April 11, 1967 D. W. RICE 3,313,562

STRUCTURAL PIVOT JOINT

Filed April 27, 1964

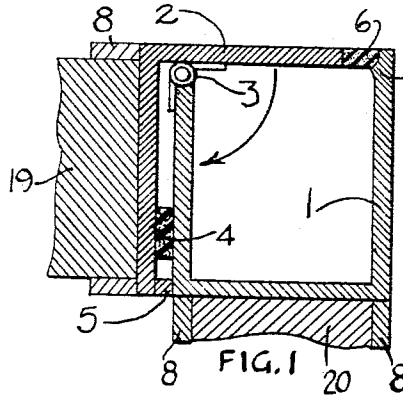

FIG. 1

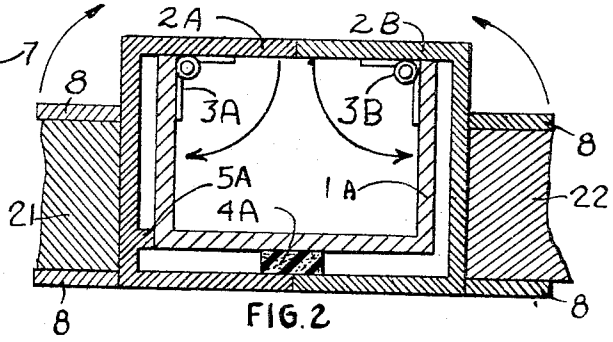

FIG. 2

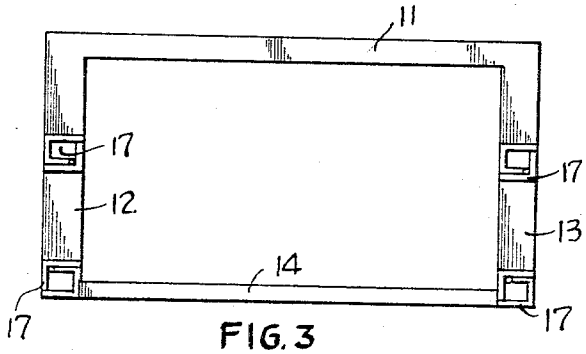

FIG. 3

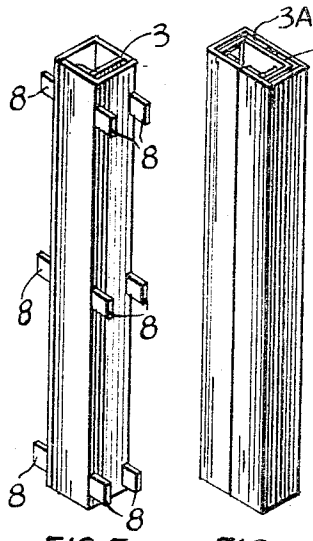

FIG. 5

FIG. 6

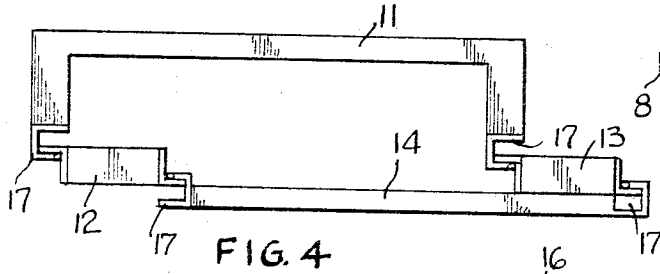

FIG. 4

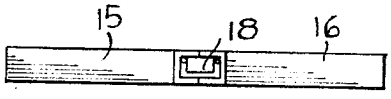

FIG. 7

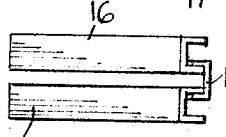

FIG. 8

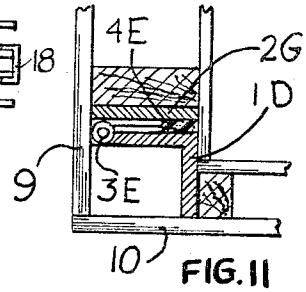

FIG. 11

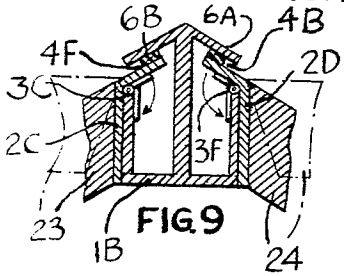

FIG. 9

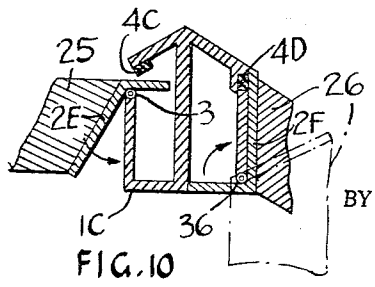

FIG. 10

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STRUCTURAL PIVOT JOINT

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The invention relates to a pivot joint to be used in buildings, structures, containers, boxes and other related products having pivotally attached components which must be collapsed or folded for essentially storage, transportation or handling reasons.

A pivot joint according to this invention has particular application to relocatable buildings and other structures which utilize hinges or other pivotal means attached to movable sections which fold into compact form to reduce the size of the structure to transportable dimensions.

It is the object of the invention to provide a unitized device comprising structural, pivotal, weatherproofing and appearance enhancing properties which preferably can be conjoined with conventional or customary structural shapes to provide basic frames for the types of structures contemplated herein. These joints may be produced in numerous sizes, styles and degrees of strength.

Aluminum extrusions, fabricated or otherwise formed steel shapes, in addition to other materials would be used for the components of structural and pivotal nature. Various standard hinges and other pivotal attaching means may be used to connect the structural components.

Other objects, benefits, and advantages will become evident from a study of the following detailed description taken in conjunction with the accompanying drawing in which:

FIGURE 1 is an end view of a single action pivot joint.

FIGURE 2 is an end view of a double action pivot joint.

FIGURE 3 is a top plan of a walled structure using a single action pivot joint in each of four locations, the structure being shown in expanded or conventional open configuration.

FIGURE 4 is a plan view of the same structure in collapsed or closed position in order to economize on space during storage or transportation.

FIGURE 5 is an isometric view of a single action pivot joint.

FIGURE 6 is an isometric view of a double action pivot joint.

FIGURE 7 is a top plan view of a wall using a double action pivot joint. The wall is shown in expanded or normal "open" configuration.

FIGURE 8 is a top plan view of the same wall shown in FIGURE 7 in collapsed position as during storage or transportation.

FIGURE 9 is an end elevational view of a modified form of the invention adapted for use as a roof ridge beam.

FIGURE 10 is an end view of another form of the invention adapted for use as a roof ridge beam.

FIGURE 11 is an end view of a modified pivot which utilizes outer panel covering as beam closures.

As will be evident from the drawing, the pivot joint resembles a generally hollow rectangularly shaped longitudinally split tubelike member located at a juncture of two of the sections of a wall to be hinged. A portion of one face of the device tips into the hollow of the tube as rotation of the hinged sections is effected. This action in a square or rectangular tube allows approximately 90° relative rotation of the parts. In a double acting joint there is a combined approximately 180° of rotation possible. Certain modifications of the tubelike appearance can be made without departing from the basic function and "tip in" feature of the pivot joint. Examples of this application relating to roof ridge beams are illustrated in the accompanying drawing.

The hinge pin or pintle mechanism lies more or less concealed within the hollow of the joint and, at such location it is not visible when the joint is in normal use and does not interfere with the attachment of siding, roofing, lining, and other coverings to the outer surfaces of the joint. In some cases the hinge pin will be of full length in order that it can be removed to separate the structural members of the joint and the attached panel for maintainance, repair, replacement or other reasons.

Referring now specifically to the drawing, all basically corresponding components carry the same numerical designation with or without an alphabetical suffix. The suffix denotes application to the figure involved only. For example, channel 1 in FIGURE 1 corresponds to channel 1A in FIGURE 2.

FIGURE 1 relates to a single acting joint. Channel shape member 1 is pivotally connected between the outer end portion of its inside flange to the underside surface of one of the flanges of the L-shape member 2 by means of a hinge 3. The hinge means 3 may comprise a common form of commercial leaf hinge having a pintle, the leaves being welded or otherwise secured to the structural members 1 and 2. A type similar to the well known piano hinge may also be provided. As rotation of the hinge is effected in the direction indicated by the arrow, one flange of member 2 proceeds pivotally into the open channel of member 1 while the other flange of member 2 rotatably recedes from the outer flange surface of member 1. Attached panels 19 and 20 may be rotated about the hinge from a generally perpendicular relationship to a generally parallel relative relationship insofar as the surface of the panels are concerned. Weatherseal material 4 may be cemented to member 1 (or 2) along the full length of the joint in order to weatherseal the joint and thereby prevent passage of elements of weather through this area as the weather stripping is compressed and the joints are extended to open configuration as shown on FIG. 3. Spacer 5 may be attached to either channel 1 or L-shape member 2 to assist in weatherproofing and in enhancing the functional and dimensional aspects of the joint such as for instance to limit the movement of the parts and also to conceal misalignment or gaps which may occur during assembly. Likewise lip 6 can be embodied in either of the structural members. Additional weather sealing could be provided in the general area of lip 6 in much the same manner as shown in FIGURE 9 if desirable or necessary. A detent means 7 in the form of a shallow groove is provided along the inside portion of the nonhinged flange of member 1 to hold the joint in a predetermined configuration. In the present instance lip 6 may be connected to L-shape member 2 and may be of a resilient material such as polyethelene or the like in order to pass over the detent 7, furthermore the slight flexibility of the outer flange of the structural member 1 may permit the required deflection of the parts during rotation thereof. Similarly a detent means (not shown) may be incorporated in the channel member 1 to permit locking the parts in collapsed position. Mounting lugs 8 may be secured to the joint by welding or other fastening means to facilitate incorporation of the joint in a structure. Used in this manner the lugs 8 may be fastened (by various fasteners such as screws not shown) to the edges of panel members 19 and 20 in order to hingedly join the two panel members to form a particular portion of a wall.

FIGURE 2 shows a double acting joint wherein two right and left hand elements of the single acting joint

shown in FIG. 1 may be combined to form a structure which is adapted particularly for use in walls where a rotation of 180° may be required. The flanges (not shown) in FIG. 2 which would normally abut in back to back arrangement by integrally combining right and left members 1 of FIG. 1 have been omitted in this construction. While it may usually be advisable to omit these flanges in double acting joints it may be desirable to integrally incorporate them in double acting structures such as shown in the roof ridge beams of FIGURES 9 and 10. Furthermore it may be noted that the structural members 2A and 2B of FIG. 2 are essentially channel shaped rather than being composed of L-shaped members as is the case in FIG. 1. Either shape can be used in conjunction with the single (90°) or the double (180°) joint.

In FIG. 2 the hinges 3A and 3B are shown installed along the inner surfaces of the flanges of the channel member 1A, one leaf of each hinge being connected to the opposite edges of the flange surfaces in order to facilitate full 90° rotation of the hinged parts. Mounting lugs 8 are provided for the purpose of facilitating connection of the device to a wall structure embodying panel members 21 and 22. A rubber like seal strip 4A (cemented to channel member 1A) is located in an area where the meeting edges of the parts 2A and 2B abut, while the spacer 5A lies along an area near the heel of the member 1A. The abutting edge surfaces of the top flanges of members 2A and 2B act in the manner of a detent to resiliently hold the device in a closed position. Normal deflection of the parts in most cases is adequate to render the device operable by slight application of pressure. In other instances adequate clearance between the abutting surfaces may be provided or the surfaces may be grooved or bevelled in such a manner as to permit sequential or staggered rotation of members 2A and 2B. Similarly as in FIG. 1 as rotation of the parts around the hinges are effected in the direction indicated by the arrows each of the upper flanges of members 2A and 2B proceed pivotally downwards into the open channel of member 1A while the outer flanges rotatably recede from the outer flange surfaces of member 1A. Building panels 21 and 22 attached thereto rotate upwardly and outwardly as indicated in the drawing to a relative position as indicated in FIG. 8.

FIGURE 3 is a top plan view of a walled structure in expanded form using four single action joints 17 in predetermined locations. These joints are incorporated by means of mounting lugs (not shown) extending into and fastened to the respective members 11, 12, 13, and 14 of the walled structure. FIGURE 4 is a top plan view of the same structure in collapsed configuration.

FIGURE 5 is an isometric view of the invention in single acting version having lugs 8 to facilitate incorporation of the device in a structure.

FIGURE 6 is an isometric view of a double acting version of the invention, the mounting lugs of FIG. 5 being omitted in this view.

Methods other than those utilizing lugs may be used to incorporate the devices in structures. One such method would be to butt weld or otherwise secure structural angles or other structural shapes perpendicularly from the ends of one joint to the ends of another joint to form a generally rectangular frame which could be reinforced and/or covered to form an enclosed panel. This panel when combined with other pivot joints similarly incorporated and covered could form structures similar to those shown in FIGURES 3 and 4 or 7 and 8 in addition to other numerous arrangements.

FIGURE 7 is a top plan view of a wall having a double acting joint 18 similar to the device shown in FIGURE 6. This wall is shown in expanded configuration. FIGURE 8 is a top plan view of the same wall in collapsed configuration.

FIGURE 9 shows a double acting form of the invention for use as a roof ridge beam. Two open channels are provided in member 1B instead of the single channel used in FIG. 2. Lips 6A and 6B are supported by a common web formed by the integrally joined flanges of right and left hand forms of the device shown in FIG. 1. These lips overlie the channels and the top flanges of L-shape members 2C and 2D. Weatherseal 4B and 4F may be cemented to the underside of the lips along the length of the joint in order to weatherseal the joint in open configuration and remain under compression during normal use. Members 2C and 24 attached by hinges 3C and 3F to the right and left sides of member 1B rotate as indicated by the arrows. Roof panels 23 and 24 are attached to members 2C and 2D to lie in parallel relation to the base of the joint when the joint is rotated to the closed or transportation configuration, thus allowing these portions of the roof to collapse and lie flat in a generally horizontal position (as indicated by the dotted lines) during transportation.

FIGURE 10 shows another double acting form of the device used as a roof beam. The left side member 2E and attached panel 25 (shown rotated to storage or closed configuration) operates the same as in FIG. 9, however the right side member is hinged to allow the attached roof panel 26 affixed to member 2F (member and panel shown in open or use configuration) to rotate downward and perpendicular in relation to the base of the joint (as shown by the dotted lines) as the bottom flange of member 2F rotates into the inverted bottom open channel of member 1C as indicated by the arrow near hinge 3G.

FIGURE 11 portrays a version of the joint which utilizes wall or panel covering 9 and 10 as a substitute for portions of the above mentioned hinge structure. The lower portion of the wall cover 9 tips inwardly into the channel generated by the joint 1D and the wall cover 10. This version has particular application in a corner joint of less weight and where a minimum number of material thicknesses are desired. Inclusion of the basic material inherent in all portions of the aforesaid joint would necessitate a double material thickness which would increase the cost and would detract from the appearance of the corner in some instances.

Various caps, plugs, and other permanent or temporary end closures may be provided in order to further seal the joint and thereby improve the weatherproofing when required.

Various modifications will be suggested to the reader from the above detailed description and it is understood that such modifications can be made without departing from the scope of the invention, if within the spirit of the depending claims.

I claim:

1. An open channeled pivotal joint comprising a primary leaf member comprising a plurality of planar elements forming an open sided structural channel having flanges, a secondary leaf member comprising first and second planar elements forming first and second legs of an L-shape member, said members being arranged in longitudinal juxtaposition with each other and adapted for relative rotative movement with each other, and pivot means associated with said members having a longitudinal axis parallel to and generally near to the edge of one flange of said channel and generally within the space defined by the legs of said structural L-shape member whereby the first leg of said L-shape member overlies a portion of the open side of said channel at one stage of said rotative movement while the second leg of said L-shape member lies in adjacent proximity to the outer surface of said flange of said primary channel thereby permitting rotative movement of said first leg into said open channel and movement of said second leg away from said flange during rotative movements thereof.

2. An open channeled pivotal joint according to claim 1 comprising weatherproofing means associated with portions of said primary and secondary members to substantially obstruct passage of atmospheric elements therebetween.

3. An open channeled pivotal joint according to claim 1 wherein said first leg of said L-shape member overlies said channel to substantially close the open side thereof during one stage of rotative movement.

4. An open channeled pivotal joint according to claim 1 comprising a third leaf member comprising planar elements forming an L-shape member, secondary pivot means associated with said third member and said primary member whereby one leg of said third member may overlie another portion of the open side of said channel in order to form a substantially closed structure when said secondary and third members are so oriented.

5. An open channeled pivotal joint according to claim 3 incorporating detent means associated with one flange of said channel to lock said members in a predetermined configuration.

6. In a pivotal joint for wall structures or the like the combination of a primary leaf member comprising a plurality of planar elements to form legs of an L-shape member, a secondary leaf member comprising an element to form a rectangularly shaped bar, said members being arranged in longitudinal juxtaposition, pivot means associated with said members having an axis substantially near to and parallel to one edge of said leg of said L-shape member and to one edge of said bar, and fastening means associated with said members whereby wall covering may be fixed to and supported thereon, said pivot means permitting rotative movement whereby one surface of said bar lies in generally adjacent proximity to the outer surface of one leg of said L-shape member during one rotative movement and pivotally rotates away from said surface during another stage of rotative movement.

7. In a pivotal joint according to claim 6 and comprising wall covering attached to portions of members and adapted for rotative movement simultaneously with said leaf members whereby adjacent edges of said covering may be brought together during one rotative movement of said members and spread apart during another rotative movement.

8. In a pivotal joint according to claim 6 and comprising weatherproofing means associated with portions of said primary and said secondary members to substantially prevent passage of elements of weather therebetween.

9. A structural pivot joint comprising at least one pair of movable members having parallel surfaces adapted for mutual engagement and comprising a primary channel shaped member having a hollow, a flanged L-shape member pivotally connected therewith in such a manner as to allow a flange of the L-shape member to rotate into the hollow of the primary channel, said pivot joint being adapted to simulate a closed tube when said flange is rotated out of said hollow.

10. A structural pivot joint as set forth in claim 9 comprising weatherproofing materials installed along at least one of said parallel surfaces of the members in order to effectively weatherproof the joint when said surfaces are brought into mutual engagement.

11. A structural pivot joint as set forth in claim 9 comprising right and left hand joints integrally associated to provide a double acting joint.

12. A structural pivot joint as set forth in claim 9 comprising right and left hand joints integrally associated to form a double acting joint and weatherproofing materials installed along mutually engageable surfaces of said members in order to substantially weatherproof the joint when said surfaces are engaged.

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