May 26, 1964 A. J. TOTI ET AL 3,134,468

STRUCTURAL UNIT AND ASSEMBLY THEREOF

Filed Dec. 28, 1959 4 Sheets-Sheet 1

Fig. 1

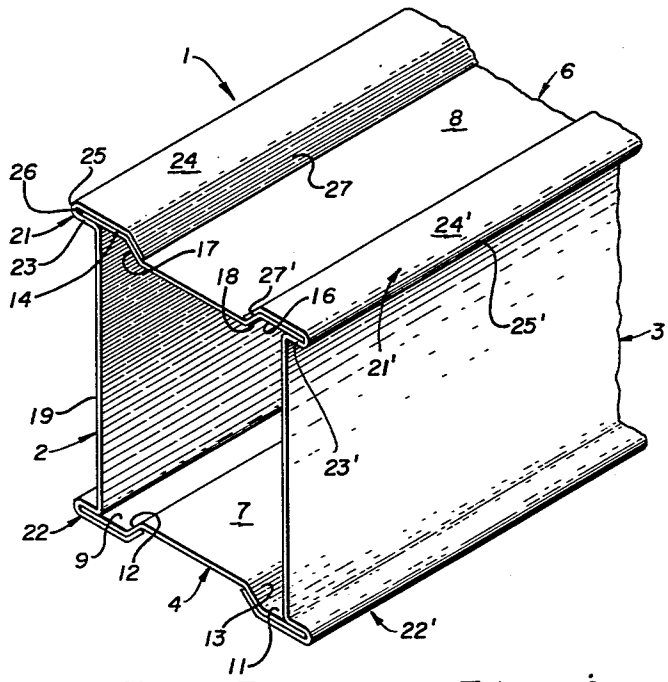


Fig. 2

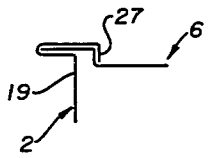


Fig. 3

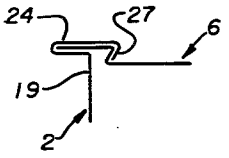


Fig. 4

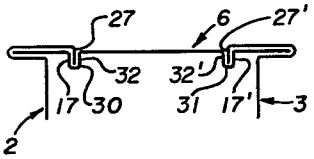


Fig. 5

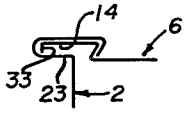
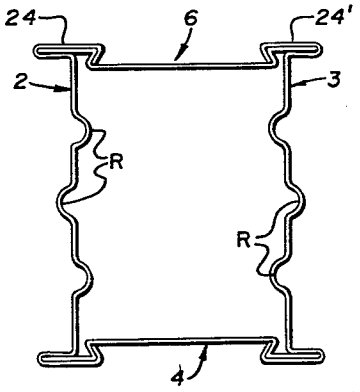


Fig. 6



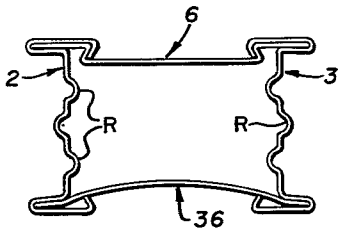


Fig. 7

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May 26, 1964 A. J. TOTI ETAL 3,134,468

STRUCTURAL UNIT AND ASSEMBLY THEREOF

Filed Dec. 28, 1959 4 Sheets-Sheet 2

Fig. 8

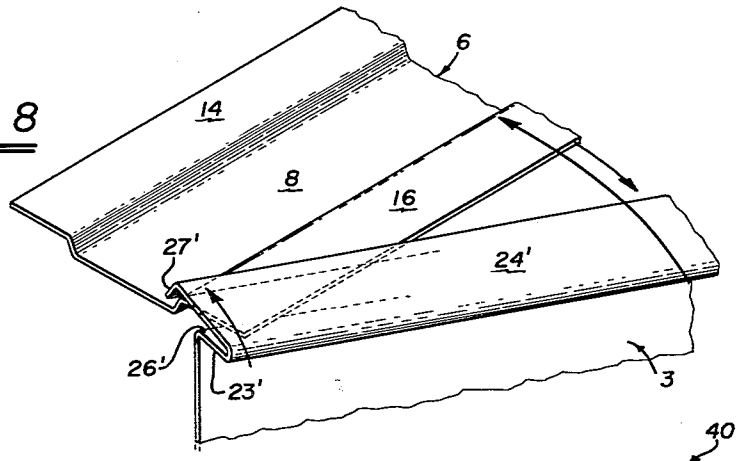


Fig. 9

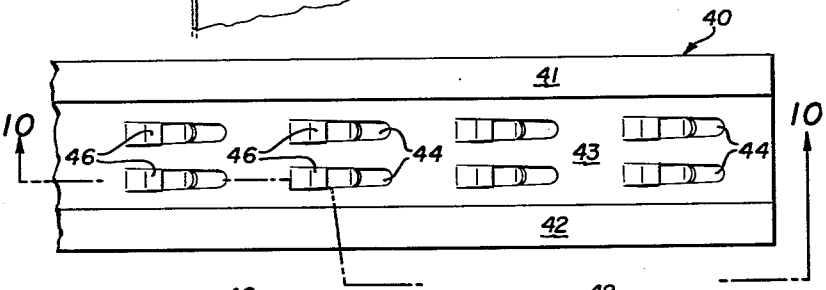
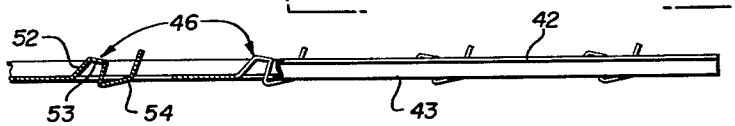


Fig. 10



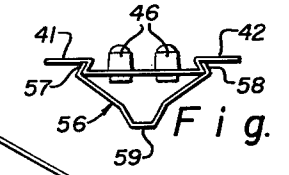


Fig. 11

Fig. 12

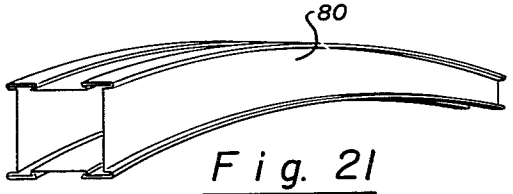


Fig. 21

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May 26, 1964 A. J. TOTI ETAL 3,134,468

STRUCTURAL UNIT AND ASSEMBLY THEREOF

Filed Dec. 28, 1959 4 Sheets-Sheet 3

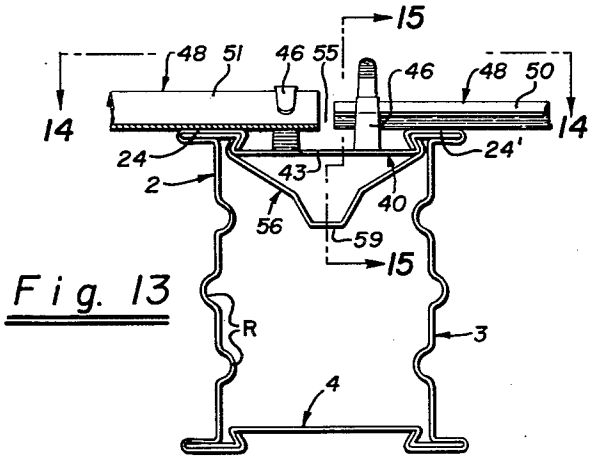


Fig. 13

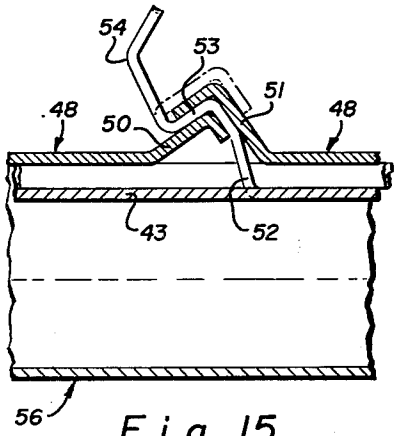


Fig. 15

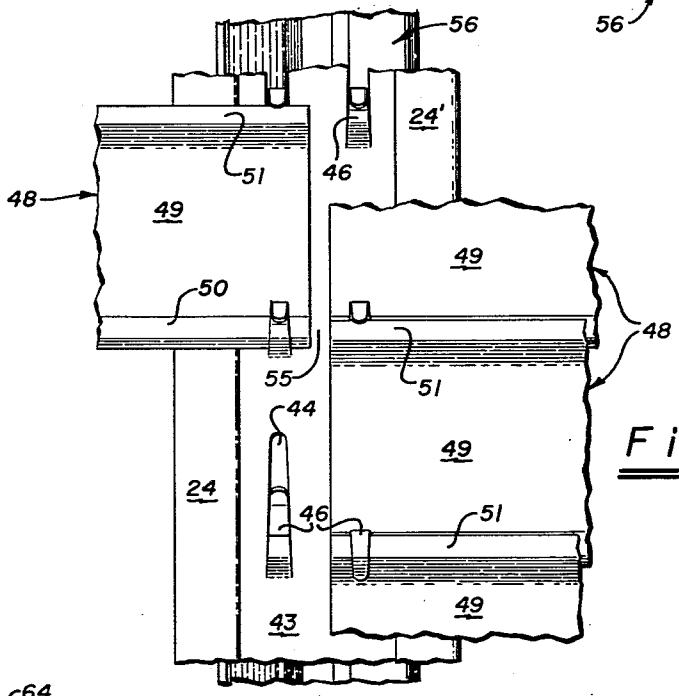
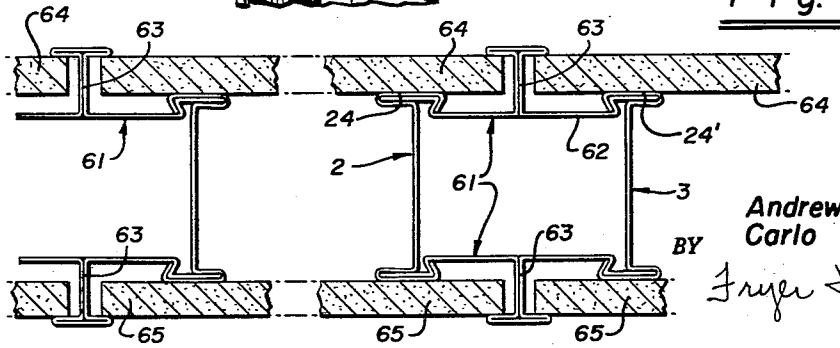


Fig. 14

Fig. 16



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May 26, 1964 A. J. TOTI ETAL 3,134,468

STRUCTURAL UNIT AND ASSEMBLY THEREOF

Filed Dec. 28, 1959 4 Sheets-Sheet 4

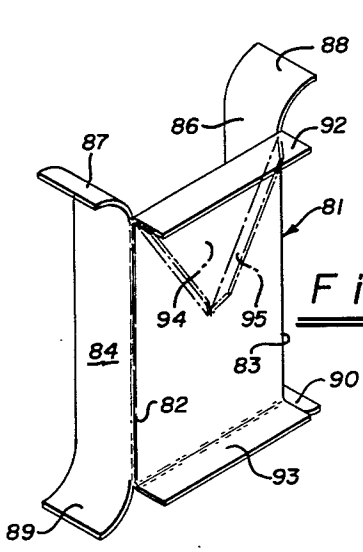


Fig. 19

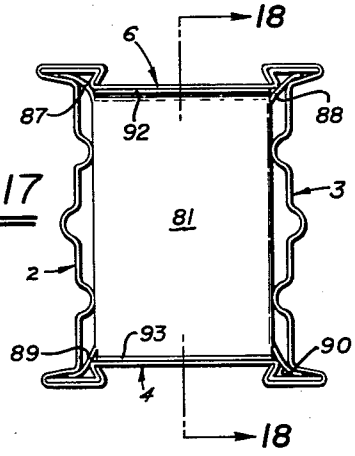
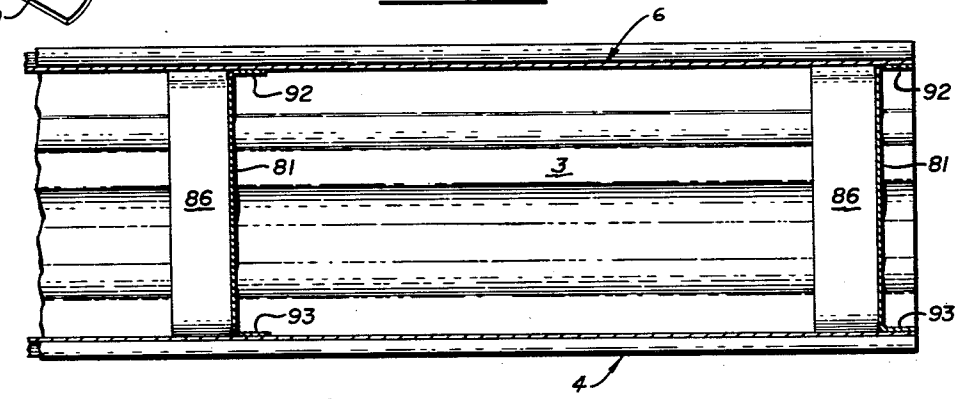


Fig. 17

Fig. 18



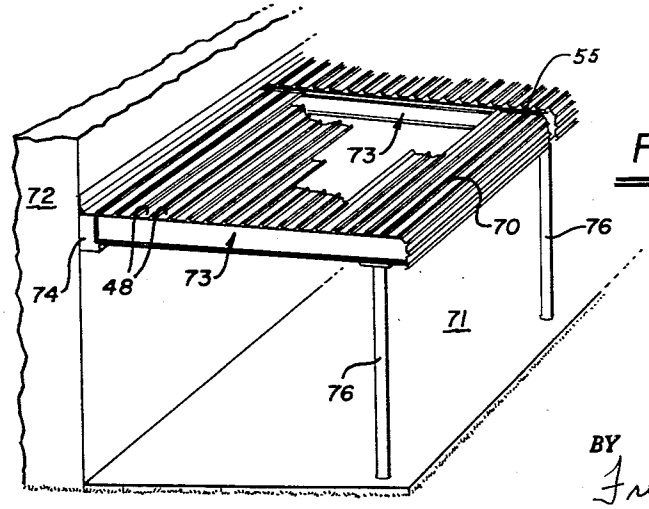


Fig. 20

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United States Patent Office 3,134,468 Patented May 26, 1964

3,134,468

STRUCTURAL UNIT AND ASSEMBLY THEREOF

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Filed Dec. 23, 1959, Ser. No. 862,321
12 Claims. (Cl. 189—37)

This invention relates generally to structural units to be used in erecting buildings and in supporting structures of various types. More particularly, the invention relates to a multi-piece readily assembled building beam, post or like structural unit which has particular utility in supporting metal awnings and covers or roofs for patios, car ports, farm storage buildings and the like.

The structural unit of the present invention is comprised of a plurality of discrete preformed structural members each of which includes means interengageable with others of the structural members whereby the body of the unit may be readily and easily assembled from the individual members. The structural members employed desirably are formed of sheet material, such as a suitable aluminum or steel alloy or a high strength plastic, and are completely preformed so that assembly of a structural unit from a plurality of structural members may be effected rapidly and easily on the job without requiring special tools and without requiring a permanent deformation or distortion of any part of the various members during or following the assembly procedure. The structural members desirably are made from sheet material which has an inherent degree of resilience so that temporary distortion of certain parts of the respective members during assembly of the structural unit may be effected if it is desired that the respective members be snap locked into tight fitting engagement with each other. If desired, however, sufficient clearance may be provided between the respective surfaces of the respective structural members to be interengaged to allow for relative sliding movement therebetween during assembly of the structural unit. Hereinafter reference will be directed to the novel construction of the structural unit as being embodied in a generally horizontally extending overhead beam intended to support a roof type structure but it should be understood that this invention may be embodied in various structural or load supporting arrangements in which light weight and high strength are desired. For example, the structural unit of this invention also may be employed as a supporting post to be vertically arranged in a generally upright position for supporting a patio cover and the like.

The subject building beam is of light weight hollow construction and possesses high strength as a result of the novel interengagement of its respective parts. The structural members of the beam are interengaged in a manner which imparts a generally polygonal cross-section to the beam, desirably in the nature of a rectangle.

While multi-piece hollow sheet metal building beams have been known generally in the art heretofore, such prior art constructions frequently require deformation of predetermined portions of the beam to effect secure interengagement between the respective members thereof. Alternatively, welding or other fastening operations frequently are employed with prior art constructions to preclude separation of the respective pieces thereof.

With the present invention, welding operations, the use of fasteners or the like are entirely unnecessary to preclude separation of the discrete structural members which make up the beam. Similarly, permanent deformation of any portion of the respective beam structural members to effect rigid and secure interlocked engagement of the respective members with each other also is entirely unnecessary. The only deformation of the structural members of this invention is of a temporary nature when

the respective members are assembled by snap locking the members into engagement with each other.

Objects of the present invention, among others, include the provision of a hollow light weight and high strength building beam which may be stored and shipped in disassembled condition and which may be readily assembled on the job without requiring special tools; the provision of means extending longitudinally of the beam and/or transversely thereof for reinforcing and strengthening the same; the provision of means for precluding inadvertent separation of the respective structural members of the beam after the same has been assembled; the provision of means in conjunction with the building beam by means of which cover structure of a building may be firmly secured to the beam; the provision of means in combination with the beam whereby water deposited on a cover structure supported by the beam may be conducted away from the cover structure for disposition; the provision of a building beam having a curved or otherwise arched configuration for imparting other than a flat configuration to the building structure supported thereby; and a method of assembling a plurality of preformed structural members into an assembled beam. These and other objects of the invention will become apparent from a study of the following specification.

Reference is directed to the accompanying drawings in which:

FIG. 1 is an isometric end view of an assembled building beam of this invention illustrating the interengagement between the various structural members which comprise the same;

FIGS. 2 through 5 are schematic illustrations of modifications of the interengagement between respective structural members of the beam;

FIG. 6 is a sectional view of a modified beam illustrating means for reinforcing the same longitudinally thereof;

FIG. 7 is a view similar to FIG. 6 illustrating another modified construction of the subject beam;

FIG. 8 is an isometric schematic view illustrating the manner in which two structural members of the beam may be snap locked into interengagement with each other during the beam assembly operation;

FIG. 9 is a plan view of a modified construction of one structural member of the building beam;

FIG. 10 is a partial cut away side view of the structural member of FIG. 9 taken along line 10—10 thereof;

FIGS. 11 and 12 are a sectional view and an isometric view respectively of the structural member of FIGS. 9 and 10 having attached thereto means for conducting water along the length of the structural member;

FIG. 13 is a sectional view of a beam which incorporates therein a structural member of the type shown in FIGS. 11 and 12 having fastening thereto one form of cover structure of a building;

FIG. 14 is a plan view of the beam construction of FIG. 13;

FIG. 15 is a longitudinal sectional view of the beam taken in the plane of line 15—15 of FIG. 13;

FIG. 16 is a generally schematic illustration of modified means for maintaining cover structure of a building in engagement with the supporting beams thereof;

FIGS. 17 through 19 illustrates means for transversely reinforcing a beam of this invention for minimizing the possibility of collapse thereof when in use;

FIG. 20 is an isometric view of a pair of subject beams used for supporting a metal patio cover;

FIG. 21 is an isometric view of a beam of this invention having a longitudinally arched configuration.

As pointed out heretofore, prior art beams of hollow sheet metal construction have been known generally but frequently such prior art beams require deformation of

the respective structural members of the beam to preclude separation thereof after assembly. While such deformation may be possible with a readily bendable material, such as soft aluminum, if the beam is to be imparted with high strength, strong and generally rigid materials such as alloys of steel or aluminum are required. Deformation of such strong materials to effect assembly of the beam would be possible only with great difficulty and only if special tools were employed.

The subject invention requires no permanent deformation of the preformed structural members in the assembly of a building beam regardless of the material chosen for the structural members and accordingly no special tools or the like are required. Similarly, no welding or like fastening operations are required as also is frequently true of prior art construction. As a result, the beams of this invention may be stored and shipped in disassembled condition to conserve space and expense and assembled on the job by unskilled workmen without requiring the use of any special tools. The only tool which may occasionally be employed is a mallet or hammer, preferably with a rubber or like non-marring head, for tapping respective structural members into snap locked interengagement with each other when a particularly snug fit between respective members is encountered.

It is contemplated that under certain situations it may be desirable that the respective structural members of the beam be slidably interengaged. This may be permitted by providing sufficient clearance between the respective portions of the structural members which are to be interengaged. A snap locked interconnection is preferred, however, in that a more rigid interengagement between the beam members is provided which virtually eliminates any play between the interengaged members and results in a stronger beam.

Referring to FIG. 1, one modification of a beam, generally designated **1**, is illustrated which is comprised of a plurality of discrete completely preformed sheet structural members which define the respective walls of the beam. It has been found that desirably the structural members of the beam are arranged to impart a generally rectangular cross-section to the beam body defined by an opposite pair of side walls and opposite top and bottom walls interengaged at the beam corners. Other generally polygonal configurations also could be employed, however.

The pair of opposite side wall structural members **2** and **3** desirably are substantially identical. The bottom of the beam is defined by a preformed structural member **4** as is the top **6** of the beam. In the embodiment of FIG. 1 top and bottom members **4** and **6** are substantially identical but are reversely oriented. It should be understood, as will be brought out hereinafter, that under certain conditions the top and bottom structural members may be of substantially different configurations and constructions.

Beams of the various types illustrated herein may be formed in any desired lengths to meet a particular need. If found suitable, long structural members may be assembled into a long beam which after assembly may be cut on the job into shorter beams of the suitable lengths required for a particular job. If the beam is formed from an aluminum alloy, such cutting may be effected with a conventional hand saw while mechanized saws may be more effective for cutting steel beams.

Irrespective of the sheet material, from which the structural members of the beam are formed, each structural member of the beam includes preformed means interengageable and interlockable with means on the other structural members so that a sturdy, rigid beam may be assembled.

In the beam of FIG. 1, top and bottom members **4** and **6** each comprises a central web portion **7** and **8** respectively. The bottom member **4** has substantially planar opposite marginal edge portions **9** and **11** integrally connected thereto by bent shoulder sections **12** and **13** which converge in the upward direction interiorly of the beam. Similarly, the top structural member **6** has substantially planar marginal edge portions **14** and **16** integrally connected by bent shoulder sections **17** and **18** to the central web portion **8** thereof. In this manner each of the top and bottom structural members is provided with a shallow depressed central channel which lies on a different level relative to the marginal edge portions thereof. In the embodiment illustrated, the depressed central webs of the top and bottom structural members are generally flat but other configurations also could be employed if so desired.

Because the structural members which define opposite side walls of the beam desirably are substantially identical only structural side wall member **2** will be specifically described. It should be understood, however, that the construction of side wall member **3** is the same with such side wall member being only oppositely oriented. Similar reference numerals primed are employed to denote portions of member **3** which correspond to similar portions of member **2**.

Side wall member **2** comprises a central web **19** along opposite upper and lower margins of which upper and lower slot forming means or structures **21** and **22** are provided which extend the full length of the member. Slot structure **21** is defined by a first flange **23** integrally connected to web **19** and which is bent generally outwardly at right angles relative thereto. A second flange **24** is integrally connected to flange **23** along a reverse bend **25** so that a preformed slot **26** is provided therebetween. Desirably the opposing faces of the flanges are spaced from each other a distance substantially equal to the thickness or gauge of the sheet material from which the top structural member of the beam is formed. Flange **23** extends outwardly generally normal to the central web **19** while the flange **24** extends in an opposite direction and overlies flange **23** and extends in an inward direction beyond the plane of web **19**. If desired, flange **24** may converge slightly relative to flange **23**.

Flange **24** terminates in an inwardly extending lip **27** bent along a well defined line **28** to extend at a predetermined angle relative to the flange **24**. The inclination of the bent shoulder **17** of the top wall of the beam and the inclination of lip **27** relative to a common reference plane are substantially the same but the degree of such inclination is not critical. Lip **27** is snugly engaged with the bent shoulder **17** and precludes inadvertent separation of the side wall member **2** and top member **6** in that it partially restricts the slot **26** so that the marginal edge portion **9** of the bottom structural member cannot inadvertently be withdrawn therefrom. Desirably the length of flange **24** is generally equal to the length of marginal edge portion **14** of top member **6** so that a snug and secure interlocking engagement can be effected therebetween.

Slot structure **22** at the lower marginal edge of side wall member **2** is substantially identical to the aforementioned described upper slot structure and is interengaged in the same manner with the marginal edge portion **9** of the beam bottom member.

In the assembled beam construction of FIG. 1 the respective bent lips of the opposite preformed side wall members generally converge inwardly of the beam relative to each other as do the respective bent shoulders of the preformed top and bottom members.

Modified interengaged bent lip and shoulder constructions are schematically shown in FIGS. 2 and 3. For sake of clarity, clearance between the relative members is illustrated but a snug fit as shown in FIG. 1 is more desirable. In FIG. 2, the bent lip **27** and bent shoulder **17** of the respective structural members extend generally parallel to the plane of central web **19** of side member **2**. In FIG. 3, bent lip **27** and bent section **17** are reversely bent relative to flange **24** and are generally hook

shaped in cross-section. That is, the respective bent lips of the side wall members are formed to diverge interiorly of the beam relative to each other as do the bent shoulders of the respective top and bottom members.

In FIG. 4 a modified top and/or bottom structural member 6 is shown in which spaced elongated longitudinal grooves 30 and 31 are preformed therein into which bent lips 27 and 27' of the side wall members 2 and 3 are positioned to preclude lateral disengagement of the structural members. With this construction the bent shoulders 17 and 17' of the top member form one wall of the respective grooves with other bent shoulders 32 and 32' forming the other walls of the grooves. As used in the claims herein, the grooves provide the central web of the top member with a depressed construction also.

A still further modification of the interengaged lip and shoulder arrangement is shown in FIG. 5 in which the marginal edge portion 14 of the top structural member of the beam is provided with a bent biting lip 33 which increases the frictional engagement between the marginal edge portion and the flange 23 which defines the slot structure of the side wall member 2 of the beam. The biting lip 33 could also be bent in the opposite direction if desired.

It should be understood that the modified constructions herein illustrated are exemplary only and that other variations of the disclosed beam structural members are contemplated also.

In the beam embodiment shown in FIG. 6, a modified side wall construction is shown in which the central webs of the opposite side wall members 2 and 3 are provided with alternately internally and externally directed longitudinally extending ribs R which strengthen and reinforce the beam in the longitudinal or axial direction. Any suitable number of ribs may be employed. While the reinforced construction of FIG. 6 is illustrated with the particular interlocked lip and shoulder engagement shown in FIG. 3, it should be understood that reinforced ribs may be employed with any of the beam modifications disclosed herein.

The reinforced beam construction of FIG. 7 is generally similar to that shown in FIG. 6 with a different beam bottom structural member 36 being employed therewith. Such bottom member before being assembled into the beam is generally flat rather than being preformed in shallow channel shape as was true of the bottom members hereinbefore described. Because the sheet material employed for the beam members possesses substantial resilience it may be bowed somewhat when it is interengaged in the slots of the side wall members 2 and 3. In this construction, the interlock between the bottom member and the side wall members is not as positive as when a preformed bottom member is employed but substantial frictional engagement is produced with this construction which provides a rigid building beam which resists strongly any inadvertent separation. A flat structural member may be employed in instances where beam cost is a factor in that flat members are somewhat less expensive than preformed members.

As noted previously, if sufficient clearance is provided in the preformed slots of the side wall members the respective side wall and top and bottom members may be slidably interengaged. Generally, and preferably, however, a more secure beam is provided if a more snug fit is produced between the marginal edge portion of one structural member and a preformed slot of another. Similarly, in beams of substantial lengths, such as those twenty feet or longer, sliding of the members longitudinally of each other is somewhat difficult to effect.

The subject structural members preferably are snap locked into interengagement with each other in the manner shown in FIG. 8. In the construction illustrated a top member 6 and one side wall member 3 are shown being interengaged but the other members which make up the beam are similarly interengageable during beam assembly. The first assembly step is to arrange the members so that the central webs thereof extend generally normal to each other. Next, one end of a marginal edge portion 16 of the top member is engaged in an end of preformed slot 26' of the side wall member. In this position, the flanges 23' and 24' which make up the slot are angularly arranged in the longitudinal direction relative to the marginal edge portion 16. Because side member 3 is made from a generally resilient material, temporary deformation of flange 24' to the extent necessary may be effected so that the end of edge portion 16 may be inserted in slot 26' to initiate interengagement thereof.

With the structural members in the position shown in FIG. 8 it merely is necessary to urge the members towards each other in the direction shown by the arrows so that the marginal edge portion 16 is progressively inserted into the preformed slot of the side wall member. A workman may readily effect interengagement by using his hands and squeezing or forcing the members toward each other along the length of the members until the gap therebetween is closed. No special tools are required for the assembly operation and no additional fastening arrangement, such as spot welding or bolting, is required. However, if the structural members are formed from a relatively rigid material, such as sheet steel, a mallet type hammer may be employed to tap the members into interengagement.

The natural resiliency of the sheet material from which the members desirably are formed permits temporary distortion of the flange 24' and/or bent lip 27' during the interlocking engagement until the marginal edge portion 16 of the one member is fully engaged in the preformed slot. Upon interengagement, the members will return automatically to their original preformed configurations. In this manner, no permanent distortion of the structural members during beam assembly is required as is frequently true of prior art devices.

While no particular dimensional relationships between the relative structural members have been set out because the size of the members may be varied to meet a certain need, it should be appreciated that the bent lips of the side wall members are of a size sufficient to preclude separation of the beam members after assembly without unduly interfering with the snap lock interengaging procedure described. Obviously, if the bent lips are made unduly long, interengagement by snap locking may be made unduly difficult or may be precluded entirely.

As noted previously, building beams of the present invention are particularly well adapted for supporting a cover structure or roof of a farm building, car port, patio, used car lot and like constructions. While conventional means such as screws or bolts may be employed to secure the cover structure to the beams, it is an important feature of this invention that fastening means may be provided integral with the building beam by which the respective elements of the cover structure may be secured directly to the beam with a minimum of effort and without requiring separate fastening elements. FIGS. 9 to 15 illustrate such an arrangement.

FIG. 9 illustrates a modified preformed structural member 40 which is intended to form the top wall of a beam and which comprises substantially flat marginal edge portions 41 and 42 which border a depressed central web portion 43 having a series of apertures 44 provided therethrough by striking but not completely severing a series of spaced tabs 46 therefrom. Tabs 46 provide means for fastening discrete elements such as roof slats or shingles of a building cover structure directly to the top of the beam.

As shown in FIG. 10, tabs 46 are preformed into a generally S-shape and prior to their employment as fastening means are located generally in the bent down position shown in FIG. 10 to facilitate shipment and storage of the structural member. The tabs 46 and apertures 44

resulting from striking out the tabs generally are tapered in a longitudinal direction to facilitate forming thereof. The particular bent configuration of the tabs is determined by the particular configuration of the preshaped elements which comprise the cover structure. Also, the spacing of the tabs is determined by the dimensions of such elements.

Referring to FIGS. 13 and 15, use of the tabs to secure elements of a cover structure in place above a beam is illustrated. With the exception of the top structural member **40**, the beam shown corresponds to the beam of FIG. 6 in that diverging lips and shoulders are desired for a purpose to become known. In the embodiment shown, the cover structure is defined by a series of separate preformed metal slats or shingles **48** each of which has a shaped cross-sectional configuration as shown in FIG. 15. Each slat is substantially identical and is provided with a flat center section **49** bounded on each side by longitudinally extending bent ridges **50** and **51**. The ridges are of the same general channel shape but ridge **50** is smaller than ridge **51** so that a ridge **50** of one slat may be overlapped by a ridge **51** of another slat as shown best in FIG. 15.

Each S-shaped tab is defined by a first leg portion **52**, a bent shoulder **53**, and a second preshaped leg portion **54**. (See FIGS. 10 and 15.) When a structural member **40** is assembled with a beam and the beam positioned, the tabs **46** are bent upwardly so that the first legs **52** thereof are generally upright. In such position, a leg **51** and bent shoulder **53** are automatically positioned to overlie, engage and hold down the smaller ridge **50** of a slat. The angle between shoulder **53** and leg **52** of the tab conforms generally to the curvature of the top of ridge **50**. After one slat is secured to the top of the beam in this manner another slat is positioned to overlap ridge **50** and shoulder **53** of the tab as shown in FIG. 15. That is, the larger ridge **51** of another slat is positioned to overlie small ridge **50** of an adjacent slat. Thereafter, second leg **54** of a tab, the bend in which corresponds generally to the curvature of ridge **51**, is bent down over ridge **51** whereby both slats are held down by the tab as shown in phantom lines in FIG. 15. By repeating this procedure, as illustrated in FIG. 14 a completed cover structure may be readily erected and securely maintained on a beam without requiring extraneous fasteners. Although preshaped fastening tabs are preferred, if desired, the tabs may be straight originally and may be bent to conform to the shape of the slat ridges during erection of the cover structure.

While in the construction of the cover structure shown in FIGS. 13 and 14 the respective slats **48** terminate with their ends spaced from each other intermediate the top of the structural member **40** so that a channel **55** is provided between such ends for a purpose to be described, if desired the slats could extend directly across the supporting building beam without interruption and the fastening tabs employed in the same manner illustrated for the discontinuous cover structure construction shown.

With the particular embodiment shown in FIGS. 13 and **14**, the slats **48** of the cover structure are discontinuous in the area overlying the building beam for a particular purpose. In use of the illustrated cover structure in areas where rainfall can be expected, it is desirable that the rain deposited on the cover structure can be withdrawn in a controlled manner rather than having such rain run indiscriminately and in an uncontrolled manner from the cover structure onto the ground surrounding the building of which such cover structure forms a part. For this purpose, means are provided in conjunction with the building beam for conducting such rain water away from the cover structure in a controlled manner.

As noted previously, the central web **43** of the beam top has apertures **44** therethrough. As a result, rain water deposited on such structural member **43** may pass through the apertures **44** into the interior of the beam. Because it is contemplated that electrical wiring and other devices may be positioned to extend longitudinally of the beam for various purposes, it is desirable that the beam interior be maintained as free of water as possible to preclude damage to any such devices located therein. For this purpose an elongated trough **56** is interengaged with the top structural member **40** of the beam and is positioned to depend therefrom, as shown in FIGS. 11 through 13.

Desirably such trough includes bent lips **57** and **58** which are slidably or snap lockingly engaged with the bent shoulders which integrally connect the depressed central web **43** of the top structural member **40** with the opposite marginal edge portions **41** and **42** thereof. In this manner, the trough **56** is securely connected to the structural member and extends longitudinally therealong so that any water deposited on the cover structure and which passes through channel **55** onto central web **43** will pass through apertures **44** and into the trough **56**. Such water is conducted by the trough longitudinally of the beam to any convenient location at which the water may be drawn off from the beam. That is, the water is conducted to a point at which a conventional down spout or the like may be integrally connected to the trough so that water may be discharged from the cover structure in a controlled manner.

The particular configuration of the trough may be varied as desired but in the embodiment illustrated the trough is generally V-shaped in cross-section, having a flat bottom **59** along which the rain water is free to flow.

FIG. 16 illustrates a further modification of the subject beam construction in which the structural members which define the tops and/or bottoms of spaced building beams are provided with modified means for fastening a cover structure thereto. Only the top structural member **61** of one beam employed for holding down a cover structure will be described but it should be understood that a similar structural member may be employed as the beam bottom for supporting a ceiling panel arrangement if desired, as shown at the bottom of FIG. 16.

Member **61** comprises a depressed central web **62** from which integrally extends an upstanding fastening head member **63** provided by preforming the structural member with a longitudinal projection shaped as a T in cross-section. By spacing the under side of the head of the T a predetermined distance from the top of the beam as defined by the inturned flange sections **24** and **24'** of the opposite side wall members **2** and **3** thereof, elements **64** of a cover structure, whether the same be metal slats, shingles or any other suitable devices, may be snugly fitted between the T head undersurface and the top of the beam. In this manner, a cover structure may be snugly secured in place between adjacent beams which cooperate to support the overall cover structure. In the same manner elements **65** of a ceiling cover structure may be supported by the beams if the bottom structural members thereof are provided with T-shaped projections.

As noted previously, the various building beam modifications described herein may be employed for supporting building structures of many types. In FIG. 20 one such building structure is illustrated as an example which comprises a metal cover **70** for positioning over and covering a patio **71** of a residential dwelling **72**. In such arrangement a series of spaced building beams **73** of the type disclosed herein are secured in any convenient and suitable manner, as by a base member **74**, to the outer wall of the dwelling **72**. The free ends of the respective beams are supported by a series of upright posts **76** of any suitable construction. If desired, the posts **76** may be of the same hollow construction as the beams **73**. With the patio cover illustrated, a channel **55** for receiving rain water to be conducted through the beam as described previously is illustrated. When the patio cover is erected it is a simple matter to impart a slope to the cover to insure that rain water will flow toward the channel **55**. If hol-

low cover supporting posts 76 are employed, the water trough in the beam may be operatively connected to the post top so that rain water may be deposited into the hollow post and conducted thereby to a suitable run off pipe or sewer connection.

If it is desired to impart an arched or curved configuration to the cover structure or roof of a building, a beam of the subject invention may be formed with a longitudinally arched configuration as shown by the beam 80 in FIG. 21. Such a curved or arched beam may be formed from a series of four preformed structural members having any of the interlock engagements described herein previously. Because the structural members may be snap locked together, assembly of an arched beam is a simple matter while sliding interengagement would be more difficult. With such construction, buildings having arched roofs, of the type well-known on quonset huts readily can be erected. It is also contemplated that arched beams of other than arcuate configuration also may be employed. All the beams disclosed herein have a particularly attractive external configuration so that such beams may be employed for supporting a roof or other cover structure without necessitating covering of the beams to hide the same. Heretofore, steel criss-cross welded or bolted beam arrangements were frequently employed to support patio covers and like building structures. Such prior art beams are unsightly in appearance and often necessitated covering or hiding thereof when used domestically. With the subject development, however, no such decorative protection is required in that the attractive appearance of the beam actually enhances the overall appearance of the cover structure.

Furthermore, because the beams are of hollow construction, as noted previously, electrical conduits and the like may be extended therethrough. Similarly, if beams of this construction are used interiorly in domestic or business buildings, the beams may be employed for conducting heated or cooled air into given locations within the building.

While generally a beam of the type illustrated herein possesses great rigidity and substantial strength when its light weight is considered, if beams of great length are to be employed it has been found desirable under certain situations to employ reinforcing means extending transversely of the beam at spaced locations for strengthening and reinforcing the same against collapse without materially increasing the weight thereof. Such reinforcing means is shown in FIGS. 19 to 21 and comprises a series of spaced preformed reinforcing plates 81 positioned at predetermined spaced locations along the length of the beam. Each such reinforcing plate is formed from a flat sheet of light weight material which is bent along spaced crease lines 82 and 83 to provide side wings 84 and 85. The plate is slotted along lines 82 and 83 for predetermined distances from its opposite ends and subsequently bent to provide a pair of upper spaced tabs 87 and 88 and a pair of lower spaced wings 89 and 90 which are bent transversely relative to the body of the reinforcing plate. Similarly, flanges 92 and 93 are bent from the body of the plate for the purpose to be described.

If the reinforcing plates are to be employed with that embodiment of the invention in which a rain conducting trough 56 is employed, a cut out 94 corresponding generally to the shape of the rain trough as illustrated by the dotted line 95 in FIG. 19 is provided in the plate so that the same may straddle the rain trough when the plate is positioned in a beam.

As shown in FIGS. 17 and 18, the upper tabs 87 and 88 and lower tabs 89 and 90 are interposed between the marginal edge portions of the upper and lower structural members of the beam and one flange which defines the preformed slots provided in the respective opposite side wall members of the beam. The bent flanges 92 and 93 of the beam are snugly engaged with the depressed central web portions of the beam top and bottom structural members. In this manner, the reinforcing plates are snugly held in place and displacement thereof while the beam is installed or while it is in use is precluded. As shown at the right of FIG. 18, one of the reinforcing plates may be employed as a cap at an end of beam to impart a neat and finished appearance thereto if such beam end is to be open to view.

The reinforcing plates may be inserted in place in the beam merely by positioning one of the interlocking tabs in a slot of a side wall member when the beam structural members are snap locked into interengagement in the manner described previously. When once thus positioned, movement of the plate relative to the remaining beam structure is precluded by the snug fit of the tabs in the preformed slots.

With this arrangement inexpensive reinforcing means of a very sturdy nature are provided from a flat metal plate desirably of the same material of that from which the structural members of the beam are provided. As a result, beams of great lengths may be employed for various purposes and collapse or failure thereof even under very substantial loads is precluded.

While several modifications of this invention have been illustrated and described herein, it should be understood that other embodiments which may be devised by persons skilled in the art also are contemplated and that the invention should be interpreted in light of the appended claims.

We claim:

1. An elongated, multi-corner hollow light weight and high strength structural unit defined by opposite pairs of elongated preformed sheet metal structural members firmly interlocked with each other; one of said structural members comprising a depressed central web and opposite marginal edge portions integrally connected along opposite margins of said web by bent shoulders whereby said one member includes a central depressed channel; said one member being interengaged at adjacent corners of said unit with two others of said structural members each of which comprises a central web portion and a preformed slot structure extending along and integrally connected to such central web portion; each said slot structure comprising a first flange section bent outwardly from the central web portion of its respective structural member and a second flange section reversely bent inwardly relative to said first flange section and spaced therefrom to provide a preformed slot therebetween, said second flange section terminating in a bent lip spaced from said central web; said one structural member having its opposite marginal edges lockingly received in the respective slots of said two other structural members with the respective bent lips of said two other members being engaged with the bent shoulders of said one member whereby lateral separation of said one member from said two other structural members is precluded.

2. The structural unit of claim 1 wherein the bent shoulders of said one structural member extend generally parallel to each other and wherein the bent lips of said two other structural members extend generally parallel to each other when said two other members are interlocked with said one member.

3. The structural unit of claim 1 wherein the bent shoulders of said one structural member generally diverge relative to each other toward the interior of said unit and wherein the bent lips of said two other structural members also generally diverge relative to each other toward such unit interior.

4. The structural unit of claim 1 wherein the bent shoulders of said one structural member generally converge relative to each other toward the interior of said unit and wherein the bent lips of said two other structural members also generally converge relative to each other toward such unit interior.

5. The structural unit of claim 1 wherein said bent shoulders of said one structural member partially define

spaced grooves extending longitudinally of the central web of said one member, and wherein the bent lips of said two other structural members are lockingly received in said spaced grooves to preclude inadvertent separation of the members.

6. An elongated hollow light weight structural unit of high strength which is generally rectangular in cross section and which is defined by two pairs of opposite elongated preformed structural members which are interlocked with each other and which define the opposite side, top and bottom walls of said unit; the opposite side wall members of said unit being substantially identical and each comprising a central web and a pair of reversely bent slot structures integrally connected to opposite margins of said central web; the top and bottom wall members of said unit each including opposite marginal edge portions on opposite sides of a central web thereof, the edge portions of the respective top and bottom wall members being lockingly received in the respective slot structures of said opposite side wall members; the slot structures of said side wall wall members terminating in bent lips which are cooperatively engaged with bent shoulders provided on the respective top and bottom wall members whereby inadvertent lateral separation of said pairs of members is precluded.

7. The structural unit of claim 6 wherein said opposite side wall members are longitudinally ribbed to reinforce and strengthen said unit.

8. A hollow building beam or like structural unit to be assembled from a plurality of at least four preformed sheet metal structural members without requiring special tools for assembly and without requiring permanent deformation of the preformed members to maintain the beam assembled; at least two of said members comprising a central web having slot structures integrally connected to opposite margins thereof, each of said slot structures being defined by a first flange setcion bent in a first direction generally normal to said web, and a second flange section reversely bent in a second direction generally normal to said web, said flange sections being spaced from each other to provide a preformed slot therebetween, said second flange section terminating in a bent lip which restricts straight direction insertion of another member into said slot; at least two others of said structural members including marginal edge portions lockingly receivable in the respective slots of the first mentioned two members, said two other members including bent shoulders engageable with the respective bent lips of said first mentioned two members for precluding inadvertent separation of the members of the beam when the same is assembled, said beam being storable and transportable in disassembled condition and being snap-lockable or slidably engageable on the job without requiring special tools.

9. Four elongated structural members of preformed sheet material to be assembled on the job into a hollow structural unit of generally rectangular cross-section without requiring special tools to effect such assembly, comprising a first pair of substantially identical members to be located opposite each other in an assembled unit, and a second pair of members to be located opposite each other in an assembled unit; each of said first pair of members including a central web and a slot structure extending along each margin of such web, each slot structure comprising a first flange integral with such web and extending in a first direction therefrom, a second flange reversely bent from said first flange and extending in a second direction relative to said web, said first and second flanges being spaced from each other whereby a preformed slot is provided therebetween, said second flange terminating in a bent lip lying at least partially in the plane of said slot and at least partially restricting the same; each member of said second pair of members including a web and opposite marginal edge portions connected with said web by bent shoulders; said four members being interengageable into a structural unit by inserting a marginal edge portion of each member of said second pair of members into a slot of a member of said first pair of members so that a bent lip engages a bent shoulder and precludes inadvertent separation of said members.

10. A structural unit for use in erecting building structures comprising a plurality of resilient structural members each of which is preformed and includes means whereby the same may be securely and readily interengaged with others of said members so that said structural unit may be rapidly and easily assembled from said plurality of members without use of special tools; one of said members including a web portion and preformed slot means extending along a margin of said web portion, another of said members including a central web having a marginal edge portion thereof interlockingly received in said preformed slot means of said one member whereby a corner of said structural unit is defined thereby, and interengaged lip and shoulder structure between said slot means and said edge portion of said interlocked members, said lip and shoulder structure precluding inadvertent lateral separation of said interlocked members at such corner and insuring secure interlocking of said edge portion in said slot means, interlocking of said edge portion and said preformed slot means being effectable without requiring permanent deformation of said preformed slot means during such interlocking; and reinforcing plates spacedly positioned internally of said unit which extend transverse to the longitudinal direction thereof for reinforcing said unit against collapse, said reinforcing plates being free of permanent connection with said structural members of said unit and including tab means thereon inserted between the interlocked edge portions and the slot means of the structural members at corners of said unit for maintaining such plates in operative position in said unit, said unit being free of separate longitudinally extending reinforcements between the edge portions and the slot means of said members whereby the weight of said unit is maintained at a minimum.

11. The structural unit of claim 10 wherein the web portion of one structural member which cooperates with another of said structural members in defining a corner of said unit is longitudinally ribbed to strengthen and reinforce the same.

12. The structural unit of claim 10 for use in supporting a roof of a building structure, wherein said structural unit is longitudinally arched whereby said roof may be imparted with an arched non-flat configuration.

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