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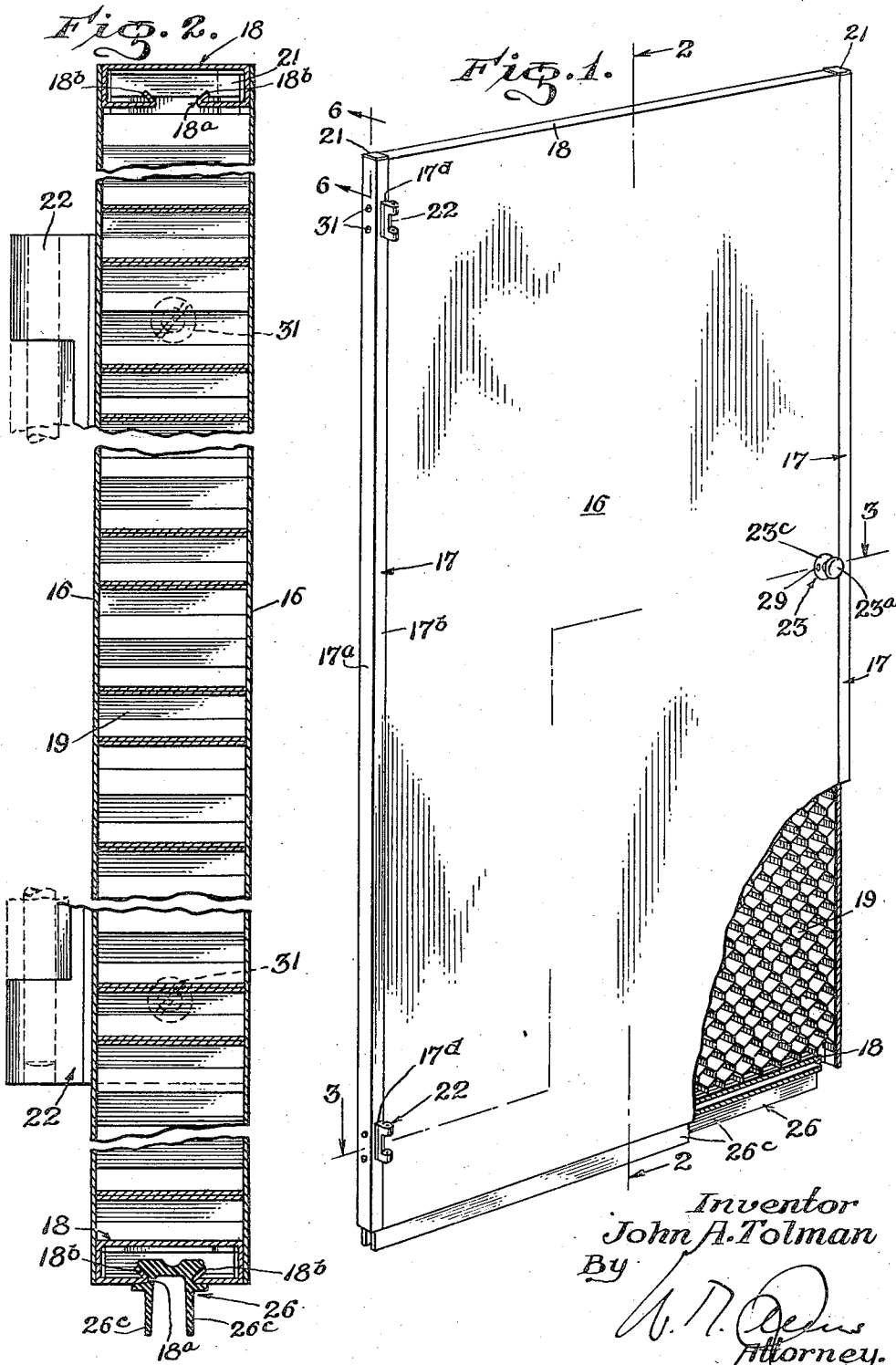
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DOORS

Filed April 30, 1951

2 Sheets-Sheet 1



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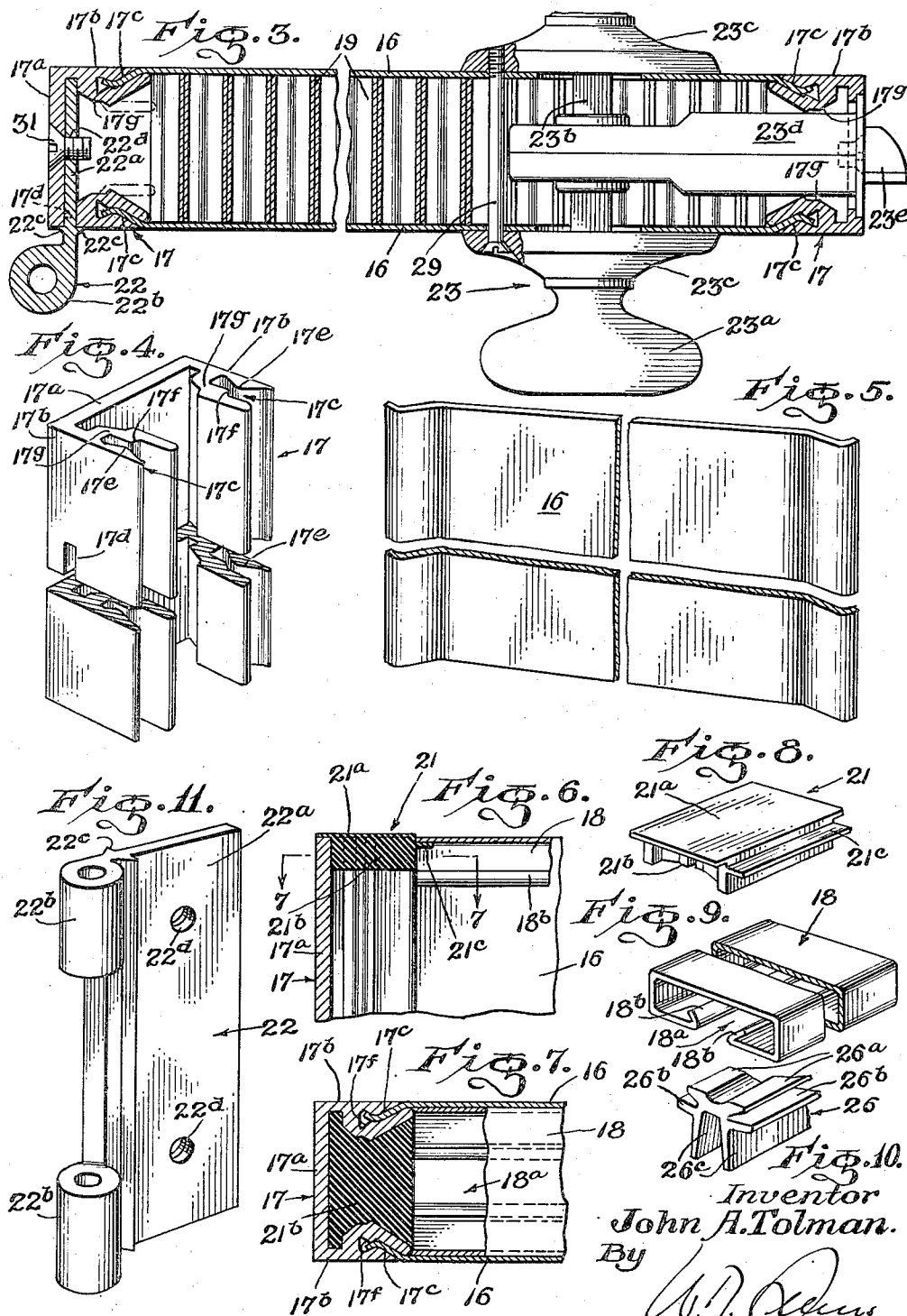
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DOORS

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12 Claims. (Cl. 189—46)

The present invention relates to doors in general and particularly to a new and improved fabricated light-weight metallic door. More specifically the invention comprises a door formed of light-weight sheet metal panels combined with extruded or rolled members and a light-weight core.

The millions of doors in use in buildings and homes are today largely made of wood. This is due primarily to historical reasons and also because doors fabricated from metal have heretofore been too expensive and frequently too heavy to compete with their more common and more readily obtainable wooden counterparts. Fabricated metallic doors have in the past incorporated joints, connections, and interfitting parts requiring relatively close tolerances and assembly operations all of which have increased the cost of production to a point as to render the product non-competitive with the wooden door. The door constructed in accordance with the present invention is free from this objection.

Metallic doors have many advantages and would have been widely accepted if competitively priced. They are not subject to warping and when made of the proper metals properly coated have an indefinite life. The wooden door is affected by atmospheric conditions and tends to warp and to absorb moisture.

With an appreciation of the problems which are present in the field of fabricated metallic building elements and particularly doors, it is an object of the present invention to provide a fabricated door so constructed as to be capable of being produced by mass-production methods at a cost rendering it competitive to wooden doors.

It is another object of the invention to provide an improved fabricated metallic door in which exterior metallic sheet panels are spaced and given rigidity by a light-weight foraminous core, the peripheral edges of the panels being closed by rigid members.

A still further object of the invention is to provide a new and improved fabricated metallic door in which metallic sheet side panels are permanently seated in side stiles and are reinforced and spaced therebetween by a foraminous honeycomb core to which they are adhesively bound.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings to which they relate.

Referring now to the drawings in which a preferred embodiment of the present invention is illustrated and in which the same reference character refers to the same part throughout:

Figure 1 is a view in perspective of a door constructed in accordance with the present invention, with certain parts being broken away;

Figure 2 is a vertical section upon the line 2—2 of Figure 1;

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Figure 3 is a broken horizontal section upon the line 3—3 of Figure 1;

Figure 4 is a view in perspective of one of the stiles with a midsection cut away;

Figure 5 is a view in perspective of a side panel showing its ends as deformed by the swaging action by which it is permanently clamped in the stiles;

Figure 6 is a partial vertical section through a corner of the door upon the line 6—6 of Figure 1;

Figure 7 is a section upon the line 7—7 of Figure 6;

Figure 8 is a view in perspective of a corner seal;

Figure 9 is a broken perspective view of one of the end strips;

Figure 10 is a view in perspective of an end portion of the weather strip; and

Figure 11 is a perspective view of one of the hinges.

Referring again to the drawings, the fabricated door constructed in accordance with the present invention is seen to comprise side panels 16 the vertical edges of which are permanently seated by swaging in stiles 17 and between the ends of which extend rectangular sectioned hollow end strips 18. A foraminous honeycomb core 19 fills the interior space between the panels 16, the gaps at the corners between the stiles 17 and the end strips 18 being closed by end or corner seals 21. The door carries a pair of spaced hinges 22 in one of the stiles 17 and a handle unit 23 is positioned adjacent the opposite edge of the door. The general construction is completed by reference to the weather strip 26 which extends along the bottom of the door being carried by the lower end strip 18.

The panels 16 are preferably made of light-weight sheet metal, such as aluminum, and may be cut from continuous rolls or sheets or may be made to size. The foraminous core 19 which spaces the panels 16 may be a conventional honeycomb-type core of light weight of a type in which a multiplicity of strips of stiff paper are fabricated into a honeycomb construction in which the mutual support provides flat side surfaces capable of withstanding relatively great collapsing pressures. Core 19 is permanently secured to the inner surface of each panel 16 by an adhesive applied to the panel before the parts are brought into contact. The bond between the core and the panels is permanent and is unaffected by changes in temperature and humidity.

The panels 16 extend on all sides beyond the core 19 and along their vertical edges, as viewed in Figure 1, into the bifurcated side walls of connectors or stiles 17. A stile 17 in its original configuration and before being swaged into clamping relationship with the panel edge is illustrated in Figure 4 where it is seen to comprise a back wall or base 17a from which extends at right angles a pair of bifurcated side walls 17b, each of which is formed with a panel-receiving channel 17c. The sides or legs which form the channel 17c are seen to be spaced apart and the stile can well be made as a continuous extrusion cut to length. At spaced points it is provided with slots 17d in one of its sides which open into its interior adjacent the inner surface of its base 17a where it is adapted to receive and seat a hinge plate.

In Figure 3 the stiles 17 are shown swaged into clamping relationship with the edges of the panels 16, each of the inner legs of the channel 17c having been swaged outwardly from the dotted line position to the full line position. It is to be noted that the edges of the panel 16 are reversely curved first inwardly and then outwardly to provide a positive locking relationship. The deformation of the stile leg is permanent and provides a positive clamping action. The effectiveness of this action is rendered more positive by the presence on the outer side of the stile channel 17c, in each instance,

of a convexly curved ridge 17e which functions as an anvil over and around which the extreme edge of the panel is forced and clamped by the ridge 17f on the opposite leg of the channel which functions as a shaping element as it is forced toward and adjacent the ridge 17e.

The shaping element ridge 17f is so positioned and sized that as it moves toward the convex ridge 17e upon the opposite leg of the channel, its own carrying leg pivoting about the narrow section 17g, its travel is first directly toward the crest of the convex ridge 17e and then, as it approaches more closely, down and toward the sloping side of the ridge nearest the stile back wall 17a. The effect of this movement of the ridge 17f is not only to impart the locking curve to the edge of the panel but also to draw it into the stile thereby avoiding the formation of ripples and unevenness where the panel enters the stile. This clamping action between the sides of the channel as the stile is swaged permanently to seat the panel is most important and in the final result the panel extends into the stile without ripples at any point along the line of overlapping and the retention of the panel in the stile is positive and permanent.

The upper and lower ends of the space between the side panels 16 are closed by end strips 18 rectangular in cross section and of a size to fit closely between the spaced interior faces of the side panels 16. The adhesive which binds the panels to the core 19 performs the same function between the panels and the end strips, the adhesive being of a type which is free from variation with temperature and humidity changes. Each end strip is preferably formed of sheet metal shaped, as by rolling, into a rectangularly sectioned tube formed on one side with a channel or slot 18a having diverging sides or lips 18b. As is seen in Figure 2, slot 18a is positioned interiorly of the unit and performs no function along the top of the door. Along the bottom, however, slot 18a forms the seat for the weather strip 26, shown most clearly in Figure 10 in which it is seen to comprise an elongated body which in transverse section comprises spaced upper and lower laterally extending arms or shelves 26a and 26b forming between themselves an acute angle substantially equal to the angle of inclination of the slot sides or lips 18b, and from the bottom of which extends a pair of spaced legs 26c. The weather strip 26 preferably is made of suitable resilient flexible material such as rubber, or a synthetic equivalent, and is adapted to be positioned in the slot 18a by being deformed to enable the upper arms 16a to be inserted whereupon the slot sides 18b are wedged in the acute angle between the strip flanges 26a and 26b in the manner illustrated most clearly in Figure 2. So positioned the weather strip is effectively locked in place against accidental displacement.

The ends of end strips 18 are spaced from the stiles 17 and it is necessary to provide the end or corner seals 21 to seal the interior of each door. An end seal is shown most clearly in Figure 8 and is seen to comprise a flat top surface 21a from the underside of which projects downwardly a body 21b shaped to conform to the interior configuration of the stile when sealing the panels, as illustrated in Figure 3. A laterally projecting shelf or lip 21c, positioned below the upper surface 21a by a distance equal to the thickness of the metal of end strip 18, projects from the body 21b. End seal 21 is positioned by first extending the lip 21c into the open end of the adjacent end strip 18 and then forcing the body 21b downwardly into the open end of the stile. Body 21b makes a tight resilient fit in the stile which, coupled with the interlocking action of the lip 21c under the adjacent wall of the end strip, secures the seal in place. The retention can be made more positive, if desired, by coating the seal body 21b exteriorly with the adhesive previously referred to.

The handle unit 23 includes a pair of knobs 23a upon opposite sides of the door carried by a rotatable transverse shaft 23b seated in circular positioning plates 23c the flat inner faces of which abut the apposed panels 16 which are apertured, as is the core 19, to permit the shaft to extend therethrough. One or more transverse screws 29 extend between the plates 23c and clamp them fixedly and permanently against the panels. The lock barrel 23d seats upon and is positioned by the transverse shaft 23b at its inner end, its outer end extending through an opening 17g in the adjacent stile 17, the lock bolt 23e protruding from the end of cylinder 23d as to enable it to abut a striker plate when the door is mounted. The latch unit 23 may be viewed as conventional.

The door is mounted by means of two or more spaced hinges 22 each of which includes a flat rectangular plate 22a along one edge of which are positioned spaced cylindrical pin seats 22b, a longitudinal shoulder 22c extending adjacent the seat 22b to fix the position of the hinge in the stile and to align it properly. A pair of spaced threaded holes 22d are positioned in the hinge plate 22a and seat screws 31 extended through the back wall 17a of the stile 17. The screws 31, when tightened, draw the hinge plate 22a firmly against the wall 17a and, with the abutment shoulders 22c, function to position the hinge accurately with respect to the door.

The door constructed in accordance with the present invention may be mounted in the manner of any door and its use, of course, is like that of the common wooden door. Its rigidity and light weight make it easy to open and close and long life is insured by the absence of bolts, screws and joints subject to failure. The locking of the panels in the stiles is permanent and in a preferred method of assembly the panels are provided before assembly with the locking edge curvatures.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. A building element comprising a pair of opposed parallel thin flexible sheet metal plates, and a spacer between said plates comprising a foraminous honeycomb reinforcement the open surfaces of which abut the surface of said plates, and one piece connectors extending along opposite marginal edges of said plates adjacent said reinforcement, each of said connectors being formed with spaced parallel seats for the marginal edges of said plates and into which said marginal edges extend, each of said seats being contoured upon its faces in abutting contact with a marginal edge to retain said edge in non-planar locking engagement.

2. A building element comprising spaced thin flexible sheet metal plates, a spacing reinforcing element comprising a foraminous honeycomb core adhesively secured to the inner surfaces of said plates, and one piece connectors along opposite marginal edges of said plates adjacent said reinforcement, each of said connectors being formed with spaced parallel seats for the marginal edges of said plates and into which said edges extend, each of said seats including contoured inner faces adapted to make abutting contact with opposite sides of a marginal edge and to displace that edge from a flat plane into a curve whereby the contoured faces of said seat are able effectively to lock said plate mechanically against displacement.

3. A building element comprising a pair of thin flexible parallel sheet metal plates, a foraminous honeycomb core spacing and reinforcing said plates and adhesively secured along its abutting surfaces to said plates, and connectors

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extending along opposite marginal edges of said plates, each of said connectors being formed with elongated parallel seats spaced apart a lesser distance than the thickness of said reinforcement and into which said marginal edges extend, each of said seats including an inner and an outer side the opposed faces of which are contoured as to cooperate when said sides are forced together under pressure to form said seat into a narrow channel which is curved in section in a plane normal to the length of said connector, which channel lies substantially between the planes of said plates, and in which a marginal edge is mechanically locked.

4. A door comprising a sandwich formed of parallel thin flexible sheet metal side panels spaced by a foraminous honeycomb core adhesively secured thereto and therebetween, a U-sectioned stile having bifurcated side walls seating the marginal side edges of each of said panels at a lesser distance apart than the thickness of said core and drawing said panels against said core the forks of each bifurcated side wall being bent relative to each other to clamp the associated panel side edge in permanent relationship, rectangularly sectioned and strips extended between the end edges of said plates and between the ends of said stiles and adhesively secured to the former, and end seals at the corners of said door between said end strips and said stiles to seal the interior of said unit, said stiles, end strips and end seals cooperating to seal the interior of said door and prevent atmospheric moisture from reaching the adhesive connection between said plates and said core.

5. The construction recited in claim 4 characterized in that said end strip is slotted along one side and in that a resilient compressible weather strip is seated therein and retained in place by its own resilience.

6. The construction recited in claim 4 characterized in that said stile is slotted at spaced points and in that a hinge comprising a plate formed with a shoulder along one side and with cylindrical pin seats extends through said slot with said shoulder abutting the adjacent side of said stile, and in that screws removably secure said hinge in said stile.

7. A stile for a fabricated door, comprising a one piece U-sectioned metallic element each side wall of which is bifurcated to form between its legs a channel adapted to receive the edge of a sheet metal panel, the interior surfaces of said legs being contoured to form a curved channel when said legs are brought together, and one of said legs being bendable toward the other of said legs and adapted to clamp said panel therebetween in said channel in a deformed interlocked condition.

8. A stile for a fabricated door or the like, comprising a metallic element having an elongated base and an integral elongated bifurcated side wall extended angularly therefrom forming between its legs a seat to receive the marginal edge of a sheet metal member, at least one of said legs being movable toward the other to clamp said

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marginal edge, the opposed faces of said legs being contoured to draw said marginal edge into said seat and to shape it into a non-planar shape as said legs are forced together.

9. A stile for a fabricated door or the like, comprising a metallic element having an elongated base and an integral elongated bifurcated side wall extended angularly therefrom forming between its legs a seat to receive the marginal edge of a sheet metal member, at least one of said legs being pivotable toward the other to clamp said marginal edge, the opposed faces of said legs being formed with cooperative curvatures to abut the opposite sides of said edge to exert a displacing force upon said one leg being pivoted toward the other to draw said edge and the sheet of which it is a part toward said base.

10. The construction recited in claim 9 characterized in that said stile is U-sectioned and is formed with spaced parallel side walls each constructed as described.

11. The construction recited in claim 10 characterized in that the inside leg of each side wall is movable toward the outside leg of that wall.

12. In a fabricated building element, a core, flat thin metal sheets lying against the opposite sides of said core, a one piece rigid stile extended along an edge of said core formed with bifurcated walls each of which seats a marginal edge of one of said sheets between its bifurcations, the opposed faces of the bifurcations of each wall having cooperating sloping surfaces forming a curved channel between the open side of said bifurcated wall and the inner end of the seat formed by the bifurcations, characterized in that the marginal edge of said sheet is clamped in a curve between said bifurcations, said curvature of said channel providing a mechanical locking relationship.

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