Aug. 14, 1928.

1,681,019

H. C. STEWART

HELICOPTER

Filed Aug. 10. 1926

3 Sheets-Sheet 1

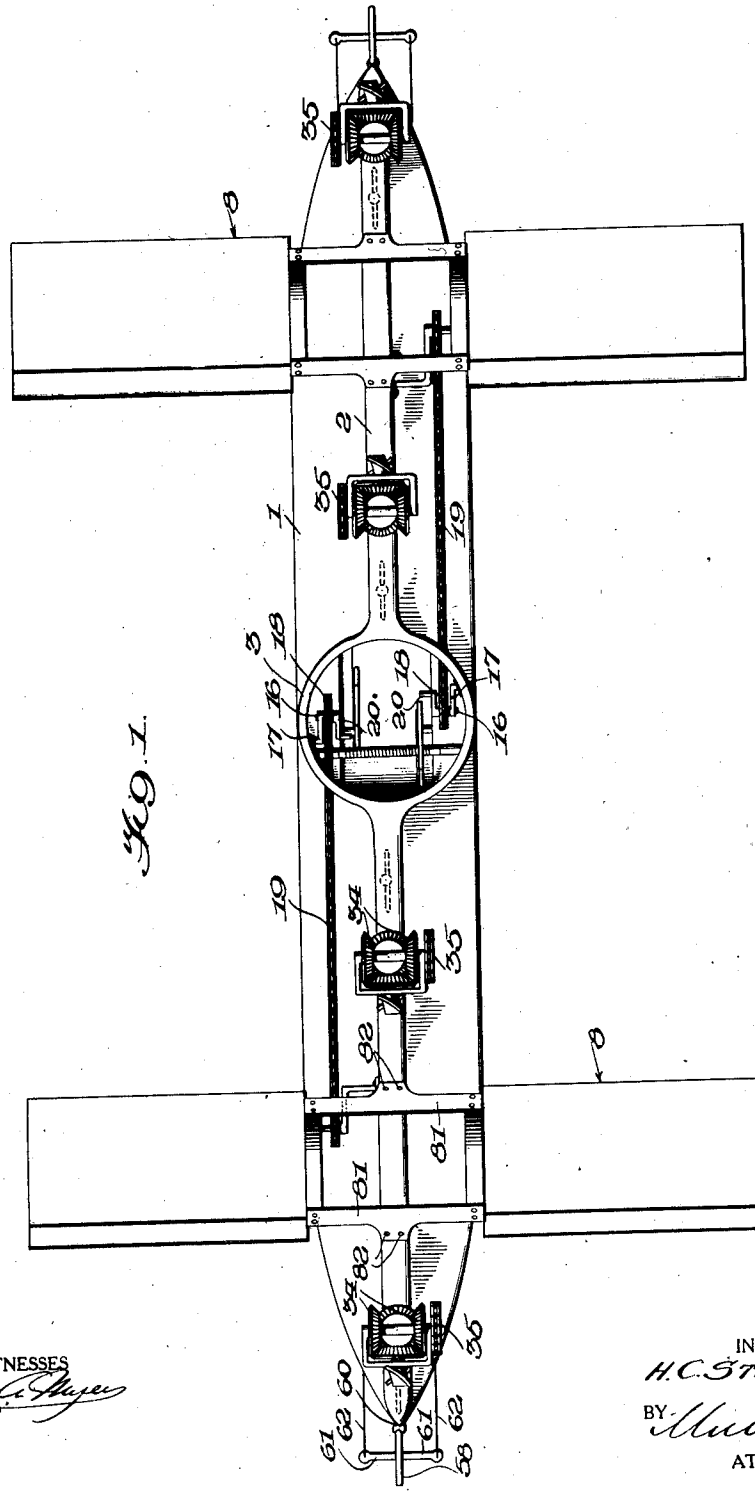


Fig. 1.

WITNESSES

George C. Hayes

INVENTOR

H. C. STEWART,

BY Munn & Co.

ATTORNEYS

Aug. 14, 1928.

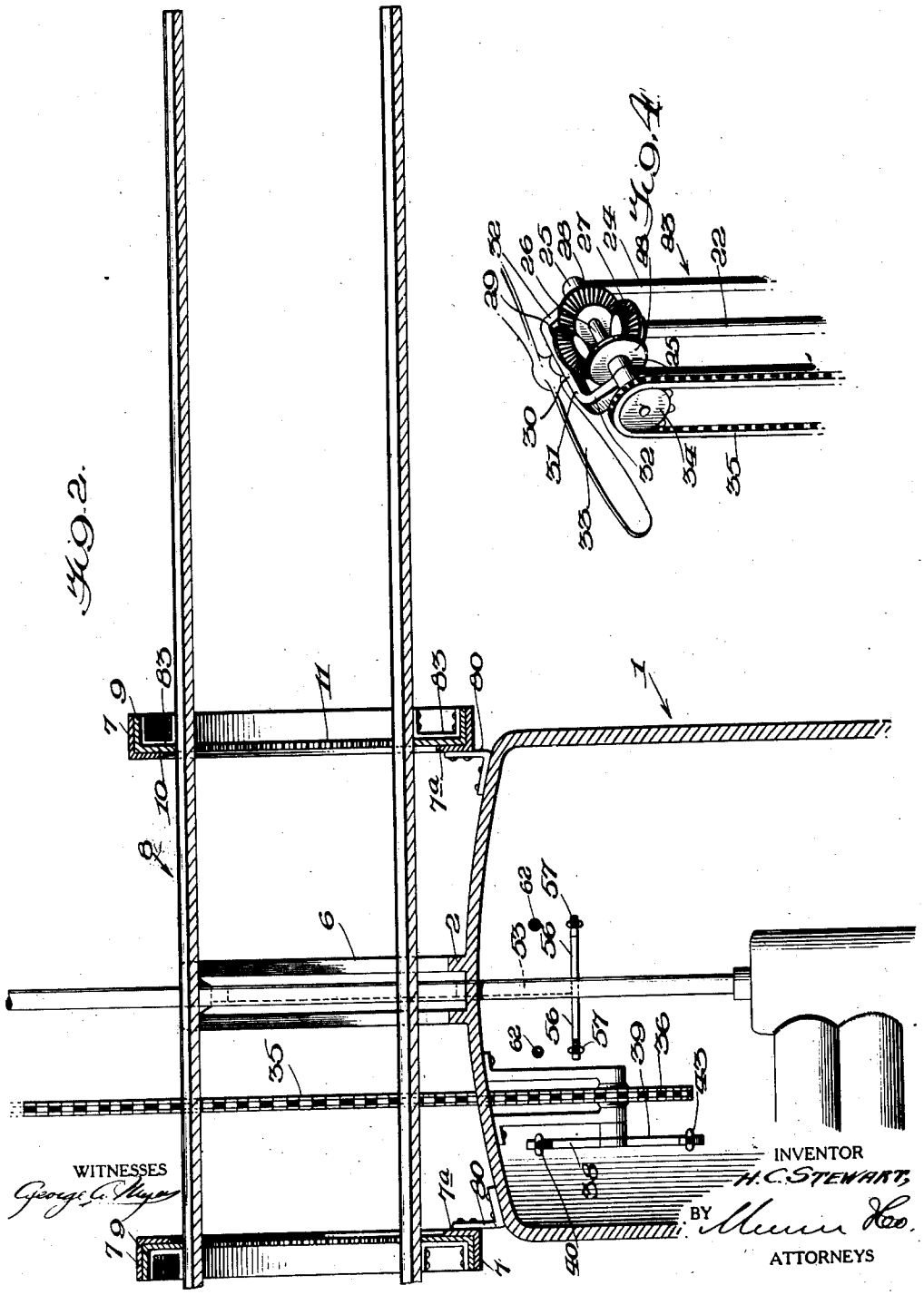
1,681,019

H. C. STEWART

HELICOPTER

Filed Aug. 10, 1926

3 Sheets-Sheet 2



Aug. 14, 1928.

1,681,019

H. C. STEWART

HELICOPTER

Filed Aug. 10, 1926

3 Sheets-Sheet 3

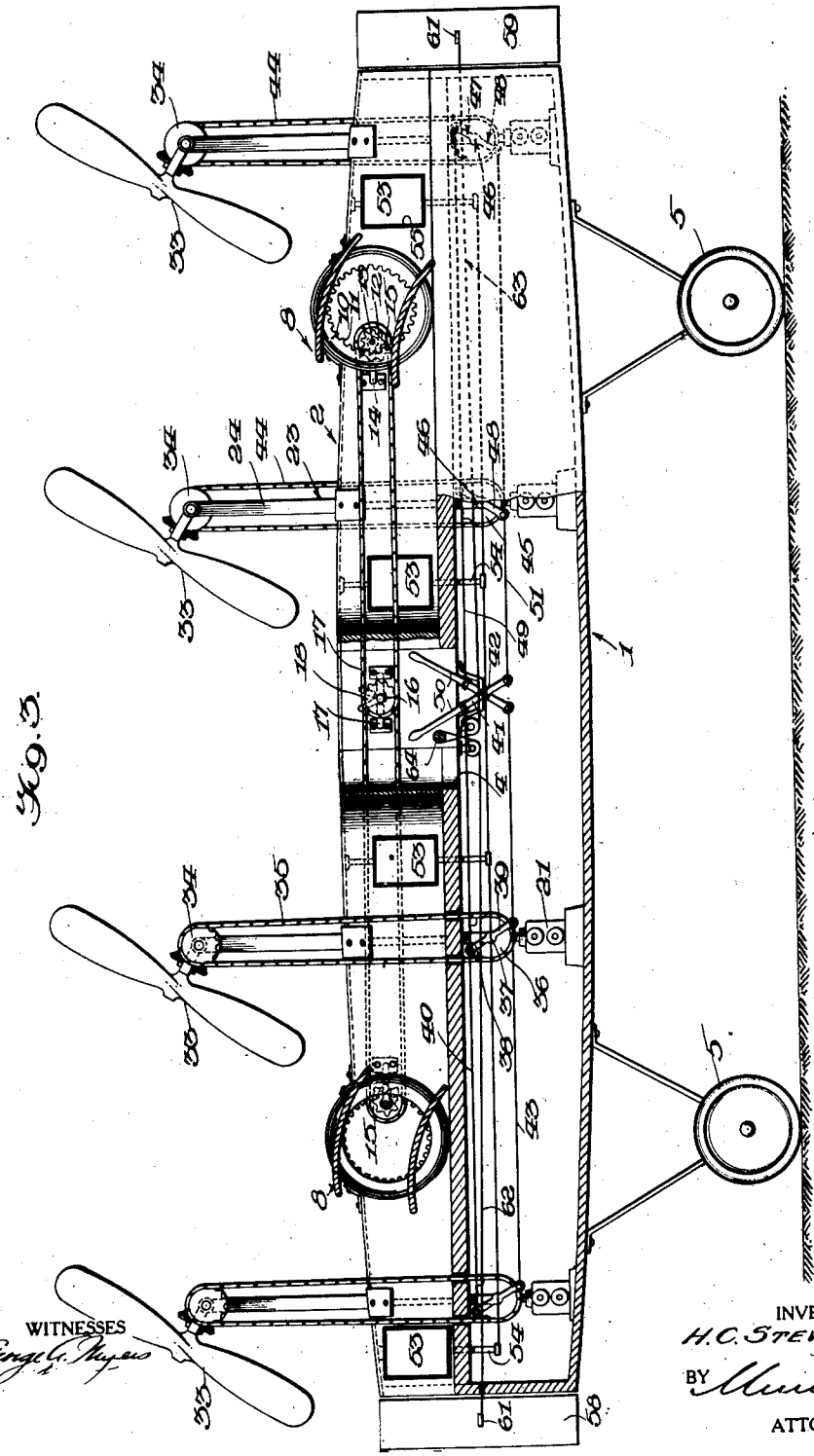


Fig. 3.

WITNESSES

George G. Thomas

INVENTOR

H. C. STEWART,

BY Munn & Co.

ATTORNEYS

Patented Aug. 14, 1928. 1,681,019

UNITED STATES PATENT OFFICE.

HARRY CLARK STEWART, OF WEBSTER, KENTUCKY.

HELICOPTER.

Application filed August 10, 1926. Serial No. 128,393.

My invention relates to improvements in flying machines, of the helicopter type, and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of the invention is the provision of a flying machine of the character described which is capable of flight at a relatively great angle to the horizontal and can be operated to rise from the ground and to descend in a substantially vertical direction.

A further object of the invention is the provision of a flying machine of the character described having means whereby it can be propelled at a relatively great speed and the direction of flight thereof controlled accurately and easily.

A further object of the invention is the provision of a flying machine of the character described which affords facilities for making use of the propellers to sustain the direction of flight of the machine as well as to control the direction of flight and to stabilize the machine while it is in flight so that laterally extending planes or wings with which the machine may be provided may be of relatively slight area.

A still further object of the invention is the provision in a flying machine of simple, reliable and easily operable means for controlling the direction of flight of the machine and efficient means for stabilizing the machine while it is in flight.

Other objects and advantages of the invention will be apparent from the following description, considered in conjunction with the accompanying drawings, in which—

Figure 1 is a plan view of the improved flying machine,

Figure 2 is a relatively enlarged fragmentary cross sectional view of the machine,

Figure 3 is a longitudinal vertical section through the machine, and,

Figure 4 is a fragmentary perspective detail view of one of the propellers and of the means for adjustably supporting the propeller and for transmitting motion thereto.

The improved flying machine comprises a body 1 which preferably is of elongated elliptical form in horizontal sectional contour as best seen in Figure 1 and tapers in width at the ends thereof to produce relatively sharp substantially vertical edges at the front and rear ends of the body 1. The top of the body 1 is formed with a narrow hollow superstructure 2 thereon which extends the full length of the body along the longitudinal median line thereof and is enlarged transversely intermediate the length of the body at 3 above the vertical opening 4 which is provided in the top wall of the body of the machine to accommodate the operator and part of the operating mechanism of the machine. The body 1 may be mounted on wheels 5 for use when the machine lands or takes flight. The superstructure 2 is formed with front and rear transversely extending cut away portions as at 6 which extend for nearly the full height of the superstructure. The front cutaway portion 6 is located at the same distance from the transverse median line of the body 1 as the rear cut-away portion 6.

A pair of bearing rings 7 is provided for each cut-away portion 6 of the superstructure. The bearing rings 7 of each pair are supported at opposite sides of the associated cut-away portion 6 by brackets 80 which connect inwardly extending flanges 7^a of the bearing rings 7 with the top of the body 1 and by means of a pair of cross connecting bars 81 (see Fig. 1) which connect the rings 7 of each pair and are secured intermediate their length at 82 to the top of the superstructure 2. The flange portions 7^a of the rings 7 are at the inner edges of the latter.

Front and rear plane units 8 of the biplane type of construction respectively extend through the front and rear pairs of bearing rings 7 and the associated cut-away portions 6 of the superstructure 2 and project equal distances beyond the planes of opposite sides of the body 1. The planes 8 are supported to have limited rotary movement about their longitudinal axial lines by means of rotary carrying rings 9 which are supported, preferably anti-frictionally, in the rings 7. The rotary carrying rings 9 have inwardly extending flanges 10 at their inner ends, for engaging with the corresponding flanges 7^a at the inner ends of the bearing rings 7, thus preventing axial movement of the plane units 8, the latter being secured to the carrying rings 9 in any suitable known manner, as by means of the brackets 83, to rotate with the carrying rings. At least one of the front carrying rings 9 and one of the rear carrying rings 9 is provided with teeth 11 in the inner periphery or edge of the flange portion 10 thereof. Pinions 12 are supported on transverse shafts 13 with the teeth thereof in mesh with the teeth 11.

The shafts 13 are carried by brackets 14 which are secured within the superstructure 2 of the machine. The shafts 13 also carry sprockets 15. A pair of aligned transverse shafts 16 are supported on brackets, as indicated at 17, within the space that is provided in the enlarged portion 3 of the superstructure 2 above the opening 4 in the top of the body of the machine. Such space within the superstructure 2 on the body of the machine for the accommodation of the operator of the machine will be hereinafter referred to as the cockpit. The respective shafts 16 are disposed adjacent to opposite sides of the cockpit at the front of the latter and carry sprockets such as indicated at 18. The sprocket 18 on one of the shafts 16 is connected by a chain 19 with the front sprocket 15 and the sprocket 18 on the other shaft 16 is connected by a chain, also designated 19 with the rear sprocket 15. The shafts carry crank handles 20 which can be conveniently manipulated by the operator of the machine to cause turning of the front and rear pairs of carrying rings 9 about axes which extend transversely of the body 1 of the machine either simultaneously or independently of each other and the angular relation of the upper and lower members of the front and rear plane units 8 therefore can be varied at the will of the operator of the machine and the actions of these plane units 8 in affecting the direction of flight of the machine therefore can be varied.

The driving mechanism of the machine includes any even number of internal combustion engines 21 or other suitable prime movers arranged within the body 1 of the machine so that the same number of engines 21 will be disposed in advance of the transverse median line of the body 1 as at the rear of the transverse median line of the body and so that the engines 21 in advance of the transverse median line of the body 1 and rearwardly of the transverse median line of the body 1 are similarly arranged with respect to the transverse median line of the body. The engines 21 may be secured to the bottom of the body 1 of the machine in any suitable known manner and comprise vertical drive shafts 22 which extend upwardly through the superstructure 2 on the body of the machine and through suitable openings which are provided in the crown of the superstructure 2 above the longitudinal median line of the body 1 of the machine. A bracket 23 is provided for each vertical drive shaft 22. Each bracket 23 is secured on the superstructure 2 of the machine in association with one of the drive shafts 22 so that arms 24 of the bracket will extend upwardly at opposite sides of the upper end portion of the associated drive shaft 22 above the level of the upper end of the latter. The arms 24 are provided with bearings 25 at their upper ends for supporting a rock shaft 26 which extends in a direction at right angles to the direction of length of the body 1 of the machine and above the upper end of the associated drive shaft 22 so that the axis of the rock shaft 26 intersects the extended axial line of the associated drive shaft 22. A bevel gear 27 is secured to the upper end of each drive shaft 22 and is in mesh with a pair of spaced bevel gears 28 which are freely rotatable on the rock shaft 26. The gears 28 are adapted to transmit motion from the gear 27 on the associated drive shaft 22 to a gear 29 that is secured to a propeller shaft 30. The propeller shaft 30 is journaled in a transverse opening in the web 31 of a yoke which is substantially U-shaped and which has arms 32 secured at their extremities to the rock shaft 26 at equal distances from the point of intersection of the axis of the rock shaft 26 with the extended axial line of the associated drive shaft 22. The propeller shaft carries a propeller 33 of the screw type at its outer end.

With the arrangement just described, the rock shaft 26 can be turned about its axis to swing the associated yoke and the associated propeller shaft in a vertical plane which intersects the longitudinal median line of the body 1 of the machine.

Each rock shaft 26 has an extended end portion on which a sprocket 34 is secured. The sprockets 34 of the rock shafts 26 which are located in advance of the transverse median line of the body of the machine are connected by chains 35 with sprockets 36 which are secured on rotary transverse shafts 37 within the upper part of the space within the body 1 of the machine. Each shaft 37 carries a pair of oppositely extending arms 38 and 39 respectively. A cable 40 connects the upper ends of the arms 38 and is attached at its rearward end to the upper end portion of an operating lever 41. The operating lever is fulcrumed on a transverse support 42 underneath the opening 4 at a point which is located at the same distance from the lower end of the lever as from the point of connection of the lever with the cable 40. A cable 43 similar to the cable 40 connects the arms 39 and is attached at its rearward end to the lower end of the lever 41. It therefore will be obvious that swinging of the lever 41 about the axis of the fulcrum 42 will cause motion to be transmitted to the rock shafts 26 of the propellers which are located in advance of the transverse median line of the body 1 of the machine and such propellers can be swung about the axes of the rock shafts 26 with which they are associated to vary the lifting and propelling action of the propellers on the body of the machine within a considerable range.

The propellers 33 which are located rear-

wardly of the transverse median line of the body of the machine can be adjusted about the axes of the rock shafts 26 on which they are supported in substantially the same manner as the propellers that are disposed forwardly of the transverse median line of the body 1 of the machine. The sprockets 34 on the rear rock shafts 26 are connected by chains 44 with sprockets 45. The sprockets 45 are secured on transverse shafts 46 in the rearward portion of the space within the body 1 of the machine. The shafts 46 carry oppositely extending arms 47—48. The ends of the arms 47 are connected by a cable 49 which is attached at its forward end to the upper end portion of a lever 50 which may be fulcrumed on the same transverse supporting member 42 on which the lever 41 is supported. A cable 51 connects the ends of the arms 48 and is attached at its forward end to the lower end of the lever 50. The upper end portions of the levers 41 and 50 extend through the opening 4 into the cock pit and constitute handle members which can be conveniently grasped and manipulated by the operator of the machine. The cables 40, 43, 49 and 51 may be provided at desirable places along their length with adjusting devices, not shown, which may be of any well known construction that affords facilities for keeping the cables desirably taut or adjusted as to length. The propellers 33 preferably are alternately right and left hand screw propellers and adjacent drive shafts 22 therefore are actuated to turn in opposite directions, whereby the concerted action of all the screw propellers will not cause any lateral stress on the body of the machine.

Lateral oscillation of the body 1 of the machine may be further prevented by means of stabilizing vanes 53 which are mounted on the upper end portions of vertical shafts 54 and are swingable about the axes of the shafts 54 to be entirely disposed within the confines of the superstructure 2 of the machine as shown in Figures 1 and 3 or to extend through openings 55 in the side walls of the superstructure 2 of the machine equal distances laterally of opposite sides of the ridge portion 2 of the body of the machine and at any one of a plurality of different angles to the direction of length of the body of the machine. The vane supporting shafts 54 are provided at their lower ends with laterally extending arms such as indicated at 56 and corresponding arms of the various shafts 54 are connected by operating cables 57 which extend longitudinally of the body 1 of the machine and which pass underneath the opening 4 so that either cable 57 can be grasped and manipulated to operate the vanes 53 in unison and to the same extent.

The machine also includes front and rear rudders 58 and 59 respectively which are attached swingingly in any suitable known manner to the front and rear ends of the machine, as by means of vertical pivot elements at 60 in Figure 1. Each rudder 58 or 59 can be swung about the axis of its pivotal support by force transmitted thereto through oppositely extending lateral arms 61. Cables 62 extend from the ends of the arms of the front rudder through the space within the body 1 of the machine into the cockpit of the machine. Cables 63 extend from the ends of the arms 61 of the rear rudder through the body of the machine into the cockpit. A transversely extending rotary roller 64 is supported within the cockpit of the machine. The right hand cable 62 and the left hand cable 63 are passed around the roller 64 several times from the upper side, of course in opposite directions, and are secured to the roller while the left hand cable 62 and the right hand cable 63 are passed around the roller several times from the underside of the cable, also in opposite directions, and are secured to the roller, whereby turning of the roller 64 about its axis will swing the rudders 58 and 59 in unison to the same extent laterally of opposite sides of the longitudinal median line of the body 1 of the machine.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. The members of the planes 8 may be of relatively slight area since the propellers can be adjusted to sustain the flight of the machine. It will be observed that these propellers can be adjusted to swing about vertical axes as well as about axes which are nearly horizontal and that therefore the machine can rise from the ground in a nearly vertical direction and can land in the same manner. The plane units 8 can be adjusted to supplement the action of the propellers to control the direction of movement of the machine or the direction of flight of the machine can be changed by operating or adjusting the positions of the plane units or the propellers as desired.

Obviously, my invention is susceptible of embodiment in forms other than that illustrated in the accompanying drawing, and I therefore consider as my own all such modifications and adaptations of the form of the device herein described as fairly fall within the scope of the appended claims.

I claim:—

1. In a flying machine, an elongated body, a longitudinally extending superstructure on the body, spaced propellers supported at the upper side of the body above the longitudinal median line of the body, said propellers being swingable bodily about axes extending at right angles to the direction of length, and plane units extending laterally through and upon opposite sides of the

front and rear end portions of the superstructure and supported by said superstructure independent of the propellers to rotate about axes which extend at right angles to the direction of length of the body of the machine, said plane units being positioned below the lowermost point in the peripheral movement of the said propellers.

2. In a flying machine, an elongated body, brackets at the upper side of the body, each including a pair of upstanding arms, spaced propellers supported at the upper side of the body above the longitudinal median line of the body, the supporting means for each propeller including a transverse rock shaft supported at the upper ends of the arms of one of said brackets and extending across the vertical plane of the longitudinal median line of the body of the machine, a substantially U-shaped yoke having arms journalled at their extremities to said rock shaft, the web of said yoke having a transverse opening intermediate its length, a propeller, a propeller shaft journaled in said opening in the web of the yoke, a bevel gear secured at the inner end of the propeller shaft, a drive shaft extending from the body of the machine between the arms of the associated bracket and in the longitudinal median line of the machine, a bevel gear at the upper end of said drive shaft, and a pair of motion transmitting gears freely turnable on said rock shaft for transmitting motion from the bevel gear on the drive shaft to the bevel gear on the propeller shaft.

3. In a flying machine, an elongated body, a narrow superstructure extending on the body intermediate the width of the body, each of the end portions of the superstructure having transverse cut-away portions, bearing rings supported at opposite sides of the end portions of the superstructure, plane units extending transversely of the machine through said cutaway portions of the superstructure and through said aligned bearing rings, and carrying rings encircling said plane units and rotatably supported in said bearing rings, said carrying rings being secured to said plane units.

4. In a flying machine, an elongated body, a narrow superstructure extending on the body intermediate the width of the body, each of the end portions of the superstructure having transverse cut-away portions, bearing rings supported at opposite sides of the end portions of the superstructure, plane units extending transversely of the machine through said cut-away portions of the superstructure and through said aligned bearing rings, and carrying rings encircling said plane units and rotatably supported in said bearing rings, said carrying rings being secured to said plane units, one of the front carrying rings and one of the rear carrying rings having teeth in their inner peripheries, pinions in mesh with said teeth, and manually operable means for operating said pinions.

5. In a flying machine, an elongated body having its end portions tapering in width, a relatively narrow hollow superstructure on the body intermediate the width of the body and having side walls, helicopter propellers carried above said superstructure and above the longitudinal median line of the body, planes having end portions extending laterally of opposite sides of the superstructure adjacent to opposite ends of the latter, and stabilizing vanes supported in openings formed in the wall of said superstructure and arranged to be turned about the vertical axes from positions normally in line with the said side walls to various angular positions with respect thereto.

6. In a flying machine, an elongated body, upper and lower supporting planes mounted on the upper side of said body immediately inward of the front and rear ends of the body and extending outwardly from the opposite sides thereof, said planes being adapted for rotation on axes at right angles to the longitudinal axis of said body, and propellers adapted to act as helicopters supported from the upper side of said body and operable in planes at a substantial distance above the uppermost surfaces of said supporting planes, said propellers being disposed in longitudinally spaced relation with respect to said body and one immediately in advance of the vertical planes of the leading edges of each of the forwardly and rearwardly disposed of the upper of said supporting planes and one immediately in rear of the vertical planes of the trailing edges thereof, and means for rotating said propellers.

7. In a flying machine, an elongated body, upper and lower supporting planes mounted on the upper side of said body immediately inward of the front and rear ends thereof and extending outwardly from the opposite sides of the same, said planes being adapted either for independent or simultaneous rotation on axes at right angles to the longitudinal axes of said body, and propellers adapted to act as helicopters supported from the upper side of said body and operable in planes at a substantial distance above the uppermost surfaces of said supporting planes, said propellers being disposed in longitudinally spaced relation with respect to said body and one immediately in advance of the vertical planes of the leading edges of each of the forwardly and rearwardly disposed of the upper of said supporting planes and one immediately in rear of the vertical planes of the trailing edges thereof, and means for rotating said propellers.

HARRY CLARK STEWART.