

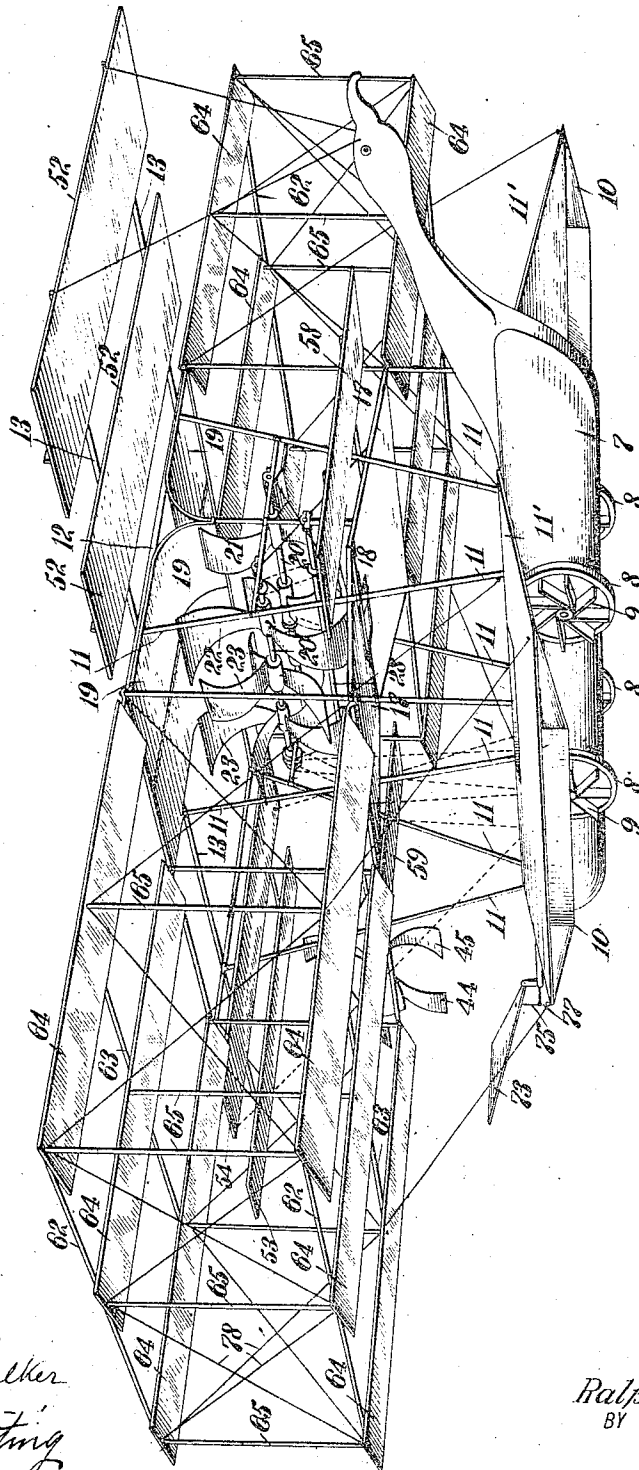
R. M. METCALF.
FLYING MACHINE.
APPLICATION FILED OCT. 14, 1909.

1,086,199.

Patented Feb. 3, 1914.

5 SHEETS—SHEET 1.

FIG. 1



WITNESSES

H. J. Walker

H. Whiting

INVENTOR

Ralph M. Metcalf

BY

Munn & Co

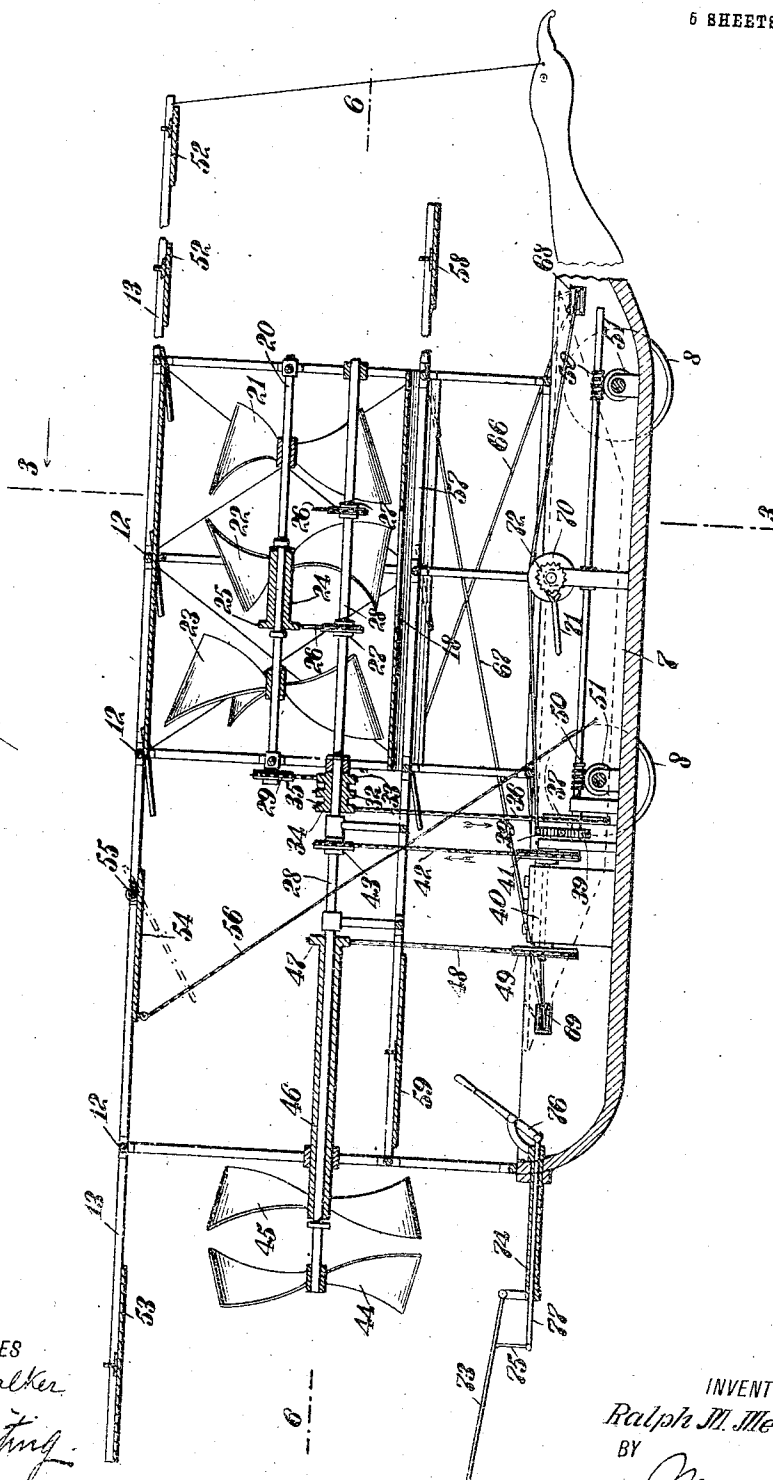
ATTORNEYS

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5 SHEETS—SHEET 2.

Fig. 2.



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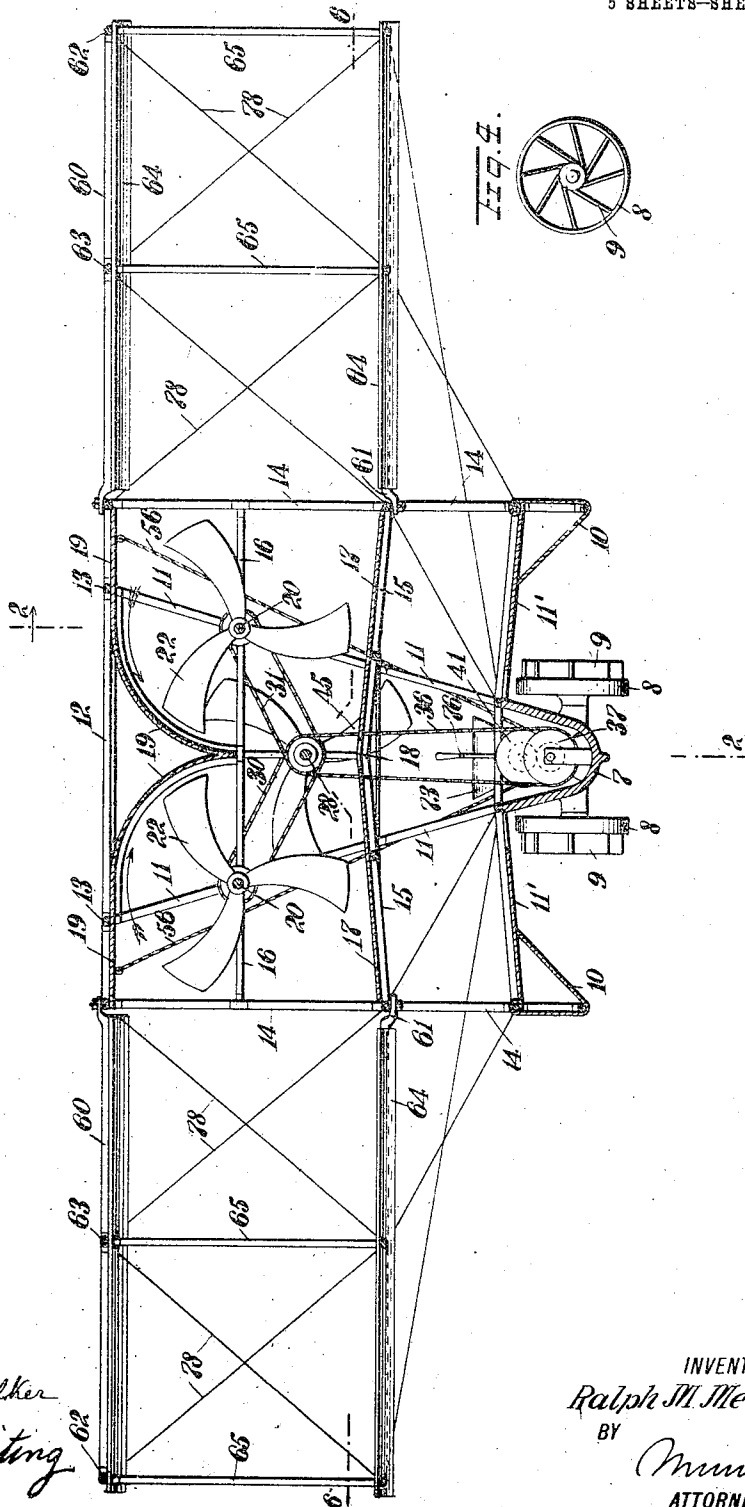
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5 SHEETS—SHEET 3.

Fig. 3.



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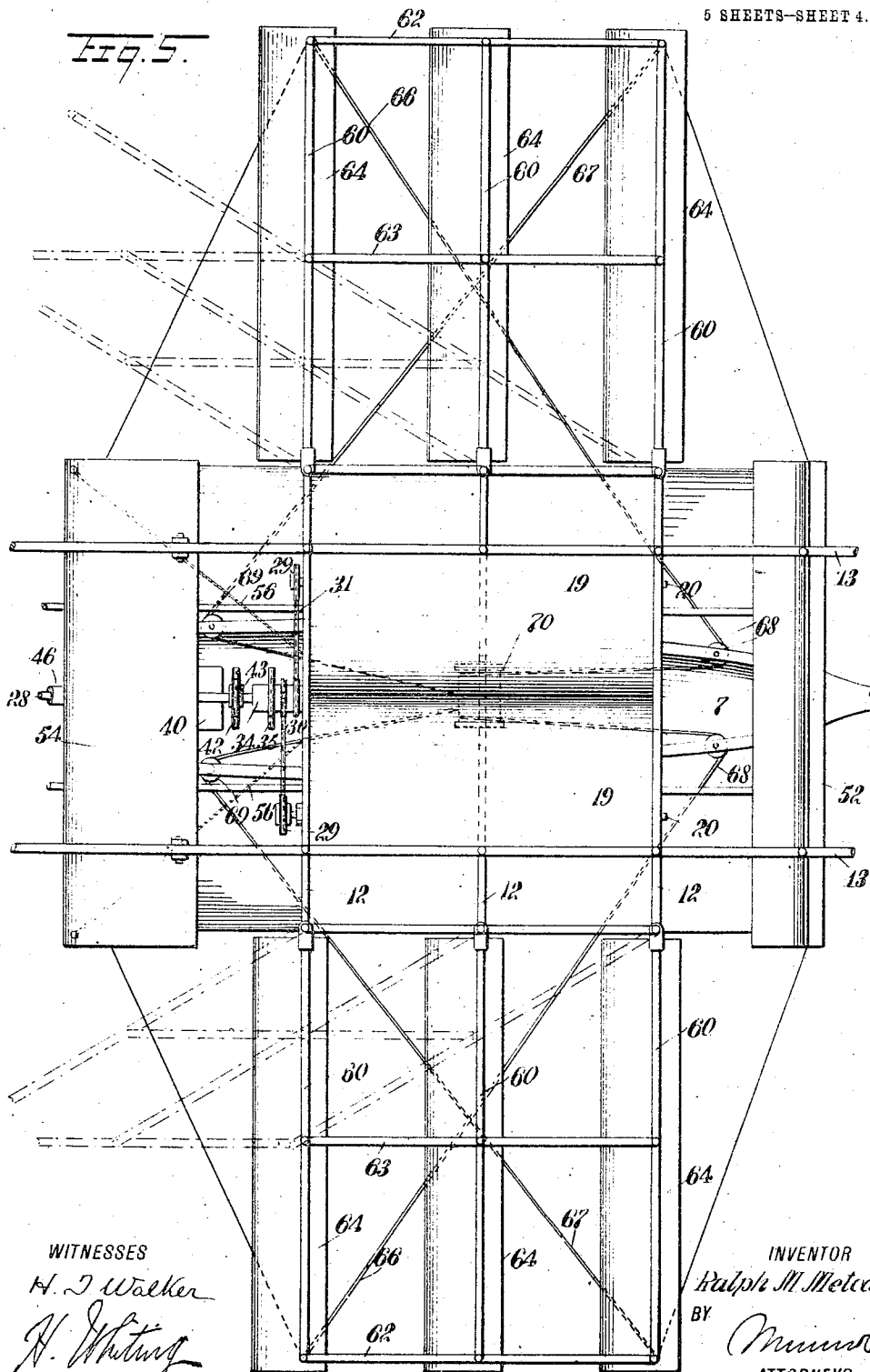
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5 SHEETS-SHEET 4.

Fig. 5.



WITNESSES

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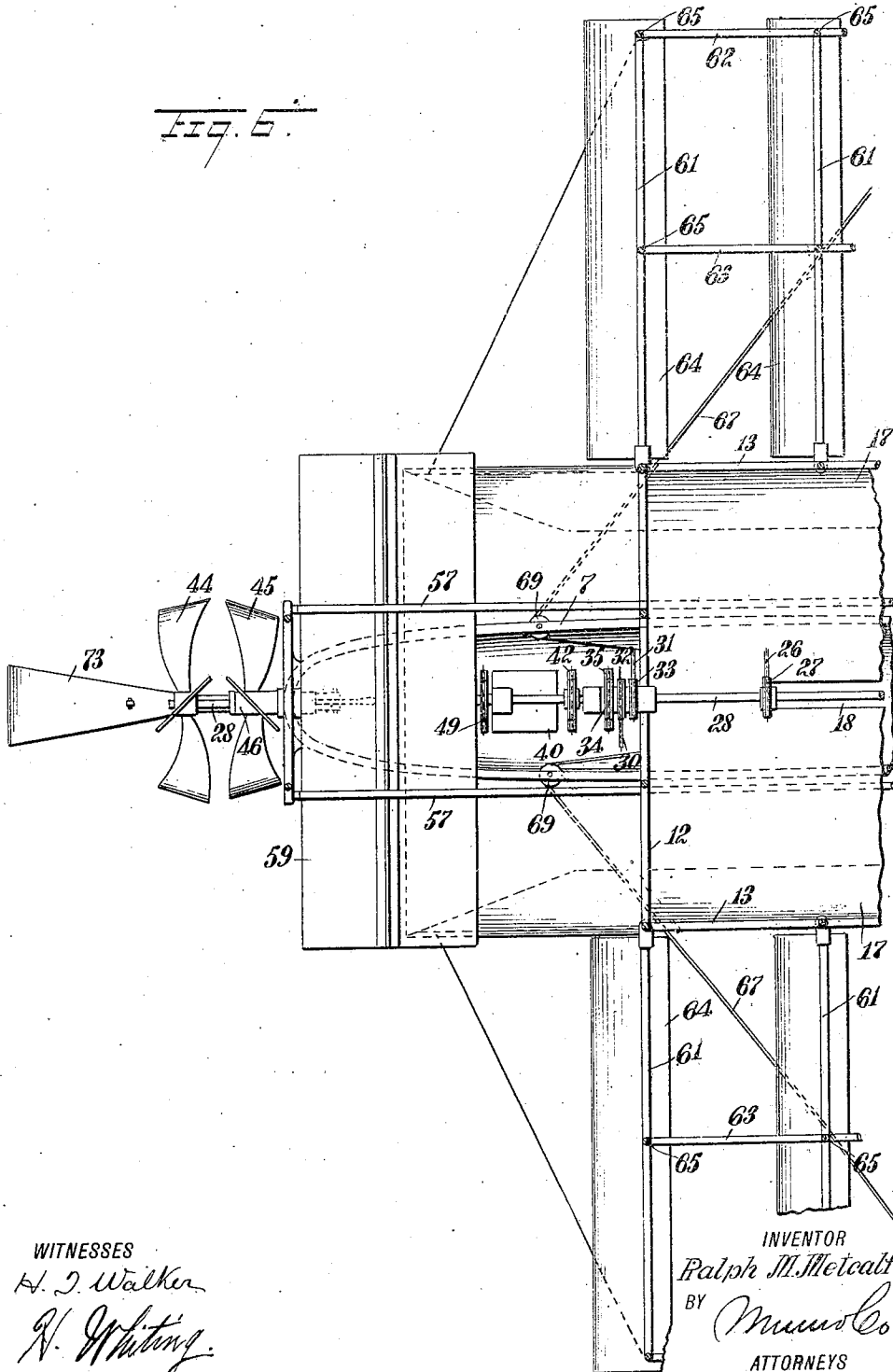
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5 SHEETS—SHEET 5.

Fig. 5.



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UNITED STATES PATENT OFFICE.

RALPH MASON METCALF, OF DRISCOLL, NORTH DAKOTA.

FLYING-MACHINE.

1,086,199.

Specification of Letters Patent.

Patented Feb. 3, 1914.

Application filed October 14, 1909. Serial No. 522,525.

To all whom it may concern:

Be it known that I, RALPH M. METCALF, a citizen of the United States, and a resident of Driscoll, in the county of Burleigh and State of North Dakota, have invented a new and Improved Flying-Machine, of which the following is a full, clear, and exact description.

This invention relates to a flying machine of that type known as self-propelled aeroplanes; and an object of the invention is to provide a device which will be simple in construction, of light weight and great strength, which will run at a high speed in a steady manner, and which will be capable of easy control.

A further object of this invention is to provide a flying machine of the aeroplane type with means for automatically balancing itself during its flight in the air.

A further object of this invention is to provide means for supporting a flying machine on a body of water; and with means for balancing the machine on said body of water.

A still further object of this invention is to provide a flying machine with means for propelling it through the water and raising it from the water by the action of said means against the water.

These and further objects, together with the construction and combination of parts, will be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a perspective view of my device; Fig. 2 is a vertical longitudinal section on the line 2—2 of Fig. 3; Fig. 3 is a vertical transverse section on the line 3—3 of Fig. 2; Fig. 4 is a vertical end view of one of the combined propeller wheels; Fig. 5 is a fragmentary top plan view with parts broken away to show the underlying structure, and showing in full and dotted lines the different positions of the side supporting planes; Fig. 6 is an enlarged fragmentary horizontal section on the line 6—6 of Fig. 2.

Referring more particularly to the separate parts of the device, 7 indicates the body of a flying machine, which is preferably in the form of a boat, having an ornamental figure-head at the front thereof. The boat

7 will readily support the device on a body of water, but is also provided with a plurality of wheels 8, pivotally secured in any well known manner to the sides of the boat and arranged to form a rolling support for the flying machine on land. These wheels 8 are also provided with a plurality of paddles 9, extending in a tangential line from the hub to the rim of the wheel and forming an efficient means for propelling the boat and the flying machine, as a whole, through the water, and also for lifting the boat and flying machine from the water.

In order to balance the boat and flying machine, as a whole, on a body of water, there are provided floats 10, which are of any form suitable to float on the water, such as light air-tight tanks, and are secured to the outer ends of supporting planes 11', which extend downwardly from each side of the body 7, and are secured thereto in any well known manner.

Secured to the body 7 in any well known manner, and extending upwardly therefrom in diverging lines, there are provided a plurality of uprights 11, which are connected across the top by means of transverse rods 12 and longitudinal rods 13. These uprights and rods form the main supporting frame for the flying machine. Extending from the transverse rods 12 downwardly to the floats 10 and secured thereto in any well known manner, there are provided vertical rods 14, which form additional means for supporting the planes 11' and the floats 10. The rods 14 are suitably connected to the uprights 11 by means of transverse rods 15 and 16, and are also connected to each other by means of longitudinal rods 17. Supported on the rods 15 intermediate the rods 14, there are provided a pair of planes 17, which extend at an angle to each other and meet at about the center of the flying machine. At the meeting point of these planes 17, there is provided an opening 18, which serves as a vent for the surplus air beneath the aeroplane, tending to form an upward current of air, balancing the machine while in flight and supplying a part of the air displaced by mechanism above.

Extending inwardly from each side of the upright rods 14 and considerably above the planes 17, there are provided a pair of planes 19, which extend in horizontal planes for a short distance and then curve downwardly and inwardly to form arcs of perfect

circles, and then coincide and extend still farther down to meet the apex of the junction of the planes 17. These planes form suitable cavities in which propellers, which will now be described, will rotate.

At the point where the uprights 11 intersect the cross bars 16, there are provided journal bearings for a pair of shafts 20, to which are connected a series of propellers 21, 22 and 23. These propellers are so formed that the first propeller has two blades; the second, three; and the third, four. If more propellers are needed, the next one would contain five blades, and so on down through the series, the blades on each propeller exceeding the number on each preceding propeller by one. The alternate propellers on each of the shafts 20 are arranged to rotate in reverse directions. The propellers 21 and 23 are secured to the shafts 20 and rotate therewith. The propellers 22, on the other hand, are secured to sleeves 24, which are loosely mounted to rotate on the shafts 20. These sleeves 24 each have a sprocket wheel 25, which is driven through a sprocket chain 26 by means of a sprocket 27 on a shaft 28, which rotates in a direction opposite to that of the shafts 20. The shafts 20 have sprockets 29 secured thereon, which are driven through sprocket chains 30 and 31 by sprockets 32 and 33 on a sleeve 34, which is loosely mounted on the shaft 28. The sleeve 34 has another sprocket 35 thereon, which is driven through a chain 36 by a sprocket 37. The sprocket 37 is driven through gears 39 by a motor 40. The motor 40 also drives a sprocket 41, which drives the shaft 28 through a chain 42 and a sprocket 43. The shaft 28 extends to the rear of the machine, where it is provided with another propeller 44, which rotates in a direction opposite to a propeller 45 which is secured on a sleeve 46 arranged concentric with the shaft 28 and adjacent to the propeller 44. The sleeve 46 has a sprocket wheel 47 thereon, which is driven through a chain 48 by a sprocket 49, which is in turn driven by the motor 40.

The shaft on which the sprocket wheel 37 is secured extends through its bearing, and is provided with a plurality of worms or any other suitable gears 50, which mesh with worm wheels 51 secured to the shafts of the propelling wheels 8. These worms may be so arranged that they can slide into and out of engagement with the worm wheels 51, so as to be able to drive the propelling wheels 8 at will.

The longitudinal rods 13 extend beyond the front and rear of the frame, and are provided with a plurality of transverse supporting planes 52 at the front of the machine, and with a single transverse plane 53 at the rear of the machine. There is also provided a movable plane 54, pivotally con-

nected to a transverse rod 55, which is secured to the longitudinal rods 13 and extends between them. This plane is capable of pivotal motion, so as to control the equilibrium of the flying machine, and has secured thereto in any well known manner a flexible connection 56, whereby it may be tilted down and held down against the force of the air through which it is rushing. The force of the air, while the machine is traveling forward, will raise this plane when the pull on the flexible connection 56 is released. The longitudinal rods 57 extend beyond the front and rear of the planes 17, and have supported thereon additional supporting planes 58 and 59.

In order to form additional supporting surfaces for the flying machine which may be thrown into and out of play manually, there are provided side planes for my device. Pivotally secured to the upright rods 14 in any well known manner, there are provided a plurality of rods 60 and 61, which extend outwardly from each side of the main frame of the machine in a horizontal direction at two different levels, spaced apart from each other by means of rods 65, said levels corresponding to the planes 17 and the horizontal portions of the planes 19. These rods 60 and 61 are pivotally connected by means of rods 62 and 63. The framework thus formed by the rods 60 to 63 is collapsible, and may be folded up along the side of the framework of the flying machine, as is partially indicated by the dotted lines in Fig. 5. Secured to these collapsible frameworks, there are provided a plurality of supporting planes 64, which are secured to the cross rods at the different levels, and are curved and formed in such a manner that they will nest one within the other when the collapsible frameworks are folded up along the sides of the machine.

In order to extend and fold up the collapsible frames, supporting the planes 64, there are provided flexible connections 66 and 67, which are secured to the outer corner upright rods 65 and cross each other, and extend over suitable pulleys 68 and 69, to opposite sides of a double drum 70. This drum may be rotated in either direction by any suitable means, such as a pawl-carrying lever 71 operating a ratchet wheel 72 secured to the drum in any well known manner. Thus by rotating the drum 70 in one direction, the ropes 67 will be drawn in, collapsing the foldable frames up against the sides of the machine, the ropes 66 paying out at the same time, to allow for the travel of the opposite portion of the collapsible frames. In order to unfold the collapsible frames, the drum 70 is rotated in the opposite direction, drawing in the ropes 66 and paying out the ropes 67.

In order to control the direction of the

5 flying machine, there is provided a suitable
rudder 73, which is pivotally secured on a
hollow bracket 74 extending from the rear
of the body 7. Extending through the hol-
low bracket 74, and pivotally connected to
the rudder 73 at one end by means of a link
75, and pivotally connected at the other end
to a pivoted lever 76, there is provided a
connecting rod 77. By this means, the rudder
73 can be controlled from the hand lever
76, to direct the travel of the flying machine.
The various parts of the machine
are tied together, for additional strength,
by means of suitable diagonally arranged tie
wires 78, which may be of any suitable high
tensile material, such as piano wire.

The operation of the device will be readily
understood from the above description.

If the machine is on land, it may be
started by rotating both the propelling
wheels 8 and the propellers 21, 22, 23, 44
and 45 until sufficient momentum has been
attained to lift the machine from the
ground. When once in flight, the equilib-
rium and direction of travel of the machine
may be controlled by the plane 54 and
the rudder 73. If the machine is not carry-
ing many passengers or other weight, the
auxiliary planes 64 and the frames sup-
porting them, may be folded up along the
sides of the machine by drawing in on the
ropes 67 by means of the drum 70. In case
the machine acquires a number of passen-
gers or other weight during its flight from
place to place, additional support may be
obtained by extending the supporting planes
64 into their outermost and operative posi-
tion, by means of the drum 70 and the
ropes 66.

If it is desired to alight on a body of
water, this can be readily done because of
the fact that the body of the machine con-
sists of a boat, and further, because of the
side floats 10, which will prevent the machine
from tilting and tipping the support-
ing planes beneath the surface of the water.

When it is desired to rise from the water,
the propeller wheels 8 may be rotated
rapidly, at the same time rotating the pro-
pellers 21, 22, 23, 44 and 45, thereby causing
the paddles 9 to exert a lifting and forward
propelling force on the water, which is
added to the propelling force of the air pro-
pellers. The aeroplane will thus rise from
the water in a ready and stable manner.

The arrangement of the curved planes 19
and the oppositely rotating alternating pro-
pellers 21 to 23, all tend to form a stable
machine, which will automatically balance
itself during its flight in the air. This is
aided by the contour of the planes 17 and
the opening 18 provided at their junction.
The provision of the propellers 21, 22 and
23 with successively increasing numbers of
blades, provides a propelling force, which

will be steady in its operation, and will
eliminate all shocks and jars due to the pro-
pelling force.

Having thus described my invention, I
claim as new and desire to secure by Let-
ters Patent:—

1. In a flying machine, the combination
with a supporting frame, of supporting
planes on said frame, substantially rigid
auxiliary planes connected to said frame
and adapted to nest one within the other,
and means for nesting said auxiliary planes
together.

2. In a flying machine, the combination
with a frame, of supporting planes on said
frame, auxiliary collapsible frames con-
nected to said frame, substantially rigid
supporting planes on said auxiliary frames,
and means for collapsing said frames.

3. In a flying machine, the combination
with a frame, of supporting planes on said
frame, auxiliary collapsible frames con-
nected to said frame, substantially rigid
supporting planes on said auxiliary frames,
means for collapsing said auxiliary frames,
and means for extending said auxiliary
frames.

4. In a flying machine, the combination
with a frame, of supporting planes on said
frame, auxiliary frames pivotally connected
to said frame, rigid planes on said auxiliary
frames, adapted to nest one within the other,
and means for folding said auxiliary frames
along the sides of said frame.

5. In a flying machine, the combination
with a frame, of supporting planes on said
frame, auxiliary frames pivotally connected
to said frame and comprising a plurality of
vertical transverse and longitudinal rods
pivotally connected together, a plurality of
curved supporting planes connected to said
auxiliary frames and adapted to nest one
within the other, and means for folding and
extending said auxiliary frames.

6. In a flying machine, the combination
with a body portion, of oppositely arranged
planes inclined upwardly and inwardly and
meeting at the center of the machine, the
said planes being provided with an opening
at their meeting point and propelling means
arranged above the said planes, whereby a
steadying current of air is drawn up through
said opening.

7. In a flying machine, the combination
with a body portion, of a pair of supporting
planes converging upwardly toward each
other and having an opening between them,
a plurality of propellers rotatably sup-
ported above said planes, a plurality of sup-
porting planes superposed and arching
around said propellers, means for operating
said propellers, a rudder connected to said
body portion, and means for operating said
rudder.

8. In a flying machine, the combination

with a body portion, of a pair of planes converging upwardly toward each other and having an opening between them, a series of propellers arranged above each plane of the pair of planes, planes arching around the propellers, and means for rotating alternate propellers of each series in the same direction.

9. In a flying machine, the combination with a body portion, of a pair of planes converging upwardly toward each other and having an opening between them, a series of propellers arranged above each plane of the pair of planes, each successive propeller having a greater number of blades than the next preceding one, planes arching around the propellers, and means for operating the propellers.

10. In a flying machine, the combination with a body portion, of a pair of planes converging upwardly toward each other, a series of propellers arranged above each plane of the pair of planes, each successive propeller having a greater number of blades than the next preceding one, planes arching around the propellers, and means for rotating alternate propellers of each series in the same direction.

11. In a flying machine, a body portion, planes extending outwardly from the sides of the body portion, floats at the outer portions of the planes, a supporting frame above the body portion, planes in said frame, and propellers mounted in the frame on each side of the longitudinal center of the body portion and over the planes thereof.

12. In a flying machine, a body portion, wheels upon which the body portion is mounted, said wheels having paddles, planes extending outwardly from the sides of the body portion beyond the said wheels, floats at the outer portions of the planes, and propellers mounted above the body portion on each side of the longitudinal center of said body portion and over the planes thereof.

13. In a flying machine, a body portion, wheels upon which the body portion is mounted, said wheels having paddles, planes extending outwardly and downwardly from the sides of the body portion beyond the said wheels, floats at the outer portions of the planes, propellers mounted above the body portion on each side of the longitudinal center of said body portion and over the planes thereof, a motor in the body portion, means for operating the propellers from the motor, and means for operating the wheels from said motor.

14. In a flying machine, a body portion, planes secured to and extending outwardly from the body portion, an upright frame carried by the body portion and planes, a pair of planes in the frame and converging

toward each other, propellers mounted in the frame above the planes thereof, and on each side of the longitudinal center of the body portion, and curved planes extending partly around the propellers, said planes merging into each other and extending down to the apex of the first-named planes of the frame.

15. In a flying machine, a body portion in the form of a boat, planes extending outwardly from the sides of the body portion, an upright frame carried by the body portion and the outer portions of said planes, planes carried by the frame above the first planes and parallel therewith, curved planes in the upper part of the frame, and propellers mounted in the upper part of the frame adjacent to the curved planes and on each side of the longitudinal center of said frame.

16. In a flying machine, a body portion in the form of a boat, planes extending outwardly from the sides of the body portion, an upright frame carried by the body portion and the outer portions of said planes, a plurality of planes within the frame and above the first named planes, planes pivoted to the upper portions of the sides of the frame to fold against the same, and propellers mounted in the upper part of the frame on each side of its longitudinal center.

17. In a flying machine, the combination with a frame, of a plurality of supporting planes fixed to said frame, a parallel-link frame hinged on each side of said frame, and a plurality of supporting planes mounted on each parallel link frame in different horizontal planes, said planes being adapted to nest one within the other when said parallel-link frames are folded alongside of said first-mentioned frames, so as to vary the effective supporting area of said flying machine.

18. A flying machine comprising a body portion in the form of a boat and mounted on wheels having paddles, planes extending outwardly from the sides of the body portion and having floats at their outer edges, a plurality of planes within the frame, planes pivoted to the sides of the frame to fold against the same, propellers mounted in the frame on each side of its longitudinal center, propellers at the rear of the frame, a motor in the body portion, means for operating the propellers from the motor, and means for operating the wheels from the motor.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RALPH MASON METCALF.

Witnesses:

ROY COLTON,
JOHN E. SPALDING.