W. PAIN.

AERIAL MACHINE.

APPLICATION FILED JULY 28, 1916. RENEWED NOV. 25, 1918.

1,309,152.

Patented July 8, 1919.

3 SHEETS—SHEET 1.

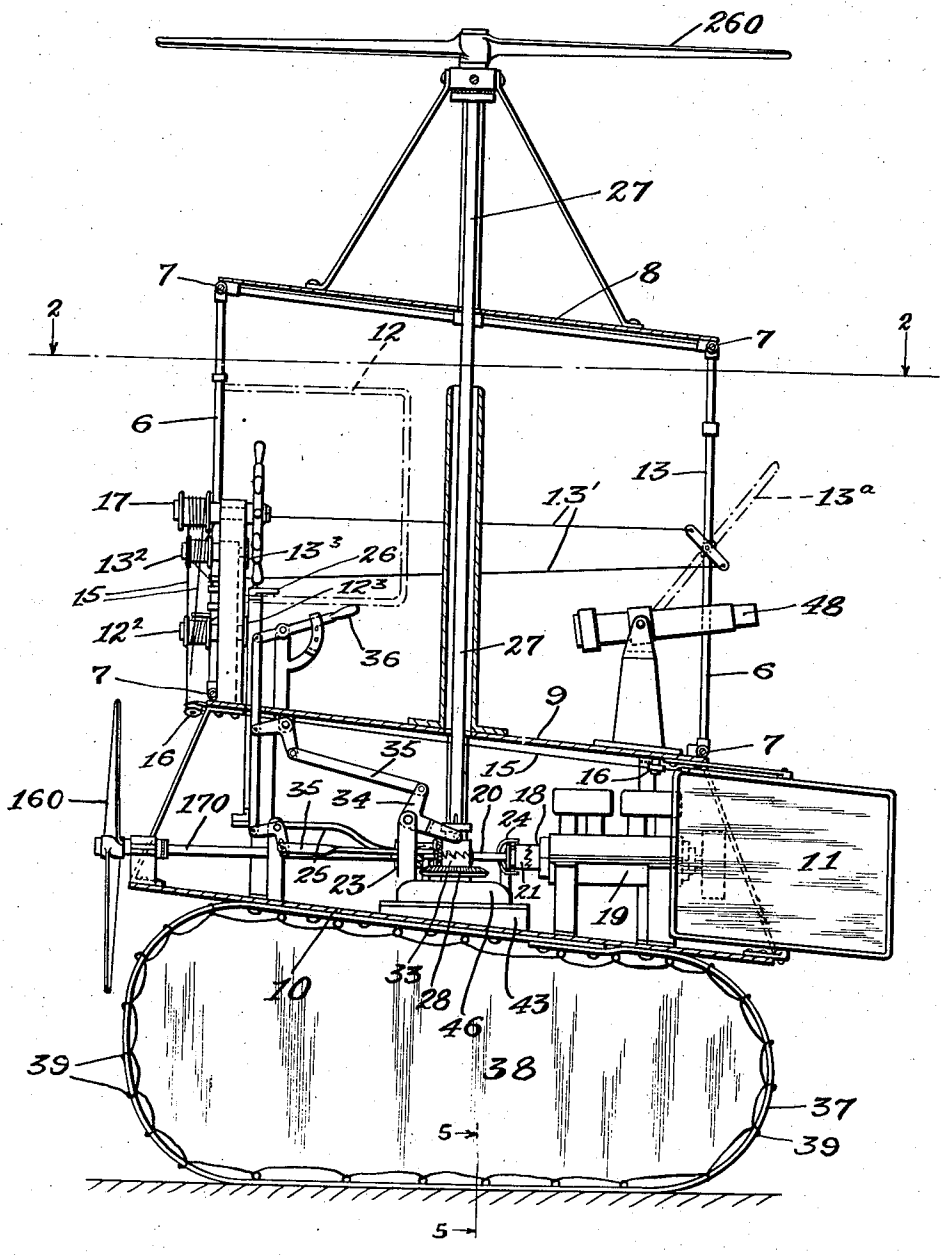


Fig. 1

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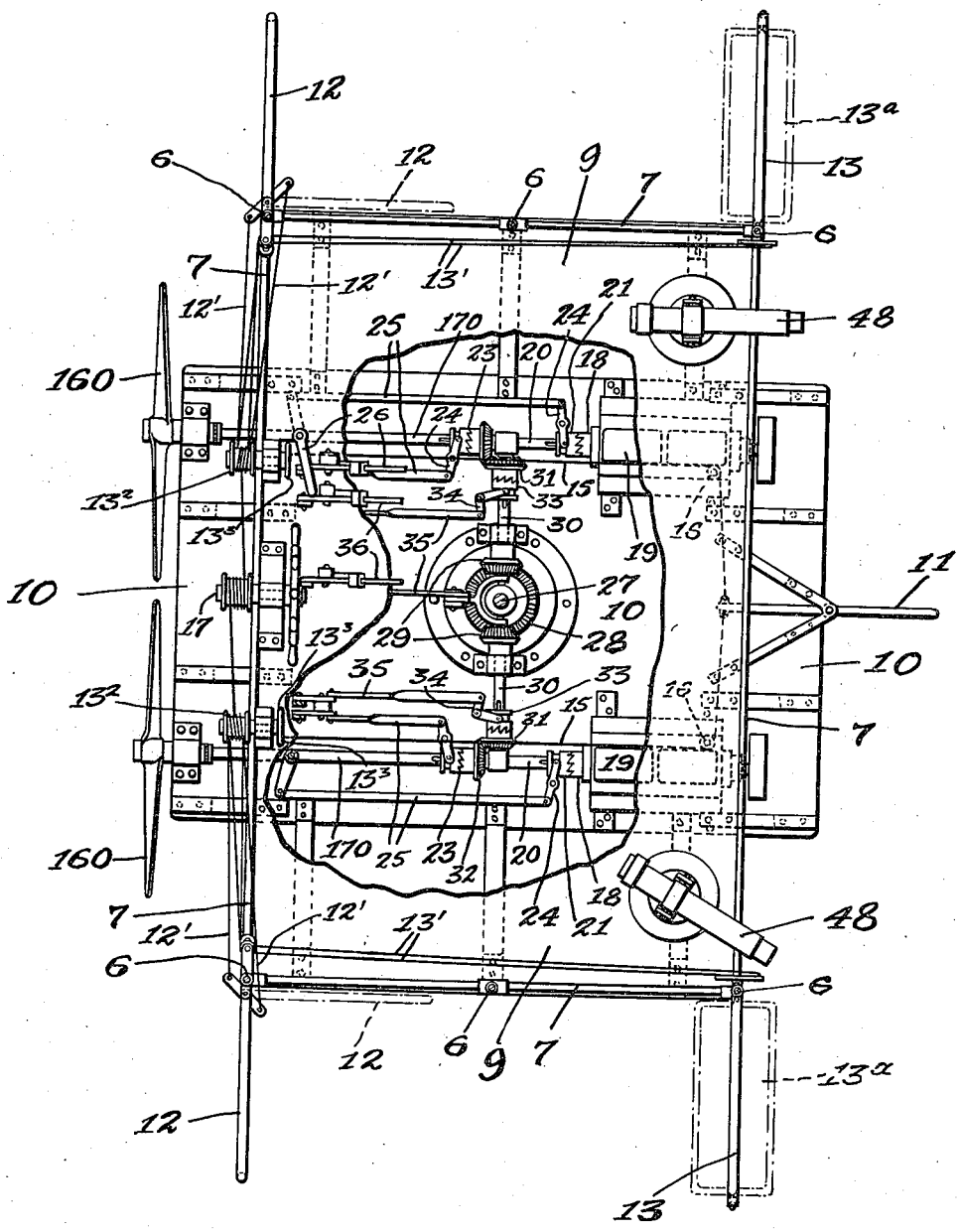


Fig. 2

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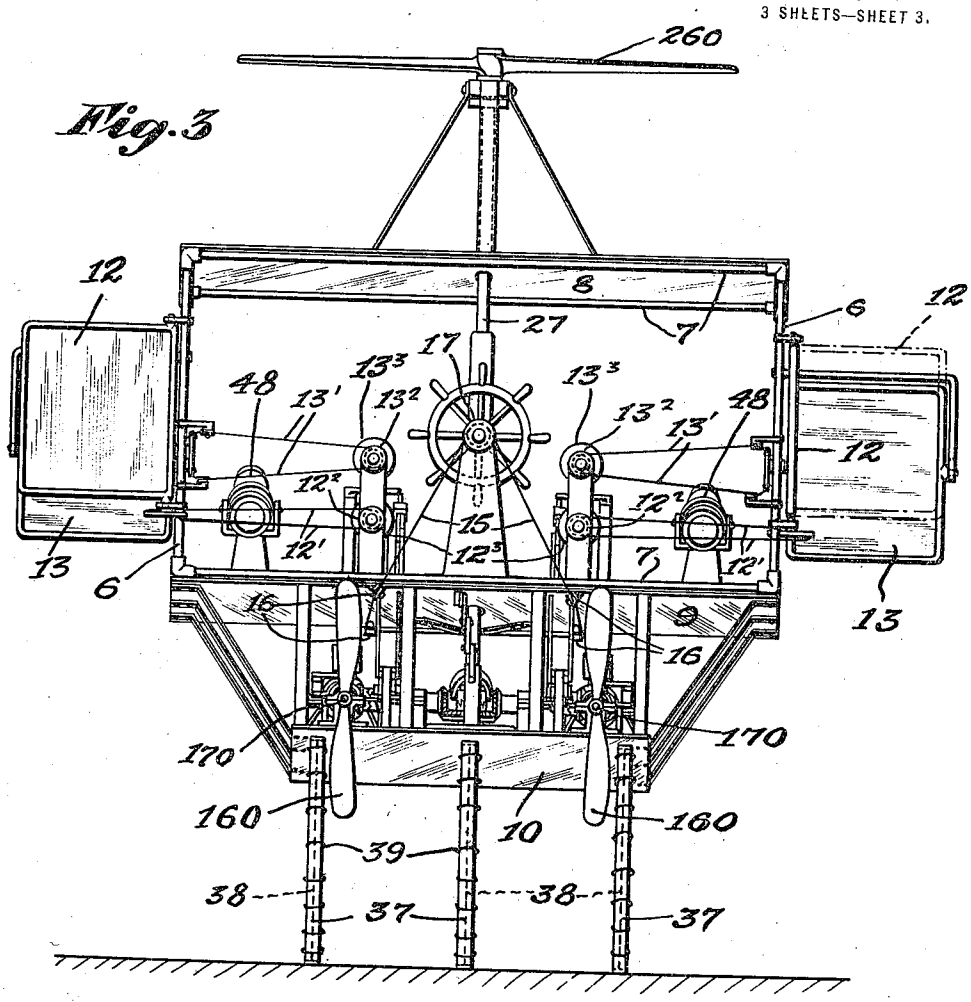
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3 SHEETS—SHEET 3.

Fig. 3



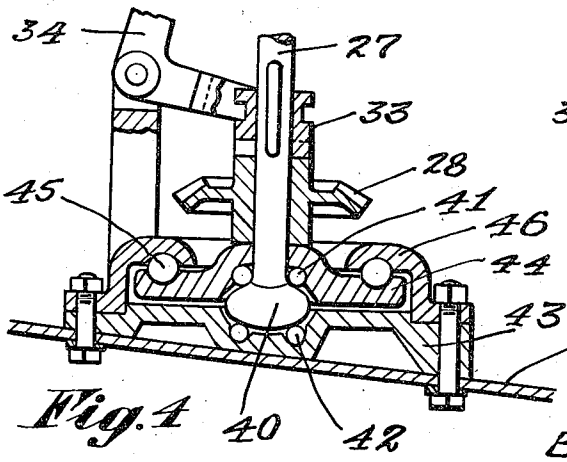


Fig. 4

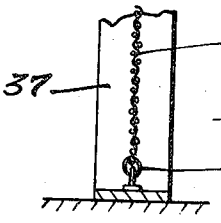


Fig. 5

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UNITED STATES PATENT OFFICE.

WILLIAM PAIN, OF LITTLEROCK, WASHINGTON, ASSIGNOR OF ONE-FOURTH TO JOHN NICHOLIS, ONE-FOURTH TO SELTINO LAZZURI, AND ONE-FOURTH TO ANGELO LAZZURI, ALL OF SEATTLE, WASHINGTON.

AERIAL MACHINE.

1,309,152. Specification of Letters Patent. Patented July 8, 1919.

Application filed July 28, 1916, Serial No. 111,837. Renewed November 25, 1918. Serial No. 264,129.

To all whom it may concern:

Be it known that I, WILLIAM PAIN, a subject of the King of England, residing at Littlerock, in the county of Thurston and State of Washington, have invented certain new and useful Improvements in Aerial Machines, of which the following is a specification.

This invention relates to aerial machines; and its object is the perfecting of apparatus of this class so as to combine the advantages of both the aeroplane and helicopter types and thereby enable the machine to be primarily elevated from the earth in a substantially vertical direction and thence be driven in horizontal or inclined directions by means of driving propellers while being sustained through the offices of a lifting propeller and the planes provided therefor in the machine.

A further object is the provision of improved regulating and guiding devices whereby the machine may be conveniently controlled as to its pose or balance and as to its direction of flight. With these and other ends in view, the invention consists in the novel construction, arrangement and combination of devices as will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal vertical section of my improved machine. Fig. 2 is a view in a horizontal section taken through 2—2 of Fig. 1 and with a portion of the plane next below broken away. Fig. 3 is a front elevational view. Fig. 4 is a detail sectional view illustrating the preferred form of step bearing for the shaft of the lifting propeller. Fig. 5 is a sectional view through 5—5 of Fig. 1.

The reference numerals 6 designate upright members and 7, the floor members of the machine frame which are joined and braced in any suitable manner. Supported by said frame are planes 8 and 9 which are inclined upwardly toward the front to afford a lifting effect in flight. A third relatively fixed and inclined plane 10 is provided below the plane 9 and serves as a platform for the motors, power transmission devices, etc.

In addition to the aforesaid planes supplementary adjustable planes, 11, 12, and 13 are employed therewith. The plane 11, disposed at the rear, is rotatable about a vertical axis and constitutes the main rudder. The planes 12 which also serve as rudders are disposed to turn on vertical axes, being hingedly connected to opposite sides of the frame. The last named planes are preferably disposed near the front of the machine, as best shown in Fig. 2, and to the rear of such planes are positioned the other planes 13. These planes are mounted upon horizontal axes and are movable into selected rotary positions according to the direction in which the machine is to travel and are primarily designed to regulate the pose or trim of the machine. When ascending in a substantially vertical direction the planes 13 would be regulated to be vertical or nearly so as shown by full lines in Fig. 2 but when the machine is being propelled forwardly, the referred to planes are accordingly adjusted as indicated by broken lines 13^a in the view to cooperate with the main planes of the machine. The planes 13 may be individually regulated as will be presently explained to maintain the lateral balance of the machine or to cause one or the other side to be elevated to a greater height as may be deemed advantageous when moving in a curve. The rudder 11 is controlled by tiller lines 15 passing about suitable guide pulleys such as 16 to the drum 17 of a steering wheel. The other planes 12 and 13 are in like manner controlled by lines 12^1 and 13^1 from drums 12^2 and 13^2 through the agency of manually operated wheels 12^3 and 13^3.

160 represents driving propellers mounted in front of the machine frame upon substantially horizontal shafts 170 in axial alinement with the shafts 18 of motors 19 and intermediate shafts 20 for the respective propeller and motor shafts. 21 represents clutches provided for operatively coupling the respective motor shafts to the associated intermediate shafts and to couple the latter with the propeller shafts 170 I provide clutches 23. The movable elements of the various clutches are arranged to be shifted into and out of engagement with the other clutch elements in any suitable manner as, for example, by levers 24 actuated through the medium of connecting rods 25 from operating levers 26 disposed within convenient reach of the operator. The motors 19 also

serve to drive a lifting propeller 260 secured to the upper end of an upright shaft 27 and above the uppermost of the planes so that when in operation the suspended weight will have the effect of a pendulum which tends to obtain a vertical position. More particularly, the shaft 27 is driven through the medium of beveled gears 28 and 29 from transversely arranged shafts 30 which, in turn, are driven through by bevel gears 31 and 32 from the intermediate shafts 20. Said bevel gears are loosely mounted on the respective shafts and upon occasion are coupled therewith by clutches 33, one part of each being secured to the respective gears and the complementary parts splined to the shafts. 34 represents shifting levers for the splined clutch elements which are actuated by connecting rods 35 from operating levers 36. By use of the above explained system of shafting and couplings, it is apparent that the lifting and driving propellers may be rotated in unison or independently from both motors or they in like manner may be driven from either motor, which is an important advantage in case one or both of the motors become deranged or other wise unserviceable. Furthermore the lifting propeller may be driven by one or both of the motors simultaneously or otherwise with respect to the driving propellers. Depending from the lower plane 10 the machine is provided with one or more fins which are severally formed of a spring metal framework 37 inclosing a web 38 of fabric or other suitable flexible material and which may be secured in place by lacings such as 39, Figs. 1 and 5. The framework 37 of each fin is desirably provided with curved ends to furnish resiliency in the fin sufficient to withstand injury to the machine in landing.

The various shafts of the machine are provided with anti-friction bearings, the preferred form for such bearing of the lower end of the lifting propeller shaft being illustrated in Fig. 4. As shown, the shaft terminates in an oblate spheroidal extremity 40 which is interposed between series of balls 41 and 42 operating in a base 43 which is fixedly secured to the machine frame or the plane 10 therefor, and a rotary plate 44. This plate distributes the strain due to the upward thrust of the lifting propeller through the agency of balls 45 to an annular plate 46 which is secured to the base 43. The use of the spheroidal shaped extremity 40 with the bearing balls above and below the same affords, in effect, a ball-and-socket joint with sufficient flexibility to compensate for any relative movements likely to occur to the structure of the machine when in use.

The central plane 9 is intended to be utilized as a platform to be occupied by the crew and for carrying supplies, cargo or equipment such, for example, as ordnance pieces indicated by the numeral 48.

The operation of the invention, will, it is throught, be understood from the foregoing description.

What I claim is:—

1. In a machine of the class described having a series of superposed planes, a lifting propeller, and a substantially vertical shaft for said propeller, of means provided on said shaft and connected with the machine structure, whereby the latter is supported from in proximity to its lower plane by the lower end of the shaft, and means to rotate the propeller.

2. In a machine of the class described, a pair of driving propellers rotatable on horizontal axes, a lifting propeller rotatable on a vertical axis, shafts for the respective propellers, a pair of motors, shafts therefor, intermediate shafts between the motor shafts and the respective shafts of the driving propellers, bevel gear connection between the shaft for the lifting propeller and said intermediate shafts, and coupling devices provided on the various shafts whereby any of the propellers may be rotated by either motor while the remaining propellers are rendered inoperative.

Signed at Seattle, Washington, the 22d day of July 1916.

WILLIAM PAIN.

Witnesses:
PIERRE BARNES,
JAMES E. SPROLL.