Feb. 18, 1936. J. E. L. HALL 2,031,310

FLIGHT APPARATUS

Filed April 16, 1932 3 Sheets-Sheet 1

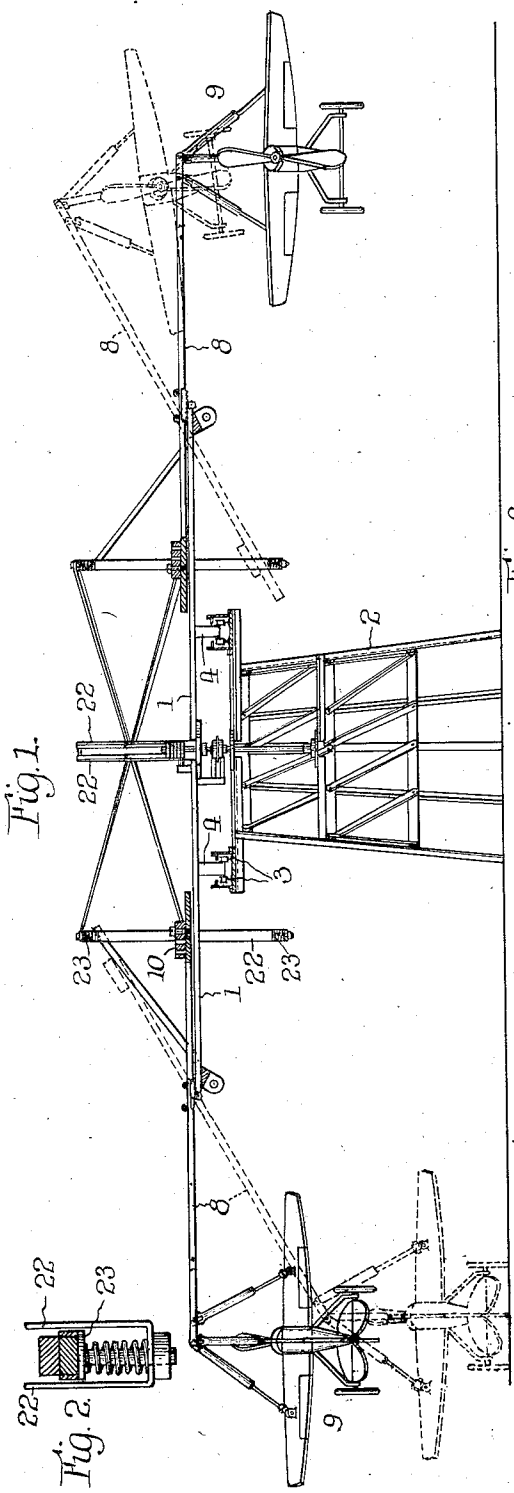

Fig. 1.

Fig. 2.

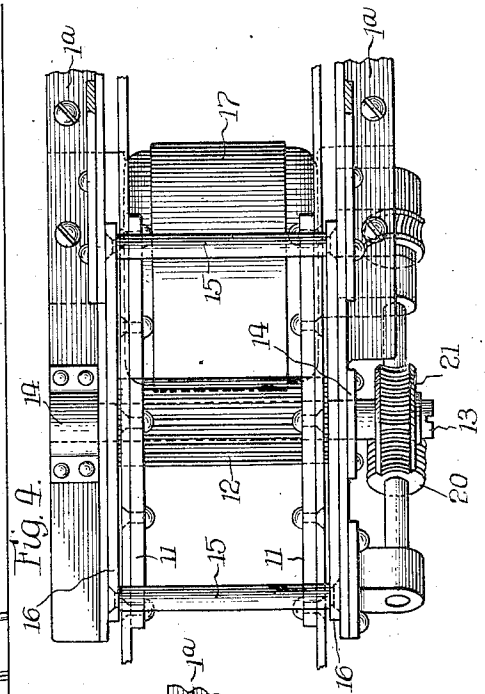

Fig. 4.

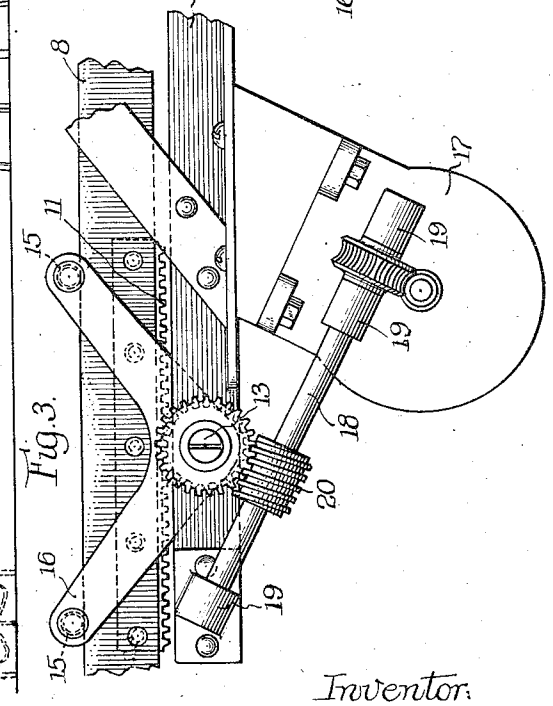

Fig. 3.

Inventor:
James E. L. Hall,
By Churchill Parker Marks
Attys.

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FLIGHT APPARATUS

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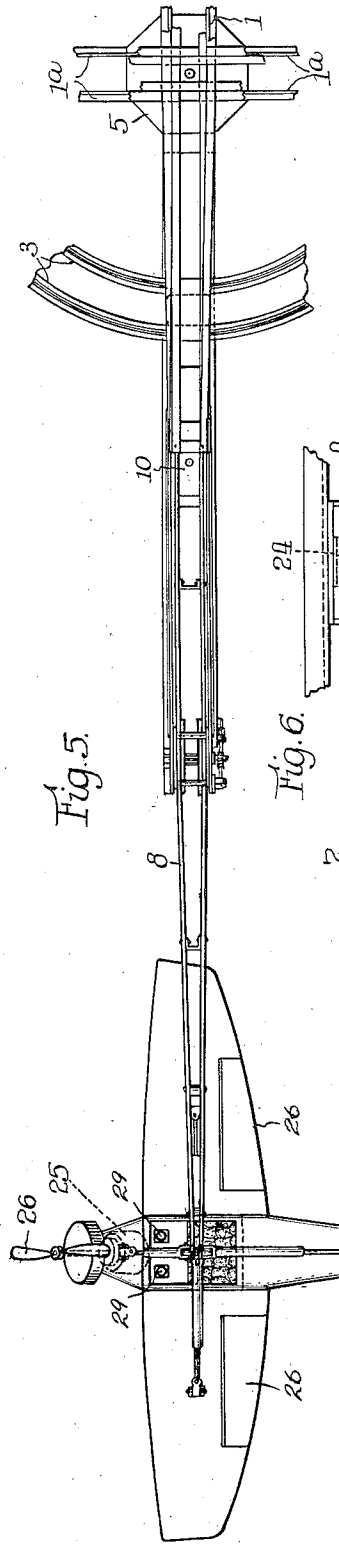

Fig. 5.

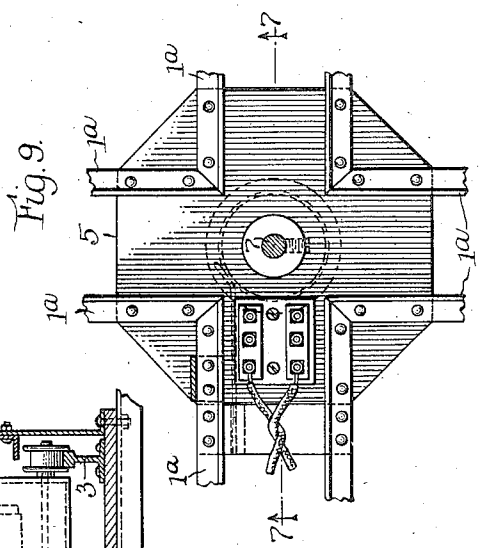

Fig. 9.

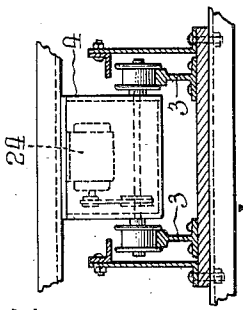

Fig. 6.

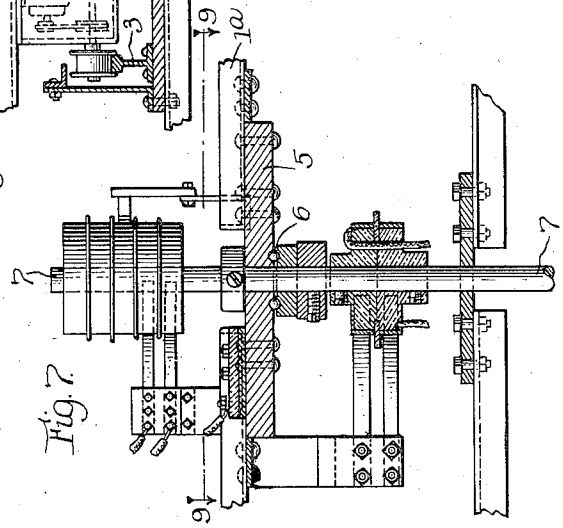

Fig. 7.

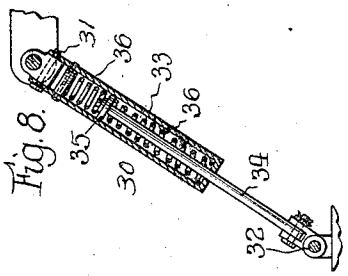

Fig. 8.

Inventor:
James E. L. Hall,
By Kindell Parker Marlow
Attys

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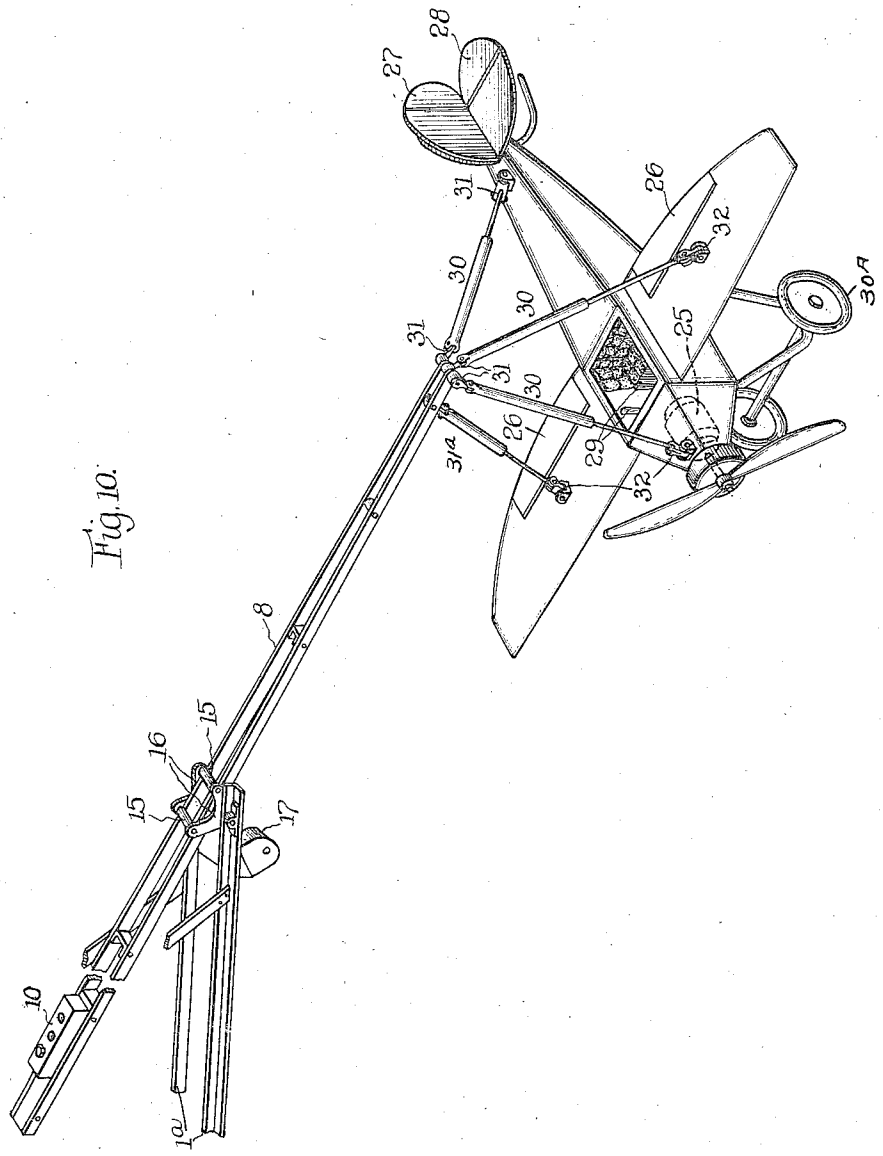

Fig. 10.

Inventor:
James E. L. Hall,
By Churchill Parker Carlson
Attys.

Patented Feb. 18, 1936 2,031,310

UNITED STATES PATENT OFFICE

2,031,310

FLIGHT APPARATUS

James E. L. Hall, Chicago, Ill., assignor to Cecil Martin, Chicago, Ill.

Application April 16, 1932, Serial No. 605,609

17 Claims. (Cl. 35—12)

The object of this invention, generally stated, is to produce an apparatus utilizing aircraft for instruction and amusement. More specifically, the aim is to provide apparatus whereby an inexperienced person may operate an airplane with safety and cause it to take off, land, bank right or left, level off, execute half-turns, side-slip, zoom, glide and power-dive. Other objects and advantages will appear from the following detailed description of one of numerous possible embodiments of the invention.

In the accompanying drawings

Figure 1 is a fragmental elevation of the apparatus.

Fig. 2 is a fragmental detail of a guide for the pivoted arm 8.

Fig. 3 illustrates, in side elevation, a means for adjusting the apparatus to compensate for differences in the weights of the occupants.

Fig. 4 is a plan view of the device shown in Fig. 3.

Fig. 5 is a fragmental plan view of the apparatus.

Fig. 6 illustrates a truck for supporting one of the booms.

Fig. 7 illustrates the pivotal support for the booms.

Fig. 8 is a view of one of the links by means of which each airplane is connected to the revolving structure through which the operator exercises general control of the airplanes.

Fig. 9 is a section on line 9—9 of Fig. 7.

Fig. 10 is a fragmental perspective view of the apparatus.

The embodiment herein shown of the invention comprises a mooring structure including a plurality of booms 1, each boom being constructed of two spaced bars 1a rigidly connected together. The booms 1 radiate from a common center and are arranged to revolve upon a vertical axis. These booms may be supported for such rotation by any preferred means. Herein I have shown a tower or central framework 2 carrying two concentric rails 3 (Fig. 6) upon which trucks 4 are arranged to travel. These trucks support the booms 1 for rotation in a horizontal plane. The inner ends of the booms are rigidly secured to a central member 5 which is supported upon an antifriction bearing 6 for rotation upon a fixed vertical shaft 7. Said shaft is carried by the tower 2.

An arm 8 is pivoted to the outer end of each boom 1 for tilting movement in a vertical plane. The outer end of each arm supports an occupant carrier, herein shown as an airplane 9 of any preferred type, and to the inner end of each arm is attached a counterweight 10 for partially counterbalancing the airplane and its pilot. The counterweight may be adjustably connected to the arm in any preferred manner.

In order to adjust the counterbalance for variations in the weights of pilots, I provide means for adjusting the arms 8 toward and away from the axis 7. As shown in Figs. 3 and 4, the arm 8 carries racks 11 that mesh with a pinion 12. The pinion 12 is fixed upon a shaft 13 which is mounted in bearings 14 on the boom 1. Guide rollers 15 overlie the arm 8, these rollers being carried by brackets 16 which are pivoted on the shaft 13. Any preferred means may be used to drive the pinion 12 to adjust the arm 8 toward and away from the axis 7. Herein I have shown a reversible electric motor 17 attached to the boom 1 and geared to a shaft 18 that is mounted in bearings 19 on the boom and the motor housing. On the shaft 18 is a worm 20 that meshes with a worm wheel 21 on the pinion shaft 13. It will be seen that rotation of the pinion will cause longitudinal adjustment of the arm 8, and that the arm is free to tilt on the axis of the pinion 12.

In order to maintain the arm 8 in the vertical plane of the boom to which it is attached, there is provided suitable means, such as a guide rigidly secured to the boom and serving to prevent lateral displacement of the inner end of the arm with respect to the boom. As herein shown, said guide consists of two parallel vertical bars 22 forming between them a guideway for the inner end of the arm, the ends of said guideway being closed to limit vertical swinging movement of the arm. To cushion shock as the arm reaches the limits of such swinging movement I provide resilient means such as spring-supported buffers 23 (Figs. 1 and 2).

Motion may be communicated to the airplanes 9 in various ways. For example, the booms 1 may be caused to revolve by means of an electric motor 24 (Fig. 6) mounted upon one of the trucks 4 and connected to one of the axles of said truck to drive the latter and thus cause the truck to travel upon the rails 3. An alternative method of imparting movement to the airplanes consists of equipping each airplane with an electric motor 25 (Fig. 5) for driving the propeller 26 of the airplane. The last-mentioned method is the one I prefer, but either or both forms of drive may be used.

Electric current may be supplied to the arm-adjusting motors 17, the boom-revolving motor

24 and the airplane motors 25 in any conventional or desired manner.

Whether or not the airplanes are provided with individual motors, it is preferred that each airplane be provided with the usual means for directing its course, such as ailerons 26, a rudder 27 and elevators 28 arranged to be operated by the ordinary control sticks 29. Preferably, the supply of current to the individual airplane motors 25 is controlled by the operator in charge of the apparatus, so that if any pilot puts his airplane through excessive evolutions his motor may be slowed down or stopped, and so that the entire apparatus may be brought to rest upon the expiration of the time for which the riders have paid. Each airplane is provided with landing gear 30A.

Each airplane is connected to its arm 8 in such a manner as to permit the pilot a large measure of freedom in guiding his craft. In the construction herein shown, the airplane is suspended from the arm 8 by means of four struts 30, 31a connected to the airplane at four separate points. The struts are connected to the arm and to the airplane through the medium of universal joints 31 and 32. Preferably, each strut is yieldably variable in length so that it may contract and lengthen to permit the airplane to tilt to a limited extent in any direction with relation to the arm 8. In the construction herein shown, each strut consists of a tubular section 33 connected to the arm 8, and a rod 34 extending through the lower end or head of the section 33. On the upper end of the rod 34 is a head 35 the movement of which in either direction is yieldingly resisted by springs 36 enclosed in the tubular section 33.

The strut 31a which is connected to the wing that extends toward the axis of rotation is connected to the arm 8 at a point located inwardly of the points at which the remaining struts are attached, in order to counteract the tendency of the airplane to swing outwardly under centrifugal force.

The operation is as follows: When the apparatus is idle, the airplanes rest upon the ground, as indicated in dotted lines at the left-hand side of Fig. 1. After the pilots have seated themselves in the cockpits of the airplanes, the operator in charge of the apparatus supplies current to the motors 25, whereupon the airplanes are caused to travel in a circular path. As the speed of the planes increases, they leave the ground, whereupon the pilots may bank right or left, make half-turns, side-slip, glide, zoom, power-dive or level off into general flight position. As indicated in dotted lines in Fig. 1, the planes may fly in an undulating course above and below the horizontal plane of the booms 1.

When the operator so desires, he reduces or cuts off the supply of current to the motors 25, whereupon the planes land and come to rest.

It will be seen that the apparatus herein disclosed enables persons safely to acquire practice in controlling an airplane and affords thrills and amusement to the occupants of the airplanes and to the spectators.

I claim as my invention:

1. The combination of a rotatory structure, positioned in a horizontal plane for rotation upon a central axis, an arm pivoted between its ends to the peripheral portion of said structure, an occupant carrier connected to the outer end of said arm, a partial counterweight connected to the inner end of said arm, and means on said structure engaging the inner end of said arm to prevent lateral displacement of said arm with respect to said structure, said arm being pivoted to swing to carry the outer end thereof above the horizontal plane of said structure whereby to permit the occupant carrier to rise higher than it could under centrifugal force due to the rotation of said structure.

2. The combination of a rotatory structure, an arm pivoted between its ends to the outer portion of said structure, an occupant carrier connected to the outer end of said arm, means on said structure engaging the inner end of said arm to prevent lateral displacement of said arm with respect to said structure, said arm being pivoted to swing to carry the outer end thereof above the horizontal plane of said structure, whereby to permit the occupant carrier to rise higher than it could under centrifugal force due to the rotation of said structure, and means for adjusting said arm to shift the fulcrum point thereof longitudinally of the arm.

3. The combination of a rotatory structure, an arm pivoted between its ends to the outer portion of said structure, an occupant carrier connected to the outer end of said arm, a partial counterweight connected to the inner end of said arm, and means for adjusting said arm to shift the fulcrum point thereof longitudinally of the arm whereby to vary the relative leverages of the occupant carrier and the counterweight.

4. The combination of a rotatory structure, a plurality of struts, universal joints connecting the upper ends of said struts to the outer portion of said structure, an occupant carrier, and universal joints connecting the lower ends of said struts to said occupant carrier, said struts having yieldably connected rigid sections whereby the struts are yieldably extensible and contractible, said carrier being in the form of an airplane having power operated means for driving the plane through the air and occupant manipulatable flight controlling means including ailerons, elevators and a rudder for controlling the flight of the plane under its own power about the axis of rotation of the rotatory structure and to the extent limited by the strut connection of the plane to the rotatory structure.

5. The combination of a rotatory structure, a plurality of struts, universal joints connecting the upper ends of said struts to the outer portion of said structure, an airplane having a motor-driven propeller for driving said airplane, and universal joints connecting the lower ends of said struts to said airplane, said struts having yieldably connected rigid sections whereby the struts are yieldably extensible and contractible, said carrier being in the form of an airplane having power operated means for driving the plane through the air and occupant manipulatable flight controlling means including ailerons, elevators and a rudder for controlling the flight of the plane under its own power about the axis of rotation of the rotatory structure and to the extent limited by the strut connection of the plane to the rotatory structure.

6. The combination of an airplane having landing gear and carrying power means to drive the airplane through the air, a rotary structure, an arm pivoted between its ends to said structure in outward spaced relation to the axis of rotation of said structure and extending in a plane radial to said structure, the outer end of said arm being normally beyond the peripheral edge of said structure and connected to said airplane for ap-

proximately universal movement relative to said arm, the inner end of said arm being weighted to counterbalance partially the weight of the airplane, but not sufficiently to lift the airplane off the ground when the structure is not rotating.

7. The combination of a revoluble structure disposed for rotation about a vertical axis, an arm pivoted intermediate its ends upon said structure and terminating at its inner end short of the axis of rotation of said structure, a self propelled and occupant flight controlled airplane suspended from the outer end of the arm, counterweight means for the inner end of the arm whereby the outer end of the arm may swing above and below the pivotal connection of the arm to the supporting structure in response to the occupant controlled movements of the plane, said suspension means providing a connection of the airplane with the outer end of the arm whereby the airplane may have approximately universal movement with relation to the arm in addition to its movement with the arm above and below the pivotal connection of the arm with the supporting structure and thus enable the self propelled airplane to have movements simulating a regular airplane under control of the occupant.

8. The combination with a mooring structure having means rotatable on said structure in a horizontal plane, an arm pivoted intermediate its ends upon said rotatable means in outward radial spaced relation to the axis of rotation of said means, said arm having its inner and outer ends free for movement in a vertical plane, a self propelled airplane suspended from the outer end of said arm, said airplane being equipped with a power driven propeller for driving it through the air in a path about the axis of rotation of said rotatable means and with standard controls in association with the wings at the sides of the plane allowing the occupant to take off, land, bank right or left, ascend or descend at will under the power of the plane, and means suspending the airplane from the outer end of the arm, said means being so constructed and arranged that universal movement within limits in response to the flight control of the plane by the occupant may be had with respect to the arm in the movement of the arm on its pivot and the travel of the airplane under its own power in its path of rotation about the supporting structure.

9. The combination of an airplane adapted to carry an occupant and having power operated means for driving the airplane through the air and flight controlling means including ailerons, elevators and a rudder manipultable by the occupant of the plane for controlling the flight of the plane under its own power, a mooring structure rotatable in a horizontal plane, and a connection between the airplane and the mooring structure restraining the flight of the airplane under its own power and in response to the manipulation of the flight controlling means by the occupant of the plane above and below the plane of said mooring structure and about the axis of rotation thereof.

10. The combination of a rotatory structure, a plurality of struts, universal joints connecting the upper ends of said struts to the outer portion of said structure, an occupant carrier, and universal joints connecting the lower ends of said struts to said occupant carrier, said carrier being in the form of an airplane having power operated means for driving the plane through the air and occupant manipulatable flight controlling means for controlling the flight of the plane under its own power about the axis of rotation of the rotary structure and to the angular extent limited by the struts and their universal joint connection to the plane and said structure respectively, said struts having the capability of changing length to a limited extent in response to the angular movement of the airplane relatively to the rotatory structure.

11. The combination of a rotatory structure, four struts grouped about a common axis, universal joints connecting the upper ends of said struts to the outer portion of said structure, an occupant carrier, and universal joints connecting the lower ends of said struts to said occupant carrier, the upper ends of said struts being relatively close together about said axis and the lower ends being relatively remote from one another, said occupant carrier being in the form of an airplane having power operated means for driving the plane through the air and occupant manipulatable flight controlling means for controlling the flight of the plane under its own power about the axis of rotation of the rotatory structure and to the extent limited by the strut connection of the plane to said structure, said struts being constructed to change in length to a limited extent in response to the movement of the plane relatively to said structure.

12. In an apparatus of the character described, the combination of a main support, a revoluble central structure disposed for rotation on the main support about a vertical axis, an air craft device in the form of an airplane disposed exterior of the main support and having a power operated propellor for driving the airplane through the air and flight controlling means operable by the occupant of the airplane for controlling the flight thereof under its own power, and means connecting said airplane to the outer peripheral portion of the revoluble structure, said means carrying the airplane for flight under the control of the occupant thereof about the axis of rotation of said revoluble structure and above and below the connection of the plane to said revoluble structure.

13. The combination of a revoluble central structure disposed for rotation in a horizontal plane, an arm pivoted intermediate its ends upon the central structure, said arm extending radially of the central structure and having its inner end terminating short of the axis of rotation of said central structure, and its outer end beyond the periphery of said central structure, a self-propelled and occupant flight controlled airplane adjacent the outer end of said arm, a hanger suspending the airplane from the outer end of the arm, said hanger comprising means extending between the outer end of the arm and the airplane and having a universal joint connection with the arm and airplane, respectively, whereby to limit the angular movement of the airplane with respect to the arm below the same in response to the occupant flight controlled movement of the airplane, and a counter-weight carried by the inner end of the arm, whereby the outer end of the arm may swing to carry the airplane above and below the pivotal connection of the arm to the central structure.

14. The combination of a revoluble central structure disposed for rotation in a horizontal plane, an arm pivoted intermediate its ends upon the central structure in outward spaced relation to the axis of rotation thereof, said arm having its inner and outer end portions in substantial alignment and disposed with its inner end por-

tion terminating short of the axis of rotation of the central structure and its outer end portion extending outwardly beyond said central structure, a self-propelled and occupant flight controlled airplane suspended from the outer end portion of the arm exteriorly of the central structure and a counter-weight for said airplane cooperable with the inner end portion of the arm whereby the outer end of the arm may swing above and below the pivotal connection of the arm to the central structure and carry the airplane therewith in response to the occupant flight controlled movements of the plane.

15. The combination of a revoluble central structure disposed for rotation about a vertical axis, an arm pivoted upon the outer peripheral portion of the central structure on a horizontal axis for swinging movement in a vertical plane, said arm having its inner and outer end portions in substantial alignment and disposed with its inner end portion terminating short of the axis of rotation of the central structure and its outer end portion normally extending outwardly beyond the peripheral portion of said central structure, a self-propelled and occupant flight controlled airplane suspended from the outer end of the arm exteriorly of the central structure, and a counter-weight for the airplane cooperable with the arm whereby the outer end of the arm may swing above and below the pivotal connection of the arm to the central structure and carry the airplane therewith in response to the occupant flight controlled movements of the plane.

16. The combination of a revoluble central structure disposed for rotation about a vertical axis, arms pivoted upon the central structure in outward spaced relation to the axis of rotation thereof and disposed in circumferentially spaced relation about the same, said arms being pivoted on the central structure for swinging movement in vertical planes and having their inner end portions terminating short of the axis of rotation of the central structure whereby the arms may move independently of each other and having their outer end portions extending radially beyond the central structure to provide relatively large clearance spaces for the airplanes at the outer ends of the arms, self-propelled and occupant flight controlled airplanes suspended, one from the outer end of each arm exteriorly of the central structure, and counter-weights for the airplanes cooperable with the arms whereby the outer ends of the arms may swing above and below the pivotal connection of the arms with the central structure and carry the airplanes therewith in response to the occupant flight controlled movements of the respective planes, the central structure being revolved by the combined pull of the self-propelling devices of the airplanes suspended over the outer ends of the arms.

17. The combination of a revoluble central structure disposed for rotation about a vertical axis, arms pivoted intermediate their ends upon the central structure in outwardly spaced relation to the axis of rotation thereof and disposed in circumferentially spaced relation about the same, said arms being pivoted on the central structure for swinging movement in vertical planes and having their inner and outer end portions in substantial longitudinal alignment and disposed with their inner end portions terminating short of the axis of rotation of the central structure and their outer end portions extending outwardly beyond the central structure, self-propelled and occupant flight controlled airplanes suspended, one from the outer end of each arm exteriorly of the central structure, and counter-weight for the airplanes, cooperable with the inner ends of the arms whereby the outer ends of the arms may swing above and below the pivotal connection of the arms with central structure and carry the airplanes therewith in response to the occupant flight controlled movements of the respective planes.

JAMES E. L. HALL.