

Aug. 5, 1930.

S. LAKE

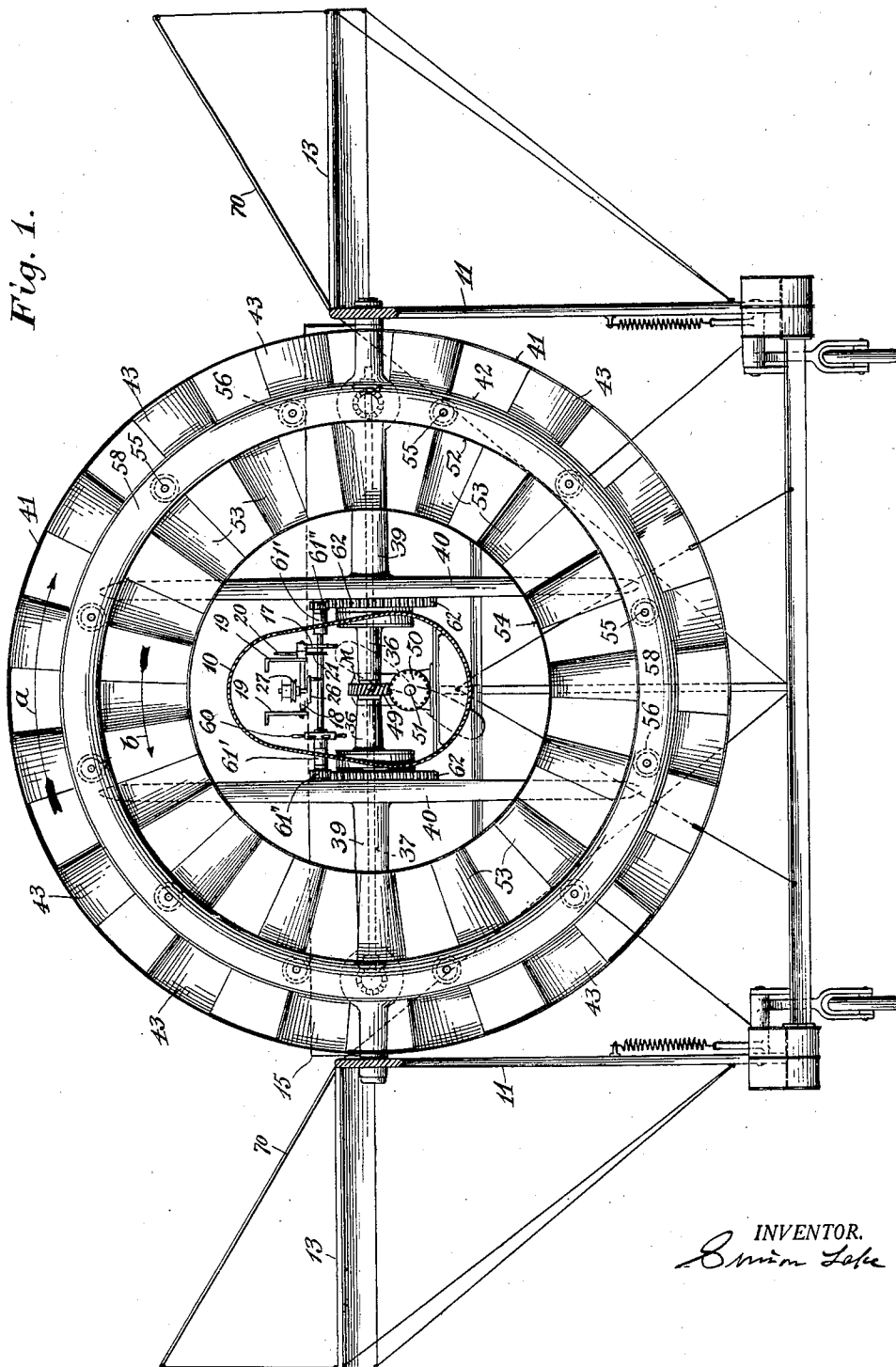
1,772,049

FLYING MACHINE

Filed Sept. 10, 1927

4 Sheets-Sheet 1

Fig. 1.



Aug. 5, 1930.

S. LAKE

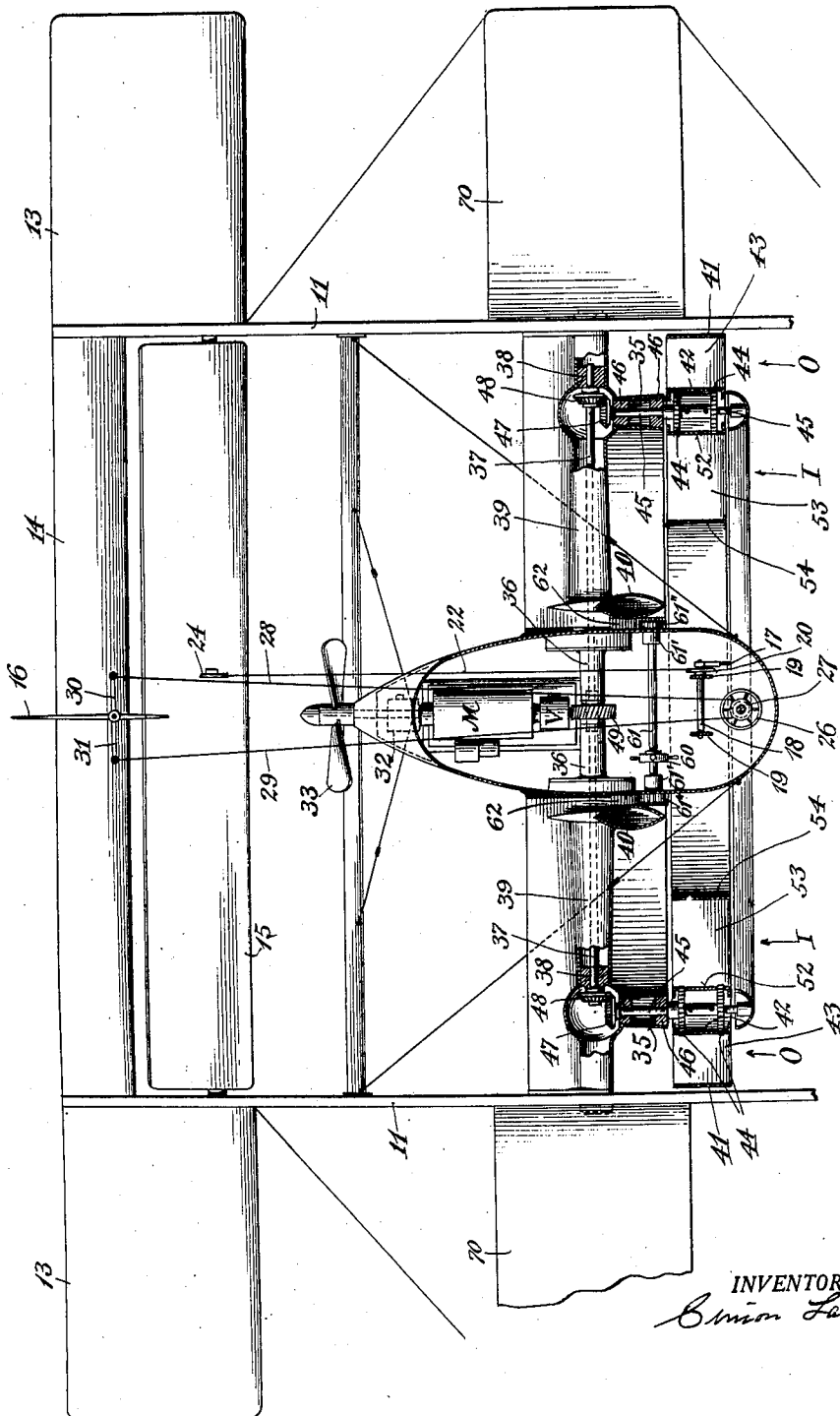
1,772,049

FLYING MACHINE

Filed Sept. 10, 1927

4 Sheets-Sheet 2

Fig. 2.



INVENTOR.
Simon Lake

Aug. 5, 1930.

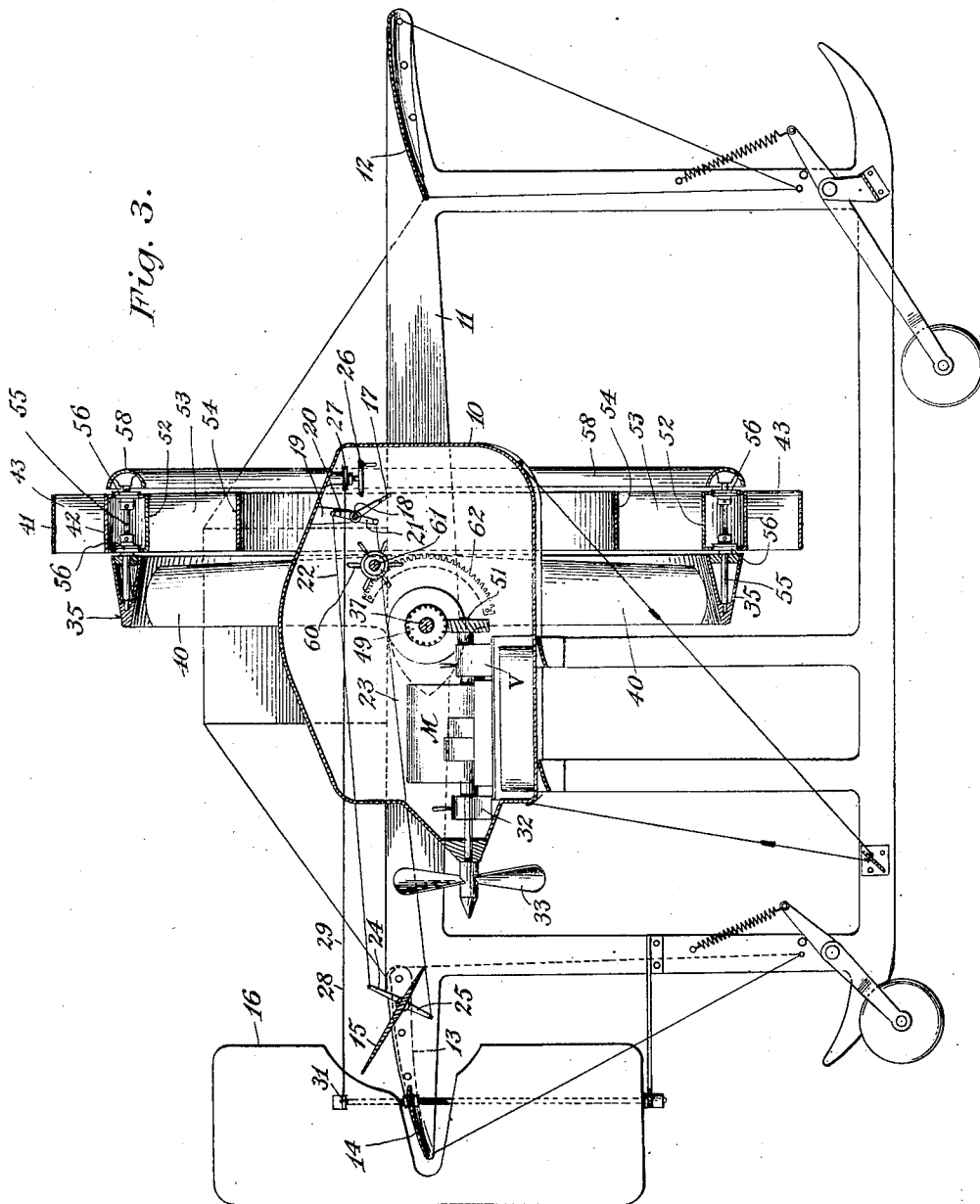
S. LAKE

1,772,049

FLYING MACHINE

Filed Sept. 10, 1927

4 Sheets-Sheet 3



INVENTOR.
Ernest L. Loh

Aug. 5, 1930.

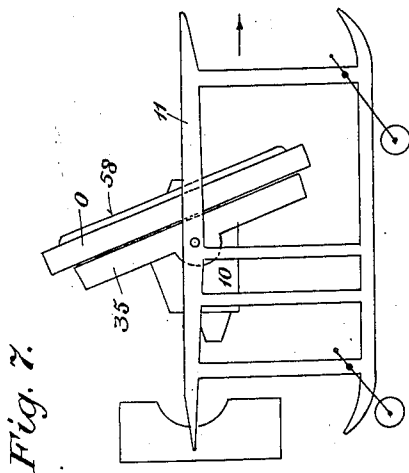
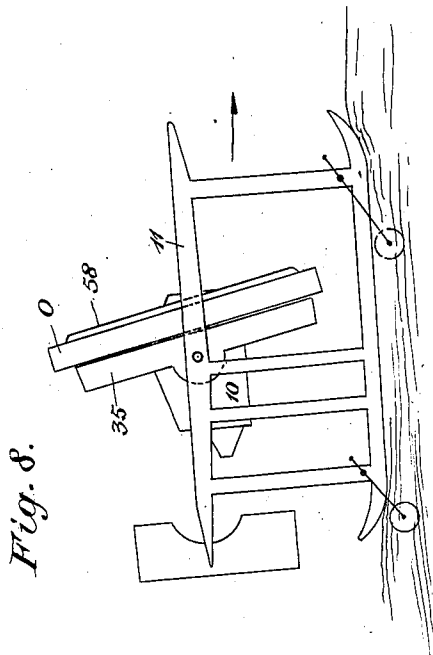
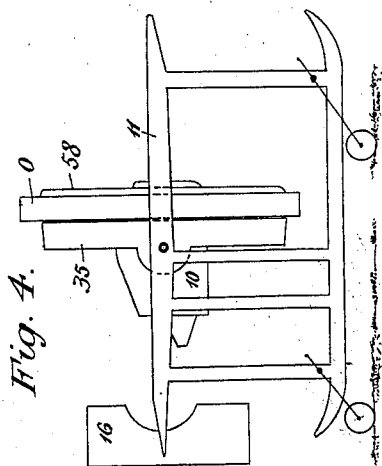
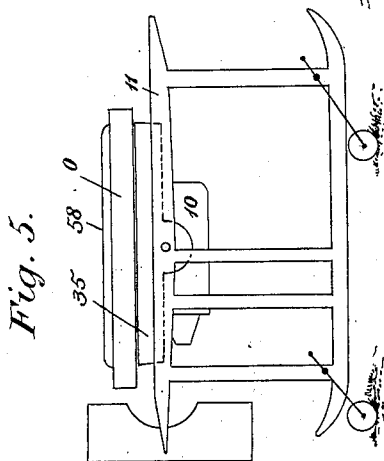
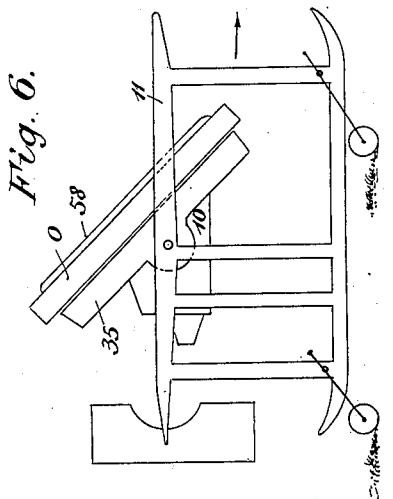
S. LAKE

1,772,049

FLYING MACHINE

Filed Sept. 10, 1927

4 Sheets-Sheet 4



INVENTOR.
Simon Lake

UNITED STATES PATENT OFFICE

SIMON LAKE, OF MILFORD, CONNECTICUT

FLYING MACHINE

Application filed September 10, 1927. Serial No. 218,752.

This invention relates to flying-machines, and more especially to that class thereof which are generally known as "heavier-than-air" machines, and it has for one of its objects the provision of a machine of the character comprising improved propelling devices which may be variably positioned so as to impart a propelling force in any direction ranging from the horizontal to the vertical.

A further object of the invention is to provide improved mechanisms and controls for the various planes and steering-devices. Another object consists in the provision of improved stabilizing means which tend to maintain the machine normally on an "even keel". Other objects of the invention will hereinafter appear and be pointed out in the claims.

In a general way the present invention relates to a number of improvements on the machines illustrated, described and claimed in Letters Patent which were granted to me under Nos. 889,693, 928,524 and 1,247,412, respectively.

In the drawings, Figure 1 is a front view of a flying-machine embodying my improvements, the front end of the cab being broken away to disclose the interior; Fig. 2 is a plan view of the machine, the top of the cab being removed; Fig. 3 is a central longitudinal section; Figs. 4, 5, 6, 7 and 8 are diagrammatic views of the machine as operated under different conditions.

In the drawings, 10 denotes the cab in which the pilot is situated, with the various controls ready at hand, and which is suitably supported between a pair of side-frames 11 made of light material and serving also as supporting members for the various planes which comprise; front planes 12, rear side-planes 13, a rear center-plane 14, the adjustable horizontal rudder 15 and vertical rudder 16.

The means for controlling the position of the horizontal rudder 15 consists preferably of a lever 17 located in the front portion of the cab 10 and secured to a cross-shaft 18 which is mounted in bearings 19 and carries arms 20, 21 which are respectively connected (by cords 22, 23) with arms 24, 25 ex-

tending from the opposite faces of the rudder 15.

The vertical tail-rudder is preferably controlled by a hand wheel 26 operably connected with a pulley 27 carrying a cord whose ends 28, 29 are attached to side-arms 30, 31 projecting from the opposite faces of the rudder-blade 16.

Suitably supported in the cab 10, is a motor M whose shaft extends longitudinally of the cab and drives (thru the medium of a variable-speed and reverse mechanism 32) a rear propeller 33 principally used for maneuvering purposes during rising and landing.

It is an acknowledged fact that a really satisfactory flying-machine should be capable of rising or descending in a practically vertical direction, a feature which obviously becomes important when the landing space is more or less hemmed-in by obstructions which would prevent very gradually inclined ascent or descent. For this reason, my present invention comprises, as one of its features, a propelling device which may be positioned to exert a moving force on the machine, as a whole, in any direction between vertical and horizontal, so that, for instance, the machine may be lifted "straight-up" from its resting place without any movement in any other direction. Furthermore, this "straight" rising movement may be readily changed into a very gradual or even into an abrupt movement deflecting angularly from the vertical direction of rising, thus causing the machine to travel a vertically-curved course which is entirely under the immediate control of the operator, without in any way interfering with steering the machine during its progressive flight by the vertical rudder.

One form of device for accomplishing the above described result is illustrated in the drawings and consists, in its preferred form, of an annulus 35 which surrounds the central portion of the cab and is pivotally supported thereon on a diagrammatically-central axis thru a supporting member which consists of passing horizontally thru the cab and also a pair of trunnion-members 36 rigidly secured on the inner wall of the cab and supporting, in suitable bearings, a shaft 37 whose ends

are supported in bearings 38 carried by tubular sleeves 39, each of which constitutes an integral part of the annulus 35 and extends from its particular side of the cab to the side-frame 11 on which it is pivotally supported.

The annulus 35 is provided with a pair of substantially parallel arms 40 whereby the annulus is not only stiffened but also properly positioned for swinging movement around the axis of the trunnion-members 36 and the shaft 37 above referred to.

It should be understood, at this time, that the annulus 35 constitutes a supporting member for a series of devices whereby certain propelling planes are operated and which act as supporting elements for these several planes.

Referring to Figs. 1 and 2, it will be noted that, in the present instance, I employ two distinct plane-rings O and I, the outer plane-ring O being formed of a pair of concentric annular bands 41, 42, of channeled or flanged metal, as clearly shown in Figs. 2 and 3, with the flanges projecting toward the center of rotation, both bands being properly spaced by a series of inclined air planes 43 similar to those of an ordinary exhaust fan. This outer plane-ring O is rotated around the central axis of the annulus 35, by means of suitable gears or sprockets 44 which are secured to spindles 45 extending thru bearings 46 in the annulus 35 and the inner ends of which are provided with bevel gears 47 meshing with similar bevel gears 48 secured to the shaft 37 above mentioned.

Rotating movement is imparted to the shaft 37 by a spiral gear 49 secured to said shaft and engaged by a similar gear 50 secured to the transmission shaft 51 which may be directly driven from the main shaft to the motor M, through the medium of a variable-speed and reverse mechanism V.

It will now be understood that, when the motor is running and the shaft 51 is rotated, the shaft 37 will also be rotated, causing the bevel gears 48 to drive the bevel gears 47, the spindles 45 thus rotating the gears or sprockets 44, the teeth of which enter suitable perforations provided therefor in the main portion of the channeled ring 42, therefore rotating the plane-ring O in the direction of the arrow *a* (see Fig. 1) and exerting a forward pull on the annulus 35 and all members carried thereby, such as the side frames 11 and the parts carried thereby including the cab.

An analysis of the operation of the device as thus far described will lead to the conclusion that the rotation of the plane ring O will have a tendency of gradually deflecting the direction of the cab and its supporting frame laterally, and, in order to counteract this tendency, my improved device includes the other annulus or plane-carrying ring I which constitutes the inner-plane ring, the

entire plane area of which is calculated relatively to the neutral speed and plane area of the outer ring O so as to balance the strains in opposite lateral directions. This inner ring I is rotated by the same gears 44 which operate the outer ring O. The outer circular channel member 52 of the inner ring I also has suitable perforations to permit the teeth of the gears 44 to enter therein, while its several planes 53 are supported between it and the inner circular member 54, these planes being inclined in a direction opposite to that of the planes 43 above referred to, and the inner ring, as a whole, being naturally also operated in a direction opposite to that of the outer ring O, as indicated by arrow *b* in Fig. 1.

In order to provide free easy running of the inner and outer rings, and to keep them in proper concentric relation, the annulus 35 is provided with a plurality of preferably evenly-spaced spindles 55 (see Fig. 3) which are preferably fixed in the annulus 35; while their forward ends support grooved pulleys 56 on which the flanges of the channeled members 42 and 52 may find a freely running support. (See Fig. 3.) In order to lessen the air-resistance, when the machine is traveling in accordance with the position of the annulus, the spindles 55 support with their extreme forward ends a "fairing" device shown herein as a ring 58 which also aids in stiffening the entire structure, and especially ties the outer ends of the spindles 55 together.

As above stated, one of the most essential elements of the present invention resides in the organization of the air-propeller in such a way that it may be tilted from a vertical to a horizontal position to produce the desired effective force to be manifested on the machine as a whole. The particular mechanism for making the desired adjustment comprises preferably a hand wheel 60 secured to a shaft 61 extending laterally thru the cab and supported in suitable bearings 61' on the side walls thereof, and having at both of its outer ends pinions 61'' which are in engagement with sectors 62 secured to the inner faces of the arms 40, so that, when said wheel 60 is rotated, the arms 40 and all of the parts supported thereby are swung bodily around the axis of the shaft 37 and of the trunnions 39, to bring the propeller-rings O and I into the position required to produce a certain desired traveling effect on the machine.

In Figs. 4 to 8 inclusive, there are shown a number of diagrams illustrating different positions of the aeroplane-rings. Fig. 4 shows the machine resting on the ground with its several parts in positions corresponding to the positions illustrated in the several views of the drawings previously described. The rotation-axis of the aeroplane-rings is here substantially horizontal and may be used for

taxying along level ground and without tendency of raising the machine.

In Fig. 5 the machine is resting on the ground but the aeroplane-rings have been swung around into a horizontal position, so that when the motor is started a straight vertical rise will be effected.

Fig. 6 shows the machine with the rings tilted to "take-off" or in other words; to start a gradually rising flight.

Fig. 7 illustrates approximately the position the aeroplane rings will be caused to assume when the machine is in the air to travel on a level keel, and in Fig. 8, the machine is illustrated as riding waves, a condition which is made possible by virtue of the peculiar construction of the lowermost members of the side frames 11, such construction being clearly shown in Fig. 1, in which it will be noted that the bottom longitudinal members of the frame are formed with hollow enclosed air spaces to render them buoyant to act similarly to pontoons. It should, of course, be understood that any other construction suitable to the purpose may be employed.

As previously stated, the present invention also comprises improved means for stabilizing and automatically "righting" the machine during its normal straight run and to counteract the side-sway which is often caused by air pockets. For this particular purpose I provide on the sides of the side frames outwardly-extending planes or wings 70 which are upwardly angularly disposed relatively to the horizontal plane of the machine as is clearly shown in Fig. 1. These planes will react efficiently if the machine should tilt sideways, in which instance the descending side-plane 70 would naturally encounter a greater resistance against falling perpendicularly; while the opposite plane 70 would then tilt upwardly and therefore have a decreasing resistance-efficiency. In other words: if, when looking at Fig. 1, the right hand plane 70 should drop while the left hand plane 70 would consequently rise, the right hand plane would naturally encounter a great deal more resistance than the left hand plane would, and vice versa.

In connection with the machine described, any suitable taxying wheels may be employed, as desired. Furthermore, additional planes may be provided, and other changes in the construction and organization of the various elements shown and described, may be made.

Also, the particular construction pertaining to the different controls may be varied as may be deemed most suitable, and other departures from the particular embodiment of the invention herein shown and described may be made without departing from the spirit of the invention and the scope of the following claims.

I claim:

1. A flying-machine comprising a frame,

an annulus tiltable on said frame, an aeroplane-ring supported on said annulus at a plurality of points around its circumference, means for variably positioning said annulus relatively to the frame, and means for rotating said aeroplane-ring.

2. A flying-machine comprising a frame, an annulus carried by said frame, a pair of aeroplane rings supported on said annulus and arranged for operation in the same plane, means for variably positioning said annulus relatively to the frame, and means for rotating said rings in opposite directions.

3. A flying-machine comprising a frame, fixed aeroplanes extending therefrom, a cab supported thereby, an annulus surrounding the cab and pivoted thereon, aeroplane rings supported for rotation on said annulus, means for tilting the annulus relatively to the cab, and a motor for rotating said rings in opposite directions.

4. A flying-machine comprising a cab, an annulus surrounding said cab and including a pair of arms disposed on the opposite sides of said cab, an aeroplane-ring rotatably supported on said annulus, means for operating said aeroplane-ring, and means attached to said arms exteriorly of the cab and operable from the interior thereof, for tilting said annulus relatively to the cab.

5. A flying-machine comprising a cab, steering rudders connected therewith, an annulus surrounding said cab and pivoted thereon on a horizontal axis, a propeller-ring rotatably supported on the annulus, means for rotating said propeller-ring, and means for variably positioning said annulus relatively to the cab.

6. A flying-machine comprising a frame, fixed aeroplanes attached to said frame, an annulus located between said fixed aeroplanes and pivoted to said frame, an aeroplane carrier revolubly supported on said annulus at a plurality of points around its circumference, aeroplanes fixed to said carrier, and means for varying the angle of said annulus and carrier in relation to the frame.

7. A flying machine having a frame, an annulus carried by said frame, a pair of aeroplane rings revolubly mounted on said annulus one within the other and lying in the same plane, and means carried by said annulus and interposed between said rings and in engagement with the peripheries of both of same for imparting rotation thereto in opposite directions.

8. A flying machine having a frame, an annulus carried by said frame, a pair of concentric aeroplane rings, a plurality of pulleys carried by said annulus and upon which said rings are peripherally rotatably mounted, and means in engagement with the peripheries of said rings for imparting rotative motion thereto.

9. A flying machine having a frame, an

annulus carried by said frame, a pair of concentric aeroplane rings arranged one within the other, common means carried by said annulus for supporting both of said rings rev-
5 olubly thereon, and driving means interposed between said rings and in engagement with the inner periphery of the outer ring and with the outer periphery of the inner ring for imparting rotative motion to both
10 of same but in opposite directions.

10. A flying machine having a frame, an annulus carried by said frame, a pair of concentric aeroplane rings arranged one within the other in the same plane, common means
15 carried by said annulus for supporting both of said rings revolubly thereon, and driving means interposed between said rings and in engagement with the inner periphery of the outer ring and with the outer periphery of
20 the inner ring for imparting rotative motion to both of same but in opposite directions.

SIMON LAKE.

25

CERTIFICATE OF CORRECTION.

30

Patent No. 1,772,049.

Granted August 5, 1930, to

SIMON LAKE.

35

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 97, strike
40 out the words "passing horizontally thru the cab and also" and insert the same to follow after the word "axis" in line 95; page 2, line 1, for the misspelled word "carired" read carried; and that the said Letters Patent should be read with
45 these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of September, A. D. 1930.

50

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

55

60

65

70