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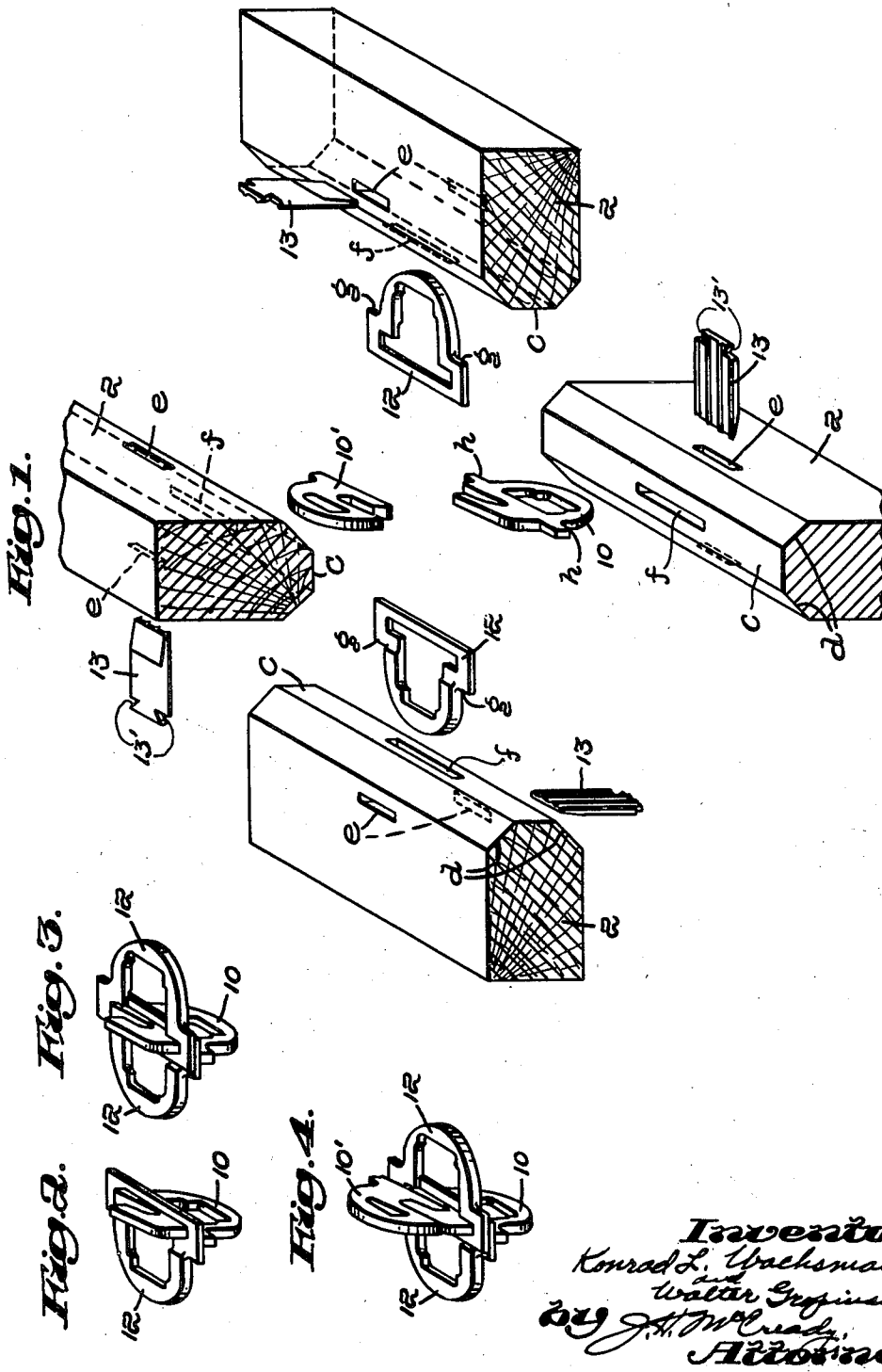
K. L. WACHSMANN ET AL

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BUILDING STRUCTURE

Filed Aug. 10, 1945

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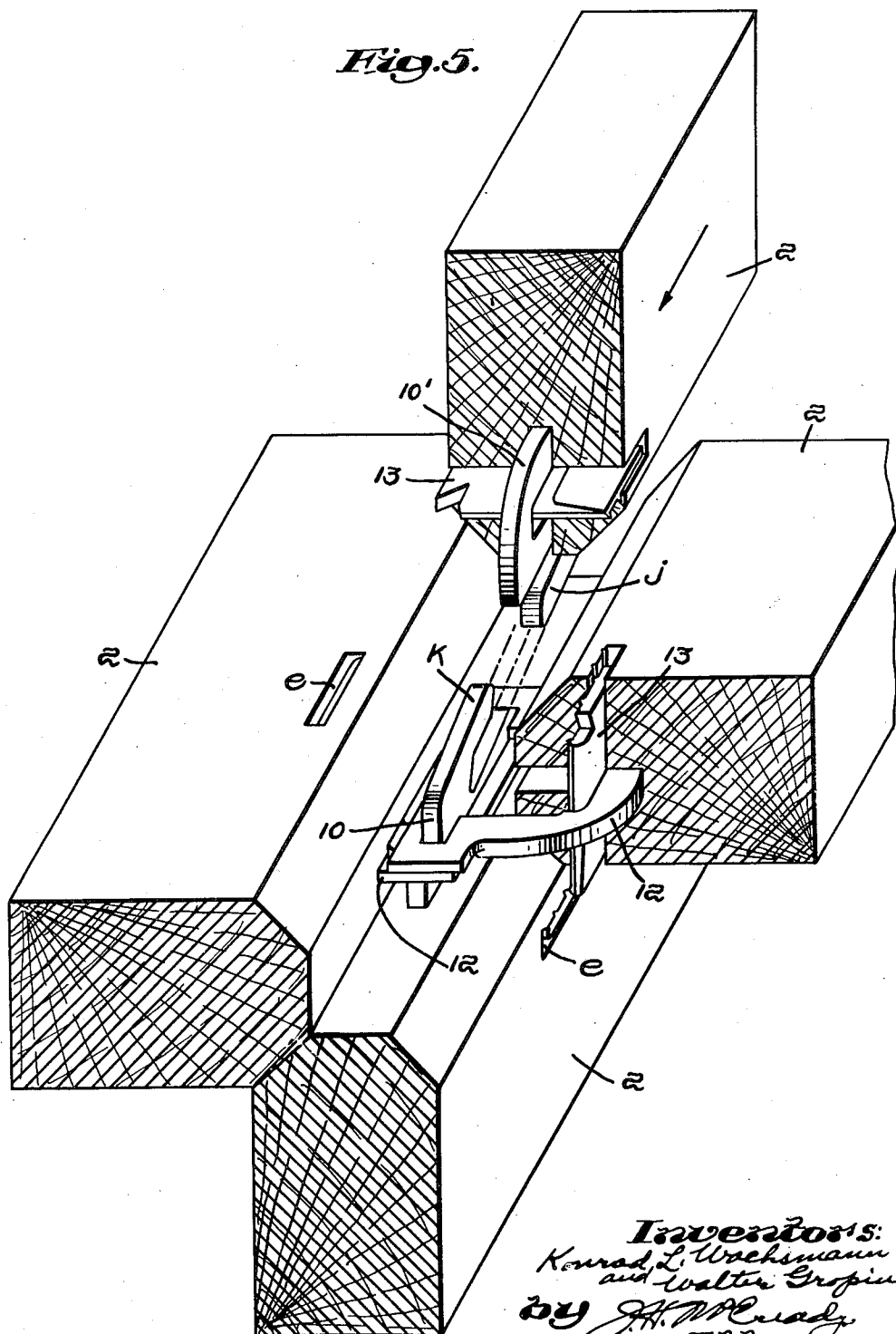


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Fig.5.



Inventors:
Konrad L. Wachsmann
and Walter Gropius,
by J. H. McCready,
Attorney.

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K. L. WACHSMANN ET AL

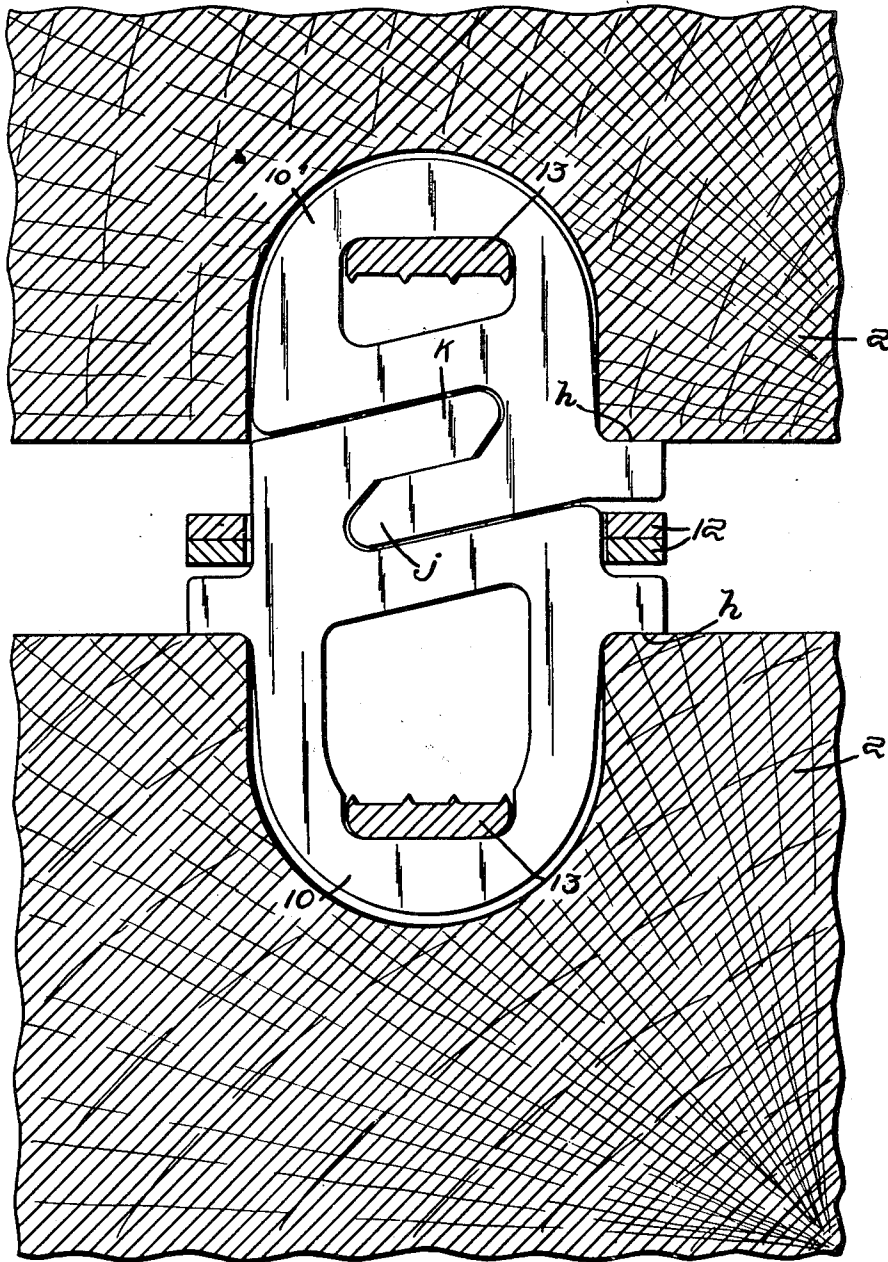
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Fig. 6.



Inventors:
Konrad L. Wachsmann
and Walter Grojnow,
by J. H. Mearns,
Attorney.

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K. L. WACHSMANN ET AL

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Fig. 7.

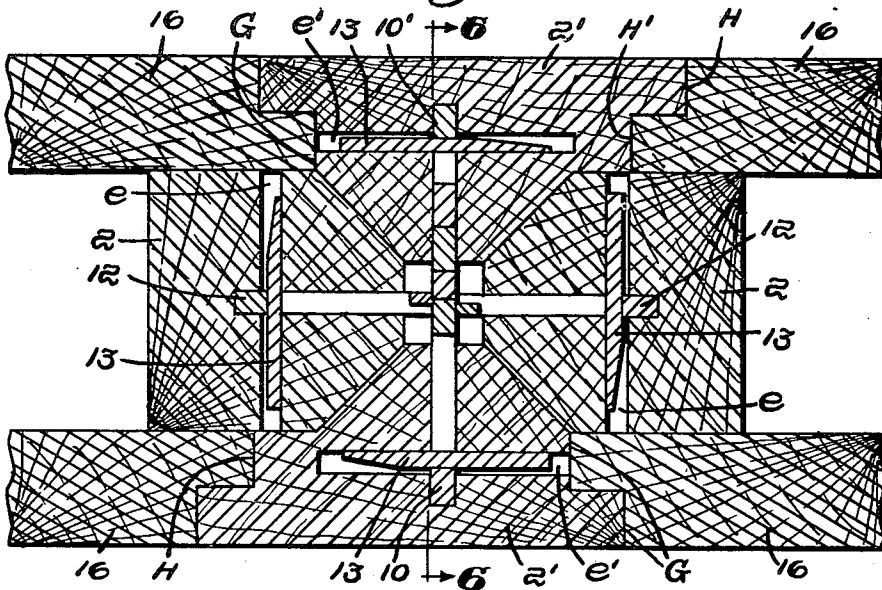
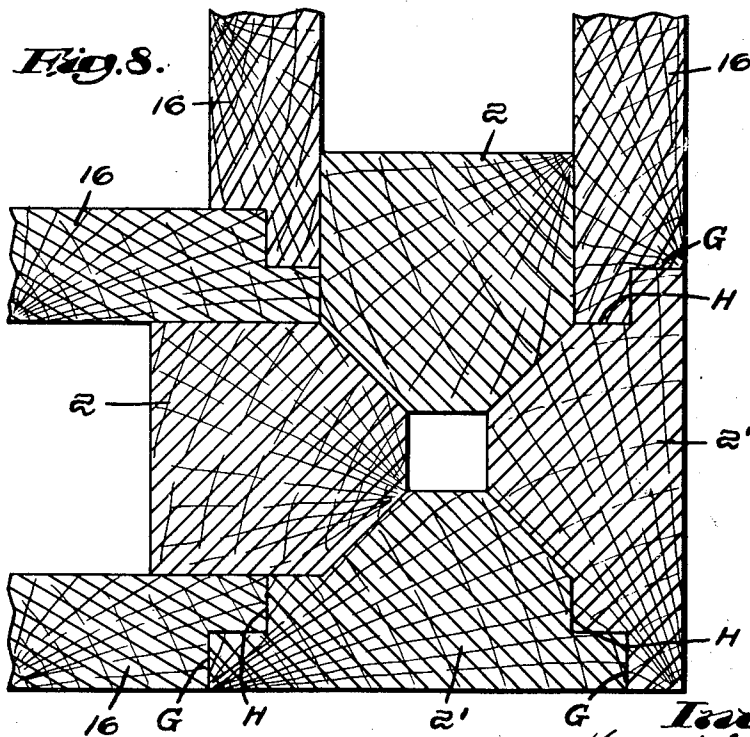


Fig. 8.



Inventors
Konrad L. Wachsmann
and Walter Gropius,
by *J. A. McQuady,*
Attorney.

UNITED STATES PATENT OFFICE

2,421,305

BUILDING STRUCTURE

Konrad L. Wachsmann, New York, N. Y., and
Walter Gropius, Lincoln, Mass., assignors to
General Panel Corporation, New York, N. Y.,
a corporation of New York

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10 Claims. (Cl. 20-4)

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This invention relates to buildings intended for various purposes, such as dwellings, camps, barracks, and others.

In Patent No. 2,355,192, granted August 8, 1944, to us, a building is disclosed which is composed of prefabricated units which are releasably secured together substantially throughout the structure by wedge connectors of a novel form. That invention represents an important advancement in the art of prefabricated buildings, and the present invention aims both to develop and perfect the invention disclosed in said patent and also to devise other means for performing, even more effectively, certain functions of elements of the building there disclosed.

Stated more specifically, this invention aims to improve the wedge connectors used in said building in such a manner that all of these connector elements can be installed in the panels, or other building units, at the factory, thus simplifying the assembling operation at the site of the building and reducing the labor of assembly.

In the building shown in the patent, matched siding was used because of the manner in which the final sealing strips which concealed the lines of wedges were installed. This made it possible to remove that sealing strip easily, after which certain wedges essential to the integrity of the building could also be removed, and the building thus dismantled. While this feature has its advantages, particularly when the buildings were to be used for mobile operations as, for example, to house construction crews, or other forces shifting rapidly from place to place, it nevertheless is a distinct disadvantage in buildings intended for more permanent housing. It is one of the objects of this invention, therefore, to devise a construction in which this difficulty will be avoided.

The matched siding with its seams or grooves also is objectionable in buildings of some types where smooth walls are much preferred, and it is also an object of this invention to devise a construction in which either type of siding can be employed, as desired. In some cases, also, parts of the junction of adjoining panels, unless very carefully made, permitted considerable leakage of air, and the present invention aims to overcome this difficulty.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is an exploded view of the more essential

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parts of a building joint constructed in accordance with this invention;

Figs. 2, 3 and 4 are perspective views showing successive steps in a typical method of assembling the elements of the joint structure;

Fig. 5 is a perspective view, with some parts in section, in order better to illustrate the construction and showing the final step in the assembly of the four building members which are united at any joint by a wedge connector embodying this invention;

Fig. 6 is a sectional view immediately beside the connector of a joint structure embodying this invention;

Fig. 7 is a horizontal, sectional view through a building wall at the junction of two sections; and

Fig. 8 is a view similar to Fig. 7 but taken at a point above or below the wedge connector.

As above indicated, this invention preferably makes use of the standard frame units or building units disclosed in the patent above designated, and reference may be made to that patent for a better description of the details of construction of those units. In the accompanying drawings the side pieces 2 are shown as made substantially in accordance with the construction illustrated in the patent, each side piece and each end piece being assumed to be made of joist of 2 x 4, 2 x 3, or some other convenient dimension. Each of these edge pieces has a flat edge face *c*, Fig. 1, flanked by two bevelled faces *d-d'*, and this is true whether these are side or end pieces. These bevelled faces make an angle of 90° with each other and form angles of 45° with the edge faces *c*. Four of these edge members are connected at any building joint as shown, for example, in Figs. 7 and 8, but at some of these joints a frame section or a wall or floor panel will be replaced by a filler strip, such as those shown in Figs. 7 and 8 at 2'. This is also true in the construction shown in the patent, but the filler strips provided by this invention are different from those illustrated in the patent.

The wedge connector provided by this invention also is different from that shown in the patent, although in its general organization it is similar to the latter. It comprises a two-part connector consisting of plate-like elements 10 and 10', Fig. 1, and two cross pieces 12-12 which, when the joint has been completed, are associated with the cross pieces in the manner illustrated in Fig. 4. As above stated, at each building joint four of these joists or edge pieces 2 are secured together by one or more wedge connectors. For this purpose each of the four pieces 2 is slotted at inter-

vals, as shown at *e*, and each slot *e* is intersected by another slot or mortise *f* cut into it from the edge face *c*. This is like the construction of the patent, and for convenience the reference characters used in the patent will be used in this application, so far as possible, to designate corresponding parts.

In assembling the parts the shank portions of the two cross pieces 12—12 are inserted in the edge slots *f*—*f* of two opposing joists 2—2 which are to be connected together. One of these cross pieces is reversed with reference to the other because their longer, straight-edged, slotted portions are designed to be overlapped, one upon the other, as shown in Figs. 3 and 4, but this overlap is intended to be only of approximately the same total thickness, when the slots are registered with each other, as that of the shank portions of the cross pieces. The round edged shank portions of these parts 12—12 also are slotted, and after they are inserted in the joists 2—2, wedges like those shown at 13, are driven through the slots 3—3 and through the slots in the cross pieces where the wedges anchor said cross pieces securely to the respective joists. The shoulders *g*—*g*, Fig. 1, formed at the offset in each cross piece abut against the edge surfaces *c* at the ends of the slots *f* and limit the rearward movement of the cross pieces into the respective joists.

The two parts 10 and 10' of the connector are similarly secured in their respective joists 2—2 by wedges 13, and these parts have shoulders *h* to engage the edge surfaces *c* and limit their movement rearwardly into the joists. These shoulders are best shown in Fig. 6. Preferably the wedges 13 are grooved on the faces opposite to those which engage the wedge connector elements so as to bite into the wood and get a better hold. All of these parts can be secured to their respective joists at the factory where these operations and the driving of the wedges can be performed most efficiently.

Similar joint elements are likewise secured at points spaced apart by equal distances along the perimeter of each building unit, as shown in Fig. 9, and as explained more fully in the above-mentioned patent. In the construction shown in this application, however, all of this work of securing the wedge connector members to the building units is performed at the factory.

When four of these building members are to be united in assembling any building embodying this invention, three of these edge members 2 are first brought together in essentially the manner shown in Fig. 5, the cross-pieces 12—12 of two of these members being overlapped, one upon the other, and placed upon the connector member 10, as there shown, said member extending through the overlapped sections of the openings of the two members 12—12. These steps are illustrated in Figs. 2, 3 and 4, the building units being so manipulated that, at each joint, one of the parts 12 is first placed over its corresponding connector element 10, as shown in Fig. 2, after which the third section is similarly disposed with its cross-piece 12 overlapped upon the first cross-piece and both releasably interlocked with the member 10 by the engagement of walls of the overlapped openings in said cross pieces with opposite sides of said member 10. The final step of interlocking the member 10' with the part 10 remains to be performed. For this purpose the edge of the fourth member 2, in which the connector piece 10' is secured, is placed sub-

stantially in the groove formed by the edge faces of the other three joists 2 and it is slid in the direction indicated by the arrow in Fig. 5 until the hook *j* of the part 10' is engaged firmly under the corresponding hook *k* of the connector piece 10. Assuming that these parts 2 are side members of a standard building section, there will be three of these wedge connectors and, consequently, three of these hooks *j*, to be operatively associated simultaneously with their respective hooks *k*. However, the bevelled edges of the two side pieces in which the cross members 12 are secured are already so associated with the third member carrying the connector elements 10, that they serve to guide the fourth joist 2 with its three hooks *j* into wedging relationship with those of the parts 10. It will readily be seen from an inspection of Fig. 6 that the hooks *j* and *k* have meeting surfaces so inclined with reference to the direction of relative movement of these members and to the common axis of said members, that a very firm wedging connection of them is produced. And this movement not only interlocks the parts 10 and 10' of the connectors with each other, but it also operates through them to draw the edge members 2 in which they are secured together until any further such movement is prevented by the wedging engagement of the bevelled surfaces of all four pieces with each other. This will be clear from an inspection of Fig. 7.

In this connection it may be noted that the two parts 2—2 in which the cross pieces 12—12 are located are not pulled toward each other by the action just described, but they are prevented by the interlocking of the cross pieces with the connector 10 from moving away from each other. However, the sliding engagement of the meeting planar surfaces of the two hooks *j* and *j'* at each joint does positively draw both connector elements 10 and 10' toward each other laterally, and at the same time draws the two joists 2—2, to which they are anchored, inwardly toward the common central axis in which the planes of the bevelled surfaces *d*—*d* of all four joists intersect and from which all four parts of the wedge connector joint radiate. Ample clearance is provided at the center of the assembly so that this relative inward radial movement is limited only by the meeting of the bevelled surfaces *d* into mutual wedging abutment with each other. At this time, however, the four edge pieces 2 will be in the desired relationship to each other.

The various wall, floor, ceiling, door, window, roof, and other sections of the building, may be secured together in the same manner, and buildings having essentially the same characteristics as those described in the patent above mentioned may be fabricated with this novel joint structure while securing the advantage of economy, because of the greater amount of assembling which can be performed in the factory, and the correspondingly reduced amount of time and labor involved in assembling at the site of the building. The erection of buildings such, for example, as those shown in our patent above mentioned, can be performed in essentially the same manner as described and illustrated in said patent, the only differences being those occasioned by the fact that the parts are delivered to the building site ready for immediate connection to each other, and the further fact that the final step in completing any union of one building section with another is performed

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by sliding a filler strip, or the other fourth section, into place in a direction to interlock the hooks *f* with their respective cooperating members *k*.

While, as above stated, four of these building elements *2* are connected directly together at each building joint, the nature of the parts associated with these joists *2* necessarily will vary with the character of the standard sections united at any individual joint.

Fig. 7, for example, shows a typical construction in a building wall, ceiling, floor, or roof. The two lateral sections there shown are covered with siding or lining members *16* and the other two sections *2'—2'* are filler pieces or filler strips. One of the objects of this invention is to produce a junction of the sections so tight that these joints will be substantially weather-tight and no objectionable air leakage will occur through them. For this purpose a substantial departure from the construction shown in the patent above referred to has been made. Considerable of this air leakage occurred through the slots *e* in the constructions there shown because the ends of these slots were not tightly sealed. In the arrangement shown in Fig. 7, however, the filler strips *2'* are provided with slots *e'—e'* which are closed at one end, the other end being left open for the driving of the wedges *13—13*, but each piece *2'* is extended laterally in opposite directions from the body part thereof and is provided with a stepped edge, one of these edges being shown at *G* and the other at *H* at the top of Fig. 7. The adjoining edges of the parts *16—16* have complementary steps fitted tightly against the edges *G* and *H* so that weather-tight joints are provided at these areas. In addition, the inner extension of the edge *G*, Fig. 7, seals all of the wedge slots *e'* which otherwise would be left open at the filler strip *2'* shown at the upper part of Fig. 7. At the opposite edge of the upper filler strip *2'* the slot *e* of the right-hand edge piece *2* is sealed by the extending portion *H'* of the filler piece, and the stepped edge *8* abutting against the complementary edge surface of the part *16* produces a joint through which any substantial air leakage is prevented.

At the bottom of Fig. 7 the same construction is provided with the same result. Here the edge *G* of the filler piece *2'* seals the open end of the wedge slot *e'*, while the opposite stepped edge *H'* cooperates with the siding piece *16* in the same manner as do like members shown at the upper part of Fig. 7. The extension *H'* of the lower filler piece also seals the end of the slot *e* in the part *2* immediately above it which otherwise would be open.

Such sealing of the parts against air leakage in this simple manner is made possible by the fact that the two edge sections of each filler strip *2'* are not symmetrical with respect to the longitudinal median plane of this member, one side, including the part *H'*, being extended laterally considerably more than the other.

This asymmetrical relationship of the filler pieces is of further advantage in making a corner construction on a building, as will be evident from an inspection of Fig. 8. There the outer exposed corner consists simply of two filler pieces but they are joined to each other and to the two standard sections in the manner above described. The edges *G* and *H*, however, of the two filler strips cooperate with each other at the extreme corner of the building to make a very tight, weather-resistant junction, while their opposite edges co-

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operate with the standard sections in the manner above described in connection with Fig. 7. This is not only a better construction from the standpoint of air leakage and weather-tightness, but is also stronger mechanically, particularly when the building sections are used horizontally in a wall.

It should be observed that the opposite edges of each wedge *13* are notched, as shown at *13'* in Fig. 1, to give the rearward end portion of the wedge a dove-tail outline which facilitates the gripping of it by a pair of pincers, or similar tool, in order to withdraw the wedge in connection with the operation of dismantling the building, or when it is desired to remove it for any other reason.

In addition to the advantages of this construction above referred to, it also permits the use of either smooth, grooved, or other special siding and lining materials, and the sealing strip which was required in the earlier construction has been eliminated. Thus the disadvantage of using a strip which could readily be removed to expose the wedges and thus permit the possibility of the building being dismantled by an unauthorized person is avoided. At the same time the advantage of being able to dismantle the building, when that becomes necessary or desirable, is retained because this can be done by initially removing the last of the filler strips inserted during erection of the building, and then proceeding to dismantle the other sections in a reverse order to that followed in assembling or erecting the building.

While we have herein shown and described a preferred embodiment of our invention, it will be evident that the invention is not limited to embodiment in the precise form shown.

Having thus described our invention, what we desire to claim as new is:

1. In a building, the combination of four building panels positioned edge to edge about a common axis, each panel having bevelled edges positioned in abutting relationship to the corresponding edges of those panels at opposite sides of it, a joint connecting said panels and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, and two other parts located in opposed relationship to each other, one of the latter parts extending into said openings and engaging walls of said openings which cooperate with said part to limit the movement of the first two parts away from each other, the second pair of said parts having surfaces in wedging relationship, one to the other, the plane of one at least of said wedging surfaces being inclined at an angle to said common axis, and means anchoring each of said panels to a corresponding radiating part of said joint.

2. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface

of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint.

3. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other two parts extending into said openings and having substantially planar mutually engaging surfaces, the planes of which are inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint.

4. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, said openings in the first pair of said parts having walls engaging opposite sides of the part positioned in said openings whereby these three parts cooperate to hold the two building members to which the first mentioned pair of joint parts are connected in fixed spaced relationship to each other.

5. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, said anchoring means including a plurality of wedges.

6. In a building, the combination of four building member positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the

other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, said anchoring means including a plurality of wedges, and slots in said building members and in said joint parts into which said wedges extend when said parts are in assembled position.

7. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, said anchoring means in some at least of said building members including anchoring elements positioned transversely in slots formed in said members with the ends of the slots exposed at the sides of the members.

8. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, said anchoring means in some at least of said building members including anchoring elements positioned transversely in slots formed in said members with ends of the slots exposed at the sides of the members, the said four building members having surfaces in snug overlapping relationship to adjoining surfaces of other building members, thereby closing said open ends of the slots and making substantially weather-tight joints with said other building members behind said bevelled edges.

9. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having substantially planar mutually engaging surfaces, the planes of which

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are inclined at an angle with said common axis, and means anchoring each of said building members to a corresponding radiating part, whereby said second pair of joint parts are operable through the action of said inclined surfaces, one on the other, to draw the building members to which they are connected toward each other, and certain of said joint parts having shoulders adapted to engage said members.

10. In a building, the combination of four building members positioned edge to edge about a common axis, each member having bevelled edges positioned in abutting relationship to the corresponding edges of those members at opposite sides of it, a joint connecting said members and including four parts substantially in radiating relationship with respect to said axis, one pair of said parts which are in oppositely disposed relation overlapping each other and having openings therein which also overlap each other, the other pair of said parts having surfaces wedged, one against the other, one of the latter parts extending into said openings, the wedging surface of at least one of the latter parts being inclined

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at an angle to said common axis, and means anchoring each of said building members to a corresponding radiating part of said joint, the said four building members having stepped surfaces in snug overlapping relationship to adjoining surfaces of other building members at the outer ends of said bevelled edges, thereby making substantially weather-tight joints behind said edges.

KONRAD L. WACHSMANN.
WALTER GROPIUS.

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