

[54] **STRUCTURAL ASSEMBLY JOINT AND METHOD FORMING SAME**

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[51] Int. Cl. F16b 5/00

[58] Field of Search 287/189.36 D, 189.36 R; 52/472, 482, 494, 495, 497, 288

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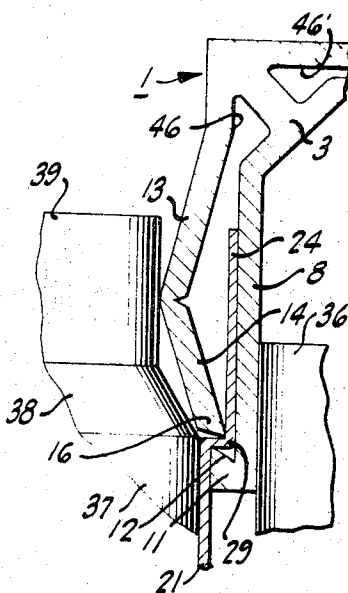
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[57] **ABSTRACT**

A structural assembly comprised of at least two structural members interconnected with each other into a rigid assembly joint without requiring separate fastening means to effect interconnection. The assembly includes a deformable connecting member defining one or more slot structures into which one or more panel members, such as deformable sheets, may be inserted and rigidly locked in place upon deformation of the slot structures. Sealing means may be introduced into the slot structures to render the assembly airproof and waterproof. Each slot structure is defined by a deformable locking flange for urging a predetermined portion of a panel member into secure engagement with a recessed shoulder. The assembly method may be performed mechanically or by hand, in a continuous or discontinuous operation.

34 Claims, 18 Drawing Figures



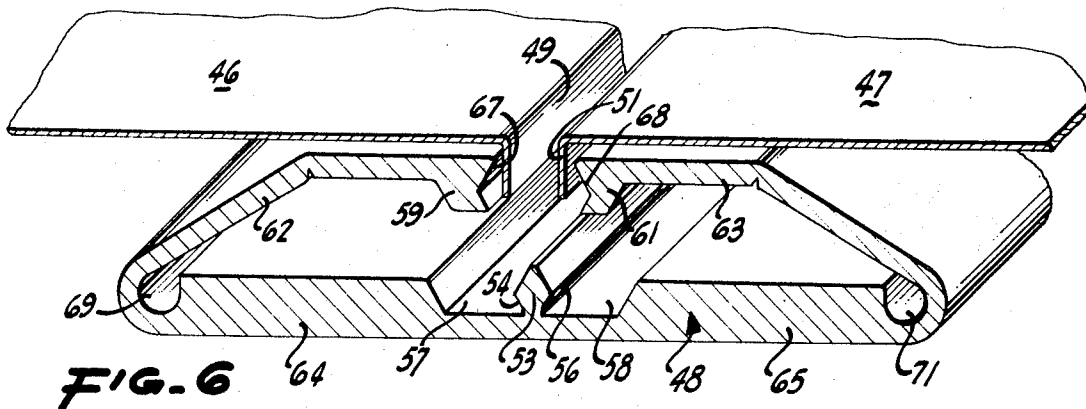


FIG. 6

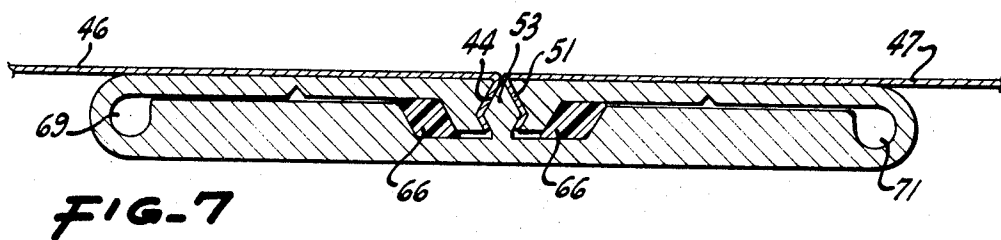


FIG. 7

FIG. 8

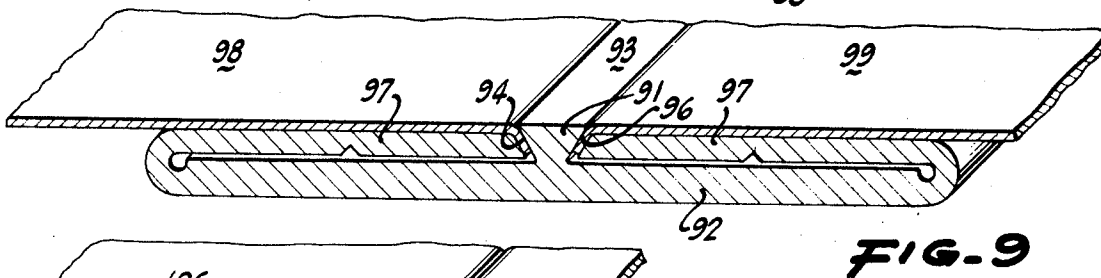
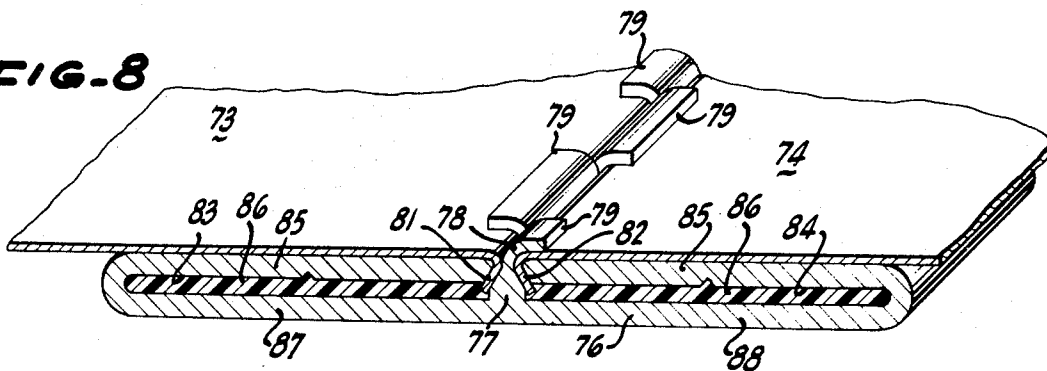


FIG. 9

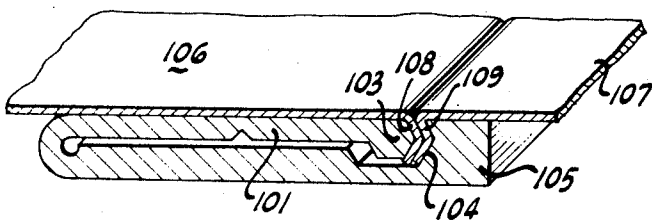


FIG. 10

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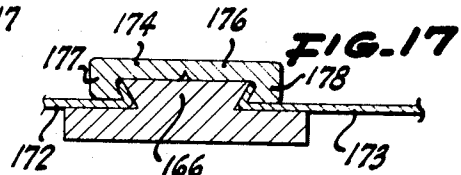
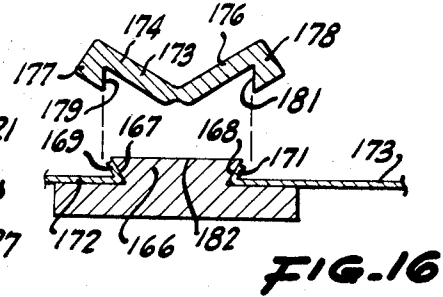
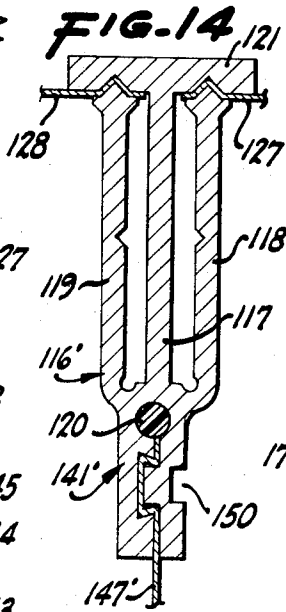
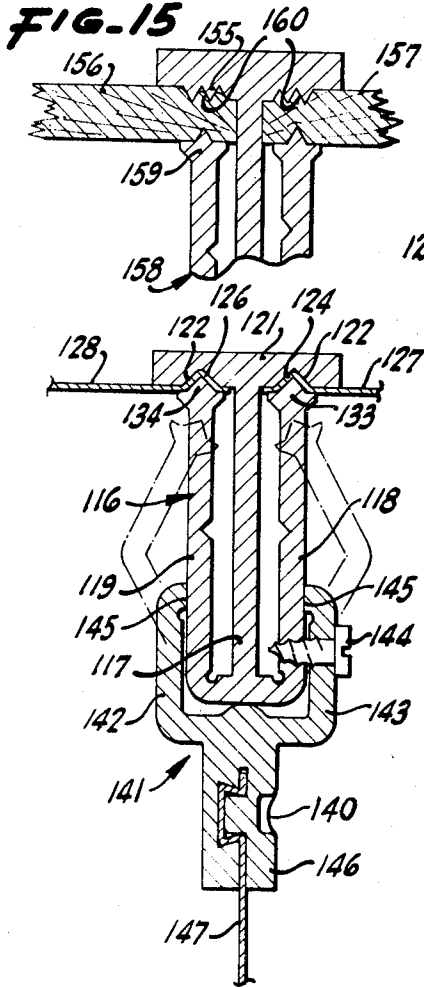
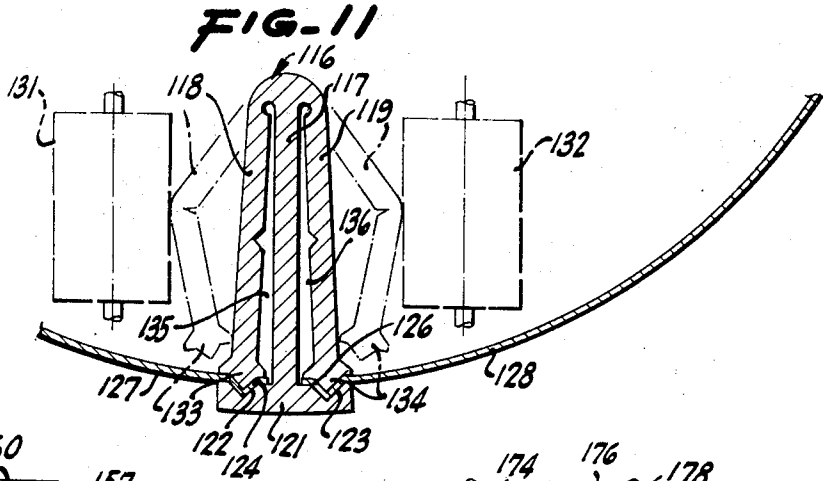
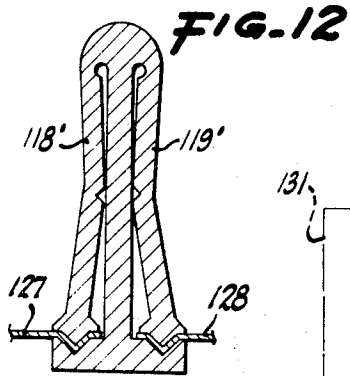
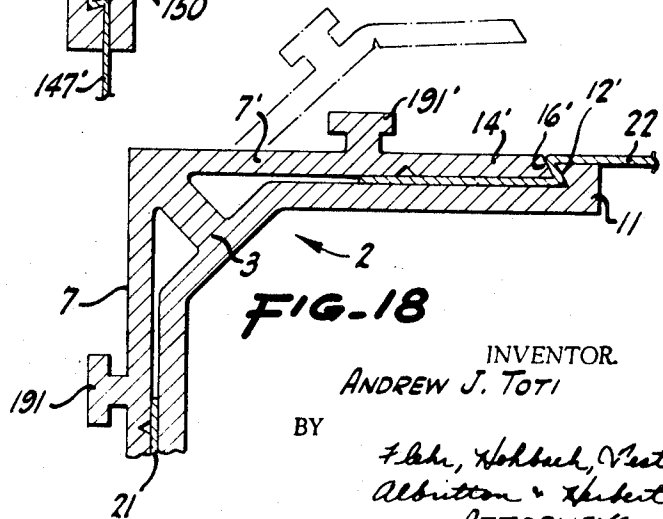


FIG. 13



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STRUCTURAL ASSEMBLY JOINT AND METHOD FORMING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a structural assembly joint and to a method for producing the same. More particularly, this invention relates to an improved joining method and the resulting structure which may be used in producing a wide variety of metal or plastic products, such as: structural building beams for use in supporting patio covers, canopes, roofs of screened-in porches and like building structures; wall panel structures; structural members suitable for use in manufacturing furniture; vehicles including trailers and boats; and other assemblies of a wide and varied type in which it is desired to lock one or more deformable panel members in engagement with a deformable connecting member without requiring separate fastening means, such as screws, bolts, welds, adhesives and the like.

Still more particularly, in a preferred embodiment this invention relates to an assembly joint defined by two panel members, such as deformable sheet metal or plastic members, rigidly interconnected with each other in predetermined relationship by a deformable connecting member, such as an extrusion of permanently deformable metal or plastic.

2. Description of the Prior Art

Assembly joints utilizing deformable connecting members for securing thereto one or more deformable panel members into a jointed structure have been generally known in the art heretofore. However, so far as is known, the particular assembly method and assembly joint construction disclosed herein has not been utilized or known heretofore. Nor, so far as is known, have a pair of opposed panel members been integrally joined by means of a single deformable connecting member in the particular improved fashion disclosed herein which permits the assembly joint to be manufactured in discrete lengths or to be cut from a substantially continuous assembly into lengths of predetermined size.

Furthermore, so far as is known, the novel locking function hereof, by means of which a panel member is rigidly locked by tooth structure of a deformable flange of a connecting member so that the panel member is urged into close conformity to the contour of a recessed shoulder in the connecting member in the manner disclosed herein, has been unknown heretofore.

Characteristic of prior known joint constructions which utilize a preformed connecting member to connect one or more deformable panel members thereto are the U.S. Pat. Nos. to Jewell 3,028,192 dated Apr. 3, 1962; Abolins 3,205,001 dated Sept. 7, 1965; and LaBarge 3,290,077 dated Dec. 6, 1966. However, the respective assembly joints and structures disclosed in such patents do not employ the improved features of the present assembly joint, nor is the subject assembly

CROSS-REFERENCE TO RELATED APPLICATION

An applicant's copending application Ser. No. 888,717 filed Dec. 29, 1969 entitled "Improved Structural Unit, And Method And Apparatus For Producing Same," an improved procedure for joining together two or more components into a securely interconnected assembly joint is disclosed. In such copending application the invention is disclosed in conjunction

with the formation of a light weight improved structural unit, such as building beam.

The present invention is well suited for use in conjunction with formation of a beam construction of the general type disclosed in said application but utility of the present invention in other diversified fields as disclosed herein is also contemplated.

SUMMARY OF THE INVENTION

The present invention relates to an improved structural assembly joint and to a method for producing the same. More particularly, this invention relates to a structural assembly defined by an elongated connecting member, such as a permanently deformable metal or plastic extrusion, predetermined portions of which are to be deformed to lock thereto predetermined portions of one or more panel members to be connected therewith into said structural assembly.

Still more particularly, this invention relates to a joint assembly construction produced from one or more deformable panels, such as permanently deformable sheets of metal or plastic or wood, which are to be interconnected with the connecting member or with each other solely by utilizing the connecting member, to the exclusion of separate fastening means such as screws, bolts, welds, adhesives or the like.

Still more particularly, this invention relates to an improved method for uniting one or more deformable panels with a preformed deformable connecting member into an assembly joint by employing segments of the connecting member itself to effect such interconnection.

From the foregoing, it should be understood that objects of this invention include the provision of an improved assembly joint structural unit and assembly method; the provision of an assembly joint defined by a permanently deformable preformed connecting member and one or more panel members to be interconnected with the connecting member without requiring separate fastening means; the provision of a selectively continuous or intermittent method and procedure for interconnecting a plurality of members into a securely interconnected joint assembly; and the provision of an improved assembly joint and method for producing the same by means of which one or more panels may be securely connected in a predetermined orientation relative to a connecting member.

These and other objects of this invention will become apparent from a study of the following detailed disclosure in which reference is directed to the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of one embodiment of this invention showing one portion of the assembly joint completely formed and the other portion thereof prior to complete formation thereof.

FIGS. 2 through 5 are vertical sectional views of the assembly joint structure shown in FIG. 1 illustrating the sequential operation by means of which the assembly may be formed in a continuous mechanical operation.

FIG. 6 is an isometric view of an alternate embodiment of the subject invention shown prior to joining thereof into a completed assembly.

FIG. 7 is an end elevational view of the embodiment of FIG. 6 showing the same in its assembled condition.

FIG. 8 is an isometric view of another embodiment of the subject assembly joint.

FIG. 9 is an isometric view of an additional modification of the subject assembly joint.

FIG. 10 is an isometric view of a further embodiment of the subject assembly joint.

FIG. 11 is a vertical sectional view of yet another modification of the subject assembly joint illustrating in dotted lines a procedure for forming the same.

FIG. 12 is a vertical sectional view of the assembly joint construction of FIG. 11 illustrating a modification thereof.

FIGS. 13 and 14 are vertical sectional views of other embodiments of the subject assembly joint corresponding generally to the embodiment of FIGS. 11 and 12 but reoriented relative thereto and illustrating structure interconnected therewith and depending therefrom for supporting other structure therebeneath.

FIG. 15 illustrates a further alternate embodiment of the subject invention.

FIGS. 16 and 17 illustrate an additional embodiment of the subject assembly joint in which the same is formed initially in two pieces which are interconnected into a rigid single integral assembly as shown.

FIG. 18 is a vertical sectional view of an assembly corresponding generally to the embodiment shown in FIGS. 1 through 5 which includes graspable means in conjunction therewith by which the assembly joint may be disassembled selectively as desired.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

From the attached drawings it will be noted that the subject invention may take various and varied forms. However, each of such forms employs and utilizes the novel structural assembly features and secure interengagement capability characteristic of this invention which positively precludes unauthorized and unwanted disengagement of the respective structural members of the assembly following their formation into a rigid joint. Additionally, each embodiment of the joint assemblies illustrated may be formed manually or mechanically in continuous or discontinuous operations as desired to meet a particular need. Thus, wide adaptability and applicability for a wide variety of uses is provided by the subject invention.

Referring to FIGS. 1 through 5, a first embodiment of the subject invention, and a method for forming the same into a rigid assembly joint, will be described. In FIG. 1, the assembly joint, generally designated 1, comprises a preformed connecting member, generally designated 2 formed from a suitable material of a strength adequate for the intended purpose therefor. For example, the connecting member 2 may be formed from a suitable metal extrusion, such as aluminum or aluminum alloy, or a plastic extrusion formed from a suitable permanently deformable plastic material.

The connecting member illustrated comprises a central web, generally designated 3, from which extend generally laterally a pair of deformable slot structures designated 4 and 6. Thus, the connecting member has a generally T-shaped configuration in cross section.

In the embodiment shown, the slot structures 4 and 6 extend angularly relative to each other. The angle of inclination between the respective slot structures may vary according to particular needs and to meet particular requirements. In the embodiment illustrated, gener-

ally a 90° relationship exists between the slot structures.

Each slot structure in its initial condition prior to formation of the completed joint assembly, as illustrated by referring to slot structure 4, is defined by a deformable locking flange 7 which is normally spaced from a wall 8. Both flange 7 and wall 8 project from and are integral with central web 3. The locking flange 7 and wall 8 form a slot or groove therebetween, generally designated 9, into which a panel member to be connected with the connecting member is insertable.

At its free end extending along the margin thereof, wall 8 is defined by and includes an elongated undercut ridge 11 which defines a recessed shoulder 12 therebetween and the outer planar surface of the wall 8. The recessed shoulder 12 is generally undercut as perhaps best seen from FIGS. 2 through 5.

Locking flange 7 is defined by a pair of integrally connected sections 13 and 14 which are angularly oriented relative to each other during formation of the connecting member so as to space section 14 an adequate distance away from wall 8 to permit insertion of a panel member into the slot 9 of the slot structure. Along its free margin, flange section 14 is defined by and includes tooth structure 16 which preferably is contoured generally on conformance with the contour or configuration of the recessed shoulder 12. Thus, upon deformation of the locking flange 7 from the open position shown in FIG. 1 to the closed position shown in FIG. 5, tooth structure 16 is urged into close conformity with the contour of the recessed shoulder. Interengagement of the locking flange with a panel member is also shown in the upper right hand portion of FIG. 1.

In that regard, in the upper right hand portion of the showing of FIG. 1 which illustrates locked interengagement of slot structure and a panel member, corresponding reference numerals primed are employed to identify the portions of slot structure which correspond to similar parts of slot structure 4 just described and to be described.

It will be noted from FIG. 1 that an elongated notch 17 preferably is formed between the sections 13 and 14 of the locking flange to facilitate initial positioning of the flange in the open bent position shown in such figure.

With the arrangement shown in FIG. 1, it should be understood that a corner joint assembly is defined because of the angular relationship between the respective slot structures described. As noted previously, the angularity of such joint assembly may be varied to meet specific requirements.

With the arrangement shown, two panel members 21 and 22 are to be interconnected with each other by connecting member 2. In that regard, in the arrangement illustrated, such panel members are in the form of deformable sheets of metal or plastic, an inner portion 23 of each of which is initially inserted into an associated open slot structure 4 or 6 prior to deformation of the respective locking flanges 7 and 7'. However, as described hereinafter, the contour, configuration and construction of the panel members to be interconnected into the assembly joint may vary appreciably from the flat panels shown in FIG. 1, according to particular needs.

Depending upon the size of the panel members to be connected with the connecting member, the locking flanges may be utilized to directly deform the same into

the locked and assembled position shown. In that regard, if a suitable sheet metal, such as aluminum or aluminum alloy of proper gauge is selected, such deformation of the panel members may be effected simultaneously with formation of the assembly joint. Alternatively, some preliminary formation or complete preformation, of the panel members may be carried out if desired to meet a particular need.

In any event, in the embodiment shown in FIGS. 1 through 5, the inner portion 23 of panel member 21 is inserted in any suitable fashion in the position shown with its free margin 24 spaced a substantial distance from recessed shoulder 12. As a result, when locking flange 7 is deformed, the panel member is snugly engaged with the recessed shoulder 12 at a location and along an area spaced inwardly a substantial distance from the free margin 24 of the panel.

Referring to FIGS. 2 through 5, it should be understood that the joint assembly of the embodiment illustrated is well suited to be formed mechanically in a sequential operation using mechanical rollers or like mechanisms for such formation. In that regard, it should be understood that such rollers may be mounted at a deforming station of a forming apparatus in any suitable manner within the skill of a person knowledgeable in the metal working art.

As seen in FIG. 2, during the first step in forming the assembly, the wall 8 of connecting member 2 is engaged by a backup roller 26 having a smooth periphery which engages the inner flat surface of wall 8 while a contoured deforming roller 27 having an enlarged diameter cylindrical shoulder 28 thereon is brought into engagement with the panel member 21 at a location spaced inwardly from its free margin 24. Such interengagement at the deforming station while panel member 21 and the connecting member 2 are being moved past the station in any suitable fashion results in a substantially right angled bent shoulder 29 being formed in the panel member.

Continued movement of the panel member and connecting member past the deforming station carries the same past a second smooth surfaced backup roller 31 and a second deforming roller 32, the latter of which includes an inclined frustoconical portion 33 and a reduced diameter cylindrical extremity 34 positioned and designed to engage the elbow of the deformable locking flange 7 generally at the interface between flange sections 13 and 14. Such engagement initiates straightening of the flange.

Continued movement of the connecting member and panel member at the deforming station carries the same past a third smooth surfaced backup roller 36 and a third deforming roller 37, the latter of which includes another frusto-conical inclined section 38 and a reduced diameter cylindrical section 39, the latter of which further straightens the locking flange by urging the elbow thereof inwardly to bring tooth structure 16 into engagement with the previously deformed bent shoulder 29 of the panel member.

Following such engagement, further movement of the connecting member and panel member at the deforming station carries the same past a fourth smooth surfaced backup roller 41 and a fourth deforming roller 42, the latter of which is formed with a smooth cylindrical periphery the purpose of which is to complete straightening of the locking flange to the generally planar condition shown in FIG. 5. In such condition, and

because of the inward urging of deforming roller 42 against the locking flange, tooth structure 16 of the locking flange urges and further deforms the bent shoulder 29 of the panel member into secure and close conforming engagement with the recessed shoulder 12 of wall 8 as best seen in FIG. 5.

It should be understood that while the slot structure 4 and panel member 21 are being sequentially deformed as described, the other slot structure 6 and panel structure 22 may be simultaneously deformed into secure engagement with each other in a corresponding manner. Alternatively, one of the slot structures may be first deformed at the deforming station and the other slot structure subsequently deformed in separate operations at such deforming station, depending upon manufacturing requirements and capability.

In any event, the resulting interengagement between the locking flange of the respective slot structures of the connecting member and the panel members being locked in place insures a rigid interconnection therebetween for producing a joint assembly having a wide variety of uses as noted herein.

Still referring to FIG. 1, it will be noted that each of the slot structures 4 and 6 further includes an elongated channel extending substantially the length thereof, such channels being designated 46 and 46' respectively. The purpose of such channels is to permit reception within the respective slot structures of an assembly joint means for sealing the assembly to impart airproof and waterproof capability thereto. Within the respective channels noted, such as shown in the upper portion of FIG. 1 by reference numeral 47', is inserted a settable sealing material of suitable flowable plastic or rubber composition. Such sealing material preferably is introduced therein by extrusion under pressure, after formation of the assembly joint or substantially simultaneously with such formation, depending upon manufacturing capabilities and requirements. In any event, such sealing material flows and fills in and closes off all areas through which air or moisture might pass in a completed assembly. Upon being forced into place, such sealing material sets or hardens. When thus sealed, the assembly is particularly well suited for use as a conduit or like structure in which air and water tightness are required or desired.

Although in FIGS. 1 through 5 a sequential mechanical operation is illustrated for forming the subject joint assembly shown therein, it should be understood that hand tools also may be utilized for effecting such an assembly joint if preferred. It should also be understood that the assembly joint formed with the procedure of FIGS. 1 to 5 may be formed in elongated sections in a substantially continuous operation utilizing elongated sections of connecting members 2 and lengths of panel members 21 and 22 withdrawn from rolls thereof. Such sections may then be cut to predetermined lengths to meet particular needs. Reference is directed to the disclosure of the above identified pending application for an illustrative description of the type of procedure and apparatus which may be utilized in forming an assembly of the present invention.

It should also be understood that the other embodiments of the assembly joint disclosed hereinafter may be formed utilizing similar mechanical assembly procedures and methods in which a panel member to be connected to a connecting member is first inserted in a slot structure and thereafter a locking flange having tooth

structure in conjunction therewith is deformed into secure locking engagement with a predetermined portion of the panel member to lock the same together into a rigid assembly. The particular apparatus utilized to form such an assembly may be varied depending upon the particular needs to be met.

Referring now to FIGS. 6 and 7 another embodiment of the subject assembly joint is illustrated. In such figures, two panel members 46 and 47 are to be interconnected into a rigid assembly joint by a deformable connecting member 48. In this embodiment, panel members 46 and 47 are formed with preformed bent marginal edge portions 49 and 51 respectively. Such preformed marginal edge portions will not obviate coiling of such panel members into rolls for convenience in shipping and handling for subsequent use in manufacturing assemblies of the type shown.

The connecting member illustrated includes a central web 53 which defines an elongated ridge having along each of its opposite margins undercut or recessed shoulder portions 54 and 56. Such shoulder portions are generally V-shaped in configuration as shown in FIG. 7 and the same open onto elongated channels 57 and 58 which extend longitudinally of the connecting member. The channels are positioned to receive therein the ridges 59 and 61 of locking flanges 62 and 63 respectively. The locking flanges cooperate with walls 64 and 65 of the connecting member, and the central web 53 thereof, in defining slot structures into which panel members 46 and 47 are to be lockingly positioned.

The channels 57 and 58 are formed of a size sufficient to receive therein settable sealing means 66, as shown in FIG. 7, in accordance with the prior description of sealing means 47' in FIG. 1.

With the arrangement shown in FIGS. 6 and 7, the locking flanges 62 and 63 may be deformed from the open position shown in FIG. 6 to the closed position shown in FIG. 7 in any suitable fashion, such as by engaging the same with a roller as the same passes a deforming station in the general manner described previously. In that regard, the respective locking flanges 59 and 61 are provided with tooth structure 67 and 68 along their marginal edges which is contoured to conform to the generally V-shaped configuration of the respective undercut shoulder portions 54 and 56 of the web 53 as best seen in FIG. 7.

As a result, the bent marginal edge portions 49 and 51 of the panel members 46 and 47 are deformed during formation of the assembly joint into secure and conforming locking engagement with the central web 53. That is, the panel edge portions are reversely bent into close conforming contact with the web 53 to preclude inadvertent separation of the panel members from the connecting member.

If desired, additional sealing means may be inserted into other longitudinal channels 69 and 71 which are formed along the hinge sections of the connecting member by means of which the locking flanges are integrally connected with the central web in the manner shown.

In the embodiment of FIGS. 6 and 7, it will be noted that the slot structures shown are oriented in generally co-planar relationship to each other in distinction to the angular orientation of the slot structures of the embodiment of FIGS. 1 - 5. Accordingly, the panel members 46 and 47 are interconnected in essentially co-

planar relationship as substantial continuations of each other, as seen in FIG. 7 to provide a generally smooth surface across the joint interface.

FIG. 8 shows a further embodiment of the assembly joint which corresponds generally to the construction of FIGS. 6 and 7 with certain modifications thereof. In that regard, two panel members 73 and 74 are interconnected in substantially co-planar relationship by a deformable connecting member 76. Connecting member 76 is defined by a central web 77 which comprises an elongated ridge having an extension 78 thereof which is deformed during or after formation of the assembly into a series of oppositely directed locking tabs 79 which are bent to overlie the edge portions of the panel members which are engaged with the connecting member. Such locking tabs cooperate with the upstanding portion of the ridge defined by the central web to define the recessed locking shoulders which insure against inadvertent separation of the panel members from the connecting member.

In that regard, it should be noted that the central portion of the web 77 is formed with upwardly tapered outer surfaces against which the preformed bent marginal edge portions 81 and 82 of the respective panel members are engaged as shown. Initially such panel edge portions are bent to the configuration shown at 49 and 51 in FIG. 6 and are subsequently deformed to their locking position shown in FIG. 8 when the assembly joint is formed, such locking deformation being effected when opposed locking flanges 85 are moved to their locking position.

In the arrangement shown in FIG. 8, elongated channels 83 and 84, which extend the full width of the connecting member, remain partially open following completion of the assembly joint. Such channels, if desired, are filled for their full width and length with sealing means of the type described previously which is identified by reference numeral 86. Thus a completely airtight structure is insured.

Locking flanges 85 are formed with tooth structure along the free margins thereof which corresponds generally to the tooth structure illustrated in the embodiment of FIGS. 1 to 5. The locking flanges 85 and web 77 cooperate with the walls 87 and 88 of the connecting member in defining slot structures in which the panels 73 and 74 are lockingly received.

FIG. 9 shows a further embodiment which is closely related to the embodiment of FIG. 8, except that the central web 91 which defines an elongated ridge of the connecting member 92 has a planar or flat upper surface 93 which defines undercut or recessed shoulders 94 and 96 along opposite sides thereof. It is against such recessed shoulders that the marginal edge portions of the panel members are urged by the locking tooth structure of the respective locking flanges 97 as seen. With the arrangement shown in FIG. 9, the strong lateral pressure exerted by the tooth structures of the locking flanges against the recessed shoulders of the central web precludes separation of the panels 98 and 99 which are connected together in substantially coplanar relationship by the connecting member. The embodiment of FIG. 9 may include sealing means therein if desired, but the assembly shown is designed to have essentially surface to surface contact between the locking flanges and the walls of the connecting member, as shown in the drawing.

FIG. 10 shows a further embodiment which employs only a single deformable locking flange 101 on a connecting member 102 which includes only one slot structure. With the arrangement shown, the tooth structure 103 of the locking flange is provided with a V-shaped configuration designed to cooperate with a similarly V-shaped recessed shoulder 104 on the web 105 which defines an elongated ridge of the connecting member.

In that regard, two panel members 106 and 107 are interconnected in generally co-planar relationship with each other by being deformed by the single locking tooth structure into secure engagement with each other and with the locking shoulder. That is, the marginal edge portions 108 and 109 of the respective panel members are rigidly clamped together between the locking tooth structure and the recessed shoulder upon deformation of the locking flange to the position seen in FIG. 10. The reverse bend formed in the panel edge portions insures against inadvertent separation of the panel members from the connecting member.

As noted previously, the embodiment shown in FIGS. 1 through 5 provides an assembly joint in which the panel members being interconnected extend at a predetermined angular relationship relative to each other.

With the arrangement of FIGS. 1 through 5, the interengagement of the locking tooth structures with the recessed shoulders urges portions of the respective panel members against the recessed shoulders at locations spaced inwardly from the free margin of such panel members. With the arrangements shown in FIGS. 5 through 10, the free marginal edge portions of the respective structures are engaged with the undercut shoulders and locking tongue structures in the manner seen. In either event, however, secure interengagement between the respective components of the assembly joint is insured by the rigid strut-like wedging action which results when lateral wedging pressure is applied by a locking flange against a panel member to urge the panel member tightly against an associated recessed shoulder.

FIG. 11 shows a further modification of the subject assembly joint in which a connecting member 116 is formed so that its slot structures extend generally parallel to each other along opposite sides of the central web 117 thereof. With the arrangement shown, the respective slot structures are defined by a pair of generally parallel locking flanges 118 and 119 which, in the initial position shown in dotted lines in that figure, impart a generally U-shaped configuration to the connecting member. The central web 117 includes a headed portion or ridge 121 in which parallel spaced recessed or under-cut shoulders 122 and 123 are provided along opposite sides thereof. In the embodiment illustrated such recessed shoulders are generally V-shaped in configuration and extend the length of the locking member. The opposite outer surfaces of the central web 117 constitute inner walls of the slot structures.

It is into recessed shoulders 122 and 123 that the marginal edge portions 124 and 126 of panel members 127 and 128 are positioned. Upon such positioning being effected, the locking flanges 118 and 119 are deformed inwardly toward each other by any suitable means, such as by compression rollers 131 and 132 shown in dotted lines, at a deforming station. Alternatively, hand tools of any suitable type may be employed to deform the locking flanges.

In any event, the locking flanges are moved to the full line position shown in FIG. 11 in which the tooth structures 133 and 134 formed along the free edges of the locking flanges are urged into engagement with the marginal edge portions of the panel members to deform the same into V-shaped configurations conforming to the contour of the recess shoulders 122 and 123 as shown. Initially such panel marginal edge portions may be flat upon insertion into the slot structures for deformation by the locking flanges during formation of the assembly joint.

When thus deformed into the recessed shoulders, the panel members 127 and 128 are positively precluded from separation from the locking member in the manner seen by the rigid strut-like wedging action of the locking flanges.

The channels 135 and 136 extending longitudinally of the locking member along the central web 117 may be filled with a suitable sealing means if desired to completely airproof and waterproof the assembly in the manner described previously. Such airproofing and waterproofing is particularly important in a construction of the type shown as FIG. 11 which may define the hull of a boat or other construction designed to be exposed to water. In that regard, by preforming the panel members 127 and 128 into concave configurations as shown, a boat hull or similar construction may be easily formed with the connecting member 116 forming the boat's keel.

FIG. 12 shows a modification of the construction shown in FIG. 11. In the embodiment shown in FIG. 12, the respective locking flanges, identified as 118' and 119', are deformed past their straight line position to impart additional rigidity and wedging action thereto. That is, comparing FIG. 12 with FIG. 11, the locking flanges are deformed inwardly to an overcenter position which imparts additional resistance to lateral separation thereof when the assembly joint is formed.

FIG. 13 shows a further embodiment which utilizes the basic configuration of the connecting member shown in FIG. 11. In that arrangement, corresponding reference numerals are employed for the sections of the locking flanges and the panel members to be secured together thereby. Additionally, however, the connecting member 116 is shown in an inverted position in which separate structure may be secured thereto and supported thereby. In that regard, a clevis member designated 141 having spaced arms 142 and 143 is engaged with the connecting member 116. Such engagement is positively maintained by means of screws 144 or like fasteners extending through one or both arms of the clevis into one or both of the locking flanges 118 and 119.

With the clevis arrangement shown, the clevis may be utilized as a hand tool to deform the locking flanges to the closed position when the clevis is forced upwardly against the locking flanges. Alternatively the locking flanges may be deformed initially and the clevis member engaged therewith and secured thereto subsequently.

The clevis 141 includes an integral extension 146 thereof with which a separate sheet metal or plastic panel 147 or the like may be secured thereto in any suitable fashion. Particularly well suited to effect such interconnection is the procedure described in the aforementioned copending application, particularly with respect to FIGS. 14, 16 and 19 thereof. In that re-

gard, the clevis member preferably is longitudinally recessed as shown at 140 to facilitate such interconnection.

Thus, the assembly joint of this invention, once it is supported from an overhead supporting structure, such as a ceiling characterized by panel members 127 and 128, may be utilized to support a vertical wall panel or the like of a building construction or other like structure.

While the embodiment shown in FIG. 13 illustrates a separate clevis member 141 secured to connecting member 116 by screws 144, it should be understood that clevis 141 may be formed integrally in one piece with the connecting member and extruded as part thereof. That is, in the areas indicated by reference numerals 145, the arms 142 and 143 of the clevis may be integral with the locking flanges 118 and 119. In such case, the clevis arms would initially be bent outwardly with the locking flanges, generally to the dotted line position shown for the locking flanges.

FIG. 14 corresponds generally to the showing of FIG. 13 with the exception that the clevis member designated 141' is formed integrally and extruded in one piece with the connecting member 116'. In other respects the relationship between the clevis member and the connecting member and the functions thereof are the same as in the FIG. 13 embodiment. However, in the FIG. 14 embodiment, a longitudinal recess 120 is formed at the upper end of panel 147' to receive sealing means at that location if desired. Also in FIG. 14, to further facilitate deformation of the clevis member to lock panel 147' in place, the clevis is formed with a longitudinal groove 150 extending the length thereof to make it easier to deform the clevis member as shown to hold the panel 147' securely locked thereto in the manner disclosed in the above identified copending application.

In FIG. 15, an embodiment corresponding generally to the showings of FIGS. 13 and 14 is illustrated but in such embodiment the interengagement between the recessed or undercut shoulders and the locking tooth structures of respective locking flanges is modified to adapt the same to more effectively engage the deformable panel members shown interconnected therewith. Such a modified arrangement is designed to facilitate securing of fibrous or other deformable panels, such as wood panels 156 and 157, to the connecting member generally designated 158.

Such connecting member corresponds generally in basic construction to the connecting members described previously in FIGS. 11 through 14 with the exception of the modification of the recessed or undercut shoulders designated 160 and the cooperating locking tongue structures 159. In that regard, the recessed shoulders are defined by a series of alternate projections and grooves while the locking tooth structures are defined by one or more projecting teeth or ridges which are to be embedded in the deformable fibrous material of the panel members as seen in FIG. 15. Thus a secure interlock between the connecting member and the panel member is insured.

While hereinbefore, reference has been directed generally to assembly joints which are defined by a preformed extruded connecting member and two flat deformable or partially preformed panels, under certain conditions it may be desired to inter-connect two preformed extrusions with each other. In such case, one of

the extrusions would correspond to the panel member or members described previously and would be provided with marginal edge portions which include preformed longitudinal grooves. Such grooves would be contoured to conform with the contour of the tooth structures and recessed shoulders of the other preformed extrusion. Thus, the two extruded members could be interconnected by deforming the teeth of the locking flanges of one extruded member into the grooves of the other extruded member.

That is, referring to FIG. 14 by way of example, instead of panel members 127 and 128 being separate from each other, they could be formed from a more sturdy and thicker material and integrally connected into a predetermined shape as a one piece extrusion. Such extrusion would then be slidably interfitted with the extruded connecting member 116' in straddling relationship to web 121 thereof. In such case, the marginal edge portions of the members 127 and 128 would be preformed with generally V-shaped grooves which interfit between the tooth structures of locking flanges 118 and 119 and the recessed shoulders of web 121 to be securely held therebetween.

Heretofore reference has been directed to one piece connecting members but it should also be understood that this invention has utility in conjunction with a modified connecting member which is formed initially of two separate pieces as shown in FIGS. 16 and 17. In that regard, the slot structures of such a two piece connecting member is defined by a central web 166 having along opposite margins thereof undercut or recessed shoulders 167 and 168 into which marginal edge portions 169 and 171 of deformable panel members 172 and 173 are received. Preferably, but not necessarily, such marginal edge portions are preformed to be somewhat reversely bent in the manner seen in FIG. 16 so as to be initially in conformance with the undercut contour of the recessed shoulders.

To lock the panel members in place in conjunction with and in contact with the recessed shoulders a locking member 173 is provided, which completes the slot structure of the connecting member. Such locking member is defined by a pair of integral angularly oriented locking flanges 174 and 176 which terminate in tooth structures 177 and 178 respectively. Such tooth structures are defined by undercut teeth 179 and 181 respectively.

Upon movement of the locking member 173 into engagement with the upper planar surface 182 of the central web and by applying downward pressure to the locking member in any suitable fashion, such as by a suitably contoured pressure roller, the locking member and its respective locking flanges may be deformed to the locking position shown in FIG. 17 in which the same is securely locked and engaged with a central web of the locking member. When thus deformed, the tooth structures of the locking flanges 174 and 176 maintain the panel members securely interconnected with each other.

Thus, the two piece arrangement shown in FIGS. 16 and 17 employs the basic concept disclosed and illustrated herein. Hand tools or mechanical means may be employed to form the assembly joint of FIGS. 16 and 17.

Referring now to FIG. 19, a portion of an assembly joint is shown which corresponds generally to the illustration of FIGS. 1 through 5. In that arrangement, simi-

lar reference numerals corresponding to those of FIG. 1 are employed. However, added to one or both of the locking flanges 7 and 7' is means for effecting release and separation of the assembly joint under preselected conditions. In that regard, such release means comprises a graspable structure defined by one or more headed members 191 or 191' positioned generally centrally of the respective locking flanges 7 and 7'. Upon grasping and upward pulling of the headed members 191 or 191' the respective locking flanges may be bent to the dotted line unlocked position shown in which position it is possible to remove the panel member 21 or 22 from engagement with their associated recessed shoulders.

Having thus made a full disclosure of several preferred embodiments of the assembly joint and method constituting the subject invention, reference is directed to the appended claims for the scope of protection to be afforded thereto.

I claim:

1. A structural assembly joint defined by a one piece deformable connecting member and at least one panel member securely interconnected with said connecting member without requiring separate fastening means for effecting such interconnection; said connecting member comprising a preformed slot structure in which a marginal portion of said panel member is receivable, said slot structure being defined by a generally rigid web of said connecting member which includes a ridge which is at least partially undercut to define an integral recessed shoulder against which said marginal portion of said panel member is engaged, and a deformable locking flange initially spaced from said shoulder a distance sufficient to allow said panel marginal portion to be inserted between said flange and shoulder, said locking flange being hingedly connected with said web at a location spaced from said recessed shoulder, said locking flange having a panel engaging tooth structure along a free margin thereof generally facing and adjacent said shoulder; said panel-engaging tooth structure of said locking flange having a configuration which is contoured so as to be compatible with the contour of said recessed shoulder to securely hold said panel member marginal portion engaged in said slot structure and wedged securely in strut-like locking engagement against said shoulder when said flange is moved from an open position, which permits said insertion of said panel member marginal portion into said slot structure, to a closed position following such insertion, which effects said interconnection of said connecting member and said panel member into said assembly; said panel member marginal portion conforming to the contour of and generally filling the recess defined by said shoulder when said locking flange is deformed to move the same to said closed position, said flange and tooth structure thereon thereby serving as the principal means for holding said panel member marginal portion securely wedged against said shoulder to insure against inadvertent separation thereof.

2. The assembly of claim 1 which includes two said panel members interconnected with each other by said connecting member; said connecting member including two said slot structures as defined in claim 1 extending along opposed margins of said web, each of said slot structures having a marginal portion of one of said panel members received therein and locked in place therein by an associated locking flange.

3. The assembly of claim 2 in which said connecting member is formed with said slot structures extending angularly relative to each other at opposite sides of said web.

4. The assembly of claim 2 in which said connecting member is formed with said slot structures extending generally in the same plane with each other at opposite sides of said web.

5. The assembly of claim 2 in which said connecting member is formed with said slot structures extending generally parallel to each other at opposite sides of said web.

6. The assembly of claim 1 which further includes sealing means extending longitudinally of said slot structure between said locking flange and said web to render said assembly generally air tight and water tight.

7. The assembly of claim 8 which further includes a channel extending longitudinally of said slot structure through which said sealing means is insertable after interconnection of said panel member and said connecting members.

8. The assembly of claim 1 in which said panel engaging tooth structure of said locking flange comprises at least one locking tooth for engaging and deforming said panel marginal portion to securely hold said panel marginal portion wedged against said recessed shoulder.

9. The assembly of Claim 1 which further includes supporting means integral with said connecting member by which other structure is connectable with said assembly.

10. The assembly of claim 9 in which said supporting means is formed integrally in one piece with said connecting member.

11. The assembly of claim 9 in which said supporting means is initially formed separate from said connecting member and is integrally connected therewith during interconnection of said assembly.

12. The assembly of claim 1 in which said panel member marginal portion is initially flat upon insertion into said slot structure and is deformable into said recessed shoulder during formation of said assembly.

13. The assembly of claim 1 which further includes graspable means integral with said locking flange for effecting deformation of and disengagement of said flange from said panel member to permit selective disassembly of said assembly when desired.

14. The assembly of claim 1 in which said panel member marginal portion includes an edge margin positioned in said slot structure, said tooth structure of said locking flange being engaged with said panel member at a location spaced inwardly of said edge margin thereof.

15. The assembly of claim 1 in which said panel member marginal portion includes an edge margin positioned in said slot structure adjacent said recessed shoulder, said tooth structure of said locking flange being engaged with said panel member generally along said edge margin thereof to hold the same in said recessed shoulder.

16. The assembly of claim 2 in which said two panel members extend from said connecting member generally in coplanar relationship with respect to each other.

17. The assembly of claim 2 in which said two panel members extend from said connecting member at a predetermined angular relationship with respect to each other.

18. A structural assembly joint defined by a one piece deformable connecting member and two panel members securely interconnected with each other by said connecting member without requiring separate fastening means for effecting such interconnection; said connecting member comprising a generally rigid central web, and two slot structures extending longitudinally along said web into which marginal portions of said respective panel members are receivable, said web including ridges which are at least partially undercut to define integral recessed shoulders extending therealong against which said respective panel member marginal portions are engaged, and a pair of deformable locking flanges initially spaced from said shoulders a distance sufficient to allow said panel marginal portions to be inserted between said flanges and said shoulders, said locking flanges being hingedly connected with said web at locations spaced from said recessed shoulders, said locking flanges each having a panel engaging tooth structure along a free margin thereof generally facing and adjacent said shoulders; said tooth structure having a configuration which is contoured so as to be compatible with the contours of said recessed shoulders to securely hold said panel member marginal portions engaged in said slot structures and wedged securely in strut-like locking engagement against said respective shoulders when said flanges are moved from an open position, which permits said insertion of said panel member marginal portions into said slot structures, to a closed position following such insertion, which effects said interconnection of said connecting member and said panel members into said assembly; said panel member marginal portions conforming to the contours of and generally filling the recesses defined by said shoulders when said flanges are deformed to move the same to said closed position, said flanges and tooth structures thereon serving as the principal means for holding said panel member marginal portions securely wedged against said shoulders to insure against inadvertent separation thereof.

19. The assembly of claim 18 which further includes a channel extending longitudinally of each said slot structure between an associated locking flange and said web, and sealing means in each said channel to render said assembly air tight and water tight.

20. The assembly of Claim 18 in which said panel engaging tooth structure of each of said locking flanges comprises at least one locking tooth for engaging and deforming an associated panel marginal portion to securely hold such panel marginal portion wedged against its associated recessed shoulder.

21. The assembly of claim 18 in which each of said panel member marginal portions is initially flat and is deformable into its associated recessed shoulder during deformation of locking flanges to provide said assembly.

22. A method of making a securely interconnected structural assembly joint without requiring separate fastening means to effect interconnection between members to be joined, comprising providing a one piece preformed deformable connecting member having an open slot structure extending therealong defined by a generally rigid web which includes a ridge which is at least partially undercut and a deformable locking flange cooperable with said web and hingedly connected therewith, said flange having a free margin with tooth structure extending therealong, and an integral

recessed shoulder defined by said undercut ridge and extending along said web, said tooth structure on said flange generally facing said recessed shoulder in spaced relationship thereto and having a configuration which is contoured so as to be compatible with the contour of said recessed shoulder; providing a panel member to be securely interconnected with said connecting member; inserting a marginal portion of said panel member into said slot structure to position the same between said tooth structure and said recessed shoulder; and deforming said locking flange to bring said tooth structure into locking engagement with said panel member marginal portion to urge said marginal portion into strut-like locking engagement with said recessed shoulder to wedge said marginal portion into secure locking engagement with said recessed shoulder and in close conformity to the contour thereof.

23. The method of claim 22 which includes providing said connecting member which includes two open slot structures along opposite sides of said web, each of which includes a recessed shoulder; providing two panel members to be interconnected by said connecting member into said assembly; inserting a marginal portion of each of said panel members into an associated slot structure adjacent an associated recessed shoulder; and deforming said locking flanges into engagement with said respective panel member portions to wedge the tooth structure of said respective flanges into locking engagement with said panel member portions to deform the latter into secure engagement with their associated recessed shoulders.

24. The method of claim 23 which further includes deforming each of said panel member marginal portions to conform generally to the contour of its associated recessed shoulder during formation of said assembly joint.

25. The method of claim 22 in which said locking flange during formation of said assembly joint is deformed to a beyond-center position to rigidly urge the same against said panel member portion.

26. The method of claim 22 which further includes introducing a sealing medium longitudinally of said slot structure in conjunction with deformation of said locking flange to render said assembly joint generally air tight and water tight.

27. The method of claim 22 which includes deforming preselected portions of said web following deformation of said locking flange to positively preclude separation of said panel member portion from said engagement with said recessed shoulder.

28. The method of claim 23 which includes deforming said locking flanges serially into engagement with their associated panel member marginal portions.

29. The method of claim 23 which includes deforming said locking flanges generally simultaneously into engagement with their respective panel member marginal portions.

30. The method of claim 22 in which said panel member marginal portion is at least partially preformed to facilitate interengagement thereof with said recessed shoulder when said locking flange is subsequently deformed to close said slot structure.

31. The method of claim 22 in which said connecting member and said panel member are moved past a deforming station in predetermined fashion with said panel member portion positioned in said slot structure; and in which said locking flange is progressively de-

formed into locking engagement with said panel member portion during such movement past said station.

32. The method of claim 23 in which said connecting member and said panel members are moved past a deforming station in predetermined fashion with said panel member marginal portions positioned in said respective slot structures; and in which said respective locking flanges are progressively deformed into locking engagement with said panel member portions during

such movement past said station.

33. The method of claim 32 in which one of said locking flanges is deformed at said station prior to deformation of the other locking flange thereat.

34. The method of claim 32 in which said locking flanges are deformed substantially simultaneously at said station.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,741,593 Dated June 26, 1973

Inventor(s) Andrew J. Toti

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, after line 59, insert -- method disclosed or suggested therein. --; line 61, "An" should read -- In --.
Column 2, line 8, "alos" should read -- also --; line 35, "inclnde" should read -- include --; Column 3, line 10, "assembty" should read -- assembly --. Column 4, line 20, "rebative" should read -- relative --; line 26, "on" should read -- in --; line 38, after "structure" insert -- 6 --. Column 6, line 12, "Alternativly" should read -- Alternatively --.
Column 10, lines 49 and 50, "engagd" should read -- engaged --.
Column 12, line 65, "FIG. 19" should read -- FIG. 18 --. Column 14, line 17, "8" should read -- 6 --; Column 16, line 64, "saied" should read -- said --.

Signed and sealed this 27th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents