United States Patent

[11] 3,589,758

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Continuation-in-part of application Ser. No. 835,106, June 20, 1969.

[54] **ATTACHMENT SYSTEM FOR PREFABRICATED UNITS**
9 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **287/189.35,** 52/593, 248/224
[51] **Int. Cl.** **F16b 3/00**
[50] **Field of Search** ..... 287/189.35, 189.36 C, 189.36 D, 20.924, 20.925, 20.926, 20.92 C; 52/122, 489, 495, 498, 580, 582, 584, 593, 594, 595; 220/4, 7; 217/12, 13, 43, 45; 248/224, 300

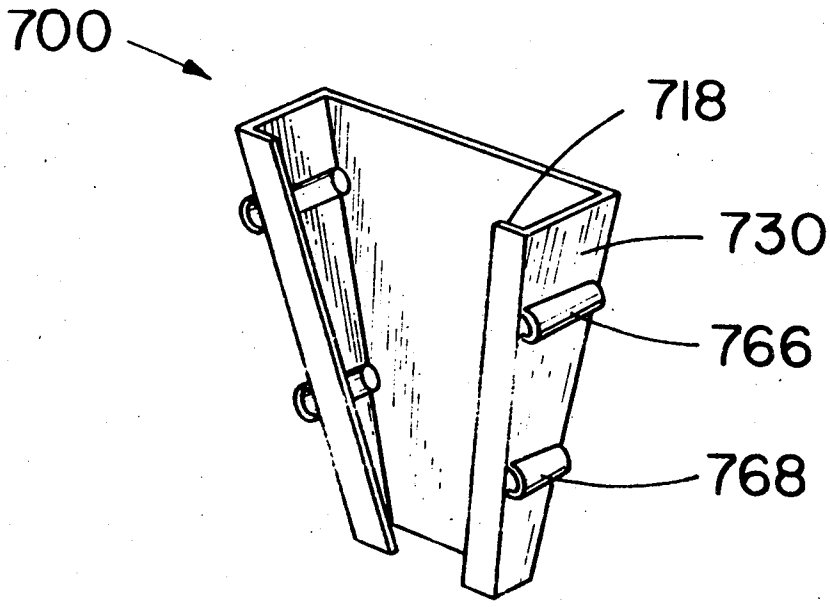
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ABSTRACT: An attachment system for prefabricated construction, such as assembly of panels, posts, trusses, and the like, the system including double-tapered interconnective clips for installation on the respective structures to be secured together, and spacer provisions to tension the clips against each other on engagement, which consists of a vertical-sliding tightening interconnection of the clips. In further embodiments of the invention the spacers are provided as integral parts of the wall structure by recessing the clips in the wall structure, and various clip extensions are provided to stiffen the clips and to facilitate mounting the clips.



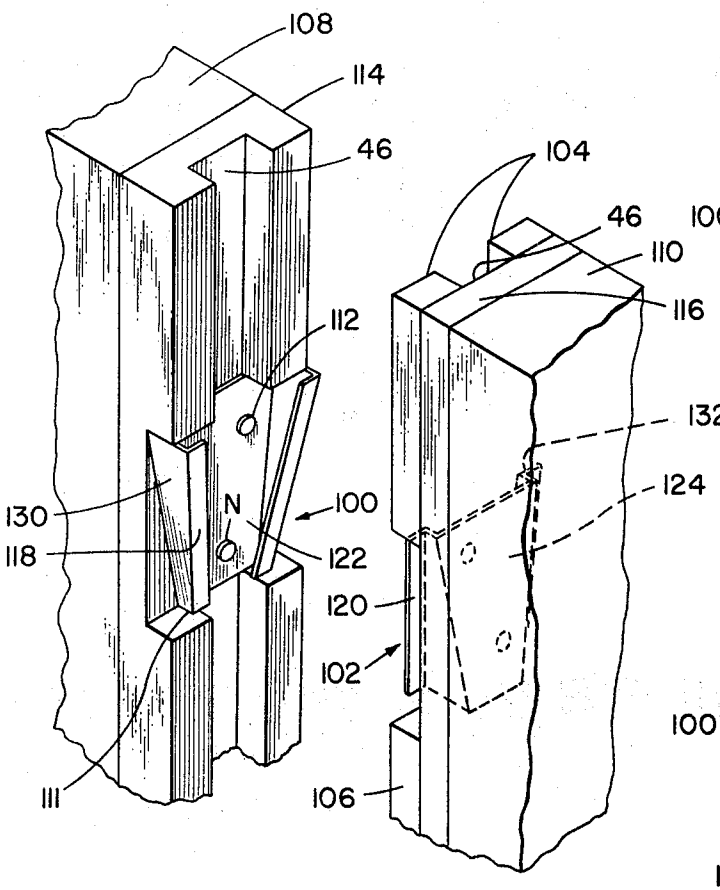


FIG. 1

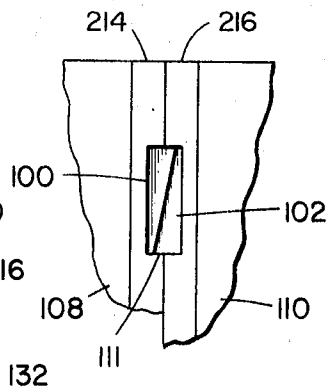


FIG. 2

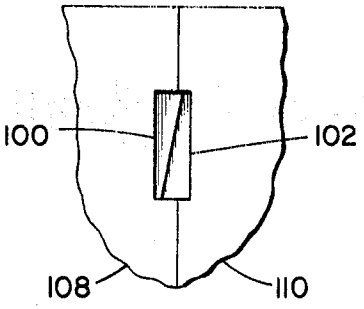


FIG. 3

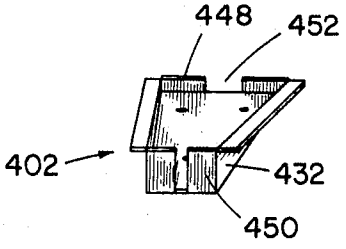


FIG. 4

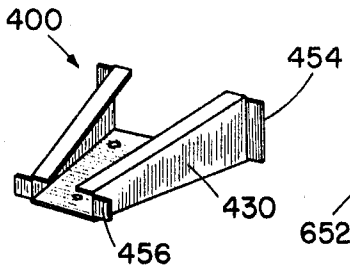


FIG. 5

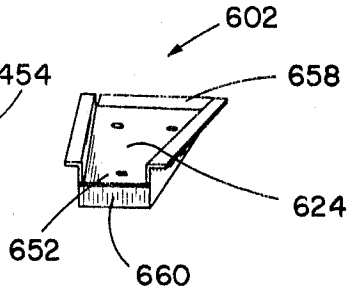


FIG. 6

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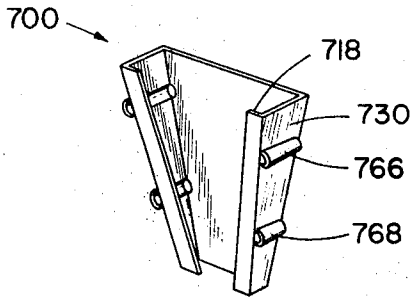


FIG. 7

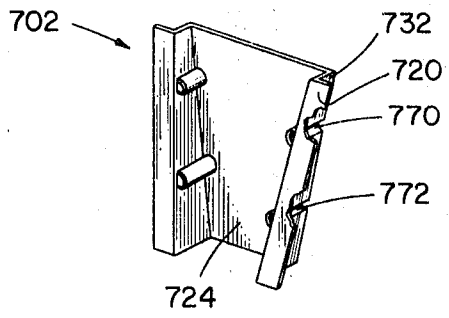


FIG. 8

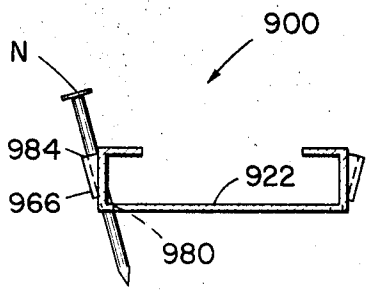


FIG. 9

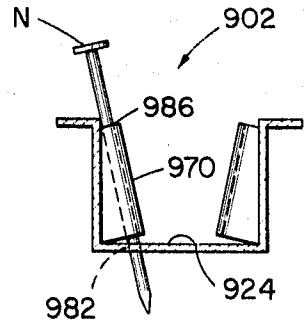


FIG. 10

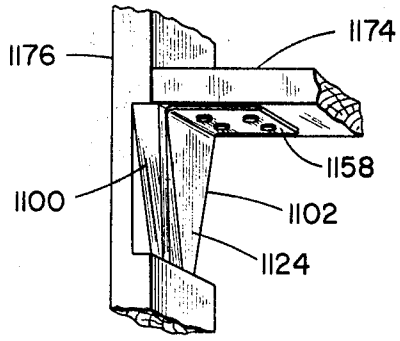


FIG. 11

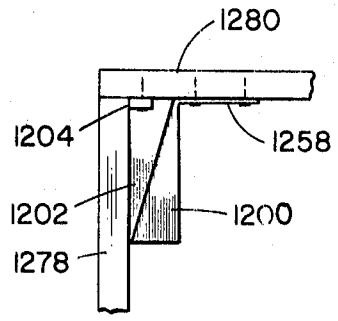


FIG. 12

ATTACHMENT SYSTEM FOR PREFABRICATED UNITS

This application is a continuation-in-part of my copending application for U.S. Pat. Ser. No. 835,106 filed June 20, 1969, for Prefabricated-Wall Attachment System.

This invention relates to building construction generally, and to prefabricated construction specifically.

An increasing percentage of housing in this country is being made as prefabricated construction, for reasons of economy and speed. Old methods of joining building elements, including methods of fastening prefabricated walls, shelving, and the like, are costly and require much in individual designing.

A principal object of this invention is to provide a novel attachment system for prefabricated buildings which overcomes objections found in prior methods and which provides advantages not previously available.

Briefly, my novel attachment system consists of one or more sets of interlocking double-tapered spring clips and spacers for installation of prefabricated walls, shelving, roof, porch, and corner elements, and the like, one clip of each set being affixed to the structure to which these elements are to be attached. The sets of tapered clips are recessed, or are fixed in vertical alternation with spacers to give the same effect as being inset, providing substantially lighttight, self-buttressing joints.

As an example of use, to install a prefabricated wall in a building using the system of this invention, one or more clips are attached to the wall and a mating clip or clips are attached to the standing member of the building to which the wall is to be attached. The wall is then raised slightly, brought next to the standing member in the building so that the clips on the wall and on the standing member are vertically nested, and lowered into self-tightening, clip-aligned studding-spaced final position.

Another object of this invention is to provide an attachment system which is compatible with wood frame construction and accommodative of variations ordinarily encountered in such construction, while preserving precise alignment and rigid positioning on installation of prefabricated structural elements.

And another object of this invention is to provide an attachment system which is easy to align and attach and which is secure on installation.

And still another object of this invention is to provide an attachment system having clips adapted to draw the attached structural elements into place before final engagement of the clips.

Yet another object of this invention is to provide a wall attachment system which is effectively resilient during the initial part of the engagement, but which forms a joint which is rigid in all directions when the attachments seat together.

A further object of this invention is to provide an attachment system which is equally well adapted for use at panel junctions of the T-type, the corner type, and the butt type.

And a further object of this invention is to provide an attachment system having clips adapted to for knockdown box construction.

Yet a further object is to provide a system of the type described which is adopted to minimize corrosive effects of water leakage, through free draining design.

Still a further object is to provide a system of the type described which is adapted to minimize corrosive effects of water leakage, through free draining design.

Still a further object is to provide a system of the type described which is adaptable in the same pattern to light gauge and heavy gauge construction, and to construction employing a variety of materials.

And still a further object of this invention is to provide a system as described in which clips of different gauge construction can be used together, and as replacements in the same application.

And further objects of this invention are to provide a system of the type described which requires no expensive materials, is easy to manufacture, is accommodative of loose tolerances in manufacture, is difficult to damage, and is easy to repair.

Additional and very important objects of this invention are to provide an attachment system as described in which the clips are recessed in the attached structure with zero clearance above and below the clips, lessening the load on the clip-fastening means and forming a substantially lighttight wall joint; to provide for utility line passage vertically through the clips; to provide self-bracing and stiffening means integral with clips; to provide integral extensions facilitating clip fastening; and to provide optimal stacking and shipping embodiments of the clips.

These and other objects of this invention will become more easily understood on examination of the details of the disclosure, including the drawings in which:

FIG. 1 is a perspective of the system of this invention installed in walls for attachment of the walls;

FIG. 2 is an elevation detail of walls joined by this invention;

FIG. 3 is a further elevation detail of walls joined by this invention;

FIGS. 4, 5, 6, 7 and 8 are perspective drawings of various clip embodiments according to this invention;

FIG. 9 is a section through an embodiment similar to that of FIG. 7, but modified;

FIG. 10 is a section through an embodiment similar to that of FIG. 8, but modified;

FIG. 11 is a perspective drawing of a clip assembly detail; and

FIG. 12 is side elevation of a clip assembly detail.

The clips of FIGS. 4 and 5, FIGS. 7 and 8, and FIGS. 9 and 10 form matched pairs as the numbering indicates, although this pairing is not exclusive.

FIG. 1 shows clips **100** and **102** of one embodiment of this system attached to studding **114** and **116** of wall sections **108** and **110** by fastening means such as nails N. Holes **112** are provided in the bases **122** and **124** of the clips for the fastening means, but appropriate types of fastening means may be driven directly through the bases.

Spacers **104** and **106** are nailed to the studding of the walls above and below the clips or alternatively, the spacers may be integral parts of studding, the clips being inset or recessed as illustrated by the installation of clip **100**. Vertical openings **46** may be provided in ends of the wall sections for passage of utility cables, tubing, antenna leads and the like between the walls, taking advantage of the vertical opening in the clip structure.

Clip **100** is a vertically directed, symmetrical U-section channel with a tapered flat base having tapered arms **130** normal to the base with inwardly turned right-angle flanges **118** at the open side. Both tapered dimensions increase upwardly, that is, both the base taper and the taper of the arms tend in the same direction.

Clip **102** is of complementary shape and taper to clip **100**, comprising a vertically directed symmetrical U-section channel with a tapered flat base **124** having tapered arms **132**. The base taper of clip **102** widens upwardly and the arm tapers widen downwardly. Flanges **120** of clip **102** are outwardly turned and proportioned to engage flanges **118** of clip **100**.

The clips are made of sheet metal, such as, for example, 16- to 28-gauge galvanized iron, cut and bent to modular dimension. In the FIG. 1 embodiment, the module chosen is the section of the common 2×4 used in studding. Spacers **104** and **106** are one-half the thickness of a 2×4. This may also be the depth of inset used in lieu of spacers, as for clip **100**, FIG. 1.

FIG. 2 shows the relation of the spacer and clip dimensions as assembled, each of the clips being recessed an equal amount, with the total depth of the recessing equaling the depth of the engaged clips. In FIG. 2, wall section **110** of FIG. 1 has been butted against wall section **108** and wall section **110** has been lowered, engaging and tightening the clips and the wall sections.

To engage the clips, it is not necessary to raise one wall section the full height of the clip. The double-tapered design allows the clip flanges to be "nested" at appreciably less difference in height than the height of a clip, the exact engaging height depending on flange width and taper.

In the embodiment shown, with a flange width of three-sixteenths inch and a vertical taper of 1 to 6 on each side of each clip, less than 1 inch height difference frees the clips for engagement.

The clips draw the walls together, align the walls laterally, and fix the walls in place, on engagement, as noted. Recessing the clips in the walls makes it unnecessary to leave gaps between the tops of the clips and the spacers or between the bottoms of the clips and the spacers.

The design of the clips of this invention is especially well adapted for wood frame house construction, in which it is usually not practical to demand extremely close tolerances because of normal variations in materials, workmanship, and lack of time. The double-tapered configuration of the matched clips produces the necessary constructional rigidity and strength in both plan dimensions, that is, transverse to the wall, and horizontally in the plane of the wall.

Additionally, the upper and lower edges of the recesses, as inset **111**, support the clips vertically, relieving the load on the fasteners used to mount the clips. The recessed mounting method also protects the clips before the wall sections are connected, since the protrusion required for each clip is a relatively small amount. If a shallow taper is employed, the necessary clip protrusion can be as little as twice the thickness of material used in the flanges of the clips.

FIG. 3 illustrates the arrangement in case it is found useful in a particular application to recess one of the clips the maximum amount possible, and the other clip the minimum amount possible. This will vary the proportions but not the principle illustrated in FIG. 2. One clip, **100**, will be recessed an amount equal to the depth of the clip (the greatest extension of the arm) less twice the flange material thickness. The other clip, **102**, will be recessed an amount equal to twice the flange material thickness. No clearance will be required above or below either clip, and the joint at this stage of construction will be practically lighttight as viewed from the side.

The FIG. 2 and FIG. 3 arrangements can be constructed by adding shims or spacers to the surface on which the clip is mounted, as well as by recessing the clips into the surface. In either case, the same tight joints result.

Recessing the clips shifts part of the attachment load to surrounding structure, as when the clips bear on the tops and bottoms of the recesses. This allows the use of lighter gauge metal in the clips, but in that case the clips should be stiffened or reinforced by alteration in the design.

FIGS. 4 through 12 show various means of stiffening and reinforcing the clips of this invention using bent extensions of the clips.

In FIG. 4 inwardly bent extensions **448** and **450** of arms **432** stiffen the arms of the clip against bending out-of-plane and also against flexing toward the center of the clip. Gaps **452** may be left between these extensions for passage of utility cables.

FIG. 5 shows a similar use of bent extensions of arms to stiffen the mating clip **400**. In this case the extensions **454** and **456** of arms **430** are outwardly bent, substantially normal to the axis of symmetry of the clip.

FIG. 6 shows the use of upwardly bent extensions **658** and **660** of the base **624** to reinforce the clip by preventing the base from bending and the arms from flexing towards the center of the clip. Extension **660** may be less than the height of the arms, to provide a passage between the paired clips when engaged, thereby adapting the clips for use with structures having utility grooves substantially aligned with the passage, as in FIG. 1, for example. It will be noted that extension **658** is shown at a slightly open angle. This open angle facilitates stacking clips to save space and avoid damage in shipping, and also causes the clip to hold itself in place prior to fastening when pressed into a recess. Pressing the clip into a recess forces the extension to the required right-angle relation with the rest of the clip.

In regard to stacking or nesting the clips for shipping, it can be seen by inspection that any number of clips **100**, FIG. 1 will nest together longitudinally for shipping. Clips **102** will nest together for shipping in a similar manner.

It is to be noted that the inwardly or upwardly bent extensions at the ends of the clips as shown in FIGS. 4, 5 and 6 also prevent the clips from digging into the recesses of the wall structure under load; this preserves the dimensions of the assembly.

FIGS. 7 and 8 show a further embodiment of the clips **700** and **702** respectively, of this invention.

In FIG. 7, fastener tunnels **766** and **768** have been punched outward from the inside of arms **730** to place the fasteners closely in line with tensile loads on the arms.

Since flanges **718** are formed to the inside of clip **700**, this arrangement allows room to drive the fasteners without interference by the flanges and provides better nailing access with recessed clips, and more secure holding.

In FIG. 8, the arrangement is similar to that of FIG. 7, but opposite. Here the flanges **720** are formed to the outside, and the fastener tunnels **770** and **772** are protruded inwardly.

In both the FIG. 7 and FIG. 8 embodiments, the convolutions of the fastener tunnels, being at a substantial angle to the base, stiffen the clip arms against bending. There is also a buttressing effect which improves load resistance of the assembled clips in any direction, as follows: when the clips are coupled and a tensile load is applied across the juncture, the inner ends of outwardly protruding tunnels **766** and **768** bear against the surface to which the clip **700** is fastened, and prevent arms **730** from turning outward. In similar manner, the inner ends of the inwardly protruding tunnels **770** and **772** bear against the back **724** of clip **702** and prevent the arms **732** from turning inward. In both embodiments the tunnels also stiffen the arms against bending out-of-plane. Although two tunnels are shown in each flange, it will be appreciated that more or less may be used to suit particular applications.

The net result of the stiffening and buttressing is that lighter gauge stock metal can be used for any particular load than would otherwise be possible.

FIG. 9 is a section through a clip similar to that of FIG. 7, except that the fastener tunnels **966** are semiconical, being widest at the end **984** at which fasteners such as nail N are inserted, and narrowest at the base of the clip. A hole **980** is provided in base **922** at each fastener location. This structure directs the fasteners at an inward angle, so that the clips are in effect "toenailed," increasing pullout resistance and reducing possibility of splitting the underlying structure to which the clips are fastened.

FIG. 10 is a section of a clip similar to the FIG. 9 clip, except that the fastener tunnels **970** are inverted semicones narrowest at the end **986** at which fasteners such as nail N are inserted, and widest at the base of the clip. Hole **982** is inboard, directing the fasteners at an inward angle, to provide the same pullout resistance and antisplitting advantages described above in reference to FIG. 9.

FIGS. 11 and 12 show two applications of a further embodiment of this invention. Clip **1100** may be of any of the designs shown in FIGS. 1, 5, 7 or 9, or a combination of these. It is inset in upright **1176**. Clip **1102**, however, is of a unique design somewhat like clip **602**, FIG. 6, except that the extension **1158** formed out-of-plane from the wider part of the back is bent at right angles away from the "U" of the clip. In this embodiment the base taper and the taper of the arms tend in substantially opposite directions, and the flanges of the arms turn outwardly. The extension **1158** is perforated for attachment to other structure, as to shelf **1174**, which is here shown removably affixed to upright **1176** by means of the clip assembly. As in the FIG. 6 embodiment, the bent extension stiffens the back **1124** of the clip against bending.

The necessary spacer relation between the mating parts of the clip in the FIG. 11 embodiment is supplied by butting the shelf 1174 against the upright 1176.

FIG. 12 shows another use for the novel clip assembly similar to FIG. 11. In FIG. 12, sidewall 1278 and top 1280 of a box are removably joined by clips 1200 and 1202. Spacer strip 1204, secured to the top, provides the necessary spacing to tension the clips against each other. Extension 1258 is shown as part of clip 1200, although it can be seen from FIG. 11 that it can as readily be a part of either of the mating clips. In this embodiment the base taper and taper of the arms of clip 1200 tend in the same direction, substantially, the flanges of the arms being turned inwardly.

In conclusion, it will be seen that many construction problems requiring skill in nail, bolt, and screw attachment are entirely avoided by the use of this invention. It will be seen further that the invention is well suited for applications involving prefabricated construction of any nature whether for permanent or demountable use.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

WHAT I CLAIM IS:

1. In a fastening system including paired, symmetrical clips for attachment to members to be fastened together, for fastening said members together, each said clip comprising a U-section channel having a tapered flat base, tapered arms normal to the base, and flanges on the arms substantially normal thereto, the improvement comprising: a said clip having a lateral, tunnellike extension of a part of a said arm for receiving a fastener, thereby stiffening said clip and improving said attachment to a member to be fastened.

2. A device as recited in claim 1, wherein the base taper and the taper of the arms tend in substantially opposite directions, wherein the flanges of the arms are turned outwardly, and wherein the extended part comprises a part of said arm extended inwardly.

3. A device as recited in claim 1, wherein the base taper and the taper of the arms tend substantially in the same direction, wherein the flanges of the arms are turned inward, and wherein the extended part comprises a part of said arm extended outwardly.

4. A device as recited in claim 2 wherein the inward extension of part of an arm comprises a tunnel protrusive to the interior of the arm intermediate the length of the arm and positioned at a substantial angle to said base.

5. A device as recited in claim 4, wherein the shape of the tunnel is semiconical, with the wide portion of the cone proximate said base, and wherein said base has a hole therein aligned with the tunnel.

6. A device as recited in claim 3, wherein the outward extension of part of an arm comprises a tunnel protrusive to the exterior of the arm intermediate the length of the arm and at a substantial angle to said base.

7. A device as recited in claim 6, wherein the protrusion of the tunnel is semiconical, with the narrow portion of the cone proximate said base.

8. A device as recited in claim 1, wherein the paired clips are adapted for recessed mounting in the members to be fastened together, with each of said clips recessed for a portion of the depth of said clip, with the total depth of said recessing equaling the depth of said clips when engaged to each other, and with said extension on a clip adapted to stabilize when recessed.

9. A device as recited in claim 8, wherein said extension leaves a passage along the axis of symmetry of said paired clips when engaged, thereby adapting the clips for use with structures having utility grooves substantially aligned with said passage.