H. THADEN.

AIRSHIP.

APPLICATION FILED JUNE 17, 1910.

1,002,093. **Patented Aug. 29, 1911.**

4 SHEETS—SHEET 1.

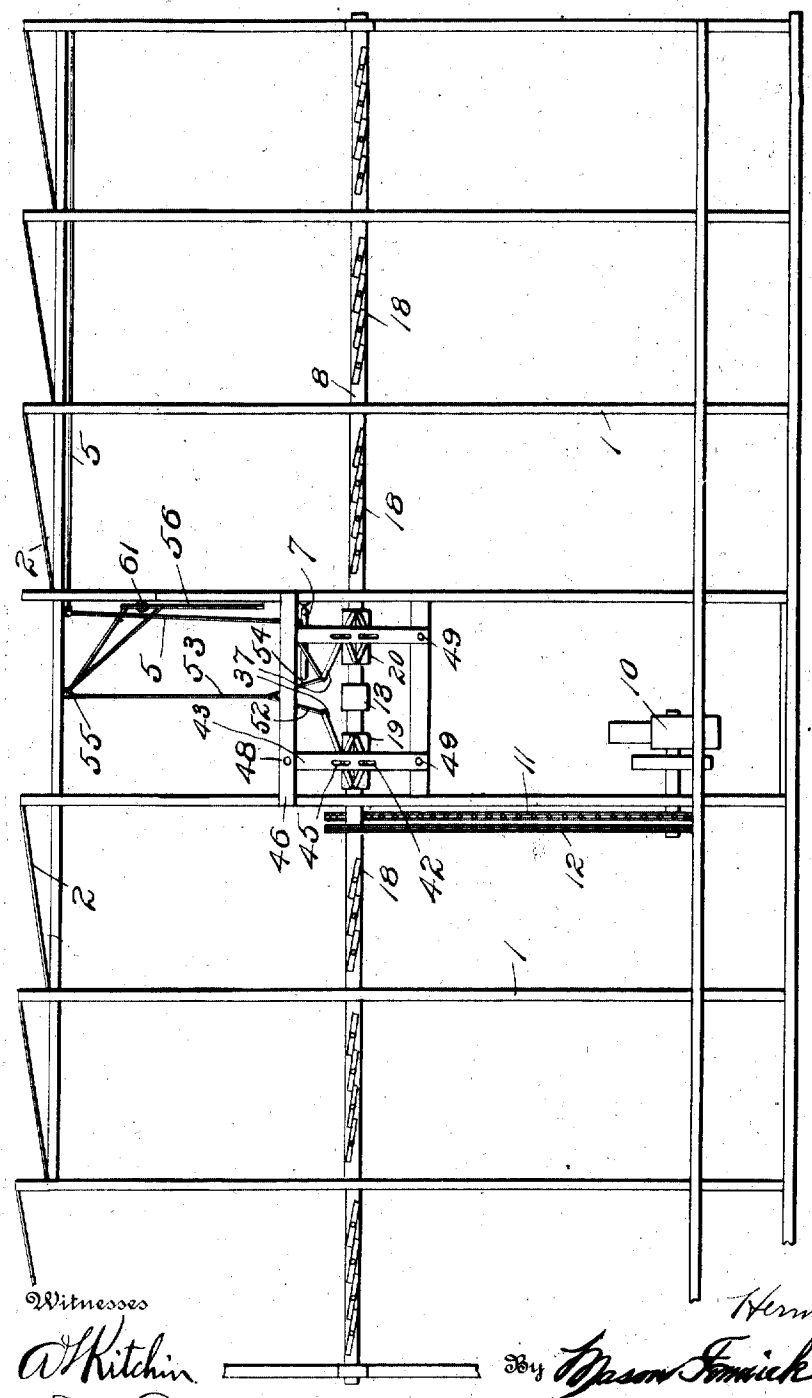


Fig. 1.

Witnesses

A. H. Kitchin

E. L. Duffy

Inventors

Herman Thaden

By Mason Fenwick & Lawrence

his Attorneys

H. THADEN.

AIRSHIP.

APPLICATION FILED JUNE 17, 1910.

1,002,093.

Patented Aug. 29, 1911.

4 SHEETS—SHEET 2.

Fig. 2.

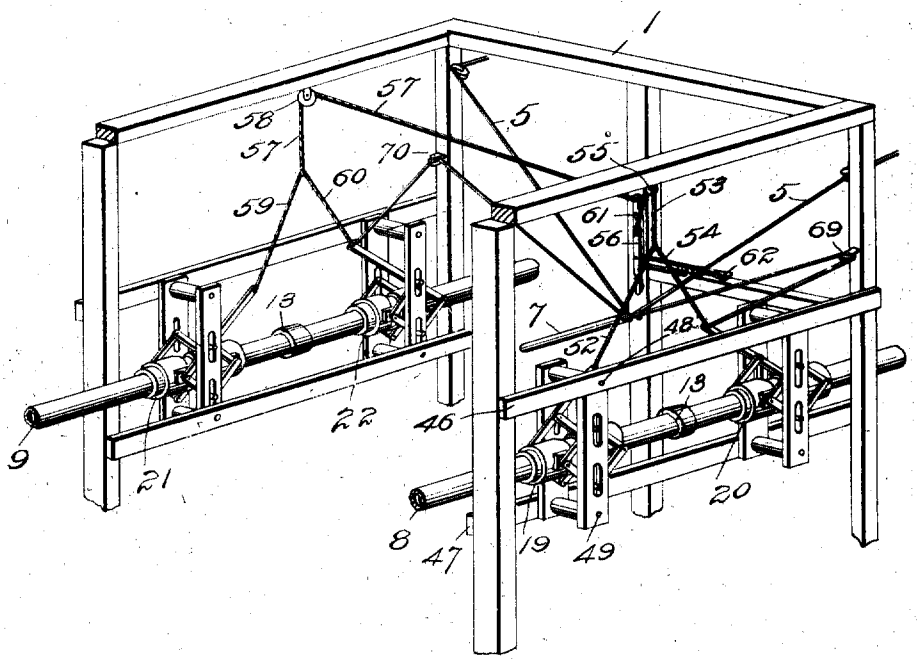
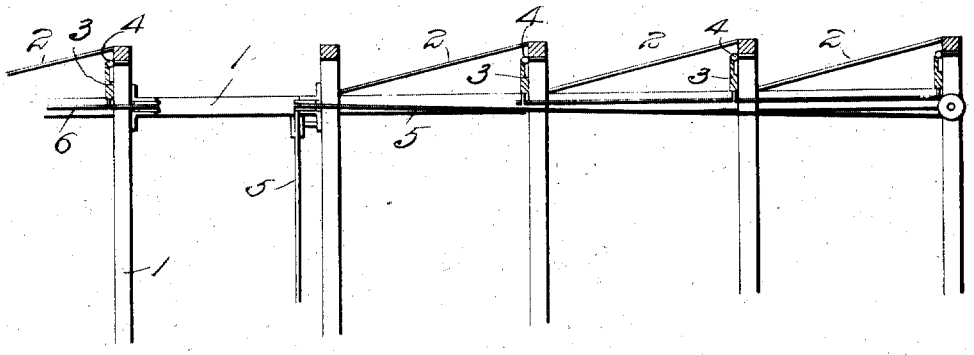


Fig. 3.



Witnesses

A. L. Kitchin

E. G. Duffy

Inventors

Herman Thaden

By Mason Fenwick & Lawrence.

his Attorneys

H. THADEN.

AIRSHIP.

APPLICATION FILED JUNE 17, 1910.

1,002,093.

Patented Aug. 29, 1911.

4 SHEETS—SHEET 3.

Fig. 4.

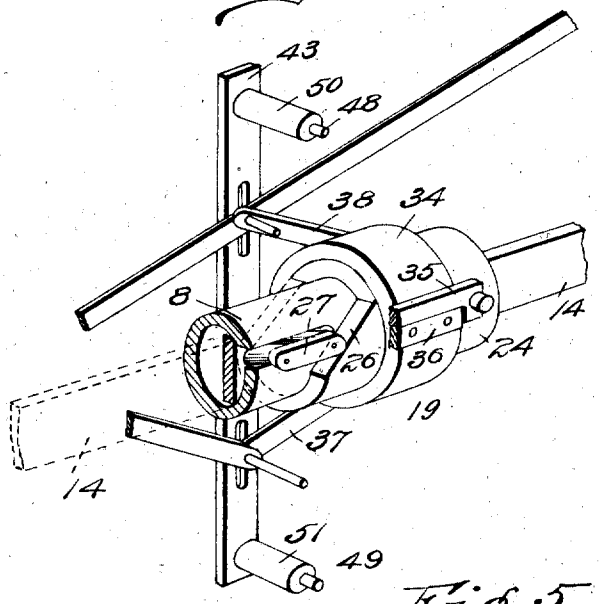


Fig. 5.

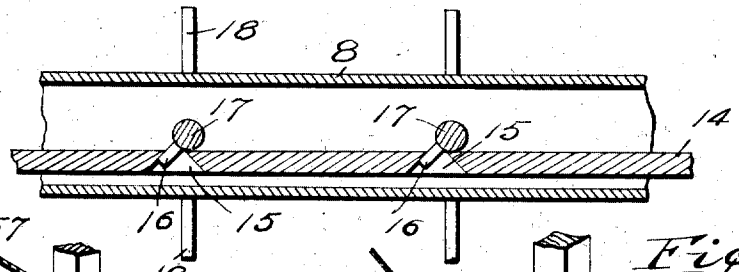


Fig. 6.

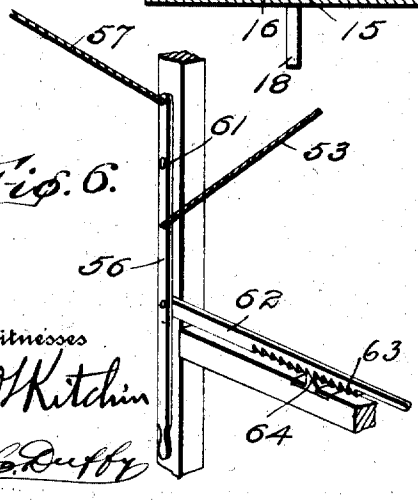
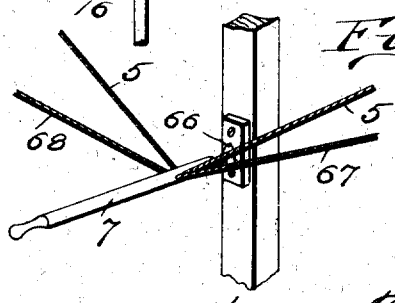


Fig. 7.



Witnesses

A. H. Kitchin

E. L. Duffy

Inventor.

Herman Thaden

By Mason Fenwick & Lawrence.

his Attorneys

H. THADEN.

AIRSHIP.

APPLICATION FILED JUNE 17, 1910.

1,002,093. **Patented Aug. 29, 1911**

4 SHEETS—SHEET 4.

Fig. 8.

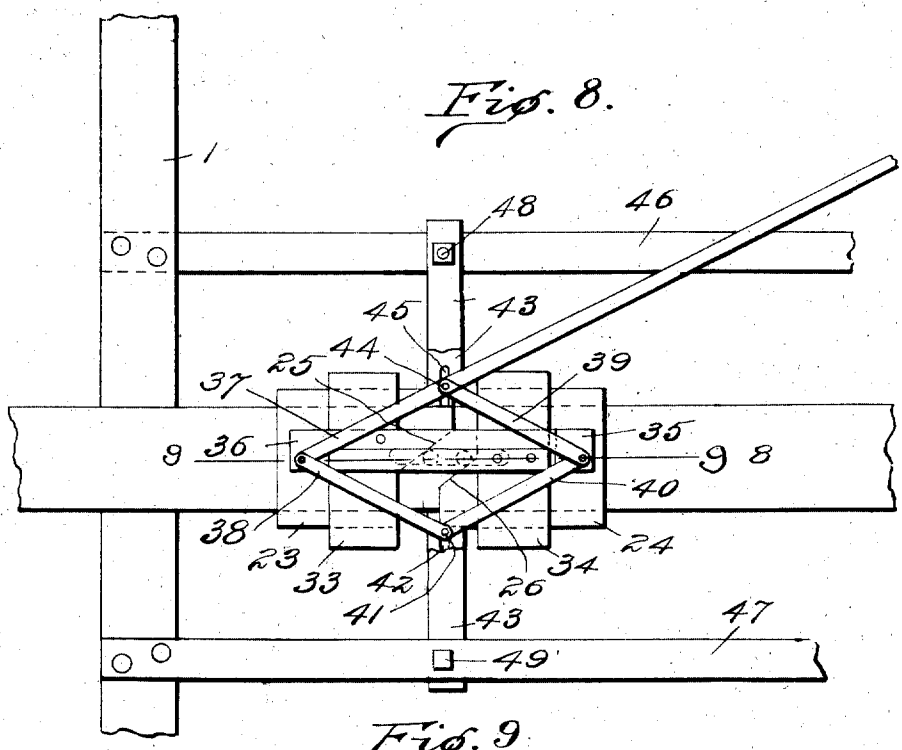


Fig. 9

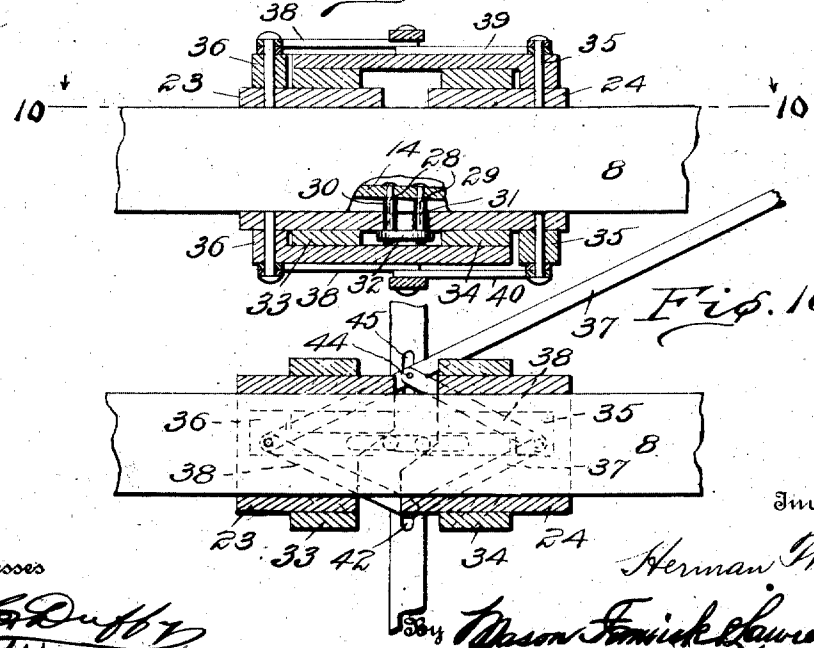


Fig. 10.

Witnesses

E. G. Duffy

A. Kitchin

Inventors

Herman Thaden

By Mason Fenwick & Lawrence,

his Attorneys

UNITED STATES PATENT OFFICE.

HERMAN THADEN, OF ATLANTA, GEORGIA.

AIRSHIP.

1,002,093. Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed June 17, 1910. Serial No. 567,488.

To all whom it may concern:

Be it known that I, HERMAN THADEN, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Airships; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in air ships, and particularly to air ships arranged with lifting and propelling means which operate from one or more prime movers and controlled to any desired extent for properly guiding and changing the position of the ship.

The object in view is the arrangement of combined lifting and propelling means, together with a plurality of controllers for shifting and varying the action of the lifting and propelling means as may be desired.

Another object of the invention is the arrangement in an air ship of lifting and propelling means adapted to co-act with lifting and sustaining planes, the planes and lifting and propelling means being connected with controlling means for varying the action of the planes and the lifting and propelling means in proper relation to each other for guiding, lifting and thoroughly controlling the various actions of the ship.

A still further object of the invention is the arrangement in an air ship, of lifting and propelling means comprising a rotating shaft having a plurality of propellers arranged thereon designed to engage the air flatwise on the down stroke when lifting, and to engage the air edgewise on the up stroke, the propeller blades being associated with a plurality of controllers designed to be operated in unison or individually for varying the action of all of the propellers, or any particular group.

With these and other objects in view the invention comprises certain novel constructions, combinations, and arrangement of parts as will be hereinafter more fully described and claimed.

In the accompanying drawings: Figure 1 is a side elevation of an air ship embodying the invention. Fig. 2 is a detail fragmentary perspective view of the central part of the air ship, showing the controllers and operating levers. Fig. 3 is a fragmentary sectional view through the front half of the upper part of the air ship, showing the arrangement of planes and controlling curtains. Fig. 4 is an enlarged detail fragmentary view of one of the controllers. Fig. 5 is a fragmentary sectional view through part of the propelling shaft showing the arrangement of the reciprocating bar and means for shifting the position of the propeller blades. Fig. 6 is an enlarged detail perspective view of one of the controlling levers for regulating the action of the controllers. Fig. 7 is an enlarged detail perspective view of a controlling lever used for varying the action of the controllers at the front of the machine. Fig. 8 is a side elevation of one of the controllers and surrounding parts. Fig. 9 is a longitudinal sectional view through Fig. 8 approximately on line 9—9 thereof. Fig. 10 is a section through the controller shown in Figs. 8 and 9, approximately on line 10—10 of Fig. 9.

In forming an air ship according to the present invention a framework of any desired kind may be provided, braced in any desired manner for forming a strong and rigid support. To the upper part of the framework is connected a plurality of planes arranged at angles to the general direction of the framework. Arranged at the front of each of the planes are a plurality of curtains for controlling the amount of air pressure permitted to engage the respective planes, the curtains being controlled by suitable cables extending to the operator's position. Arranged at any desired distance below the planes is a propeller shaft on each side of the framework, to each of which are connected a plurality of propeller blades. These propeller shafts may be operated from a single source of power or from a plurality of sources of power if desired. The propeller shafts extend for the full length of the framework and each contain a reciprocating bar which is preferably divided into independent sections. Each of these sections of the reciprocating bar are connected with a controller, which in turn is connected with a controlling lever so that all of the controllers, and consequently all of the propeller blades, may be controlled as desired. In order to steer or guide the air ship the front sections of propeller blades are arranged to be controlled independently of the rear sec-

tions and also independently of each other, so that the front of the air ship may be pointed upward or from one side to the other as desired. The controllers are arranged to cause the propeller blades to act as lifting means for the air ship when held in one position, and to act as propelling means for forcing forward the air ship when held in another position, so that the air ship may be raised and moved as desired independently of the planes or in combination therewith, the planes being brought into operation preferably only when moving substantially horizontally. When the planes are in use as supporting members the propelling means are used as means for forcing forward the ship and not as lifting means unless the ship is moving very slowly.

In order that the invention may be more clearly understood an embodiment of the same is shown in the accompanying drawings, in which 1 indicates a framework which may be formed of any desired material and which is designed to be provided with suitable braces for firmly supporting the various planes and the various moving parts. Connected with the framework 1 are a plurality of lifting and sustaining planes 2 which may be arranged at any desired angle. Arranged at the front of each of these planes are one or more curtains 3. The curtains are hinged at 4 so that unless positively prevented they will move back against the planes 2 when the air presses against the same. This will permit the planes to act freely in their normal way, but if it should be desired at any time to prevent the planes from acting the curtains may be closed by operating cables 5 and 6, cables 5 operating the curtains at the front of the machine and cables 6 operating the curtains at the rear of the machine. Preferably there are two curtains for each plane, and an operating cable 5 for each set of curtains, so that the curtains may be used to assist in turning the machine by closing one side or the other according to the direction it is desired to turn the machine. The cables 5 are connected with lever 7 so that when lever 7 is moved to the right the curtains on the left will be closed, and when lever 7 is moved to the left the curtains on the right will be closed. At the same time that the respective right and left curtains are closed the propellers on the right and left side of the machine are caused to lift. That is when the curtains on the left side of the machine are closed the propeller blades on that side are caused to lift instead of urge the machine forward, and when the curtains on the right side are closed the propeller blades on that side are caused to lift instead of urge the ship forward.

Arranged any desired distance beneath planes 2 are propeller shafts 8 and 9. The propeller shafts 8 and 9 are formed tubular and extend for the entire length of the ship, so that the prime mover 10 may be located any desired place, and yet rotate the propeller blades at the desired speed. Preferably power is conveyed from prime mover 10, through chains 11 and 12 to the shafts 8 and 9. When the size of the air ship necessitates comparatively long shafts 8 and 9 the same may be divided into sections and secured together by a coupling sleeve or member 13 which rigidly secures the sections together for causing the same to act as a continuous shaft. Arranged in each of the propeller shafts 8 and 9 is a reciprocating bar 14, which bars are preferably divided into sections, each of which sections is controlled by a controlling device hereinafter fully described. In the drawings four controllers are disclosed, and consequently four reciprocating sections are used. By this means each bar may be controlled independently if desired. The reciprocating bars 14 are provided with an aperture 15 for each of the propeller blades. The apertures 15 are beveled preferably at an angle of 45 degrees for accommodating the movement of pin 16, which is rigidly secured to the shaft 17 of each of the propeller blades 18. When the reciprocating bar 14 is in the position shown in Fig. 5 the blades 18 engage the air flatwise on the down stroke, and edgewise on the up stroke. If it is desired to cause the propeller blades to act as means for forcing the ship forward the reciprocating bar 14 is moved for causing pins 16 to extend at a substantial right angle to the general direction of bar 14, which will set the blades 18 at a 45 degree angle which will give the maximum forward impulse.

The controllers, as more clearly shown in Figs. 4 and 8 to 10 inclusive, are loosely mounted upon the shafts 8 and 9, and also are made identical so that the description of one will be sufficient for all. Referring more particularly to Figs. 4 and 8 to 10 inclusive there is disclosed a controller which will be designated for the purpose of description as 19, and which controller is of like construction as controllers 20, 21 and 22. The controller 19 comprises sleeves 23 and 24 which have co-acting cam surfaces 25 and 26 for engaging a projection 27. Projection 27 is formed with pins 28 and 29 which are rigidly secured to bar 14 and which carry anti-friction rollers 30 and 31. The outer ends of pins 28 and 29 are connected by a suitable link 32 so that the pins will act as a unit for forming a rigid projection which has anti-friction members thereon. These anti-friction members are designed to engage the cams 25 and 26 so as to permit the cams to cause a proper reciprocation of the bar 14 for properly set-

ting the blades 18 at the desired angle. Surrounding sleeves 23 and 24 are sleeves 33 and 34 which sleeves are in effect rings. The sleeves 23 and 24 are loosely mounted on shaft 8, and sleeves 33 and 34 are loosely mounted on sleeves 23 and 24. In order to cause a proper movement of the cams on sleeves 23 and 24, and also to bring into action sleeves 33 and 34 when the cams are thrown out of operation, connecting members 35—35 and 36—36 are provided. The connecting members 35—35 are rigidly secured at one end to sleeve 33 and at the other end to sleeve 24, while members 36—36 are rigidly secured at one end to sleeve 23 and at the other end to sleeve 34. By this arrangement whenever members 35—35 and 36—36 are moved longitudinally of shaft 8 and in opposite directions the cams 25 and 26 will move apart but sleeves 33 and 34 will move together, so that as projection 27 rotates the same will engage part of one of the cams 25 or 26 and engage sleeves 33 and 34 for a partial rotation if the cams are moved a short distance apart.

In order to control the action of the cams and sleeves a pair of links 37—37 and 38—38 are pivotally connected to the ends of members 36—36 and a pair of links 39—39 and 40—40 are pivotally connected to the ends of members 35—35. Links 38—38 and 40—40 are pivotally connected together by a pin 41 which extends through apertures 42—42 in bars or guiding members 43—43. Links 37—37 and 39—39 are pivotally connected together by a pin 44 which extends through bars 43—43 and is slidingly mounted in slots 45—45. One of the bars 43 is bolted to cross braces 46 and 47 by bolts 48 and 49. Bolts 48 and 49 pass through sleeves 50 and 51 and through both bars 43 and braces 46 and 47, so as to firmly hold in position both of the bars 43 and provide ample support for the pins 41 and 44. One of the links used for opening and closing the cams, namely link 37, is lengthened to any desired extent forming a handle or lever. To the outer end of link 37 is secured cable 52 which is connected with cable 53. A cable 54, similar to cable 52 is also connected with cable 53, and extends down to the lever or long link of controller 20, so that when cable 53 is pulled both of the controllers 19 and 20 will be operated for throwing the cams 25 and 26 into operation. When cable 53 is released the projection 27 will automatically force apart the cams 25 and 26 and at the same time force together sleeves 33 and 34 leaving only sufficient space between the same for the free rotation of the projection.

Cable 53 passes upward over pulley 55 and from thence to lever 56. Connected to lever 56 is a second cable 57 which acts similar to cable 53 except that the same passes over pulley 58 and moves cables 59 and 60 for actuating controllers 21 and 22 on the opposite side of the machine to controllers 19 and 20. Lever 56 is pivotally mounted at 61 and cables 53 and 57 are secured to the lever on opposite sides of its pivotal point, so that a pivotal movement in one direction will pull both cables 53 and 57 and a pivotal movement in the opposite direction will release both cables. For instance, if lever 56 had the lower end thereof swung to the left both cables will be pulled, but if swung in the opposite direction both cables will be slacked. In pulling cables 53 and 57 the respective levers 37 of the controllers will be pulled or raised pivotally for throwing the cams into operation. In order to hold the cams properly in operation as long as desired a pivotal member or pawl 62 is pivotally connected with lever 56 and is formed with teeth 63 which engage a catch or tooth 64 rigidly connected with one of the cross bars of the framework. This tooth and ratchet construction permits a free movement of lever 56 in such a direction as to pull cables 53 and 57 but will not permit a return thereof until pawl 62 has been lifted out of engagement with tooth or catch 64. When the controllers are held to act in the position shown in Fig. 8 the blades 18 of the propellers are acting in such a manner as to lift the machine so that in order to hold the controllers in position for causing the blades to continue a lifting motion all that is necessary is to move lever 56 to the left and allow pawl 62 to hold the lever in that position. When a sufficient height has been attained and it is desired to move longitudinally pawl 62 is raised and lever 56 permitted to take its normal position and sleeves 33 and 34 of the controllers permitted to contact with the projection 27. If it should be desired to cause the blades 18 to give a lifting and slightly propelling action lever 56 could be moved only a short distance to the left and held in that position by pawl 62.

In guiding the air ship the same is caused to turn to the right or left as desired by causing one side of the front section or propellers to lift, while the remaining front section and the rear section are forcing the machine in a forward direction. In order to control and regulate the action of each of the front sections independently of the rear sections, a controlling or guiding lever 7 is provided. Lever 7 is connected with part of the framework by a universal joint 66 (Figs. 2 and 7), so as to permit a free movement in any direction of the lever according to what may be desired. Connected with lever 7 at any desired distance from joint 66 are cables 67 and 68

which cables pass over pulleys 69 and 70, and from thence to the links 37 of the controllers 20 and 22. By this arrangement when lever 7 is moved downward pivotally both cables 67 and 68 are pulled so that both controllers 20 and 22 are operated for causing cams 25 and 26 to be moved into an operative position. This will cause a lifting action for both of the front sections of the propeller blades so that the machine will be slanted or inclined upward. If lever 7 is moved to the right cable 68 is pulled and cable 67 loosened, so that only controller 22 will be operated for causing the section controlled thereby to lift. This will cause the machine to turn to the left. The movement of lever 7 to the left will cause the machine to move to the right. Cables 5—5 are also connected with levers 7 at substantially the same point as cables 67 and 68, so that when either of the cables 67 or 68 is pulled one of the cables 5 will be pulled for closing the curtains 3 on that side of the machine. The closing of the curtains will destroy the lifting and sustaining power of the planes on that side of the machine which will be counter-balanced by the lifting of the blades 18 on that side of the machine, so that, as far as that particular side of the machine is concerned, it is not given either an upward or a forward motion, while the remaining parts of the machine are given a forward motion. This will cause the machine to turn.

What I claim is:

1. In an air ship, a framework, a plurality of hollow longitudinal rotating shafts, means for rotating said shafts, propeller blades connected with said shafts, a reciprocating bar in each of said shafts connected with the propeller blades for controlling the angle at which the propeller blades operate, cams for moving and controlling the reciprocating bars, a lever mechanism for moving the cams into and out of operation, and a slidably mounted sleeve arranged on each of said cams for maintaining the bars in a fixed position for causing the propeller blades to operate at a predetermined angle after the cams have been moved out of operation.

2. In an air ship, a framework, a plurality of longitudinally disposed hollow rotating shafts, means for rotating said shafts, propeller blades connected with the shafts, a reciprocating bar for each of said shafts and connected with the propeller blades for controlling the angle at which the propellers operate, a pin projecting from each of said reciprocating bars, a pair of cams between which said pins operate, whereby the longitudinal motion of said reciprocating bar is created, pivotally mounted means for throwing said cams out of operation, slidingly mounted sleeves operated by said pivotally mounted means for maintaining the bars in a fixed position when the cams have been moved out of operation for causing the propeller blades to operate at a predetermined angle.

3. In an air ship, a frame, a plurality of longitudinally disposed hollow rotating shafts, means for rotating the shafts, propeller blades connected with the shafts, a reciprocating bar in each of the shafts connected with the propeller blades for controlling the angle at which the propeller blades operate, means for moving and controlling the reciprocating bars, means for throwing the bar moving and controlling means out of operation, and a plurality of sleeves for maintaining the bars in a fixed position for causing the propeller blades to operate at a predetermined angle.

4. In an air ship, a frame, a plurality of longitudinally disposed hollow rotating shafts, means for rotating the shafts, propeller blades connected with the shafts, a reciprocating bar for each of the shafts and connected with the propeller blades for controlling the angle at which the propeller blades operate, cams for moving and controlling the action of the reciprocating bars, means for throwing the cams out of operation, and a plurality of sleeves for maintaining the bars in a fixed position when the cams have been thrown out of operation for causing the propeller blades to operate at a predetermined angle.

5. In an air ship, a framework, a pair of rotatable shafts extending longitudinally of said framework, means for rotating said shafts, propeller blades arranged along substantially the entire length of said shafts, a plurality of controllers for the propeller blades of each of said shafts, and a single means for varying the action of said controllers.

6. In an air ship, a framework, a plurality of propeller blades for raising and propelling said framework, means for actuating said propeller blades, and a controller for controlling the action of said propeller blades, said controller comprising a pair of cams, means for slidingly moving said cams for varying the action thereof, and a pair of sleeves moved by said last mentioned means for holding said propeller blades in a predetermined position when said cams are moved out of operation.

7. In an air ship, a framework, propelling members arranged on each side of said framework, a shaft on each side of said framework for rotating said propelling members, means for rotating said shafts, a reciprocating bar arranged in each of said shafts for controlling the position and action of said propeller blades, a lug projecting from each of said bars, and a controller engaging each of said lugs for controlling

the action thereof, each of said controllers comprising a pair of cams adapted to engage said lugs for moving the same longitudinally of said shafts, a pair of sleeves for holding said lugs against longitudinal movement, and means for simultaneously moving said cams from said lugs and for moving said sleeves against said lugs, whereby said lugs are permitted a free rotary movement and prevented any longitudinal movement.

In testimony whereof I affix my signature in presence of two witnesses.

HERMAN THADEN.

Witnesses:
LUCIEN H. THADEN,
E. T. FENWICK.