A door for hangars and other structures in which the door is made up of a plurality of sections with each section being comprised of slidably mounted panels guided in fixed and movable guide structures. The movable guide structures are mounted intermediate the length of the door and include telescopic parts which move with the panels to clear the door opening when the panels are elevated. The panels and movable guide structures are stored in the head frame of a door opening of any desired configuration. The construction permits the central portion of the door configuration to be of a greater elevation in the side portions to accommodate high-tailed aircraft.

9 Claims, 6 Drawing Figures
DOOR FOR HANGARS AND OTHER STRUCTURES

My invention relates to a door for hangars and other structures and more particularly to an improved hangar door having sections adapted to open to varying heights and with the sections being selectively opened to vary the size of the opening therethrough.

Hangar doors are generally made in sections to cover the opening span in the side of a hangar with the doors being generally slidably or rollably mounted such that they may be shifted in one direction or the other to adjust the horizontal opening therein. However, such doors because of the height requirements for airplanes are built to correspond to the height opening making each of the individual sections extremely large, difficult to manufacture and install. Attempts have been made to overcome this problem by making the individual sections of roll-up type doors with provisions for shifting the guide posts horizontally to provide the opening therethrough. However, such structures are subject to problems of wind resistance and high maintenance and are restricted to doors having the same height dimensions for all sections. Attempts have been made to make individual door sections in a plurality of leaves which are spaced from one another and slidably mounted in guides so that the individual leaves may be elevated in their guides to adjustable positions. Such doors have been restricted to a same height dimension corresponding to the maximum height opening of the hangar. With such structures, complicated guide structures which pivot to clear the door opening are required.

The present invention is directed to an improved hangar door or door closure for hangars or other structures in which the individual door sections are made of a plurality of slidably mounted leaves but in which the individual sections have different height dimensions so that a door opening is provided which will accommodate modern aircraft having extremely high tails. This improved door will permit the exit and egress of such aircraft to the hangar through the opening of individual sections and does not require a door in which all sections are of the same dimension. Thus, the cost of the overall door and the cost of field fabrication and maintenance is reduced and many of the problems of wind resistance is eliminated. The improved hangar door may be constructed to fit any sized hangar door opening or opening in the similar structure with a minimum amount of door surface to provide a desired opening of a particular type and width for the purpose intended.

Thus, in hangars the door can be constructed to open for varying wing widths and varying tail heights with a minimum number of door elements and door sizes involved. In addition, the leaves of the door section construction are guided in channels or guides which are fixed at the outer edges of the opening and telescopically mounted at the inner edges of the intermediate sections so that a complete opening is obtained by moving the guides vertically after the leaves of the sections are raised to eliminate all obstructions in the openings. The door is constructed so that any leaf of any section may be opened to vary the size of door opening without requiring the operation of additional sections. Similarly, the leaves of each section are stored in an elevated position behind a head frame requiring a minimum spacing or minimum amount of storage area and no obstruction to the desired opening. Further, the improved hangar door may be manufactured from standard parts designed to fit any size hangar opening with the doors being assembled in the field with a minimum amount of cost of field fabrication.

Therefore it is the principal object of this invention to provide an improved hangar door construction.

Another object of this invention is to provide a door for hangars or other enclosures in which varying portions of the door open to different elevations.

A still further object of this invention is to provide an improved hangar door which may be adjustably opened to any width opening and to varying sized height openings to accommodate varying sized aircraft.

A still further object of this invention is to provide an improved hangar door which has a lower initial cost and reduced installation and maintenance costs.

These and other objects of this invention will become apparent from a reading of the attached description together with the drawings wherein:

FIG. 1 is a schematic view in front elevation of an improved hangar door incorporating the invention;

FIG. 2 is a sectional view of the door of FIG. 1 taken along the lines 2—2 therein;

FIG. 3 is an enlarged broken section view of the door construction showing the guide structures for the door panel;

FIG. 4 is a plan view of a guiding and lifting bracket for the telescopic portion of the guide structure for the improved hangar door;

FIG. 5 is a schematic view in elevation of another embodiment of the hangar door showing a larger opening central section; and

FIG. 6 is a perspective view of a door panel.

FIG. 1 shows schematically an enclosure at 10 which simulates a hangar or other structure having at least one open side thereof into which a door or door sections are positioned for the purpose of closing the same to permit ingress and egress of equipment, such as airplanes, thereto. The hangar or enclosure is shown schematically as including a supporting frame structure 15 including trusses and beams, indicated generally at 20, defining the roof, walls and floor position for the door structure as will be hereinafter identified. The face of the enclosure around the door opening includes side frame parts 25 and an integrally supported head frame part 30 in which the sections of the door and its operators are mounted. The door opening is substantially the width of the enclosure and the height of the door opening may be selected or constructed to be higher at the central section or sections than at the side sections, such as is indicated in FIG. 1. Thus, the door closure is identified as incorporating three sections numbered 35, 40 and 45. The individual door sections are made of a plurality of leaves or panels, indicated generally at 50, which as will be hereinafter described, ride in guide structures and are positioned in a side-by-side relationship so that they may be placed edge to edge to define the door section and provide the closure for that portion of the door opening. As will be seen in FIG. 1, the schematic disclosure shows a composite door structure formed of the sections 35, 40 and 45 which provide for openings of two, three and two panel heights respectively. Thus, the outer or side door sections, 35 and 45 are comprised of two panels each, one edge of which is mounted in a stationary guide structure indicated at 55 and 60 respectively. These stationary guide structures are attached to the side 15 and head frames 20 and define the edges of the opening. As
will be hereinafter noted, the opposite edges of the wing panels 50 forming the sections 35 and 45 are guided in special movable guide structures, indicated generally at 70, with the three panels of the door section 40 riding in parts of the movable guide structures 70 on the opposite surfaces of each of the movable guide structures. This side-by-side arrangement of the panels which is guided in the fixed and movable guide structures will best be seen in the sectional view of FIG. 2 looking down on the individual panels or leaves in the respective guide structures from the top.

FIG. 3 shows an enlarged and broken view of a portion of the door from the top standing on the details of the mounting guide and panels therein. Thus, as will be seen in FIG. 3, one of the fixed guide structures 55 is shown as a C shaped channel member having an L shaped flange mounted therein to define the two channels for the door sections 50 defining the wing panels of FIG. 1. The channel construction for this end of the wing panels or the fixed guide structures 55 and 60 are identical and are slightly greater in height than three times the height of a single wing panel so that both wing panels mounted therein will be moved to a minimum clearance of the height of two wing panels. Omitted in FIG. 3 are the roller guides on the ends of the panels which will be evident from a consideration of FIG. 6. These fixed guide structures are rigidly attached to the head frame 30 which in turn is attached to the building frame. Also shown in FIG. 3 is one of the movable guide structures indicated generally at 70 which is formed of a fixed guide part 75 and a pair of movable guide channels 76, 77 slidably mounted therein. The fixed guide part 75 is generally an L shaped beam having a pair of L shaped channel members 78, 79 mounted therein which serve to mount a bearing guide surface 80 extending down on the fixed guide part which extends to the maximum height of opening from the lower door panel in the open position or that for the wing panels as will be evident in FIG. 1. The L shaped channel member 79 defines with one end of the L shaped beam 75 a fixed channel surface for the upper wing panel 50 which in its closed position represents the highest of the tail panels in the door section 40. The movable channel parts are generally C shaped channel members with L shaped channels welded thereto, such as is indicated at 82 and 83, to define the side-by-side channels with the similar construction for the fixed guide member 55. The rear end of the beam 75 mounts a pair of fixed guide members 88 on the edges thereof corresponding to the guide members 80 which will serve for guiding the channels 76, 77 in the L beam as will be hereinafter defined. The channel 76 mounts the opposite ends of the wing panels 50 which are journeled in the fixed guide structure 55 and one of these panels or door leaves will be moved to the lower most position in contact with the ground while the other will be moved so as to overlap the same at the upper edge thereof forming the two panel closure for the wing section of this portion of the door. Suitable seal members such as is indicated at 90 are mounted on one face of each of the panel members 50 and cooperate with the guide structures to seal the panels therein in sliding movement in the respective guide structures. Thus, as will be seen in FIG. 3 that the channel parts 76, 77 are positioned on opposite surfaces of the stationary part 75 of the movable guide structure and each of the channel sections or guides 76, 77 are movable independent of one another and as will be hereinafter noted will be guided on the fixed part 75.

FIG. 4 shows a bearing plate 100 having bearing members 102, 103 positioned on each end of the same and cooperating with an outwardly directed bearing member 104 to form a three-sided bearing surface which will cooperate with the bearing guides 80 and 88 positioned on the stationary parts 75 of the guide structure 70. The plate 100 is positioned on top of the channel members 76, 77 and suitably secured thereto such that the bearings 102, 103 and 104 will be positioned around the respective bearing guides on either ends of the plate to guide the channel members in vertical movement on the stationary part 75 of the telescopic guide structure. The stationary part, as previously indicated, is attached to the overhead frame and depends therefrom in a cantilever fashion with the channel parts 76, 77 telescoping vertically upward through movement of a cable mechanism such as is indicated at 110 and 112 in FIG. 1. This attaches to a cable lift bracket 115 positioned on top of the plate. The same construction will be found with respect to the opposite movable guide structure 70 positioned at the other end of the tail panels. Thus, it will be understood that the movable guide structure will be formed of stationary and movable guide parts 75, 76 and 77, respectively, to guide the wing panels for the door section 45 and the opposite end of the wing panels for the door sections 40, 45. The third or upper most panel 50 in the door section 40 is guided in the channels formed in the fixed or stationary guide part 75 and defined by the angle irons 79 and one end of the L shaped beam. A similar construction will be found at each end of the door section 40 so that the upper most panel for the tail section or door section will have a separate channel spaced from the movable channel members 76, 77 and formed entirely in the stationary channel part 75 which will guide the upper or third section in the three part door section shown in FIG. 1. It will be understood that this door section, as will be hereinafter noted, may include several panels to increase the height of the center section of the door.

The individual panels in each of the door sections 35, 40 and 45, with mounted in fixed channel guides or movable channel members may be all of the same dimensions and construction as shown in the embodiment herein. For example, with a ninety foot hangar door opening, individual panels will be of approximately a 30 foot length to cover the opening. The individual panels are constructed of a basic angle iron frame part such as is indicated at 51 in FIG. 6 with intermediate cross braces to strengthen the same. This frame part is closed with a strake sheeting configuration, such as is indicated at 52, which is mounted on the face of the frame and constructed in sections to span the entire length such that the composite panel includes a supporting frame and sheeting face 52 along the extent of the same. The individual frames for the panels include roller guide members, such as is indicated at 54, at the upper and lower edges of the frames and on each end of the same for the purpose of guiding the panels in the respective guide structures. In addition, guide bearings 56 are mounted on flange plates and attached to the upper and lower surface of the frame parts 51 and at each end of the same to provide a roller bearing surface in a direction 90 degrees to the direction of the roller bearing guides 54. The actual
bearing surfaces 54, 56 are omitted in FIGS. 1, 2 and 3 for simplicity, but it will be understood that the ends of the panel frames as they are mounted in the fixed guide members 55 and 60 and in the telescopic or movable guide members 70 or the channels 76, 77 in each of said telescopic guide structures will bear against three sides of the generally U shaped configuration of the channel to guide the panels therein. Although not shown, it will be understood that each individual panel section will have suitable cabling attached thereto such that the panel may be elevated and rest positions in the respective guide members vertically from a closed to an open position through the use of cabling, as will be hereinafter defined. Thus, the panels or the extremities of the same as they are mounted in the fixed guide members 55 and 60 and in the telescopic channel members 76, 77 of the movable guide members 70 will have bearing surfaces thereon bearing against the respective guide and channel members at each extremity of the panel to guide the panel for sliding movement therein. The movable channel parts 76, 77 are similarly guided in the stationary portion 75 of the movable guide structure by means of the bearings 102, 103, 104 cooperating with the guides 80 and 88 on the stationary portion 75. The bearing plate will be at the top of each of the individual channel members 76, 77 and guide strips 120, 121 at either side of the channel members 76, 77 will slide between similar bearing constructions attached to the fixed guide structure parts 75 (not shown) near the extremity of the same to provide points of bearing support and guiding contact of the movable guide parts 76, 77 in the stationary part 75 of the movable guide structure as the channel members or guide parts 76, 77 are moved vertically upward in the stationary part after the panels have been elevated partially and then simultaneously therewith to clear the opening as the panels are elevated.

In FIG. 1, there is shown schematically three different sets of panel operators 130, 135 and 140 mounted on portions of the head frame and each having a plurality of cabling attached thereto by means of which the individual panels in the door sections 35, 40 and 45 may be elevated and in which the channel parts 76, 77 or the telescopic guide parts will be elevated as the door is opened. The actual details of this construction and connection may vary but it will be understood that the operators are such that they may selectively elevate the wing panels or the panels in the door sections 35 and 45 selectively. Similarly, the panels in the section 40 will be elevated and it will be obvious that as the panels 50 in any and all of the sections are elevated, the ends of the same guided in the movable channel parts 76, 77 necessitate elevation of the channel parts 76, 77 to maintain the panels in guiding relationship in the channels. Thus, although not shown, it will be understood that the actuators will be sequenced in such a manner that the panels will be elevated only as the channel parts are raised to keep the ends of the panels being guided by the movable channel parts 76, 77 in guiding relationship within the channels necessitating simultaneous movement of the channels. With the improved door structure, however, the panel members for any of the door sections 35, 40 or 45 may be opened to their maximum dimension without operating any of the panels in the remaining door sections to selectively vary the door opening. Similarly, the height of the opening for any of the sections may be varied by moving one or more of the individual panels up to the rest position.

As shown schematically in FIG. 5, the door construction may be varied. Thus, the outer or wing panel sections of the door may include two panels, as in the before-mentioned embodiment, while the intermediate or center section of the door may include four panels and provide an additional height clearance for the center section to accommodate high-tailed aircraft to be moved into and out of a hangar type enclosure.

In the operation of the hangar doors, the movable parts of the guide structures as they are lowered to the ground's surface to close the doors cooperate with socket type apertures (not shown) in the ground's surface to rigidly secure the same and provide a door structure capable of standing wind resistance and side loading. As the panels are elevated and the movable parts of the guide structures are elevated they will be shielded and stored in the head frame 25, 30 to be properly supported against wind loading. The improved door construction permits the standardization of panel sections in sizes which can be readily transported to an installation site and one in which the similarity in panel sections permits reduction in cost of fabrication of the same. Similarly, the entire door may be installed on the side with a minimum amount of fabrication costs compared to prior constructions to provide an improved hangar door structure.

In considering this invention it should be remembered that the present disclosure is illustrative only and the scope of the invention should be determined by the appended claims.

What is claimed is:

1. A door for hangars and other structures having an opening therein comprising, a plurality of door sections positioned across said opening side-by-side relationship and closing the same, each of said door sections including a plurality of leaves forming the section with said leaves being guided in structures at the edges thereof and parallel to one another, fixed guide structures positioned at the edges of said opening and mounting the edges of the leaves forming the end sections in said opening, movable guide structures mounted on the edges of the leaves of the intermediate door sections and one edge of the leaves of the end section, said movable guide structures being formed of telescopic parts one of which is fixed and with a pair of movable parts having guide surfaces at the edges of the same to guide the leaves in vertical movement, and roller means positioned between the part of the guide structure to guide the movable parts on the fixed part independent of movement of the leaves in the elevation of the same to hold and guide the leaves in all positions of vertical movement.

2. The door for hangars and other structures of claim 1 in which the intermediate door sections open to a height greater than the end sections.

3. The door for hangars and other structures of claim 1 in which the leaves of each of the door sections are guided in a side-by-side relationship and where there are a greater number of leaves in the intermediate sections of the door than in the end sections.

4. The door for hangars and other structures of claim 3 in which the leaves of each of the door sections have the same dimensions.
5. The door for hangars and other structures of claim 3 and including motive means for elevating the individual leaves of the respective door sections.

6. The door for hangars and other structures of claim 5 and including additional motive means for telescoping the parts of the movable guide structures to raise the same and clear the opening after the leaves thereof have been elevated.

7. The door for hangars and other structures of claim 1 and including a head frame attached to the enclosure over the top of the opening in which the leaves and the telescopic parts of the movable guides are stored when the door is open.

8. The door for hangars and other structures of claim 1 in which the movable parts of the guide structure includes channel like frame members suspended from the head frame in a cantilever fashion.

9. A door for hangars and other structures having an opening therein comprising, a plurality of door sections positioned across said opening in side-by-side relationship and closing the same, each of said door sections including a plurality of leaves forming the section with said leaves being guided in structures at the edges thereof and parallel to one another, fixed guide structures positioned at the edges of said opening and mounting the edges of the leaves forming the end sections in said opening, a movable guide structure mounting the opposite edges of the leaves of the end sections, said movable guide structure being formed of a fixed part and a pair of movable parts in a telescopic relationship with guide surfaces at the edges of the movable parts to guide the leaves in vertical movement, and roller means positioned between the fixed and movable parts of the guide structure to guide the movable parts within the fixed part in the elevation of the same with the leaves being positioned in the movable parts in all positions in elevation.