United States Patent

Lickliter et al.

[15] **3,638,465**

[45] **Feb. 1, 1972**

[54] METHOD OF FORMING A STRUCTURAL ELEMENT

[72] Inventors: **Robert Paul Lickliter; Earl Abbot,** both of Hamburg; **John F. Reeves,** Tonawanda, all of N.Y.

[73] Assignee: **Flangeklamp Corporation,** Buffalo, N.Y.

[22] Filed: **Mar. 10, 1969**

[21] Appl. No.: **805,542**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 777,438, Nov. 20, 1968, Pat. No. 3,537,222, which is a continuation-in-part of Ser. No. 703,955, Feb. 8, 1968, Pat. No. 3,537,217.

[52] **U.S. Cl.** **72/181**

[51] **Int. Cl.** **B21d 5/08**

[58] **Field of Search** 29/155, 417, 411; 72/366, 234, 72/181; 52/481, 690, 493, 738, 404, 497

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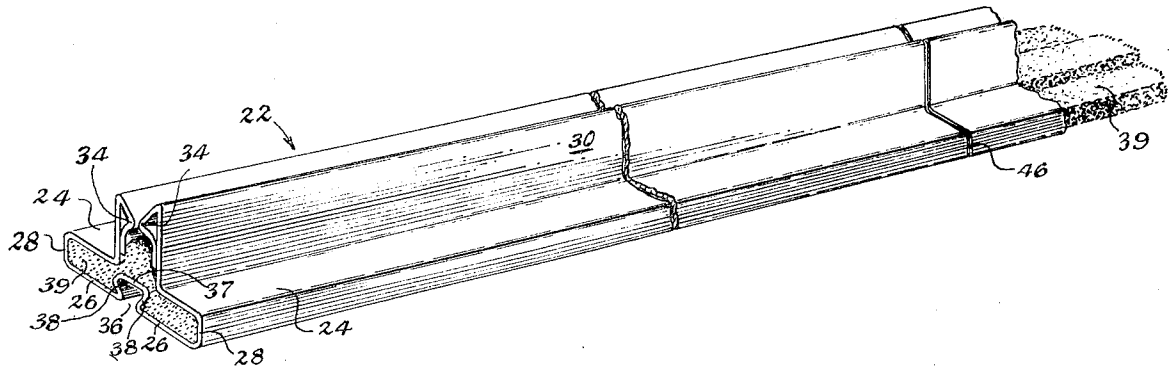
Primary Examiner—Charlie T. Moon

Attorney—Christel & Bean

[57] **ABSTRACT**

A method of forming a structural element comprising feeding a continuous strip of material through a series of forming rolls to progressively bend the elongated strip into a desired transverse configuration. Insulating material is applied to the material as it is being formed. The continuous strip of material is notched to provide longitudinally spaced transverse grooves in the strip prior to forming and is severed at the grooves after the strip has been formed into the desired shape.

5 Claims, 20 Drawing Figures



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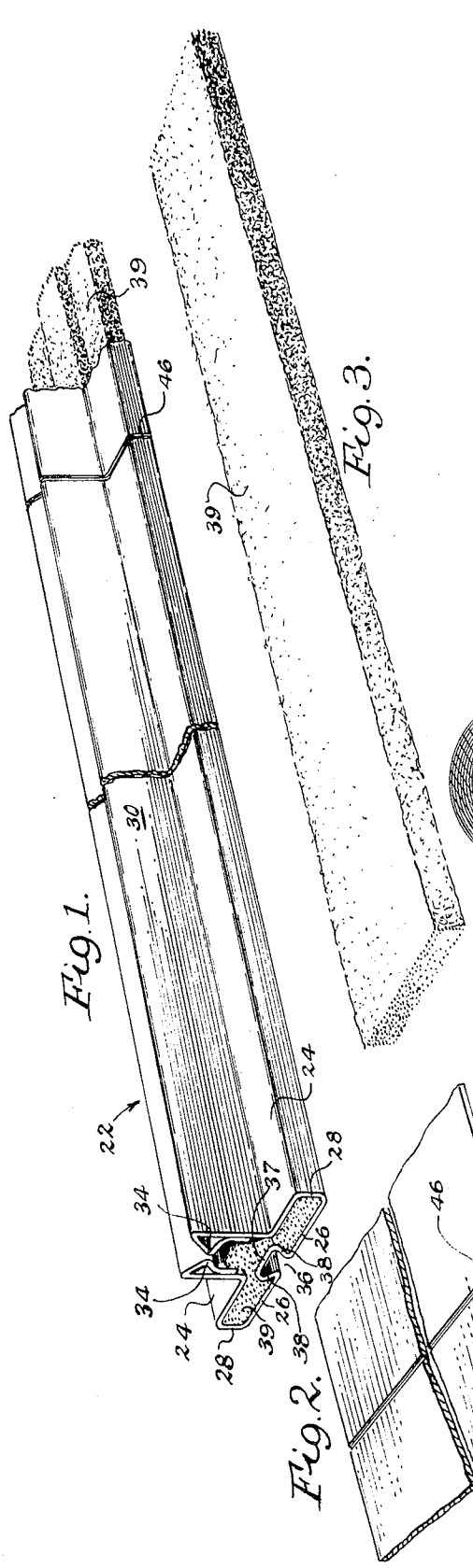

Fig. 1.

Fig. 3.

Fig. 2.

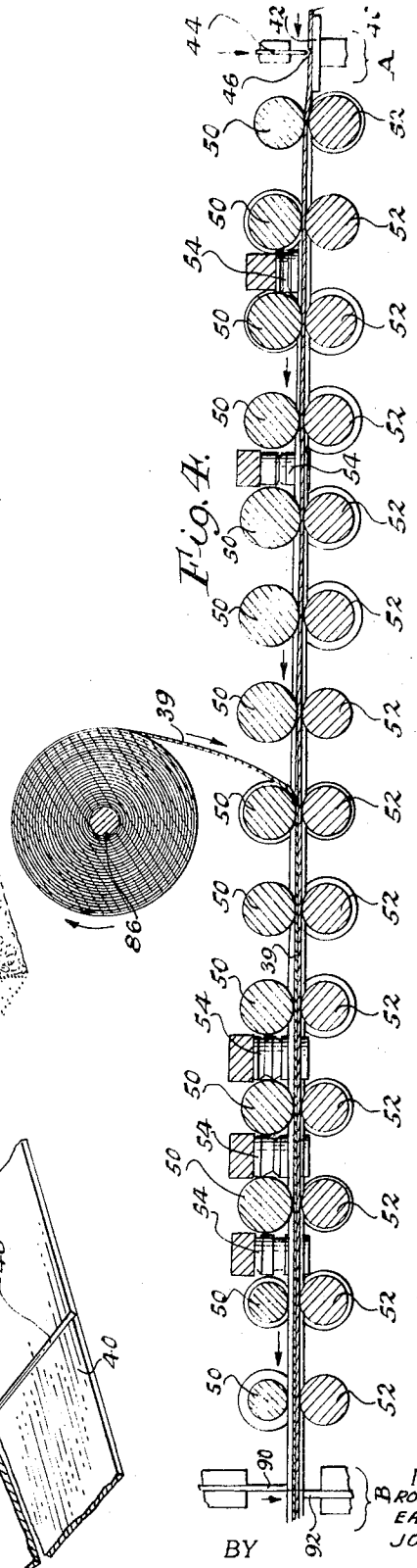

Fig. 4.

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Fig. 5.

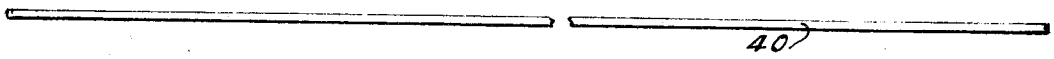

Fig. 6.

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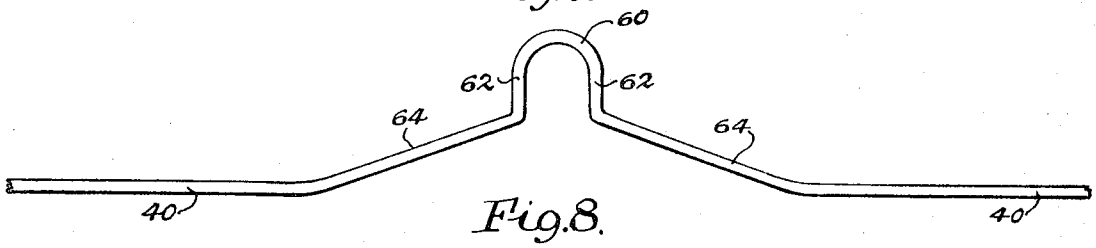

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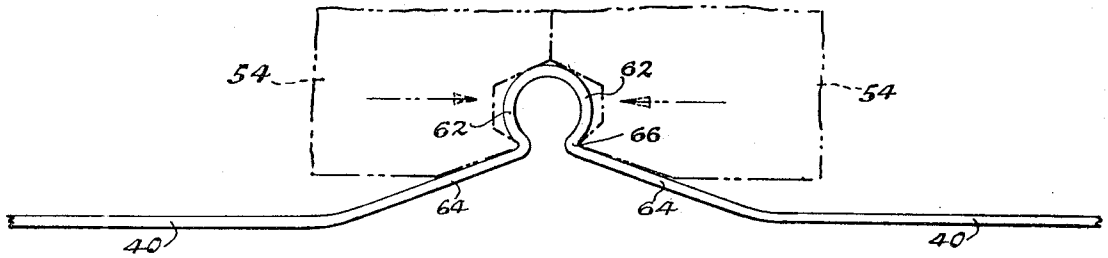

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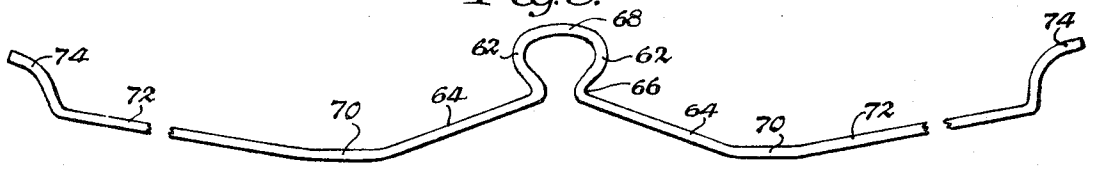

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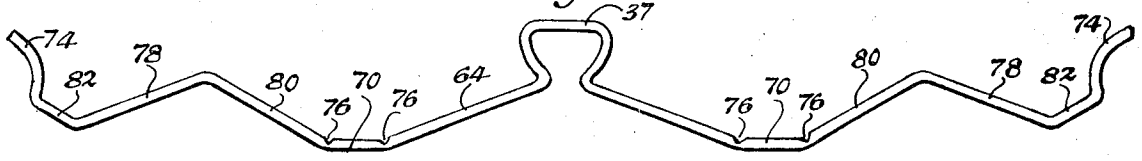

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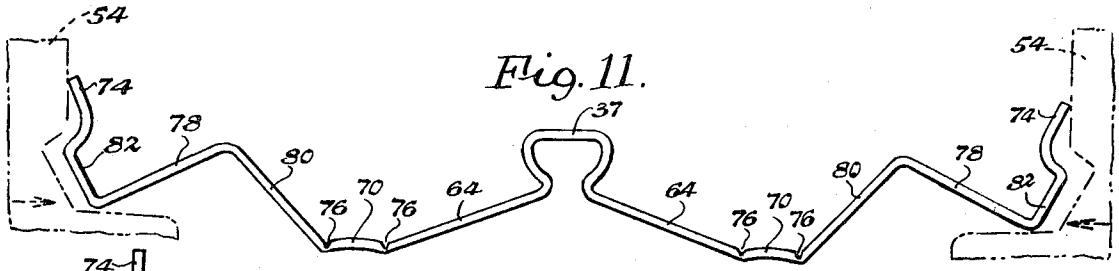
Fig. 11.



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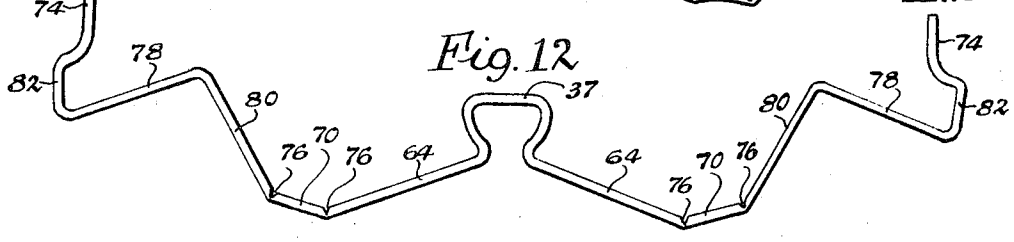

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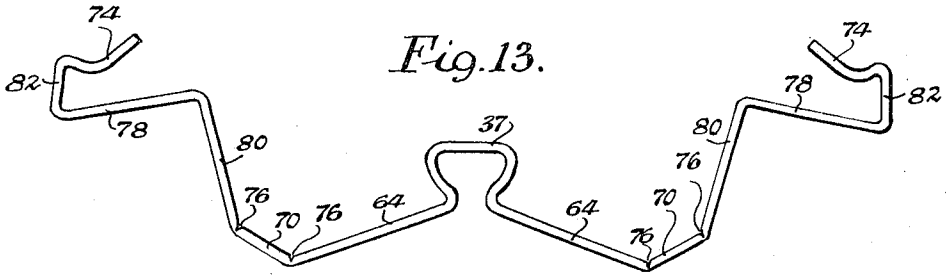

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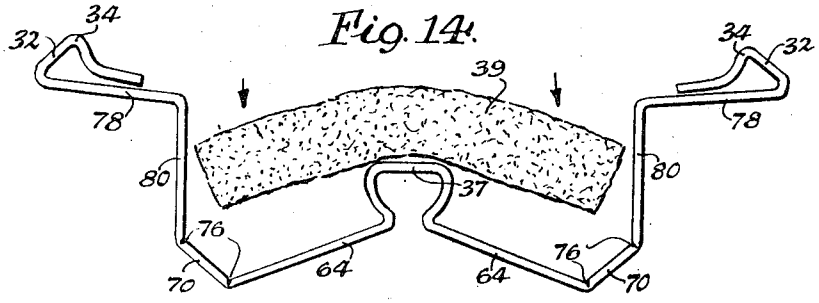

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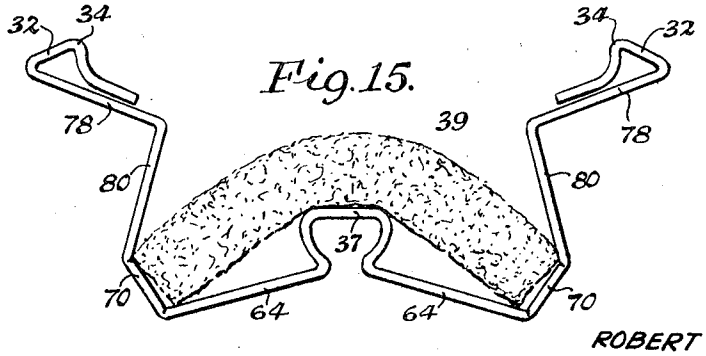

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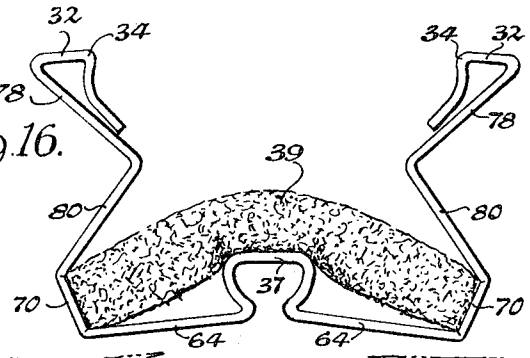
Fig. 16.



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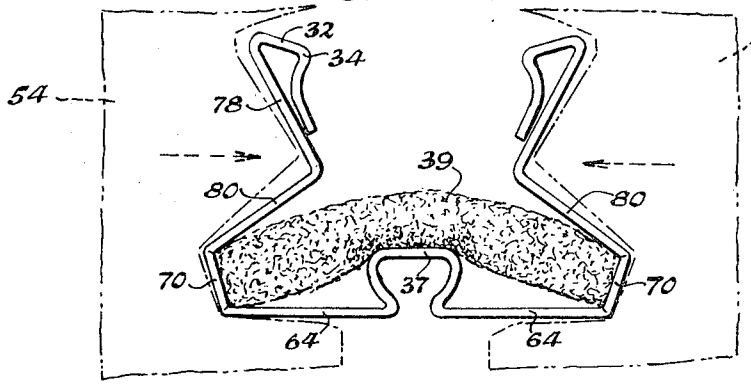

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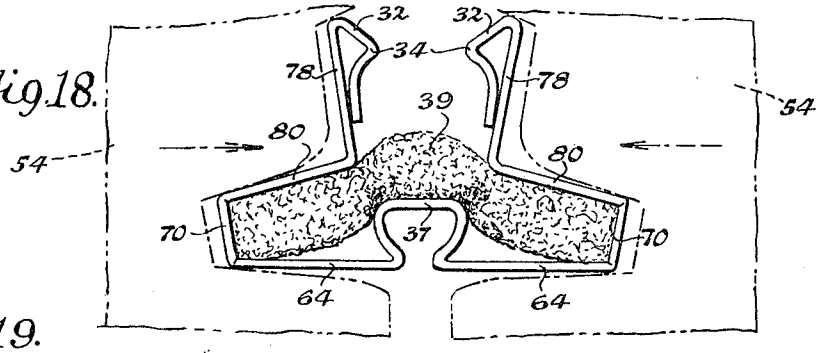

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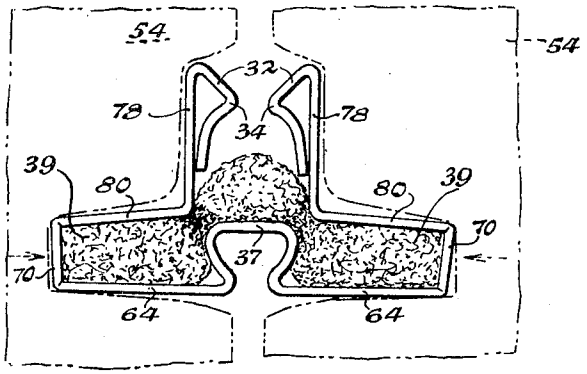
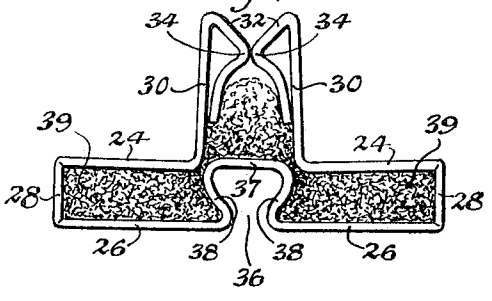


Fig. 20.



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METHOD OF FORMING A STRUCTURAL ELEMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of our pending application Christel & Bean Ser. No. 777,438 filed Nov. 20, 1968, now U.S. Pat. No. 3,537,222 for Wall Structure, which application is a continuation-in-part of our application Ser. No. 703,955 filed Feb. 8, 1968, now U.S. Pat. No. 3,537,217, for Wall Structures.

BACKGROUND OF THE INVENTION

The present invention relates to a method of forming a structural element and, more particularly, to a method of forming an insulated sheet metal panel connector employed in the construction art.

In the construction field, it is known to employ various prefabricated modular wall and ceiling paneling arrangements for erecting wall, floor, and ceiling structures which can be readily installed and easily dismantled. Pending application Ser. No. 703,955 discloses structures which utilize sheet material panel connectors to provide a quickly assembled supporting framework on which wall and/or ceiling panels together with door and window frame assemblies can be readily snap fitted in place.

It has been found desirable to mass-produce these panel connectors from a supply of continuous stock by forming the material into the desired traverse configuration and then cutting such formed element into predetermined lengths. The cutting action deforms the shape of the end portions of the finished product and also produces irregular and jagged edges.

Tests are conducted on building structures to determine the rate of heat transfer in a given amount of time, and they are "fire rated" in accordance with their ability to resist heat transfer. Panel connectors formed of metal present a problem because they conduct heat. Application Ser. No. 777,438 discloses insulated panel connectors, and this application is concerned with a method for continuous forming thereof.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method of forming metallic structural elements possessing insulating means for minimizing the transmission of heat therethrough.

It is another object of this invention to provide a method of forming an insulated structural element by progressively bending a flat strip of material into the desired transverse shape while simultaneously applying insulation thereto.

It is still another object of the present invention to provide a method of forming a structural element by progressively bending a continuous flat strip of material transversely into the desired configuration and severing the elongated formed strip into discrete elements having smooth, flat, opposite ends.

In carrying out this invention, a continuous strip of metal is advanced through a series of forming rolls to progressively form the elongated strip into a desired transverse configuration. As the forming operation takes place, insulating material is applied to and deposited within the confines of the outer walls of the partially formed strip to become a permanent component of the finished product. Prior to the forming operation, the strip of metal is notched to provide longitudinally spaced transverse grooves in the strip so that at the completion of the forming operation, the continuous length of formed strip can be clearly severed at the grooves into predetermined lengths of finished elements having unbent, smooth, flat, opposite ends.

The foregoing and other objects, advantages and characterizing features of this invention will become clearly apparent from the ensuing detailed description of an illustrative embodiment thereof, taken together with the accompanying drawings wherein like reference numerals denote like parts throughout the various views.

DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a fragmentary, perspective view of a structural element of continuous length formed by the method of the present invention;

FIG. 2 is a fragmentary, perspective view of a strip of material of which the element is formed showing a transverse groove notched therein;

FIG. 3 is a fragmentary, perspective view of the insulating material used to form a part of the finished structural element;

FIG. 4 is a diagrammatic side-elevational view of the apparatus for performing this invention;

FIGS. 5–19 are end-elevational views of the structural element of FIG. 1 illustrating various stages of the transverse configuration of the element as it is being formed; and

FIG. 20 is an end-elevational view of the structural element formed by the method of this invention.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now in detail to the drawings, there is shown in FIG. 1 an illustrative embodiment of a panel connector strip, generally designated **22**, formed by the process of this invention. Panel connector strip **22** comprises a sheet metal fabrication of a unitary, one-piece construction formed to provide a rectangular body portion having front face portions **24** and a rear face **26** jointed and spaced apart by opposite side faces **28**. A pair of flange portions **30** extend outwardly from front face portions **24** away from rear face **26** to form a pair of corners adapted to receive the edge portions of adjacent wall panel members for example. The metal or other sheet material of which panel connector **22** is fabricated is folded over at the outer end of flange portions **30** to provide cam surfaces **32** leading to opposed shoulder portions **34**, the opposite edges of the sheet material retreating and terminating within the opening between flange portions **30**. Rear face **26** is provided with a restricted inlet opening **36** having diverging sidewalls **38** to form a channel **37** within rectangular body portion **24–28**. A heat-insulating material **39**, such as fiberglass or substantially pure braided asbestos for example, is disposed within the rectangular body portion **24–28** and partially between opposed flange portions **30** behind channel **37** of panel connector **22** along the entire length thereof to minimize thermal conduction of the connector.

Referring to the diagrammatic view of FIG. 4, an elongated flat strip of metal **40** (FIG. 5) of the desired width and gauge is continuously advanced longitudinally and subjected to a plurality of operations including forming transverser notches or grooves in the strip at longitudinally spaced intervals, shaping the strip into the desired configuration while applying a heat-insulating material thereto, and severing the formed continuous strip at said notches into discrete lengths as will be described below.

As strip **40** is advanced, it passes through means at station A including a flying tool couple having a backup plate **42** and a notching punch **44** which is actuated downwardly at predetermined time intervals. The cutting edge of punch **44** acts against the upper surface of strip **40** to score or notch said upper surface and provide longitudinally spaced grooves **46** (FIG. 2) in strip **40**.

A significant feature of this invention is that punch **44** forms a relatively deep cut in strip **40** so that it may be readily severed at the end of its run after it has been formed to its final shape. It should be noted, however, that the transverse grooves **46** in strip **40** will in no manner impede or restrict the subsequent forming operation that takes place.

After the continuously advancing work leaves station A, it passes through a plurality of sets of horizontally disposed forming rolls **50–52** and vertically disposed forming rolls **54**. Although each set of forming rolls **50, 52** and **54** differ in configuration at successive stations, they have been indicated by identical reference characters for ease of description. The

pressure of these forming rolls 50–52 and 54 upon strip 40 and the structural element being formed also serves to feed the strip forwardly. FIGS. 5–19 illustrate progressive stages of the forming of strip 40 into a structural element as it advances through successive forming rolls until it reaches its final shape as shown in FIG. 20.

As shown in FIG. 6, a loop 60 is formed midway of the width of strip 40, hereinafter referred to as a structural element, by the first set of forming rolls 50, 52 and is progressively bent to form opposite walls 62 in loop 60 and angular portions 64 (FIG. 7) extending outwardly from the legs of loop 60. Next, element 40 passes through vertically disposed rollers 54 which form a necked portion 66 in loop 60 (FIG. 8). Thereafter, the top of loop 60 is slightly flattened as at 68 (FIG. 9) and generally horizontal portions 70 are formed laterally outwardly of angular portions 64. The other ends of portions 70 are connected to upwardly inclined portions 72 which terminate in reverse-curved portions 74. In the next progressive step (FIG. 10) notches 76 are formed at opposite sides of portions 70 and portions 72 are bent to form an inverted V-shape having leg portions 78 and 80 while the top of loop 60 is completely flattened to form channel 37. Also, angular portions 82 are formed between portions 72 and curved portions 74.

FIG. 11 illustrates the next forming step whereby vertically disposed rolls 54 acting on opposite sides of strip 40 bend portions 82 inwardly toward each other. Thereafter, the entire width of element 40 is progressively bent inwardly as shown in FIGS. 12, 13 and 14 until portions 82 have been bent to form the cam surfaces 32 and shoulders 34 shown in the finished element of FIGS. 1 and 20. In this stage of the forming operation, a continuous strip of insulating material 39 is applied to element 40 and is deposited between portions 80 which are now oriented upwardly substantially parallel to each other to define a pocket (FIG. 14). As shown in FIG. 4, the strip of insulating material 39 is supplied from a reel 86 and is placed within the walls of the partially formed element 40.

In the next succeeding forming operations, as shown in FIGS. 15 and 16, portions 80 are further bent inwardly about insulating material 39. The partially shaped element is then passed through a series of forming rolls 54 as depicted in FIGS. 17, 18 and 19 to shape the element in its final form as shown in FIG. 20 wherein a portion of the insulating material 39 is confined within rectangular body portion 24–28 and a portion is disposed behind channel 37 between flange portions 30.

Upon completion of the final forming operation, the advancing structural element passes through a shearing station B comprising a flying cutting mechanism having an upper cutting tool 90 which acts against the edge of a lower cutting tool 92 to sever continuous element 40 into discrete structural elements of predetermined length. The cutting mechanism is timed with the rate of feed continuous element 40 to sever the same at the grooves 46 earlier formed by the notching mechanism at station A. As hereinafter mentioned, grooves 46 were deeply cut into strip 40 so that the cutting mechanism is not required to penetrate or cut through the entire thickness of the sheet material, but rather only a fraction thereof to clearly sever or break off a given length of formed element from the continuous length thereof with a smooth, flat edge. Were the cutting edge of tool 90 required to penetrate the entire thickness of the continuous formed element, the cutting action would produce irregular and jagged edges at the end portions of the finished element. Moreover, since the element is now formed into its final shape, the end portions of the severed element would tend to be deformed or bent inwardly by the cutting tool. The method of the present invention eliminates the above deficiencies by notching the material when in a flat strip form to sufficiently weaken the same so that the formed element can be readily severed at the notched grooves producing smooth, flat edges.

From the foregoing, it is apparent that the objects of the present invention have been fully accomplished. As a result of this invention, an improved method for forming a structural element is provided in which a flat strip of material is notched prior to forming and subsequently severed after the forming operation to produce burr-free, smooth, flat edges. Also, heat-insulating material is applied to the element as it is being formed to produce a rigid, fire-rated structural element possessing the requisite stability and strength for use in construction walls and ceilings.

A preferred embodiment of this invention having been described and illustrated, it is to be understood that this has been done by way of illustration only.

We claim:

1. A method of forming an elongated structural element comprising feeding a continuous strip of sheet material in a longitudinal path of movement, progressively bending said strip inwardly from the sides thereof to form a continuous length of structural element having a body portion of generally rectangular cross section comprising a pair of generally parallel front and rear faces connected by side faces, and a pair of generally parallel flanges extending outwardly from said front face away from said rear face.

2. The method of claim 1 wherein said strip also is formed to provide a channel having a restricted inlet opening disposed within said body portion.

3. A method according to claim 1 including notching transverse grooves in said continuous strip of sheet material at predetermined longitudinally spaced intervals therealong prior to bending said strip, and severing said continuous length of structural element after forming the same at said grooves into discrete structural elements.

4. A method of forming an elongated structural element comprising feeding a continuous strip of sheet material in a longitudinal path of movement, progressively bending said strip inwardly from the sides thereof to form a continuous length of structural element having a body portion of generally rectangular cross section comprising a pair of generally parallel front and rear faces connected by side faces, and a pair of generally parallel laterally spaced flanges extending outwardly from said front face away from said rear face, said flanges being folded over at the outer ends thereof to provide cam surfaces leading to opposed shoulder portions.

5. A method according to claim 4 wherein the opposite edges of said strip are formed to retreat from said opposed shoulder portions toward said front face and terminate within the opening between said flange portions.

* * * * *