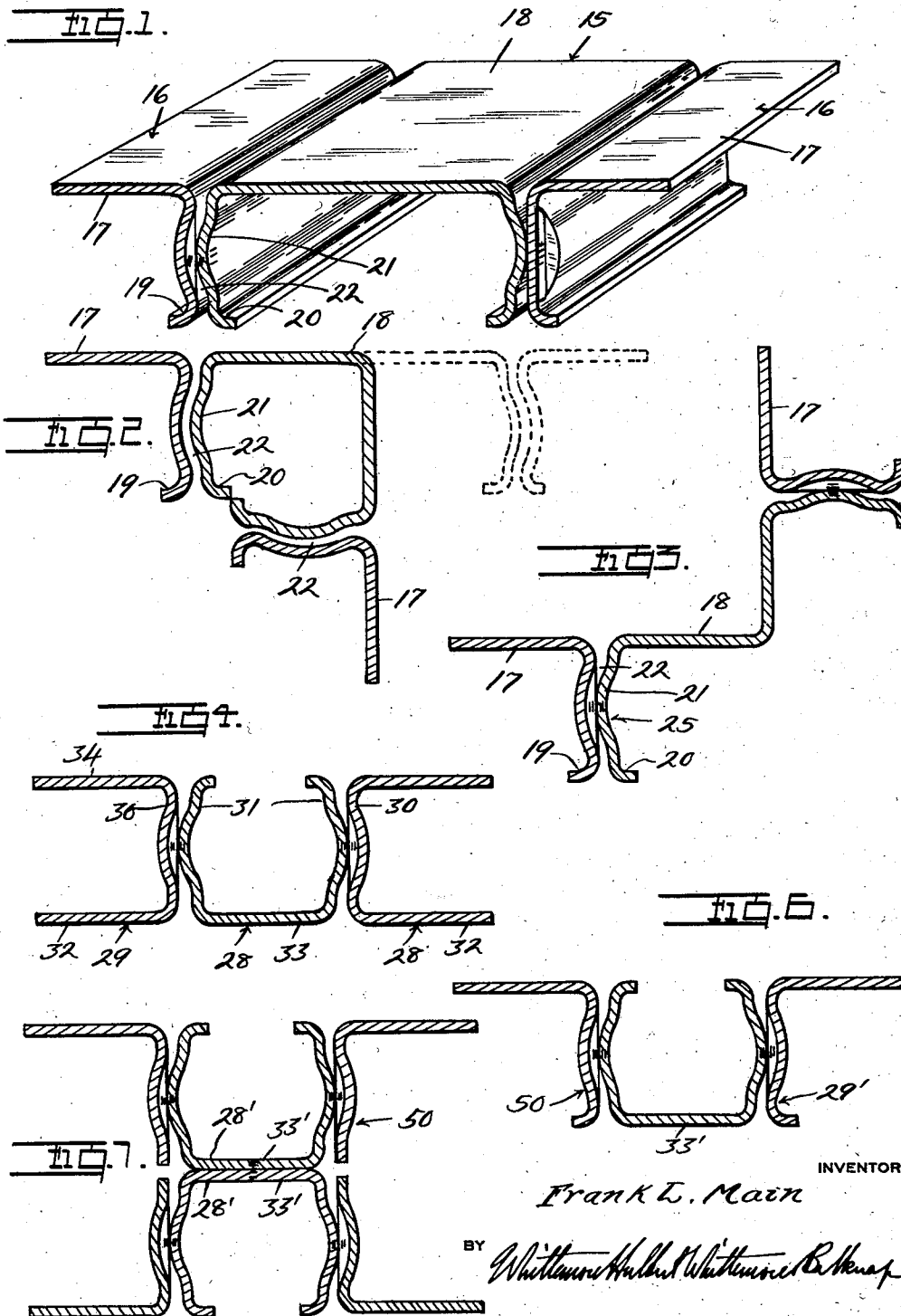


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F. L. MAIN
STRUCTURAL ELEMENT
Filed Jan. 6, 1934

2,028,554

2 Sheets-Sheet 1



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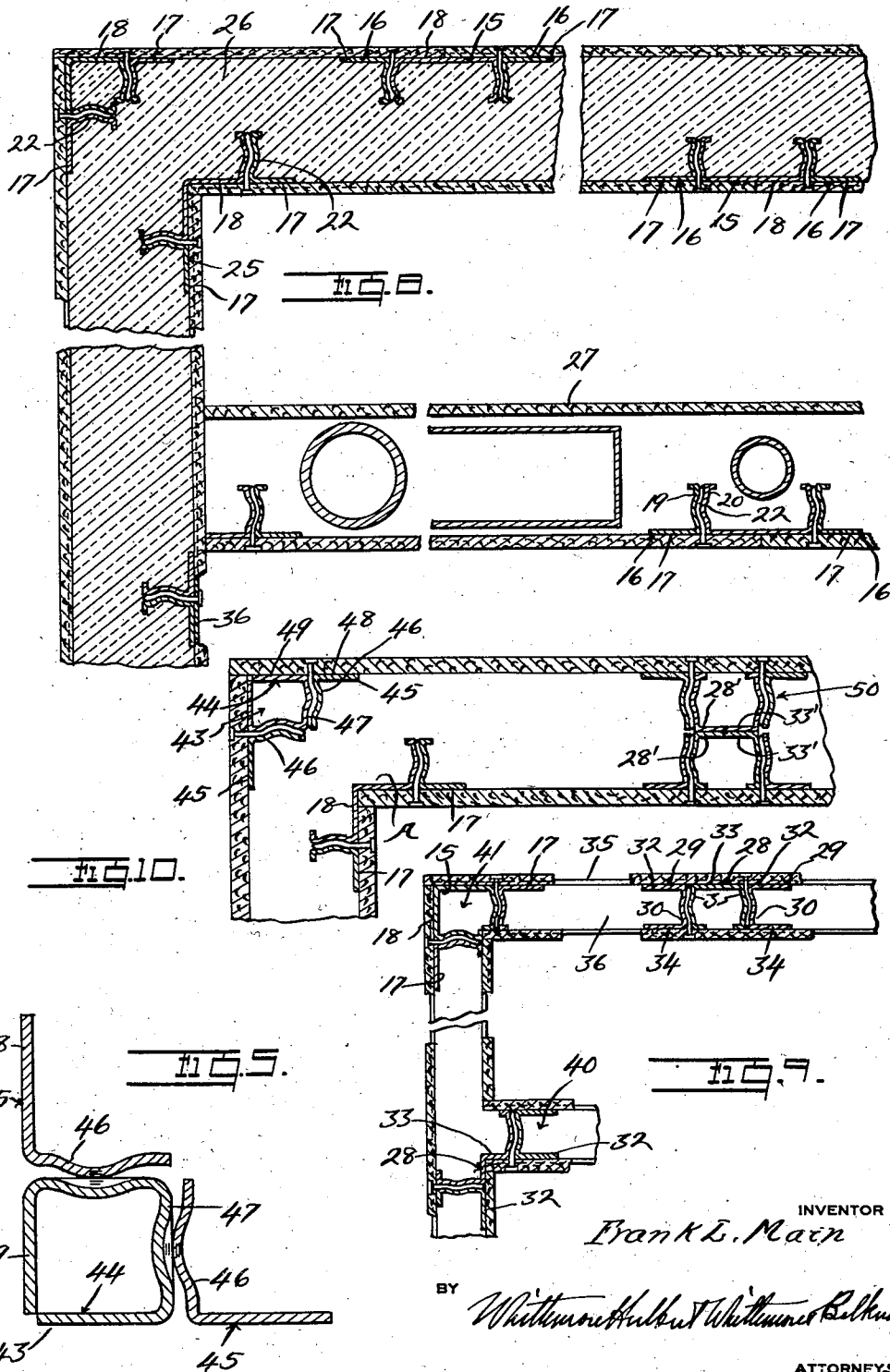
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UNITED STATES PATENT OFFICE

2,028,554

STRUCTURAL ELEMENT

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12 Claims. (Cl. 189—34)

This invention relates generally to structural elements and refers more particularly to improvements in the type of structural elements commonly employed in the fabrication of buildings and in the method of forming said elements.

The structural elements forming the subject matter of this invention offer the possibility of not only simplifying the fabrication of buildings and reducing the cost of such fabrication, but in addition render it possible to obtain lighter and more durable constructions.

One of the features of the present invention which contributes materially to the realization of the foregoing advantages consists in the provision of metallic structural elements having portions cooperating to receive and retain fastener elements, such as nails and the like, in place. In accordance with this invention the cooperating portions of the structural elements are designed to not only afford driving the nails or other fastener elements with substantially the same ease as the latter are driven into wood, and to retain these fastener elements with at least the same efficiency as the latter are retained by wood, but to also afford removal of the fastener elements with practically the same degree of facility as the latter are capable of being removed from wood.

A further advantageous feature of the invention which also contributes materially to simplifying fabrication as well as reducing the cost of the latter resides in the provision of structural elements of the type set forth in the preceding paragraph so designed as to permit readily altering the particular shape of the same in dependence upon the particular use thereof in the building construction. For example, a plain stud constructed in accordance with this invention is so designed as to permit readily bending the same to provide either an outside corner stud or an inside corner stud. By reason of the foregoing feature of this invention, a number of specially designed structural elements required in the fabrication of a building is materially reduced, resulting in a corresponding reduction in the time required for assembly and in the cost of the latter.

In addition to the foregoing this invention contemplates the provision of a structural element having portions cooperating to form laterally spaced nailing grooves and designed to be bent about a line extending longitudinally of the element between the nailing grooves to form a corner strip with the latter grooves extending at an angle to each other.

With the foregoing, as well as other objects in view, the invention resides in the peculiar constructions of the metallic structural elements about to be described.

In the drawings:

Figure 1 is a fragmentary perspective view of a structural element constructed in accordance with this invention;

Figure 2 is a cross sectional view of the structural element shown in Figure 1 illustrating the manner in which the latter may be bent inwardly about a line extending longitudinally of the element between the nailing grooves to form an outside corner stud;

Figure 3 is also a cross sectional view of the structural element shown in Figure 1 illustrating the manner in which the latter may be bent to form an inside corner stud;

Figure 4 is a view similar to Figure 1, showing a slightly modified form of structural element;

Figure 5 is a cross sectional view through another modified form of structural element;

Figure 6 is a cross sectional view illustrating still another modified form of structural element;

Figure 7 is a cross sectional view illustrating a further modified form of structural element;

Figure 8 is a fragmentary view illustrating one application of the structural elements shown in Figures 1 to 3 inclusive;

Figure 9 is a view similar to Figure 8 showing one application of the structural elements shown in Figure 4;

Figure 10 is also a view similar to Figure 8 showing one application of the structural elements featured in Figures 5, 7 and 3.

The structural element shown in Figure 1 comprises a channel shaped strip 15 and a pair of angle strips 16 located upon opposite sides of the strip 15 with the flanges 17 lying in a common plane with the base 18 of the channel shaped strip 15 and with the flanges 19 positioned opposite the flanges or sides 20 of the aforesaid channel shaped strip. The flanges 19 are spaced outwardly from the flanges 20, a sufficient distance to receive therebetween a fastener element such as a nail, and both sets of flanges are provided with longitudinally extending complementary corrugations 21 cooperating with each other to form sinuous grooves or recesses 22. The angle strips 16 are permanently secured to the channel shaped strip 15 by bending longitudinally spaced portions of the corrugations in the flanges 19 inwardly to engage these portions with the crests of the corrugations in the flanges 20 and

thereafter welding or otherwise suitably securing the contacting portions together.

The foregoing arrangement is such that when a nail or equivalent fastener element is driven into the grooves 22, the same are reversely bent laterally between the complementary corrugations previously described so as to produce kinks in the nails. Alternate bending of the nails in opposite directions as the latter are driven into the grooves permits the use of nails differing in length and diameter without materially affecting the holding properties of the nails. It should also be understood that, while the degree of curvature of the corrugations is so determined as to effect the required clinching action on the nails, the same offers the minimum resistance to the passage of the nails into the groove. As a matter of fact the corrugations are so designed as to permit driving the nails into and removing the latter from the structural element in the same manner and with the same degree of facility that nails are driven into and removed from wood structural elements.

The structural element previously described is especially designed for use in cases where it is desirable to provide only limited space between the nails or other fastener elements. In other words, the structural element described above, provides two nail grooves in close proximity to each other and consequently may be advantageously employed at the joints between the covering material for the structural elements to secure the adjacent edges of this material in place.

One specific application of the structural element hereinbefore described is shown in Figure 8, and as will also be observed from this figure, the structural element may be employed as an outside corner stud, or an inside corner stud by merely bending the same about the longitudinal median line of the base of the channel shaped strip 15 thereof. In Figure 2, I have shown the portion of the structural element at one side of the longitudinal median line of the base 18 as bent inwardly with respect to the remaining portion to form an outside corner stud. The degree of bending of the structural element depends entirely upon the angular relation between the side walls of the building construction. In the specific embodiment shown in Figure 8 the outside walls are arranged at right angles to each other so that the structural element is bent to locate the nailing grooves 22, 90° apart. On the other hand, when it is desired to provide an inside corner of the type shown by the reference character 25 in Figure 8, the portion of the structural element at one side of the longitudinal median line is merely bent outwardly with respect to the remaining portion as clearly illustrated in Figure 3 of the drawings. One instance where both the aforesaid types of corner studs are particularly useful is illustrated in Figure 8 wherein the outer wall assembly 26 of the building is shown as relatively thick to accommodate a liberal quantity of insulating material and wherein the inner wall 27 is also relatively thick to provide ample space for the plumbing and heating conduits.

In cases where neither insulating material, plumbing or heating fixtures are required the walls may be of less thickness as shown in Figure 9 and this construction affords one use for the type of structural element featured in Figure 4. The structural element illustrated in this latter figure comprises a central substantially channel shaped strip 28 and complementary side strips 29 also substantially channel shaped in cross section. The side strips 29 are arranged

with the base portions 30 opposite the sides or flanges 31 of the strip 28 and with the channels thereof opening outwardly with respect to the strip 28. The sides or flanges 32 of the channel shaped strips 29 adjacent the base 33 of the strip 28 are located in a common plane with the latter base 33 and the opposite flanges 34 of the strips 29 are also disposed in a common plane preferably parallel to the plane aforesaid. The base portions 30 of the strips 29 are of the same width as the flanges 31 and this dimension approximates the width between the flanges 35 of the channel plate 36 so as to permit inserting the end of the structural element into the channel plate 36 in the manner shown in Figure 9.

Referring again to Figure 4, it will be noted that the base portions 30 of the strips 29 are spaced outwardly from the flanges 31 of the strip 28 a sufficient distance to provide for the insertion of a nail or equivalent fastener element therebetween and both of the aforesaid portions are correspondingly transversely curved to clinch the fastener elements in the same manner as the latter are clinched by the sinuous grooves 23 in the first described form of the invention. It should be understood at this point that the strips 29 may be permanently secured to the strip 28 by merely bending the transversely curved portions of the strips 29 inwardly at longitudinally spaced points to contact the latter with the adjacent portions of the strip 28 so as to permit welding or riveting the same together.

The structural element formed in accordance with the foregoing description not only provides a double nailing groove for the purpose clearly discussed in connection with the first described form of the invention but also permits nailing covering material to either or both sides thereof, since the nailing grooves formed by the strips extend for substantially the full width of the plate as shown in Figure 9. This structural element may also be formed into a corner stud for the relatively narrow wall construction shown in Figure 9 and this may be accomplished by merely bending the base portion 33 of the strip 28 to locate the nailing grooves in the angular relation shown in Figure 9 so as to permit the use of one of the grooves for securing the covering material to one side wall of the building structure and to permit the other of said grooves to be employed for securing the covering material of the other angularly extending wall in place. The desired angular relationship between the two nailing grooves of the structural element required to secure covering material to the angularly extending walls is shown by the reference character 40 in Figure 9 and may be effected by bending the base portion 33 of the strip 28 outwardly intermediate the nailing grooves thereof. As will be observed from the above figure a strip 28 bent in the manner designated may be employed as an inside corner and when utilized in combination with the narrow channel plate 36 provides for securing covering material to opposite sides thereof. The outside corner 41 may be formed by the element 15 bent to assume the shape shown in Figure 2 or may be formed by the structural element featured in Figure 5 which is about to be described in detail.

In Figure 5 of the drawings, I have shown a specially designed corner stud 43 and in Figure 10 I have illustrated this stud as employed in association with a side wall construction of the type shown in Figure 8. In detail, the structural element 43 is formed of a strip 44 substantially 75

rectangular in cross section and a pair of angle strips 45. The angle strips 45 are located with the flanges 46 opposite adjacent side walls 47 of the strip 44 and with the flanges 48 disposed in substantially common planes with the other side walls 49 of the strip 44. The aforesaid adjacent walls 47 of the strip 44 and the flanges 46 of the angle strips 45 are not only spaced from each other to provide for the insertion of a nail or equivalent fastener element therebetween, but are also correspondingly transversely curved so as to clinch the fastener elements as the latter are driven between the same. The angle strips 45 are permanently secured to the walls 47 of the strip 44 by bending the transversely curved portions of the walls 47 outwardly at longitudinally spaced points to contact these points with the adjacent portions of the flanges 46, permitting the parts to be welded or riveted together at these points. As shown in Figure 10 the structural element 43 is especially adapted for use as an outside corner and, for the purpose of illustration, the inside corner A is shown as formed by bending the element featured in Figure 1 to the shape shown in Figure 3, although the structural element featured in Figure 4 may also be used for this purpose by merely bending the same to the shape shown at 40 in Figure 9.

In Figure 6 of the drawings, I have shown a structural element 50 identical to the structural element shown in Figure 4 with the exception that the flanges 32 of the strips 29 in Figure 4 are removed so that the members 29' in Figure 8 instead of being substantially channel shaped in cross section are in the form of angle strips. This construction is particularly advantageous since it offers the possibility of securing two of the structural elements 50 together in the manner shown in Figure 7 to form a double stud. The double stud, of course, has a width twice as great as the single structural element in Figure 6 and may be used in association with the side wall construction shown in Figure 10 to provide for securing the covering material to opposite sides of the wall. In detail, when it is desired to form a double stud from the structural element shown in Figure 6, two of the latter structural elements are selected and one of the latter is inverted with respect to the other so as to provide for engaging the base portions 33' of the strips 28' in the manner clearly shown in Figure 7. These base portions may then be welded or otherwise permanently secured together in such a manner that the nailing grooves of each element are in effect coextensive. It will, of course, be understood that this double structural element, or for that matter any one of the above described forms of structural elements are not limited to the specific use referred to herein for the purpose of illustration, but may be employed as joists, or as any one of the numerous other structural elements required in fabricating buildings.

Although, in the foregoing, no attempt has been made to disclose all of the possible types of structural elements that may be constructed in accordance with this invention, nevertheless, it will be apparent that with this invention the use of wood in fabricating buildings may be practically eliminated, but notwithstanding this fact, structural elements may be assembled by ordinary carpenters using their customary tools and craftsmanship. In other words, my invention combines the strength and rigidity of steel plus the easy working qualities of wood in fabricating buildings.

What I claim as my invention is:

1. A metallic structural element comprising a strip substantially channel shaped in cross section and having the base portion designedly bendable on a line extending longitudinally of the strip between the flanges to locate the latter at an angle to each other, and strips fixed to the channel upon opposite sides of the latter and cooperating with the flanges thereof to form grooves for the reception of fastener elements.

2. A metallic structural element comprising a strip substantially channel shaped in cross section having portions of the flanges transversely curved and having a base portion bendable on a line extending longitudinally of the strip between the flanges thereof to locate the flanges at an angle to each other, angle strips having flanges complementary to the flanges aforesaid and secured to the channel strip opposite the flanges thereof to form with the latter grooves for the reception and retention of fastener elements.

3. A metallic structural element comprising a strip substantially channel shaped in cross section and having longitudinally extending transversely curved corrugations in the flanges thereof, strips secured to the channel on opposite sides thereof and having flanges complementary to the flanges aforesaid of the channel cooperating with the latter flanges to form laterally spaced sinuous grooves for receiving and retaining fastener elements in place, and the base portion of said channel strip being bendable on a line extending longitudinally of the strip between the flanges thereof to locate the sinuous grooves at an angle to each other.

4. A metallic structural element comprising a strip substantially channel shaped in cross section and having longitudinally extending transversely curved corrugations in the flanges thereof, strips secured to the channel on opposite sides thereof and having flanges complementary to the flanges aforesaid of the channel cooperating with the latter flanges to form laterally spaced sinuous grooves for receiving and retaining fastener elements in place, and the base portion of said channel strip being bendable in either one of two directions on a line extending longitudinally of the channel strip between the flanges of the latter to form either an outside or inside corner element.

5. A metallic structural element comprising a strip substantially channel shaped in cross section and having longitudinally extending transversely curved corrugations in the flanges thereof, strips secured to the channel on opposite side thereof and having flanges complementary to the flanges aforesaid of the channel cooperating with the latter flanges to form laterally spaced sinuous grooves for receiving and retaining fastener elements in place, the width of the base portion of the channel being so proportioned to the length of said complementary flanges as to permit bending said base on a line extending longitudinally of the channel strip between the flanges to form a corner element.

6. In a metallic structural element comprising a member substantially channel-shaped in cross section, strips secured to the channel and having portions opposite the exterior surfaces of the flanges of the channel cooperating with the latter flanges to form grooves for the reception and retention of fastener elements, and the base portion of the channel member being bendable in either one of two directions on a line extending

longitudinally of the channel member between the flanges of the latter to form either an outside or an inside corner element.

5 7. A metallic structural element comprising a member substantially channel-shaped in cross section, strips secured to the channel exteriorly of the latter and having portions opposite the flanges of the channel cooperating with said flanges to form grooves for the reception and retention of fastener elements, and the base portion of the channel being bendable on a line extending longitudinally of the channel between the flanges thereof to locate the free edges of the flanges adjacent each other to form a box section with the grooves aforesaid on adjacent sides of the section. 10 15

8. A metallic structural element comprising a member substantially channel-shaped in cross section, angle strips secured to the channel on opposite sides thereof with one flange of each strip extending outwardly from the channel in the plane of the base to form extensions of the latter and with the other flanges of the strip cooperating with the flanges of the channel to form grooves for the reception and retention of fastener elements, and the base portion of the channel being bendable on a line extending longitudinally of the channel between the flanges thereof to locate the grooves at an angle to each other. 20 25

30 9. A metallic structural element comprising a member substantially channel-shaped in cross section and having the base portion thereof designedly bendable on a line extending longitudinally of the member between the flanges to

locate the latter at an angle to each other, and strips secured to the member exteriorly thereof and cooperating with portions of the member to form angularly disposed grooves fashioned for the reception and retention of fastener elements. 5

10. A metallic structural element comprising a member substantially channel-shaped in cross section and having the base portion designedly bendable on a line extending longitudinally of the channel between the flanges to locate the free edges of the flanges adjacent each other to form a box section, and strips cooperating with adjacent sides of the box section to form angularly disposed grooves fashioned for the reception and retention of fastener elements. 10 15

11. A metallic structural element comprising a member having integrally connected angularly disposed portions and having flanges at the free ends of said portions extending at an angle to the latter, and strips secured to the member and having portions cooperating with the flanges to form grooves fashioned for the reception and retention of fastener elements. 20

12. A metallic structural element comprising a member having angularly disposed portions and having flanges at the free edges of said portions extending at an angle to the portions, and strips having portions co-extensive with the angularly disposed portions aforesaid and having other portions cooperating with the flanges to form grooves fashioned for the reception and retention of fastener elements. 25 30

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