March 8, 1966 G. R. BONZER 3,238,995

BUILDING STRUCTURE

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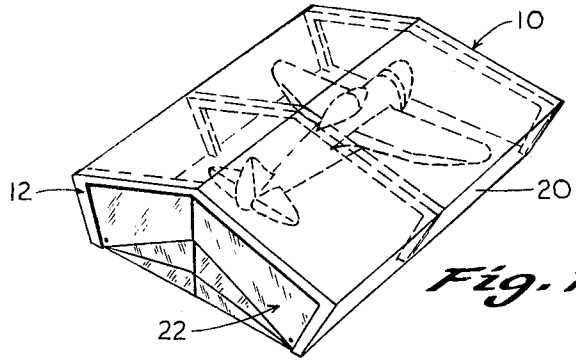


Fig. 1

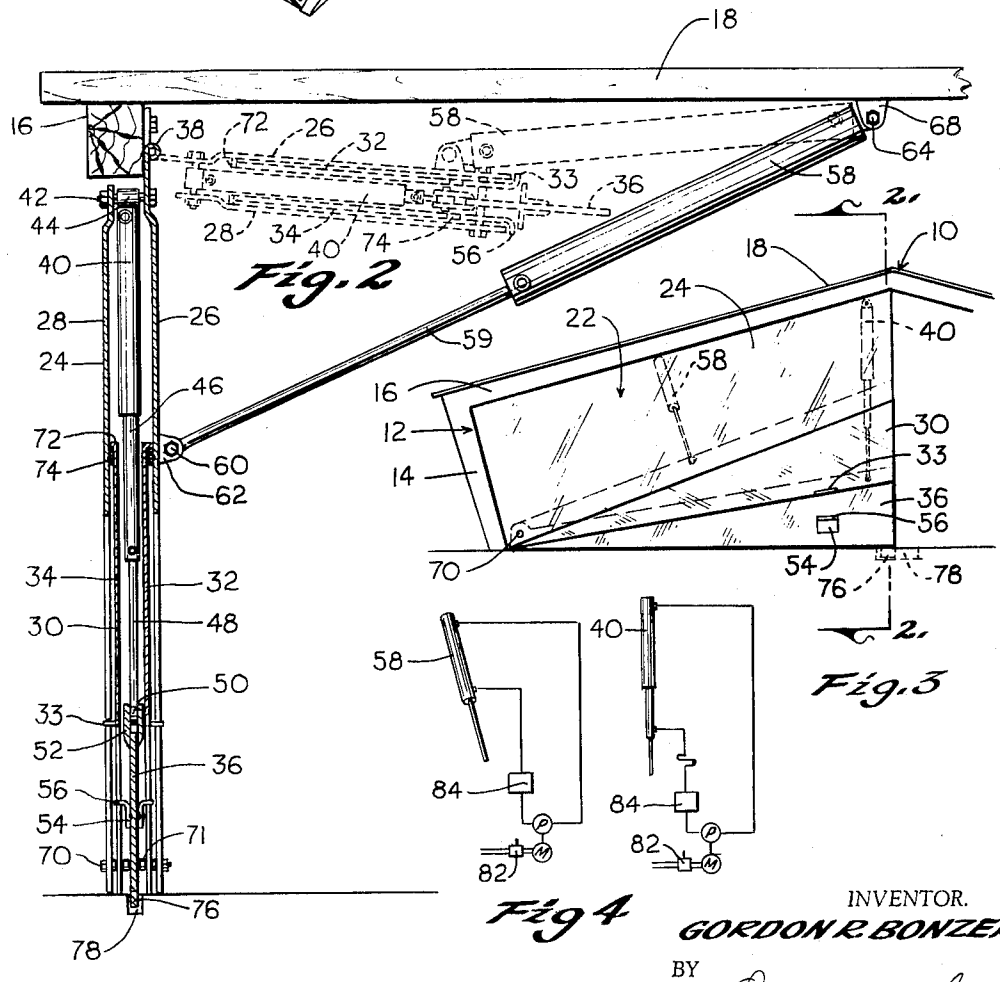


Fig. 2

Fig. 3

Fig 4

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BUILDING STRUCTURE

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The problem of providing doors for large buildings has always been difficult. Overhead doors have been devised but require numerous tracks, springs, etc. and require that a rectangular or square opening be utilized. Sliding doors have also been devised but these also require tracks, beams, etc. Sliding doors never seem to operate easily inasmuch as debris is always accumulating in the tracks or channels of the door. In addition, the suspension beams for the sliding doors detract from the appearance of the building in that the smooth lines of the building are broken up. Ordinary swinging doors have proven unsatisfactory for large buildings because of the difficulty in opening and closing these doors in a high wind.

The task of providing doors for airplane hangars raises additional problems than those listed above. The building height necessary to hangar an airplane is usually determined by the distance from the ground to the upper tip of the propeller when in a vertical position or to the upper tip of the tail assembly whichever is the greatest. The wing tips are usually located closer to the ground, therefore it would be wasted building space to build a hangar which is rectangular in cross-section. The ideal dimension or shape of an airplane hangar would be a peaked roof with said peak being slightly higher than the highest building dimension needed as hereinbefore determined. The roof would slope downwardly to wall portions which would be high enough to accommodate the wings of the airplane. By designing the building in this fashion much building material is thereby saved by elimination of wasted space. However, when a building is designed in this fashion the overhead door cannot be effectively utilized and a sliding door will be irregular in shape and when opened cause a distracting appearance to the building. The ordinary swinging doors are unsatisfactory for the reasons mentioned above.

Therefore, one of the principal objects of the invention is to provide a building structure which will be suitable for hangaring an airplane.

A further object of the invention is to provide a door which may be opened or closed quickly and easily.

A further object of the invention is to provide a building structure which will be neat in appearance.

A further object of the invention is to provide a movable door which requires a minimum amount of space to be opened and closed.

A further object of the invention is to provide a door which may be opened or closed automatically.

A still further object of the invention is to provide a building structure which will be economical to manufacture, durable in use and refined in appearance.

These and other objects of the invention will be apparent to one skilled in the art.

This invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of the device with an airplane being hangared therein,

FIG. 2 is a cross-sectional view of the device as seen on line 2—2 of FIG. 3, at an enlarged scale illustrating the door means in a lowered and opened position,

FIG. 3 is a fragmentary front elevational view of the device, and

FIG. 4 is a schematic drawing of the means for operating the movable doors in the structure.

I have used the numeral 10 to generally designate a building. Building 10 includes a plurality of supporting beams 12. Supporting beam 12 is comprised of opposite wall members 14 and rafter members 16. Roof 18 is secured to rafter members 16 while sides 20 are secured to wall members 14.

In FIG. 3 rafter member 16 is shown to extend from wall member 14 at a right angle. Applicant has found this structural arrangement to be ideally suited for the type of doors hereinafter described but a different angle than that shown will also work satisfactorily. Building 10 has at least one end thereof which is capable of being opened and is accomplished by means of a pair of movable doors 22. Movable door 22 is comprised of an upper door member 24 which includes vertically disposed flat members 26 and 28. Movable door 22 is also comprised of an intermediate door member 30 which includes vertically disposed flat members 32 and 34 and are adapted to be slidably embraced within door member 24. Movable door 22 is also comprised of a lower door member 36 which is adapted to be slidably embraced by door member 30. Flat member 26 of door member 24 is somewhat wider than flat member 28 and is adapted at its upper end to form hinge 38 which is secured to rafter member 16 by any convenient means. Door members 24, 30 and 36 are pivotally secured together at their lower outside ends with respect to building 10 by means of pin 70 extending through door member 24, 30 and 36 and spacers 71. Lower door member 36 is comprised of a flat member 54 with a flange member 56 extending at right angles from both sides of flat member 54. The lower inside edge of flat member 54 is provided with an elongated portion 75 adapted to extend downwardly into groove 78 in the floor of building 10 to act as a means for limiting inwardly or outwardly movement of the movable door 22 when in a closed position. The upper end of flat member 54 is provided with bracket 52 located intermediate its length. Flat members 32 and 34 of intermediate door member 30 have a flange 33 which extends outwardly from the bottom edge of flat members 32 and 34 at a point intermediate their length and in the pivotal path of flange 56 of flat member 54. The upper edges of flat members 32 and 34 each have flanges 72 extending outwardly at a right angle thereto. Flanges 72 are located intermediate the length of member 30 and are adapted to engage stop elements 74 which are secured to the inner surfaces of members 26 and 28. The engagement of flanges 72 with stop elements 74 limits the downwardly movement of intermediate door 30 when movable door 22 is in a closed position.

A telescopic hydraulic cylinder 40 is vertically disposed between flat members 26 and 28 and is secured to the upper end of door member 24 by means of a bolt 42 extending through flat members 26 and 28 and eyelet portion 44 of cylinder 40. Cylinder 40 has a first telescopic rod member 46 which is capable of extending downwardly between flat members 32 and 34 of intermediate door member 30. A second telescopic rod member 48 extends downwardly from telescopic rod member 46 and is adapted at its lower end to be secured to lower door member 36 by means of a bolt extending through eyelet 50 of rod member 48 and bracket 52 of door member 36.

A second hydraulic cylinder 58 is pivotally secured at one end to the outer surface of flat member 26 by means of bolt 60 extending through bracket 62 and the eyelet of rod member 59 of cylinder 58. Cylinder 58 is hingedly secured at its other end to building 10 by means of a bolt 64 extending through bracket 68 and the eyelet of cylinder 58.

In FIG. 4 the numeral 82 represents a two-way switch. The letters M and P represents an electric motor and hydraulic pump respectively. An oil reservoir 84 is present in both systems. The operation of the cylinders and associated apparatus is in the ordinary manner.

The normal method of operation of the doors is as follows: Hydraulic cylinder 40 is activated which causes the telescopic rod member 48 to move upwardly. As member 48 moves upwardly, elongated portion 76 withdraws from groove 78 and lower door member 36 pivots upwardly about pin 70. As door member 36 slidably moves upwardly within door member 30, flange members 56 engage flanges 33 of intermediate door 30 which causes door member 30 to be pivoted about pin 70 also. When telescopic rod member 48 has reached its maximum withdrawal, rod member 46 will continue to move door member 36 upwardly. When flanges 33 of members 32 and 34 engage flat members 26 and 28 of door member 24 the door has been raised upwardly as much as is possible. Hydraulic cylinder 58 is then activated and cylinder rod 59 is drawn into cylinder 58. This causes door members 24, 30 and 36 to be hingedly moved upwardly and inwardly from the door opening until said door members are substantially horizontal. The method of closing movable door 22 would be exactly like the foregoing steps but in the reverse order.

The foregoing has described the door opening process as if separate switches on each hydraulic cylinder were utilized. It is possible for cylinders 40 and 58 to be controlled by a central control means thereby providing for a more automatic door opening process.

Thus from the foregoing it is seen that the invention accomplishes at least all of its stated objectives.

Some changes may be made in the construction and arrangement of my building structure without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In a door structure,
a supporting means,
a plurality of movable doors hingedly secured to said supporting means,
said movable doors each having an upper door member, an intermediate door member slidably embraced within said upper door member and a lower door member slidably embraced within said intermediate door member,
said upper door member comprised of a pair of vertically disposed flat members,
said intermediate door portion comprised of a pair of vertically disposed flat members,
said lower door member comprised of at least one flat member,
a first hydraulic cylinder disposed within said upper and intermediate door portions,
said first telescopic hydraulic cylinder being secured at its upper end to said upper door,
said first hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,
a second hydraulic cylinder being pivotally secured at one end to the inside surface of said upper door member,
said second hydraulic cylinder being pivotally secured at its other end to said supporting means,
and a means for normally operating said hydraulic cylinders.

2. In a building structure,
a building,
said building having at least one normally open end,
a pair of movable doors hingedly secured to said building at its open end,
said movable doors each having an upper door member; an intermediate door member pivotally slidably embraced within said upper door portion; and a lower door member pivotally slidably embraced within said second door member,
said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper end of said upper door member and extending to the roof of said building,
said door members being pivotally secured together at their lower outer edges by means of a pin extending through said door members,
said upper door member comprised of a pair of vertically disposed flat members,
said intermediate door member comprised of a pair of vertically disposed flat members,
said lower door member comprised of at least one flat member,
a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its inner edge with respect to said building,
said telescopic hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,
said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,
a second hydraulic cylinder being pivotally secured at one end to said upper door member and pivotally secured at its other end to the ceiling of said building,
and a means for normally operating said hydraulic cylinders.

3. In a building structure,
a building,
said building having at least one normally open end,
a pair of movable doors hingedly secured to said building at its open end,
said movable doors each having an upper door member; an intermediate door member pivotally slidably embraced within said upper door portion; and a lower door member pivotally slidably embraced within said second door member,
said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door member and extending to the roof of said building,
said door members being pivotally secured together at their lower outer edges by means of a pin extending through said door members,
said upper door member comprised of a pair of vertically disposed flat members,
said intermediate door member comprised of a pair of vertically disposed flat members,
said lower door member comprised of at least one flat member,
a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its inner edge with respect to said building,
said telescopic hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,
said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,
a second hydraulic cylinder being pivotally secured at one end to said upper door member and pivotally secured at its other end to the ceiling of said building,
said lower door member having at its lower inner end an elongated member extending downwardly at a right angle to the bottom edge of said lower door member, said elongated member adapted to engage a door stop groove in the floor of said building,
and a means for normally operating said hydraulic cylinder.

4. The structure of claim 3 wherein said means for normally operating each of said hydraulic cylinders in-

cludes a two-way switch, an electric motor, an oil pump and an oil reservoir.

5. In a building structure,
a building,
said building having at least one normally open end,
a pair of movable doors hingedly secured to said building at its open end,
said movable doors each having an upper door member; an intermediate door member pivotally slidably embraced within said upper door portion; and a lower door member pivotally slidably embraced within said second door member,
said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door member and extending to the roof of said building,
said door members being pivotally secured together at their lower outer edges by means of a pin extending through said door members,
said upper door member comprised of a pair of vertically disposed flat members,
said lower door member comprised of at least one flat member,
a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its inner edge with respect to said building,
said telescopic hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,
said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,
a second hydraulic cylinder being pivotally secured at one end to said upper door member and pivotally secured at its other end to the ceiling of said building,
said lower door member having at its lower inner end an elongated member extending downwardly at a right angle to the bottom edge of said lower door member, said elongated member adapted to engage a door stop groove in the floor of said building,
a flange extending at a right angle from both sides of lower door member intermediate its length,
a flange extending outwardly at right angles to said flat members of said intermediate door member along the lower edge thereof and in the pivotal path of said flange on said lower door member,
a flange extending outwardly at right angles to the upper portion of said flat member of said intermediate door member intermediate its length,
a pair of rectangular stop elements secured to the inside surface of said flat members of said upper door member in the pivotal path of the uppermost flanges of said intermediate door member,
and a means for normally operating said hydraulic cylinders.

6. In a building structure,
a building,
said building comprised of a plurality of supporting beams,
said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,
said building having at least one normally open end,
a plurality of movable doors hingedly secured to said rafter members,
said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,
said upper door portion comprised of a pair of vertically disposed flat members,

said intermediate door portion comprised of a pair of vertically disposed flat members,
said lower door portion comprised of at least one flat member,
a plurality of hydraulic cylinders secured to said movable doors,
a telescopic hydraulic cylinder vertically disposed within said upper and intermediate door members,
a second hydraulic cylinder pivotally secured at one end to the outside surface of said upper door member,
said second hydraulic cylinder being pivotally secured at its other end to said building,
and a means for normally operating said hydraulic cylinders.

7. In a building structure,
a building.
said building comprised of a plurality of supporting beams,
said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,
said building having at least one normally open end,
a plurality of movable doors hingedly secured to said rafter members,
said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,
said upper door portion comprised of a pair of vertically disposed flat members,
said intermediate door portion comprised of a pair of vertically disposed flat members,
said lower door portion comprised of at least one flat member,
a plurality of hydraulic cylinders secured to said movable doors,
a telescopic hydraulic cylinder vertically disposed within said upper and intermediate door portions,
said telescopic hydraulic cylinder being secured at its upper end to said upper door,
said telescopic hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,
a second hydraulic cylinder being pivotally secured at one end to the outside surface of said upper door member,
said second hydraulic cylinder being pivotally secured at its other end to said building,
and a means for normally operating said hydraulic cylinders.

8. In a building structure,
a building,
said building comprised of a plurality of supporting beams,
said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,
said building having at least one normally open end,
a plurality of movable doors hingedly secured to said rafter members,
said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,
said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door portion and extending to said rafter member of said building,

said door portions being pivotally secured together at their lower outer edges with respect to said building by means of a pin extending through said door portions,

a plurality of hydraulic cylinders secured to said movable doors,

and a means for normally operating said hydraulic cylinders.

9. In a building structure,

a building,

said building comprised of a plurality supporting beams,

said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,

said building having at least one normally open end,

a plurality of movable doors hingedly secured to said rafter members,

said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,

said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door portion and extending to said rafter member of said building,

said door portions being pivotally secured together at their lower outer edges with respect to said building by means of a pin extending through said door portions,

a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its inner edge with respect to said building,

said telescopic hydraulic cylinder being secured at its lower end to uppermost portion of said lower door portion,

said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,

a second hydraulic cylinder being pivotally secured at one end to said upper door portion and pivotally secured at its other end to a rafter member of said supporting beam,

and a means for normally operating said hydraulic cylinders.

10. In a building structure,

a building,

said building comprised of a plurality of supporting beams,

said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,

said building having at least one normally open end,

a plurality of movable doors hingedly secured to said rafter members,

said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,

said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door portion and extending to said rafter member of said building,

said door portions being pivotally secured together at their lower outer edges with respect to said building by means of a pin extending through said door portions,

a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its inner edge with respect to said building,

said telescopic hydraulic cylinder being secured at its lower end to uppermost portion of said lower door portion,

said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,

a second hydraulic cylinder being pivotally secured at one end to said upper door portion and pivotally secured at its other end to a rafter member of said supporting beam,

said lower door member having at its lower inner end an elongated member extending downwardly at a right angle to the bottom edge of said lower door member, said elongated member adapted to engage a door stop groove in the floor of said building,

and a means for normally operating said hydraulic cylinder.

11. The structure of claim **10** wherein said means for normally operating each of said hydraulic cylinders includes a two-way electrical switch, an electric motor, an oil pump and an oil reservoir in combination.

12. In a building structure,

a building,

said building comprised of a plurality of supporting beams,

said supporting beams each having a pair of opposite wall members with a rafter member extending at right angles from the uppermost inner surface of each of said wall members, said rafter members forming an obtuse angle at their juncture,

said building having at least one normally open end,

a plurality of movable doors hingedly secured to said rafter members,

said movable doors each having a first upper door portion, a second intermediate door portion slidably embraced within said first door portion, and a lower door portion slidably embraced within said intermediate door portion,

said movable doors hingedly secured to said building by means of a hinge secured to the upper end of said upper door portion and extending to said rafter member of said building,

said door portions being pivotally secured together at their lower outer edges with respect to said building by means of a pin extending through said door portions,

a telescopic hydraulic cylinder vertically disposed within said upper door member adjacent its innner edge with respect to said building,

said telescopic hydraulic cylinder being secured at its lower end to uppermost portion of said lower door portion,

said telescopic hydraulic cylinder being secured at its upper end to the upper portion of said upper door member,

a second hydraulic cylinder being pivotally secured at one end to said upper door portion and pivotally secured at its other end to a rafter member of said supporting beam,

said lower door member having at its lower inner end an elongated member extending downwardly at a right angle to the bottom edge of said lower door member, said elongated member adapted to engage a door stop groove in the floor of said building,

a flange extending at a right angle from both sides of lower door member intermediate its length,

a flange extending outwardly at right angles to said flat members of said intermediate door member along the lower edge thereof and in the pivotal path of said flange on said lower door member,

a flange extending outwardly at right angles to the upper portion of said flat members of said intermediate door member intermediate its length,

a pair of rectangular stop elements secured to the inside surface of said flat members of said upper door member in the pivotal path of the uppermost flanges of said intermediate door member,

and a means for normally operating said hydraulic cylinders.

13. In a building structure,

a building,

said building having at least one normally open end,

a plurality of movable doors hingedly secured to said building,

said movable doors each having at least an upper door member and a lower door member operatively slidably embraced within said upper door member,

said upper door member comprised of a pair of vertically disposed flat members,

said lower door member comprised of at least one flat member,

a first hydraulic cylinder disposed within said upper door member,

said first hydraulic cylinder being secured at its upper end to said upper door,

said first hydraulic cylinder being secured at its lower end to the upper portion of said lower door member,

a second hydraulic cylinder being pivotally secured at one end to said upper door member,

said second hydraulic cylinder being pivotally secured at its other end to said building whereby said movable door may be hingedly moved with respect to said building,

and a means for operating said hydraulic cylinders.

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