Sept. 28, 1926. 1,601,519

C. YOUNG

DOOR CONSTRUCTION

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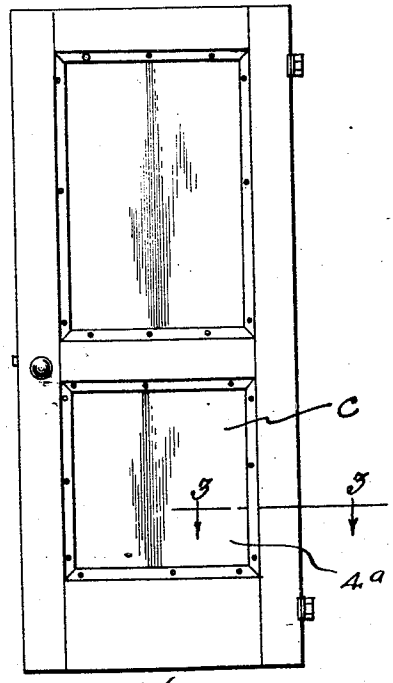


Fig. 1

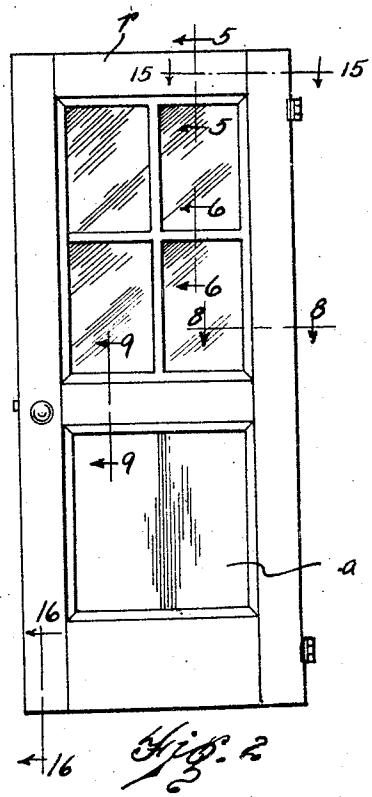


Fig. 2

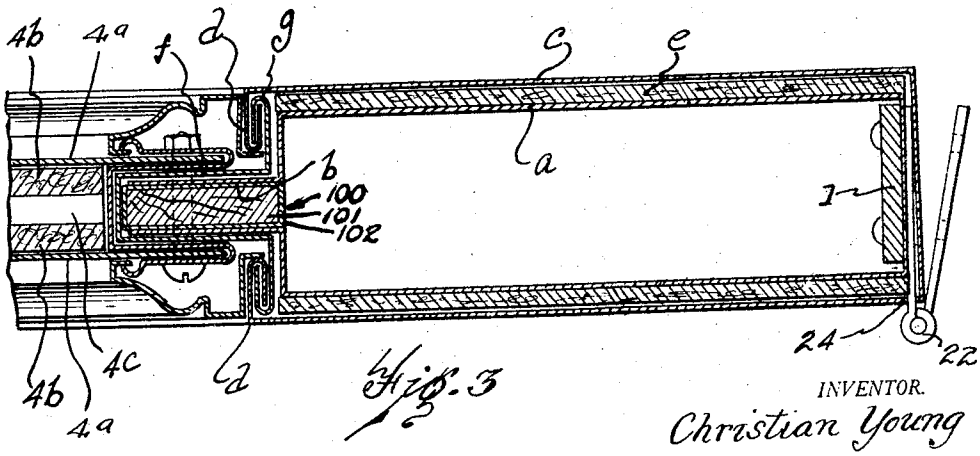


Fig. 3

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DOOR CONSTRUCTION

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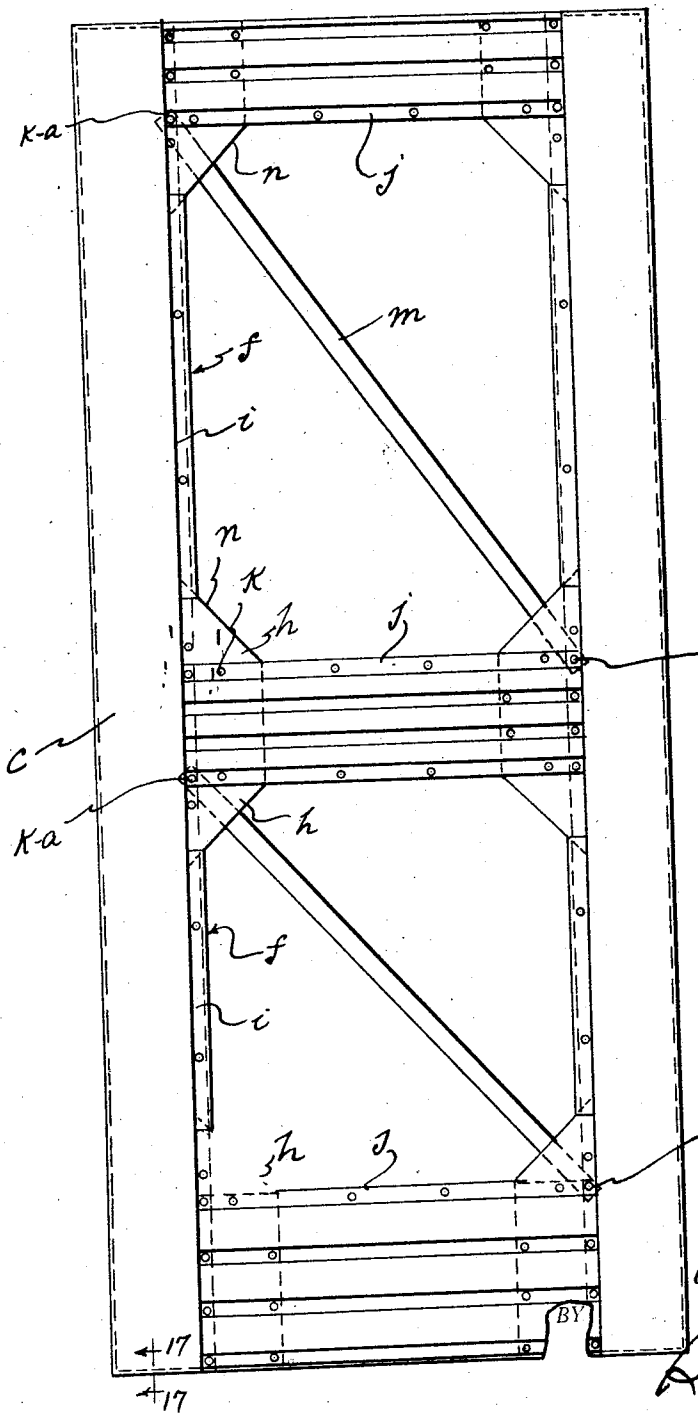


Fig. 4

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DOOR CONSTRUCTION

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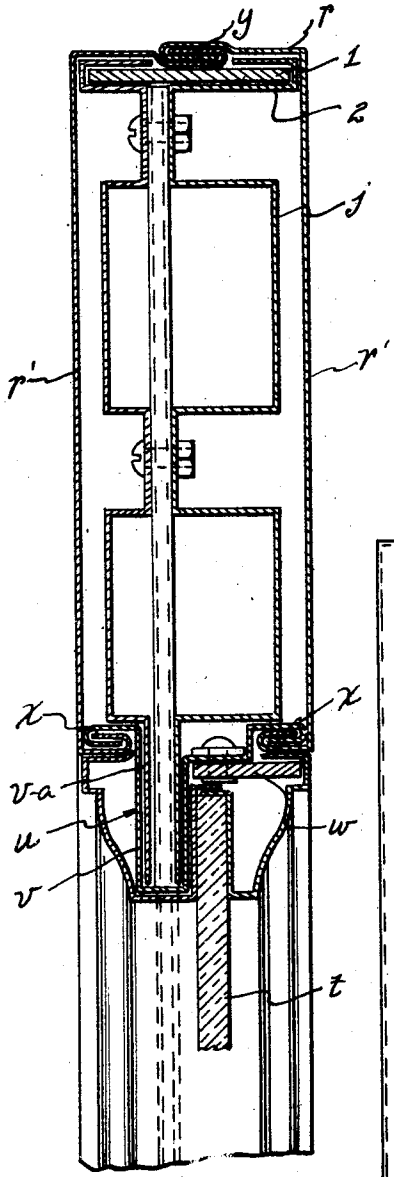


Fig. 5

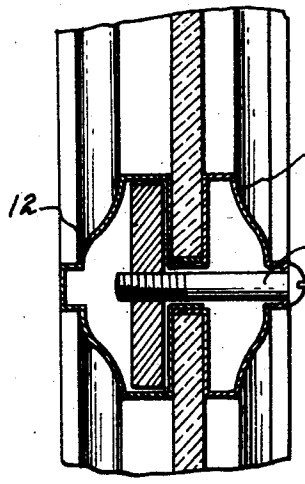
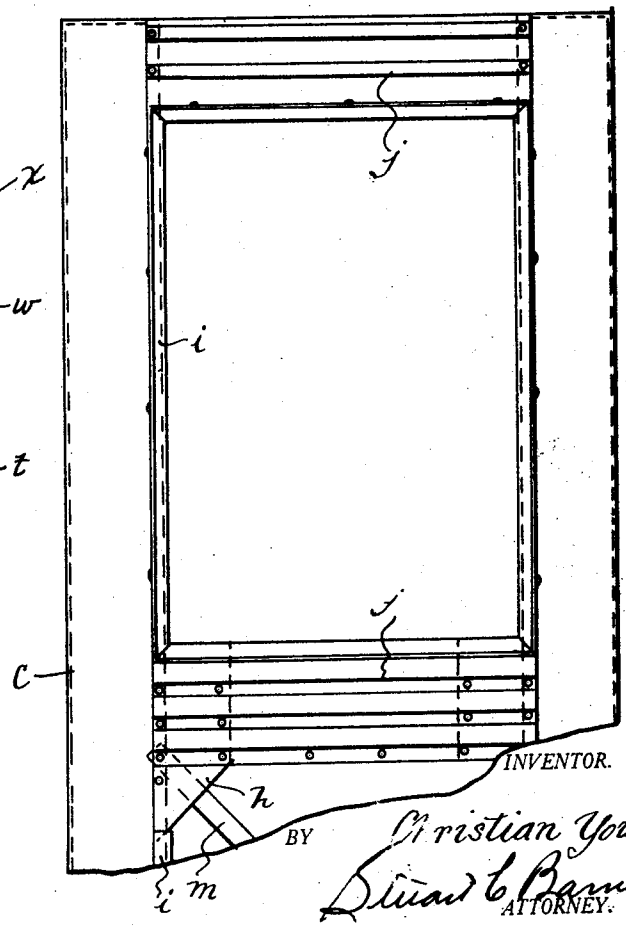


Fig. 6

Fig. 7



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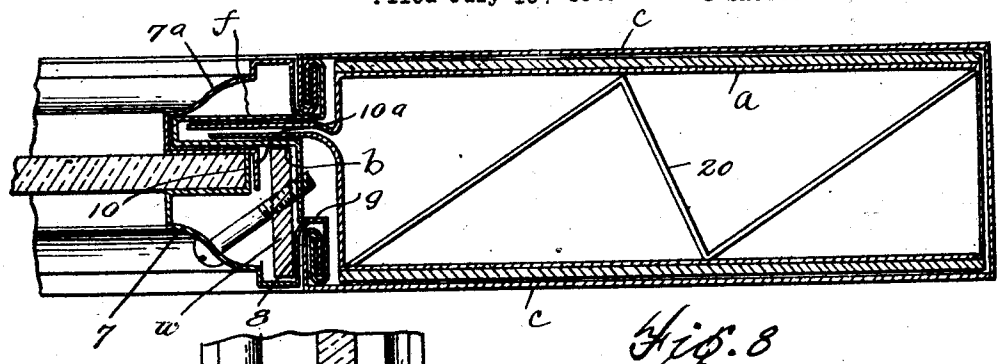


Fig. 8

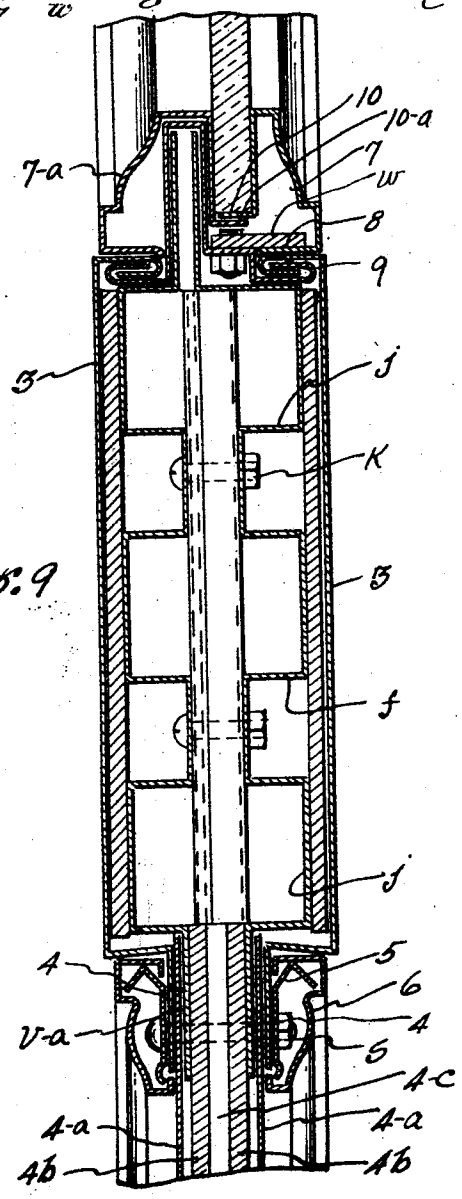


Fig. 9

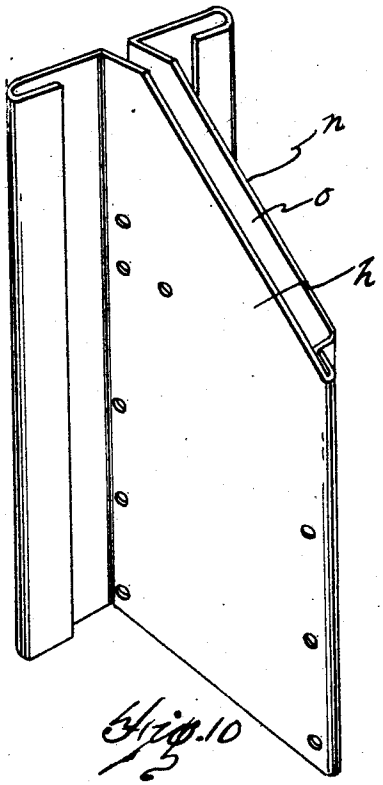


Fig. 10

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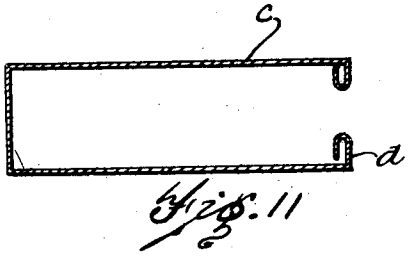


Fig. 11



Fig. 12

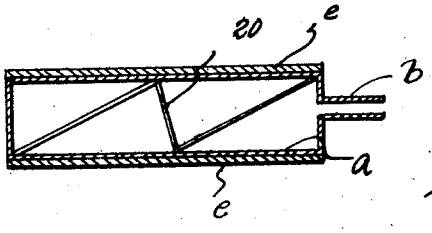


Fig. 13

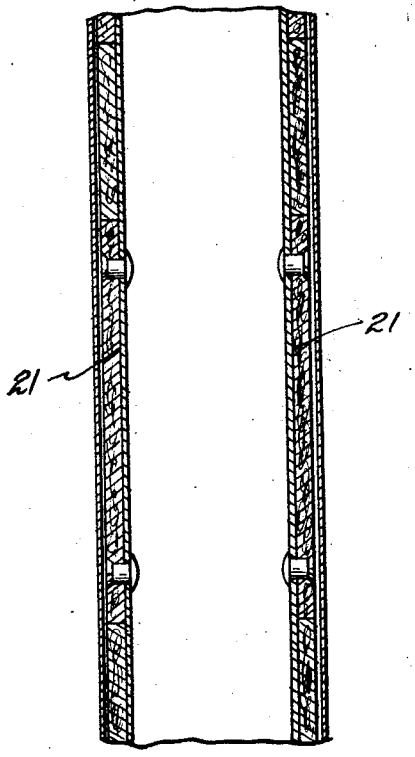


Fig. 14

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DOOR CONSTRUCTION

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Fig. 15

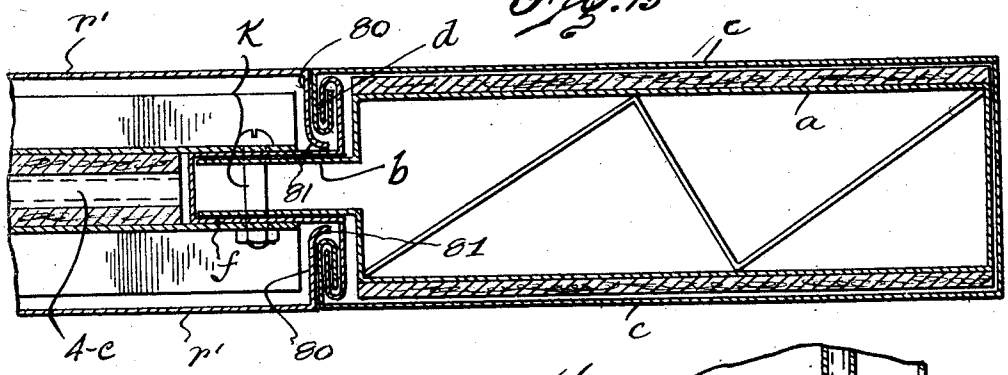
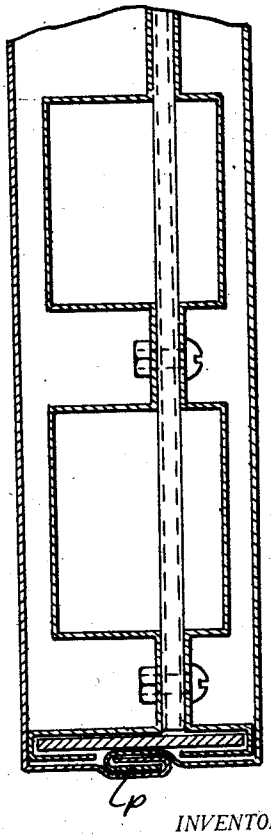


Fig. 16



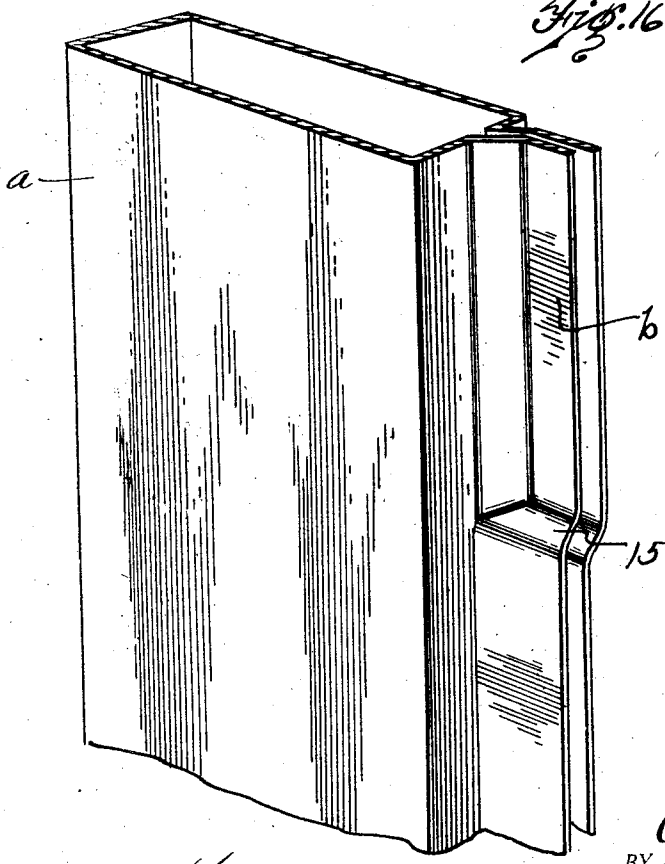


Fig. 17

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DOOR CONSTRUCTION

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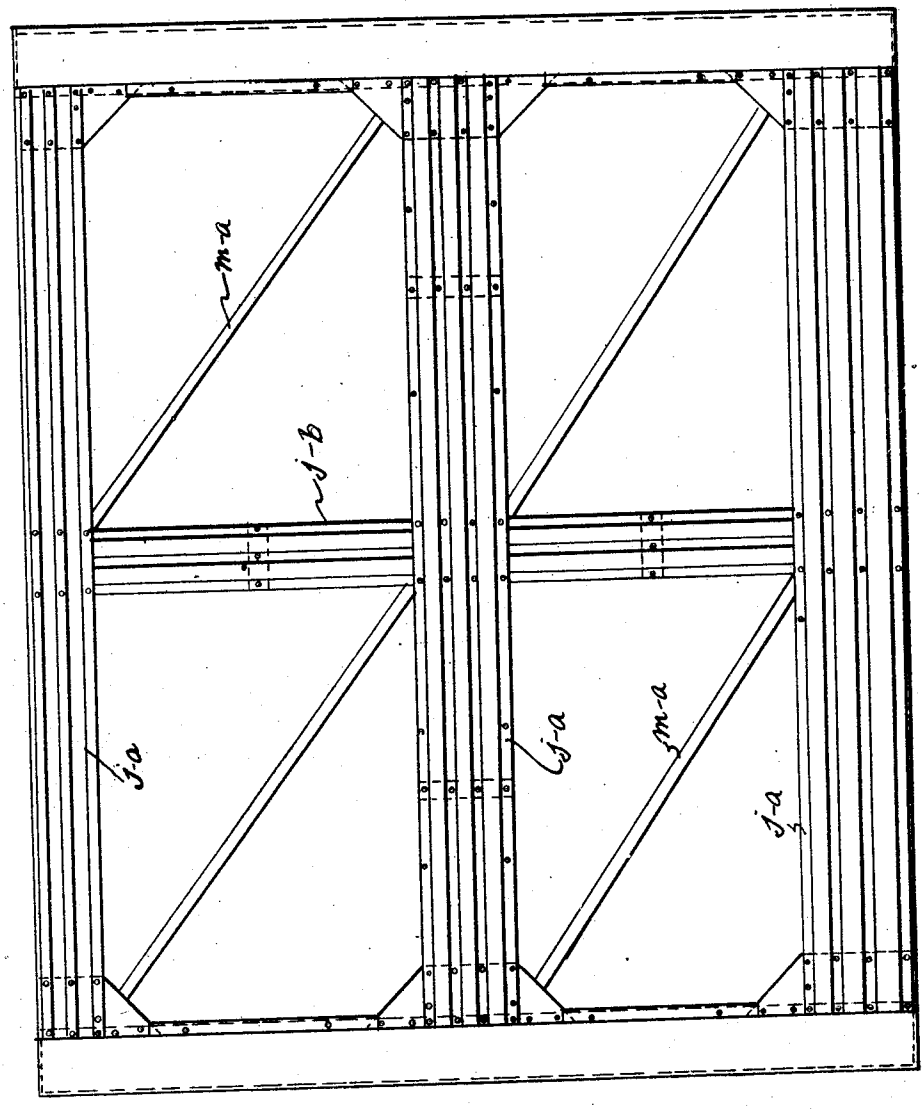


Fig. 18

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DOOR CONSTRUCTION

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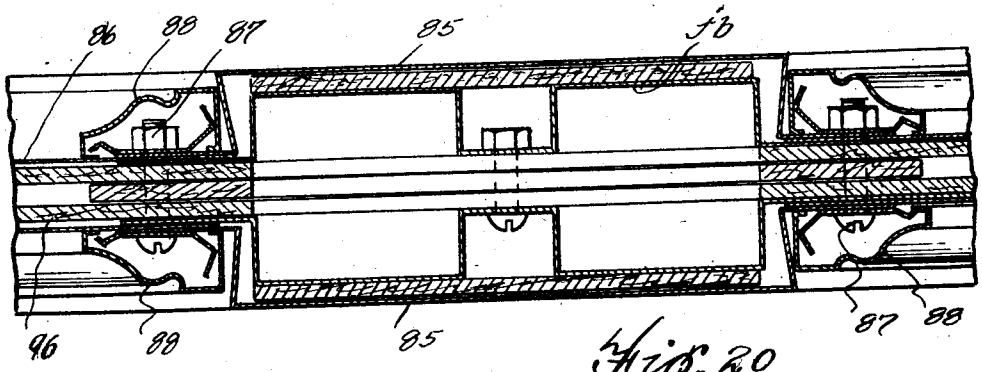


Fig. 20

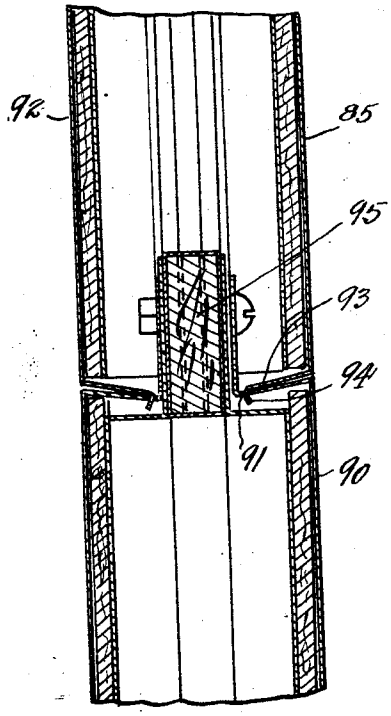


Fig. 21

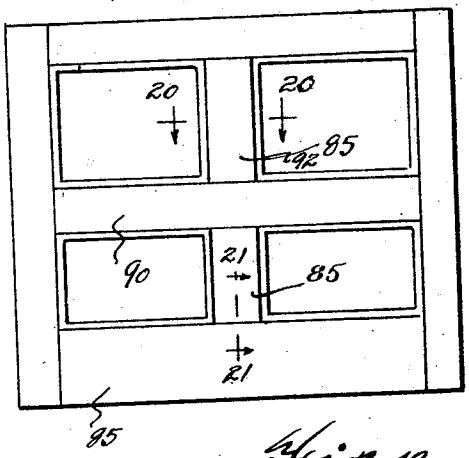


Fig. 19

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UNITED STATES PATENT OFFICE.

CHRISTIAN YOUNG, OF DETROIT, MICHIGAN.

DOOR CONSTRUCTION.

Application filed July 16, 1925. Serial No. 44,084.

This invention relates to a door construction, and more particularly to a door which is commonly known as a fire-proof door. This term "fire-proof" is only a relative one, as such doors, known as fire-proof doors, merely serve as fire retarders; that is, they retard the fire from breaking through the door for a considerable length of time, though if these doors are exposed to an intense heat for a long period of time they will finally break down.

It is the object of this invention to so construct a door as to prolong the usefulness of the door when the same is exposed to an intensive heat. This result is preferably obtained by building a double door structure which is permitted to have relative movement between the parts, thereby allowing the outer part of the door adjacent the hot or intense heat to expand and warp without affecting the inner door construction. This inner door structure, of course, will in time give way, but due to the fact that it is protected first by the outer door, and secondly, by the insulation which may be interposed between the two door structures, its life is very much prolonged. This inner door structure will probably not be heated to such an extent as to cause the same to warp or distort until the outer door structure is broken down.

A further object is the provision of an air passageway through the door structure which permits the circulation of the air through the interior of the door, thus serving to cool the inner door structure and prolong the life of the door.

An advantage of this construction is that the door, comprising inner and outer door structures, is very easily assembled as the different parts are arranged to fit with each other in such a way as to permit a bolt to tie the same all together.

In the drawings:

Fig. 1 is an elevation of a door provided with solid metal panels.

Fig. 2 is an elevation of the door in which the upper half is provided with a glass panel.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is an elevation of the door structure with the panels removed.

Figs. 5 and 6 are sectional views taken on the lines 5—5 and 6—6 of Fig. 2.

Fig. 7 is a partial elevation of the door construction which shows the inner door frame where a glass panel is incorporated in the upper portion of the door.

Figs. 8 and 9 are sectional views taken on the lines 8—8 and 9—9 of Fig. 2, respectively.

Fig. 10 is a perspective view of the gusset member included in the inner door structure, showing the vent openings which permit air to enter into the interior of the door posts.

Fig. 11 is a sectional view through a frame member of the outer door post.

Fig. 12 is a sectional view of a locking strip.

Fig. 13 is a section through the frame member of one of the inner door posts showing the reinforcements.

Fig. 14 is a sectional view showing the reinforcements incorporated between the inner and outer door structures for supporting hardware secured to the door at this point.

Fig. 15 is a sectional view taken on the line 15—15 of Fig. 2.

Fig. 16 is a section view on the line 16—16 of Fig. 2.

Fig. 17 is a perspective view of a portion of the frame of the inner door post.

Fig. 18 is a view in elevation of the inner door structure of a large size door.

Fig. 19 is a view in elevation of a completed large size door.

Fig. 20 is a section taken on the line 20—20 of Fig. 19.

Fig. 21 is a section taken on the line 21—21 of Fig. 19.

This door is built preferably out of relatively thin gauge sheet metal and is built as a double door with independent inner and outer door structures.

The inner door frame is preferably constructed of a plurality of hollow rectangular frame members *a* provided with reinforcements 20 and which I term the inner door post. These frame members are folded and bent so as to provide the flanges *b* which are spaced as shown in Figs. 13 and 3. These hollow frame members extend vertically and serve as vertical door posts for the inner door structure. Fitted over this inner door post of the inner door structure is another rectangular hollow member *c* which is provided with the inwardly turned back flanges *d*; I preferably term this the outer door post. Asbestos or other insulating material, *e*, is fitted between the walls of these two

frame members and serves to provide a better insulation between the two door posts than could be had by merely an air space. Preferably the asbestos is cemented to the outside of frame members *a* (see Fig. 13).

In order to secure these two frame members together and to lock the same in spaced relation with each other, I provide a channeled locking strip *f* (see Figs. 3, 4 and 12) which is provided with the turned over flanges *g* arranged to interlock with the turned over flanges *d* carried by the outer frame member or outer door post *c*. As shown in Fig. 4 these channeled locking strips are made in sections and of various lengths. Some of these locking strips, as shown in Fig. 10, are provided with an extended web portion *h*, while the others are provided with short web portions *i*. These locking strips are attached to the outer door post as above described, the different sections being fitted together as shown in Fig. 4, which provides deep webs at the top and bottom and the middle point serving as gussets and with small or shallow webs in between. The inner door post is preferably assembled to the outer door post after the locking strips have been secured thereto by simply sliding the inner post in lengthwise into the outer post.

Fig. 4 shows an inner door structure which is built specially for a door having no glass panels. When a glass panel is incorporated in the upper part of the door these deep web portions *h* are omitted at the top of the door and the deep web at the middle point of the door is cut off square on one end, as the glass is square and must fit in the panel and not be obstructed by a gusset member, (see Fig. 7).

In a door structure, as shown in Fig. 4, I construct two of these door posts which are identical in form, but one is a right-hand post and the other is a left-hand post. To connect these door posts I provide the cross beams *j*, preferably in pairs at the top and bottom and the middle point. These cross beams are folded as clearly shown in Fig. 9, into grooves and ridges for materially strengthening the same, and are bolted to the posts by means of the bolts *k* which pass through these cross beams and the web portions of the channeled locking strips *h*. Also as shown in Fig. 16 it will be seen how some of the bolts *k* pass through the flanges *b* carried by the inner frame member as well as through the web of the locking strips. The diagonal braces *m* may be utilized for further reinforcing the door structure. It will be noticed that where the channeled locking strips are chamfered off as at *n* (Figs. 4 and 10) there is provided an air opening *o* which permits air to enter into the interior of the door posts. It will be noticed that these air openings occur at the corners of the door structure, and this permits a complete circulation of air through the posts. Also these openings permit the diagonal braces to enter into the interior of the door posts to be secured to the posts by the bolts *k*—*a*.

The inner door structure is now complete and the outer door structure is assembled to this inner door structure in a way that will now be described. The outer frame member *c* is in reality a part of the outer door structure, although it is first assembled to the frame members *a*, while the inner door structure is being built. The top and bottom of these door posts are constructed as shown in Fig. 16, where the outside walls of the outer frame member are bent over at the top and bottom, the meeting edges being lock-seamed together as at *p*.

The next step in the assembly of the door is the securing of the metal rail *r* to this inner door structure (see Fig. 2). In the detailed sectional views, Figs. 5, 8 and 9, I show a door which is provided with a glass panel *t* in the upper half. This necessitates a slightly different construction than if all metal panels are used. Refer to Fig. 15. Fitted over the top cross beam *j* is a rail structure made up of the two rail sections *r'* joined together on the inside by the channeled locking strip *u*, which is constructed somewhat similar to the locking strips *f*, but as shown in Fig. 5, it will be seen that the web *v* is offset from the center line and also carries the relatively heavy reinforcing strip *w* which is bolted or riveted to the strip. The locking strip *u* is also provided with the turned back flanges which interlock with the turned back flanges carried by the rail sections *r'*, as shown at *x* (Fig. 5). These rail sections *r'* are connected together first by the locking strip *u* forming a U-shaped panel structure and then slipped over the top cross beam *j*, the upper free edges of said rail sections *r'* being turned over and interlocked together as at *y*. This will securely lock this rail structure to the inner door structure and hold the same in spaced relation therewith as the hollow rail *r* fits closely over the lower portions *v*—*a* of the cross beams *j*, which are spaced apart.

In Fig. 5 I show a reinforcement strip 1 which extends along the top of the door and is supported by the turned out portions 2 of the cross beam *j*. It will be noticed that this reinforcement strip is practically as wide as the door is thick, and of course it will properly space the rail sections *r'* with respect to the cross beam of the inner door.

The rail sections 3 (see Fig. 9) are secured over the cross beam *j* at the middle point of the door in a somewhat similar manner, the difference being that the free edges of said rail sections are not lock-seamed together as at the top of the door,

but are folded in along one edge, here shown along the bottom edge, to provide the flanges 4 lying in the plane of the door, but set in from the face of the door. The panels 4^a are slipped in between these flanges 4 and the portion *v—a* of the cross beam *j*. The moulding lock strip 5 is assembled therewith on both sides of the door and the bolts *s* are passed through these locking strips 5, flanges 4, panels 4^a of the rail sections and the cross beam *j*, and when these bolts are tightened down all these members are secured together. I provide two panels 4^a which are spaced apart, each lying adjacent to one of the cross beams *j*, the spaced cross beams thereby spacing the panels. Preferably I put in the space between the panel 4^a, asbestos or other suitable insulation 4^b and preferably provide an air space 4^c between the two panels. These moulding lock strips 5 serve merely to provide means by which the moulding 6 may be secured to the door. These mouldings serve only as decorative parts of the door, and with the construction shown here, these mouldings are very easily assembled to the door.

Where a glass panel is used, I provide a different means for securing the moulding about the glass panel. This is clearly shown in Figs. 8, 5 and 9, and show a combination window channel and moulding. The same is made in two parts—one part positioned on one side of the window and the other part positioned on the opposite side of the window. One of these moulding strips designated 7 is adapted to be secured to the door by driving the flange 8 carried by the moulding strip in between the turned-in flange of the panel section 3 and the reinforcing strip *w*. When this moulding strip is driven home it will be noticed that the inner end of this flange 8 is bent over as at 9, which of course, securely locks the moulding in place. The other moulding 7^a on the opposite side of the window is secured in a very similar manner and the inside edge of said moulding strip is turned back against the glass and then under the edge of the glass as at 10^a, where it will engage under the flange 10 carried by the first mentioned strip. The glass is fitted in the channel formed by these moulding strips, but the glass may be readily removed if it becomes broken by prying out and removing these moulding strips. Fig. 8 shows a slightly different construction, in which the same principle is employed with only minor structural changes.

In Fig. 6 I show a section through a part of the glass portion of the door which shows how the glass may be divided into smaller panels. This shows a moulding and channel member formed of two parts 11 and 12. When these are bolted together by means of the bolt 13 they provide a channel for receiving the glass panels and also serve as an ornamental moulding.

Fig. 17 shows how the flanges *b* are offset as at 15 so as to enable the assembly of a glass panel in the upper half of the door, and a metal panel in the lower half of the door.

At any point where it is desired to secure some hardware, such as hinges, locks or knobs I preferably reinforce the door. It is my purpose to make the inner door structure of great strength and to simply provide an outer door structure which may be secured thereto in spaced relation for protecting the inner door structure and preventing fire from reaching the same until it first breaks down the outer door structure. However, if this outer door structure were secured to the inner door structure rigidly it would become warped and distorted when the outer door structure warps and distorts when exposed to the heat. As I carry the hinges on the inner door structure it is quite essential that this inner door should not warp or distort or be prevented from doing so for as long a time as is possible, as the longer the inner door structure stands up the longer the door will block the travel of the flames.

Fig. 14 shows how the metal plate 21 may be placed in between the two shell structures where it is desired to secure a lock or other hardware to the door. This prevents the bending or springing of the thin metal panel of the door when fastening the lock or other hardware thereto. Fig. 3 shows a hinge 22 secured to the inner door structure, the said inner door structure being reinforced by a plate 23 and the outer shell provided with an opening 24 which permits this hinge to pass through.

To obtain a relative movement between the outer and inner door structures I so secure the same together as above described as to provide a slight clearance at the joints. For example, Fig. 3 shows how the channeled locking strip *f* and the outer shell *c* of the door posts are connected together by a lock seam joint. There is sufficient clearance in this lock seam joint so as to allow room for the outer shell to expand without pulling on the inner door structure. In fact, the actual door is so designed as to provide sufficient clearance to allow for a movement of approximately $\frac{3}{32}$ of an inch of the outer door with respect to the inner door. The clearance in the lock seam joint on both sides of the door permits this relative movement, and all this clearance is taken up before any strain is placed on the inner door. In addition there is clearance between the bolt holes and bolts which secure the outer panels in place, thus permitting relative movement at this point. As the metal in the outer shell expands, the bolt holes enlarge

and provide more clearance which permits more expansion or relative movement between the parts.

It will thus be seen that as the temperature on one side of the door rises the metal of the outer door structure expands due to this heat, and sufficient clearance has been provided for in the construction of the door and in the joints between the inner and outer door structures so as to permit the outer door structure to become extremely hot before any real pull or stress is transmitted to the inner door structure. It is believed that such a door construction in which there are provided two door structures, an inner door structure entirely enclosed by an outer door structure, the said outer door structure permitted to have relative movement with respect to the inner door structure, is an aid in prolonging the life of the door. This is due primarily to the fact that the inner door structure is protected and insulated from the heat and also is so connected to the outer door structure that any warping of the outer door structure is not transmitted immediately to the inner door structure. Such warping of the outer door structure which is due to the expansion is considerable before it begins to affect the inner door structure. The door is supported by hinges carried by the inner door structure so the distorting of the outer door structure will not weaken the door support until the distortion begins to affect or warp the inner door structure.

If desired. I may enlarge on this plan and construct a door having a larger width than the one shown in Fig. 4. Figs. 18 to 21 show such a door and I here construct a door provided with end posts and intermediate vertical posts, connected together by the cross beams *j*—*a* and braces *m*—*a*. Obviously, I could have more than one intermediate post, depending upon the width of the door required. I prefer to construct the intermediate posts similar to the cross beams *j*—*a*. The panels would be secured in place the same way as before.

The essential feature governing the large door is that the great width should be properly braced so that the door will not bow or bend. To obtain this end, I provide as many reinforcing beams *j*—*a* as is necessary and that portion of the door between the two end posts is assembled in the same manner as described in assembling the two posts in the narrow door. It is quite obvious that such a principle as outlined above which provides a double door structure, consisting of an inner and outer door structure, and which structures have relative movement with respect to each other, could readily be incorporated in a wide door as well as in a narrow door.

To summarize, I provide a door serving as a fire retardant comprising inner and outer door structures, which are secured together in spaced relation with respect to each other. The door structures are properly insulated from each other and are secured together with sufficient clearance so as to permit relative movement to allow the outer door structure to warp or distort within certain limits without warping or distorting the inner door structure.

Another feature of this construction is that I may use copper, bronze or other metals in my outer door structure. These metals or other alloys which might be used are not required to carry any of the strain of the door support, since the inner door structure is built to carry the load. As a result I am permitted to have a wide range in selecting the kind of metal used in the outer door structure.

Preferably I use the fillers 100 to fill up the space inside of the web in the locking strips, see Fig. 3. These fillers comprise a strip of wood 101 enclosed by the metal sheathing 102. When such a filler is exposed to fire the wood simply chars and does not blaze.

The rails are secured to the adjacent outer post. Fig. 15 clearly shows this. This shows the rail section *r'* turned in as at 80, and which is forced inwardly and is bent over as at 81 in behind the lockseam joint which secures the outer panel *c* of the door post to the locking strip. In this way all the outer panels, rail sections and outer post panels are secured to each other.

In Figs. 19 to 21 inclusive I show details of the assembly of the panels in the large size door. Refer to Fig. 20 which is a horizontal section through one of the intermediate door posts. This intermediate door post is similar in cross section to the cross beams *j* and is designated *j*—*b*. The intermediate door post panels 85 are bent inwardly and then flanged outwardly in the plane of the door, each forming substantially a U-shaped panel structure. The outer flange of these post panels 85 are secured to the panels 86 and to the posts *j*—*b* by means of the bolts 87. Moulding strips 88 are secured to the door structure the same way as the moulding strips in the narrow panel door. Fig. 21 shows the construction at the inter-section between the intermediate door post and cross beam *j*—*a*. The outer rail sections which enclose the cross beam *j*—*a* are similar in cross section to the post panel 85, and are designated 90. Each rail section 90 preferably extends from one side of the door to the other between the two side door posts and is provided with a slot 91 at the center having a width approximating the width of the intermediate door post *j*—*b*. The post panels 85 which enclose this intermediate door post are bent in as at 93 and are provided with

the turned out lip 94 which when the post panel 85 is forced in, is arranged to spring in the slot 91 and thus secure the post panel 85 in place. The fillers 95 are used to space the two metal forms which when secured together, form the intermediate door post. Asbestos sheets 96 are also assembled between the inner and outer door structures, as in the narrow door for the purpose of insulating the two structures.

What I claim is:

1. A door for the purpose specified, comprising two independent self-supporting spaced door structures, one of which is located within the other.

2. A door for the purpose specified, comprising inner and outer door structures secured together by joints which permit the structures to have a limited relative movement bodily in all directions with respect to each other.

3. A door for the purpose specified, comprising a metal inner door structure, and a separate metal outer door structure complete in itself enveloping said inner door structure and which is secured thereto.

4. A door for the purpose specified, comprising an inner metal door structure, and an outer door structure enveloping said inner door structure and secured thereto, to permit a limited relative movement bodily in all directions between said door structures.

5. A door for the purpose specified, comprising two separate self-contained sheet metal structures secured together one within the other.

6. A door for the purpose specified, comprising two separate self-contained sheet metal door structures secured together in spaced relation one within the other.

7. A door for the purpose specified, comprising an inner reinforced sheet metal door structure, and an outer sheet metal door structure, said door structures secured together in spaced relation, one within the other but arranged to have a limited relative movement with respect to each other.

8. A door for the purpose specified, comprising two independent self-contained and self-supporting metal door structures secured together in spaced relation one within the other, and insulation material located between said door structures.

9. A door for the purpose specified, comprising two independent sheet metal door structures secured together one within the other and permitted to have a limited relative movement with respect to each other, the inner door structure arranged to carry the door hinges for supporting the door, thereby permitting the outer door structure to warp or expand relative to the inner door structure.

10. A door for the purpose specified, comprising two independent sheet metal door structures secured together one within the other and permitted to have a limited relative movement with respect to each other, the inner door structure provided with reinforcements at the point of attachment of hardware fixtures.

11. A door for the purpose specified, which comprises an inner door structure which includes a door post provided with spaced flanges along the inside edge, and an outer door structure which includes a door post open along the inside edge to permit the spacing flanges carried by the inner door post to project therethrough, a locking strip provided with a hollow web arranged to fit over said spacing flanges and secured to the free edges of said outer door post to close the opening in the door post of the outer door structure, and a panel secured to the web portion of said locking strip.

12. A door for the purpose specified, which comprises an inner door structure having an inner door post, an outer door structure which includes an outer door post which encloses the inner door post, a panel, and locking means for securing the outer door post and panel together and to the inner door post but permitting relative movement therebetween.

13. A door for the purpose specified, which comprises an inner door structure, and an outer door structure which includes a door post and panel, and means for loosely joining said door post and panel together but which permits relative movement therebetween.

14. A door for the purpose specified, which comprises an inner door structure, and an outer door structure which includes a door post and panel, and a locking strip having a relative loose lock seam connection with said door post and secured to said panel for the purpose of tying the panel and door post together but permitting relative movement therebetween.

15. A door for the purpose specified, comprising an inner door structure which includes inner door posts and cross beams connecting the posts and both formed of sheet metal and an outer door structure which includes sheet metal door posts and panels joined together and to said inner door structure and enclosing the same and which are permitted to move bodily relative to said inner door structure and to each other.

16. A door for the purpose specified, comprising an inner door structure which includes an inner door post provided with inwardly projecting spacing flanges and reinforcing cross beams, and an outer door structure which includes a panel and an outer door post arranged to be fitted over the inner door post and locking strips secured to said outer door post and provided with a

web fitting over said spacing flanges, said locking strips formed in sections, some of said sections having relative deeper web portions, the said cross beams secured to said deeper web portions and to the spacing flanges of said inner door post.

17. A door for the purpose specified having a glass panel, which includes inner and outer door posts, a locking strip for securing the inner and outer doors posts together and which permits relative movement therebetween, said locking strip provided with a reinforcing strip extending longitudinally thereof, and a combined moulding and window channel member secured to said door posts.

18. A door for the purpose specified, comprising an inner door structure which includes door posts and cross beams secured thereto, and an outer door structure, which includes sheet metal rails secured together along one edge and arranged to enclose said cross beams, the panels folded along their free edges over the cross beam and secured together.

19. A door for the purpose specified, comprising an inner door structure which includes door posts and cross beams secured thereto, and an outer door structure which includes sheet metal rails, a locking strip for tying a pair of said rails together in spaced relation along one edge to form a rail structure substantially U-shaped in cross section and arranged to be fitted over one of said cross beams, and the free edges of said U-shaped rail structure folded on over the cross beam and secured together to enclose the cross beam of said inner door structure, and means for securing said U-shaped rail to a next adjacent panel.

20. A door for the purpose specified, comprising an inner door structure which includes door posts and cross beams secured thereto, and an outer door structure composed of sheet metal panel strips, locking strips each tying the panel strips together in pairs and in spaced relation along one edge to form rail structures substantially U-shaped in cross section and which are arranged to be fitted over the cross beams and folded in over the cross beams, the free edges of said U-shaped rail structures secured together to enclose said cross beams, said locking strips provided with projecting webs, and panels secured to said webs.

21. A door for the purpose specified comprising an inner door structure having inner door posts, and an outer door structure consisting of a plurality of panels and outer door posts secured together and to the inner door structure, said outer door posts enclosing said inner door posts while the panels span the gap between the door posts and are spaced apart to provide an air space, said door posts provided with air openings which connect the interior of the said inner door posts with the air space between the panels which permits the circulation of air through the interior of the door.

22. A fire door comprising an inner door structure and an outer door structure, means for locking the door structures together, this locking means consisting of joint forming members which permit relative movement between the inner and outer door structure.

23. A fire door comprising an inner and an outer door structure secured together in spaced relation, the inner door having an air space formed therein, and means permitting circulation of air from the interior of the inner door to the space between the two door structures.

24. A fire door comprising an inner door structure and an outer door structure, means for securing these doors together in spaced relation the said inner door structure being formed to provide an air chamber therein, a part of the said securing means being open to connect the space between the doors and the air space within the inner door to permit circulation of air.

In testimony whereof I have affixed my signature.

CHRISTIAN YOUNG.