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A concealed fixing retaining clip for roof cladding sheets with profiled ribs

5 The present invention relates to a clip for fixing a roof or other cladding sheet to an underlying support structure.

10 The present invention relates particularly, although by no means exclusively, to a clip for fixing a roof cladding sheet to an underlying roof support structure.

15 Typically, roof cladding sheets are roll-formed from painted or unpainted steel strip and include one or more parallel ribs with opposed sides, pan sections, and side edge formations that enable the sheets to be positioned side by side in overlapping relationship.

20 It is known to secure cladding sheets to an underlying roof support structure, such as roof purlins, by fastening the sheets directly to the underlying structure using fasteners, such as roofing nails and screws, that pierce the sheets and penetrate the underlying structure.

25 It is also known to secure cladding sheets to an underlying structure by using clips that are secured to the structure by fasteners and are formed to extend into the ribs of the sheets and include retaining members or tabs that can engage re-entrant portions of the ribs and thereby retain the sheets to the clips. These clip
30 assemblies are often preferred over nails because they enable concealed fixing of cladding sheets to an underlying structure.

35 In use, the concealed fixing retaining clips are secured to an underlying structure at spaced intervals related to the spacing between the ribs of the cladding

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5 sheets. Thereafter, cladding sheets are positioned on the clips in overlapping relationship by successively pressing the sheets down onto the clips so that the sides of the ribs are initially forced outwardly to allow the re-entrant portions of the ribs to pass over the retaining members and then snap inwardly into engagement with the retaining members.

10 There are a number of known concealed fixing retaining clips. The clips include a clip disclosed in Australian patent 2003249763 in the name of the applicant. The clip disclosed in the patent is marketed in Australia under the trade mark KLIPLOK.

15 The present invention provides an alternative concealed fixing retaining clip to the KLIPLOK clip described in Australian patent 2003249763 and to other known concealed fixing retaining clips.

20 The above description is not to be taken as an admission of the common general knowledge in Australia or elsewhere.

25 The present invention provides a concealed fixing retaining clip for fixing a roof or other cladding sheet to an underlying support structure that is formed from a resilient material and comprises:

- 30 (a) a base;
- (b) a pair of side walls that extend from the base; and
- 35 (c) a pair of flanges that define retaining members for engaging re-entrant portions in the sides of ribs of cladding sheets, with one flange defining an arch that extends outwardly and

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downwardly from an upper end of one side wall and the other flange defining an arch that extends outwardly and downwardly from an upper end of the other side wall, with the flanges being a mirror image of each other about a centreline plane that passes perpendicularly through the base, and with each flange having a stiffener on each side of a centreline of the flange.

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The arch of each flange may include a crown and a downwardly and outwardly sloping wall.

The stiffeners of each flange may be elongate and extend along an upper part of the side wall and over the crown of the flange and at least a part of the way down the sloping wall of the flange.

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The stiffeners of each flange may be symmetrical about the centreline of the flange.

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The stiffeners of each flange may be convex in transverse section when viewed looking at an external surface of the flange.

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Each flange may also include an elongate reverse stiffener extending along the centreline of the flange.

The reverse stiffener may be concave in transverse section when viewed looking at an external surface of the flange.

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The stiffeners of each flange may extend towards but not to an outer end of the flange.

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The stiffeners of each flange may stop at least 5 mm from the flange end.

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The reverse stiffener of each flange may extend towards but not to an outer end of the flange.

5 The reverse stiffener of each flange may stop at least 5 mm from the flange end.

Each flange end may have a relief in a centre section of the flange end.

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The relief may be a shallow relief.

Each flange end may be a sharp end that contacts and thereby engages securely the re-entrant portion of one
15 of the ribs of a cladding sheet when, in use, the cladding sheet is positioned on the clip.

Each flange end may be outwardly directed. In other words, the flange ends may not be inwardly turned
20 towards the side walls of the clip.

Each flange may include the two corner sections that are folded inwardly and form surfaces that extend transversely to the outer end of the flange and contact
25 and thereby engage a re-entrant portion of one of the ribs of a cladding sheet when, in use, the cladding sheet is positioned on the clip. This feature increases the surface area of contact between the flanges and the re-entrant portions and thereby makes it possible to minimise
30 damage to the sheet when it is necessary to remove the sheet from the clip.

The side walls of the clip converge towards each other.

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The side walls of the clip may be formed so that they do not contact each other in the as-manufactured form

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of the clip and are forced inwardly towards each other or into contact with each other when, in use, a cladding sheet is positioned on the clip. This feature makes it easier to install the clip to an underlying structure
5 because there is a gap between the clip side walls for inserting a screw-driver or other suitable tool to facilitate securing the clip to the underlying structure.

The side walls and the base may be straight sides
10 so that the side walls and the base define a triangular structure when viewed from a side of the clip. This feature contributes to the overall strength and stiffness of the clip. More particularly, the triangular structure contributes to the capacity of the clip to withstand
15 downward loading of the clip, for example when a person presses down on a rib of a cladding sheet to force the rib over the clip. In addition, the triangular structure can accommodate off-centre downward loading that may be applied to the clip when a cladding sheet is forced down
20 onto the clip. Specifically, the side walls of the clip can slide relative to each other in response to off-centre downward loading and return to the original profile. In addition, the triangular structure contributes to the resistance of the side walls to outward movement of the
25 side walls beyond the as-manufactured positions of the side walls and therefore is a factor in the clip being able to resist uplift forces on a cladding sheet.

The side walls may include inturned side edges
30 that improve the rigidity of the side walls.

The flanges may be relatively long, for example at least 25% of the height of the clip.

35 An approach angle of the flanges, described by each flange and the base of the clip, may be between 40° and 75°.

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5 The upper ends of the side walls may be shaped to define a generally circular opening in the as-manufactured clip to facilitate insertion of a screw-driver to secure the clip to an underlying structure.

10 The present invention provides a concealed fixing retaining clip for fixing a roof or other cladding sheet to an underlying support structure that is formed from a resilient material and includes:

- (a) a base;
- (b) a pair of side walls that extend from the base;
15 and

20 a pair of flanges that define retaining members for engaging re-entrant portions in the sides of ribs of cladding sheets, with one flange defining an arch that extends outwardly and downwardly from an upper end of one side wall and the other flange defining an arch that extends outwardly and downwardly from an upper end of the other side wall, with the flanges being a mirror image of each other about a centreline plane that passes
25 perpendicularly through the base, and with each flange having a relief at an end of the flange.

 The relief may be a shallow relief.

30 The side walls may converge towards each other.

 The side walls may include inturned side edges that improve the rigidity of the side walls.

35 The present invention provides a concealed fixing retaining clip for fixing a roof or other cladding sheet

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to an underlying support structure that is formed from a resilient material and comprises:

- 5 (a) a base;
- (b) a pair of side walls that extend from the base, with the side walls including inturned side edges that improve the rigidity of the side walls; and
- 10 (c) a pair of flanges that define retaining members for engaging re-entrant portions in the sides of ribs of cladding sheets, with one flange defining an arch that extends outwardly and
- 15 downwardly from an upper end of one side wall and the other flange defining an arch that extends outwardly and downwardly from an upper end of the other side wall, with the flanges being a mirror image of each other about a
- 20 centreline plane that passes perpendicularly through the base.

The flanges may be relatively long, for example at least 25% of the height of the clip.

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An approach angle of the flanges, described by each flange and the base of the clip, may be between 40° and 75°.

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The present invention also provides a clip assembly which comprises:

- (a) an elongate strap; and
- 35 (b) a plurality of the concealed fixing retaining clips described above mounted to an upper surface of the strap.

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The present invention is described further by way of example with reference to the accompanying drawings, of which:

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Figure 1 is a perspective view of one embodiment of a clip in accordance with the present invention in an as-manufactured form;

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Figure 2 is a side elevation of the clip shown in Figure 1 in the direction of the arrow "A" in Figure 1;

Figure 3 is a side elevation of the clip shown in Figure 1 in the direction of the arrow "B" in Figure 1;

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Figure 4 is a top view of the clip shown in Figure 1;

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Figure 5 is a bottom view of the clip shown in Figure 1;

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Figure 6 is a side elevation of a section of the length of one embodiment of a clip assembly in accordance with the present invention which includes a strap and two of the clips shown in Figures 1 to 7 in an as-manufactured form mounted to the strap; and

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Figure 7 is a perspective view of a section of the length of the clip assembly shown in Figure 7 with one of the clips spaced above the strap and illustrating how aligned openings in the clip and the strap that facilitate connecting the clip to the strap.

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Figures 1 to 5 illustrate one embodiment of a clip 3 in accordance with the present invention.

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The clip 3 is formed by folding a flat metal, preferably steel (but not necessarily spring steel), blank into the configuration shown the figures.

5 The clip 3 includes:

- (a) a base 5;
- (b) a pair of side walls 7 that extend from the base
10 and converge towards each other; and
- (c) a pair of flanges 9 that define retaining
 members for engaging re-entrant portions of ribs
 of cladding sheets, with one flange 9 extending
15 from an upper end of one side wall 7 and the
 other flange 9 extending from an upper end of
 the other side wall 7.

20 The base 5 includes an opening 63 to facilitate
 securing the clip 3 directly to an underlying roof
 structure, such as a roof purlin (not shown) or to a strap
 29 (see Figures 6 and 7) that, in turn, can be secured to
 the underlying structure.

25 The side walls 7 and the base 5 are straight
 walls and define a substantially triangular structure in
 side view shown in Figure 2.

30 The side walls 7 have inturned side edges 61 that
 improve the rigidity of the side walls.

 In the as-manufactured form shown in Figures 1 to
 5 the side walls 7, whilst converging towards each other,
 do not actually contact each other and there is a gap G
35 (see Figure 2) between the side walls 7 at the upper end
 of the side walls. However, in use, the side walls 7 are
 forced into contact with each other at the upper ends of

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the side walls when a cladding sheet is positioned on the sides walls 7.

Each flange 9 has a relatively steep approach angle of the order of between 40° and 75° described by the flange 9 and the base 5. With reference to Figure 2, the approach angle of the flanges 9 is described by the 2 lines on the left side of the Figure and the angle between the lines is indicated to be 60° .

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The flanges 9 are shaped to form at least part of an arch 27. More particularly, the arch 27 of each flange comprises a crown 51 and a downwardly and outwardly sloping wall 31. As can be seen in Figure 1 in particular, the arches 27 are well defined arches. As a consequence, the flanges 9 take full advantage of the structural rigidity inherent in an arch structure and maximises the resistance of the flanges 9 to opening outwardly in response to roof uplift in high wind situations.

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The sloping wall 31 of each flange 9 terminates in a sharp lower outwardly facing (as opposed to inwardly turned) end 37 that forms a contact surface for engaging a re-entrant portion of one of the ribs of a cladding sheet. Each flange end 37 has a central relief 31.

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Each flange 9 includes in-turned sections 17 at the two corners at the lower ends of the flange 9. The corner sections 17 form contact surfaces that extend transversely to the contact surface of the outer end of the flange 9.

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Each flange 9 includes a stiffener 41 on each side of a centreline of the flange. The dotted line X-X on Figure 4 indicates the centreline of the flanges. The stiffeners 41 are elongate and extend along an upper part

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of the side wall 7 and over the crown 29 of the flange 9 and at least a part of the way down the sloping wall 31 of the flange 9. The stiffeners 41 are symmetrical about the centreline of the flange 9 and are convex in transverse section when viewed looking at an external surface of the flange.

Each flange 9 also includes an elongate reverse stiffener 45 extending along the centreline of the flange 9. The reverse stiffeners 45 are concave in transverse section when viewed looking at an external surface of the flange 9 and extend towards but not to an outer end of the flange 9.

More particularly, the stiffeners 41 and the reverse stiffener 45 of each flange 9 stop 5 mm from the flange end 37.

It is evident particularly from Figures 1 and 3 that the stiffeners 41 and the reverse stiffeners 45 are quite pronounced and are significant features of the structure of the flanges 9. The stiffeners 41 and the reverse stiffeners 45 are provided for the same reason as the well-defined arch structure of the flanges 9, namely to maximise the resistance of the flanges 9 to opening outwardly in response to roof uplift in high wind situations.

Figure 6 is a side elevation of one embodiment of a clip assembly in accordance with the present invention which includes a strap 29 and two clips 3 mounted to the strap 29. Figure 7 is a perspective view of a section of the assembly shown in Figure 6 with the clip 3 shown in the Figure spaced above the strap 29 to reveal a detail of the assembly.

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The strap 29 is a convenient means of fastening a plurality of the clips 3 to purlins (not shown) at required spaced intervals along the length of the purlins.

5 The strap 29 is formed from steel and includes a flat base 87 and raised lengthwise extending sides 89 that contribute to the rigidity of the strap. The sides 89 are in the form of downwardly opening channels. The strap 29 also includes a series of openings 79 at spaced intervals
10 along the length of the strap. Only one such opening 29 is shown in the Figures. The clips 3 can be secured to the strap 29 by aligning an opening 63 in a base 5 of a clip with one of the openings 79 in the strap and using a suitable fastener (not shown) to attach the clip 3 to the
15 strap 29.

Many modifications may be made to the preferred embodiment of the roofing system described above without departing from the spirit and scope of the present
20 invention.

By way of example, whilst the embodiment of the clip 3 includes side walls 7 that converge towards each other, the present invention is not so limited and extends
25 to arrangements in which the side walls 7 are not convergent.

In addition, whilst the embodiment of the clip 3 includes flanges 9 that have elongate reverse stiffeners
30 45 extending along the centreline of the flange 9, the present invention is not so limited and extends to arrangements that do not include reverse stiffeners 45.

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CLAIMS

1. A concealed fixing retaining clip for fixing a roof or other cladding sheet to an underlying support structure that is formed from a resilient material and comprises:

- (a) a base;
- 10 (b) a pair of side walls that extend from the base; and
- (c) a pair of flanges that define retaining members for engaging re-entrant portions in the sides of ribs of cladding sheets, with one flange defining an arch that extends outwardly and downwardly from an upper end of one side wall and the other flange defining an arch that extends outwardly and downwardly from an upper end of the other side wall, with the flanges being a mirror image of each other about a centreline plane that passes perpendicularly through the base, and with each flange having a stiffener on each side of a centreline of the flange.

2. The clip defined in claim 1 wherein the arch of each flange includes a crown and a downwardly and outwardly sloping wall and the stiffeners of each flange are elongate and extend along an upper part of the side wall and over the crown of the flange and at least a part of the way down the sloping wall of the flange.

3. The clip defined in claim 1 or claim 2 wherein stiffeners of each flange are symmetrical about the centreline of the flange.

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4. The clip defined in any one of the preceding claims wherein the stiffeners of each flange are convex in transverse section when viewed looking at an external surface of the flange.

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5. The clip defined in any one of the preceding claims wherein each flange includes an elongate reverse stiffener extending along the centreline of the flange.

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6. The clip defined in claim 5 wherein the reverse stiffener is concave in transverse section when viewed looking at an external surface of the flange.

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7. The clip defined in claim 5 or claim 6 wherein the stiffeners and the reverse stiffener of each flange extend towards but not to an outer end of the flange.

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8. The clip defined in claim 7 wherein the stiffeners and the reverse stiffener of each flange stop at least 5 mm from the flange end.

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9. The clip defined in claim 7 or claim 8 wherein each flange end has a relief in a centre section of the flange end.

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10. The clip defined in any one of claims 7 to 9 wherein each flange end is a sharp end that contacts and thereby engages securely the re-entrant portion of one of the ribs of a cladding sheet when, in use, the cladding sheet is positioned on the clip.

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11. The clip defined in any one of the preceding claims wherein each flange includes the two corner sections that are folded inwardly and form surfaces that extend transversely to the outer end of the flange and contact and thereby engage a re-entrant portion of one of

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the ribs of a cladding sheet when, in use, the cladding sheet is positioned on the clip.

12. The clip defined in any one of the preceding
5 claims wherein the side walls converge towards each other.

13. The clip defined in any one of the preceding
claims wherein the side walls include inturned side edges
that improve the rigidity of the side walls.

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14. A concealed fixing retaining clip for fixing a
roof or other cladding sheet to an underlying support
structure that is formed from a resilient material and
includes:

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(c) a base;

(d) a pair of side walls that extend from the base;
and

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a pair of flanges that define retaining members for
engaging re-entrant portions in the sides of ribs of
cladding sheets, with one flange defining an arch that
extends outwardly and downwardly from an upper end of one
25 side wall and the other flange defining an arch that
extends outwardly and downwardly from an upper end of the
other side wall, with the flanges being a mirror image of
each other about a centreline plane that passes
perpendicularly through the base, and with each flange
30 having a relief at an end of the flange.

15. The clip defined in claim 14 wherein the relief
is a shallow relief.

35 16. The clip defined in claim 14 or claim 15 wherein
the side walls converge towards each other.

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17. The clip defined in any one of claims 14 to 16 wherein the side walls include inturned side edges that improve the rigidity of the side walls.

5 18. A concealed fixing retaining clip for fixing a roof or other cladding sheet to an underlying support structure that is formed from a resilient material and comprises:

10 (a) a base;

(b) a pair of side walls that extend from the base, with the side walls including inturned side edges that improve the rigidity of the side walls; and
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(c) a pair of flanges that define retaining members for engaging re-entrant portions in the sides of ribs of cladding sheets, with one flange defining an arch that extends outwardly and downwardly from an upper end of one side wall and the other flange defining an arch that extends outwardly and downwardly from an upper end of the other side wall, with the flanges being a mirror image of each other about a centreline plane that passes perpendicularly through the base.
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19. The clip defined in claim 18 wherein the flanges are relatively long, for example at least 25% of the height of the clip.
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20. The clip defined in claim 18 or claim 19 wherein an approach angle of the flanges, described by each flange and the base of the clip, is between 40° and 75°.
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21. A clip assembly which comprises:
- (a) an elongate strap; and
- 5 (b) a plurality of the concealed fixing retaining clips defined in any one of the preceding claims mounted to an upper surface of the strap.