

May 9, 1944.

C. FERRO

2,348,249

HELICOPTER

Filed Feb. 8, 1941

2 Sheets-Sheet 1

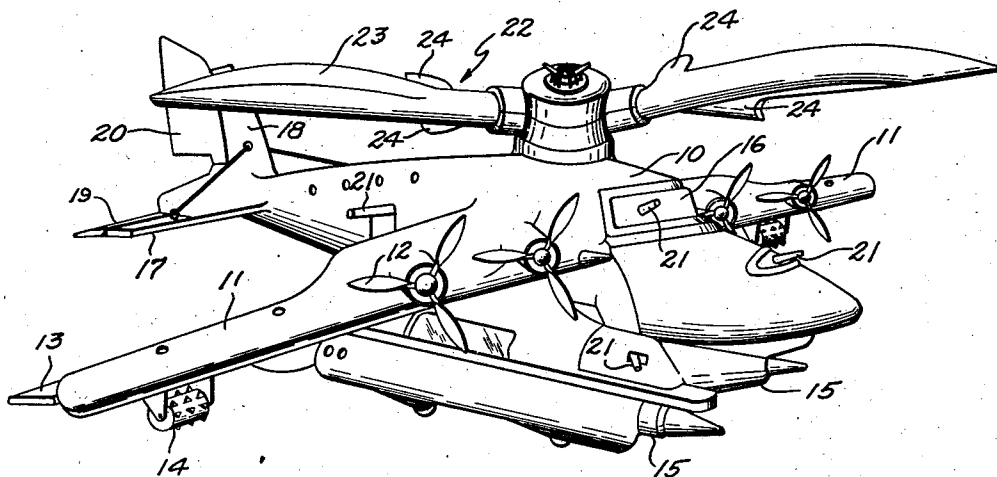


Fig. 1

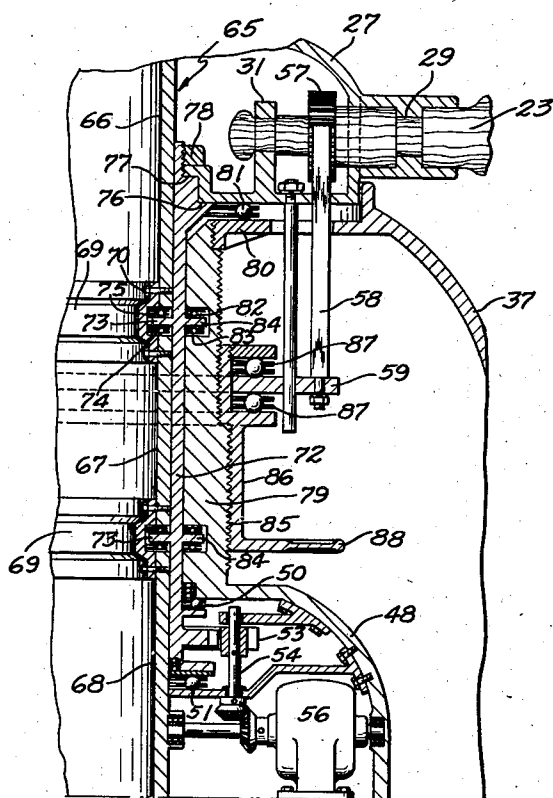


Fig. 5

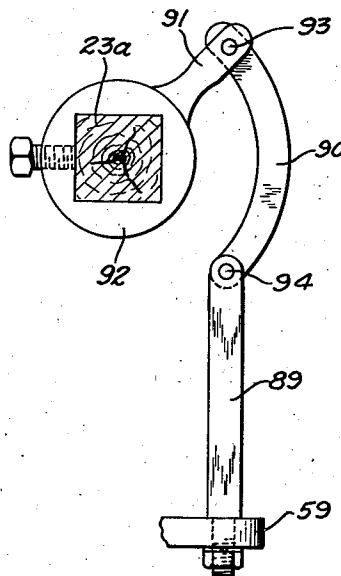


Fig. 6

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2 Sheets-Sheet 2

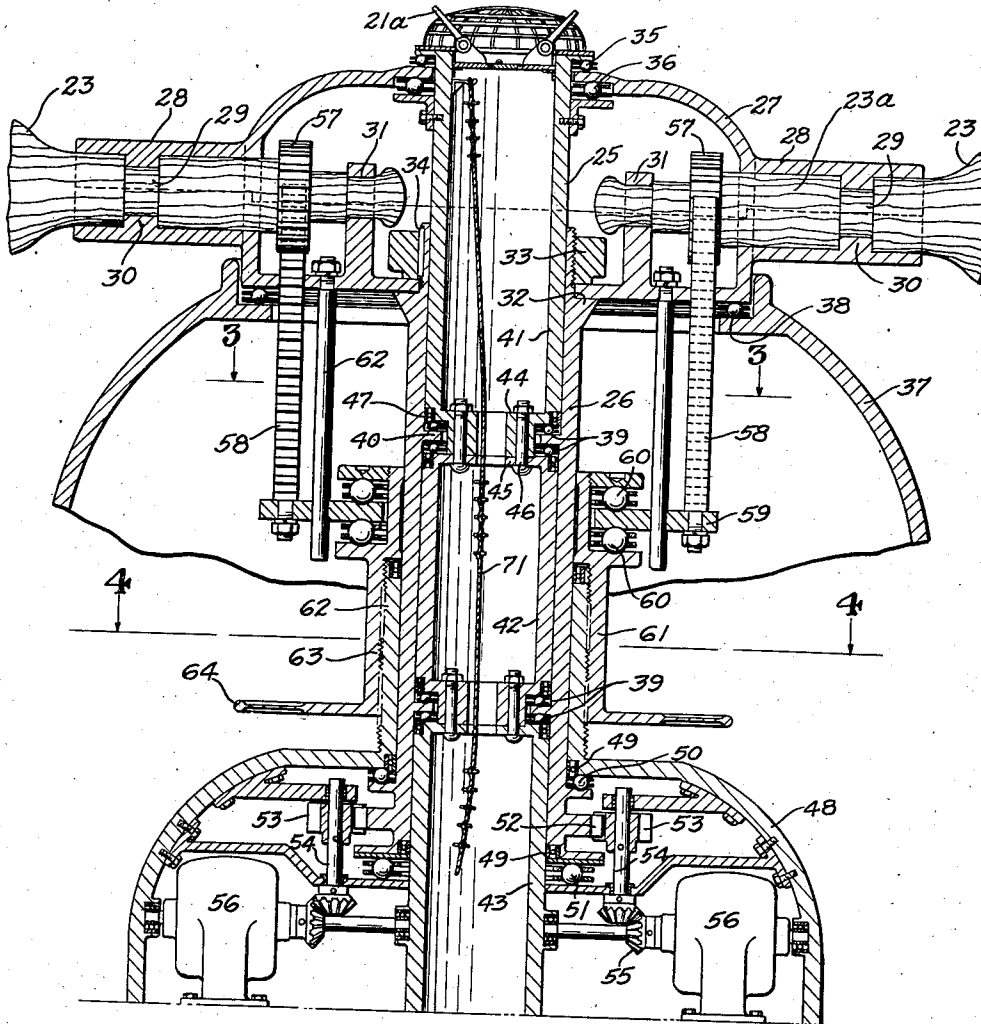


Fig. 2

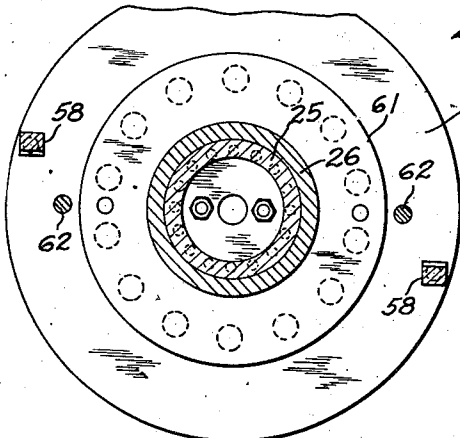


Fig. 3

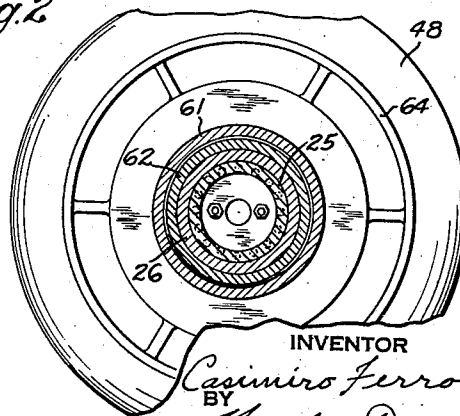


Fig. 4

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2,348,249

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Application February 8, 1941, Serial No. 378,032

3 Claims. (Cl. 244-17)

This invention relates to airplanes, and particularly an airplane which also has one or more lifting propellers so that it may be used as a helicopter in taking off and landing in relatively restricted spaces or in lowering or discharging a boat, torpedo or the like while in flight, and has for an object in addition to the above to provide improved means for mounting and operating the lifting propeller.

With the foregoing and other objects in view I have devised the construction illustrated in the accompanying drawings forming a part of this specification. It is however to be understood that I am not limited to the exact construction and arrangement shown but may employ various changes and modifications within the scope of the invention.

In these drawings:

Fig. 1 is a perspective view of an aircraft constructed according to my invention;

Fig. 2 is a vertical section through one means for mounting and operating the lifting propeller;

Fig. 3 is a transverse section substantially on line 3-3 of Fig. 2;

Fig. 4 is a transverse section substantially on line 4-4 of Fig. 2;

Fig. 5 is a vertical section similar to Fig. 2 showing only a portion of the construction and showing a slight modification; and

Fig. 6 is a detailed view showing a modified connection for adjusting the blades to vary their pitch.

The aircraft as illustrated comprises a longitudinal body 10 having supporting wings 11 projecting laterally at opposite sides thereof. Mounted in each wing, preferably at the forward edge thereof, is one or more propellers 12 operating to drive the plane forwardly and of course operated by suitable motors, not shown. The wings have the usual aileron 13 and may have braking fins or other attachments as desired, and also each preferably has mounted on the lower side thereof suitable rotating floating pontoons 14 to support the wings in landing on water. The under side of the body is preferably constructed in the general shape of the hull of a boat so as to be buoyant and capable of floating on water, and may have any suitable number of torpedo tubes 15 if it is to be used as a war craft. The pilot's compartment is preferably located at about the point 16 above the nose of the plane giving him a clear unobstructed view. At the tail end of the body may be the usual stabilizers 17 and 18, elevators 19

and rudder 20. If used for fighting craft machine guns or other guns may be mounted at different desired locations such as indicated at 21. No attempt has been made to indicate all possible arrangements, only a few being indicated, and other guns may be mounted in the tail or rear of the body to protect against attack from the rear.

Mounted on the top of the body may be one or more lifting propellers 22. In the present case a single propeller having a plurality of blades 23 is shown, there being three for this particular propeller, and if desired there may be a second lifting propeller located above the one shown and rotating in the opposite direction thereto so that their tendencies to turn the craft in the air neutralize each other, but with the propellers 12 in the wings this effect of turning the craft by the lifting effect and reaction of the air as the lifting blades are rotated can be counteracted by use of one or more of the propellers 12 to keep the plane headed in the proper direction. The wings 11 have sufficient spread and area to support the craft in horizontal flight, and the lifting propeller 22 is relatively large and has sufficient lifting power to substantially support the craft so that it may be raised or lowered for take-off and landing in restricted spaces, and also the speed may be greatly reduced for discharging torpedos or other missiles or for lowering the boat detachably carried by the craft without requiring a landing.

The blades 23 of the lifting propeller may be of the usual or standard aeroform or aerofoil cross section, and to increase the bite and lifting effect may have laterally projecting blades or projections 24 also of aeroform or aerofoil cross section, and projecting laterally from the body of the blade and inclined with the free ends toward the free ends of the main blade.

Improved means for mounting this lifting propeller comprises a stationary hollow upright column 25 mounted in the body and embraced by a rotatable sleeve 26. Mounted on this sleeve is a head 27 in which the lifting blades 23 are mounted and from which they project laterally in a substantially horizontal plane to rotate about an upright axis and the column 25. These blades are mounted in the head so as to turn about their longitudinal axes for the purpose of adjusting the blades to vary their pitch. They may be mounted in various ways but in the present means they are shown as each mounted in a horizontal bearing 28 in the

head, and the shank of the blade may be reduced in the bearing as indicated at 29 with the corresponding flange or shoulder means 30 in the groove thus formed to retain the blade in the bearing, the bearing being a split bearing so that the blade may be readily mounted or dismounted. A second bearing 31 may be provided at the inner end of the blade stem to give it further rigidity and support. The head 27 is mounted on the rotatable sleeve 26 so as to turn therewith. In the present case it seats on a shoulder 32 formed on the sleeve and to which it may be clamped by a nut 33 threaded on the sleeve and held against loosening by any suitable means, such for example as a key 34. The head also has suitable bearing on the column 25 such as the anti-friction bearings 35 and 36, these being thrust bearings to carry the weight of the head and operating parts or to assist in transferring the lift of the blades to the column and through the column to the body of the aircraft. A hood 37 enclosing a part of the mechanism and also firmly anchored to the body may also have an anti-friction bearing 38 at the under side of the head.

Other bearings for the rotary sleeve 26 on the column are shown at 39 and are anti-friction thrust bearings. They are located on opposite sides of inwardly extending annular projections 40 on the inner side of the sleeve 26 and located in suitably formed annular grooves in the column 25. To facilitate assembly the column 25 may be made in a plurality of sections 41, 42 and 43 connected by inwardly extending flanges 44 and 45 and bolts 46, the flange 44 being recessed to form the grooves to receive the bearings 39. Radial bearings between the column and the sleeve may also be provided at 47.

Other radial bearings between the sleeve and a lower supporting hood or housing 48 may be provided at 49 and thrust bearings at 50 and 51. Various means may be provided for driving the sleeve 26 and the lifting blades, that shown being somewhat diagrammatic. It comprises a spur gear 52 on the sleeve meshing with driving pinions 53 on shafts 54 driven through suitable gearing 55 by motors 56. These motors are merely shown in outline diagrammatically, and could be of any desired type, preferably gasoline motors, or electric motors driven from a generator driven by a gasoline motor at some suitable location within the craft.

To adjust the pitch of the blades 23 mechanism is provided which may be operated from within the body or from the pilot's compartment. That shown comprises a gear 57 on the stem of each blade meshing with a vertically slidable rack 58 connected to a ring 59. This ring rotates between thrust bearing 60 on an adjustable collar 61 so that the ring may rotate with the head 27, the ring being connected to the head by guide rods 62 connected to the head and having sliding connections with the ring 59. The collar 61 is adjustable longitudinally on a stationary sleeve 62 embracing the rotatable sleeve 26, and in the present case forming an upward extension of the housing or hood 48 so that it is supported thereby. Various means may be provided for adjusting the collar 61 longitudinally on the sleeve 62. In the present instance it is threaded to the sleeve as shown at 63, and by rotating the collar by any suitable means, such as the hand wheel 64, the collar may be adjusted longitudinally by this threaded connection. It will be evident that shifting of the collar up or down relative to the column will

shift the ring 59 and through it the racks 58. Shifting of these racks will, through the gears 57, turn the propeller blades 23 about their longitudinal axes to adjust their pitch.

At the top of the column 25 may be mounted suitable machine or other guns 21a protected in any suitable manner, and there may be provided a ladder or other suitable means 71 to give access from the interior of the body to the compartment in which these guns are mounted. This also makes a convenient observation tower or lookout station.

A somewhat modified construction is shown in Fig. 5. Here the supporting column 65 is also made in sections, but instead of having the connecting flanges integral with the sections 66, 67 and 68 they are in the form of a ring 69 connected to the adjacent sections by any suitable means such as bolts 70.

Embracing the column is a rotatable sleeve 72 corresponding to the sleeve 26, and it has inwardly extending annular flanges or walls 73 running on thrust bearings 74 mounted in annular grooves 75 in the ring 69 and between the sections of the column. The head 27 carrying the lifting blades 23 are mounted on this sleeve the same as the head 27 in the first arrangement is mounted on the sleeve 26. It may rest on the shoulders 76 and 77 and be clamped thereto by the nuts 78. The stationary sleeve 79 embracing the sleeve 72 and extending upwardly from the housing 48 is carried higher than the sleeve 62 of the first form and carries a support 80 for a thrust bearing 81 under the head 27. It has inner channels 82 in which are mounted thrust bearings 83 for outwardly extending annular flanges 84 on the sleeve 72. Threaded on the sleeve 79 at 85 is a collar 86 corresponding to the collar 61 of the first form and carrying thrust bearings 87 for the plate 59 operating the racks 58 to turn the blades about their horizontal axes to adjust the pitch. This collar 86 may be rotated by any suitable means such as a hand wheel 88 to adjust it along the sleeve 79 to adjust the pitch of the blades.

In Fig. 6 is shown a modified arrangement for connecting the shiftable plate 59 to turn the blades on their horizontal axes to effect the pitch adjustment. This is to take the place of the rack 58 and pinion 57, and comprises a bar 89 connected to the plate 59 and connected by curved link 90 to an arm 91 on a collar 92 to fasten it to the stem 23a of the blade. The link 90 being pivoted to the arm of the collar at 93 and to the bar at 89 and 94 it will be understood that shifting of the blade 59 by adjusting the collar 86 will shift the bar 89 and link 90 and turn the blade about its axis by means of the arm 91. The underside of the body comprises two large pontoons 92 which are in the form of boats or miniature yachts, and may be fully equipped with lights, lounge and sleeping quarters and in which the torpedo tubes are mounted. These pontoons may also have driving screws for locomotion on the water driven by suitable engines, and may have retractible wheels for locomotion on land or landing on land or running up on to land or docks from the water.

The foregoing construction and arrangement gives an airplane which may be employed for a large number of purposes as it may be operated in the same manner as a conventional plane, but through the combination of the supporting wings and driving propellers associated therewith and the large lifting propellers 22, the plane may land

and take off in a very restricted space. It also may be operated at very slow speeds for the launching of a boat, torpedo or other operations, and if other parts of the plane such as the wing or propellers 12 and their motors are not functioning properly it may be landed with less danger of serious damage.

Having thus set forth the nature of my invention what I claim is:

1. In an aircraft of the type described, a body, 10 an upright column in said body, a sleeve embracing the column and rotatable thereon, a head carried by the sleeve, a plurality of lifting propeller blades carried by said head and projecting laterally therefrom, means for mounting the individual blades to turn about their longitudinal axes to vary the pitch of the blades, a stationary sleeve embracing the rotatable sleeve, a collar threaded on the stationary sleeve for longitudinal movement thereon, an operative connection from said collar to each blade to turn 15 the blade to change its pitch on longitudinal movement of the collar, means to turn the collar to adjust the blades, and power means for rotating the sleeve to rotate the blades about an upright axis.

2. In an aircraft of the type described, a body,

an upright hollow column in said body and comprising a plurality of connected sections, a sleeve embracing said column and rotatable thereon, a plurality of thrust bearings carried by the column 5 at the joints between the sections, supporting elements carried by the sleeve running in said bearings, a rotatable head connected with said sleeve, lifting propeller blades carried by the head, and power means for driving the sleeve to rotate the blades.

3. In an aircraft of the type described, a body, 10 an upright column in said body, a sleeve embracing said column and rotatable thereon, a rotatable head connected with the sleeve, a plurality of lifting propeller blades projecting laterally from said head, means for mounting the blades in the head to turn about their longitudinal axes, a stationary sleeve embracing the rotatable sleeve, a collar threaded on the stationary sleeve 15 for longitudinal adjustment thereon, a plate carried by said collar, bearings for the plate in the collar to permit relative turning movements, an operative connection between the plate and each blade to turn the blade to vary its pitch on shifting movements of the collar, and power means 20 for driving the sleeve to rotate the blades.

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