

Dec. 28, 1965

P. S. O'BRIEN
STRUCTURAL MEMBER

3,225,872

Original Filed March 5, 1957

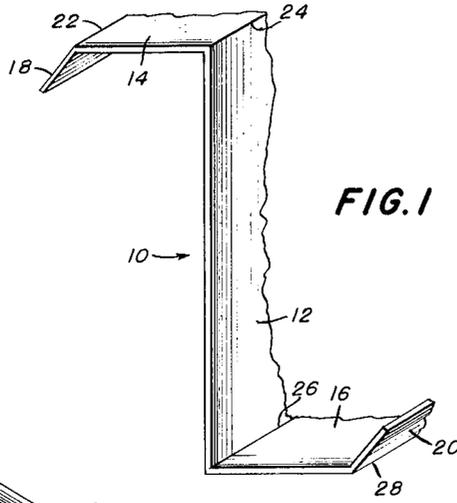


FIG. 1

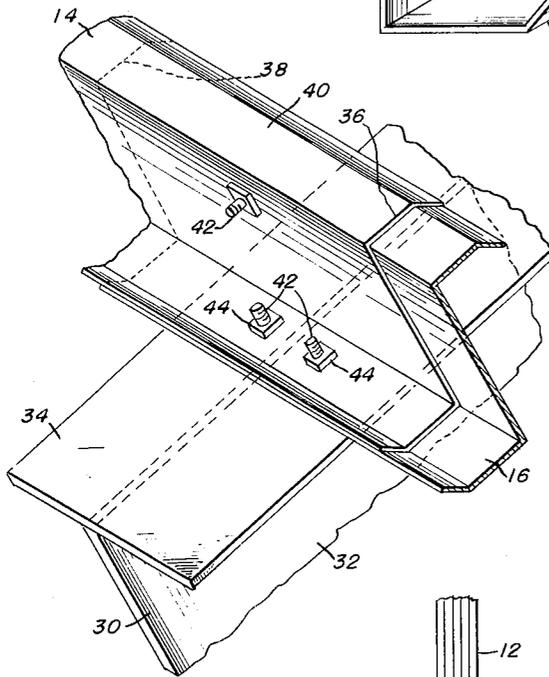


FIG. 2

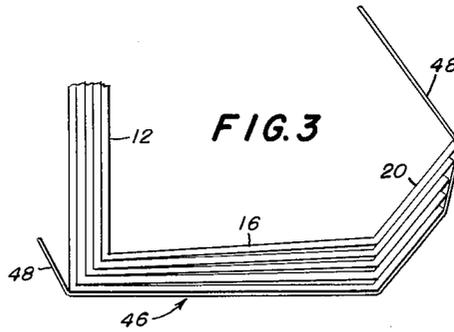


FIG. 3

INVENTOR

PAUL S. O'BRIEN

BY *James J. Shanley*
Robert Neil

ATTORNEY

1

3,225,872

STRUCTURAL MEMBER

Paul S. O'Brien, Houston, Tex., assignor to National Steel Corporation, a corporation of Delaware
 Continuation of application Ser. No. 644,087, Mar. 5, 1957. This application Dec. 31, 1962, Ser. No. 248,720
 6 Claims. (Cl. 189—36)

This application is a continuation of copending application Serial No. 644,087, filed March 5, 1957, now abandoned.

This invention relates to structural members, and more particularly to metallic structural members having a generally Z-shaped cross-sectional configuration and adapted to be stacked together in a compact package.

This invention has utility in all fields of construction in which metallic support or spacer members are required, and will be illustrated by way of example in connection with those structural members known to the art as purlins, that is, horizontal members forming component parts of certain roofs, and resting on the principal frame members for supporting upper roof members such as rafters or roof sheets.

In general, the present invention provides novel structural members each comprising an elongated flat web having a flat flange extending laterally from each side edge thereof and integral with the web, the flanges being disposed on opposite sides of the plane of the web, and each flange having means disposed along the outer side edge thereof for stiffening the structural member. The invention also provides a package comprised of a plurality of such members, the individual members of the package being so constructed that a plurality may be nested together in a compact group or package.

The specific features and objects of the invention will appear more fully below from the following detailed description considered in conjunction with the accompanying drawing, which discloses a preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is not designed for the purpose of defining the limits of the invention, but is designed for purposes of illustration only, reference for the former purpose being had to the appended claims.

In the drawing, in which similar reference numbers denote similar elements throughout the several views:

FIGURE 1 is a fragmentary isometric view of an end of a structural member according to the invention;

FIGURE 2 is a fragmentary isometric view of partially installed structural members according to the invention; and

FIGURE 3 is a fragmentary end elevational view of a package comprising a stack of nested structural members according to the invention.

Referring now to the drawing in greater detail, there is shown a structural member comprising a purlin or horizontal support for upper roof members, indicated generally at 10, and comprising an elongated flat central web 12 having along each side thereof flat flanges 14 and 16 integral with web 12 and extending laterally from the plane of web 12 at right angles on opposite sides of that plane.

Extending along the outer side edges of flanges 14 and 16, that is, the edges of the flanges remote from web 12, is a pair of flat lips 18 and 20, respectively, integral with flanges 14 and 16, respectively, and extending laterally of the flanges on the same side of the planes thereof as web 12. Each of lips 18 and 20 is disposed at an obtuse angle to its associated flange.

Thus, purlin 10 comprises an elongated metal strip having a plurality of bend lines extending longitudinally thereof, all of the bend lines being parallel to each other

2

and to the side edges of the strip. In the embodiment shown, there are four bend lines, 22, 24, 26 and 28. Web 12 is defined between bend lines 24 and 26, line 24 forming the junction between flange 14 and web 12, and line 26 forming the junction between flange 16 and web 12. Flanges 14 and 16 extend away from each other on opposite sides of the plane of web 12; and hence, the dihedral formed by flange 14 and web 12 opens away from the dihedral formed by flange 16 and web 12.

Bend line 22 forms the junction between lip 18 and flange 14; and line 28 forms the junction between lip 20 and flange 16. Lip 18 and flange 14 together form an obtuse dihedral which opens toward the obtuse dihedral formed by lip 20 and flange 16.

Lips 18 and 20 are parallel to each other; and flanges 14 and 16 are parallel to each other and at right angles to web 12. Thus, purlin 10 comprises in effect five elongated panels, each of which is angularly related to its immediate neighboring panels, but all of which are so related that each half of purlin 10 on either side of any plane including a line lying in web 12 and parallel to and spaced equal distances from lines 24 and 26, will be the mirror image of the other half of purlin 10.

In practice, purlin 10 may be formed by breaking a flat metal strip about the various bend lines.

Structural members according to the invention are shown in partially installed condition in FIGURE 2 in connection with a rigid frame member in the form of an inclined beam 30 having a web 32 and flanges 34. The upper sides of flanges 34 provide a flat surface; and it will be understood that other cross-sectional configurations of beams may be used instead of beam 30, so long as a comparable flat surface is provided thereby. It will also be understood that beams 30 are elongated and that a plurality thereof in parallelism to each other are ordinarily provided along the length of a building. Adjacent ends 36 and 38 of a pair of purlins 10 are disposed in overlapping relationship relative to each other, so as to provide a region of overlap 40 of a length substantially greater than the width of the flat surface of beam 30 provided by the flanges 34. The purlins 10 having overlapped adjacent ends 36 and 38 are disposed transversely of beam 30; and region of overlap 40 preferably extends an appreciable distance to either side of the flat surface of beam 30. This overlapping arrangement of adjacent ends 36 and 38 is extremely important in a building construction in which a plurality of purlins is disposed in line so as to form in effect a single structural member of a length a number of times greater than the length of an individual purlin, for the purpose of imparting rigidity to the line of purlins as a whole.

Means are provided for securing together in unitary assembly the beam 30 and a flange 16 of each purlin 10 in region of overlap 40, comprising bolts 42 passing through flanges 34 and 16 in region of overlap 40, and through webs 12 in region of overlap 40, and secured by nuts 44, so that a portion of flange 16 of one purlin 10 is contiguous and in contact with a portion of the flat surface of beam 30. It will also be understood that the assembly shown in FIGURE 2 will be completed by adding further members such as roof sheets atop the structure there shown and securing them through the overlapping portions of flanges 14.

It should be particularly noted in connection with FIGURE 2 that, despite the plurality of angulated surfaces of each overlapping structural member, the members are nevertheless so formed that they nest snugly together, and in this sense form a stack or package of two members. Considering the overlapping portions of FIGURE 2 to form a package, the bolts 42 and nuts 44 comprise detachable means for retaining the package in assembled rela-

tionship. It should also be noted in connection with the overlapping portions of FIGURE 2 that the web, flanges and lips of end 36 are contiguous and in contact along at least a portion of the surface thereof, with the web, flanges and lips, respectively, of adjacent end 38.

In FIGURE 3 is shown a package indicated generally at 46 and comprising a plurality of structural members identical with those previously shown, nested together in a stack and having a flexible metal strap 48 tightly bound thereabout as a detachable means for retaining the package in assembled relationship. The relationship of the individual members of the package, each to the other, can be seen in FIGURE 3. As there shown, the flange 16 tends to ride up on the lip 20 of the member next below, so that flange 16 is contiguous and in contact with the subjacent flange 16 only along a line disposed at the left of flange 16, as seen in FIGURE 3. Nevertheless, these lines of contiguity comprise portions of a surface of the flanges or lips, respectively. Similarly, each lip 20 is contiguous and in contact with the adjacent lip or lips 20 in package 46. Except in those instances in which the webs 12 are warped out of uniplanar relationship, the webs in package 46 will be contiguous with their neighbors over most of their surface. It will of course be understood that the members assume these relationships to their neighbors in the stack by virtue of the limited resiliency inherent in all such structural members.

In practice, package 46 forms a unit by which a plurality of frame members may be stored, shipped or handled together with ease. To use the structural members, it is necessary only to break or otherwise detach metal strap 48 and unstack purlins 10 for installation.

There is thus provided by the present invention a novel structural member and package, the individual components of which can be nested together without interference, but which individual components at the same time have a plurality of angularly related portions which impart great rigidity to the member. There is also provided a similar assembly having like advantages, in unitary assembly with a different type of structural member.

Although various embodiments of the invention have been disclosed and described herein, it is to be expressly understood that various changes and substitutions may be made therein without departing from the spirit of the invention, as those skilled in the art will readily understand. Reference, therefore, will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In combination with an elongated first structural member having a flat surface, a plurality of second structural members disposed transversely of the elongated first structural member, the second structural members overlapping each other in a region of overlap of a length substantially greater than the width of the flat surface of the elongated first structural member; each second structural member comprising an elongated flat web and a flat flange extending laterally from each side edge of each web and being disposed on opposite sides of the plane of the web, each flange including a lip integral and disposed at an obtuse angle therewith each lip extending along the outer side edge of its associated flange to form an obtuse dihedral therewith, the obtuse dihedral formed by one lip and its associated flange opening toward the obtuse dihedral formed by the other lip and its associated flange; the web, flanges and lips of each second structural member being contiguous along at least a portion of the surfaces thereof with the web, flanges and the lips, respectively, of another second structural member in the region of overlap; a portion of a flange of a second structural member being contiguous with a portion of the flat surface of the first structural member; the second structural members having uniform cross-sectional dimensions substantially throughout their length; and means for securing

together in unitary assembly the first structural member and a flange of each second structural member in the region of overlap.

2. In combination with an elongated first structural member having a flat surface, a plurality of second structural members disposed transversely of the elongated first structural member, the second structural members overlapping each other in a region of overlap of a length substantially greater than the width of the flat surface of the elongated first structural member; each second structural member comprising an elongated flat web and a flat flange extending laterally from each side edge of each web and being disposed on opposite sides of the plane of the web, each flange including a lip integral and disposed at an obtuse angle therewith, each lip extending along the outer side edge of its associated flange to form an obtuse dihedral therewith, the obtuse dihedral formed by one lip and its associated flange opening toward the obtuse dihedral formed by the other lip and its associated flange; the web, flanges and lips of each second structural member being contiguous along at least a portion of the surfaces thereof with the web, flanges and the lips, respectively, of another second structural member in the region of overlap; a portion of a flange of a section structural member being contiguous with a portion of the flat surface of the first structural member; the second structural members having uniform cross-sectional dimensions substantially throughout their length; and means for securing together in unitary assembly the first structural member and both of the second structural members in the region of overlap.

3. The combination defined in claim 2 in which the lip of each flange is disposed at an obtuse angle of about 135° with its associated flange.

4. In combination with an elongated first structural member having a flat surface, a plurality of second structural members disposed transversely of the elongated first structural member, the second structural members overlapping each other in a region of overlap of a length substantially greater than the width of the flat surface of the elongated first structural member, each second structural member comprising an elongated flat first portion and a pair of elongated flat second portions one extending along and integral with each longitudinal side edge of said first portion, said second portions forming angles with said first portion and being disposed both on the same side of the plane of said first portion, one of said angles being an obtuse angle and the sum of said angles being greater than a straight angle, said first and second portions of each second structural member being contiguous along at least a portion of the surface thereof with said first and second portions, respectively, of another second structural member in the region of overlap, a part of said first portion of a second structural member being contiguous with a portion of the flat surface of the first structural member, the second structural members having uniform cross-sectional dimensions substantially throughout their length, and means for securing together in unitary assembly the first structural member and said first portion of each second structural member in the region of overlap.

5. In combination with an elongated first structural member having a flat surface, a plurality of second structural members disposed transversely of the elongated first structural member, the second structural members overlapping each other in a region of overlap of a length substantially greater than the width of the flat surface of the elongated first structural member, each second structural member comprising an elongated flat first portion and a pair of elongated flat second portions one extending along and integral with each longitudinal side edge of said first portion, said second portions forming angles with said first portion and being disposed both on the same side of the plane of said first portion, one of said angles being an obtuse angle and the sum of said angles being greater than a straight angle, said first and second portions of each second structural member being contiguous along at least

5

a portion of the surface thereof with said first and second portions, respectively, of another second structural member in the region of overlap, a part of said first portion of a second structural member being contiguous with a portion of the flat surface of the first structural member, the second structural members having uniform cross-sectional dimensions substantially throughout their length, and means for securing together in unitary assembly the first structural member and both of the second structural members adjacent the region of overlap.

6. In combination with a first elongated structural member having a flat surface, the first elongated structural member being inclined and having a lower end portion and an upper end portion located heightwise above the lower end portion, a plurality of second elongated structural members disposed transversely of the first elongated structural member, the second structural members overlapping each other in a region of overlap of a length substantially greater than the width of the flat surface of the first elongated structural member; each second structural member comprising an elongated flat web, a first flat flange extending laterally from one side edge of the web, a second flat flange extending from the other side edge of the web, the first flange and the second flange being disposed on opposite sides of the web in perpendicular relationship with the plane of the web, the first flange and the second flange each including an integral lip disposed at an obtuse angle of about 135° therewith and extending along the outer side edge of its associated flange to form an obtuse dihedral therewith, the obtuse dihedral formed between the first flange and its lip opening in a direction

6

toward the obtuse dihedral formed between the second flange and its lip; the web, flanges and lips of one second structural member being contiguous along at least a portion of the surfaces thereof with the web, flanges and the lips, respectively, of another second structural member in the region of overlap; the second structural members being positioned relative to the first elongated structural member with their webs substantially perpendicular to the flat surface and with a portion of a flange of a second structural member being contiguous with a portion of the flat surface of the first elongated structural member and extending away from its web in a direction toward the lower end position of the first elongated structural member; the second structural members having uniform cross-sectional dimensions substantially throughout their length; and means for securing together in unitary assembly the first structural member and both of the second structural members in the region of overlap.

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HARRISON R. MOSELEY, *Primary Examiner.*

REINALDO P. MACHADO, *Examiner.*