Feb. 27, 1923. 1,446,522

R. B. SMITH

AEROPLANE

Filed Mar. 5, 1921 4 sheets-sheet 1

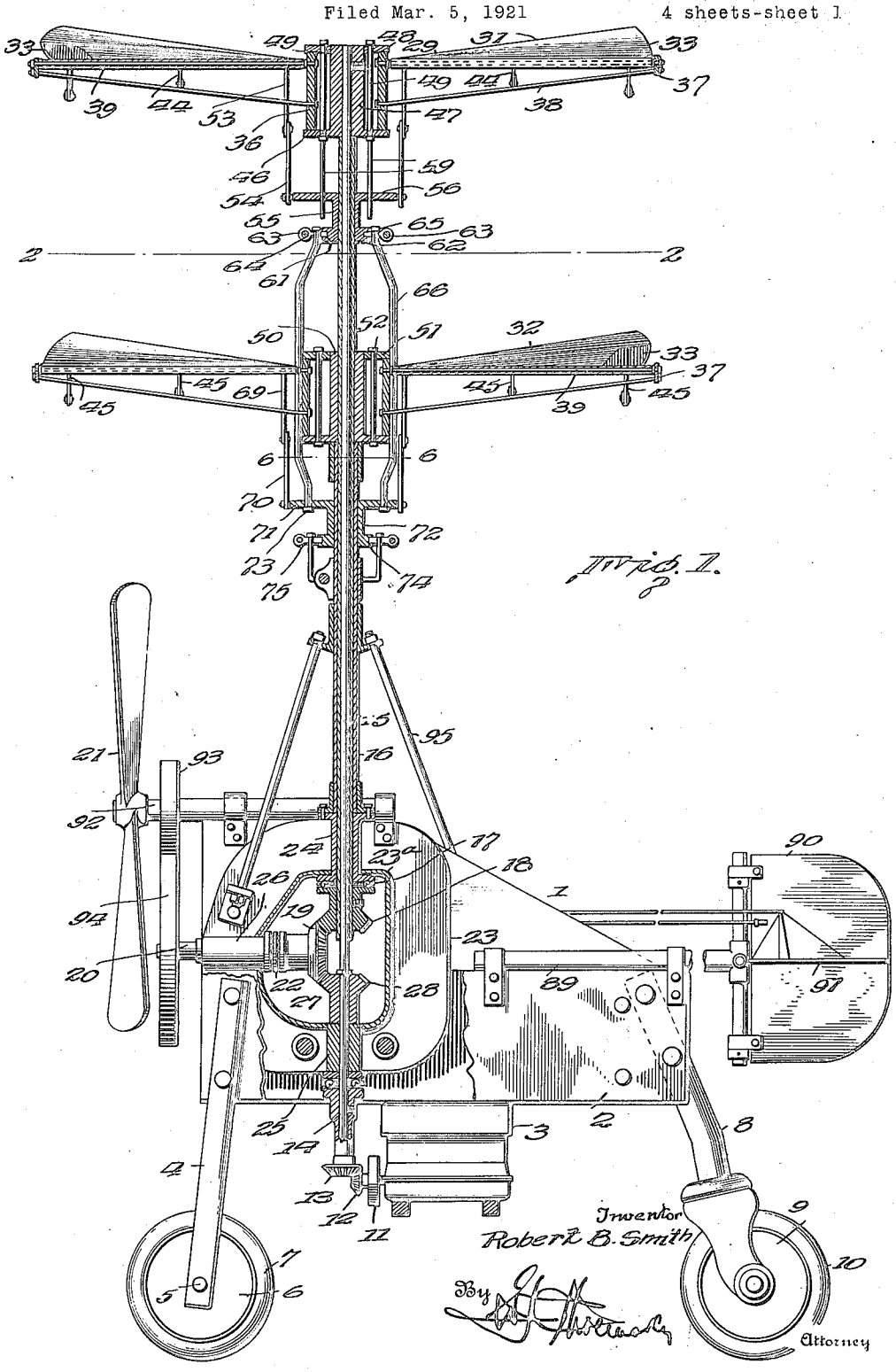

Fig. 1.

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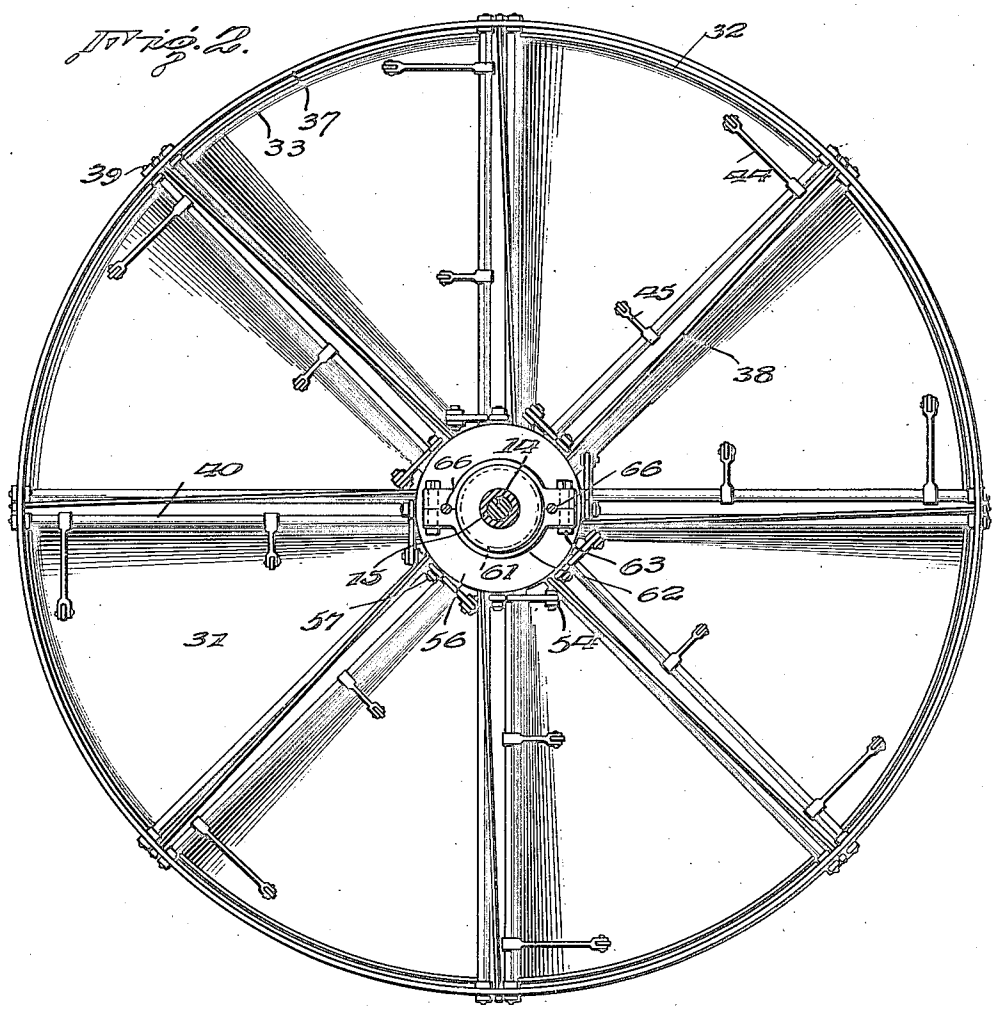

Fig. 2.

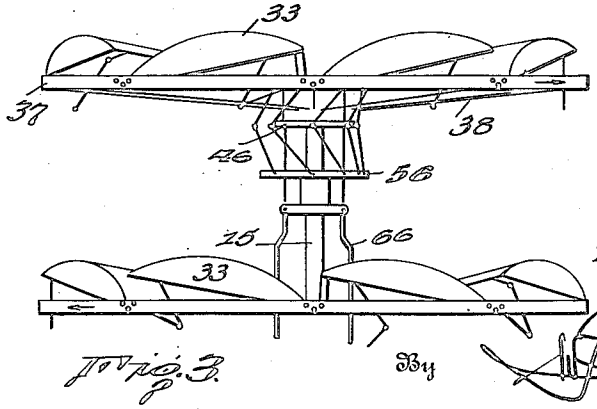

Fig. 3.

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AEROPLANE

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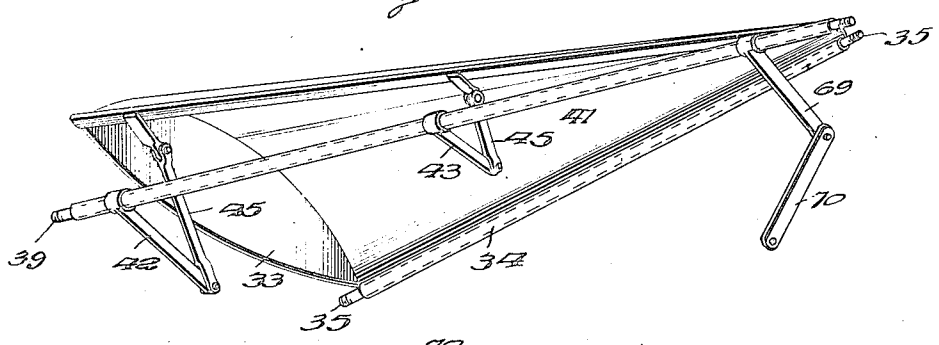
Fig. 5.



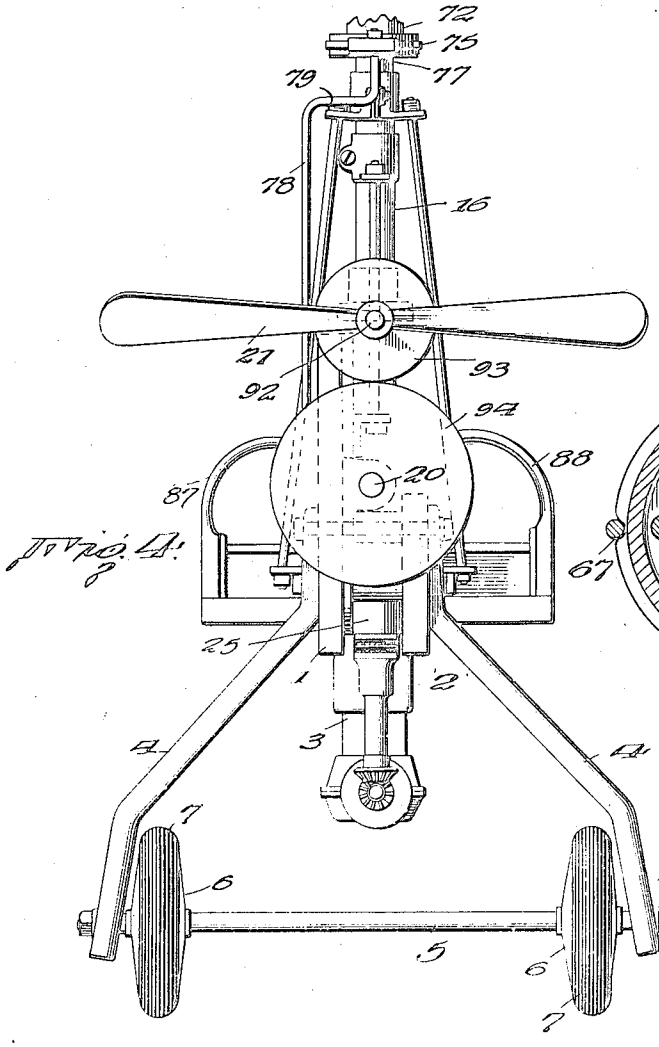


Fig. 4.

Fig. 6.

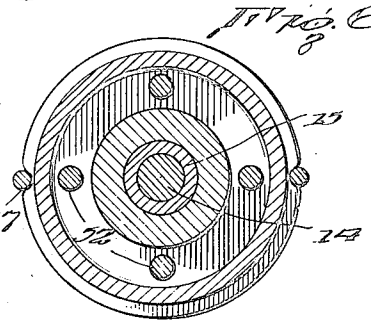


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Fig. 7.

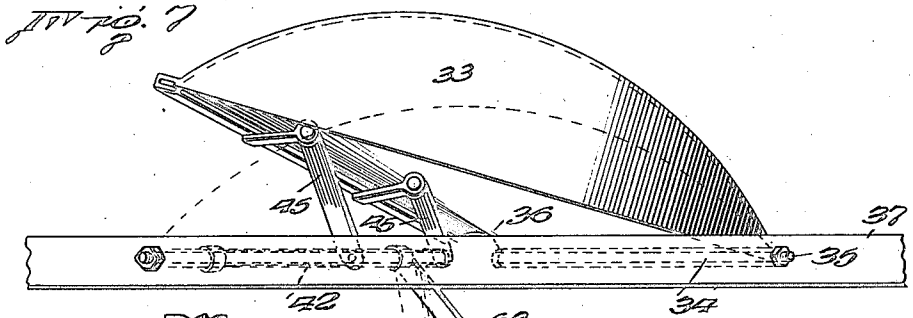
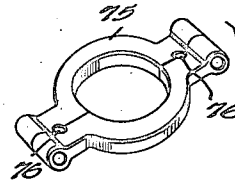
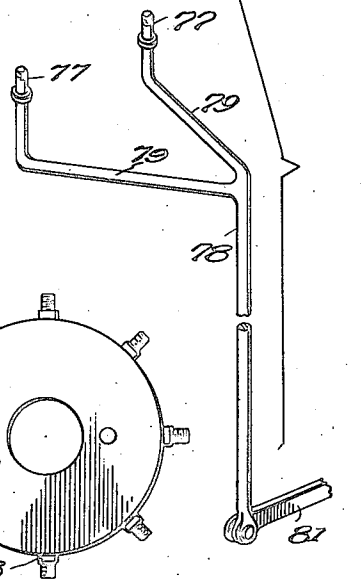


Fig. 9.





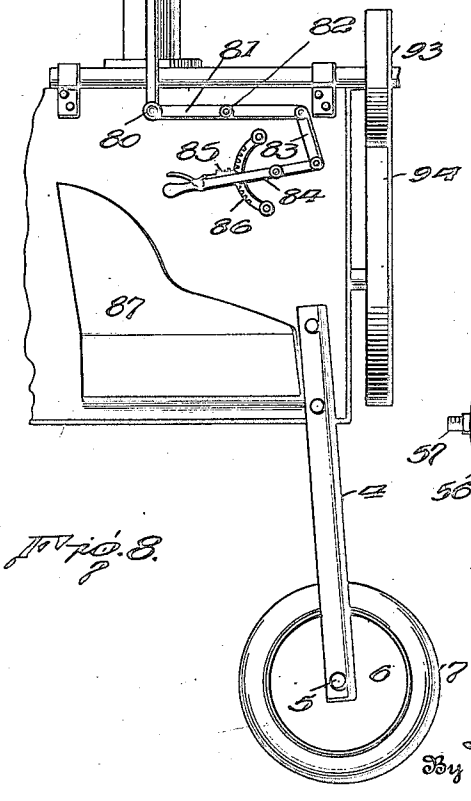


Fig. 8.

Fig. 10.

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Patented Feb. 27, 1923. 1,446,522

UNITED STATES PATENT OFFICE.

ROBERT B. SMITH, OF ANSLEY, NEBRASKA, ASSIGNOR TO ANSLEY AERIAL COMPANY, COMPOSED OF ROBERT B. SMITH, ROSCOE C. SECORD, WILLIAM A. WOLFORD, H. L. KERR, R. D. BREEDEN, H. D. REED, AND H. GUY MARSH, ALL OF ANSLEY, NEBRASKA.

AEROPLANE.

Application filed March 5, 1921. Serial No. 449,657.

To all whom it may concern:

Be it known that I, ROBERT B. SMITH, a citizen of the United States of America, residing at Ansley, in the county of Custer and State of Nebraska, have invented new and useful Improvements in Aeroplanes, of which the following is a specification.

The invention relates to an aeroplane.

The object of the present invention is to improve the construction of aeroplanes and to provide a simple, practical and efficient aeroplane of strong, durable and comparatively inexpensive construction, equipped with reversely rotating horizontal lifting planes and a driving propeller simultaneously operated with the lifting propellers.

A further object of the invention is to provide an aeroplane of this character in which the reversely rotating horizontal lifting propellers will be equipped with adjustable plane sections adapted to be opened and closed to control the ascent and descent and constructed also to secure a parachute effect both in their lifting or sustaining action and in controlling the descent of the machine.

Another object of the invention is to provide means for enabling the adjustable plane sections to be operated to open and close the lifting propellers while the same are rotating at any desired speed, so that it will not be necessary to vary the speed of the rotating lifting propellers in order to change the position of the blades or planes.

With these and other objects in view the invention consists in the novel construction, combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention

In the drawings, in which like numerals of reference designate corresponding parts in the several figures,—

Figure 1 is a vertical sectional view partly in elevation of an aeroplane constructed in accordance with this invention;

Figure 2 is a horizontal sectional view on the line 2—2 of Fig. 1;

Figure 3 is a diagrammatic view of the upper and lower lifting propellers illustrating the reverse arrangement of the blades or planes and indicating the reverse rotary movement of the propellers;

Figure 4 is a front elevation of the aeroplane;

Figure 5 is an enlarged detail perspective view of one of the blades or plane sections;

Figure 6 is an enlarged detail horizontal sectional view on the line 6—6 of Fig. 1;

Figure 7 is an enlarged detail view of one of the adjustable plane sections or blades showing the same open in full lines and closed in dotted lines;

Figure 8 is a detail elevation illustrating the arrangement of the operating mechanism for controlling the opening and closing of the blades or plane sections from the operator's seat;

Figure 9 is a detail view illustrating the construction of the forked bifurcated connecting rod and collar of the controlling mechanism; and

Figure 10 is a detail view of the upper hub.

In the accompanying drawings, in which is illustrated the preferred embodiment of the invention, the aeroplane is preferably equipped with a skeleton main frame composed of spaced frame members 1 and 2 preferably spaced apart by blocks and connected by suitable bolts and having the engine or motor 3 suitably suspended from them. The skeleton frame is also equipped at the front with laterally diverging standards 4 connected at their lower ends by a transverse axle 5 on which are mounted front wheels 6 preferably provided with pneumatic tires 7 and the skeleton frame is equipped at the rear end with a centrally arranged rearwardly inclined standard 8 having a rear castor wheel 9 also equipped with a pneumatic tire 10 but the frame or body of the machine may be equipped with any other suitable running gear and may be cushioned in any other preferred manner.

The engine or motor, which may be of any desired type, is equipped at the front with a balance wheel 11 and a vertical spur pinion 12, which meshes with a horizontal spur gear 13. The pinion and gear are preferably bevel gears, and the horizontal bevel gear 13 is suitably mounted on the lower

end of an inner vertical shaft 14 operating within and extending through an outer tubular shaft 15, which extends through and is supported by an outer vertical sleeve or casing 16. The inner vertical shaft 14, which may be either tubular or solid, is supported at the lower portion by a ball thrust bearing which receives the end thrust and the lower end of the outer tubular shaft 15, which is also equipped with an end thrust bearing 17, has mounted on it a horizontal bevel gear 18 which meshes with a vertical bevel gear 19 of a forwardly extending horizontal shaft 20. The horizontal shaft, from which rotary motion is communicated to a driving propeller 21, is also equipped with end thrust ball bearings 22 and the vertical and horizontal shafts are mounted in a bearing bracket 23, provided with vertically alined upper and lower bearings 24 and 25 and having a front horizontal bearing 26. The bearing bracket is also provided with a central opening or space 27, within which are located the bevel gears 18 and 19 and also a horizontal bevel gear 28, which is mounted upon and suitably affixed to the inner vertical shaft 14, whereby when the engine is in operation, rotary motion will be communicated to the horizontal propeller driving shaft 20, and also to the outer tubular shaft 15. The bearing bracket 23 is equipped with a suitable housing 23a for protecting the gearing, and this housing may be applied to the bearing, in any desired manner, and may be of any preferred construction. This arrangement of gears also rotates the inner and outer shafts 14 and 15 in opposite directions for reversely rotating upper and lower horizontal lifting propellers 29 and 30, the reverse rotary movement of the propellers counteracting the torque and preventing the rotary movement of the horizontal lifting propellers from affecting the body of the machine or the control of the same by steering mechanism hereinafter described.

The upper and lower horizontal lifting propellers are equipped with reversely disposed hinged blades or plane sections 31 and 32, which are constructed in the same manner, but are disposed in the reverse arrangement, so that the movable longitudinal edges of the blades, which define the openings of the same in the operation of the propellers, will face the direction of movement of the propellers. Each of the blades is inwardly tapered or substantially sector-shaped and is curved in cross section to present an upper convex face and a lower concave face, and it is provided at the outer end with a curved peripheral end wall 33, which with the body of the blade or plane forms a pocket at the lower face of the said blade or plane, whereby the same is adapted to catch the air and cause the same to bank or pack beneath the blades or planes and enable the same to perform the functions of a parachute, both in ascending and in descending, or controlling the descent of the machine. Each of the blades or planes is provided at its rear radial edge with a tubular bearing 34, preferably formed by bending or rolling the metal of the blade or plane and receiving a radial pintle rod 35, which has its inner end secured to a central hub 36 and its outer end secured to a rim or ring 37. The outer ends of the pintle rods pierce the rim or ring and are threaded for the reception of inner and outer nuts which clamp the rim or ring. The inner ends are also preferably threaded and are secured in openings of the hub 36 by means of suitable nuts. Adjacent to each of the pintle rods is a radially arranged brace 38, which is preferably set at an inclination and which cooperates with the framework of the propeller to form a truss structure. The inner and outer ends of the inclined radially arranged braces are secured adjustably to the hub and to the rim or ring by nuts engaging inner and outer threaded portions of the braces and the latter operate both as a brace and as a tensioning device for applying the proper tension or strain to the lifting propeller. The propeller frame is further braced by means of radial rods 39, which are similarly secured adjustably at their inner and outer ends to the hub and ring or rim members of the framework of the rotary lifting propellers and they constitute supports for upper and lower tubular rock shafts 40 and 41, which are equipped with one or more upper and lower arms 42 and 43 connected by links 44 and 45 with the blades and planes of the upper and lower horizontal lifting propellers. This arrangement of the radial rods provides a spoke-like structure composed of three separate radial rods or members at each of the longitudinal or side edges of the blades or plane sections, and are sufficient to afford a rigid structure for supporting the adjustable blades or planes to the size, strength and number of the radial bracing rods or members may, of course, be varied to afford the necessary strength for the character of machine to be constructed.

The hub of the upper horizontal lifting propeller is supported upon a lower annular flange 46 of a vertical bearing sleeve 47 seated upon and supported by the upper end of the tubular shaft 15, and it is provided in its bottom portion with a central opening through which passes the inner vertical shaft 14. The sleeve is equipped at the top with an annular plate or ring 48, which fits over the upper edge of the hub 36 and is secured in position by vertical bolts 49, which pass through the top ring or plate and through the annular flange 46. The

lower horizontal lifting propeller is mounted in a similar manner upon a lower sleeve 50, which is seated upon and supported by the upper end of the outer tube or casing 16, and which has an opening of sufficient size through it for the passage of the tubular shaft 15. A plate or ring 51 is secured at the top of the lower sleeve 50 by means of vertical rods or bolts 52 for holding the upper plate or ring in position for retaining the lower horizontal lifting propeller upon the flange of the sleeve 50. Any other suitable form of bearing or support may, of course, be employed for mounting the upper and lower lifting propellers and any suitable anti-friction bearing means may, of course, be employed at the hubs of the horizontal lifting propellers, if desired.

In practice, the upper horizontal lifting propeller preferably rotates in a counter-clockwise direction when viewed in plan view, and the lower horizontal lifting propeller rotates in clockwise direction when viewed in the same manner from the top. The tubular rock shafts of the upper horizontal lifting propellers are provided at their upper portions with depending arms 53, which are connected by links 54 with an upper vertically sliding sleeve 55, movable upwardly and downwardly on the outer tubular shaft 15, and provided at the top with a horizontal flange 56, which is equipped with radially projecting peripheral studs 57 threaded for the reception of nuts 58 for retaining the lower ends of the links 54 on the radially projecting studs of the upper sliding sleeve. The lower ends of the links are provided with suitable eyes or openings to receive the projecting studs 57 and the upper ends of the links may be pivoted to the depending arms of the radial rock shafts by any suitable means, and the upper vertically slidable sleeve is held against relative rotary movement by means of spaced vertical guide rods 59 suitably fixed at their upper ends to the sleeve 47 and extending downwardly therefrom and passing through apertures 60 in the horizontal flange of the top of the upper vertically slidable sleeve 55. By this guiding means, the rock shafts will be positively actuated and the blades or plane sections of the upper horizontal lifting propeller positively opened and closed when the sleeve 55 is moved upwardly or downwardly. The sleeve 55 is also provided at the bottom with an annular enlargement having an annular or circumferential groove 61 in which is mounted a sectional collar 62 composed of similar sections and provided at opposite sides with similar lugs 63. The lugs 63 are connected by suitable fastening devices 64, which retain the sectional collar in place in the circumferential groove at the bottom of the upper slidable sleeve. The collar is provided at opposite sides with openings. The collar 62 of the upper sleeve is provided at opposite sides with openings 65, through which pass the upper ends of spaced vertical connecting rods 66 which extend through and are guided by the lower flange of the sleeve 50, suitable notches 67 being provided in the said bottom flange at opposite sides thereof, as clearly illustrated in Figure 6 of the drawing. By this construction, the rods 66, which are movable vertically, are guided on and held against rotary movement independently of the lower horizontal lifting propeller and the upper ends of the connecting rods 66 are rigidly secured to the upper collar 62 by means of nuts arranged on reduced threaded portions of the rods, shoulders being preferably provided at the lower face of the collar for engaging the same, but any other suitable means may, of course, be employed for this purpose. A sleeve and collar connection between the rods and the links 54 permit free, independent rotary movement of the upper and lower lifting propellers and the rotary movement of the propellers in opposite directions does not interfere with the operation of the controlling means for opening and closing the planes or blades of the upper propeller.

The blades or planes of the lower horizontal lifting propeller are connected by links 67 with one or more arms of the lower radially arranged rock shafts 68, which are provided at their inner portions with depending arms 69 and the latter are connected by links 70 with an upper flange 71 of a lower sliding sleeve 72 rigidly secured by nuts or other suitable fastening means to the lower ends of the spaced connecting rods 66 and preferably adjustable by means of threaded portions and nuts 73. The lower sliding sleeve 72 is provided at the lower end with an annular enlargement having a circumferential flange 74 in which is arranged a sectional collar 75 constructed similar to that heretofore described and provided with spaced openings 76 for the reception of the upper terminals 77 of a forked or bifurcated connecting rod 78. The forked or bifurcated connecting rod 78 has diverging arms or portions 79 at its upper end and the terminals 77 thereof are bent vertically as shown for attachment to the lower collar 75. The lower end of the forked connecting rod is pivoted at 80 to the rear end of a lever 81 fulcrumed intermediate of its ends at 82 and connected at its front end by a link 83 with an operating lever 84. The operating lever 84 is equipped with latch mechanism 85 for engaging a notched segment or bar 86 for securing the operating lever in its adjustment. The operating lever 84, which is mounted in substantially a horizontal position, has a rear handle portion located adjacent a seat 87

for the accommodation of the operator, and it will be apparent that by moving the rear handle portion of the operating lever 84 upwardly or downwardly, the blades or plane sections of both horizontal lifting propellers, may be adjusted to open and close the same. The upper and lower sleeves and collars permit the necessary freedom of rotation of the horizontal lifting propellers. The operator's seat is located at one side of the skeleton frame and a seat 88 is located at the opposite side of the skeleton frame, but any other suitable form of frame or body may be employed, and it is equipped with a horizontal shaft 89, preferably tubular, and extending rearwardly from the frame and adapted to support vertical and horizontal rudder blades or planes 90 and 91 which are of the standard construction and which in practice will be controlled by the usual equipment. The driving propeller 21 is mounted on a horizontal propeller shaft 92 and is actuated by a friction drive comprising an upper friction pinion 93 and a lower friction wheel 94 and any suitable means may be employed for controlling the friction drive for driving the propeller at the desired number of revolutions within the capacity of the engine or motor. As any suitable friction or other drive may be employed for this purpose, specific description of the controlling means is deemed unnecessary.

The aeroplane is adapted to ascend in a vertical direction without the rapid forward movement or drive necessary with the ordinary aeroplane and it is also adapted to descend as slowly as desired and may, if desired, hover or remain at a predetermined altitude. Also, the horizontal rotating propellers, which are continuously rotated during the operation of the engine and while the driving propeller is in operation, are adapted also to operate as planes and the plane sections or blades are fully closed when it is desired to operate the machine for gliding or volplaning. As the control of the driving propeller through the friction drive gearing is independent of the rotation of the upper and lower horizontal lifting propellers, all the power may be employed for lifting the areoplane from the surface of the ground prior to applying the power for driving the machine in a forward direction. After the machine has made a landing, the propeller may be operated for moving the machine into a hangar or for other purposes. The outer tube or casing is supported or braced by inclined guy rods 95 connected at their upper ends with the upper portion of the outer tube or casing and at their lower ends with the frame members, and provided with terminal tensioning means preferably formed by threaded portions of the guy rods and suitable nuts. The outer tube or casing is suitably secured at its lower end to the bearing bracket 23.

I claim:—

1. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, with their minor ends disposed adjacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, and operating means connected with the blades for opening and closing the same.

2. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, with their minor ends disposed ajacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, another set of radially arranged rods connecting the hub and rim, a rock shaft mounted on each of the second mentioned rods, arms connected to the rock shafts, links pivotally connected to the arms and to the respective blades, and means connected to the rock shafts, to rock the same so as to swing the blades on the first mentioned rods.

3. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, with their minor ends disposed adjacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, a second set of radially arranged rods connecting the hub and the rim, a rock shaft mounted on each of the second mentioned rods, connections between the rock shaft and the blades to effect a swinging movement of the blades, and means to rock the shafts to swing the blades.

4. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, with their minor ends disposed adjacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, radially disposed rock shafts between the hub and rim and arranged one adjacent the edge of each blade opposite the hinged edge of the blade, connections between the rock shafts and the blades to permit swinging movement of the latter and means for actuating the rock shafts to swing the blades.

5. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, the minor ends of the blades being disposed adjacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, inclined braces between the hub and rim arranged one adjacent each of the aforesaid rods, and operating means connected to the blades for opening and closing the same.

6. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, radially arranged rods connecting the hub and the rim, blades of substantially sector-shape hinged at one edge to the radially arranged rods and having their major ends disposed adjacent the rim, the minor ends of the blades being disposed adjacent the hub, each blade being curved in cross section to form pockets at their lower faces which decrease in depth from the major to the minor end thereof, each blade having an end wall at its major end arranged transversely of the blade to catch the air and cause same to bank beneath the blades, inclined braces between the hub and rim arranged one adjacent each of the aforesaid rods, radially disposed rock shafts between the hub and rim and arranged one adjacent the edge of each blade opposite the hinged edge of the blade, connections between the rock shafts and the respective blades to permit opening and closing of the blades, and operating means having connection with the rock shafts to rock the latter to effect an opening and closing of the blades.

7. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, and concentric therewith, radially arranged rods connecting the hub and the rim, blades hinged at one edge to the radially arranged rods, each blade being curved in cross section and each blade having an end wall at its outer end arranged transversely of the blade so as to provide each blade with a pocket to catch the air and cause same to bank beneath the blades, another set of radially disposed rock shafts between the hub and the rim and arranged one adjacent each blade at the edge of the latter opposite the hinged edge of the blade, a rock shaft on each of the second mentioned rods, connections between the rock shafts and the respective blades to permit opening and closing of the blades and operating means connected to the blades for opening and closing the same.

8. A flying machine including a lifting propeller comprising an inner hub and outer rim, radially arranged horizontal rods connecting the hub and the rim, blades or plane sections hinged to the rods, tubular rock shafts, horizontal rods extending through the tubular rock shafts and also connecting the hub and the rim, inclined bracing rods connecting the hub to the rim and forming tensioning means, blades or plane sections hinged to the first mentioned horizontal rods, means for connecting the blades or plane sections with the rock shafts, and means for operating the rock shafts.

9. A flying machine including upper and lower rotating lifting propellers having hinged radially arranged blades, inner and outer vertical shafts connected respectively with the upper and lower propellers, an upper sliding sleeve arranged between the propellers, a lower sliding sleeve located below the lower propeller, said sliding sleeves being provided with collars, means for connecting the upper sliding sleeve with the blades of the upper propeller, means for connecting the lower sliding sleeve with the blades of the lower propeller, separate connections extending through the lower propeller and connecting the lower sliding sleeve with the collar of the upper sliding sleeve, operating mechanism connected with the collar of the lower sleeve, and means for rotating the inner and outer shafts from a common source of power without affecting the operating means or the connections between the same and the blades of the upper and lower propellers.

10. A flying machine including upper and lower reversely rotating propellers provided with reversely arranged hinged blades, radially arranged rock shafts mounted on the propellers and connected with the blades for

opening and closing the same, inner and outer vertical shafts connected with the propellers, upper and lower sliding sleeves through which the said shafts pass, means for connecting the sliding sleeves with the rock shafts of the upper and lower propellers, collars mounted on the sleeves and rotatable independently of the same, rods guided by the lower propeller and connecting the upper collar with the lower sleeve, means for guiding the upper sleeve in its vertical movement, and operating means connected with the collar of the lower sleeve.

11. A flying machine including upper and lower reversely rotating propellers provided with reversely arranged hinged blades, radially arranged rock shafts mounted on the propellers and connected with the blades for opening and closing the same, inner and outer vertical shafts connected with the propellers, upper and lower sliding sleeves through which the said shafts pass, means for connecting the sliding sleeves with the rock shafts of the upper and lower propellers, collars mounted on the sleeves and rotatable independently of the same, rods guided by the lower propeller and connecting the upper collar with the lower sleeve, vertical rods carried by the upper lifting propeller and arranged to guide the upper sleeve, and operating means connected with the collar of the lower sleeve.

12. A flying machine, including inner and outer vertical shafts, spaced gears mounted on the shafts at the lower portions of the same, an intermediate gear meshing with the said gears, a propeller connected with and actuated by the intermediate gear, and means connected with the inner shaft at the lower portion thereof for actuating the same and the lower gear.

13. A flying machine including inner and outer vertical shafts, reversely rotating horizontal lifting propellers mounted on the said shafts, and having hinged adjustable blades, spaced gears mounted on the lower portions of the said shafts, an intermediate gear meshing with the said gears, a propeller connected with and actuated by the intermediate gear, means for driving the lower gear, and means for adjusting the blades of the propellers without affecting the speed of the same.

14. A flying machine including an outer tubular shaft, an inner shaft extending above and below the outer tubular shaft. upper and lower lifting propellers mounted on the said shafts at the upper portions thereof, and having hinged blades, a gear mounted on the tubular shaft at the lower end thereof, a similar gear mounted on the lower portion of the inner shaft and spaced from the said gear, an intermediate vertical gear meshing with the said gears, a propeller, means for driving the propeller from the intermediate gear, means for actuating the lower gear of the inner shaft, and means for adjusting the blades without affecting the speed of the propellers.

15. A flying machine including a lifting propeller comprising a hub, a rim spaced therefrom, and concentric therewith, radially arranged rods connecting the hub and the rim, blades hinged at one edge to the radially arranged rods, each blade being curved in cross section and each blade having an end wall at its outer end arranged transversely of the blade so as to provide each blade with a pocket to catch the air and cause same to bank beneath the blades, another set of radially disposed rock shafts at the edge of the latter opposite the hinged edge of the blade, a rock shaft on each of the second mentioned rods, connections between the rock shafts and the respective blades to permit opening and closing of the blades and bracing and tensioning rods connected to the hub and the rim, and operating means connected with the rock shaft to rock the latter to actuate the connections between the rock shafts and blades to open and close the blades.

16. A flying machine including upper and lower lifting propellers provided with hinged blades, inner and outer vertical shafts connected with the propellers, upper and lower sliding sleeves provided with collars, means for connecting upper and lower sleeves with the blades of the upper and lower lifting propellers, the aforesaid sleeves being mounted for independent rotary movement, and operating means including a rod having a laterally directed forked portion connected to the lowermost sleeve, a lever pivoted intermediate its ends and having connection with said forked rod and an operating lever having connection with the aforesaid lever.

In testimony whereof I have hereunto affixed my signature.

ROBERT B. SMITH.