United States Patent [19]

Cookson

[11] **3,852,929**

[45] **Dec. 10, 1974**

[54] **SHEET FIXING DEVICE**

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[73] Assignee: **Cookson Sheet Metal Developments Limited,** Southampton, England

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[30] **Foreign Application Priority Data**

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Aug. 16, 1972 Great Britain 38150/72

[52] **U.S. Cl.** **52/543,** 52/553
[51] **Int. Cl.** **E04d 3/36**
[58] **Field of Search** ..... 52/478, 519, 520, 521, 52/522, 545, 712, 714, 715, 543, 537, 538, 551, 760, 74–78; 24/73 MF, 259 R

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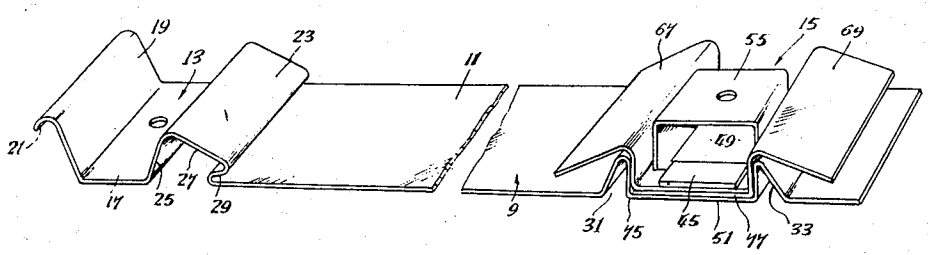
Primary Examiner—John E. Murtagh
Attorney, Agent, or Firm—Cooper, Dunham, Clark, Griffin & Moran

[57] **ABSTRACT**

A fixing device for securing a cladding sheet to a structural member has arms to engage in pockets in the sheet, the arms being resiliently mounted on a base by means of members the ends of which joined to the arms are closer together than the ends joined at the base. In another aspect means are provided to restrict the movement of the arms towards the base when a sheet is pressed towards the base. A clip part of the device, including the arms which engage into pockets of the sheet, may be separate from the remainder of the device, for assembly of the device in situ.

4 Claims, 14 Drawing Figures



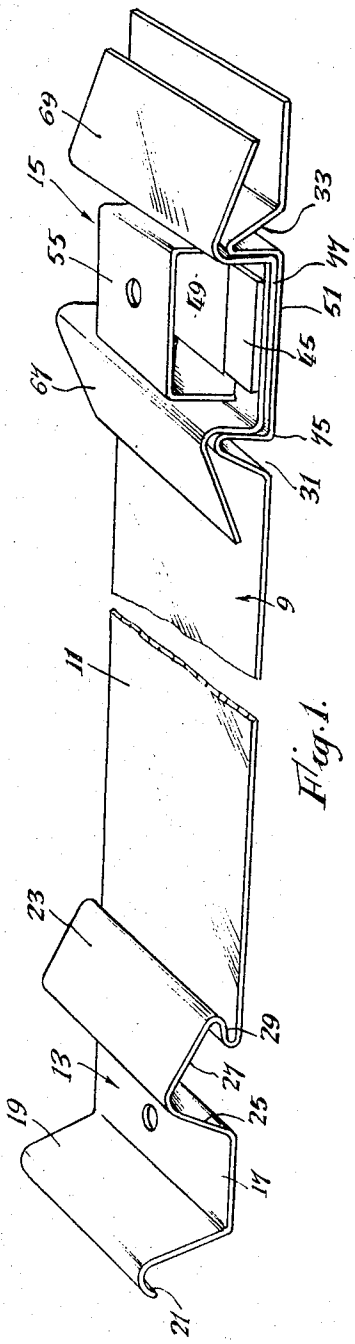


Fig. 1.

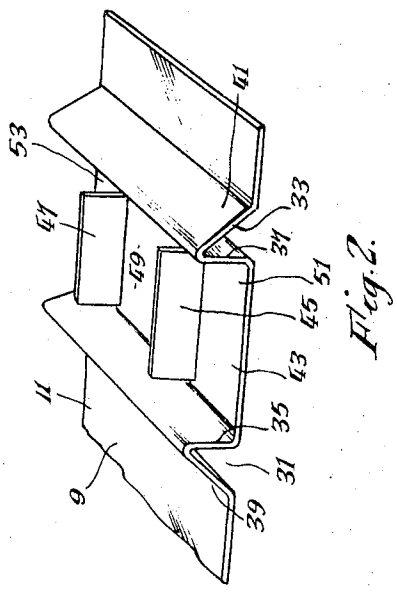


Fig. 2.

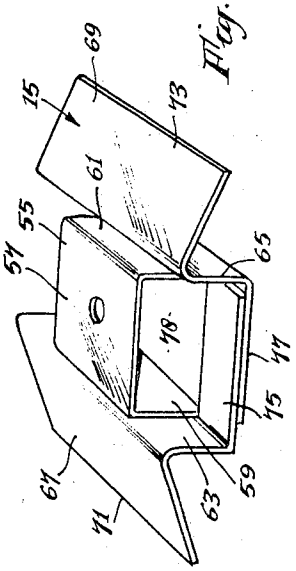


Fig. 3.

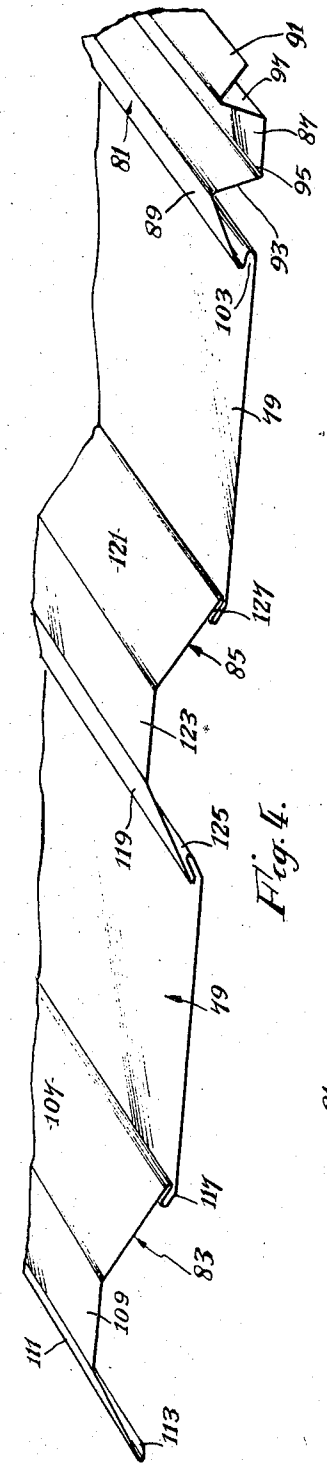


Fig. 4.

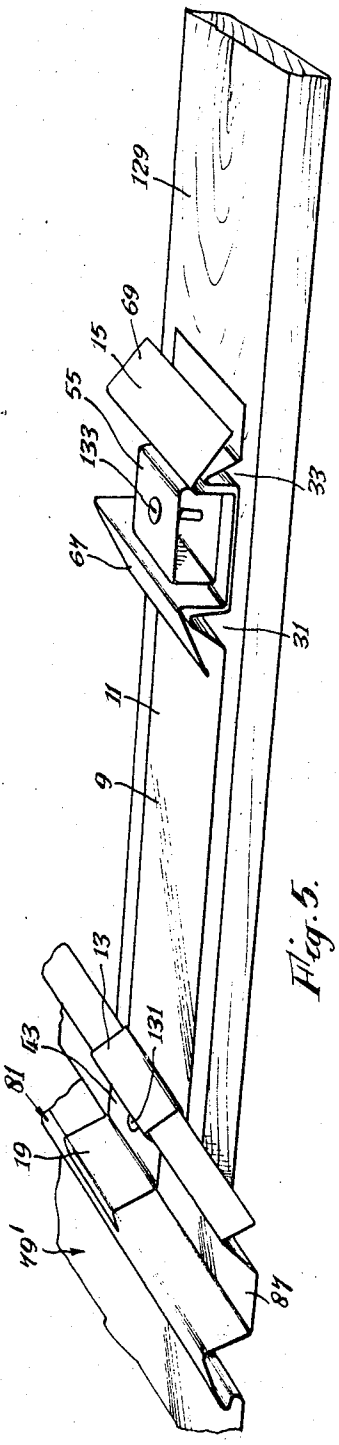


Fig. 5.

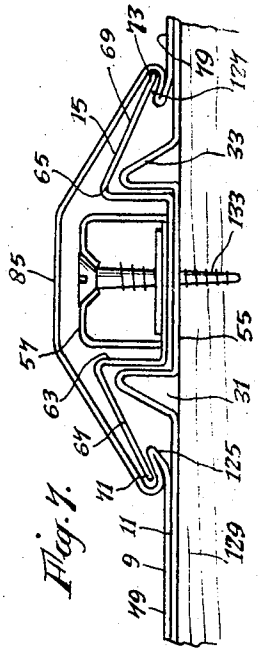


Fig. 7.

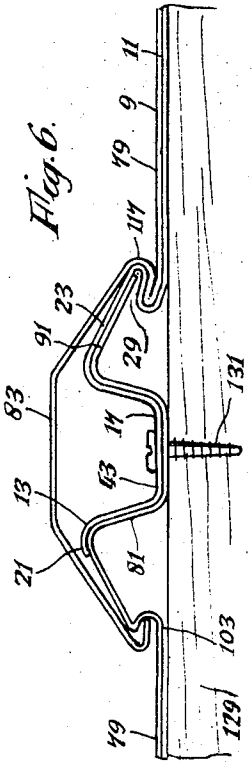


Fig. 6.

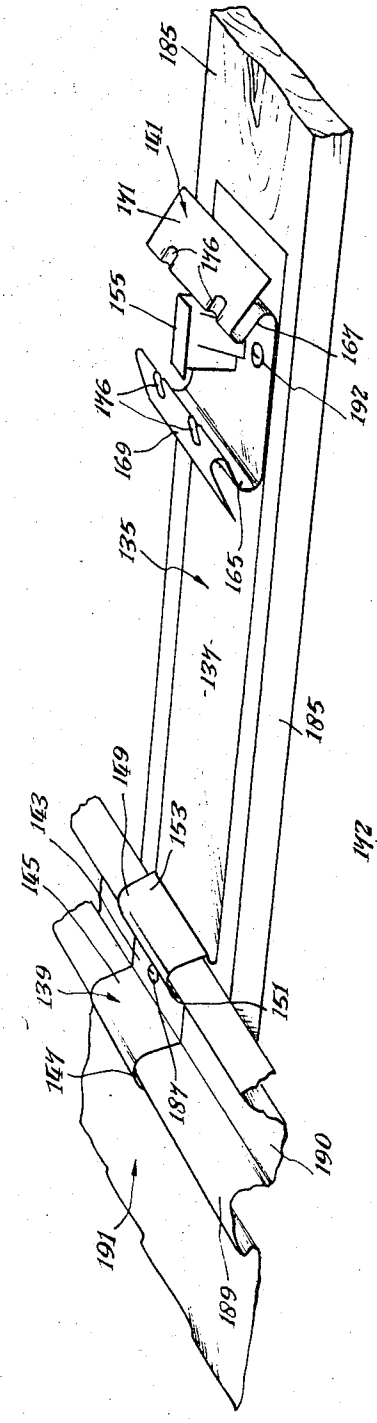


Fig. 8.

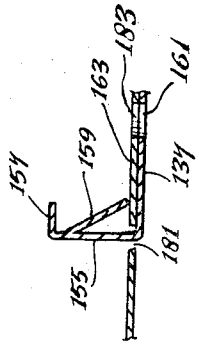


Fig. 11.

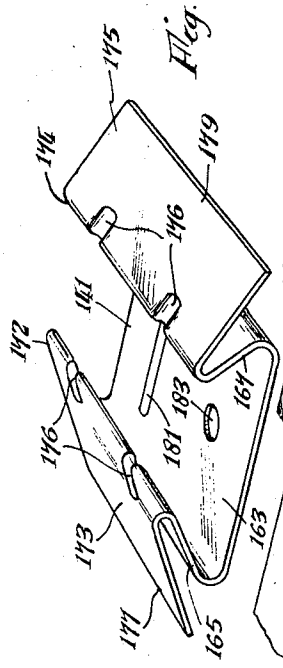


Fig. 9.

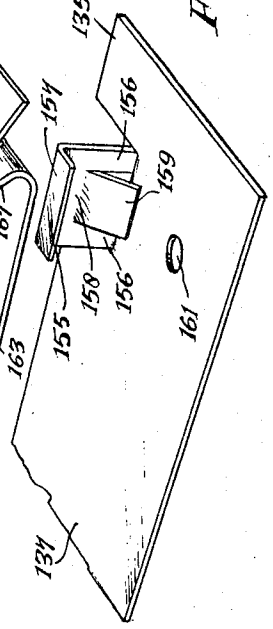


Fig. 10.

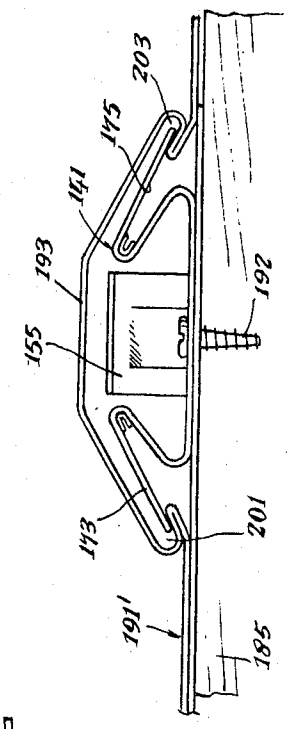


Fig. 14.

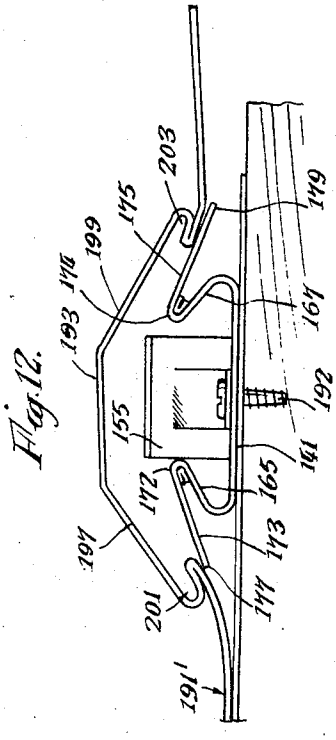


Fig. 12.

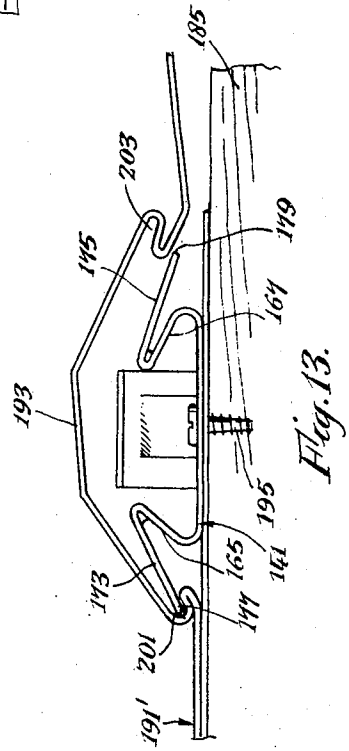


Fig. 13.

SHEET FIXING DEVICE

FIELD OF THE INVENTION

This invention relates to fixing devices for cladding sheets, e.g., roofing and siding sheets, and especially to concealed snap-action fixing devices for such sheets. The invention also relates to assemblies of cladding sheets and fixing devices.

BACKGROUND OF THE INVENTION

Cladding sheets are fixed onto the framework of a building by means of fixing devices which are themselves secured to structural members of the framework and which engage into recesses, e.g., the inside of ribs, in the sheet to lock the sheet to the structural member. It is desirable that the fixing device be concealed in the finished assembly and also that the roof or wall can be assembled onto the framework of the building from the outside only, in order that the necessity for access from the inside is avoided. For these purposes, fixing devices having clips onto which a rib of the sheet is pressed to engage with a snap-action are known. Problems arise particularly with sheets having wide-angle ribs, i.e., ribs whose sidewalls are at an angle of less than 45° to the general plane of the sheet, because the sheets tend to disengage from the clips when subjected to severe wind suction loading.

In my U.S. Pat. No. 3,724,154 there is described a device which has springs arms on the clip when engaged into internal pockets in a rib of a sheet being fixed when the sheet is pressed onto the clip and also has, spaced from the clip, locating means to locate the device with respect to a previously fixed sheet.

SUMMARY OF THE INVENTION

One aspect of the invention provides a fixing device for a cladding sheet having a clip in which arms which engage into pockets of walls of a recess of the sheet are resiliently mounted on a base by means of members, of which the ends joined to the arms are closer together than the ends joined to the base. Preferably the members, which may be formed integrally with the base and arms from metal sheet, are resiliently joined to the base to allow pivotting relative to the base. The arms may be rigidly joined to the members.

According to another aspect, the invention provides a fixing device for a cladding sheet, having a clip which locks the sheet to the device, the clip having a base and two arms mounted on the base and having free ends which engage in a snap-action into pockets of walls of a recess of the sheet when the sheet is pressed towards the base, these being means to restrict movement of the arms towards the base. The said means may be abutment means and this may consist of projections, e.g., ribs of sheet metal, upstanding from the base towards the arms.

Where the fixing device for a cladding sheet includes a clip having two arms which engage into pockets in walls of a recess of the sheet and, spaced from the clip, locating means to locate the device with respect to an adjacent cladding sheet, it has been found to be advantageous if the clip is separate from, but engageable with, the remainder of the device, so that the device can be assembled in situ.

DESCRIPTION OF PREFERRED EMBODIMENTS

Two forms of this invention will be described by way of example with reference to the drawings accompanying this specification wherein:

FIG. **1** is a perspective view of an assembled fixing device according to the invention;

FIG. **2** is a part perspective view of a part of the fixing device of FIG. **1** before assembly of the clip means onto that part;

FIG. **3** is a part perspective view of clip means of the fixing device of FIG. **1** before assembly;

FIG. **4** is a part perspective view of a roofing sheet to be fixed by the fixing device of FIG. **1**;

FIG. **5** is a part perspective view of a male rib of the roofing sheet of FIG. **4** secured to a purlin and engaging the fixing device of FIG. **1**;

FIG. **6** is an enlarged partial cross-section of the male rib and fixing device shown in FIG. **5**, together with a female rib of a second like sheet interlocked with them and;

FIG. **7** is an enlarged cross-section view of an intermediate rib of the said second roofing sheet of FIG. **6** assembled on the clip means of the fixing device of FIG. **1**;

FIG. **8** is a perspective view of a fixing device according to the invention having end locating means and a fastening clip means;

FIG. **9** is a perspective view of the clip means of FIG. **8**;

FIG. **10** is a part perspective view of the fixing strap and bridge portion of the fixing device of FIG. **8**;

FIG. **11** is an enlarged cross-section view of the assembly by snap-action of the clip means and fastening strap of the fixing device of FIG. **8**;

FIG. **12** is an enlarged cross-section view of the fixing device of FIG. **8** and the centre rib of a roofing sheet prior to assembly of the latter on the clip means;

FIG. **13** is an enlarged cross-section view of the rib shown in FIG. **12** partly assembled on the clip means; and

FIG. **14** is an enlarged cross-section view of the rib shown in FIGS. **12** and **13** assembled on the clip means.

In this description and claims, the terms "downwardly," "upstanding," etc., are used as if the fixing device of the invention is secured on top of a horizontal structural member and the cladding sheet which it secures is pressed downwardly onto it. However the fixing devices of the invention may be used in any orientation.

The fixing device **9** shown in FIGS. **1, 2** and **3** is made of light gauge sheet metal or other suitable material appropriately cut and formed. It has a spacing member in the form of a strap **11** and at one end of the strap **11** locating means **13**, integral with the strap **11**, and at the other end of the strap **11** a fastening clip **15**. The locating means **13** has a trough formed by a base wall **17**, and two slanting walls **19, 25**. The wall **19** is joined to an outwardly and downwardly directed lip **21** which is one extremity of the fixing device. Between the wall **25** and the strap **11** is a slanting wall **27** which is joined to the strap by a double reverse fold in the sheet which forms a pocket **29**. At the opposite end of strap **11** and integral with the strap are two upstanding spaced ribs **31, 33**, each of which has a vertical wall **35, 37** opposed to the other rib and an outer slanting wall **39, 41**. The

ribs 31, 33 are separated by a base wall 43 from which upwardly projecting members in the form of two upright flanges 45, 47 are cut and bent up leaving an aperture 49. The base wall 43 is thus separated into two flat portions 51, 53. The base wall 43 and flanges 45, 47 constitute clip-receiving means.

The clip 15 shown in FIG. 3 is a separate part from the locating means 13 and strap 11 and is cut and formed from a single piece of light gauge sheet metal or other suitable material. It has a base described below, an upstanding central bridge 55 constituted by a top wall 57 and two vertical walls 59, 61, two resilient upstanding members in the form of inner walls 63, 65 adjacent to but slightly spaced from the vertical walls 59, 61, and two spring arms 67, 69 joined at their inner ends to the upper ends of walls 63, 65 and outwardly and downwardly projecting to free ends 71, 73. The walls 63, 65 resiliently mount the arms 67, 69 on the base. The bridge 55 is not as long as the inner walls 63, 65 and there are two overlapping flat base portions 75, 77 at each end of bridge portion 55 which form the base of the clip means. Between the pairs of base portions 75, 77, under the bridge 55, the base of clip has an aperture 78. To assemble the fixing device, the flanges 45, 47 are inserted through the aperture 78 and folded down outwardly over the overlapping base portions 75, 77 clamping the base portions 75, 77 onto flat portions 51, 53 of the strap 11, thereby locking the clip part 15 to the strap 11. When thus assembled, the upstanding ribs 31, 33 are respectively outwardly adjacent the upstanding walls 63, 65 with their upper ends located beneath the arms 67, 69 adjacent their inner ends.

The first roofing sheet 79 shown in FIG. 4 is made of light gauge sheet metal or suitable material and has an one edge a male rib 81, at the opposite edge a female rib 83 and in between an intermediate rib 85, all being wide angled ribs as above defined and being separated by planar sheet parts. A second identical sheet 79 is shown in FIG. 5 (and is given the same reference numerals for the same parts), the second sheet lying adjacent the first sheet in the completed roof. The male ribs 81 have a shape which conforms to the shape of the locating means 13, having an outermost slanting wall 91, joined to a slanting wall 97 which is separated by a base wall 95 from another slanting wall 93. The walls 93, 95 and 97 provide the fixing channel 87, the base wall 95 lying on and being secured to a purlin 129 in the assembled roof and the slanting wall 93 is joined to an innermost slanting wall 89 which itself is joined to the planar sheet part by a double reverse fold which provides an external pocket 103.

The female ribs 83 which in the assembled roof overlie male ribs 81 of neighbouring sheets, have an inner slanting wall 107, a top wall 109 and a resilient outer wall 111, the sheet being turned inwardly at the outer edge of the wall 111 to provide an inwardly turned hook 113. At the joint of the inner slanting wall 107 to the adjacent planar sheet part is a double reverse fold providing an internal pocket 117.

The intermediate rib 85 has two opposed slanting walls 119, 121 to each side of a top wall 123. The walls 119, 121, 123 bound a recess formed by the rib 85. Each slanting wall 119, 121 is joined to the adjacent planar sheet part by a double reverse folding providing identical internal pockets 125, 127 which open into the recess.

In the assembly of a roof, each sheet 79 is fixed down in turn beside the previously fixed sheet 79. First the locating means 13 and strap 11 of the fixing device are secured to a structural member (shown as a wood purlin 129 in FIG. 5) so that the locating means overlies the male rib 81 of the already fixed first sheet 79, the lip 21, the wall 19, the base wall 17, the wall 25 and the wall 23 of the locating means respectively engaging the wall 89, the wall 93, the base wall 87, the wall 97 and the wall 91 of the rib. The free end of the wall 91 is located in the pocket 29, of the locating means. The first sheet 79 and the locating means 13 are now locked together against relative lateral movement. A screw 131 is passed through the two base walls 17 and 87 to secure both rib 81 and locating means 13 to the purlin 129. The clip part 15, if not already secured to the strap 11, is now secured to it in the manner described earlier and a screw 133 is passed through the top wall 57 of the bridge 55.

The clip 15 of the fixing device and the male rib 81 of the already fixed sheet are now suitably spaced to receive respectively the intermediate rib 85 and the female rib 83 of the next sheet (called the second sheet) to be fixed onto the roof. Sheets suitable for fixing by a fixing device 9 are more fully described in my U.S. Pat. application Ser. No. 89165. The female rib 83 of the second sheet 79 is downwardly pressed on to male rib 81 of the first sheet until the hook 113 of the female rib 83 latches into the pocket 103. At the same time the pocket 117 of female rib 83 embraces the outside of the pocket 29 of the locating means 15 so that the female and male ribs are securely located together and cannot part through wind suction loading on the surface of the sheet (see FIG. 6).

The intermediate rib 85 of the second sheet is next downwardly pressed on to the clip 15 causing the outside portions of pockets 125, 127 to ride down the spring arms 67, 69 of the clip. This action moves the resilient inner walls 63, 65 towards each other, so that their inner ends almost touch the upstanding walls 59, 61. The ribs 31, 33 prevent the arms 67, 69 moving too far downwards towards the strap by engaging the arms adjacent their inner ends. As a result the free ends 71, 73 of spring arms 67, 69 when clear of the outsides of the pockets 125, 127 can spring with a snap-action into said pockets as shown in FIG. 7. The pockets 125, 127 are suitably spaced apart for this purpose. In this manner the intermediate rib is securely locked to the clip. Under wind suction on the surface of the sheet the rib cannot be sprung off the clip device because a slight upward lift of the sheet causes the inner ends of resilient inner walls 63, 65 to come into contact with the upstanding walls 59, 61 of bridge portion 55. The bridge 55 acts as an abutment between the walls 59, 61 carrying the spring arms 67, 69, limiting their movement towards each other. Succeeding sheets are secured, by means of similar fixing devices, to the purlins in the manner described.

The use of the fixing device provides an easy and accurate method for securing cladding sheets to a building. If desired the clip part 15 may be used as a separate unit with the rest of the fixing device not being required. In this case the position of the clip 15 has to be accurately measured off from the male rib 81 of the previously secured sheet (which is fixed by means of a drive screw through the base wall 87) otherwise the

clip means may not be securely fixed in the intermediate rib of the next sheet.

Referring to FIG. 8 the fixing device **135** is made of light gauge sheet metal or other suitable material appropriately cut and formed. It comprises, when assembled, a spacing strap **137** in the form of a strap provided at one end with locating means **139** and towards the other end with a fastening clip **141.** The locating means **139** has a base wall **143,** a slanting wall **145** having an outwardly and downwardly directed lip **147,** and a rib **149** with two slanting walls **151, 153.** At the opposite end of strap **137** there are provided clip-locating means as shown in FIGS. **10** and **11** a portion of the strip having been cut out and bent upwardly from the strap **137** to provide an upstanding member which is a tongue in the form of a bridge portion **155** having legs **156** and a cross-piece **158** which has a top flange **157.** Joined to the cross-piece and bent away from the legs **157** is a spring leaf **159** which forms non-return locking means for easy and rapid assembly of the clip means **141** onto the strap **137.** The rest position of the leaf **159** is shown in FIG. **10.** It is biassed towards this position by the resilience of the sheet metal. A hole **161** is provided in the strap **137** for a nail or bolt fixing to a structural member.

In FIGS. **8** and **9** are shown the clip **141** which is formed from light gauge sheet metal or other suitable sheet material which is bent to provide a generally planar base wall **163** resiliently joined through curved sheet portions to and overhung to two members in the form of also generally planar inwardly and upwardly slanting inner walls **165, 167** which at their upper ends join through folds **172, 174** the inner ends of generally planar outwardly and downwardly projecting arms **173, 175** which have free ends **177, 179.** The arms **173, 175** are at an acute angle to the inner walls **165, 167.** A slot **181** and a fixing hole **183** are provided in the base wall **163.** The lower ends of the inner walls **165, 167,** joined to the base wall **163,** are further apart than the upper ends which are joined to the arms **173, 175.** The inner walls **165, 167** are at an angle of about 40° to the base **163.** Angles less than 70° are preferred. The free ends **177, 179** of the arms are at opposite sides of the clip and project beyond the ends of the walls **165, 167.**

The clip means being made of resilient sheet metal, the clip is deformable to allow engagement with pockets of a rib of a sheet as described below, and the free ends **177, 179** of the arms **173, 175** spring with a snap-action into the pockets.

The arms **173, 175** are resiliently mounted on the base wall **163** by the inner walls **165, 167** which can pivot resiliently relative to the base wall **163** in a plane passing across the clip from side to side by deformation of their joins with the base wall **163.** The folds **172, 174** are made rigid by depressions or swages **176** in the sheet at the folds. The spring action of the arms **173, 175** is derived from the rotation of the inwardly slanting inner walls **165, 167** about their point of join to the base wall **163** of the clip means **141.**

To assemble the clip means **141** on the strap **137** the bridge portion **155** is passed through the slot **181** until the spring leaf **159,** which is bent towards the legs **156** by the sides of the slot **181,** has snapped back to its rest position after passing through the slot, so preventing return of the bridge portion **155** through the slot (see FIG. **11**). Alternatively the clip means **141** may be secured on the strap **137** by riveting, spot welding or other securing means.

The fixing device **135** is intended for use with cladding sheets similar to those described fully in my U.S. Pat. No. 3,690,085. These sheets have at one edge a male rib engaged by the locating means of a fixing device, a female rib at an opposite edge which overlies and locks onto the male rib of an adjacent sheet, and an intermediate rib which locks onto clip means of the fixing device. The sheet **191** shown in FIG. **8** of the drawings accompanying the present application has a male rib **189** which is suitably shaped to underlie the locating means **139** of the fixing device **135.** A screw **187** passes through the base wall **143** of the locating means **139** and the base **190** of a channel of the male rib against which the base wall **143** lies, thereby securing both the fixing device and the rib to a purlin **185** across which the sheets are being laid. When secured, the fixing device and the male rib are restrained from relative transverse movement.

During assembly of sheets to form a cladding, after the locating means **139** has been placed over and secured to the male rib **189** of a first sheet, the clip means **141** is attached to the strap **137** as described above (if it is not already attached) and the arms **173, 175** of the clip means **141** are then located in the correct position to engage in pockets **201, 203** provided at the lower edges of slanting side walls **197, 199** of the intermediate rib **193** of the next sheet **191'** which is identical to sheet **191** when the female rib (not shown) of the said next sheet is locked to the male rib **189** of the said first sheet. A screw **192** secures the clip means **141** and the end of the strap **137** to which the clip is fixed to the purlin **185.**

In FIGS. **12, 13** and **14** the engagement of the intermediate rib **193** with the clip means **141** is shown. In FIG. **12** the intermediate rib **193** is shown resting on the arms **173, 175.** It is then downwardly pressed causing the lower wall of the pocket **201** to ride down the arm **173** thereby rotating the inner wall **165** inwardly and downwardly about its point of join to the base **163** until the fold **172** almost contacts the bridge portion **155.** Because of the lack of flexibility of the folds **172, 174,** as mentioned above resilient deformation of the clip **141** occurs at the join of the inner walls **173, 175** to the base, not at the folds **172, 174.** The result of this is to restrict movement of the arms **173, 175** towards the base, which has the advantage of reducing the risk of the arms **173, 175** failing to engage in the sheet pockets. At the position shown in FIG. **13** the free end **177** of arm **173** engages with a snap-action into the pocket **201** of the rib **193.** Similarly, with further movement of the rib **193** towards the strap **137** the free end **179** of arm **175** snaps into pocket **203** to provide a secure connection between rib **193** and clip means **141** as shown in FIG. **14.**

Severe wind suction loading on the surface of sheet **191'** tends to lift the sheet and its intermediate rib upwardly from the roof purlins, but the movement does not release the arms **173, 175** of the clip means from the pockets **201, 203** in the rib because firstly the mouths of the pockets **201, 203** are upwardly directed, secondly inward movement of the inner walls **165, 167** beyond a certain limit is prevented by the bridge portion **155** and thirdly the rigidity of the folds **172, 174** restrains the arms **173, 175** from rotating relative to the inner walls **165, 167.**

What is claimed is:

1. Fixing device for cladding sheets, each of which has a male rib at one end, a female rib at the other end and at least one intermediate hollow rib with internal pockets, the device being securable to a structural member and having,

a. means for locating the device with respect to a male rib of a first one of the sheets, the locating means being engageable with the said male rib so that the fixing device and the said first sheet are restrained from a relative lateral movement,

b. a snap-action fastening clip spaced from the locating means including arms having free ends for engagement with the internal pockets of an intermediate rib of a second one of the sheets, which second sheet is to be secured to the structural member adjacent the first sheet,

c. a spacing member having the locating means at one end and means for receiving the clip at the other end and maintaining the locating means and clip receiving means at a predetermined distance apart,

d. said clip being separate from the remainder of the fixing device and having an aperture, and the clip-receiving means having at least one member to pass through the aperture for subsequent deformation to clamp the clip to the clip-receiving means, whereby the clip is engageable with the clip-receiving means for assembly of the device in situ.

2. Fixing device for cladding sheets, each of which has a male rib at one end, a female rib at the other end and at least one intermediate hollow rib with internal pockets, the device being securable to a structural member and having,

a. means for locating the device with respect to a male rib of a first one of the sheets, the locating means being engageable with the said male rib so that the fixing device and the said first sheet are restrained from a relative lateral movement,

b. a snap-action fastening clip spaced from the locating means and including arms having free ends for engagement with the internal pockets of an intermediate rib of a second one of the sheets, which second sheet is to be secured to the structural member adjacent the first sheet,

c. a spacing member having the locating means at one end and means for receiving the clip at the other end and maintaining the locating means and clip-receiving means at a predetermined distance apart,

d. said clip being separate from the remainder of the fixing device and having an aperture, and the clip-receiving means having a latching member which has a movable projection which is resiliently biassed towards a rest position, the projection being arranged so that on passage of the latching member through the aperture, the projection is engaged by the clip and is moved against the bias from the rest position to allow it to pass through the aperture, the projection springing back after passage through the aperture to prevent withdrawal of the latching member from the aperture, whereby the clip is locked to the clip-receiving means, the clip thus being engageable with the clip-receiving means for assembly of the device in situ.

3. In combination, at least two cladding sheets and a fixing device for use with the sheets,

a. each cladding sheet having a male rib at one end and a female rib at the other end and at least one intermediate hollow rib having two opposed walls and an internal pocket in each wall, the said male rib of a first sheet being capable of underlying an interlocking with said female rib of a second sheet when the first and second sheets are juxtaposed,

b. the fixing device being securable to a structural member and having,

c. means for locating the device with respect to the said male rib of the said first sheet, the locating means being engageable with the said male rib so that the fixing device and the said first sheet are restrained from a relative lateral movement,

d. a snap-action fastening clip including arms having free ends for engagement by a snap-action into the said internal pockets of the intermediate rib of the said second sheet which second sheet is to be secured to the structural member adjacent the first sheet,

e. a spacing member having the locating means at one end and means for receiving the clip at the other end and maintaining the locating means and clip-receiving means at a predetermined distance apart,

f. said clip being separate from the remainder of the fixing device and having an aperture and the clip-receiving means having at least one member to pass through the aperture for subsequent deformation to clamp the clip to the clip-receiving means, whereby the clip is engageable with the said clip-receiving means for assembly of the device in situ, the distance apart of the locating means and the clip when engaged with the clip-receiving means being equal to the distance apart of the said male rib of the first sheet and the said intermediate rib of the second sheet engaged by the clip when the said male rib of the first sheet and the said female rib of the second sheet are interlocked.

4. In combination, at least two cladding sheets and a fixing device for use with the sheets,

a. each cladding sheet having a male rib at one end and a female rib at the other end and at least one intermediate hollow rib having two opposed walls and an internal pocket in each wall, the said male rib of a first sheet being capable of underlying and interlocking with said female rib of a second sheet when the first and second sheets are juxtaposed,

b. the fixing device being securable to a structural member and having,

c. means for locating the device with respect to the said male rib of the said first sheet, the locating means being engageable with the said male rib so that the fixing device and the said first sheet are restrained from a relative lateral movement,

d. a snap-action fastening clip including arms having free ends for engagement by a snap-action into the said internal pockets of the intermediate rib of the said second sheet which second sheet is to be secured to the structural member adjacent the first sheet,

e. a spacing member having the locating means at one end and means for receiving the clip at the other end and maintaining the locating means and

clip-receiving means at a predetermined distance apart,

f. said clip being separate from the remainder of the fixing device and having an aperture and the clip-receiving means having a latching member which has a movable projection which is resiliently biassed towards a rest position, the projection being arranged so that on passage of the latching member through the aperture, the projection is engaged by the clip and is moved against the bias from the rest position to allow it to pass through the aperture, the projection springing back after passage through the aperture to prevent withdrawal of the latching member from the aperture, whereby the clip is locked to the clip-receving means, whereby the clip is engageable with the said clip-receiving means for assembly of the device in situ, the distance apart of the locating means and the clip when engaged with the clip-receiving means being equal to the distance apart of the said male rib of the first sheet and the said intermediate rib of the second sheet engaged by the clip when the said male rib of the first sheet and the said female rib of the second sheet are interlocked.

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