Feb. 4, 1930. D. C. CARVER 1,746,101

AIR HAVEN FOR FLYING MACHINES

Filed Dec. 22, 1928 2 Sheets-Sheet 1

Fig. 1.

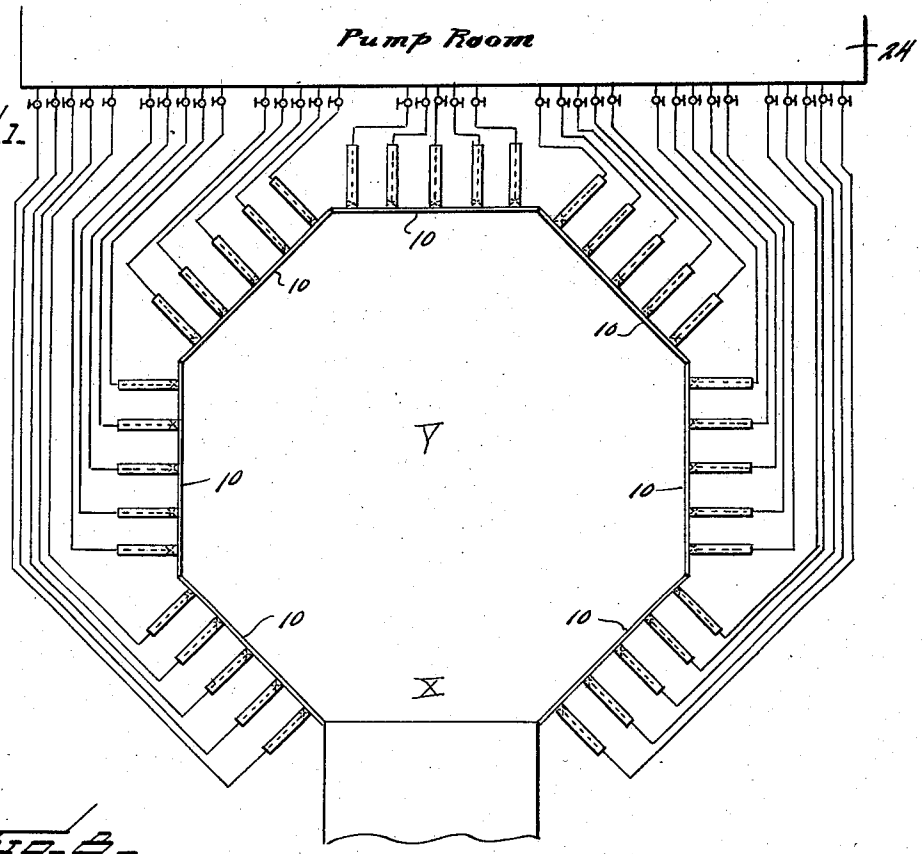


Fig. 2.

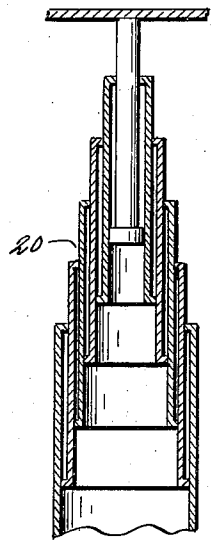


Fig. 7.

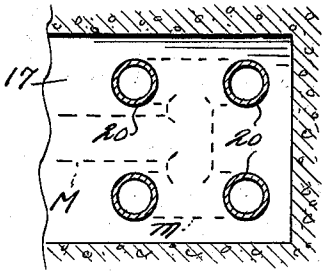
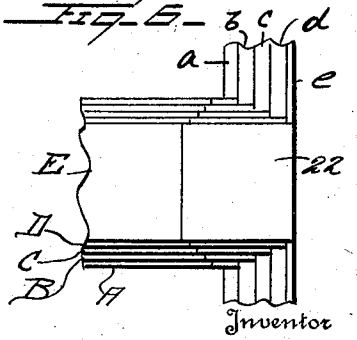


Fig. 6.



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Fig. 2.

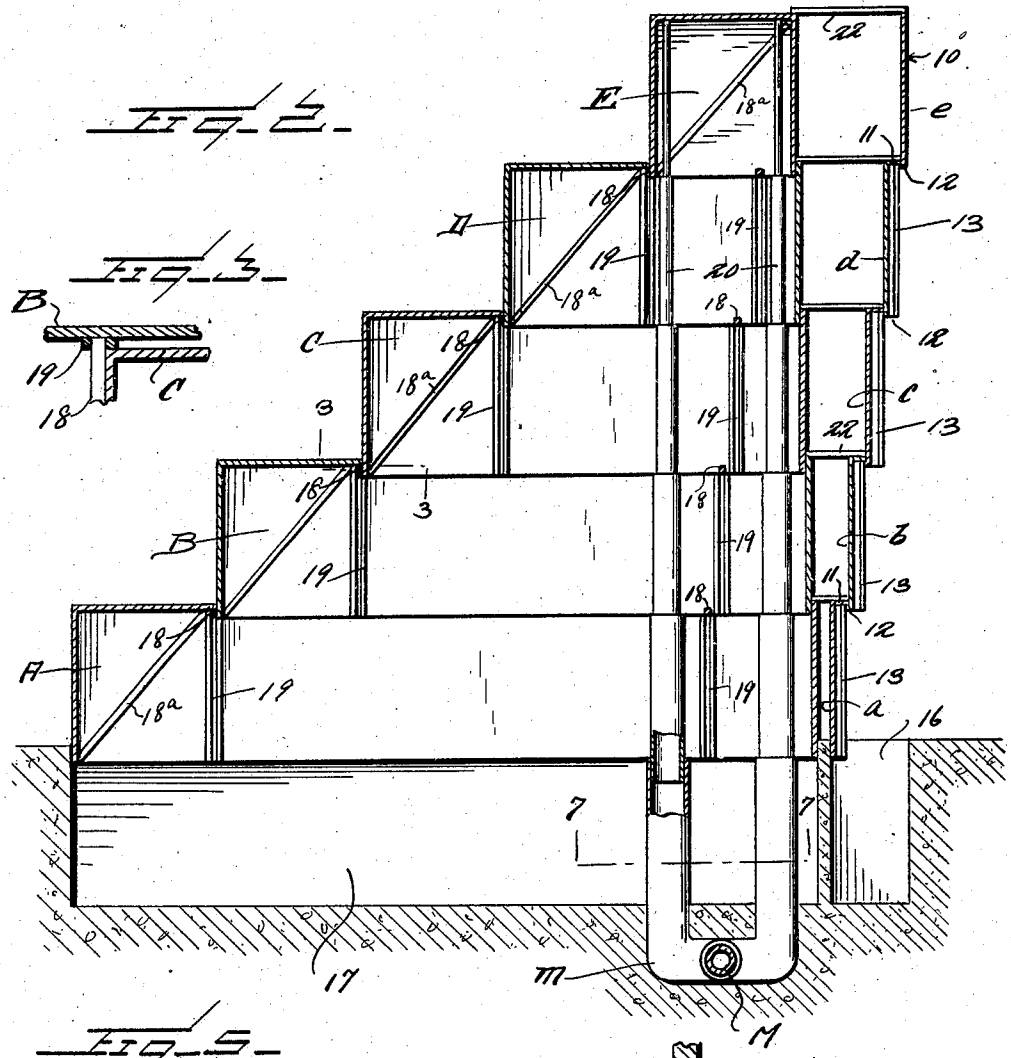
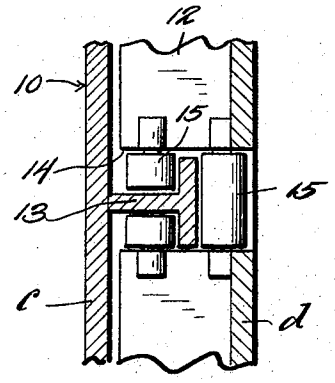


Fig. 3.

Fig. 5.



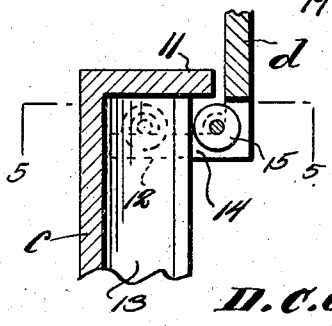


Fig. 4.

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UNITED STATES PATENT OFFICE

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AIR HAVEN FOR FLYING MACHINES

Application filed December 22, 1928. Serial No. 327,887.

This invention relates to what I may term a roofless hangar or air haven and particularly to an air haven formed of a plurality of windshields or walls and intended to surround or partially surround a flying field. The chief difficulty in the development of dirigible craft is the danger of landing and docking in unfavorable winds. At the present time, there is no way of putting these large airships in the hangar itself unless there is practically no wind and oftentimes a mooring mast is rendered necessary.

My invention contemplates the provision of a series of metal or other fabric screens or shields arranged in sections long enough so that six or eight sections will completely surround the flying field. These screens will be made in units or sections of say fifty feet in height and when the units of a shield are fully extended upward, a screen or shield will be formed having a height of at least two hundred and fifty feet and any desired length.

A further object is to provide a construction of this character which is so formed that the units or sections of each of the several shields have a nesting engagement with each other so that all of the sections of a screen could be emplaced in a concrete pit so that the several shields would be entirely out of the way when not necessary for use.

It is also an object to provide means whereby these sections can be successively elevated until the screen is fully elevated to thus form a wind break extending around all or a portion of the field.

Another object is to provide means for elevating these sections of the several screens uniformly and under ready control so that the screens shall be forced up all at one time.

Other objects have to do with the details of construction and arrangement of parts as will appear more fully hereinafter.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a diagrammatic top plan view of a flying field having shields constructed in accordance with my invention;

Figure 2 is a vertical sectional view of a series of shields and the corresponding bracing or abutting tower;

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 2;

Figure 4 is a vertical sectional view of the upper and lower ends respectively of two shield sections;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a top plan view of the shield sections and the tower sections corresponding thereto;

Figure 7 is a top plan view looking into the pit and showing the sections of the pistons on the line 7—7 of Figure 2;

Figure 8 is a vertical sectional view through the several pistons.

Referring to Figure 1, it will be seen that I have illustrated a hangar X and a field Y shown as being eight-sided though I do not wish to be limited to this and having around the seven sides of the octagonal field thus formed a series of screens as will be later described.

The screens are adapted to be raised either to windward of the flying field or entirely around the flying field as desired. These screens may be made in lengths of say five hundred feet long and each screen is made of a plurality of sections. Each of these sections has a length equal to the total length of the particular screen and has a height of say fifty feet. There are a plurality of these sections as for instance five of these sections so that when all of the sections of the screen are raised, the screen will have a height of approximately two hundred and fifty feet.

From Figure 2, it will be seen that each screen consists of five sections 10. The five sections have been designated *a*, *b*, *c*, *d*, and *e* to distinguish them from each other. Each section except section *e* at its upper end is formed with the flange 11 which projects toward the flying field and each section except the lowermost section *a* is formed with the inwardly projecting flange 12 extending away from the flying field. Disposed upon the outer face, that is, the face toward the flying field, of each section except the uppermost section *e*, are the vertical rails 13

preferably T-shaped in cross section and the lower flange of the next successive section is cut out at 14 so as to ride up on these rails, and rollers 15 are mounted upon this flange to bear against the outside face of the rail and against the inside face thereof. Thus one section is held in sliding engagement with the other section and can move upward to the full height of the section and until the flange 12 comes in contact with the flange 11.

The lower section *a* is supported for movement within a pit 16 or concrete emplacement which is approximately fifty feet deep so that when all of the sections are nested or disposed in register with each other, they may all be disposed within this pit and concealed from view therein. The rails 13 will be preferably disposed about fifty feet apart along the screen sections though obviously I do not wish to be limited to this. The rollers engaging these tracks will keep the screens from bulging toward the field and will guide the screen sections in their vertical movement.

For the purpose of bracing and raising and lowering the screen sections, I provide for each shield or screen a series of sectional towers. Preferably five towers will be used with each five hundred foot screen. These towers are formed in sections A, B, C, D, and E. In other words, there will be as many tower sections as there are shield or screen sections. The towers successively decrease in width and successively decrease in length so that the sections will telescope into each other. Thus the section E telescopes into the section D, this in turn into the section C and so on until all of the tower sections will lower into a pit 17 which is preferably lined with concrete as was the pit 16. These tower sections may be made of any suitable framework or skeletonic structure formed of any suitable structural elements. Preferably as shown, the tower sections are successively shorter from A to E and preferably the lower corners of each tower section above the lowermost one will be provided with the laterally projecting beams 18 whose ends will engage in vertically disposed channels 19 formed in the section just below so that the sections of the tower will be guided vertically as they move up or down.

For the purpose of moving the sections up or down, that is, raising them from the pit to their full height, I provide for each sectional tower four telescopic pistons 20, each piston being formed with a plurality of sections as illustrated in Figure 8, corresponding to the sections of the tower and to the screen section. These are preferably hydraulic pistons so that when water is admitted into the pit below the lowermost piston the pistons shall successively rise to carry the topmost tower section and topmost screen section out of the pit, then move upward the next succeeding piston section, carrying with it the next succeeding tower section and the corresponding screen section, etc., until all the tower sections and screen sections are raised. The several pistons are connected to the tower sections by means of transverse beams 21, the beam 21 of the topmost section E engaging with the topmost section of the piston, the transverse beam 21 of the next succeeding section D engaging the next succeeding section of the piston and so on as illustrated in Figure 8.

All screen sections except lowest are connected to the tower sections by means of head plates 22. Thus the screen section *e* is connected to the tower section E by the widest and shortest head plate. The section *d* is connected to the tower section D by a longer and narrower head plate 22 and so on so that when the entire structure is lowered, these head plates overlap as shown in Figure 6.

As before stated, there will be four sectional pistons to each of the towers and hydraulic pressure will be used for forcing the sections of the piston upward. Thus hydraulic pressure is applied to the telescoping cylinders and the innermost piston attached directly to the upper section of the tower is raised from the pit.

After the uppermost section is raised, a steadily increased pressure in the cylinder operates to raise the next succeeding section until finally the bottom section is raised from the pit and the tower is fully elevated. By maintaining the ultimate pressure at a constant figure, the tower remains steady and rigid. When it is desired to lower the tower, the downward movement is controlled by decreasing the pressure in the cylinders. By this system all of the towers are so controlled from one center, that it is easy to keep the same pressure in all of the cylinders or pistons. Thus in Figure 7, I have illustrated one of the pits as being provided with a main M and branches *m* extending to the several cylindrical pistons so that the pressure in each of the branches will be the same, there being controlling valves for each main branch leading to a tower and there being dials, one for each tower at this central tower station, which will register the height of the towers at all times during the elevating movement. Thus if there is any difference in the reading of the dials, a little additional pressure in the cylinders of the lagging tower or towers, corrects and evens the height of all of the sections. Obviously the particular form of registering dial forms no part of the present invention and has not been illustrated.

Preferably the control system will be located in the pump and compression room 24, this room containing the pumps and compression tanks necessary for producing pressure, and from this room runs a large hydraulic

line to the bottom of each tower pit where each line divides into four lines running to the individual pistons or cylinders of each tower.

A gauge attached to each line enables the operator in charge of the lifting to keep equal pressure in the five lines as above stated.

Preferably braces 25 are attached to the top of the rectangular framework of each tower section at the rear end thereof and extend upward and forward to the top of the next adjacent section. These diagonal braces 25 are rigidly attached to the section at the forward end and slide up and down on upright supports 26 at the rear of the sections beneath so that when all the tower sections are raised, these diagonal braces 25 will assume the form of the hypothenuse of a triangle.

It will be understood, of course, that as many screen sections may be erected as are necessary in order to enclose the field and these screens or shields may be of any size and composed of any number of sections or units per screen. Inasmuch as these telescopic screens or shields are ordinarily sunk in pits, the field will be entirely clear when the screens are not in use. This is a particularly desirable feature of my invention. My system permits the same field to be used both for dirigibles and for airplanes, as without such a system, separate fields would have to be provided as heavy planes could not possibly clear permanent screens which would be high enough to protect dirigibles while landing passengers. By my system, means is provided whereby dirigibles may be handled on the same fields as airplanes. The use of these telescopic screens would also facilitate the landing of airplanes in stormy weather when ground winds are heavy. Thus, for instance, let us suppose that a passenger plane approaches an air port for landing and it should happen that there is a heavy wind blowing across the field.

A landing in the open would be hazardous and might easily result in a crash but if the field were equipped with screens as desired by me, the sections to windward of the arriving plane would be elevated and the plane would land in still air and in perfect safety. The screens could also be partially elevated either to shield an arriving airplane or to assist a departing plane in taking off if the ground wind was heavy. The screens could also be used to protect planes that were moored or parked on the field and yet with all the machinery, the towers, and the screen sections themselves fully housed underground, the planes could land and take off over the pits very readily.

Let us also assume that a dirigible approaches an air port constructed in accordance with my invention and that a wind of twenty miles an hour is blowing from the west. The ship will head into the wind and by adjusting her engine speed hangs steady in front of the hangar H. The three screens to the west of her are raised and she comes down into a zone of quiet air, permitting the ground crew to turn her around and put her in the hangar at once. Such a manner of handling a zeppelin or other lighter than air machine would be impossible without the use of the system which I have described.

Under present conditions, a lighter than air vessel must be moored to a mast until the direction of the wind changes or the wind dies down and this necessity of mooring is entirely obviated by the use of this system.

Obviously I do not wish to be limited to details of construction as these might be modified in many ways without departing from the spirit of the invention as defined in the appended claims.

It will be seen that the beams 18 together with the diagonal braces 18ª form connections between the various tower sections and prevent the tower sections being pulled apart by wind pressure. At the upper limit of their movement, the beams 18 fit into the structure of the section immediately below and form a lock joint. The diagonal braces 18ª brace the sections against thrust when the sections are fully drawn out. It should be borne in mind that the lowermost tower section is fastened directly and rigidly to the lower screen section, no head plate 22 being used. This enables a powerful and rigid construction to be imparted to the other sections when elevated.

I claim:—

1. An air haven, the boundaries of which are defined by a plurality of pits, sectional shields disposed in said pits, and means for raising any one or all of said shields.

2. An air haven, the boundaries of which are defined by a series of pits, and screens normally disposed in said pits but adapted to be raised therefrom, each of said screens consisting of a plurality of sections slidingly engaged with each other, and means for raising said sections successively out of the pit until the full height of the screen has been reached or lowering said sections into the pit.

3. An air haven, the boundaries of which are defined by a series of pits, screens disposed in the pits, each screen consisting of a plurality of slidingly engaged sections, a plurality of sectional towers engaged with each screen, each tower being formed of sections corresponding in number to the sections of the screen and engaged therewith, the tower sections having telescopic engagement with each other, and means whereby the tower sections may be successively raised from the pit together with the screen sections.

4. A screen for air ports comprising a pit, a plurality of slidingly engaged screen sections adapted to be disposed in register with each other and within the pit, a plurality

of telescopic tower sections adapted to be collapsed into said pit or raised therefrom, each of the screen sections being carried by and being movable with a corresponding tower section, and hydraulic means for raising the sections successively from the pit.

5. A screen for air ports, comprising a pit, a series of screen sections normally disposed within the pit, the sections having sliding engagement with each other, a series of telescopic tower sections disposed one within the other, each section being operatively engaged with the corresponding section of the screen and said sections adapted to be collapsed within the pit, a central pumping plant having branch pipes extending to the several pits, a plurality of telescoping piston sections operatively connected to the sections of the towers and operated by the water pressure in said branches, and means at the center of the pumping station whereby the pressure in the branches may be individually controlled.

6. A shield for air ports comprising a pit, a series of screen sections normally disposed within the pit in register with each other, each of said screen sections having upon one face a plurality of vertically extending tracks and each screen section having a flange cut away to receive the tracks of the next adjacent screen section, the flange being provided with rollers engaging the track of the next adjacent screen section, and power operated means for raising said screen sections.

7. A shield for air ports comprising a pit, a series of screen sections normally disposed within the pit in register with each other, each of said screen sections having upon one face a plurality of vertically extending tracks and each screen section having a flange cut away to receive the tracks of the next adjacent screen section, the flange being provided with rollers engaging the track of the next adjacent screen section, and power operated means for raising said screen sections, each screen section at its upper end having an outwardly turned flange with which the roller carrying flange engages when the one screen section has been elevated fully above the next lower screen section.

In testimony whereof I hereunto affix my signature.

DONALD C. CARVER.