Aug. 4, 1964 T. W. LEWIS ETAL 3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Filed July 18, 1961

5 Sheets-Sheet 1

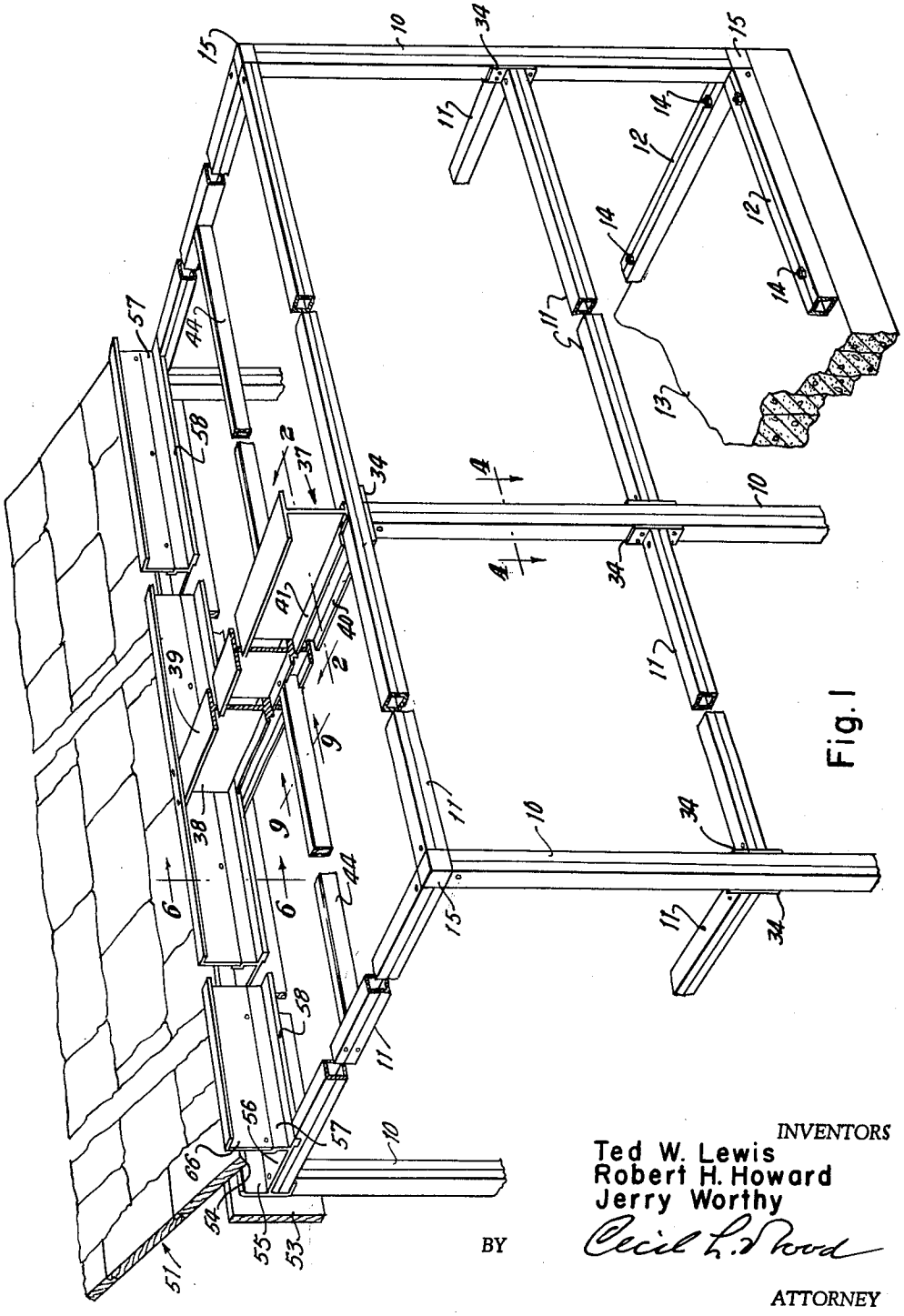

Fig. 1

INVENTORS

Ted W. Lewis
Robert H. Howard
Jerry Worthy

BY Cecil L. Howard

ATTORNEY

Aug. 4, 1964 T. W. LEWIS ETAL 3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Filed July 18, 1961 5 Sheets-Sheet 2

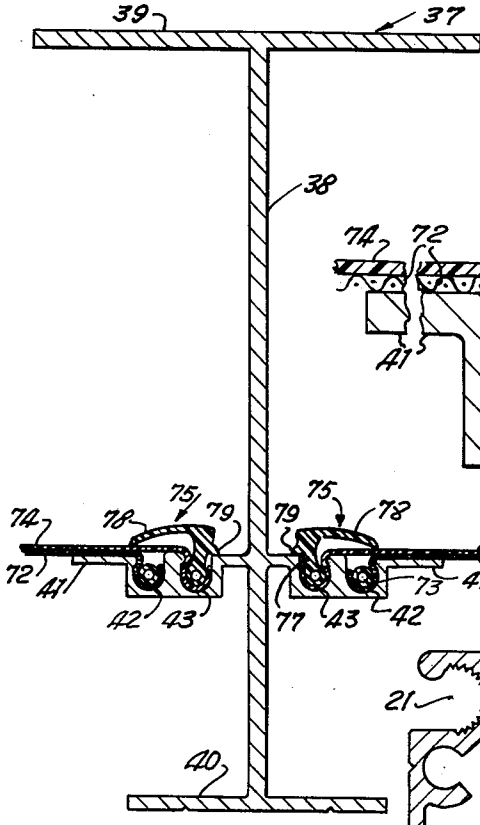

Fig. 2

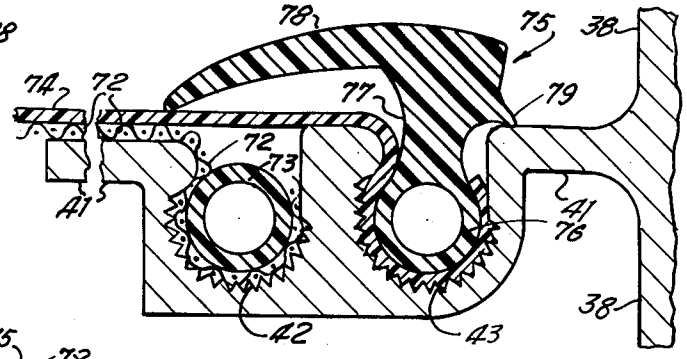

Fig. 3

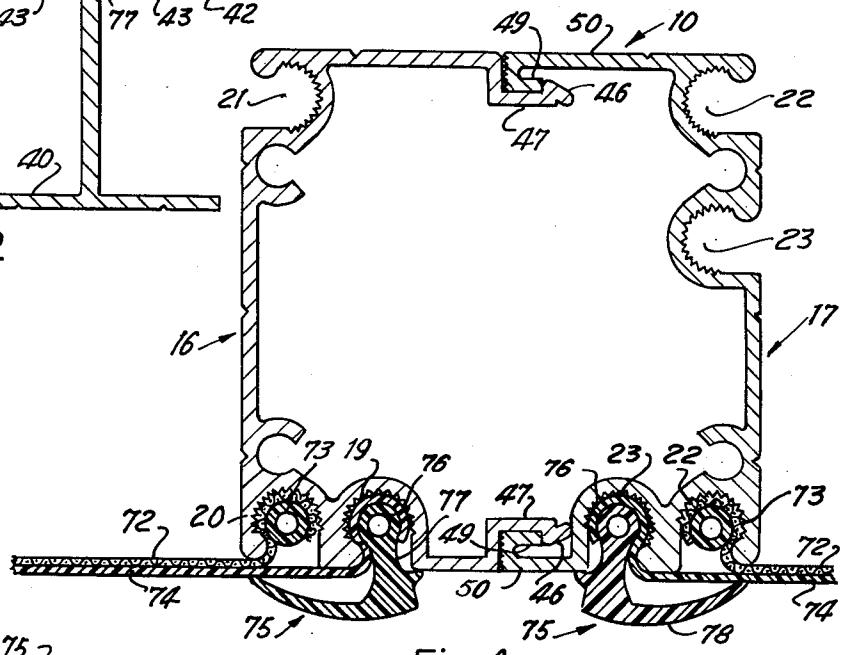

Fig. 4

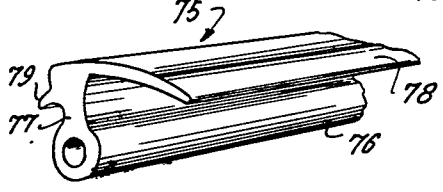

Fig. 5

INVENTORS
Ted. W. Lewis
Robert H. Howard
Jerry Worthy

BY Cecil L. Ford
ATTORNEY

Aug. 4, 1964 T. W. LEWIS ETAL 3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Filed July 18, 1961

5 Sheets-Sheet 3

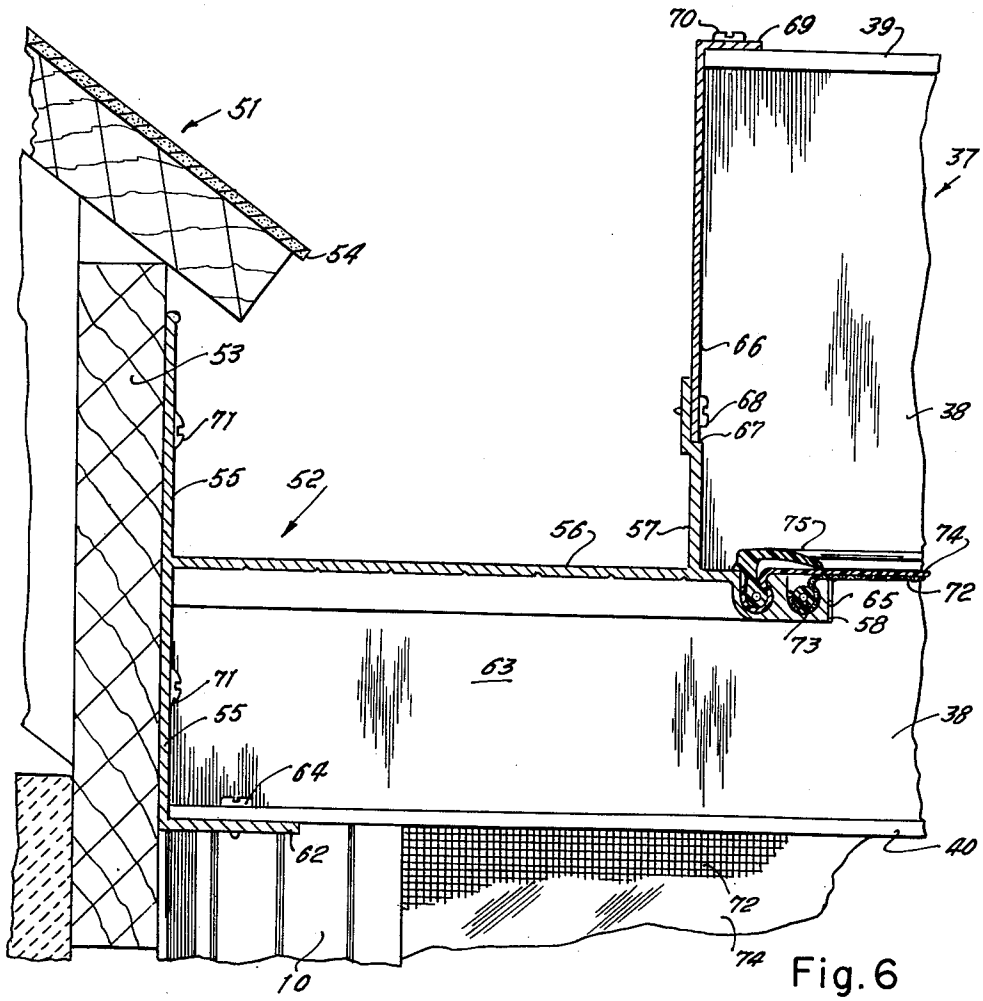

Fig. 6

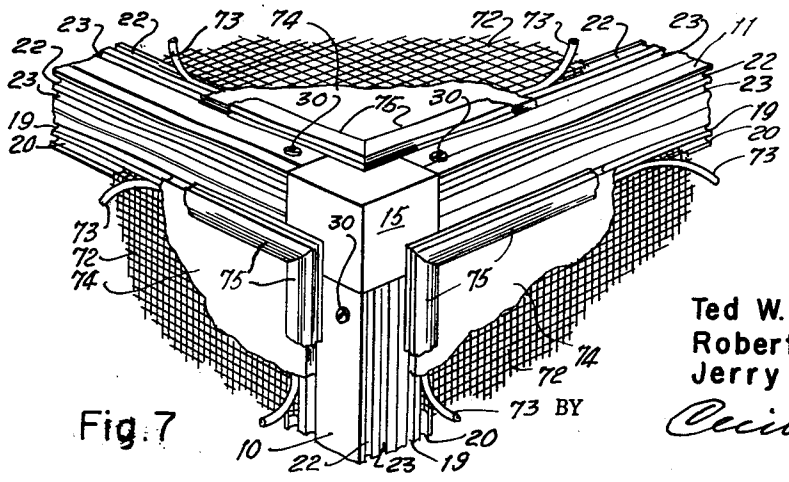

Fig. 7

INVENTORS

Ted W. Lewis

Robert H. Howard

Jerry Worthy

BY

Cecil C. Wood

ATTORNEY

Aug. 4, 1964 T. W. LEWIS ETAL 3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Filed July 18, 1961 5 Sheets-Sheet 4

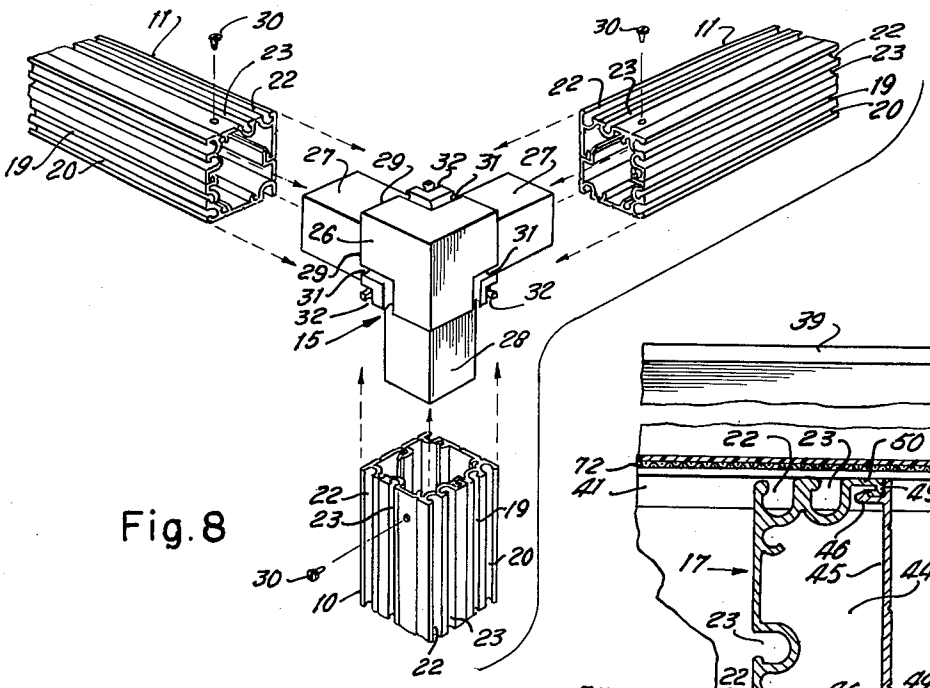

Fig. 8

Fig. 9

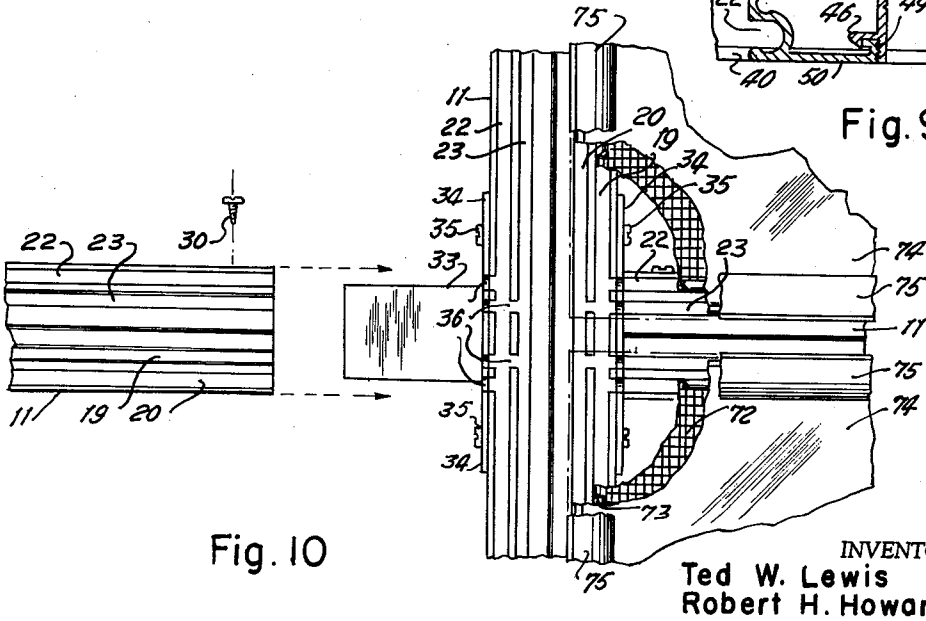

Fig. 10

INVENTORS
Ted W. Lewis
Robert H. Howard
Jerry Worthy

BY

Cecil L. Wood
ATTORNEY

Aug. 4, 1964 T. W. LEWIS ETAL 3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Filed July 18, 1961 5 Sheets-Sheet 5

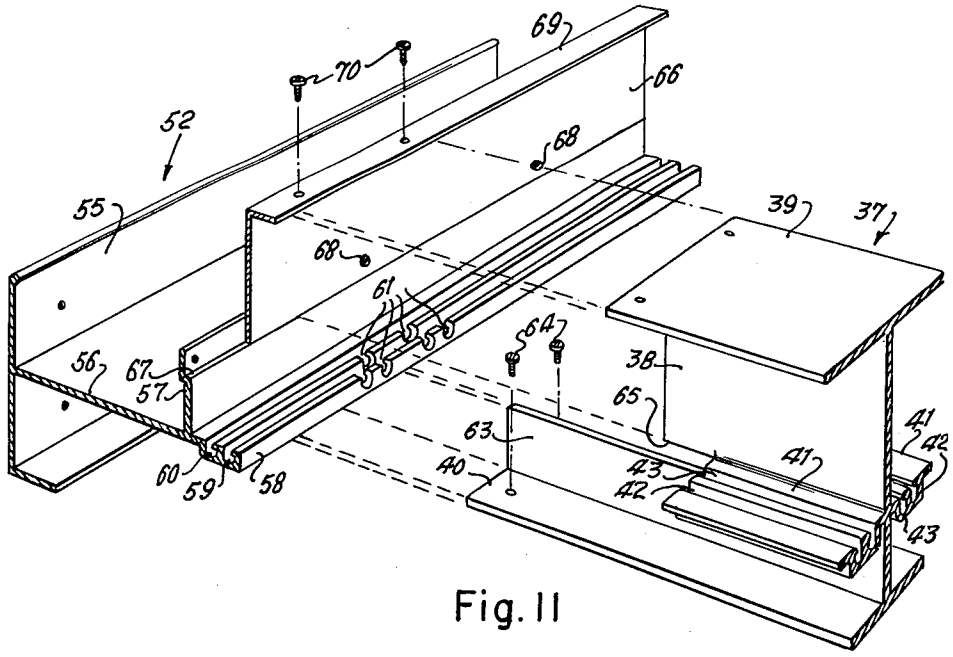

Fig. 11

Fig. 14

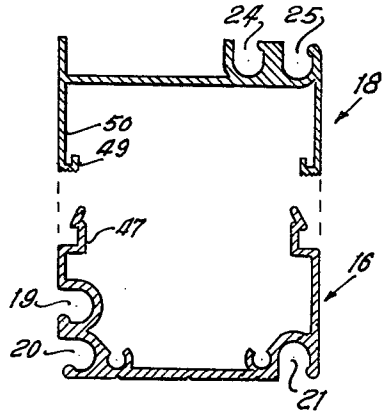

Fig. 12

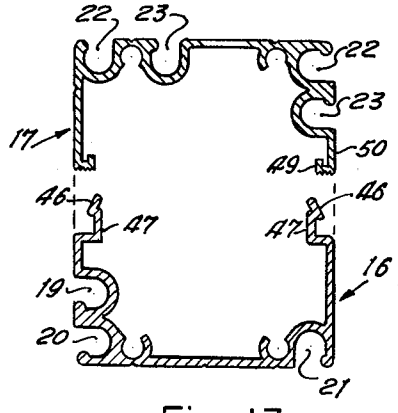

Fig. 13

INVENTORS
Ted W. Lewis
Robert H. Howard
Jerry Worthy

BY Cecil L. Ford
ATTORNEY

United States Patent Office

3,143,165

Patented Aug. 4, 1964

3,143,165

METAL FRAME STRUCTURE AND PREFORMED STRUCTURAL UNITS COMPRISING THE SAME

Ted W. Lewis, 7225 Jewel Ave., Fort Worth, Tex.; Robert H. Howard, 8109 Preston Highway, Louisville, Ky.; and Jerry N. Worthy, 2210 Main St., Big Spring, Tex.

Filed July 18, 1961, Ser. No. 124,869

2 Claims. (Cl. 160—394)

This invention relates to building construction, and it has particular reference to structures adapted to be erected as permanent or temporary enclosures for swimming pools, patios, and the like, or for the protection of nursery stock and hot house plant growth, and the principal object of the invention resides in the provision of a frame structure which can be easily and rapidly assembled with preformed aluminum parts capable of being extruded, or formed on a sheet metal break, and secured by screws, bolts, or other removable devices.

An important object of the invention, is that of providing a structural frame having means formed in its vertical and horizontal supporting members for the attachment of a screen covering to exclude insects, and other undesirable elements from the enclosure, and providing means for the application of a sheet plastic material over the screen covering, if desired, to exclude wind and moisture from outside while admitting sunlight.

Another object of the invention resides in the provision of a novel extruded I-beam unit formed with integral longitudinal grooved flanges between the top and bottom plates on opposite sides of the web for attaching roof covering thereto in a horizontal plane.

Yet another object of the invention is that of providing plate, stud and purlin units adapted to be joined in horizontal and vertical arrangement with respect to the I-beam units, and to each other, by especially designed coupling devices adapted to expedite assembly and afford detachable but rigid association of the assembled units.

An important object of the invention resides in the provision of a relatively light but economical building structure which is readily adaptable to implement existing structures, or as an independent enclosure set apart by itself, and embodying features by which structures of various floor plan dimensions can be provided.

A further object of the invention is that of providing a novel flexible spline adapted to be impressed into specially designed grooves formed in the several structural units for rigidly securing plastic sheeting thereto as a closure for the structure, and adequately sealing out moisture and inclement weather therefrom.

Broadly, the invention contemplates the provision of an arrangement of structural units which can be readily adapted for interchangeability, and assembled with a minimum of effort and time, while affording an extremely light and durable structure, capable of providing comfortable and pleasant housing in practically all types of weather.

While the foregoing objects are paramount, other and lesser objects will become manifest as the description proceeds, taken in connection with the appended drawings wherein:

FIGURE 1 is a fragmentary perspective illustration showing an assembled structural frame attached to an existing building, the latter being also fragmentarily shown.

FIGURE 2 is a transverse sectional view through the I-beam unit, on lines 2—2 of FIGURE 1, showing the integral grooved flanges and the manner of attaching the screen and plastic sheeting thereto for a roof cover.

FIGURE 3 is an enlarged fragmentary illustration, in transverse section, through one of the grooved flanges on the I-beam unit illustrated in FIGURES 1 and 2.

FIGURE 4 is a transverse sectional view, on lines 4—4 of FIGURE 1, through one of the stud units, showing the arrangement of longitudinal grooves for securing the screen and sheet plastic thereto for wall covering, and showing both screen and plastic secured thereto.

FIGURE 5 is a fragmentary perspective illustration of the flexible spline for securing the sheet plastic material to the several units, as shown particularly in FIGURES 2, 3, and 4.

FIGURE 6 fragmentarily illustrates, in partial section, the structure attached to an existing building.

FIGURE 7 is a fragmentary perspective illustration of a corner assembly, showing the manner in which the units are assembled and the attachment of the screen and sheet plastic covering.

FIGURE 8 is an exploded perspective illustration of a corner assembly showing the manner of connecting the horizontal and vertical units.

FIGURE 9 is a fragmentary transverse sectional view of one of the purlin units.

FIGURE 10 is a fragmentary plan view, partially exploded, to illustrate a four-way plate, or plate and purlin assembly.

FIGURE 11 is a fragmentary exploded view, in perspective, illustrating the association of the I-beam with the facia gutter, as shown in transverse section in FIGURE 6.

FIGURE 12 is an exploded transverse sectional view of one of the stud or plate members and the manner of its assembly.

FIGURE 13 is an exploded transverse sectional view of another stud or plate member, and showing its manner of assembly, and

FIGURE 14 is a transverse sectional view of a plate for transforming one of the elements shown in FIGURES 12 and 13 into a purlin, as shown in FIGURE 9.

The invention is primarily concerned with the provision of preformed structural units of different shapes and characteristics capable of being fitted together and rigidly joined to produce a frame structure, and although such frame structure may, if desired, be enclosed with rigid wall and roofing materials, such as sheet aluminum, wall board, and the like it is primarily designed for the erection of open structures to be enclosed by metal or plastic screening, whereby the enclosure is open to the atmosphere, and embodying means by which air and moisture can be excluded by the application of a pliable sheeting, such as sheet plastic.

A typical structure is illustrated fragmentarily in FIGURE 1 in which is shown a plurality of spaced vertical studs **10** which are connected at their upper and lower ends by horizontal plate members **11** and **12**, the latter being secured to a suitable foundation **13**, such as a concrete floor, by bolts **14**, or other device. The plates **11** and **12** are connected at the corners of the structure by specially designed fittings **15**, such as that illustrated in FIGURES 7 and 8, which will be presently described in greater detail.

The studs **10** and plates **11** and **12** are rectangular in transverse section, as shown in FIGURES 4 and 8, and comprise male sections **16** and interchangeable female sections **17** or **18**, as illustrated in the exploded views shown in FIGURES 12 and 13. The several illustrations depict a variety of cross-sectional configurations in the walls of the members **10**, **11** and **12** defining grooves **19**, **20** and **21** longitudinally of the basic male sections **16**, and similar grooves **22**, **23**, **24** and **25** in the interchangeable female sections **17** or **18** whose functions will presently become apparent.

The corner fittings **15**, by which the upper and lower plates **11** and **12** are connected at right-angles, as shown in FIGURES 7 and 8, comprises an angular molded element having a rectangular body **26** formed with a plurality of projections **27** extending from two of its surfaces in right-angular arrangement, and a similar projection **28** extending at right-angles in a plane transverse to that of the members **27**, and each of these projections **27** and **28** are rectangular in transverse section and have dimensions less than that of the body **26** to define shoulders **29** thereon.

The projections **27** and **28** are adapted to be received in the ends of the plates **11** and **12** and the studs **10** which abut the shoulders **29**, as shown in FIGURE 7, or as indicated by the dotted arrows in FIGURE 8. The studs **10** and plates **11** and **12** are secured to the projections **27** and **28** by screws **30**, or other suitable device, such as shown in FIGURES 7 and 8. The body **26** of the fitting **15** is formed on three sides with angular grooves **31** and **32** which are aligned with the grooves **19**, **20** and **21** of the base sections **16**, or the grooves **22**, **23**, **24** and **25** of the interchangeable sections **17** or **18** of the studs **10** or plates **11** and **12**.

In the construction of partitions, as illustrated in plan in FIGURE 10, the plate members **11** may be connected at right-angles by the use of fittings **33** which are rectangular in transverse section, and having dimensions adapting the same to be received in the ends of the members **11**, as indicated by the dotted arrows in FIGURE 10, and having right-angular flanges or a plate **34** by which they can be attached by screws **35** to a plate **11** arranged at right-angles thereto. Screws **30** are employed to secure the plate members **11** to the fittings **33**. The flanges which form the grooves **19**, **20**, **22** and **23**, or **24** and **25**, are slotted at **36** to provide continuous angular grooves such as provided for by the angular grooves **31** and **32** in the corner fittings **15**. The plates **11** may also be employed intermediate the top and bottom plates **11** and **12**, as shown in FIGURE 1.

The structure is capable of being erected so that no internal supports are necessary for the roof structure over relatively long spans. Supported at spaced intervals between parallel upper plate members **11** are I-beams **37** whose web **38** and top and bottom flanges **39** and **40** may be of any desired dimension according to the length of the span. The members **37** are formed of aluminum and are therefore substantially lighter in weight than steel beams of comparable dimensions. A typical beam **37** is illustrated in transverse section in FIGURE 2, and is shown in perspective in supporting position in FIGURES 1 and 11. The upper flange **39** is preferably wider than the bottom flange **40** although both flanges may be the same width if desired.

The I-beam **37** is designed to provide a suitable means for attaching the metal fabric and plastic roof covering thereto. A right-angular flange **41** is formed on each side of the web **38** and spaced above the bottom flange **40**, as shown in FIGURES 2, 3 and 11. The flanges **41** have longitudinal grooves **42** and **43** therein which correspond to the grooves in the studs **10** and plates **11** and **12**, previously described. The spacing of the flanges **41** from the bottom flange **40** of the I-beam **37** approximates lateral dimension of the plate members **11** so that, when these members are joined to the beam **37** at its ends, the grooves in the flanges **41** and the plate members **11** can register as indicated in FIGURE 1.

The beam **37** is fitted to the supporting plate **11** by cutting back the web **38** and the flanges **41** so that the lower edge of the cutaway flange **40** can rest upon the supporting plate **11** and so that the flanges **41** will abut the same in alignment with the top surface of the plate **11**, the grooves therein being notched, as at **36** in FIGURE 10, to provide an angular continuity in the position just described. The undersurface of the lowermost flange **40** of the beam **37** is suspended and is aligned with the undersurfaces of the adjacent frame members.

The intermediate supporting members of the roof, generally called purlins **44**, are connected at one end to the top plate members **11**, as shown in FIGURE 1, and at their opposite ends to the beam **37**, as shown in FIGURE 9. The purlins **44** are readily formed by combining one of the female sections **17** or **18**, shown in FIGURES 12 and 13, with a face plate **45**, shown in FIGURE 14, which is coextensive with the female section and is applied in the same manner as the male sections **16**.

The face plate **45** is formed with a pair of flanges **46** projecting at right-angles from its inner face and spaced from each longitudinal edge. The flanges **46** are identical in transverse section with the flanges **47** of the sections **16**, shown in FIGURES 12 and 13, and are bent sharply outwardly at **48** at right-angles to their axial planes and at obtuse angles to form latching members engageable with the opposing crimped edges **49** of the side walls **50** of the sections **17** or **18**, as illustrated in FIGURE 9.

The purlins **44** thus have a thickness approximating one-half that of the studs **10** or plates **11** and **12** and are arranged edgewise in the structure, and their arrangement is such, as depicted in FIGURES 1 and 9, to abut the beam **37** between the grooved flanges **41** and the bottom flanges **40**, the top and bottom surfaces of the purlins **44** being cut back the width of the flanges **40** and **41** to cause the grooves **22** and **23** in the tops of the purlins **44** to be aligned with those of the flanges **41**, and also to align the undersurfaces of the purlins with that of the beam **37**, as shown in FIGURE 9. The grooves **42** and **43** in the flanges **41** are notched, as at **36** in FIGURE 10, to produce an angular continuity thereof with the grooves **22** and **23** in the top surface of the purlins **44**.

It is desirable, especially when the structure is to be attached to an existing building **51**, as shown fragmentarily in FIGURES 1 and 6, to provide a gutter **52** along the facia **53** of the roof structure **54** to carry away rainwater and prevent its flowing on to the flat roof of the attached structure.

The gutter unit **52** is illustrated fragmentarily in perspective in FIGURE 11 and comprises an integrated unit formed with an attaching plate **55** having an integral right-angular plate **56** projecting horizontally therefrom, intermediate the upper and lower edges of the plate **55**, and having a vertical flange **57** formed therewith near its outer edge. The upper portion of the attaching plate **55** and the outer flange **57**, with the horizontally extending plate **56**, define a trough. The attaching plate **55** is secured along the facia **53** of the building **51** beneath the eaves **54** of the roof thereof.

Extending beyond the outer vertical flange **57** of the gutter unit **52** is a shelf **58** in which is formed a pair of grooves **59** and **60** which serve the same function as the grooves formed in the studs **10**, plates **11** and **12**, and the flanges **41** of the beam **37**. The grooves **59** and **60** are notched at **61** to register with the grooves **42** and **43** to provide angular continuities therefor, as indicated in FIGURES 6 and 11.

Formed with the lowermost edge of the attaching plate **55** is a right-angular flange **62** which provides a supporting surface for the beam **37** which is cut away, as shown in FIGURE 11, to cause a portion **63** of the web **38** of the beam **37**, and its lower flange **40**, to ex-

tend beneath the member **56** and the shelf **58** and rest upon the flange **62**, as indicated with greater clarity in FIGURE 6, and to which the lower flange **40** of the beam **37** is attached by screws **64**. A slot **65** is cut in the web **38**, as shown in FIGURE 11, to receive the shelf **58**, in the manner shown in FIGURE 6, so that the upper portion of the web **38** can abut the flange **57** of the gutter unit **52** and the grooves **42** and **43** can be aligned with the notches **61**.

A baffle plate **66** for the gutter unit **52** is arranged along the upper edge of the flange **57** and engages a shoulder **67** which is defined by an offset in the upper portion of the flange **57**, and the plate **66** is secured thereto by screws **68**. The upper edge of the baffle plate **66** is bent at right angles to define a flange **69** under which the upper flange **39** of the beam **37** is positioned, as shown in FIGURES 6 and 11, and secured thereto by screws **70**.

The spacing between the gutter plate **56** and the flange **62** therebelow is such that the upper plate members **11** can be joined to the gutter unit **52**, as illustrated in FIGURE 1, and a portion of the top thereof can be cut back in the same manner as the beam **37** to cause the grooves in the plate **11** to be aligned with those of the flange or shelf **58**, or with notches similar to the notches **61** therein. The facia plate **55** is secured to the existing building **51** by screws **71**.

The frame structure described above is enclosed by metal or plastic screening material **72** which is attached along the studs **10**, plates **11** and **12**, the shelf **58** and the flange **41** of the beam **37**, as indicated in FIGURES 2, 3, 4, 6, 7 and 10 by means of a flexible tubular spline **73** preferably formed of plastic, or similar material.

The spline **73**, which may be provided on spools, or the like, is pressed into the grooves against the screen material **72** in the manner shown in FIGURES 3, 4 and 7. The grooves are preferably fluted longitudinally, as apparent in FIGURES 3 and 4, to properly grip the screen **72**, and as will presently be shown, a sheet plastic material **74** which may be applied over the screen **72** and secured in the companion grooves by an especially designed spline **75** shown in FIGURES 2, 3, 4, 5 and 6, and which will be described in greater detail.

It will be noted, by reference particularly to FIGURES 2, 3 and 4, that the screen material **72** is applied to the outermost grooves in the several elements while the sheeting material **74** is secured in the innermost grooves since the plastic sheeting **74** is applied, when used, over the screen **72** and may be removed when desirable by removing the spline **75**. In mild and dry weather the plastic material **74** is not required unless it is desirable to employ an opaque or tinted material to shut out sunlight, or to subdue the sun's rays.

The spline **75**, shown in transverse section in FIGURES 2, 3 and 4, and fragmentarily in perspective in FIGURE 5, comprises a tubular body **76** having a web portion **77** formed therewith which has a flange **78** extending substantially at right-angles from one side but slightly arcuate downwardly to overlap the marginal edge of the plastic sheet material **74**, when the spline **75** is placed in its groove, and also overreaches the secured edge of the underlying screen **72**, thus covering the spline **73**, as best illustrated in FIGURE 3. Opposite the flange **78** the web **77** has a lip **79** formed therealong which engages the surface of the groove member adjacent the innermost groove and provides a cover for the latter, as shown in FIGURE 3.

The spline **73**, by reason of its highly flexible character, is capable of being arranged in the right-angular grooves **31** and **32**, as shown in FIGURES 7 and 8, or in the cross-over slots **36**, as shown in FIGURE 10, or the slots **61**, as indicated in FIGURE 11. The spline **75**, while being extremely flexible, is adapted to be mitered at the turns or corners, in the manner shown in FIGURE 7, and has the appearance of molding. It is apparent, of course, that the spline **75** may also be used to secure the screen **72**, if desired, when the plastic sheeting **74** is not applied thus providing a finished appearance to the structure in the use of either or both of the covering materials **72** and **74**.

The structural units herein shown and described are capable of being modified in form and design, from time to time, by persons skilled in the art, and joined in a variety of arrangements to provide structures of different shapes and dimensions, without departing from the spirit and intent of the invention or the scope of the appended claims.

What is claimed is:

1. In a building structure as described, an elongated structural member of hollow, thin walled construction, formed of extruded light weight metal, generally rectangular in transverse section, having a pair of closely spaced, longitudinally extending channels in a marginal portion of one side thereof, the channels being substantially U-shaped in transverse section and having longitudinally fluted bottom wall portions, one of the side walls of each of the channels having an integral longitudinal bead extending inwardly from its outer edge and forming a restricted longitudinal opening in the top of the channel, a sheet of flexible sheet material having a marginal portion thereof received in one of the longitudinally extending channels and extending outwardly beyond the adjacent longitudinal edge of said one side of the elongated structural member, and an elongated retaining member consisting essentially of a flexible tube, circular in transverse section, formed of molded plastic material and characterized by its relative stiffness, yieldably inserted in the channel above the sheet material, in frictional engagement therewith, whereby displacement of the sheet material from the channel is positively prevented, the flexible tube having a relatively thick integral longitudinal web extending radially outwardly from one side thereof, and having an integral longitudinal flange, arcuate in transverse section, extending laterally from the outer edge of the web and overlying the other of the channels and an adjacent portion of the flexible sheet material, and an integral longitudinal lip on the side of the web opposite the flange overlying the adjacent edge of said one of the channels.

2. In a building structure as described, the combination of an I beam having an integral longitudinal flange on one side of its intermediate web portion, parallel to its top and bottom flanges, in spaced apart relation thereto, having a pair of closely spaced, longitudinally extending channels therein, a sheet of flexible material having a marginal portion thereof received in one of the channels and extending outwardly beyond a longitudinal edge of the flange, and an elongated retaining member received in said one of the channels, above the flexible sheet material, in frictional engagement therewith, whereby the flexible sheet material is secured against displacement from said one of the channels, and a gutter member arranged perpendicularly to the I beam and having an end portion of the I beam connected thereto intermediate its ends, the gutter member having bottom and side portions defining a trough, and having an integral longitudinal flange extending laterally outwardly therefrom, opposite the first mentioned flange of the I beam, having a pair of closely spaced, longitudinally extending channels therein corresponding to the longitudinally extending channels of the I beam and communicating therewith, the gutter member having a downward extension of one of its side members, on the side of the trough opposite said flange, forming with said side member a vertically extending flange for atttachment of the gutter member to a supporting surface, and having an integral longitudinal flange extending laterally outwardly from

its lower edge, below the adjacent end of the I beam, whereby the I beam is supported on the gutter member, and an elongated baffle plate having one of its longitudinal edges secured to the side portion of the gutter member opposite said first mentioned side portion and extending upwardly therefrom, the baffle plate having an integral longitudinal flange extending laterally outwardly from its upper edge, immediately above the adjacent end of the I beam, and the adjacent end portion of the I beam conforming to the peripheral surface of the gutter member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,263,355	Fould	Nov. 18, 1941
2,835,325	Gilbert et al.	May 20, 1958
2,837,153	Brown et al.	June 3, 1958
2,877,877	Davis	Mar. 17, 1959
2,981,383	Dunn	Apr. 25, 1961
2,983,079	Dunn	May 9, 1961

FOREIGN PATENTS

468,582	Canada	Oct. 10, 1950