

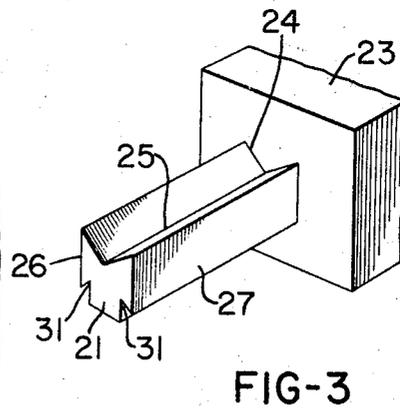
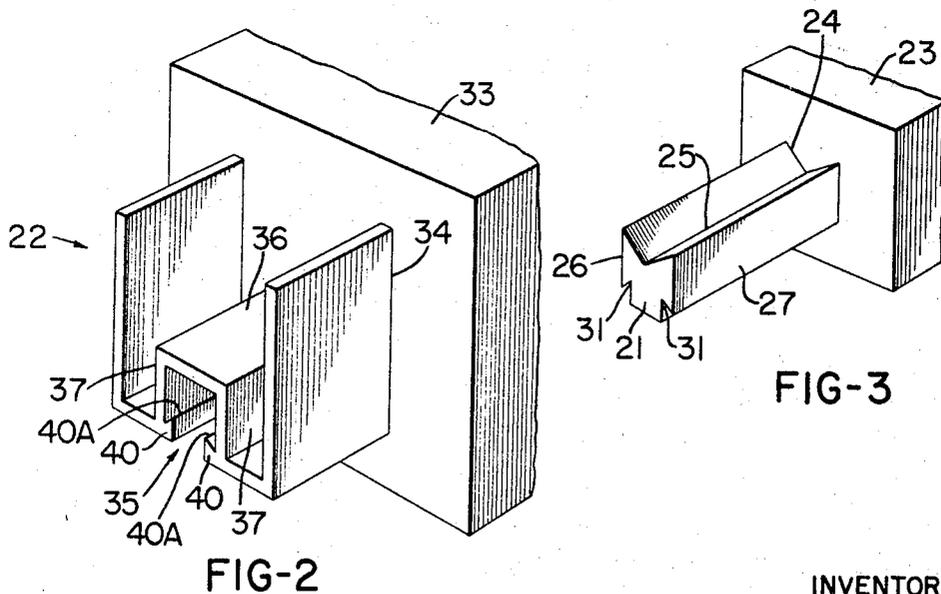
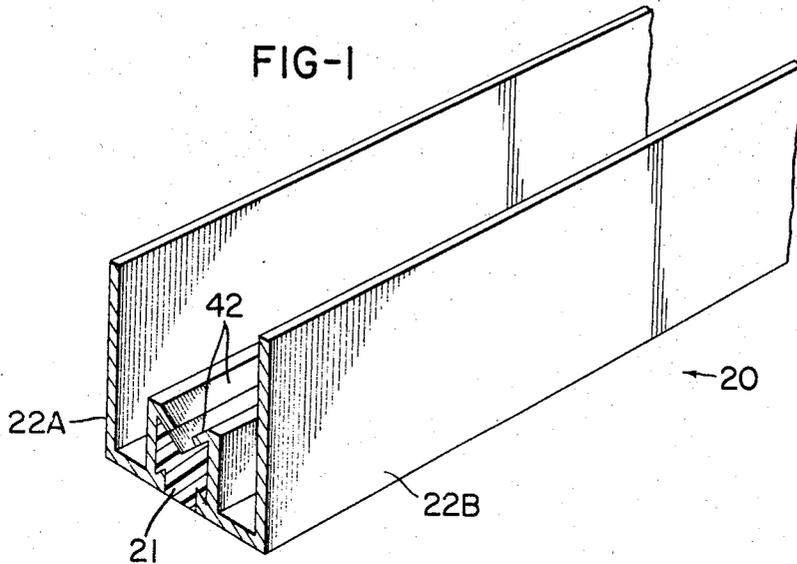
May 6, 1969

D. H. REVELL ET AL
METHOD AND APPARATUS FOR MAKING A THERMALLY
INSULATING JOINT CONSTRUCTION

3,441,995

Filed Oct. 6, 1966

Sheet 1 of 2



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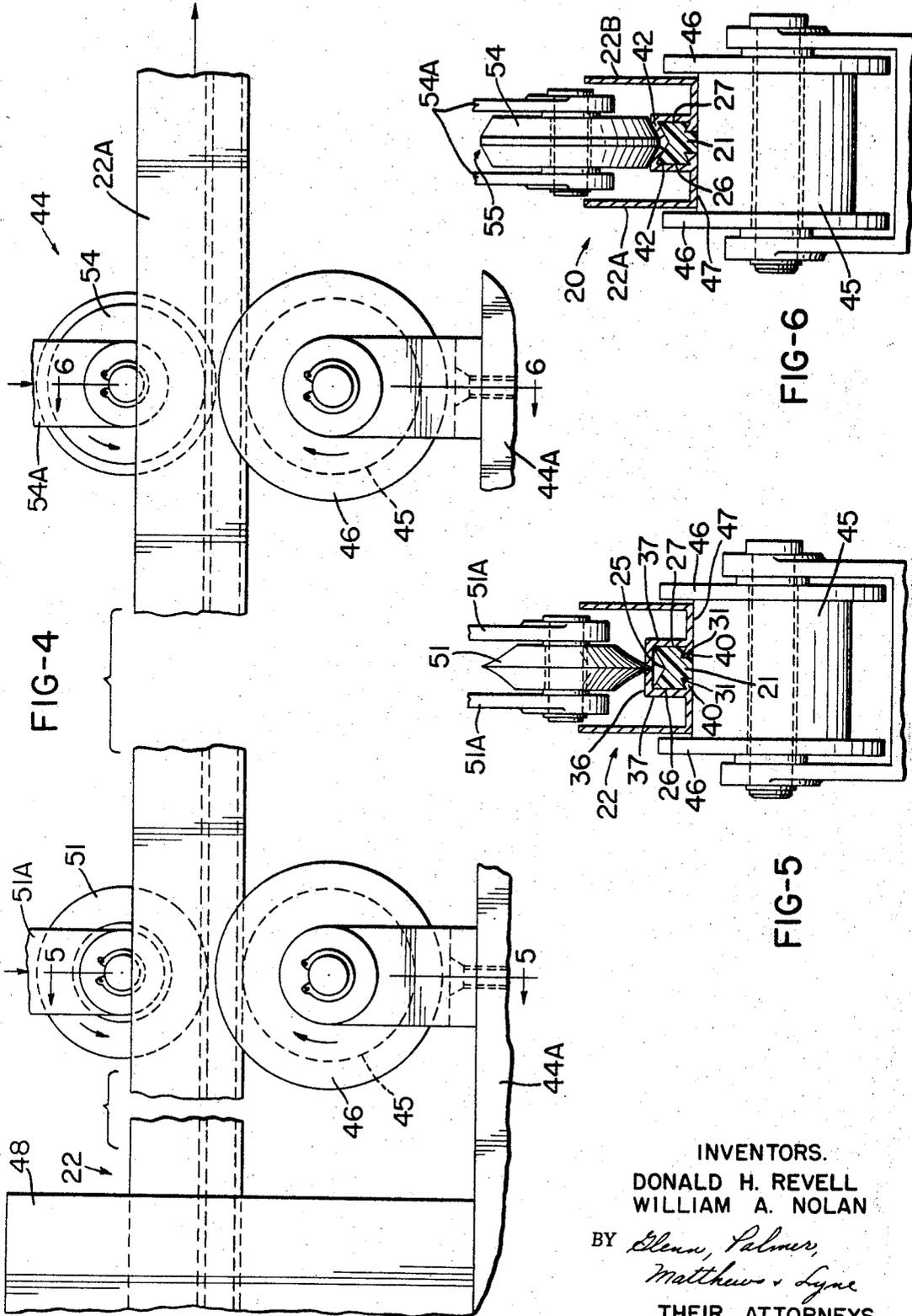
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1

2

3,441,995
**METHOD AND APPARATUS FOR MAKING
 A THERMALLY INSULATING JOINT
 CONSTRUCTION**

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13 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for making a thermally insulating joint construction from a thermal insulating member and a structural member by placing a channel portion of the structural member over the insulating member, slitting the base portion of the channel part of the structural member to define a pair of adjacent flange means thereof and forming the flange means into clamping engagement with clamping surfaces of the thermal insulating member whereby the resulting joint construction is provided having a pair of spaced apart structural members with the thermal insulating member clamped therebetween.

This invention pertains to a method and apparatus for making a thermal insulating means and more particularly to a method and apparatus for making an improved thermally insulating joint construction.

Many previously proposed joint constructions used to thermally isolate metal frame members of windows, doors, and the like, from their associated metal supporting structure are generally constructed using a plurality of two or more metal members fastened on opposite sides of a thermal insulating member. Such joint constructions using a plurality of metal members have all been comparatively expensive thereby curtailing extensive usage in a highly competitive field. Other techniques have also been proposed to reduce the cost of such a joint construction and these too have resulted in prohibitive costs.

Accordingly, it is a feature of this invention to provide a method and apparatus for making an improved high strength thermally insulating joint construction which is of simple construction and which is sufficiently inexpensive to enable extensive usage thereof.

Another feature of this invention is to provide a method and apparatus for making such improved joint construction which is easily produced using high volume production techniques.

Another feature of this invention is to provide a method and apparatus for making an improved thermally insulating joint construction utilizing essentially a thermal insulating member means cooperating with a single structural member means of inexpensive construction which is suitably cut to define a pair of spaced apart structural members separated by such thermal insulating member means.

Another feature of this invention is to provide a method and apparatus for making such an improved thermally insulating joint construction which does not require severing and scrapping of portions of such structural member means in order to provide a thermal break.

Another feature of this invention is to provide a joint construction of the character mentioned which is constructed and arranged so as to utilize the configuration of its structural member means in association with cooperating portions of its thermal insulating member means to optimum advantage to provide a high strength joint construction.

Another feature of this invention is to provide an im-

proved apparatus for making a thermally insulating joint construction of the character mentioned which enables the production of such joint construction inexpensively and in a continuous manner.

Another feature of this invention is to provide an improved apparatus for making such an improved joint construction utilizing rotary knife means to slit a single elongated structural member means into two elongated structural members and also utilizing rotary forming roll means to continuously form such structural members against thermal insulating member means to provide such joint construction in a simple and efficient manner.

Another feature of this invention is to provide an improved method of making a thermally insulating joint construction rapidly and economically.

Another feature of this invention is to provide an improved method of making such a joint construction commencing basically with a single structural member means and a single thermal insulating member means.

Another feature of this invention is to provide an improved method of making such a joint construction without wasting or scrapping any part of such component member means.

Another feature of this invention is to provide an improved method of making a joint construction of the character mentioned particularly adapted to be used in window constructions, door constructions, and the like.

Therefore, it is an object of this invention to provide an improved apparatus and method for making an improved joint construction having one or more of the novel features of this invention as set forth above or hereinafter shown or described.

Other objects, uses, and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a perspective view with parts in section and parts broken away of an exemplary improved thermally insulating joint construction of this invention.

FIGURE 2 is a perspective view with parts broken away illustrating elongated metallic structural member means being extruded as an integral unit through suitable die means, such metallic member means comprising the exemplary joint construction of FIGURE 1.

FIGURE 3 is a perspective view with parts broken away illustrating elongated thermal insulating member means being formed by extruding through suitable die means and comprising such exemplary joint construction.

FIGURE 4 is a front view with parts broken away particularly showing basic component members of an exemplary improved apparatus of this invention, such apparatus being adapted to make the joint construction illustrated in FIGURE 1.

FIGURE 5 is a sectional view on the line 5—5 of FIGURE 4 particularly illustrating rotary slitting means comprising such improved apparatus.

FIGURE 6 is a sectional view on the line 6—6 of FIGURE 4 particularly illustrating forming roll means comprising such apparatus.

While the various features of this invention are hereinafter illustrated and described as being particularly adaptable for providing an improved thermally insulating joint construction and an improved apparatus for and method of making such improved joint construction particularly adapted for use in a window construction, door construction, or the like, it will be appreciated that the various features of this invention can be utilized singly or in any combination thereof to provide a thermally insulating joint construction for other uses as desired.

Therefore, this invention is not to be limited to only the embodiments illustrated in the drawings because the

drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

In the exemplary embodiment of this invention illustrated in FIGURE 1 of the drawings, a thermally insulating joint construction designated generally by the numeral 20 is shown. Joint construction 20 is comprised of a centrally arranged thermal insulating member means shown as a thermal insulating member 21 preferably made of a thermoplastic material. Joint construction 20 further comprises elongated structural member means comprising an elongated structural member made of metal and shown as a single elongated structural member 22, as illustrated in FIGURE 5, which is subsequently slit to define two members designated by the numerals 22A and 22B as illustrated in FIGURES 1 and 6.

Joint construction 20 is thus basically formed of two members 21 and 22 by combining or assembling members 21 and 22 in any suitable manner, then slitting member 22 therealong to define two sections 22A and 22B, and finally suitably simultaneously clamping cooperating portions of sections 22A and 22B around practically the entire periphery of thermal insulating member 21 to provide a strong mechanical joint, while assuring that the previous integral surface means comprising members 22A and 22B is formed to provide a thermal break as required. The apparatus for providing construction 20 and method of making such improved joint construction 20 will be subsequently described.

Thermal insulating member 21 in this example of the invention comprises a thermoplastic material such as polyvinyl chloride, polyethylene, or the like, and is preferably made by the extrusion process. As seen in FIGURE 3, member 21 is extruded through suitable die means shown as an extrusion die 23 having suitable opening means therein shown at 24 corresponding to the configuration of member 21.

The thermal insulating member 21 has clamping surface means extending therealong which is preferably a substantially V-shaped clamping surface means or clamping surface designated by the numeral 25. The arrangement of substantially V-shaped clamping surface 25 is such that portions of members 22A and 22B are clamped thereagainst to provide a joint construction of high structural integrity.

Thermal member 21 in this example of the invention has a pair of parallel sides 26 and 27 adjoining V-shaped clamping surface 25. In addition, thermal member 21 has a pair of spaced apart parallel groove means shown as a pair of substantially V-shaped grooves extending therealong and each designated by the numeral 31. Grooves 31 are arranged along thermal member 21 generally opposite V-shaped clamping surface 25. Grooves 31 together with V-shaped clamping surface 25 cooperate to enable member 21 to be firmly clamped and locked in position in forming the improved joint construction 20 of this invention.

Elongated structural member means or elongated structural member 22 is preferably a metallic member and is preferably formed as an integral unit by extrusion through suitable die means 33 as seen in FIGURE 2 of the drawings. Die 33 has opening means therein as indicated at 34 corresponding to the configuration of member 22 and upon extruding member 22 through die 33 an integral unit having high structural integrity is provided.

Member 22 has an elongated roughly channel-shaped wall means therein as seen in FIGURE 2 which is substantially U-shaped and designated by the numeral 35. U-shaped wall means 35 comprises base portion means shown as a base portion 36 and a pair of spaced apart leg means each designated by the numeral 37 in this example of the invention and extending from terminal ends of base portion 36.

Legs 37 of this example of the invention extend in parallel relation and each has projection means shown as a projection 40 extending inwardly from its terminal

end. Thus, with legs 37 arranged in substantially parallel relation projections 40 extend toward each other. Each projection 40 has a roughly V-shaped inner tip as shown at 40A and each projection cooperates with its adjoining leg 37 to define an angular or V-shaped locking surface therebetween which is adapted to receive a cooperating portion of insulating member 21.

The substantially U-shaped wall means 35 provided in member 22 extends the full length of member 22 as previously mentioned and its base portion 36 is adapted to be cut along the full length thereof by suitable knife means which will be explained in conjunction with the improved apparatus of this invention to be subsequently described. Base portion 36 is cut as will be explained later to define a pair of flange means or flanges each designated respectively by the numeral 42.

Joint construction 20 of FIGURE 1 is thus formed by first suitably assembling members 21 and 22 together so that inner tips 40A of projections 40 provided in member 22 are inserted within associated V-shaped grooves 31 of member 21 and base portion 36 is arranged adjacent V-shaped clamping surface 25 of member 21. The base portion 36 is then cut therealong to define a pair of flanges 42 and such flanges are formed inwardly, that is, deformed against V-shaped clamping surface 25 to thereby define a pair of spaced apart structural members 22A and 22B each having one side portion of thermal member 21 clamped between its projection 40 and its flange 42. It will be appreciated that the arrangement provides a joint construction of high structural integrity while assuring that the thermal insulating characteristics of thermal member 21 are effectively utilized.

The apparatus for forming the improved joint construction 20 is shown in FIGURE 4 of the drawings and designated generally by the numeral 44. Apparatus 44 has a suitable base, fragmentary portions of which are shown at 44A, carrying suitable supporting means shown as a pair of supporting rolls or back-up wheels each designated by the numeral 45.

Thermal member 21 and structural member 22 are assembled together in apparatus 44 in any suitable manner and are preferably assembled at an assembly station designated generally by the numeral 48 in FIGURE 4 of the drawings. Members 21 and 22 of this example of the invention are both extruded as illustrated in FIGURES 2 and 3 of the drawings and suitably assembled together in station 48 prior to further processing. However, it will be appreciated that member 21 may be formed as a solid unit using any suitable process and then assembled within U-shaped wall means 35 of member 22. In addition member 21 may also be formed integrally within channel 35 in any suitable manner. Irrespective of the manner of combining members 21 and 22, the partially completed construction is moved along the material flow path by rolls 45 for further processing.

Each supporting roll 45 has guide means thereon shown as a pair of side flanges each designated by the numeral 46 on opposite sides thereof. Each supporting roll 45 is arranged to support elongated members 21 and 22 in their assembled condition as shown particularly in FIGURE 5 of the drawings. In this example of the invention the arrangement of members 21 and 22 is such that they have a flat lower surface which is supported on a straight surface 47 which is a right circular cylindrical surface comprising each roll 45.

Apparatus 44 further comprises cutting or slitting means shown as a rotary slitter or cutting wheel 51 which is supported by a suitable support bracket 51A. Slitter 51 is arranged on supporting structure 44 preferably generally opposite a supporting roll 45 so as to slit wall 36 of member 22 and define previously mentioned flanges 42. Rotary slitter 51 may be fixed on apparatus 44 in a stationary controlled position and member 22 passed thereunder to accomplish the slitting action. However, it will be appreciated that slitter 51 may be moved along

5

member 22 and toward and away from member 22 as desired to accomplish such slitting action.

The partially assembled construction as illustrated in FIGURE 5 is slit and moved along apparatus 44 so that it comes into engagement with forming means shown in this example as a forming wheel 54 which is supported by a suitable support bracket 54A. Forming wheel 54 engages flanges 42 and forms such flanges inwardly from the position shown in FIGURE 5 to the clamping position shown in FIGURE 6.

Forming wheel 54 is preferably mounted generally opposite a supporting roll 45 in a similar manner as slitter 51 is mounted generally opposite a supporting roll 45. This arrangement provides optimum support during the forming of flanges 42 inwardly against member 21.

Each forming roll 54 has an outer peripheral forming surface shown at 55 which corresponds to the V-shaped clamping surface 25 provided in thermal member 21. Also as will be apparent from FIGURE 4 of the drawings, forming member 54 is arranged downstream of slitter 51.

Thus, it is seen that the action of forming roll 54 urges each flange 42 toward an associated projection 40 and thereby clamp thermal member 21 along its opposite side portions to provide mechanical interlocking connection as well as separate the flanges 42 from each other and provide an improved thermal break. The mechanical connection thus provided is compact and provides high structural strength thus enabling the joint construction thus formed, and as seen in FIGURE 6 of the drawings, to be easily incorporated in a window construction, door construction, or the like.

The improved thermally insulating joint construction of this invention is provided simply and economically while using essentially two members. A single structural member such as a metallic member containing aluminum which is formed as an integral unit by the extrusion process, and a thermal insulating member which is arranged in suitable channel means or groove means provided within the single integral structural member comprise such two members. Through the unique use of a slitting technique and an associated forming technique, a thermally insulating joint construction is provided which has optimum thermal break characteristics yet assures that no structural material is wasted or scrapped. Furthermore, the slit material comprising member 22 is effectively utilized to provide a strong clamping interlocking action between the structural members and the thermal insulating member comprising each joint construction.

Terms such as "side," "ends," "lower," etc. have been used throughout this application for ease of description and merely to correspond to the illustrations as presented in the drawings. Such terms should not be considered as limiting the scope of this invention in any way.

Thus, it is seen that an improved thermally insulating joint construction has been provided which is of simple and economical construction and which is particularly adaptable for use in construction window means, door means, and the like.

Further, this invention provides an improved apparatus for and method of making such an improved joint construction without waste of material while assuring that a joint construction of high structural integrity is provided.

While the form of the invention now preferred has been disclosed as required by statute, other forms may be used, all coming within the scope of the claimed subject matter which follows.

What is claimed is:

1. An apparatus for making a thermally insulating joint construction comprised of elongated thermal insulating member means having clamping surface means extending therealong and elongated structural member means having elongated roughly channel-shaped wall means extending therealong comprising, means for placing said mem-

6

ber means together so that said insulating member means is arranged within said elongated channel-shaped wall means with its clamping surface means arranged adjacent base portion means of said channel-shaped wall means, supporting means for supporting said placed together member means, slitting means for slitting said base portion means of said wall means to define a pair of flange means, and forming means for engaging and deforming said flange means into clamping engagement with said clamping surface means, whereby said apparatus makes said joint construction having a pair of spaced apart structural members with said thermal insulating member means clamped therebetween.

2. An apparatus as set forth in claim 1 in which said clamping surface means comprises a grooved clamping surface and said forming means comprises forming tool means having an outer forming surface means corresponding to the configuration of said grooved clamping surface means.

3. An apparatus as set forth in claim 2 in which said slitting means comprises rotary knife means.

4. An apparatus as set forth in claim 3 in which said supporting means comprises a plurality of spaced apart supporting roll means having guide means for guiding said elongated structural member means for rolling movement therealong and said knife means is arranged to slit said structural member means as it moves along said supporting roll means.

5. An apparatus as set forth in claim 4 in which, said grooved clamping surface comprises a substantially V-shaped clamping surface, said forming tool means comprises forming roll means having an outer peripheral forming surface corresponding to said V-shaped clamping surface, and said forming roll means is arranged downstream of said rotary knife means to form said flange means into clamping engagement with said substantially V-shaped clamping surface means as said structural member means moves along said supporting roll means.

6. An apparatus as set forth in claim 5 in which, said channel-shaped wall means is substantially U-shaped having projection means extending toward each other from the terminal ends of its parallel legs, said thermal insulating member means has a pair of spaced apart parallel groove means extending therealong adapted to receive said projection means, and upon forming said flange means inwardly said thermal insulating member means is firmly locked in position between said flange means and said projection means.

7. A method of making a thermally insulating joint construction comprising the steps of, providing elongated thermal insulating member means having clamping surface means extending therealong, providing elongated structural member means having elongated roughly channel-shaped wall means extending therealong, providing means for placing said member means together, placing said member means together so that said insulating member means is arranged within said elongated channel-shaped wall means with its clamping surface means arranged adjacent base portion means of said channel-shaped wall means, providing supporting means, supporting said placed together member means with said supporting means, providing slitting means, slitting said base portion means of said wall means with said slitting means to define a pair of flange means, providing forming means, and forming said flange means with said forming means into clamping engagement with said clamping surface means, whereby said joint construction is provided having a pair of spaced apart structural members with said thermal insulating member means clamped therebetween.

8. The method as set forth in claim 7 in which said clamping surface means comprises a grooved clamping surface and said step of providing forming means comprises providing forming tool means having an outer

7

forming surface means corresponding to the configuration of said grooved clamping surface means.

9. The method as set forth in claim 7 in which said step of providing slitting means comprises providing rotary knife means.

10. The method as set forth in claim 9 in which, said step of providing supporting means comprises providing a plurality of spaced apart supporting roll means having guide means for guiding said elongated structural member means for rolling movement therealong, and said method comprising the further steps of arranging said knife means to engage and slit said structural member means as it moves along said supporting roll means.

11. The method as set forth in claim 10 in which, said clamping surface means comprises a substantially V-shaped clamping surface, said step of providing said forming tool means comprises providing forming roll means having an outer peripheral forming surface corresponding to said V-shaped clamping surface, and comprising the further steps of arranging said forming roll means downstream of said rotary knife means to thereby engage and form said flange means into said clamping engagement with said substantially V-shaped clamping surface means as said structural member means is moved along said supporting roll means.

12. The method as set forth in claim 11 in which, said channel-shaped wall means is substantially U-shaped having projection means extending toward each other from the terminal ends of its parallel legs, said thermal insulating member means has a pair of spaced apart parallel groove means extending therealong adapted to receive

8

said projection means and said forming step comprises engaging and deforming said flange means inwardly against said thermal insulating member means to firmly lock said insulating member means in position between said flange means and said projection means.

13. The method as set forth in claim 12 in which said step of providing elongated thermal insulating member means comprises providing said thermal insulating member means as a preformed unit made of thermoplastic material extruded through associated first die means, said step of providing elongated structural member means comprises providing a single structural member made of metal extruded through associated second die means to define an integral structural unit of high strength, and said placing step comprises the step of inserting said thermoplastic member means within said U-shaped channel means of said metal structural member means.

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