

CONSTRUCTIONAL PANEL

FIELD OF THE INVENTION

- 5 The present invention relates generally to a constructional panel and a method of forming a constructional panel. The invention relates particularly, though not exclusively, to metal roof panels and their methods of fabrication.

10 SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided a constructional panel comprising

at least a pair of substantially parallel and spaced apart rib formations; and

- 15 a pan disposed between said pair of rib formations, the pan including a plurality of spaced apart microflutes extending transversely relative to said rib formations wherein the microflutes being in the form of substantially parallel and spaced apart groove and ridge formations in which
- 20 the depth from ridge peak to groove root is in the range of 0.05mm to 5mm and the pitch from ridge peak to adjacent ridge peak is in the ranges 10mm to 50mm.

According to another aspect of the present invention there

- 25 is provided a method of forming a constructional panel, said method comprising the steps of:

forming at least a pair of substantially parallel and spaced apart rib formations in sheet wherein a pan is formed between the pair of rib formations; and

- 30 forming a plurality of microflutes in at least part of the pan, the microflutes being spaced apart and extending transversely relative to said rib formations, and being in the form of substantially parallel and spaced apart groove and ridge formations in which the depth from ridge peak
- 35 to groove root is in the range of 0.05mm to 5mm and the pitch from ridge peak to adjacent ridge peak is in the ranges 10mm to 50mm.

Preferably the depth is 0.1mm and the pitch is 10mm. Generally the groove and ridge formations are of essentially constant depth and pitch.

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Preferably the groove formations are of substantially V-shaped cross-section and the ridge formations are of substantially inverted V-shaped cross-section. More preferably the ridge and groove formations have rounded peaks and nadirs respectively.

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Preferably the ratio of the depth to the pitch of each of the microflutes is less than approximately 1:15.

Preferably the constructional panel is a metal constructional panel. More preferably the panel is elongate and the rib formations extend longitudinally of the panel.

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Preferably the step of forming the transverse microflutes in the pan involves roll forming the pan intermediate the pair of longitudinal rib formations. More preferably the transverse microflutes are cold roll formed in the pan.

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Preferably the plurality of transverse microflutes are each in cross-sectional profile substantially identical to one another and aligned parallel to one another.

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Preferably the transverse ribs in cross-section together define a zig-zag profile. More preferably the ribs are in the form of repeating corrugations arranged in a common plane of the pan.

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Preferably the pan at its opposing longitudinal edge portions includes a generally flat strip. More preferably the flat strip extends alongside an adjacent of the rib formations and generally at a level of grooves or ridges formed by the transverse microflutes. Generally the pair of flat strips occupy less than about 15% of the pan.

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Preferably the pair of rib formations are each in cross-section generally trapezium-shaped. More preferably the constructional panel includes a plurality of the pair of rib
5 formations being arranged parallel and equally spaced from one another, the pan being one of a plurality of pans each located between a pair of adjacent of said longitudinal rib formations.

Preferably the constructional panel at its opposing longitudinal
10 edge margins includes respective edge rib formations being adapted to interlock with a corresponding edge rib formation of an adjacent constructional panel. More preferably the interlocking longitudinal edge rib formations are together in cross-section shaped substantially identical to the longitudinal
15 rib formations.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to achieve a better understanding of the present
20 invention a preferred embodiment of a constructional panel and its method of fabrication will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of part of a
25 constructional panel according to an embodiment of the invention;

Figure 2 is an end elevational view of the panel of Figure 1; and

Figures 3 and 4 are plan views from below and above,
30 respectively, of the panel of Figure 1;

Figure 5 is a cross-sectional view taken through line A-A of Figure 4 and depicting the transverse stiffening ribs of the panel of Figure 1 in enlarged and exaggerated detail; and

Figure 6 is a graph load verses deflection for the panel
35 of Figure 1 together with comparative plots for other panels; and

Figure 7 is a schematic illustration of part of the panel

of Figure 1 when deflected under pressure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

- 5 As shown in Figures 1 to 4 there is a constructional panel in the form of a metal roof panel 10. The roof panel 10 is suitable for cladding a roof although it should be appreciated that it extends to other applications, for example, wall cladding.
- 10 The metal roof panel 10 is elongate and in this example comprises four longitudinally extending and equally spaced apart rib formations 12/14/16/18. Adjacent pairs of the longitudinal rib formations such as 12 and 14 are interconnected by a pan 20.
- 15 The intermediate longitudinal rib formations 14 and 16 of this embodiment are in cross-section generally trapezium shaped. The longitudinal ribs 12 and 18 located at opposing longitudinal edge margins of the roof panel 10 are designed to interlock with a corresponding edge rib of an adjacent roof panel (not shown).
- 20 The interlocking longitudinal edge ribs are together in cross-section shaped substantially identical to one of the intermediate longitudinal rib formations such as 14. The longitudinal rib formations 12/14/16/18 are similar in construction to those of the applicant's roof cladding
- 25 commercially available in Australia under the trade mark KLIP-LOK.

- As shown in Figure 5 the pans such as 20 each include a plurality of transversely extending and spaced apart microflutes
- 30 such as 22. The microflutes 22 of this example are in the form of substantially parallel and spaced apart groove and ridge formations such as 23 and 25, respectively. The depth from ridge peak to groove root is about 0.5mm and the pitch from ridge peak to adjacent ridge peak is around 10mm. The
- 35 groove and ridge formations are of a substantially V-shaped and inverted V-shaped cross-section, respectively. Although not clearly illustrated in Figure 5, the groove and ridge formations

23 and 25 have rounded peaks and nadirs, respectively. Accordingly, it is the rounded peaks and nadirs only of the pan 24 which is plastically deformed to form the microflutes 22. The exaggerated representation of one of the microflutes is not to
5 scale but depicts the depth from ridge peak to groove root as "D", and the pitch from ridge peak to adjacent ridge peak as "P".

The microflutes such as 22 of this embodiment provide stiffening
10 to the otherwise unstable pan such as 20. This is an advantage where for example the roof panel 10 is fabricated from relatively thin gauge strip steel, for example 0.42, 0.48 or 0.60 mm gauge strip steel. Thus, the width of the pan 20 or distance between longitudinal rib formations such as 12 and 14
15 can be increased whilst the rigidity of the pan 20 is maintained. However, particularly in the context of roof panels, the transverse microflutes such as 22 should be of a reduced height to width ratio in order to minimise the retention of water, soil or foliage. The microflutes 22 are also designed for
20 aesthetic reasons to provide an attractive and "natural" appearance.

Traditionally the roll forming of crests and troughs in profiled panels results in what is known as "oil canning" where the
25 surface of the material is distorted by stretching of the sheet metal. It has been found in the present application that formation of the transverse micro flutes in the panel substantially eliminates the likelihood of "oil canning" by substantially removing the stretch in the pan.

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Figure 6 is a graph of load versus deflection for the metal roof panel 10 of the preceding embodiments. The load is in Newtons and intended to be representative of typical uplift loads on roof cladding panels as a result of wind forces. The deflection
35 is in millimetres and is the maximum deflection of the pan such as 20 from a flat plain under the various uplifting forces. The various plots of Figure 6 include load/deflection tests for:

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- (a) a commercially available roofing panel;
- (b) the applicant's panel commercially available under the trade mark KLIP-LOK;
- (c) the metal roof panel 10 of the described embodiment; and
- (d) a KLIP-LOK panel but with relatively large transverse flutes.

That is, plot (c) relates to the described embodiment of the present invention whereas plots (a), (b) and (d) relate to conventional or comparative constructional panels. It is readily apparent that the preferred embodiment including the transverse microflutes provides increased loadings for the same deflection as the conventional or comparative examples. For example, the microfluted panel requires 70 Newtons (N) to deflect 40mm whereas the conventional panels of plots (a) and (b) required about 60 N. This represents an increase in stiffness of around 15%.

Figure 7 is a schematic and exaggerated illustration of a constructional panel such as the metal roofing panel 10 of the preceding embodiment when mounted to a roof structure or like via concealed fixing clips such as 26 and 28. The solid line of the pan 20 of the panel 10 is in its unloaded condition whereas the broken line represents the pan 20 when deflected under wind pressure. It will be apparent that the deflected pan 20 in this condition has dislodged from the concealed clips 26 and 28. The load required to dislodge a constructional panel including the transverse microflutes of the present invention is significantly higher than that of conventional or comparative roof panels as illustrated and explained in the context of the graph of Figure 6. Therefore, the metal roof panel such as 10 including the transverse microflutes is less susceptible to dislodgment from the concealed clips or other mounting means.

The pan such as 20 of the roof panel 10 shown in Figure 1 includes a generally flat strip such as 24 formed at each

- of its opposing longitudinal edge portions. The flat strip such as 24 extends alongside the adjacent longitudinal strengthening rib formation 12 and is generally at a level of the grooves formed by the transverse microflutes 22. Thus,
- 5 the flat strips such as 24 provide run-off for any water or other matter which may have collected in the grooves or troughs of the transverse ribs 22. In this example the flat strips such as 24 occupy about 10% of the pan 20.
- 10 It should be appreciated that the dimensions of the constructional panel and for example the height of the longitudinal rib formations relative to the width of the pan may vary but still remain within the scope of the present invention. However, in this embodiment the ratio of the height
- 15 of the rib formations such as 12 and 14 to the width of the intermediate pan 20 is about 1:4. This corresponds to a longitudinal rib height of about 43 mm and a pan width of about 175 mm.
- 20 The general steps involved in forming the metal roof panel 10 described above will now be outlined:
- (i) longitudinal rib formations such as 14 are roll formed in strip metal; and
 - (ii) transversely extending microflutes are roll formed
- 25 in a pan defined between adjacent pairs of rib formations in the roof panel.
- The longitudinal rib formations and microflutes such as 12 and 22, respectively will generally be cold roll formed in strip
- 30 steel. The longitudinal rib formations such as 14 and transverse microflutes 22 are formed sequentially. The strip steel is generally provided with a corrosion resistant coating.
- Those skilled in the art will appreciate that the invention
- 35 described herein is susceptible to variations and modifications other than those specifically described. For example, the constructional panel may include longitudinal rib formations at

its opposing edge margins only. The transverse microflutes may vary in cross-sectional profile and unlike the described embodiment extend the full width of the pan. The constructional panel may be partly or entirely constructed of a plastics
5 material. All such variations and modifications are to be considered within the scope of the present invention the nature of which is to be determined from the foregoing description.

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

CLAIMS:

1. A constructional panel comprising
at least a pair of substantially parallel and spaced apart rib
5 formations; and
a pan disposed between said pair of rib formations, the
pan including a plurality of spaced apart microflutes extending
transversely relative to said rib formations wherein the
microflutes being in the form of substantially parallel and
10 spaced apart groove and ridge formations in which the depth from
ridge peak to groove root is in the range of 0.05mm to 5mm and
the pitch from ridge peak to adjacent ridge peak is in the
ranges 10mm to 50mm.
- 15 2. A constructional panel as defined in claim 1 wherein
the depth is 0.1mm and the pitch is 10mm.
3. A constructional panel as defined in claim 1 or 2
wherein the groove and ridge formations are of essentially
20 constant depth and pitch.
4. A constructional panel as defined in any preceding
claim wherein the groove formations are of substantially
V-shaped cross-section and the ridge formations are of
25 substantially inverted V-shaped cross-section.
5. A constructional panel as defined in claim 4 wherein
the ridge and groove formations have rounded peaks and
nadirs respectively.
- 30 6. A constructional panel as defined in any preceding
claim wherein the ratio of the depth to the pitch of each
of the microflutes is less than approximately 1:15.
- 35 7. A constructional panel as defined in any one of the
preceding claims wherein the panel is elongate and the rib
formations extend longitudinally of the panel.

8. A constructional panel as defined in any one of the preceding claims wherein the plurality of transverse microflutes are each in cross-sectional profile substantially identical to one another and aligned
5 parallel to one another.

9. A constructional panel as defined in any one of the preceding claims wherein the transverse ribs in cross-section together define a zig-zag profile.
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10. A constructional panel as defined in claim 9 wherein the ribs are in the form of repeating corrugations arranged in a common plane of the pan.

11. A constructional panel as defined in any one of the preceding claims wherein the pan at its opposing longitudinal edge portions includes a generally flat strip.
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12. A constructional panel as defined in claim 11 wherein the flat strip extends alongside an adjacent of the rib formations and generally at a level of grooves or ridges formed by the transverse microflutes.
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13. A constructional panel as defined in claim 11 or 12 wherein the pair of flat strips occupy less than about 15% of the pan.
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14. A constructional panel as defined in any one of the preceding claims wherein the pair of rib formations are each in cross-section generally trapezium-shaped.
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15. A constructional panel as defined in any one of the preceding claims including a plurality of the pair of rib formations being arranged parallel and equally spaced from one another, the pan being one of a plurality of pans each
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located between a pair of adjacent of said longitudinal rib formations.

16. A constructional panel as defined in any one of the
5 preceding claims wherein the constructional panel at its
opposing longitudinal edge margins includes respective
edge rib formations being adapted to interlock with a
corresponding edge rib formation of an adjacent
constructional panel.
- 10 17. A constructional panel as defined in claim 16 wherein
the interlocking longitudinal edge rib formations are
together in cross-section shaped substantially identical
to the longitudinal rib formations.
- 15 18. A constructional panel as defined in any one of the
preceding claims wherein the constructional panel is a
metal constructional panel.
- 20 19. A method of forming a constructional panel, said
method comprising the steps of:
forming at least a pair of substantially parallel and
spaced apart rib formations in sheet wherein a pan is
formed between the pair of rib formations; and
25 forming a plurality of microflutes in at least part
of the pan, the microflutes being spaced apart and
extending transversely relative to said rib formations,
and being in the form of substantially parallel and spaced
apart groove and ridge formations in which the depth from
30 ridge peak to groove root is in the range of 0.05mm to 5mm
and the pitch from ridge peak to adjacent ridge peak is in
the ranges 10mm to 50mm.
20. A method of forming a constructional panel as defined
35 in claim 19 wherein the step of forming the transverse
microflutes in the pan involves roll forming of the pan
intermediate the pair of longitudinal rib formations.

21. A method of forming a constructional panel as defined in claim 20 wherein the transverse microflutes are cold roll formed in the pan.