A. J. ELLIS & C. E. NELLIS.
HOLLOW METAL DOOR.
APPLICATION FILED AUG. 27, 1910.

1,039,370. Patented Sept. 24, 1912.

2 SHEETS—SHEET 1

Fig. 1.

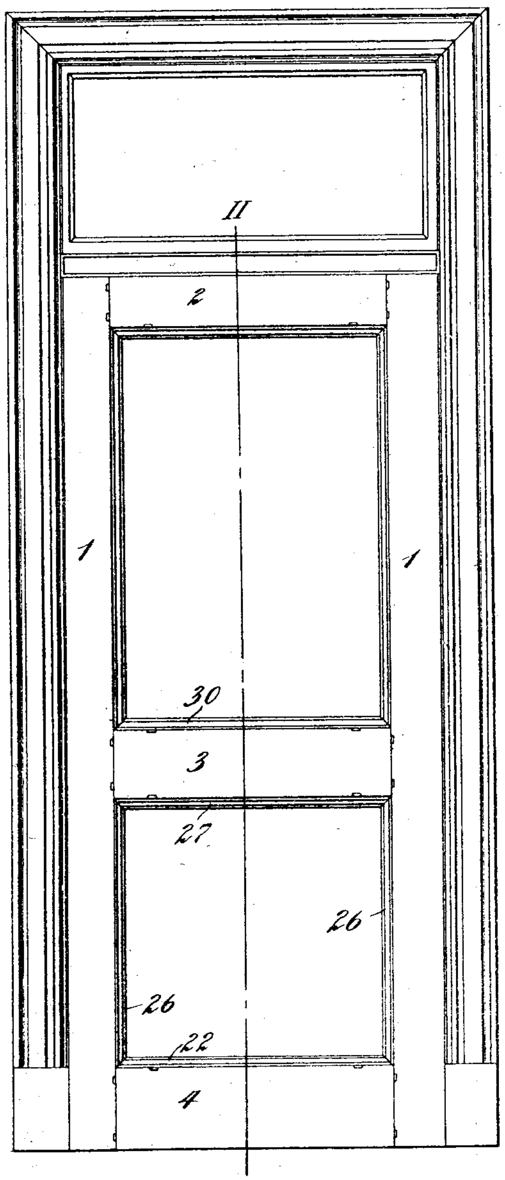
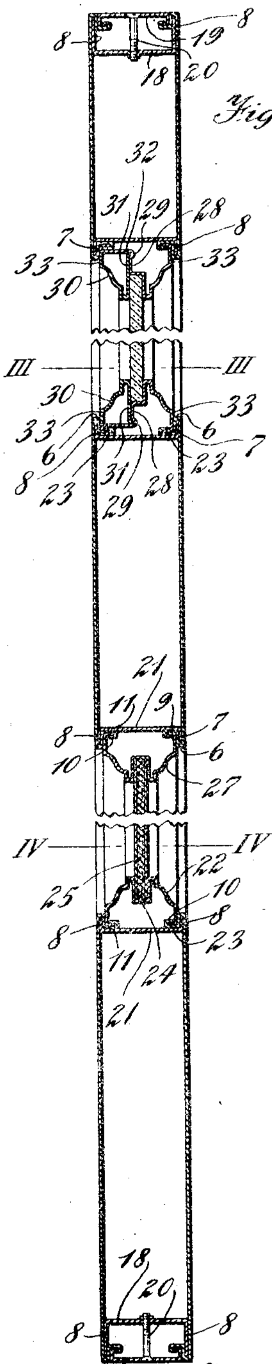


Fig. 2.



Witnesses:
Geo. C. Sheney
Chas. A. Hidden

Inventors
Alfred J. Ellis and
Charles E. Nellis
By his Attorneys
Rosenbaum & Stockbridge

A. J. ELLIS & C. E. NELLIS.

HOLLOW METAL DOOR.

APPLICATION FILED AUG. 27, 1910.

1,039,370.

Patented Sept. 24, 1912.

2 SHEETS—SHEET 2.

Fig. 3.

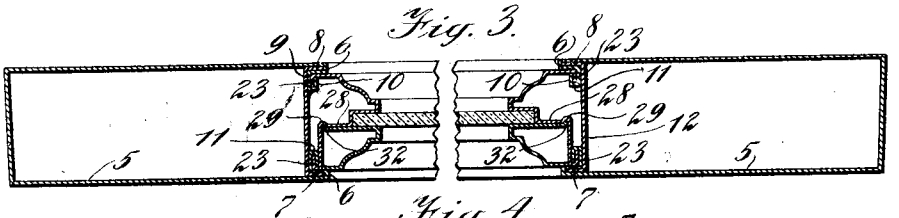


Fig. 4.

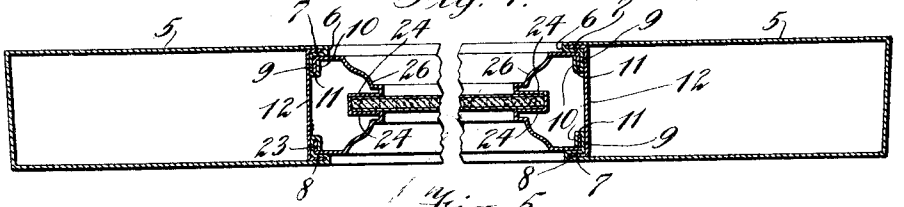


Fig. 5.

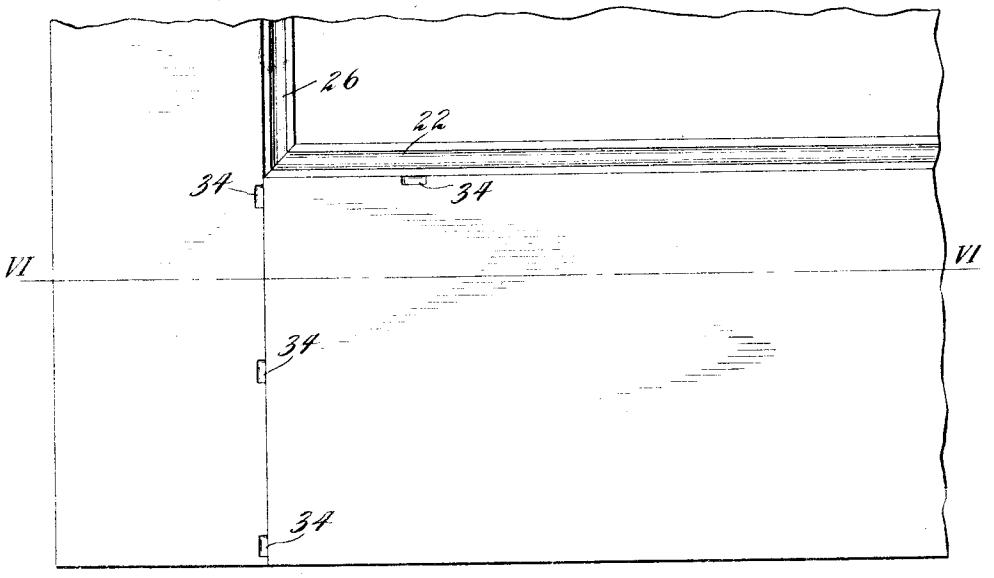


Fig. 6.

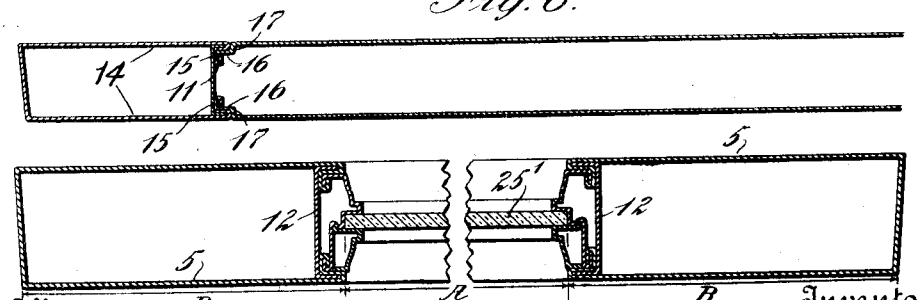


Fig. 7.

Witnesses:

Inventors,

Alfred J. Ellis, and

Charles E. Nellis

By their Attorneys

Rosenbaum & Stockbridge

UNITED STATES PATENT OFFICE.

ALFRED J. ELLIS, OF WOODCLIFF-ON-HUDSON, NEW JERSEY, AND CHARLES E. NELLIS, OF NEW YORK, N. Y., ASSIGNORS TO A. J. ELLIS, INC., A CORPORATION OF NEW JERSEY.

HOLLOW METAL DOOR.

1,039,370. Specification of Letters Patent. **Patented Sept. 24, 1912.**

Application filed August 27, 1910. Serial No. 579,219.

To all whom it may concern:

Be it known that we, ALFRED J. ELLIS and CHARLES E. NELLIS, citizens of the United States, residing, respectively, at Woodcliff-on-Hudson, township of North Bergen, in the county of Hudson and State of New Jersey, and in the city of New York, borough of Brooklyn, State of New York, have invented certain new and useful Improvements in Hollow Metal Doors, of which the following is a full, clear, and exact description.

This invention relates to hollow metal doors, and has for its object the provision of improved means for uniting the several parts employed in the construction of doors of this character, such means being characterized by extreme simplicity of construction, compact form, and by the fact that it affords great rigidity to the assembled parts. The construction in question is such that the securing devices may be made of substantially uniform size in so far as the cross section thereof is concerned for various sizes of doors, resulting in a greatly decreased cost of construction.

A further object of our invention is the provision of a novel form of molding characterized by extreme simplicity of construction and adapted to efficiently retain glass panels or the like in position in a door, such molding coöperating with the other parts of our improved door construction to the end that an inexpensive extremely simple and very rigid fire-proof door is the result.

Other features of our invention will be hereinafter more particularly pointed out and set forth in the appended claims.

Referring now to the accompanying drawings which form a part hereof and in which like reference characters designate like parts throughout the several views: Figure 1 is an elevation of our improved door showing the same in position in a frame of suitable construction. Fig. 2 is a vertical section of our door taken on line II—II of Fig. 1. Fig. 3 is a transverse section taken on the lines III—III of Fig. 2. Fig. 4 is a similar section taken on lines IV—IV of Fig. 2. Fig. 5 is a fragment of one corner of our door drawn to a somewhat larger scale. Fig. 6 is a transverse section taken on the line VI—VI of Fig. 5. Fig. 7 is a transverse section similar to that shown in Fig. 3, but showing the molding slightly modified in form to accommodate a panel of larger dimensions.

Referring now to the said drawings, and more particularly to Fig. 1, wherein the stiles have been designated 1, the upper rail 2, the middle rail 3 and bottom rail 4, it will be observed that the door has substantially the general outward appearance of doors of the usual construction; but referring to Fig. 3, it will be seen that each stile is composed of a bent sheet of metal 5, substantially U-shaped in cross section, the inner edges of which are folded over and then bent at right angles to the plane of such fold and thereafter again folded in such manner as to provide on each side of the stile a plurality of grooved flanges, such flanges being preferably substantially normal to each other. The rails also involve much the same construction, except that we prefer to form the lateral plates thereof separate and distinct from each other instead of bending a single plate into the U-shaped form employed in the construction of the stiles. This however is obviously merely a matter of detail. The feature of principal importance in the rails, as in the stile, is the peculiar arrangement of recessed or grooved flanges; the size and shape of such flanges in both the rails and stiles being preferably identical, so that but few rolls or presses need be employed in the manufacture of the parts of our door.

Considering now the parts of the compound flanges in detail, the metal or other material of which the side of the stile or rail is composed, is preferably folded back upon itself as at 6: but the laterally disposed web 7 formed by the so folded material is spaced from the body of the member to provide a rather deep interiorly opening groove 8. These grooves we shall for convenience designate channel grooves, as they are intended to receive the flanges of the channels hereinafter described. The metal is then bent substantially normal to the surfaces of the webs 7 to form the inwardly directed webs 9. Finally the edges of these inner webs are shown as being bent or folded back over the bodies thereof to form recessed or grooved, interiorly directed flanges, similar to those previously described but substantially normal thereto. The folded edges of these flanges have been designated 10 and the grooves so formed 11.

Considering now the stiles more particularly, we prefer to close the interior open sides thereof by stiffening channels 12. These channels 12 are formed by flanging up the edges of a plate, and the width of such flanges is preferably just sufficient to snugly fill the deep grooves 8 above referred to, a channel 12 being slid endwise down into the interior of the stile in such manner that the said flanges engage with the said grooves. The bottom of the channel is hence disposed against the respective inner faces of the webs 9. The grooves 11 also extend the entire length of the stile upon either side thereof and are adapted for the reception of corresponding flanges upon the respective sections 13 of the molding, and also for the reception of similarly positioned flanges or tongues disposed at the extremities of the rails.

Referring to Fig. 6, the rail therein shown in cross section is formed of two plates 14, the extremities of which are each inwardly directed and bent somewhat Z-shaped in cross section. The outermost leg 15 of the Z forms the flange or tongue above referred to which is adapted to neatly fit into one of the grooves 11; the web 16 of the Z being offset from the face of the rail by an amount substantially equal to the distance from the inner face of the web 7 to the outer face of the stile; and the upper leg 17 of the Z, which is relatively short, is preferably of just sufficient size to bring the face of the rail out flush with the outer face of the stile when the flange 15 is in position in its corresponding groove. The longitudinal edges of the plates 14 are crimped or folded to form compound recessed flanges of the shape and dimensions described at length above; and as the same characters have been used throughout to designate the several elements of these locking parts, it will suffice to say that our object in so forming the respective rails and stiles has been to provide homogeneous locking devices throughout the structure, which greatly simplifies the construction and reduces the cost of production.

The remaining parts of the door can best be described while considering the manner of assembling the same.

The bottom of the bottom rail is formed by inserting a channel 18 between the respective rail plates 14 so that the outer edges of the flanges of this channel engage the channel grooves 8 of said plates. A second channel 19 is then applied to the bottom face of the bottom rail to close the aperture between the compound flanges, the flanges snugly bearing against the inner walls of the lateral webs 7 of said plates. The lower channel 19 is provided with a series of countersunk holes provided for the reception of the heads of a series of screws or bolts 20, and the inner or upper channel is correspondingly tapped for engagement with the said bolts so that the channels 18 and 19 may be drawn toward each other to thereby, in effect, firmly clamp the lower edges of the bottom rail plates therebetween. A channel 21 is disposed for engagement with the upper channel grooves 8 of the rail plates, so that the construction of this portion of the bottom rail is substantially identical to that of the corresponding portion of each of the stiles. The lower portions of the end flanges 15 of the assembled bottom rail having been inserted into the upper ends of the stiles, thereby spacing them properly apart, a bottom molding 22 formed of bent sheet metal is fitted to the upper grooved flanges of the rail, the inwardly directed flanges 23 of said molding engaging the grooves 11, and the depending sides of the molding, above flanges 23, engaging the inner walls of webs 7 of the rail plates. The molding is suitably fluted and is rabbeted at 24 for the reception of a suitable panel 25. This panel may consist of an asbestos body faced with metal, wood, or other suitable substance. The bottom molding having been secured in position the corresponding side moldings 26 are slipped down into engagement with the stiles. The side moldings 26 are of substantially the same cross section as the bottom molding 22, being provided with inwardly directed flanges 23 which are adapted for engagement with the stile grooves 11 in the same manner in which the rail flanges 15 also engage these same grooves. It may be here observed that the molding is by reason of this construction very securely locked to the stiles.

The panel 25 is next inserted into the rabbets 24 of the side and bottom moldings and the top molding 27 is set in place, its flanges 23 being thereafter engaged with the grooves 11 of the middle rail, the respective side plates of the middle rail being substantially identical with those of the bottom rail, and being slipped laterally into position and engagement with the molding section. The molding sections and panel may also be suitably secured together to form a unitary structure before being placed in position, if desired; but the upper panel of the door being of glass, it is desirable that the same should be inserted into the door after the door has been positioned in its frame. With this end in view the molding around the upper panel is constructed somewhat differently from that around the lower panel. In this case the respective side, top and bottom members are each constructed in two parts; those shown to the right in Fig. 2 forming the main sections and being adapted for insertion into their places in much the same fashion as the lower moldings, having correspondingly engaging flanges 23, and these members, as in the lower panel, may or may

not be formed as a unitary structure prior to assembling in the door. Instead, however, of making such molding pieces substantially symmetrical in cross section, as in the former case, the metal in each part is bent in such manner as to leave its panel-receiving rabbet open upon one side, the metal of that side being bent away from the panel instead of up toward it, as shown at 28 in Figs. 2 and 3. Around the bottom edge of the web 28 so formed is provided a groove or channel 29 which is formed by bending the metal of web 28 first laterally in one direction and then [illegible] so that it extends substantially at right angles to the first bend until it has been carried a sufficient distance to [illegible] of the corresponding [illegible] after it is again bent at right angles and flanged at 23 to afford [illegible] with the edges of the [illegible] [illegible] the panel [illegible] and the [illegible] rabbet formed [illegible] of the molding [illegible] [illegible] molding [illegible] V-shaped sections is correspondingly [illegible] upon its exposed side and is provided [illegible] outer edge of each of the outer walls thereof with a bead 25 which is adapted [illegible] engagement with a channel or groove [illegible] while the outer flange [illegible] sections is adapted for engagement with [illegible] exposed portions above referred [illegible] inner face of the respective [illegible] rails and stiles. As the [illegible] [illegible] of which the molding [illegible] [illegible] somewhat [illegible] [illegible] the panel [illegible] [illegible] position and [illegible] there by reason of the engagement [illegible] bead with the corresponding channel or groove 29.

The top rail is substantially [illegible] in general construction with the bottom rail and is in turn secured to the molding in identical fashion. It is [illegible] in assembling the door not to push the sections of the bottom channel farther down between the stiles than is necessary to hold the latter in proper position, but to leave the upper edge of such rail projecting out beyond the upper ends of the stiles until the bottom molding section 22 has been secured thereto, when the whole may be pushed farther along between the stiles [illegible] molding [illegible] latter. The [illegible] should be left projecting slightly out beyond the stiles until the asbestos panel and top molding have been disposed in their proper position with respect to the bottom rail. The stiles should therefore be moved along bit by bit as the respective cross members and interior parts are assembled, until finally the entire door will have been built up. Obviously the panels, molding and rails are all held in proper alinement by the stiles, and in each case the peculiar configuration of the compound flanges upon the stiles and rails performs a plurality of functions. In the case of the rails, the plurality of angularly disposed flanges serves to retain the channel members in position and also to firmly engage the molding section, while the similar compound structures provided along the inner edges of the stiles serve to not alone retain the stiffening channels and side moldings, but also the ends of the rails.

If the engagement between the respective flanges and grooves be sufficiently snug, it is evident that a door constructed in accordance with the principles of our invention will rigidly hold itself together and will scarcely need any other fastening means. We prefer however to weld the several parts into substantially an integral and unitary structure by providing a plurality of notches or recesses 31 along the exposed inner edges of the stiles and rails, to wit, those edges formed by the bend 6. To this end the rail and stile plates after having been crimped or flanged in the manner described are nicked at intervals so that the flanges of the channel members inserted into the respective channel grooves are exposed at intervals through such nicks. By means of suitable welding apparatus we are thereby enabled to weld these channels firmly to the stiles and rails and in the case of the joints between the rails and stiles the same weld which serves to unite the stile channels to the stile plates, also serves to unite the adjacent rail end to such stile. This weld also, therefore, performs a plurality of functions, so that at one operation it becomes possible to firmly and integrally unite three separate parts. It will thus be seen that our door consists of but few parts; to the best of our knowledge considerably less in number than any metal door heretofore constructed; and these parts are united together by a compound flange construction, the principal characteristic of which is its simplicity. The parts are so related as to adapt them to be readily welded or otherwise united together in the simplest possible manner, and are further so constructed that if owing to expansion when the door is subjected to the action of intense heat, as for example in a fire, even should there by any chance occur an unequal expansion between

the respective parts whereby the welded portions might be disrupted one from the other, the door would still hold firmly together and retain its fireproof character by reason of the peculiar interlocking construction employed throughout.

A door constructed in accordance with the principles of our invention is relatively light in weight by reason of the box like character of the stiles and rails and by reason of the interlocking flanges, the engaging parts having a plurality of angularly disposed surfaces in engagement at each locking point. The hollow horizontal members are interlocked against vertical displacement; while the box like stiles interlock therewith to prevent lateral displacement of the parts; and the welding in turn serves to secure the stiles against vertical displacement, the assembled door presenting a rigid, unitary and fireproof structure.

Finally owing to the fact that the interiorly directed flanges are set back or inset into the stiles and rails from the edges 6 thereof while the flanks or sides of the projecting flanges are substantially coincident with the sides of the stiles and rails, and are thus within the proper overall width thereof, it becomes possible, when desired, to employ panels of substantially the exact dimensions of the opening between the stiles and rails. The width of the panel 25′ in this case being, as shown in Fig. 7, equal to A, the distance between the stiles, and the height obviously being the corresponding distance between rails. Thus it becomes possible, by using our novel flange locking arrangement, to make a door in which the stiles and rails may be of specified standard width and the panels of specified standard dimensions, which is particularly desirable, since large concerns will frequently insist upon having the stiles of all of their doors of uniform and standard dimensions, and since the panels, particularly when of glass are frequently necessarily furnished by the manufacturers thereof, in standard sizes. This feature is only possible by reason of the insetting of the rail and molding engaging flanges, and we therefore regard such feature as of particular importance.

Having described our invention, what we claim, is:

1. In a metal door, metal boxes forming the stiles and rails of said door, each of the stile-forming boxes having a pair of angularly disposed flanges at the inner edge of each of the sides thereof, each of said flanges having a groove therein, the respective grooves in a pair of flanges opening in two different directions, flanged stiffening members in said stiles, the respective flanges of said members being adapted for interlocking engagement with grooves of said stile flanges which open in a common direction, the rails of said door also having flanges at the ends thereof, said last mentioned flanges being adapted for interlocking engagement with the grooves in the stile flanges which open in other directions than that last mentioned.

2. In a metal door, metal boxes forming the stiles and rails of said door, each of the stile-forming boxes having a pair of angularly disposed flanges at the inner edge of each of the sides thereof, one flange of each pair extending substantially in parallelism with the sides of the stile and the other flange of each pair being disposed substantially perpendicular to the general plane of the door and extending into the body of the stile, said inwardly extending flanges being grooved, and the rails having flanges at the ends thereof adapted to enter said grooves to interlock said stiles and rails.

3. In a sheet metal structure, in combination, a sheet metal part having a portion thereof adjacent its edge folded back substantially into parallelism with the general surface of the part, the folded over portion having a substantially ninety degree bend adjacent the folding line and the material between said bend and the edge of said part being further folded back upon itself to form a recessed flange, such flange extending out laterally from the body of the part, the extreme edge of the part being spaced from the last mentioned folded portion to form together with the recess in the flange aforesaid an L-shaped groove, and a coöperating part having an L-shaped flange adapted to enter said groove.

4. In a sheet metal structure in combination, a sheet metal part having a portion thereof adjacent its edge folded back upon itself, the folded portion having a substantially ninety degree bend adjacent the folding line, and the material between said bend and the edge of the part being further folded back upon itself to form a recessed flange, such flange extending out laterally from the body of the part and stiffening the same, the extreme edge of the part being spaced from the last mentioned folded portion to form together with the recess in the flange aforesaid an L-shaped groove, a coöperating part having an L-shaped flange adapted to enter said groove, and a stiffening member having flanges adapted to enter between the walls of the first mentioned fold.

5. In a sheet metal structure, in combination, a sheet metal part having a portion thereof adjacent its edge folded back substantially into parallelism with the general surface of the part, the folded over portion having a substantially ninety degree bend adjacent the folding line and the material between said bend and the edge of said part being further folded back upon itself to

form a recessed flange, such flange extending out laterally from the body of the part, the extreme edge of the part being spaced from the last mentioned folded portion to form together with the recess in the flange a said an L-shaped groove, and a coöperating part adapted to enter said groove.