

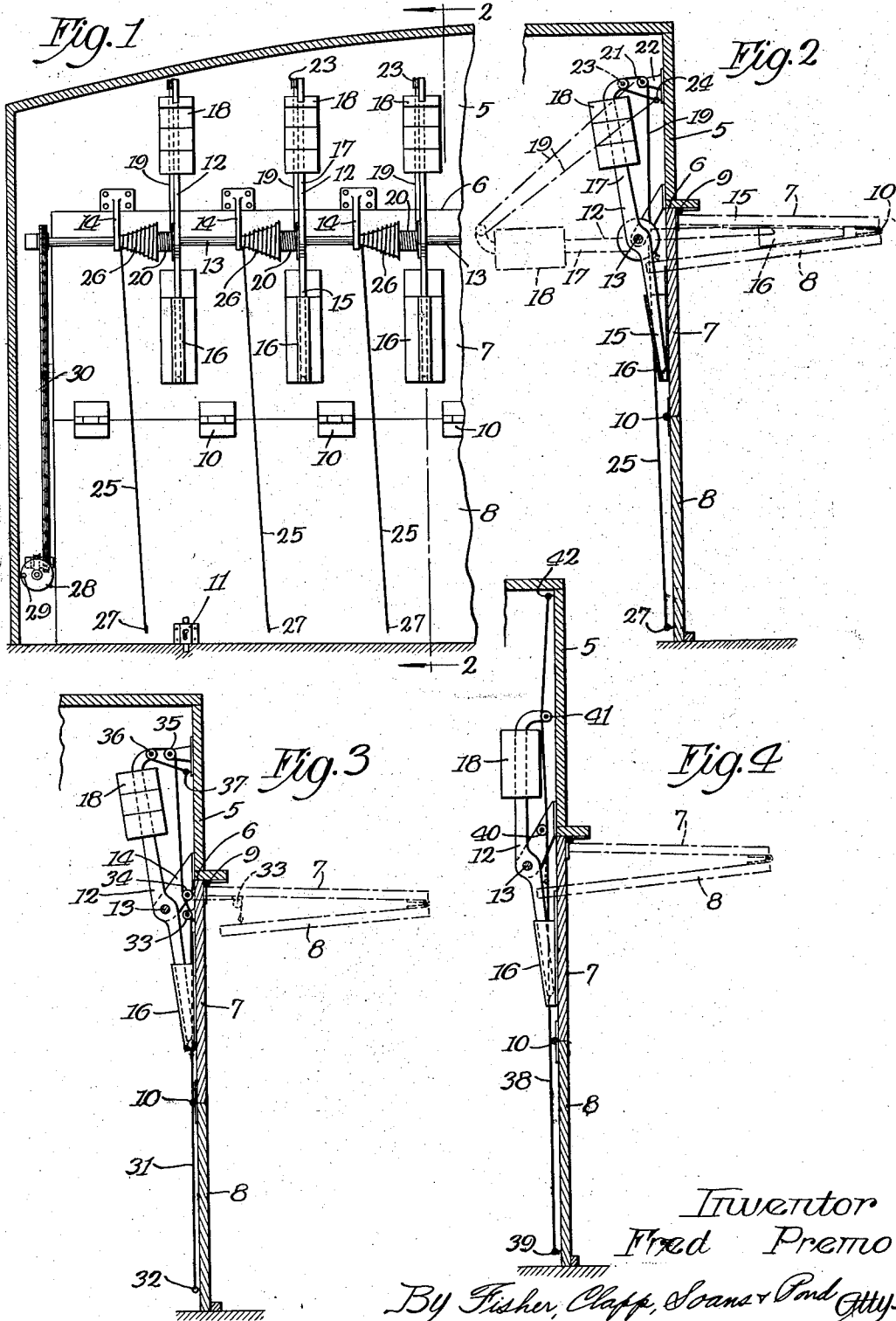
March 19, 1935.

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1,994,785

HANGAR DOOR

Filed Dec. 30, 1931



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UNITED STATES PATENT OFFICE

1,994,785

HANGAR DOOR

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Application December 30, 1931, Serial No. 583,865

7 Claims. (Cl. 20—20)

This invention relates to an improved door construction which is especially adapted for use on airplane hangars and in other places where an unusually wide door opening is required. While the door of the present invention is primarily designed for use on airplane hangars, it will, of course, be understood that it is equally applicable to buildings for other purposes where the characteristics of the door are similar to those of an airplane hangar door.

The main objects of the invention are to provide a door of the class described which may be opened and closed with comparative ease; to provide a door of the class described which, when open, will occupy a position, especially an overhead position, wherein it is out of the way; to provide such a door which is adjustable from closed to open position and vice versa through a path of travel which includes a minimum of space; to provide a door of the class described which is adjustable in a vertical direction between open and closed positions; and to provide a door construction of the class described which will be comparatively simple to manufacture and install. In general, it is the object of the invention to provide an improved door construction of the class described, and other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawing in which an improved hangar door construction embodying the invention is shown.

In the drawing:—

Fig. 1 is an elevation of the inside of a portion of a hangar door embodying the invention.

Fig. 2 is a section on the line 2—2 of Fig. 1, and, Figs. 3 and 4 are sections similar to Fig. 2 but showing modified arrangements.

Referring now to the drawing, a wall 5 represents one wall of an airplane hangar for example, and it is provided with a doorway 6 which is adapted to be closed by a suitable door.

In this instance, the door is formed of upper and lower sections 7 and 8 respectively. The upper door section 7 is hinged as indicated at 9 to the wall 5 adjacent the upper edge of the doorway 6 and the lower door section 8 is hinged as indicated at 10 to the lower edge of the upper door section 7. The doors 7 and 8 may be of any suitable length to close the doorway 6 and any suitable locking devices, one of which is indicated at 11 may be provided for locking the door in closed position.

The door sections 7 and 8 are adapted to be vertically adjusted between closed position

(shown in full lines in Fig. 2) and open position (shown in broken lines in Fig. 2), the upper section being folded or swung upwardly about its hinge connection 9 with the wall 5, and the lower section 8 being folded or swung upwardly about its hinge connection 10 with the upper door section.

For counterbalancing the weight of the doors 7 and 8 and for urging the upper section 7 to swing upwardly about its hinge mounting 9, an arm 12 is pivotally mounted intermediate its ends on a shaft 13. The shaft 13 is rotatably supported by suitable brackets such as indicated at 14 which are mounted on the wall 5 adjacent the upper edge of the doorway 6. The brackets 14 are preferably of a type having a hook-like portion for receiving the shaft 13 so that the latter may be placed in position by lateral movement relative to the brackets instead of requiring endwise insertion of the shaft through bearing openings in the brackets.

One end, the lower end 15, of the arm 12 bears against the adjacent face of the upper door section, a housing 16 being preferably provided for receiving the said arm portion 15. The housing 16 is preferably of metal construction which encloses the said arm portion 15, and serves as a wear plate for preventing wear on the door 7 by reason of movement of the arm portion 15 relative to the door section. The upper end 17 of the arm 12 is provided with a suitable weight 18 and, as shown, the arm is so arranged that the weight 18 tends to cause the lower arm portion 15 to swing upwardly about the pivot shaft 13, whereby the arm tends to swing the upper door section 7 upwardly about its hinge mounting 9.

For controlling the counterbalancing effect of the arm 12 and for causing the lower door section 8 to swing upwardly about its hinge mounting 10, the following arrangement is provided. A cable 19 is secured at one end to a cylindrical pulley 20 which is secured to the shaft 13. The cable extends upwardly from the pulley 20, around a guide roller 21 carried by a bracket 22 which is secured to the wall 5, and around another guide roller 23 which is carried by the free end of the weighted arm 17. The other end of the cable is secured or anchored as indicated at 24 to the wall 5. Another cable 25 is secured at one end to the small end of a conical pulley 26 which is mounted on the shaft 13, and the other end of the cable 25 is anchored as indicated at 27 to the lower door section 8 adjacent its lower edge.

The shaft 13 may be rotated by any suitable means, and in this instance I have indicated a

worm and worm wheel device 28 which is adapted to be manually actuated by means of a hand wheel or crank 29. This worm and worm wheel device includes a sprocket which drives a chain 5 30, which in turn drives the shaft 13 through the agency of a sprocket secured to the said shaft.

Assuming that the door is in closed position as illustrated, and that the shaft 13 is rotated in the proper direction, it will be seen that the cable 19 10 will be unwound from the pulley 20 so as to permit the weighted arm 17 to swing downwardly, whereby the opposite end of the arm urges the upper door section 7 to swing upwardly about its hinge mounting 9. At the same time, the cable 15 25 will be wound upon the conical pulley 26 to effect folding movement of the lower door section 8 about its hinge mounting 10. By reason of the differential in the rate of unwinding and winding the cables 19 and 25, due to the provision of the conical pulley 26, the lower edge portion of the lower door section 8 will be caused to rise in a substantially vertical direction, while the hingedly connected edges of the upper and lower door sections swing upwardly to the position indicated in broken lines in Fig. 2.

This arrangement is particularly desirable in that it eliminates the necessity for tracks or guides for controlling movement of the lower door section, such tracks being objectionable in that they resist adjustment of the door and thereby render it difficult to open or close the door. The described arrangement requires no such guiding means wherefore the door is freely adjustable between its open and closed positions. 35 In effect, the lower edge portion of the lower door section floats about the hinge connections 10 and 9. As shown in Figs. 1 and 2, the counterbalancing mechanism for the door is arranged on the inside thereof so that it is protected from the 40 weather, and when the doors are closed, it is protected from unauthorized manipulation. The door sections 7 and 8 in their open position project outwardly from the wall and are disposed in an overhead position where they are entirely out of the way as are also all parts of the counterbalancing mechanism. 45

In Fig. 3, the upper and lower door sections 7 and 8 are mounted in the doorway in the wall 5 in the same manner as above described in connection with Figs. 1 and 2. The counterbalancing device, in its broad aspects is also the same. However, in this arrangement there is no pulley provision for acting on the cables to control the effect of the counterbalancing device and the 55 folding movement of the lower door section. In this arrangement, the counterbalancing arm 12 is pivotally mounted intermediate its ends on a shaft 13 and it is weighted at one end and engages the upper door section 7 at its other end substantially as in the arrangement illustrated in Figs. 1 and 2. In this instance, however, a cable 60 31 is anchored at its lower end as indicated at 32 to the lower edge portion of the lower door section 8, and it extends upwardly in engagement with guide pulleys 33, 34, 35 and 36, and is anchored at its other end as indicated at 37 on the wall 5. The pulley 33 is secured to the upper door section 7 adjacent its upper edge and the pulleys 34 and 35 are carried by suitable brackets 70 secured to the wall 5. The pulley 34 may conveniently be mounted on one of the brackets 14 and it is preferably disposed adjacent the upper edge of the door opening as indicated. The pulley 36 is carried by the free end of the weighted 75 arm 12.

The cable 31 serves to hold the weighted arm 12 against pivotal movement under the influence of its weights, but when the door 8 is swung upwardly about its hinge connection 10, the weighted arm is permitted to swing to thereby effect upward folding of the upper door section 7 about its hinge mounting 9. In their fully open positions, door sections 7 and 8 assume a position substantially like that of the door sections in the arrangement shown in Figs. 1 and 2 and are 10 equally out of the way. In this arrangement, the lower edge of the lower door section swings inwardly somewhat more than is the case in the arrangement shown in Figs. 1 and 2 and hence the lower edge of the door departs somewhat 15 from a substantially vertical path of movement. In some cases, this might be objectionable in that it requires a larger amount of clear space to be left adjacent the inside of the door than is the case in the arrangement shown in Figs. 1 and 2. 20

In the arrangement shown in Fig. 4, I have also eliminated the pulley arrangement for controlling the cable, while at the same time securing the advantage of causing the lower edge of the lower door section to move upwardly in a 25 vertical path of travel. The arrangement is substantially the same as shown in Fig. 3, except for a slightly different arrangement of the cable. In this instance, the cable 38 is secured at its lower end as indicated at 39 to the lower edge 30 of the lower door section 8, and it extends upwardly around guide pulleys 40 and 41, and is secured at its upper end as indicated at 42 to the wall 5. The roller 40 is mounted in a suitable bracket secured to the wall 5, and the roller 41 is 35 carried by the free end of the weighted arm 12.

It will be seen that when the door 8 is in closed position and the cable 38 drawn to substantially straight line condition, the cable is then operative to hold the weighted arm 12 against swinging movement under the influence of its weight. 40 When the door 8 is moved upwardly, the slackness in the cable permits the weighted arm to swing substantially as described in connection with Fig. 3. In this arrangement, the extent of upward movement of the lower edge of the lower door section 8 is not equal to the extent of movement permitted by looseness of the cable to the weighted arm. In other words, while there is comparatively short upward travel of the lower 50 edge of the door section 8, the arm is permitted to swing through a comparatively long arc to thereby effect upward folding of the upper door section 7 and consequent outward and upward swinging movement of the upper edge of the 55 lower door section 8. Hence, the lower edge of the lower door section is not caused to swing inwardly as was explained in connection with Fig. 3. The arrangement shown in Fig. 4 is somewhat simpler than that shown in Figs. 1 and 2, while 60 having the same advantage of a door opening outwardly and upwardly without projecting materially inwardly from the wall 5. In this case, however, somewhat greater head room is required to provide the long reach of cable between 65 the roller 40 and its anchored end 42.

I am aware that other arrangements and changes in the described structure may be made without departing from the spirit of my invention, the scope of which should be determined by 70 reference to the following claims, the same being construed as broadly as possible consistent with the state of the art.

I claim as my invention:—

1. In a door of the class described, the com- 75

5 bination with a wall having a doorway therein, of an upper door section hinged adjacent its upper edge to said wall adjacent the upper edge of the doorway, a lower door section hinged at its upper edge to the lower edge of said upper door section, counterbalancing means acting on the upper section to swing the same upwardly about its hinged connection with the wall, said counterbalancing means including an arm, means for pivotally mounting the arm intermediate its ends on said wall, one end portion of said arm being adapted to engage the upper door section and the other end portion of said arm being weighted and thereby tending to swing said upper door section upwardly about its pivotal connection with the wall, a cable connected at one end to said lower door section, and means acting on said cable for effecting upward swinging movement of said lower section about its pivotal connection with said upper section.

2. In a door of the class described, the combination with a wall having a doorway therein, of an upper door section hinged adjacent its upper edge to said wall adjacent the upper edge of the doorway, a lower door section hinged at its upper edge to the lower edge of said upper door section, counterbalancing means acting on the upper section to swing the same upwardly about its hinged connection with the wall, said counterbalancing means including an arm, means for pivotally mounting the arm intermediate its ends on said wall, one end portion of said arm being adapted to engage the upper door section and the other end portion of said arm being weighted and thereby tending to swing said upper door section upwardly about its pivotal connection with the wall, a cable connected at one end to said lower door section, and means connected with said weighted arm and acting on said cable as an incident to swinging movement of the arm to effect upward folding movement of the lower door section about its hinge connection with the upper section.

3. In a door of the class described, the combination of a wall having a doorway therein, an upper door section hingedly connected adjacent its upper edge to said wall adjacent the upper edge of the doorway, a lower door section hingedly connected adjacent its upper edge to the lower edge of the upper door section, and counterbalancing means for facilitating upward folding of said door sections, said means comprising an elongated arm pivotally mounted intermediate its ends on said wall, said arm having one end portion adjustably engaging said upper door section and its other end portion weighted so as to tend to swing said upper door section upwardly about its hinge connection with the wall, a cable secured at one end to the lower door section adjacent its lower edge and extending upwardly therefrom, guide means carried by said upper door section adjacent its upper edge for maintaining said cable in predetermined position relative to said upper section, another guide means mounted on said wall adjacent the upper edge of said doorway for guiding said cable, said cable extending upwardly in engagement with said guides around said arm pulley and having its other end anchored to said wall whereby downward swinging movement of the weighted end of the arm serves to swing said lower door section upwardly about its hinge connection with the upper door section, the other end of said arm serving to urge the upper door section to

swing upwardly about its hinge connection with the wall.

4. In a door of the class described, the combination of a wall having a doorway therein, an upper door section hingedly connected adjacent its upper edge to said wall adjacent the upper edge of the doorway therein, a lower door section hingedly connected at its upper edge to the lower edge of said upper door section, an elongated arm pivotally mounted intermediate its ends on said wall adjacent the upper edge of said doorway, one end portion of said arm adjustably engaging said upper door section and the other end of said arm being weighted so as to urge the arm to swing about its pivot to thereby tend to swing the upper door section upwardly about its hinged connection with the wall, and means actuated by said weighted arm for effecting upward folding movement of the lower door section about its hinge connection with the upper door section.

5. In a door of the class described, the combination of a wall having a doorway therein, an upper door section hingedly connected adjacent its upper edge to said wall adjacent the upper edge of the doorway therein, a lower door section hingedly connected at its upper edge to the lower edge of said upper door section, an elongated arm pivotally mounted intermediate its ends on said wall adjacent the upper edge of said doorway, one end portion of said arm adjustably engaging said upper door section and the other end of said arm being weighted so as to urge the arm to swing about its pivot to thereby tend to swing the upper door section upwardly about its hinged connection with the wall, and means actuated by said weighted arm for effecting upward folding movement of the lower door section about its hinge connection with the upper door section, said last mentioned means comprising a cable secured at one end to said lower door section adjacent its lower end, and extending upwardly therefrom, a guide for said cable mounted on said wall adjacent the upper edge of said doorway for maintaining the cable in predetermined position, the other end of said cable being anchored to said wall at a point spaced materially above the weighted end of said arm, said weighted arm end having means for engaging said cable intermediate said last mentioned guide and anchored end when the arm swings about its pivot, the cable being thereby offset from its normal position whereby the lower end of the cable and said lower door section are caused to swing upwardly about the hinged connection of said lower section with said upper section.

6. In a door of the class described, the combination of a wall having a doorway therein, an upper door section hingedly connected adjacent its upper edge to said wall adjacent the upper edge of the doorway, a lower door section hinged adjacent its upper edge to the lower edge of said upper section, counterbalancing means tending to fold said upper door section upwardly to thereby facilitate adjustment of the door to open position, said counterbalancing means including an arm pivotally mounted on said wall and having its free end weighted, and means for effecting upward swinging movement of the lower door section about its hinge connection with the upper door section and for controlling the counterbalancing effect of said counterbalancing means on said upper door section, said last mentioned means comprising a pulley, a cable connected to

said pulley and having operative engagement with the weighted end of said counterbalancing arm, a second pulley of different diameter and a cable having one end connected to said last mentioned pulley and its other end connected to said lower door section, and means for effecting rotation of said pulleys.

7. In a door of the class described, the combination of a wall having a doorway therein, an upper door section hingedly connected adjacent its upper edge to said wall adjacent the upper edge of the doorway, a lower door section hinged adjacent its upper edge to the lower edge of said upper section, counterbalancing means tending to lift said upper door section upwardly to thereby facilitate adjustment of the door to open position, said counterbalancing means including an arm

pivotaly mounted on said wall and having its free end weighted, and means for effecting upward swinging movement of the lower door section about its hinge connection with the upper door section and for controlling the counterbalancing effect of said counterbalancing means on said upper door section, said last mentioned means comprising a pulley, a cable connected to said pulley and having operative engagement with the weighted end of said counterbalancing arm, a conical pulley connected to said first mentioned pulley for rotation in unison therewith, a cable having one end connected to said conical pulley and its other end connected to said lower door section, and means for effecting rotation of said pulleys.

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