

Oct. 29, 1963

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CONSTRUCTION MEMBERS AND METHODS OF FORMING SAME

Filed Aug. 3, 1959

4 Sheets-Sheet 1

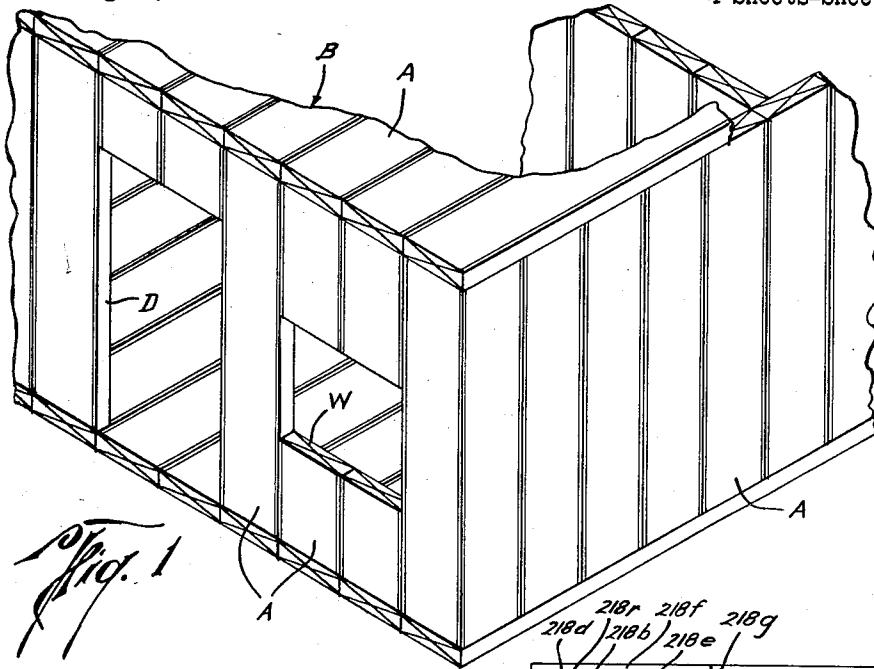


Fig. 1

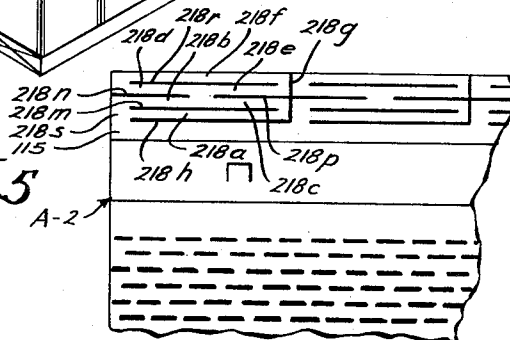


Fig. 5

Fig. 6

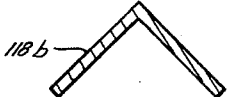
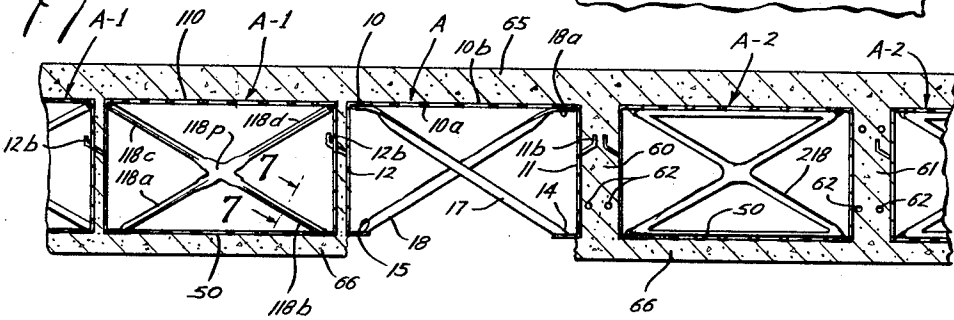


Fig. 7

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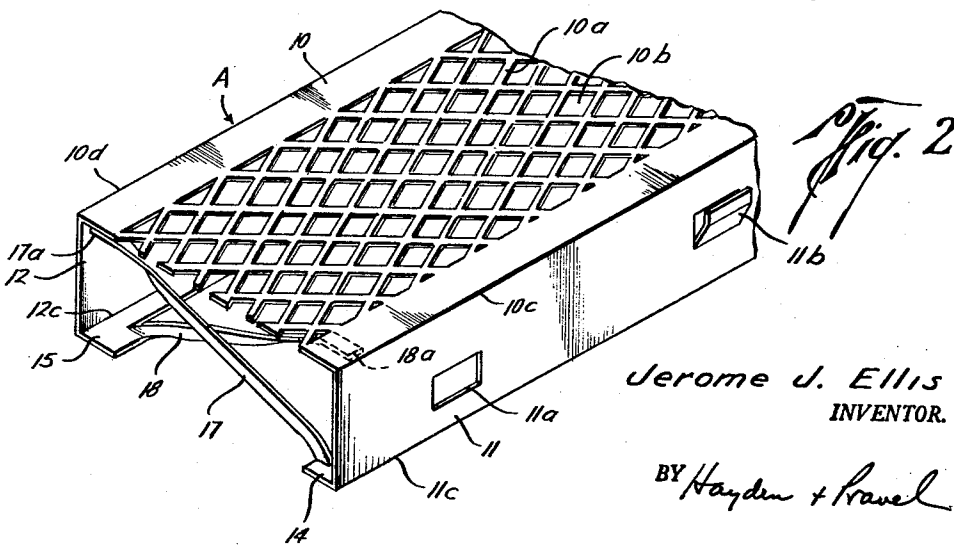
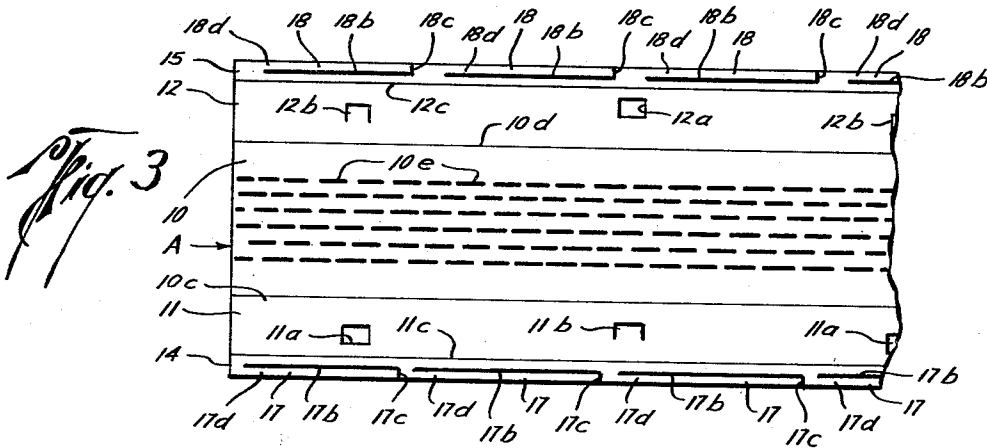
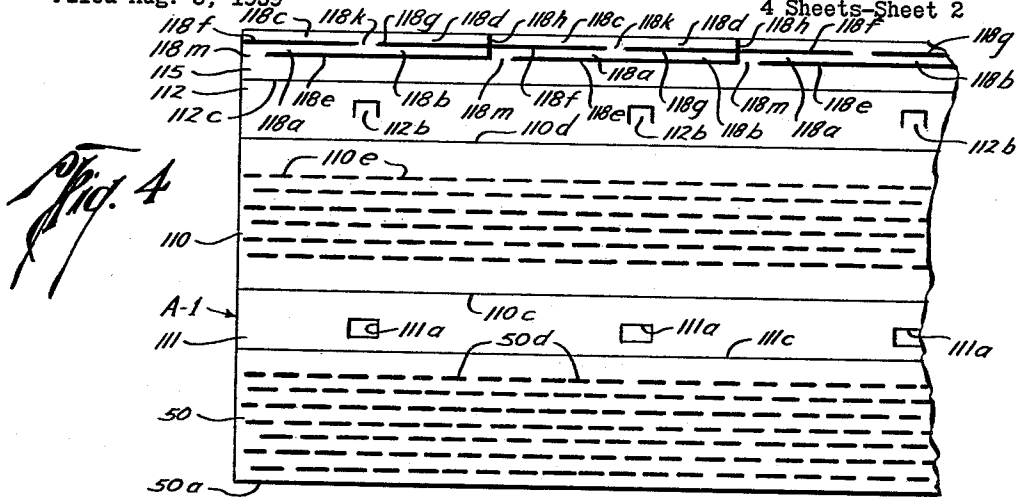
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CONSTRUCTION MEMBERS AND METHODS OF FORMING SAME

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4 Sheets-Sheet 2



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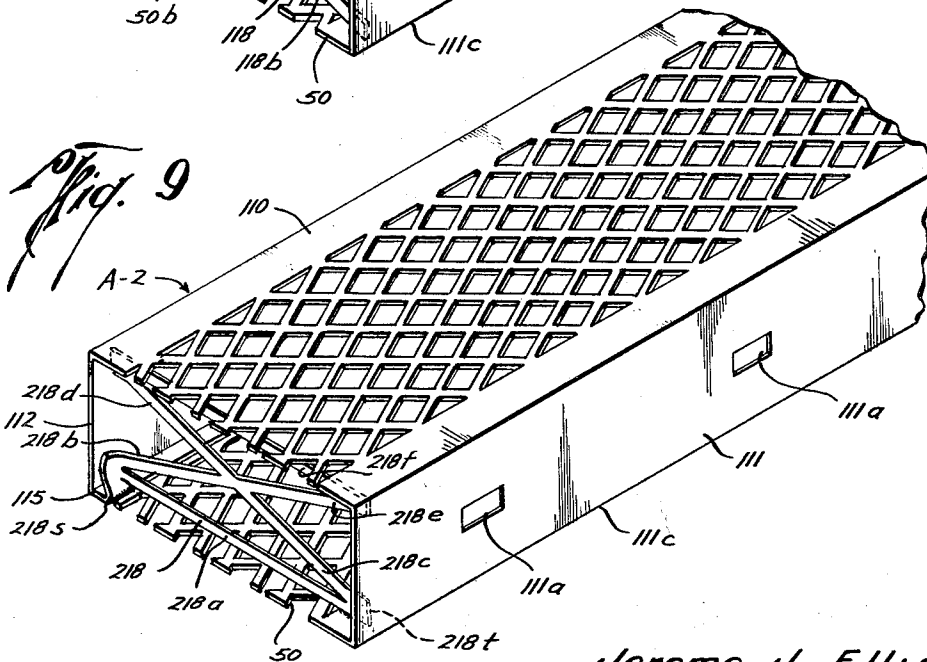
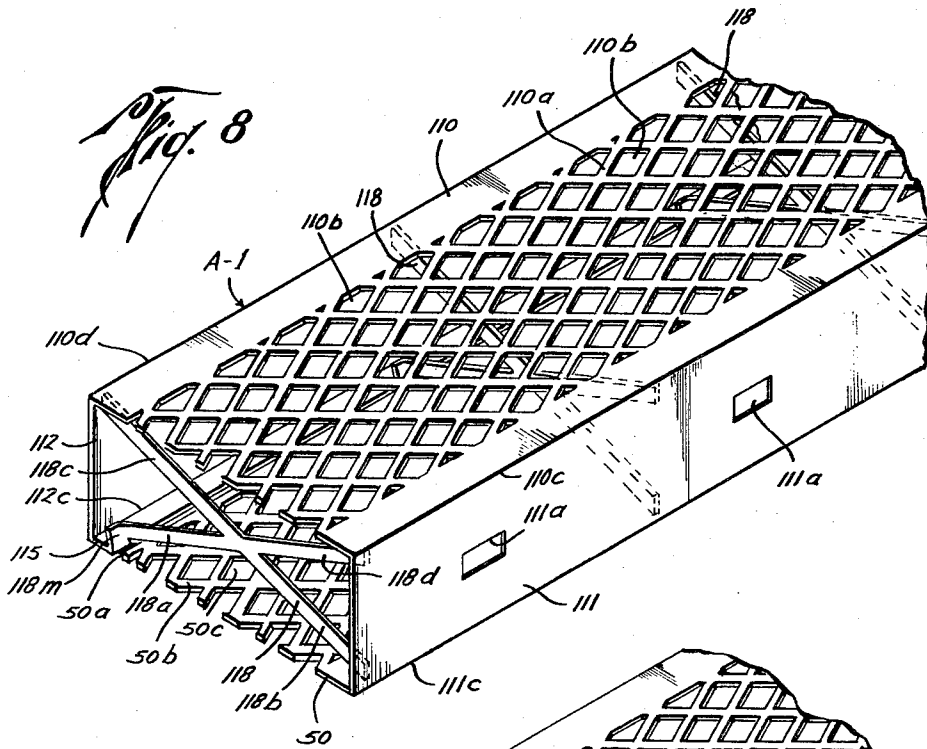
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CONSTRUCTION MEMBERS AND METHODS OF FORMING SAME

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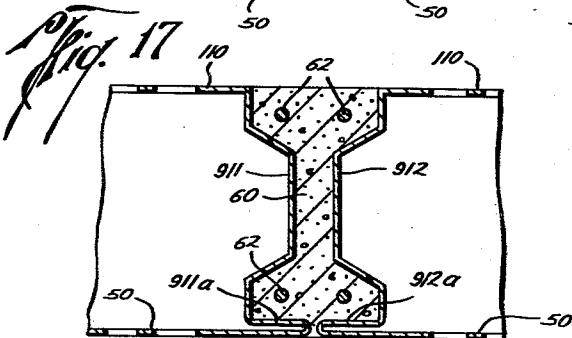
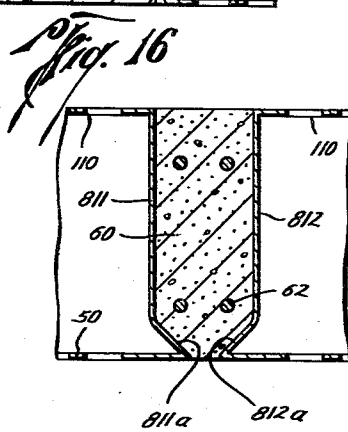
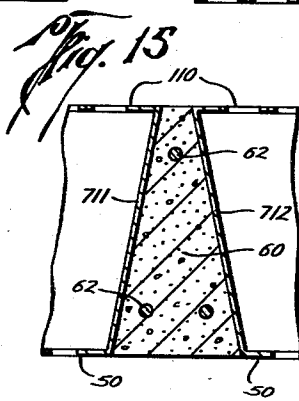
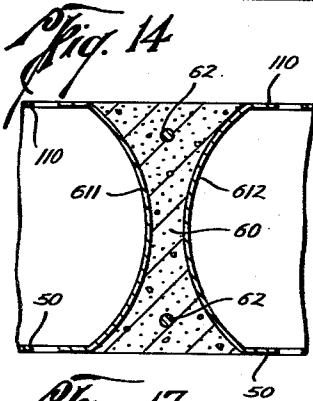
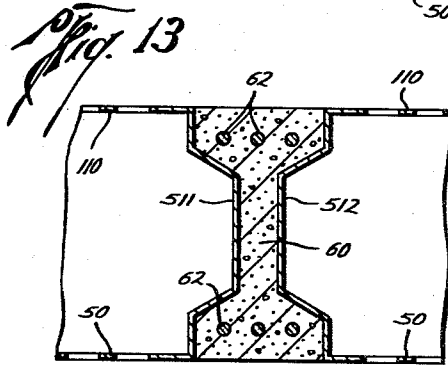
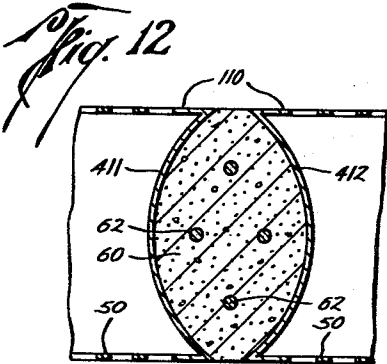
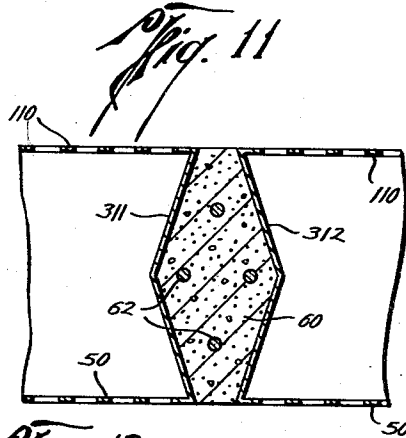
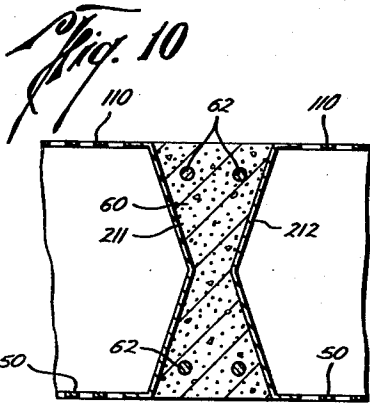
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4 Sheets-Sheet 4



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CONSTRUCTION MEMBERS AND METHODS OF FORMING SAME

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2 Claims. (Cl. 50-439)

This invention relates to construction members and methods of forming same.

Although many efforts have been made in the past to develop various types of prefabricated building components, most, if not all, of the efforts have been directed towards the manufacture of wall sections and other relatively large components, each of which requires a different pattern and different manufacturing procedures.

It is an object of this invention to provide a new and improved construction member which is capable of being used as a prefabricated building component and each of which may be made from the same pattern and with the same manufacturing procedures.

An important object of this invention is to provide a new and improved construction member, a plurality of which can be used to form a roof, a wall, a floor or any similar portion of a house or building.

Another object of this invention is to provide a new and improved construction element and method of forming same wherein the element is made from a single sheet of steel or other material, which is structurally strong enough for use as a building component, and which is also capable of having a plaster, concrete or similar surfacing material applied thereto to form a homogeneous surface on at least one exposed surface of the element.

A particular object of this invention is to provide a new and improved prefabricated element and method of forming same wherein each element is formed in a channel shape from a single sheet and also is provided with internal bracing from the same sheet whereby relatively inexpensive mass production of the element may be obtained.

A specific object of this invention is to provide a new and improved construction element and method of forming same wherein each construction element has connection means therewith for connecting to an adjacent construction element so that a plurality of such elements may be connected together rapidly and easily to form a wall or similar structure.

Still another object of this invention is to provide a new and improved construction member which is fireproof and which is adapted to receive concrete, plaster or similar fireproof material thereon to thereby provide a building component which is fireproof throughout.

A further object of this invention is to provide a new and improved method of making construction members wherein each member is formed from a single sheet of material by slitting or punching same and by thereafter bending same to form the parts of the member and to position same for welding or otherwise connecting same together into a unitary structure whereby an efficient, rapid and economical method is provided for forming each construction member.

The preferred embodiment of this invention will be described hereinafter, together with other features thereof, and additional objects will become evident from such description.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

FIG. 1 is an isometric view showing a portion of a building structure incorporating therein the construction elements or members of this invention;

2

FIG. 2 is an isometric view of a fragmentary portion of one embodiment of the construction member or element of this invention;

FIG. 3 is a plan view of the single sheet of material from which the element of FIG. 2 is formed, showing such sheet of material after it has been slit but prior to the bending or forming thereof;

FIG. 4 is a plan view of a single sheet of material which has been slit to form the modified construction element of this invention shown in FIG. 8;

FIG. 5 is a plan view of a fragmentary portion of a single sheet of material which has been slit to form another modified form of this invention which is shown in the completed form in FIG. 9;

FIG. 6 is an end view illustrating end sectional views partly in elevation, of each of the three illustrated embodiments of the construction element or member of this invention;

FIG. 7 is a cross-sectional view taken on line 7-7 of FIG. 6 to show the angular construction of the brace portions in one form of the invention;

FIG. 8 is an isometric view of a modified construction element;

FIG. 9 is an isometric view of another modified construction element; and

FIGS. 10-17 are end views in section illustrating modified portions of the sides of adjacent construction members.

In the drawings, the letter A designates generally the preferred construction of the construction member or element of this invention (FIG. 2). As will be explained in detail, each construction member or element A of this invention is adapted to be manufactured from a single sheet of metal or other material, preferably steel, so that each of such members or elements may be prefabricated rapidly and economically. The construction member or element of this invention is so made that it can be connected with other construction members or elements to form a wall, roof, floor, or any similar building section, an illustration of which is shown schematically for a portion of a building B in FIG. 1 of the drawings. As shown in FIG. 1, a plurality of the construction members or elements A are connected together for forming a floor, while others are connected together to form the walls with a window W and a door D shown therein. A flat roof or ceiling is also shown as formed of a plurality of such construction members or elements A. It will also be understood that the roof may be sloped or inclined to form a gable construction (not shown).

Considering the invention in detail, the construction member or element A includes a face section 10 which may be formed as expanded metal with the ribs 10a and the openings 10b therethrough, or in some instances, the face section 10 may be formed with punched openings (not shown) but corresponding to the openings 10b, or even without any openings or expansion of the face section 10. Side sections 11 and 12 depend or extend from the longitudinal edges or corners 10c and 10d of the face section 10. Preferably, the side sections 11 and 12 extend at right angles to the face section 10 to form a channel therewith. Since the construction member or element A of this invention is made from a single sheet of material, the side sections 11 and 12 are integral with the face section 10.

Inner strips 14 and 15 extend from the side sections 11 and 12, respectively. The strips 14 and 15 are integral with the side sections 11 and 12, respectively, and are bent at right angles to such side sections 11 and 12, respectively. The strip 14 has a plurality of braces 17 which are formed integrally therewith and which extend from the strip 14 diagonally upwardly towards the corner or inner section between the face section 10 and the side section

12. The free end 17a of each brace 17 is welded or is otherwise secured to the under or inner side of the face section 10 adjacent to the side section 12 as shown in the FIG. 2. Similarly, a plurality of braces 18 are formed integrally with the strip 15 and extend upwardly therefrom diagonally to engage the under or inner surface of the face section 10 with the free end 18a thereof adjacent to the inner section or corner 10c between the face section 10 and the side section 11. The free end 18a is welded or is otherwise secured to the face section 10. The braces 17 and 18 are formed so as to be longitudinally spaced in pairs throughout the length of the construction member or element A. The braces 17 and 18 in each pair intersect or cross each other at about the mid point of each of such braces as is more fully shown in FIGS. 2 and 6. Such braces 17 and 18 may be welded at their mid points where they cross each other to further rigidify the structure.

To connect a plurality of the construction members or elements A of this invention together in order to form a wall section or similar building section, each construction member or element A is preferably formed with a connection means on the side sections 11 and 12. One form of connection means is illustrated in the form of the invention shown in FIG. 2 wherein each of the side sections 11 and 12 has alternating openings 11a and tabs or connecting brackets 11b formed therewith. The brackets 11b are adapted to extend into openings in the side section of the construction member or element A which is positioned adjacent thereto. It is to be noted that the openings 11a are below the brackets 11b so that the upper end of the brackets 11b may extend above the upper edge of the opening 11a into which it is positioned, thereby preventing lateral movement between the adjacent construction members so connected. It is also within the scope of this invention to provide the connection means so that only the openings 11a are provided in the side section 11 and the brackets such as 11b are provided in the side section 12 in corresponding positions to the openings 11a. Such arrangement is disclosed in connection with the modification illustrated in FIG. 4, and will be hereinafter described.

In the method of manufacture of the construction member or element A of this invention, a single sheet of material such as illustrated in FIG. 3 of the drawings is first cut to the proper length and width, if necessary, it being understood that the scale for the sheet illustrated in FIG. 3 is smaller than the scale for the finished construction member or element A shown in FIG. 2. Thereafter, alternately spaced slits 10e are cut in the area of the sheet which ultimately becomes the face section 10 and which is defined by the edges or corners 10d and 10c. The corners 10c and 10d may be scored or grooved on the under surface of the sheet shown in FIG. 3 to facilitate the bending of the sheet at such longitudinal lines, but the bending may be accomplished without any scoring or grooving of the sheet. The side sections 11 and 12 extend from the face section 10 as shown in FIG. 3. Also, the strips 14 and 15 extend from the side sections 11 and 12, respectively, with the corners 11c and 12c being shown in FIG. 3 as a longitudinal line which may be scored or grooved on the underside of the sheet if desired. The braces 17 and 18 are formed by slitting or cutting the sheet longitudinally and laterally as indicated at 17b and 17c for each of the braces 17 and at 18b and 18c for each of the braces 18. It is to be noted that the braces 17 and 18 remain integral with the strips 14 and 15, respectively in view of the fact that the inner portions 17d and 18d remain attached to the strips 14 and 15, respectively.

The connection means for the construction member or element A are preferably formed in the sheet of material shown in FIG. 3 by slitting or cutting or punching out openings or windows 11a in the side section 11 and also brackets 11b in the side section 11. Corresponding brackets 12b and openings 12a are provided in the side

section 12 by suitable cuts or punches with respect to such side section 12.

After the sheet of material is slit or cut as explained in connection with FIG. 3, the material is then preferably gripped with a suitable machine for pulling on the side portions 14 and 15 to expand the face section 10 at the slits 10e to form the ribs 10a and the openings 10b (FIG. 2). Such procedure for forming expanded metal is well known, and it will also be understood that the ribs 10a may be displaced out of the same horizontal or lateral plane with respect to each other during such forming operation, and if so, the flat surface such as shown in FIG. 2 may be obtained by the rolling of the sheet to flatten the ribs 10a to the condition shown in FIG. 2. On the other hand, it may be desirable to leave the ribs 10a in the irregular condition wherein the ribs are displaced out of the same horizontal or lateral plane, which will be well understood in the art.

The brackets 11b and 12b are then pushed or are forced away from the rest of the sheet for bending to the angle shown in FIG. 2 for the bracket 11b. The sheet is then folded or bent along the corners or intersections 10c and 10d to position the side sections 11 and 12 at right angles to the face section 10 as shown in FIG. 2. The bottom or inner strips 14 and 15 are then bent along the corners or edges 11c and 12c, respectively, and the braces 17 and 18 are bent away from the bottom strips 14 and 15 and are extended diagonally so that the braces 17 and 18 in each pair cross each other at substantially the mid-points thereof. The free ends 17a and 18a are then welded to the under or inner surface of the face section 10. The complete construction member or element A is thus manufactured. Such construction member or element is ready then to be assembled into a wall section or similar building section such as illustrated in FIG. 1 of the drawings. The adjacent construction members or elements A are connected together with the connection means provided by the brackets 11b and the openings 11a in the side section 11 and the corresponding openings 12a and the brackets 12b on the side section 12. As previously pointed out, all of the openings may be on one of the side sections and all of the brackets may be on the other of the side sections for each of the construction members A, but the manner of connecting such members A together will remain the same. It is conceivable that in some instances, the adjacent construction members or elements A may be welded or may be otherwise secured together. It is also possible in some instances, as will be more fully explained in connection with FIG. 6, that some of the construction members A may be spaced from each other with a concrete or similar material therebetween for providing a strengthening effect.

Although the form of the invention shown in FIG. 2 of the drawings is the preferred form, various modifications thereof may be made within the scope of this invention. For example, in FIG. 4 of the drawings, a sheet of material is shown after it has been slit, cut or punched with the appropriate slit portions for producing the completed construction member or element A-1 shown in FIG. 8. The face section 110 of the construction member A-1 is preferably slitted and is preferably identical with the face section 10 of the construction member A and therefore the alternately spaced or staggered longitudinal slits 110e are provided for forming an expanded metal surface or area in the face section 110 as is more clearly seen in FIG. 8. When the face section is expanded the ribs 110a and the openings 110b are provided as shown in FIG. 8 and which correspond with the ribs 10a and the openings 10b of FIG. 2. Side sections 111 and 112 extend from the face section 110 and they correspond with the side sections 11 and 12, respectively, of the construction member A shown in FIGS. 2 and 3. The side section 111 has a plurality of windows 111a which correspond with the windows 11a of FIGS. 2 and 3, except that there are no corresponding connecting brackets formed in

5

the side section 111. Instead, all of the brackets 112b which correspond with the brackets 11b and 12b are all formed in the side section 112. It is to be noted that the openings 111a are lower than the brackets 112b so that brackets 112b will fit into and will extend above the openings 111a on an adjacent connecting member. The relationship between the openings 111a and 112a for adjacent connecting members A-1 would be the same as the relationship between the openings 11a and the brackets 11b in the construction member A, wherein the openings 11a are shown positioned below the brackets 11b so that they extend up into the adjacent opening on the adjacent connecting member.

The construction member A-1 preferably has an additional bottom section 50 extending from the side section 111 so as to form the bottom portion of the completed construction member or element A-1 shown in FIG. 8. The face section 110 is joined to the side sections at the corners or edges 110c and 110d which correspond with the corners or edges 10c and 10d of the construction member A, and such edges may be scored or grooved if desired. The additional bottom section 50 of FIGS. 4 and 8 is connected with the side section 111 along a longitudinal edge or corner 111c which likewise may be scored or grooved on the under surface of the sheet as shown by the line in FIG. 4. A bottom flange or strip 115 is formed with and extends from the side section 112, the intersection of which forms a longitudinal edge or corner which is designated by the line 112c and which may be scored or grooved if desired. A plurality of unitary braces 118 are formed in an X shape as shown in FIG. 8. Each brace has portions or legs 118a and 118b which initially are formed as a longitudinal strip as best seen in FIG. 4 and are subsequently bent to diagonal positions shown in FIG. 8. Also, each brace 118 includes diagonal portions 118c and 118d and which also are initially formed as a single longitudinal strip as seen in FIG. 4 but which are bent into the diagonal relationship shown in FIG. 8. Each brace 118 is formed by the longitudinal slits 118e, 118f and 118g and by a lateral slit 118h which intersects the longitudinal slits 118e and 118g. It is to be noted that the slits 118f and 118g do not connect so that there is an unslitted portion 118k therebetween. Also, the slit 118e does not extend for the full length of the brace section 118 so as to leave an uncut or unslit portion 118m which provides for the integral connection with the strip 115 for each of the braces 118.

Each of the free ends of the brace 118 is welded or is otherwise secured to the adjacent metal surface of the rest of the structure. For example, the free ends of the brace portions 118c and 118d would be connected to the sides 112 and 111, respectively, or if desired, they may be connected to the under surface of the face section 110. The free end of the brace portion 118b is preferably welded or is otherwise secured to the side section 111 or to the bottom section 50 as desired.

In FIG. 6, an end view of the construction member or element A-1 is shown wherein the brace portions 118a, 118b, 118c and 118d have been bent to form an angle as shown in FIG. 7 for strengthening such brace portions. It is to be noted that the angular bends in the brace portions do not extend to the intersecting central portion 118p.

The method of forming the construction member or element A-1 is identical with that explained previously in connection with the formation of the construction member A except for the additional slitting, cutting and bending which is required to provide the additional bottom section 50 and which is required to form the braces 118 instead of the braces 17 and 18 of the member A. It should also be noted that it is preferable to weld or otherwise secure the free edge 50a to the strip 115. Also, the bottom section 50 is preferably formed as an expanded metal area with the diagonally extending ribs 50b

6

and the diamond-shaped openings 50c which are formed in the usual manner with the alternate slit 50d (FIG. 4) which are stretched laterally with suitable apparatus. In FIGS. 5 and 9 in particular, another modified construction member A-2 is shown. Such construction member A-2 is identical in all respects with the construction member or element A-1 heretofore described, except for the construction of each of the braces 218 which differ in construction from the braces 118 of the member A-1. Therefore, all of the portions and sections of the construction member or element A-2 which are identical with the portions or sections of the construction member or element A-1 bear the same numerals and letters. Referring now to FIGS. 5 and 9 in particular, each of the braces 218 forming a part of the construction member or element A-2 includes a brace portion 218a which extends substantially parallel to and preferably in contact with the bottom section 50 (FIG. 9). Each brace 218 also includes upwardly extending diagonal portions 218b and 218c which are formed from a single longitudinal strip as seen in FIG. 5. Each brace 218 is also formed with downwardly extending diagonal brace portions 218d and 218e which also are formed from a single longitudinal strip as seen in FIG. 5. Each brace 218 also has an upper brace portion 218f which extends parallel to the face section 110 and preferably is in contact therewith as shown in FIG. 9. Each brace 218 is formed by a single lateral cut or slit 218g and by longitudinal cuts or slits 218h, 218m, 218n, 218p and 218r. After the slits have been made, the brace is formed by expanding or stretching the metal forming the brace 218 so as to provide the spaces between the brace portions at the slits or cuts formed therein. Each brace 218 remains connected to the strip 115 at the uncut area 218s. It is to be noted from FIG. 9 that the uncut area 218s is bent upwardly to suitably position the brace 218 so that the free ends thereof engage with the various inner surfaces of the rest of the member A-2. Thus, the free ends of the brace portions 218a and 218c are connected together at the end 218t and they are welded to the side section 111 and they may also be welded to the bottom section 50. The ends of the upper diagonal brace portions 218d and 218e are welded to the side sections 112 and 111, respectively, or they may be secured or welded to the under surface of the face section 110. Also, the brace portions 218a and 218f which extend parallel to the face section 110 and the bottom section 50 may be welded at spaced points to the bottom section 50 and the face section 110, respectively.

From the foregoing description, it is believed evident that the construction member or element A-2 is formed in an identical manner with the construction member or element A-1 except for the braces 218 and such construction has been described above.

In the use of the construction members or elements of this invention in a building such as indicated at B in FIG. 1 or any other type of structure, the construction members may be attached together with the connection means provided by the connecting brackets and openings as heretofore described and as shown in conjunction with the connection between the members A-1 and A in FIG. 6. In other instances, the construction members may be spaced from each other as indicated by the spacing between the construction members A and A-2 in FIG. 6. In such case, concrete such as indicated at 60 and 61 may be positioned between the construction members and suitable reinforcing rods 62 or other internal support may be provided in the concrete so as to provide a unitary wall or building structure. An outer layer of concrete 65 would normally be poured or positioned over the construction members or elements as shown in FIG. 6 when they are used in a floor or base construction. However, such concrete 65 may be placed over the construction members or elements even on vertical wall

structures or roof sections. For example, if the concrete 65 is the outside vertical section on a building, then the inside wall or surface may be formed with a layer of plaster 66 as shown in FIG. 6. It is to be noted that the plaster does not extend to the construction member A because such member does not have a bottom section 50 as is provided with the construction members A-1 and A-2 and therefore it would not be suitable for receiving the plaster layer 66. It should also be pointed out that the construction members may be welded together and may be in abutment at their side sections which are adjacent to each other if desired. It can therefore be appreciated that a fireproof and extremely strong structure can be readily fabricated and constructed into a building or portion of a building with the construction members or elements of this invention.

In FIGS. 10-17, various modifications of the side sections are illustrated to show that it is often desirable, and sometimes advantageous, to provide different shapes for such side sections, particularly where the construction members are spaced apart with a concrete beam formed therebetween. The same numerals are used in FIGS. 10-17 as are used in connection with the member A-2 of FIG. 9, except for the modified side sections, because the construction members shown in FIGS. 10-17 would preferably be otherwise made like the member A-2.

Thus, in FIG. 10, the side sections 211 and 212 are bent outwardly on a longitudinally extending intermediate line. In FIG. 11, the side sections 311 and 312 are bent inwardly as shown. In FIG. 12, the side sections 411 and 412 curve inwardly; such construction would be particularly suitable for use when the construction members extend vertically because the concrete 60 and the reinforcing 62 therebetween provide a column of concrete. FIG. 14 shows a modification wherein the side sections 611 and 612 bow or curve outwardly to provide a minimum amount of concrete 60 therebetween. FIGS. 13 and 17 are similar and are bent so that the concrete therebetween has the shape of an I beam which provides extra strength. In FIG. 13, the side sections 511 and 512 are the same as the side sections 911 and 912, except that the sections 911 and 912 have bends 911a and 912a at the bottoms thereof to provide a means to limit the flow of concrete during the pouring thereof whereby a separate form for the concrete 60 during the pouring thereof is eliminated.

In FIG. 15, the sides 711 and 712 are straight but they are inclined rather than being at right angles to the face sections 110 and bottom sections 50 as in FIG. 9. FIG. 16 shows a modification wherein side sections 811 and 812 are formed with outwardly extending bends 811a and 812a which perform the same purpose as the bends 911a and 912a.

It is to be noted that each of the construction members shown in FIGS. 10-17 may be made with the bracing of the member A, A-1 or A-2, and that the method of manufacturing would be basically the same except for the additional bending involved. Normally the connection means on the construction members would not be included with the members shown in FIGS. 10-17 since they would usually be spaced from each other as shown with the concrete 60 and the reinforcing rods 62 therebetween. It is also to be understood that the construction members in the various forms may be used in a horizontal, vertical, inclined or other position depending upon the portion of the building being formed.

Although the construction members or elements A of this invention are formed of a single sheet of material in the form of the invention described herein, in some instances, it is possible to form some of the sections or portions separately and then weld them or otherwise secure them together to form the unitary final construction member or element.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A construction member comprising, a single sheet of material having a longitudinally extending face section, a longitudinally extending side section depending laterally downwardly from each edge of said face section and formed integrally therewith, a lower portion of each of said side sections extending inwardly at an angle thereto forming a flange, a brace being struck up from each of said lower portions at the longitudinal edge of said sheet of material, and each brace having a portion in proximity to its lower portion extending substantially perpendicular thereto and with the continuation of each brace extending diagonally upwardly from its lower portion and having its free end connected to said sheet in proximity to the side section opposite from the side section having the brace formed therewith, and said braces crossing each other at an intermediate portion of each brace, said braces forming a pair, said construction member having a plurality of said pairs longitudinally spaced therealong.

2. A construction member comprising, a single sheet of material having a longitudinally extending face section, a longitudinally extending side section depending laterally downwardly from each edge of said face section and formed integrally therewith, a lower flange connected to one of said side sections, a brace being struck up from said flange at the longitudinal edge of said sheet of material and having an X-shape with one end thereof formed integrally with said flange and having a portion in proximity to said lower flange extending substantially perpendicular to said flange, two of the free ends of said brace being connected to said sheet in proximity to the side section opposite from that having said brace formed therewith, and the third free end being connected to said sheet in proximity to the side section having said brace integrally formed therewith but above said lower flange.

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