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METAL ROOF TRUSS

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FIELD OF THE INVENTION

The present invention relates generally to a metal roof
5 truss and relates particularly, though not exclusively, to
a method of forming a metal roof truss and its components
including elongate stiffening webs and chord members.

SUMMARY OF THE INVENTION

10 According to one aspect of the present invention there is
provided a metal roof truss comprising:

a lower chord member at opposing ends being connected
to respective of a pair of upper chord members; and

a plurality of elongate compression webs at opposing
15 ends being connected to the lower chord member and one of
the upper chord members, respectively, the compression
webs and said chord members each being of a channel
section profile, one or more of the compression webs at
opposing ends being configured wherein opposing flanges of
20 said compression web are cut or otherwise preformed to
engage the lower chord member and/or said one of the upper
chord members whilst a protruding end web portion of said
compression web is mounted flush with a corresponding web
of said chord member.

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It has been found that this engagement or contact of the
flanges of the compression web with the upper or lower
chord member increases the structural performance of the
roof truss.

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Preferably, the lower and upper chord members together
with the plurality of compression webs are arranged in the
same plane.



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Preferably, the chord members and the compression webs are of a substantially identical sectional profile. More preferably the chord members and the compression webs include a web and an opposing pair of flanges each having a free edge portion turned inwardly of the chord member or compression web.

Preferably at least one of the flanges of the lower chord member at its opposing ends is cut or otherwise preformed to engage or contact respective of the upper chord members.

Preferably the chord members and/or the compression webs are in sectional profile asymmetric wherein one of the opposing flanges is of a reduced height compared to the other of said flanges. More preferably, a pair of the chord members and/or compression webs are designed to interlock with one another to form a closed section. In one embodiment the web and/or the flanges of the chord members and/or the compression webs include a longitudinally extending stiffening rib.

Preferably interconnected of the chord members and the compression webs include preformed holes which are mutually aligned for fixing of the roof truss. More preferably the chord members and the compression webs are fixed together via one or more fasteners which engage the preformed and aligned holes. Fasteners commercially available in Australia under the trade mark TRUSSTITE are particularly suited.

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- Preferably, the pair of upper chord members are at an upper end connected to one another with an apex plate. More preferably the apex plate is elongate and at least one of its opposing longitudinal edges includes a
- 5 stiffening flange. In one embodiment the stiffening flange includes a lip formed orthogonal to the apex plate and the apex plate is fixed to the chord members via a plurality of apex fasteners.
- 10 According to another aspect of the present invention there is provided a method of forming a plurality of elongate stiffening webs and/or chord members of a metal roof truss, said method comprising the steps of:
- forming one or more pairs of opposing notches in
- 15 elongate strip metal; and
- roll forming the elongate strip metal to form said stiffening webs and/or chord members continuous with one another and of a channel section profile.
- 20 Preferably, the pair of opposing notches provide a frangible connection at the juncture of the stiffening webs and/or chord members, the frangible connection permitting separation of said webs and/or chord members after roll forming. Generally the frangible connection is
- 25 provided at the juncture of a web of adjoining of the webs and/or the chord members. More preferably the separation is effected by manipulation only without cutting or separation tools.
- 30 Preferably said step of forming the notches involves punching or stamping the strip metal.

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Preferably the method also comprises pre-forming fastener holes in opposing ends of the stiffening web and/or the chord member. More preferably the fastener holes are prepunched in a web of the channel section profile.

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According to a further aspect of the present invention there is provided a method of forming a metal roof truss, said method comprising of steps of:

- providing processing means and printing means being
- 10 arranged to operatively communicate with one another;
- inputting design information to the processing means wherein the metal roof truss configuration and fixing details are calculated; and
- printing at least the fixing details on components of
- 15 the metal roof truss.

Preferably the fixing details are printed on the component of the roof truss to which the detail applies. More preferably the fixing details are printed on elongate

20 stiffening webs and/or chord members of the metal roof truss.

Preferably, printing of the fixing details involves ink-jet printing on strip metal from which the roof truss

25 component is thereafter to be roll formed.

Preferably, the inputting of design information involves inputting dimensional and loading data pertaining to a building structure on which the metal roof truss is to be

30 erected.

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According to yet another aspect of the present invention there is provided a method of forming a metal roof truss, said method comprising the steps of:

- providing processing means to which design
- 5 information is inputted for the calculation of the roof truss configuration, and means for notching metal strip from which components of the metal roof truss are to be roll formed, said notching means being arranged to operatively communicate with the processing means; and
- 10 notching the metal strip utilising the notching means wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between adjacent components of the metal roof truss and being shaped dependent on the roof truss
- 15 configuration.

According to yet a further aspect of the present invention there is provided an apparatus for forming a metal roof truss, said apparatus comprising:

- 20 processing means to which design information is inputted for the calculation of the roof truss configuration; and
- means for notching metal strip from which components of the metal roof truss are to be roll formed, said
- 25 notching means being arranged to operatively communicate with the processing means wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between adjacent components of the metal roof truss and being shaped
- 30 dependent on the roof truss configuration.

Generally the adjacent components include one or more elongate stiffening webs and/or chord members.

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Preferably, the apparatus also comprises a roll former
operatively coupled to the notching means whereby the
prenotched metal strip is roll formed into a channel
5 section profile.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to achieve a better understanding of the nature
of the present invention a preferred embodiment of a metal
10 roof truss together with the various other aspects of the
invention will now be described, by way of example only,
with reference to the accompanying drawings in which;

Figure 1 is a perspective view of a metal roof truss;

Figure 2 is an exploded perspective view of the metal
15 roof truss of Figure 1;

Figure 3 is front and rear detailed views of a web to
chord connection of the roof truss of Figure 1;

Figure 4 is front and rear detailed views of a heel
connection of the metal roof truss of Figure 1;

20 Figure 5 is a perspective view of pre-notched strip
steel of roof truss components prior to roll forming;

Figure 6 is a perspective view of an apex plate of
the metal roof truss of Figure 1; and

Figure 7 is a block flow diagram of the general
25 process steps involved in forming a metal roof truss
according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Figure 1 there is a metal roof truss 10
30 comprising a lower chord member 12 at opposing ends being
connected to respective of a pair of upper chord members
14 and 16. The metal roof truss 10 also comprises a
plurality of elongate stiffening webs such as 18 and 20

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which at opposing ends are connected to the lower chord member 12 and one of the upper chord members 14 respectively. In this example one of the stiffening webs is a compression web 18 whereas the other stiffening web is a tension web 20. The metal roof truss 10 of this embodiment is shaped generally triangular wherein adjacent ends of the upper chord members 14 and 16 are connected at an apex connection 22. Opposite ends of the upper chord members 14 and 16 are connected to opposing ends of the lower chord member 12 at respective heel connection such as 24. However, it should be appreciated that the metal roof truss configuration may vary from that described whilst remaining within the ambit of the invention, for example the bottom chord may include more than one chord member and similarly the pair of upper chord members may be extended to multiple chords.

As shown in Figure 2 the lower and upper chords 12 to 16 together with the stiffening webs such as 18 and 20 are cold roll formed from strip steel into a channel section profile including a web 26 and an opposing pair of flanges such as 28 and 30. The flanges 28 and 30 include free edge portions which are turned inwardly toward one another. The bottom and top chords 12 to 16 together with the stiffening webs 18 and 20 are fabricated from relatively light gauged strip steel typically of a thickness of 0.75mm such as that commercially available in Australia.

According to one aspect of the invention opposing ends of the stiffening webs such as 18 and 20 are configured wherein opposing flanges such as 28 and 30 of the respective stiffening web 18 or 20 engage the lower chord 12 and one of the upper chords such as 14.

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This is best illustrated in Figure 3 where according to one embodiment the engagement or contact of the flanges such as 28 and 30 of the compression web 18 increases the structural performance of the roof truss 10. The lower and upper chords 12 to 16 together with the stiffening web such as 18 and 20 are arranged in the same plane and the respective webs such as 26 of the stiffening webs such as 18 and the chord members such as 12 are flush with one another. Importantly, the flanges such as 28 and 30 of the compression webs 18 are at opposing ends cut or otherwise preformed to engage or contact the lower and upper chords 12 and 14, respectively. The "depth" to which the flanges such as 28 and 30 are cut is dictated by the orientation of the stiffening web relative to the chord member such as 18 and 12 respectively.

The stiffening webs such as 18 and 20 and the lower or upper chord members 12 to 16 include preformed holes such as 32 and 34 which are mutually aligned for fixing of the roof truss 10. Screw fasteners such as those commercially available in Australia under the trade mark TRUSSTITE which have a relatively coarse thread, engage the aligned holes such as 32 or 34 so as to fix the stiffening web to the lower chord 18 and 20 respectively. The aligned holes such as 32 and 34 are generally prepunched in the strip steel from the chord member such as 12 or stiffening web 18 is roll formed.

As shown in Figure 4 the opposing flanges such as 28 and 30 of the upper chord member 14 are similarly preformed at one end to form the heel connection 24. The flanges 28 and 30 are cut or otherwise preformed at opposing ends of the

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upper chord member 14 wherein the flanges 28 and 30 engage or contact the lower chord 12. The lower and upper chords 12 and 14 also include preformed and mutually aligned holes such as 38 which is engaged by a TRUSSTITE or other
5 fastener for fixing of the lower and upper chords 12 and 14. The engagement or contact of the flanges 28 and 30 of the upper chord 14 with a corresponding flange such as 28 of the lower chord 12 further increases the structural performance of the roof truss 10. The "depth" to which the
10 flanges 28 and 30 of the upper chord 14 or 16 are cut or otherwise preformed is dictated by the configuration of the roof truss 10 and in particular the angle of the upper chord member 14 or 16 relative to the lower chord 12.

15 The channel section chords 12 to 16 and stiffening webs such as 18 and 20 of this embodiment are asymmetric in sectional profile. One of the opposing flanges such as 28 is of a reduced height compared to the other of said flanges such as 30 wherein a pair of channel section
20 chords or webs such as 12 or 18 are designed to interlock with one another to form a chord or stiffening web of a closed section. The chords 12 to 16 and/or stiffening webs 18 and 20 may include one or more longitudinally extending stiffening ribs. Preferably, the stiffening ribs are
25 formed in the web such as 26 of the channel section.

According to another aspect of the invention there is a method of forming elongate stiffening webs such as 18 and 20 and/or chord members such as 12 to 16. As shown in
30 Figure 5 this embodiment of the method involves preforming one or more pairs of opposing notches such as 36 and 38 in elongate strip steel 40. The pair of opposing notches such as 36 and 38 provide a frangible connection at the

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junction of, in this example, adjacent stiffening webs such as 18 and 20. The preformed opposing notches 36 and 38 are shaped so that:

- i) the adjacent stiffening webs 18 and 20 of this embodiment can, after roll forming of the section, be separated by manipulation or by repeated bending of the adjacent webs 18 and 20;
- ii) opposing flanges such as 28 and 30 of the respective stiffening web 18 or 20 contact the lower chord 12 or upper chord 14 or 16 when the roof truss 10 is erected.

In this example the opposing notches such as 36 and 38 extend part way into the web such as 26 of the corresponding stiffening web 18 or 20. Thus, the web 26 is sufficiently weakened at the juncture of the stiffening webs 18 and 20 to allow separation of the stiffening webs 18 and 20. However, the frangible connection is sufficiently strong to retain the connection between adjacent metal roof components such as the stiffening webs 18 and 20 during roll forming. Therefore, the various components of the metal roof truss such as the stiffening webs 18 and 20 can be fabricated as a "string". For example, the stiffening webs such as 18 and 20 together with the other stiffening webs of the roof truss 10 can be fabricated as a single "string" and separated prior to erection of the metal roof truss 10. Similarly, for relatively small trusses the upper and lower chords such as 12 to 16 may be linked in a "string". This increases the speed at which the metal roof truss components can be fabricated, reduces the risk of losing components, and facilitates the erection of the metal roof truss such as 10.

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The prenotched chords such as 12 to 16 and stiffening webs 18 and 20 may also be preholed to facilitate subsequent assembly. In this instance fastener holes such as 32 and 34 are formed in opposing ends of the respective

5 stiffening webs such as 18 and 22 together with mutually aligned fastener holes formed in this example in the bottom chord 12. The fastener holes such as 32 and 34 are prepunched in the web such as 26 of the respective roof truss component either before, after, or during

10 prenotching of the strip steel such as 40. The prenotched and preholed strip 40 is then cold roll formed into the channel section depicted in Figure 2. The roll former is relatively low cost and "dumb" whereas the prenotching and preholing of the strip steel is to be effected with a

15 relatively high degree of precision. This ensures that on fixing and erection of the metal roof truss such as 10 the flanges such as 28 and 30 of for example the stiffening webs 18 and 20 bear against the lower and upper chords 12 and 14 respectively.

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Figure 6 illustrates an apex plate 42 to be included in the apex connection 22. The apex plate 42 is elongate and includes a stiffening flange 44 along one of its longitudinal edges. The stiffening flange 44 is defined by

25 a lip which is bent at right angles to the apex plate 42. The apex plate 42 is screwed or otherwise fixed to the webs of adjoining top chords 14 and 16. The apex plate 42 is oriented generally horizontally with the stiffening flange 44 located between the top chords 14 and 16 and

30 directed inwardly of the roof truss 10. The apex plate 42 is suited to a range of apex connections up to an angle of around 40 degrees. The apex plate 42 includes a plurality of preformed holes such as 46 arranged for fixing of the

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apex plate 42 to the upper chords 14 and 16 and the webs such as 20.

Figure 7 is a block flow diagram of the various steps involved in design and fabrication of a metal roof truss such as that described in the preceding paragraph. The general steps involved in forming the metal roof truss are as follows:

- i) design information is inputted to a processor which is configured to output control information to a prenotching and preholding apparatus;
- ii) strip steel is fed to the prenotching and preholing apparatuses which form the strip steel according to the control information from the processor;
- iii) fixing details generated and outputted by the processor are printed on the prenotched and preholed strip steel; and
- iv) the strip steel is roll formed in a conventional relatively low cost roll former.

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The fixing details are preferably printed on the component such as the chord 12 or stiffening web 16 to which the detail applies. For example, the stiffening web 18 may include the fixing details or instructions wherein it requires two fasteners at each end to be secured to the appropriately designated upper and lower chord.

Additionally, the roof truss component may include post-assembly validation information for checking by a third party. The marking of components is also intended to assist with the design integrity of the roof truss and the speed at which it is assembled.

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The processor includes software which operates in a CAD "environment" and determines the preferred configuration of the metal roof truss depending on the dimensional and loading data pertaining to the building structure.

- 5 Additionally, the program accurately determines the prenotching and preholing requirements dependent on the relative angles of the various roof truss components. This is particularly important in ensuring that, for example, the flanges of the stiffening webs contact the upper and
10 lower chords.

- Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described.
- 15 For example, the sectional profile of the stiffening webs and/or chord members may vary provided the structural advantages of the opposing flanges engaging the chord members are achieved. The prenotching of the strip steel may vary provided a frangible connection is provided
20 between adjacent components, such as stiffening webs, of the metal roof truss.

- All such variations and modifications are to be considered with the scope of the present invention the nature of
25 which is to be determined from the foregoing description.

- In the preceding summary of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprising" is used in
30 the sense of "including", i.e. the features specified may be associated with further features in various embodiments of the invention.

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CLAIMS:

1. A metal roof truss comprising:
a lower chord member at opposing ends being
5 connected to respective of a pair of upper chord members;
and
a plurality of elongate compression webs at
opposing ends being connected to the lower chord member
and one of the upper chord members, respectively, the
10 compression webs and said chord members each being of a
channel section profile, one or more of the compression
webs at opposing ends being configured wherein opposing
flanges of said compression web are cut or otherwise
preformed to engage the lower chord member and/or said one
15 of the upper chord members whilst a protruding end web
portion of said compression web is mounted flush with a
corresponding web of said chord member.
2. A metal roof truss as defined in claim 1 wherein the
20 lower and upper chord members together with the plurality
of compression webs are arranged in the same plane.
3. A metal roof truss as defined in claim 1 or 2 wherein
the chord members and the compression webs are of a
25 substantially identical sectional profile.
4. A metal roof truss as defined in any one of the
preceding claims wherein the chord members and the
compression webs include a web and an opposing pair of
30 flanges each having a free edge portion turned inwardly of
the chord member or compression web.

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5. A metal roof truss as defined in claim 4 wherein the flanges of the lower chord member at its opposing ends is cut or otherwise preformed to engage or contact respective of the upper chord members.

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6. A metal roof truss as defined in any one of the preceding claims wherein the chord members and/or the compression webs are in sectional profile asymmetric wherein one of the opposing flanges is of a reduced height compared to the other of said flanges.

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7. A metal roof truss as defined in any one of the preceding claims wherein a pair of the chord members and/or compression webs are designed to interlock with one another to form a closed section.

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8. A metal roof truss as defined in any one of the preceding claims wherein the web and/or the flanges of the chord members and/or the compression webs include a longitudinally extending stiffening rib.

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9. A metal roof truss as defined in any one of the preceding claims wherein interconnected of the chord members and the compression webs include preformed holes which are mutually aligned for fixing of the roof truss.

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10. A metal roof truss as defined in claim 9 wherein the chord members and the compression webs are fixed together via one or more fasteners which engage the preformed and aligned holes.

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11. A metal roof truss as defined in any one of the preceding claims wherein the pair of upper chord members

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are at an upper end connected to one another with an apex plate.

12. A metal roof truss as defined in claim 11 wherein the
5 apex plate is elongate and at least one of its opposing longitudinal edges includes a stiffening flange.

13. A metal roof truss as defined in claim 12 wherein the
10 stiffening flange includes a lip formed orthogonal to the apex plate and the apex plate is fixed to the chord members via a plurality of apex fasteners.

14. A method of forming a plurality of elongate
stiffening webs and/or chord members of a metal roof
15 truss, said method comprising the step of:
forming one or more pairs of opposing notches in
elongate strip metal; and
roll forming the elongate strip metal to form said
stiffening webs and/or chord members continuous with one
20 another and of a channel section profile.

15. A method as defined in claim 14 wherein the pair of
opposing notches provide a frangible connection at the
junction of the stiffening webs and/or chord members, the
25 frangible connection permitting separation of said webs and/or chord members after roll forming.

16. A method as defined in claim 15 wherein the frangible
connection is provided at the juncture of a web of
30 adjoining of the webs and/or the chord members.

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17. A method as defined in claim 15 wherein the separation is effected by manipulation only without cutting or separation tools.

5 18. A method as defined in any one of claims 14 to 17 wherein said step of forming the notches involves punching or stamping the strip metal.

19. A method as defined in any one of claims 14 to 18
10 also comprising pre-forming fastener holes in opposing ends of the stiffening web and/or the chord member.

20. A method as defined in claim 19 wherein the fastener holes are prepunched in a web of the channel section
15 profile.

21. A method of forming a metal roof truss, said method comprising the steps of:
providing processing means and printing means being
20 arranged to operatively communicate with one another;
inputting design information to the processing means wherein the metal roof truss configuration and fixing details are calculated; and
printing at least the fixing details on components of
25 the metal roof truss.

22. A method as defined in claim 21 wherein the fixing details are printed on the component of the roof truss to which the detail applies.

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23. A method as defined in claim 22 wherein the fixing details are printed on elongate stiffening webs and/or chord members of the metal roof truss.

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24. A method as defined in any one of claims 21 to 23 wherein printing of the fixing details involves ink-jet printing on strip metal from which the roof truss component is thereafter to be roll formed.

25. A method as defined in any one of claims 21 to 24 wherein the inputting of design information involves inputting dimensional and loading data pertaining to a building structure on which the metal roof truss is to be erected.

26. A method of forming a metal roof truss, said method comprising the steps of:

15 providing processing means to which design information is inputted for the calculation of the roof truss configuration, and means for notching metal strip from which components of the metal roof truss are to be roll formed, said notching means being arranged to

20 operatively communicate with the processing means; and

notching the metal strip utilising the notching means wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between adjacent components of the metal roof

25 truss and being shaped dependent on the roof truss configuration.

27. A method as defined in claim 26 wherein the adjacent components include one or more elongate stiffening webs and/or chord members.

28. An apparatus for forming a metal roof truss, said apparatus comprising:

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processing means to which design information is inputted for the calculation of the roof truss configuration; and

means for notching metal strip from which components
5 of the metal roof truss are to be roll formed, said notching means being arranged to operatively communicate with the processing means wherein opposing pairs of notches are formed in the metal strip, said pairs of notches defining a frangible connection between adjacent
10 components of the metal roof truss and being shaped dependent on the roof truss configuration.

29. An apparatus as defined in claim 28 wherein the adjacent components include one or more elongate
15 stiffening webs and/or chord members.

30. An apparatus as defined in claim 28 or 29 also comprising a roll former operatively coupled to the notching means whereby the prenotched metal strip is roll
20 formed into a channel section profile.