narrow channels, each extending transversely across the surface of one of said trusses;

c. a metal support strip spanning said trusses, each said strip being a unitary element generally T-shaped in cross section and comprising a generally U-shaped base leg portion, said U-shaped portion positioned snugly in said aligned channels; and

d. nail means extending downwardly inside said U-shaped portion, through the bottom of said U-shaped portion and into the wood defining each said channel in a manner to fasten said strip in each said channel and to effect the spreading of the sides of said U-shaped portions against the respective sides of said channels.

9. The wall according to claim **8** and comprising stringers joining ends of said trusses and wherein each of said stringers is provided with one such aligned channel snugly containing said portion of said strip.

* * * * *