June 9, 1959 H. J. BIANCO 2,889,899

METAL DOOR CONSTRUCTION

Filed June 30, 1953 3 Sheets-Sheet 1

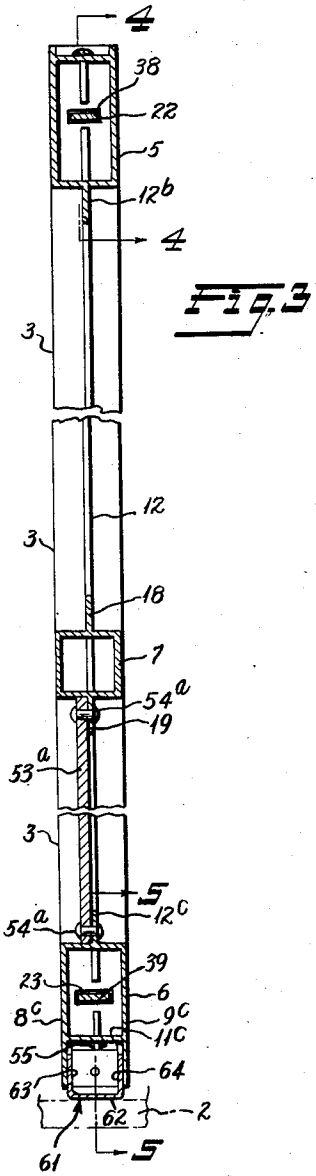
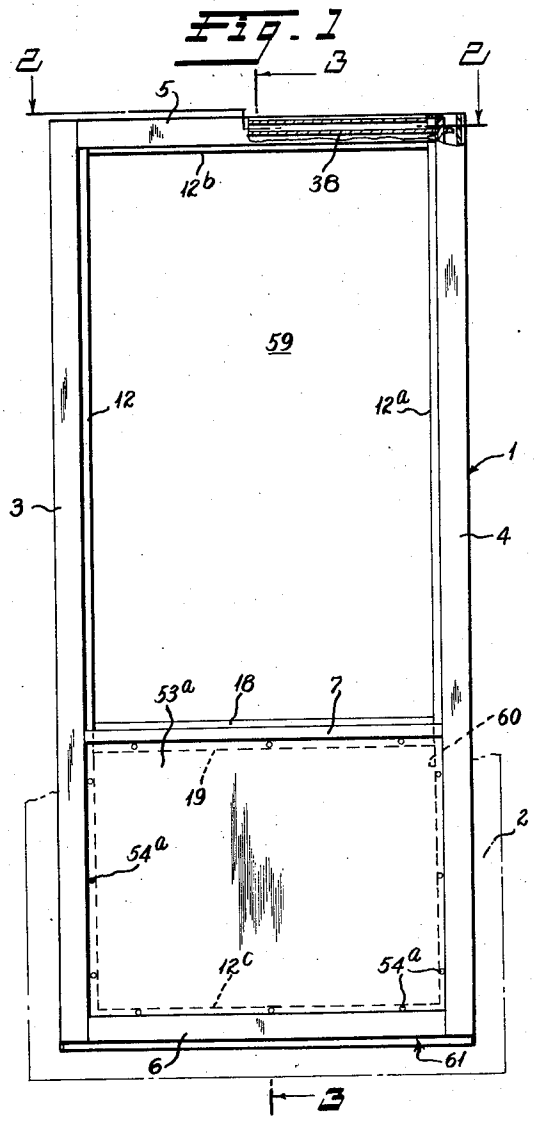


Fig. 3

Fig. 1



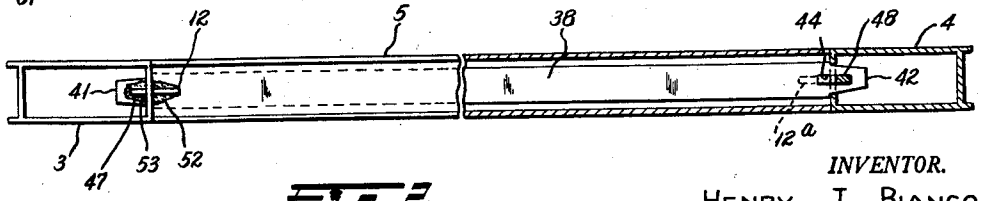


Fig. 2

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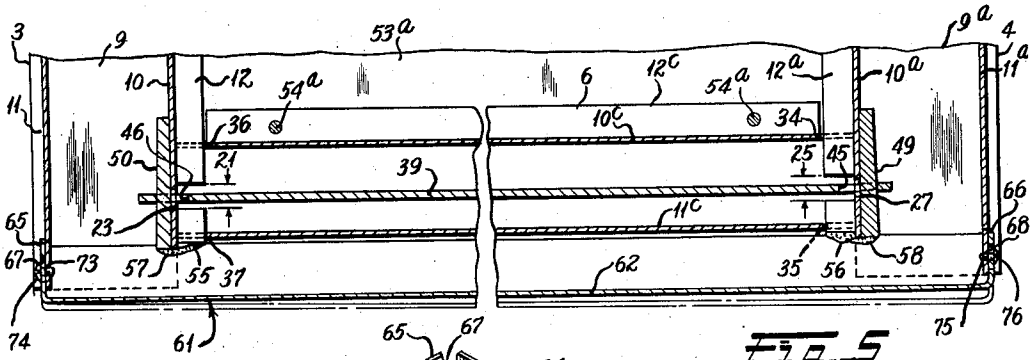


Fig. 5

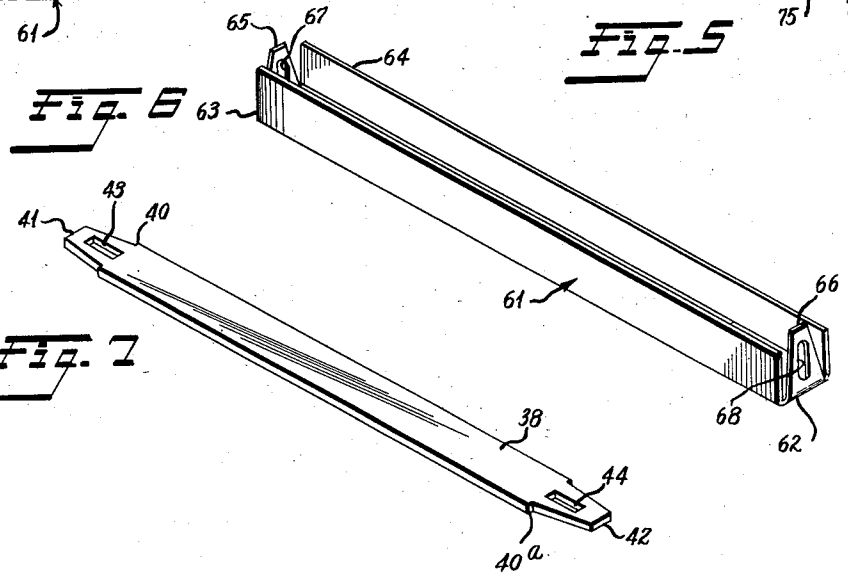


Fig. 6

Fig. 7

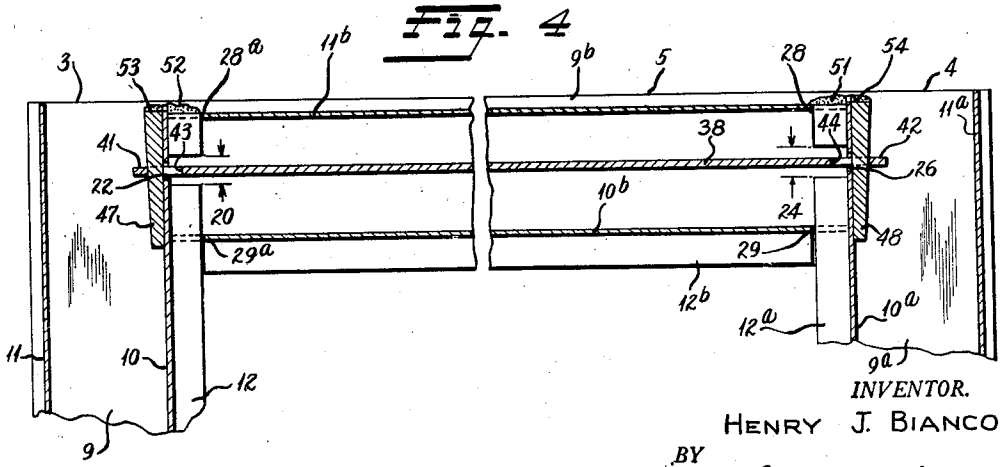


Fig. 4

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METAL DOOR CONSTRUCTION

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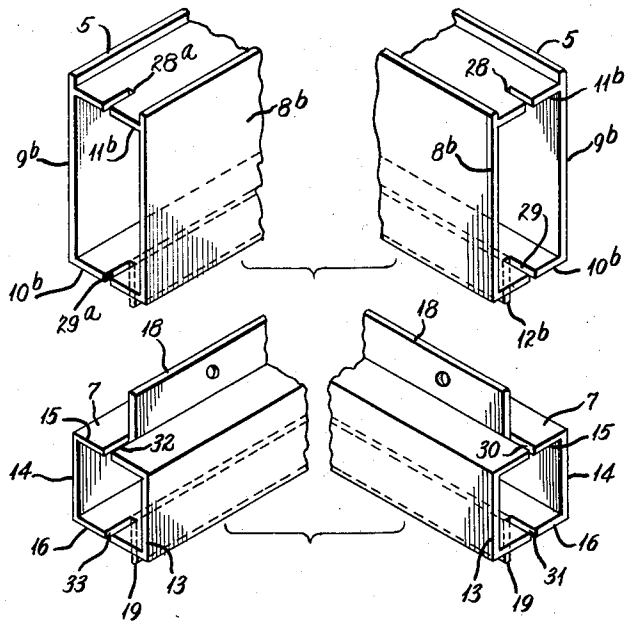


Fig. 9

Fig. 10

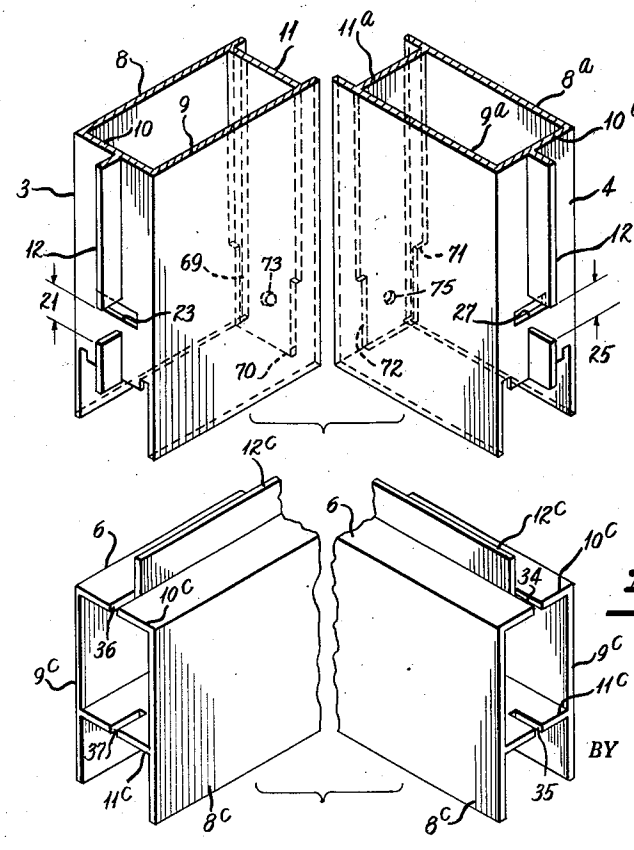


Fig. 8

Fig. 11

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2,889,899

METAL DOOR CONSTRUCTION

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Application June 30, 1953, Serial No. 365,018

1 Claim. (Cl. 189—46)

The present invention relates to a door, and, more particularly to a metal door constructed primarily from structural elements in the form of extruded aluminum alloy shapes of predetermined cross sectional configuration. It is to be understood, however, that the principles of construction embodied in the present invention are not limited to extruded shapes nor to the fabrication of doors, but are applicable to structural elements formed in any manner and to structures other than doors.

The principal object of the invention is to provide a metal door comprising parts made from structural shapes that can be quickly cut to size, punched, etc. by mass production methods, and quickly assembled into a rigid structure without the use of special clamps, jigs, tools, etc.

Another object is to provide a door construction wherein the parts are very tightly drawn together incidental to the process of assembly itself, and then, preferably, permanently fastened together.

Still another object is to provide a door construction wherein certain parts are designed to cooperate with others to aid in retaining all of the parts in a common plane during assembly.

A further object is to provide a door construction wherein the means which functions to maintain the parts in alignment during assembly is also adapted to function as a mounting means for a kick panel and for a window or screen above the kick panel.

A still further object is to provide a door construction including a built-in expansion strip for closing any gap that may be present between the bottom of the door and a door sill.

A still further object is to provide a door construction which is light in weight, but nevertheless extremely rigid, and which, if desired may be shipped in a knocked down condition. In this connection, the present door includes tie bars and wedges associated with the side, top and bottom members of the door in such manner that the assembly of the door can be effected by positioning the parts in their proper relation to each other and then simply driving the wedges into place. This manner of assembly can be employed on any construction job. When the door is factory assembled, it is preferred to fuse the wedges in position permanently after assembly of the door so that they can never work loose.

Other objects and features of the invention will be apparent from the following description taken in conjunction with accompanying drawings, wherein:

Fig. 1 is a front elevational view of a door, with a portion partly broken away, constructed in accordance with the principles of the present invention;

Fig. 2 is a horizontal sectional view taken on line 2—2 of Fig. 1 particularly illustrating the tie bar and wedges employed for drawing the side members of the door tightly against the ends of the top member of the door;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view through the side members and top member of the door as viewed on line 4—4 of Fig. 3;

Fig. 5 is a vertical sectional view through the side members and the bottom member of the door as viewed on the line 5—5 of Fig. 3;

Fig. 6 is a perspective view of the expansion strip which is adapted to be associated with the bottom member of the door;

Fig. 7 is a perspective view of one of the two tie bars employed in the door;

Fig. 8 is a fragmentary perspective view showing the lower ends of the two side members of the door;

Fig. 9 is a fragmentary perspective view of the two ends of the top member of the door;

Fig. 10 is a similar view of the opposite ends of the intermediate member which is adapted to be disposed between the side members in spaced relation to both the top and bottom members; and

Fig. 11 is a fragmentary perspective view illustrating the opposite ends of the bottom member of the door.

Referring now to Fig. 1 of the drawings, the door is generally identified by the numeral 1 and is adapted to be mounted in a door jamb 2 indicated in dot-and-dash lines. The door comprises a left side member 3, a right side member 4, a top member 5, a bottom member 6 and an intermediate member 7. The side members 3 and 4 and the top member 5 are formed from hollow extrusions of identical cross section. The cross-sectional shape of the left side member 3 is best illustrated in Fig. 8, wherefrom it will be noted that said member comprises side walls 8 and 9 interconnected at one edge by a transverse web 10, and interconnected at a point spaced inwardly of the opposite edges thereof by a second web 11. The end web 10 has a flange 12 projecting therefrom along its mid portion and extending throughout substantially the full length thereof. The right side member 4 includes corresponding side walls 8*a* and 9*a*, end webs 10*a* and 11*a*, and a central, projecting flange 12*a* extending longitudinally thereof. The top member 5, Fig. 9, is of the same cross-sectional shape as the side members 3 and 4 and comprises corresponding side walls 8*b* and 9*b*, and webs 10*b* and 11*b* and a flange 12*b* projecing from the web 10*b*.

The cross-sectional shape of the bottom member 6 is best shown in Fig. 11 wherefrom it will be noted that said member comprises side walls 8*c* and 9*c*, an end web 10*c*, a transverse web 11*c*, spaced much farther inward from the edges of the side walls 8*c* and 9*c* than the corresponding webs 11, 11*a* and 11*b* of the members 3, 4 and 5. A central flange 12*c* projects from the end web 10*c*.

The cross-sectional shape of the intermediate member 7 is also best shown in Fig. 10 from which it will be apparent that said member has upright walls 13 and 14 interconnected by horizontal webs 15 and 16, the members 13, 15, 14 and 16 defining a substantially rectangular cross sectional shape. A central flange 18 projects upwardly from the horizontal web 15 and a similar flange 19 projects downwardly from the web 16.

Referring to Fig. 4, the flange 12 of the side member 3 is removed or cut away adjacent the upper end thereof in a region indicated by the dimension lines and numeral 20. The flange 12 is similarly cut away adjacent its lower end, as shown in Fig. 8, in the area indicated by the dimension lines and numeral 21. A rectangular slot 22 is formed in the web 10 in the region 20 (Fig. 4) and a similar slot 23 (Figs. 5 and 8) extends through said web in the region 21. The flange 12*a* of the side member 4 is similarly cut away at its upper end in the region indicated by the dimension lines and the numeral 24 in Fig. 4. The flange 12*a* is also cut away at its lower end in the region indicated by the dimension lines and the numeral 25, as illustrated in Fig. 8. The web 10*a* has

a slot 26 (Fig. 4) extending therethrough in the region 24 and a slot 27 (Figs. 5 and 8) extending therethrough in the region 25.

The web 11*b* (Figs. 4 and 9) of the top member 5 has a slot 28 extending inwardly therein of a depth slightly greater than the height of the flange 12*a*. The web 10*b* has a similar slot 29 and the flange 12*b* is cut away so that it is flush with the inner end of the slot 29. The slots 28 and 29 are of a width substantially equal to the thickness of the flange 12*a*, and of a depth to receive said flange therein. The opposite end of the top member 5 has the webs 10*b* and 11*b* similarly slotted as indicated at 28*a* and 29*a* to receive the flange 12 of the side member 3.

The intermediate member 7 (Fig. 10) has the horizontal webs 15 and 16 similarly slotted and portions of the flanges 18 and 19 cut away to provide slots 30 and 31 adapted to receive the flange 12*a* of the side member 4. The opposite end of the intermediate member 7 is also provided with slots 32 and 33 for the reception of the flange 12 of the side member 3.

Referring to Figs. 5 and 11, one end of the bottom member 6 has a portion of the web 10*c* and flange 12*c* cut away to provide a slot 34 and the intermediate web 11*c* is provided with a slot 35, the slots 34 and 35 being adapted to snugly receive the flange 12*a* of the right side member 4. The opposite end of the bottom member 6 is provided with similar slots 36 and 37 adapted to receive the flange 12 of the left side member 3.

The side members 3 and 4 are held together at the upper end thereof by means including a tie bar 38, Figs. 1 and 4, and at their lower ends by means including a tie bar 39, Fig. 5. The tie bar 38 is shown in perspective in Fig. 7 and has a width less than that of the space between the webs 8*b* and 9*b* of the top member 5 and a width greater than the length of the slots 22 and 26 formed in the webs 10 and 10*a* of the side members 3 and 4, respectively. However, the ends of the tie bar 38 are shouldered as indicated at 40 and 40*a* and tapered extensions 41 and 42 extend beyond said shoulders. The extension 41 has a longitudinally extending slot 43 extending therethrough, and the extension 42 has a similar slot 44. These slots are adapted to receive tapered fastening elements or wedges, as will be presently described.

The lower tie bar 39, Fig. 5, is identical to the tie bar 38 and the extensions thereof are provided with slots 45 and 46, also adapted to receive wedge shaped fastening elements to be described later. The tie members 38 and 39 are adapted to be readily fabricated from strip material by simple shear and punch press operations which sever the tie bars successively from a long strip, form the reduced extensions at the ends thereof, and punch the holes in the extensions.

In assembling the present door, the tie member 38 is inserted in the top member 5 and the side members 3 and 4 are placed at the opposite ends of the top member 5 with the reduced portion 41 of the tie member 38 extending through the slot 22 in the member 3 and the reduced extension 42 extending through the slot 26 in the member 4. A wedge 47 is then inserted in the slot 43 in a position inwardly of the web 10 and a similar wedge 48 is inserted in the slot 44 just inwardly of the web 10*a*. Of course, in assembling the side member 3 with the top member 5, the flange 12 is inserted in the slots 28*a* and 29*a*, and the flange 12*a* of the side member 4 is inserted in the slots 28 and 29, as is clearly shown in Fig. 4. These slots and flanges cooperate to maintain the top member 5 in the plane of the side members 3 and 4. The top member 5 is adjusted so that the upper longitudinal edges of the walls 8*b* and 9*b* are substantially flush with the ends of the webs 8 and 9 of the side member 3 and 8*a* and 9*a* of the side member 4, prior to driving of the wedges 47 and 48.

The intermediate member 7 is positioned between the side members 3 and 4 with the flange 12 extending into the slots 32 and 33 and the flange 12*a* extending into the slots 30 and 31. The member 7 is located in the position it will have in the finished door and then the lower tie bar 39 is extended through the bottom member 6 between the webs 8*c* and 9*c* and the ends thereof projected through the openings 23 and 27 in the side members 3 and 4, respectively. The bottom member 6 is positioned flush with the ends of the side members 3 and 4 and a wedge 49 is inserted in the slot 45 and a similar wedge 50 is inserted in the slot 46, as is clearly illustrated in Fig. 5.

The wedges 47 and 48 are tightly driven into position by a conventional hammer, as are also the wedges 49 and 50. The driving of the aforesaid wedges forces the webs 10 and 10*a* of the side members 3 and 4 into tight abutting engagement with the ends of the top member 5, bottom member 6 and intermediate member 7, respectively. After the wedges have been tightly driven into place, the parts are permanently fastened together by applying a welding flame to the upper extremities of the flanges 12 and 12*a* in the regions where they project above the web 11*b* of the top member to thereby permanently fuse the parts together, as indicated at 51 and 52, Fig. 4, and provide a strong bond therebetween. The flame is also applied to the outer end of the wedges 47 and 48 to fuse them to the adjacent webs 10 and 10*a* of the side members 3 and 4, as indicated at 53 and 54, to thus permanently secure the wedges in position.

The bottom member 6 is similarly permanently secured in place by applying the flame to the lower ends of the flanges 12 and 12*a*, Fig. 5, in the regions 55 and 56 thereof where they project beyond the web 11*c*. The outer ends of the wedges 49 and 50 are also subjected to the heat of the flame to fuse the same against the adjacent webs 10 and 10*a* of the side members 3 and 4, as indicated at 57 and 58. Thus, the parts of the door are permanently maintained in the position in which they were tightly drawn by the wedges 47 to 50 during the assembling of the door. This results in a light weight door construction which is extremely strong and rigid.

From an inspection of Figs. 3, 4 and 5, it will be noted that the slotted web 11*b*, forming the outer wall of the top member 5, is spaced inwardly from the outer ends of the side walls 8*b* and 9*b* to provide a channel construction. It will also be noted that the walls or end webs 10 and 10*a*, which carry the projecting flanges 12 and 12*a*, respectively, are somewhat shorter than the side walls 8, 9, 8*a*, 9*a*, and webs 11 and 11*a*, extending approximately to the transverse web 11*b* of top cross member 5. By virtue of this construction, the side walls 8, 9, 8*a* and 9*a* form an extension of the channel construction of walls 8*b* and 9*b*, and the webs 11 and 11*a* close the end of said channel construction. A similar arrangement is provided at the bottom of the door in which the transverse web 11*c* and side walls 8*c* and 9*c* in the bottom member 6 provide a channel construction, and the flange carrying webs 10 and 10*a* terminate substantially contiguous to transverse web 11*c*, while the side walls 8, 9, 8*a*, 9*a*, and webs 11 and 11*a* of the side members 3 and 4, continue to the same extent as the side walls 8*c* and 9*c* to provide an extension of and end closures for the channel construction of side walls 8*c* and 9*c* and web 11*c*. It is seen, therefore, that the fused parts 51, 52, 55 and 56 do not extend beyond the sides of the channel construction described. This construction provides a means whereby the several parts, having been assembled by the tie bars and wedges, may readily be permanently secured together by a simple fusing operation which does not leave parts extending beyond the sides of the door to interfere with the opening or closing thereof.

The use of the intermediate member 7 provides two spaces in the door, an upper space 59 being provided to receive a removable screen (not shown) or a removable

window (not shown), and a lower space **60** adapted to receive a kick panel **53***a*. The panel **53***a* is secured in place by rivets **54***a* extending through the flange **12** of the side member **3**, flange **12***a* of the side member **4**, and flange **12***c* of the bottom member **6**, and the flange **19** of the intermediate member **7**.

The door **1** may be mounted in a frame or jamb **2** of any suitable construction. However, in order to compensate for any excess clearance between the bottom of the door and frame or jamb, or for any abnormal inclination of the door sill, an expansion strip **61**, Figs. **3**, **5**, and **6**, is provided and adapted to be secured to the lower end of the door **1**. The strip **61** is generally U-shaped in transverse cross section and has an overall width such that it is snugly received between the side webs **8***c* and **9***c* of the bottom member **6**, in the space below the transverse web **11***c*. The strip **61** comprises a base portion **62** and side walls **63** and **64** extending upwardly therefrom. The base portion **62** has tabs **65** and **66** at the opposite ends thereof that are bent upwardly and provided with elongated openings **67** and **68**, respectively.

As is best shown in Fig. 8, the web **11** of the side member **3** is severed from the side walls **8** and **9** by slots **69** and **70**. The side member **4** has the web **11***a* provided with similar slots **71** and **72**. The slots **69** and **71** are adapted to receive the side wall **63** of the strip **61** and the slots **70** and **72** are adapted to receive the other side wall **64** of said strip. The lower ends of the webs **10** and **10***a* are removed to a depth equal to that of the slots **69—70** and **71—72**, respectively, to accommodate the expansion strip **61**. The tabs **65** and **66** are adapted to engage the external surface of the end webs **11** and **11***a*, respectively, of the said members **3** and **4**, as shown in Fig. 5. The web **11** is provided with a threaded hole **73** adapted to receive a screw **74** extending through the slot **67** in the tab **65** and the web **11***a* is provided with a similar threaded hole **75** for the reception of a screw **76** extending through the slot **68** in the tab **66**.

The elongated slots **67** and **68** in the expansion strip **61** make it possible to adjust the strip to any desired position relative to the bottom edge of the door **1** to fill any gap between the door and door sill. Thus, for illustrative purposes, the strip **61** has been shown in Fig. 5 in full lines in a position that it may assume in a door frame that is true, and has been illustrated in dot-and-dash lines in a position that it may assume when the sill of the frame slants downwardly from left to right.

Inasmuch as the side members **3** and **4** and the top member **5** are formed from extrusions of the same cross-sectional shape, it will be apparent that these parts can be formed by mass production methods by cutting the same to the desired length and then cutting away the portions of the webs **10** and **10***a* in the regions **20** and **21**, and **24** and **25**, respectively, and then punching the holes aforedescribed in these regions by simple punch press operations. The bottom member **6** and the intermediate member **7** may also be made by mass production methods by simply cutting off suitable lengths of material from long stock. The ends of the top member **5**, the bottom member **6**, and the intermediate member **7** may be slotted and the end portions of the flanges

thereof removed by a simple milling or saw operation. The wedges **47** to **50** may be readily cut from scrap metal in any conventional shear. Thus, both the fabrication and assembly of the door disclosed herein lends itself to rapid production with a minimum of costs.

While extrusions of a preferred shape have been disclosed herein for use in fabricating the parts comprising the door **1**, it will be understood that extrusions of different shape may be employed to make the door, and that minor changes may be made in the details of the remaining parts of the door, without departing from the principles of the invention or the scope of the annexed claim.

I claim:

A metal door comprising: opposed hollow side members, a hollow top cross member and a hollow bottom cross member disposed at opposite ends of said side members, said side members and said cross members being generally rectangular in cross section, a wall of each of said side members having a single flange longitudinally extending substantially midway thereof and projecting toward the other side member, said top and bottom cross members being slotted at their ends to receive said flanges, whereby said slots and flanges coact to provide the sole means to maintain said top and bottom members in a common plane with said side members, said side members having slots in the regions thereof opposite the ends of said top and bottom members, the flanges in the vicinity of said slots being interrupted; a flat tie bar extending through each of said top and bottom members and being provided with tapered and slotted end projections for passing through said slots in said side members, wedges in said slots in said tie bars securing said side members to said top and bottom cross members, the wedges being permanently secured in place by fusing a portion thereof to the wall portions of said side members, said upper and lower cross members being provided, at their upper and lower sides, respectively, with web members and a pair of flanges providing extensions of the side walls of said cross members, the side walls of said upper and lower cross members and the side walls of the said side members extending beyond the fused portions of said wedge and side members, whereby the fused portions of the wedge and side members are confined within said side walls of the cross members and said side members.

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