Oct. 5, 1948. A. B. ZIMMERMAN 2,450,821

TILTING BALANCED DUPLEX PROPELLER

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Fig. 1.

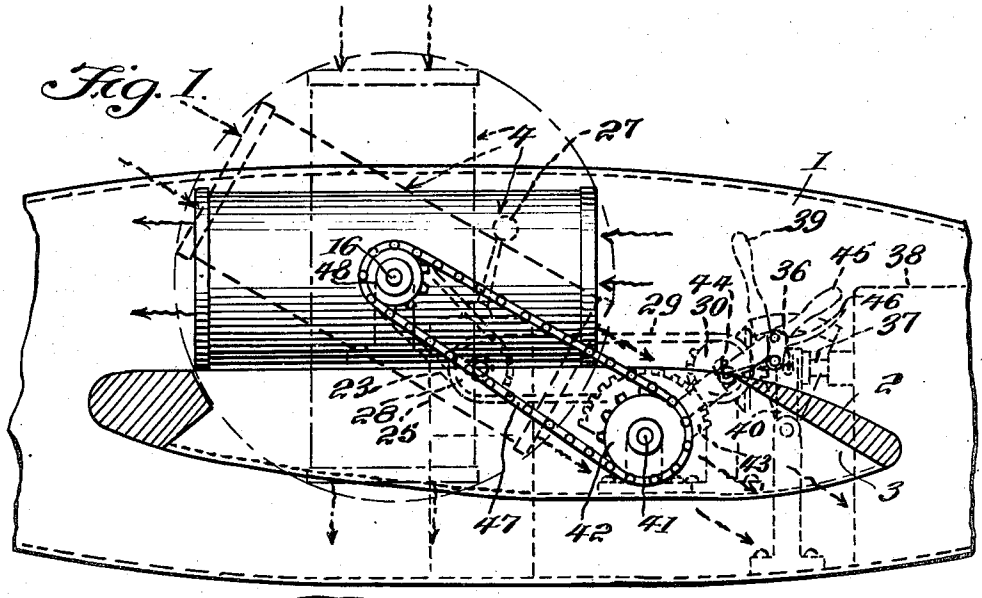
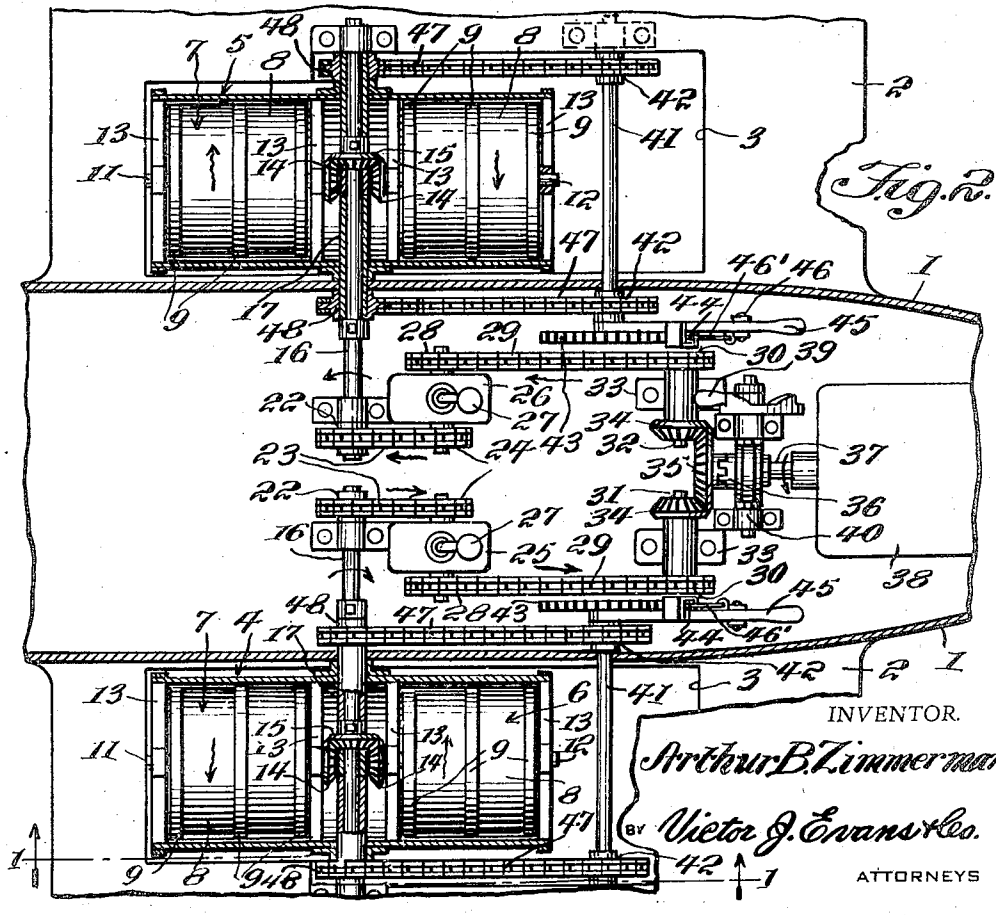


Fig. 2.



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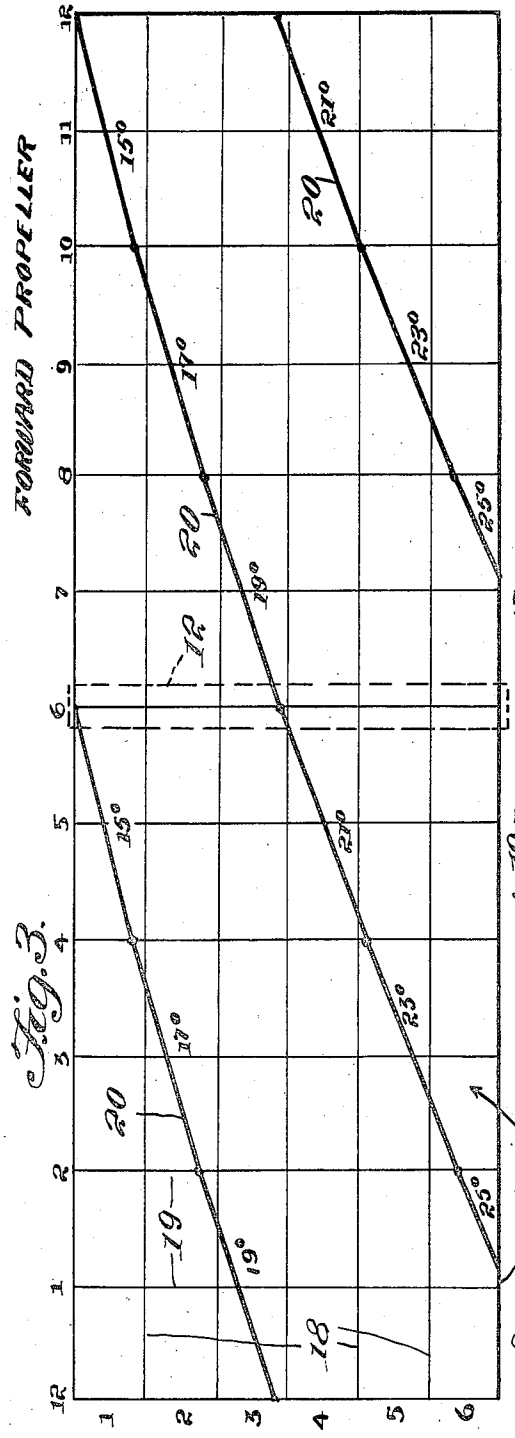


Fig. 3.

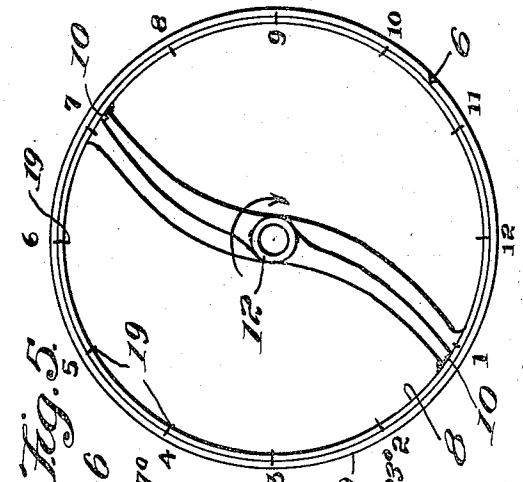


Fig. 5.

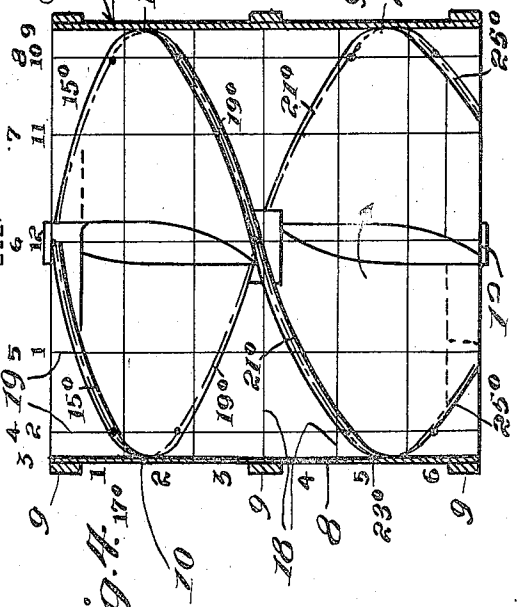


Fig. 4.

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TILTING BALANCED DUPLEX PROPELLER

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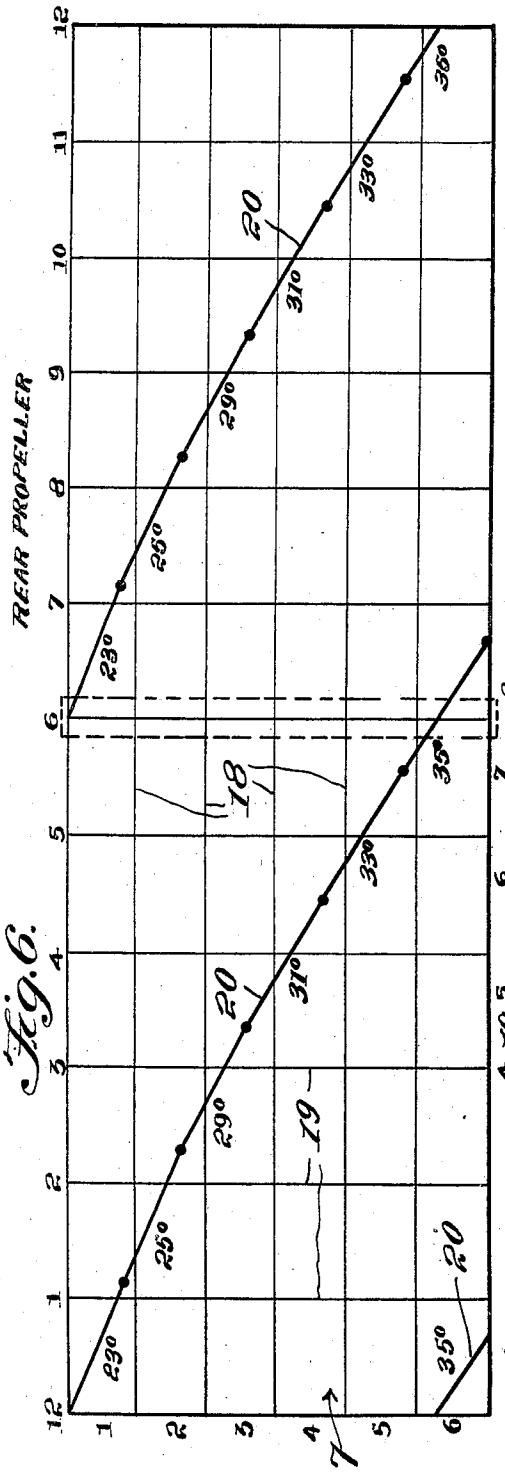


Fig. 6.

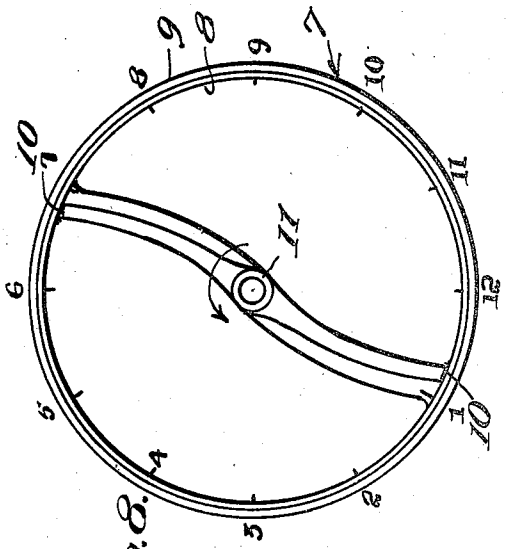


Fig. 8.

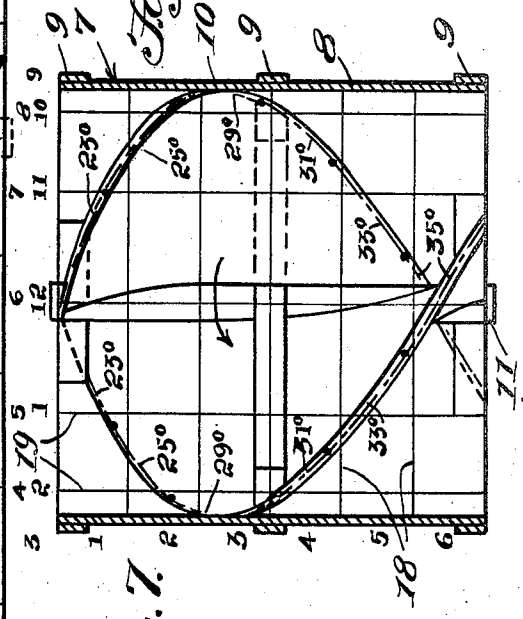


Fig. 7.

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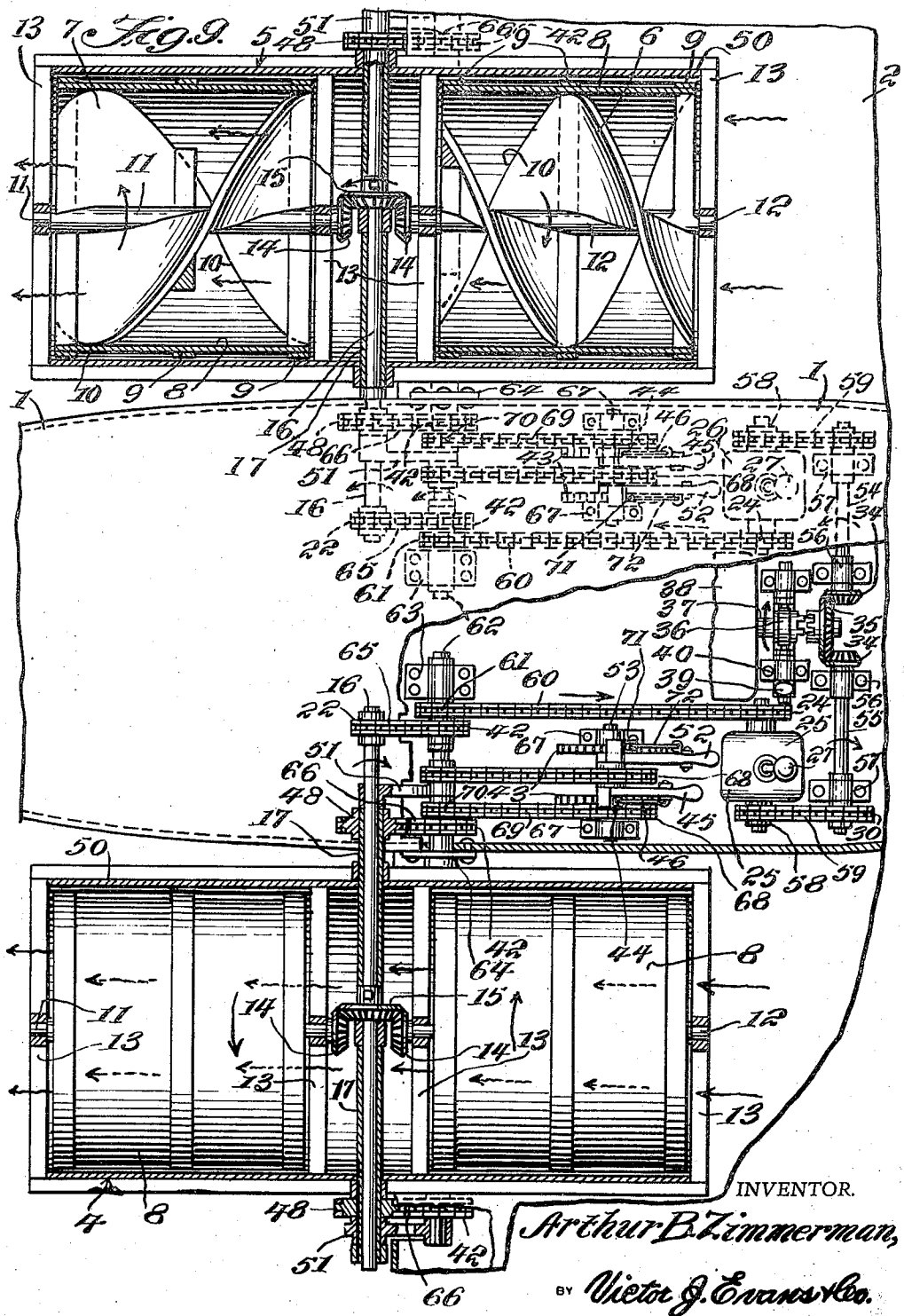
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TILTING BALANCED DUPLEX PROPELLER

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Fig. 9.



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Fig. 10.

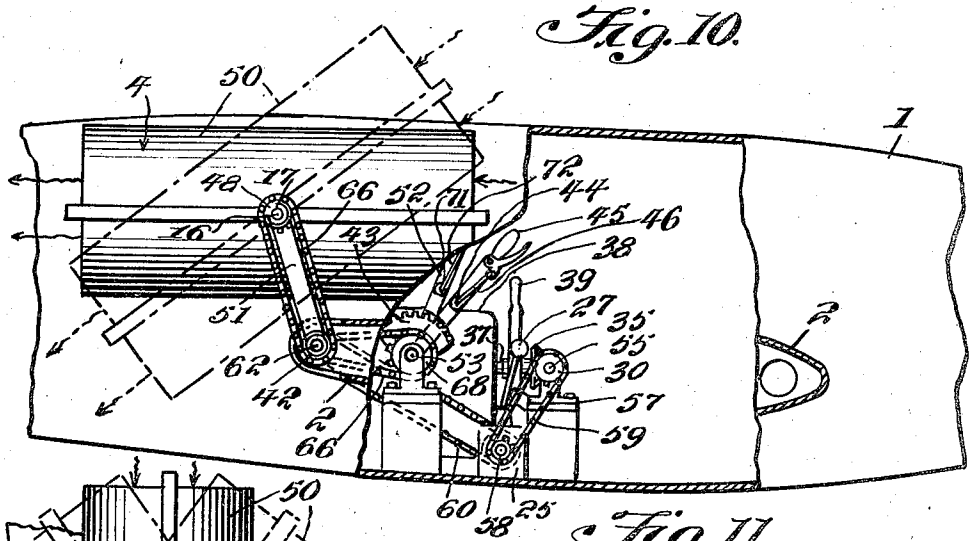


Fig. 11.

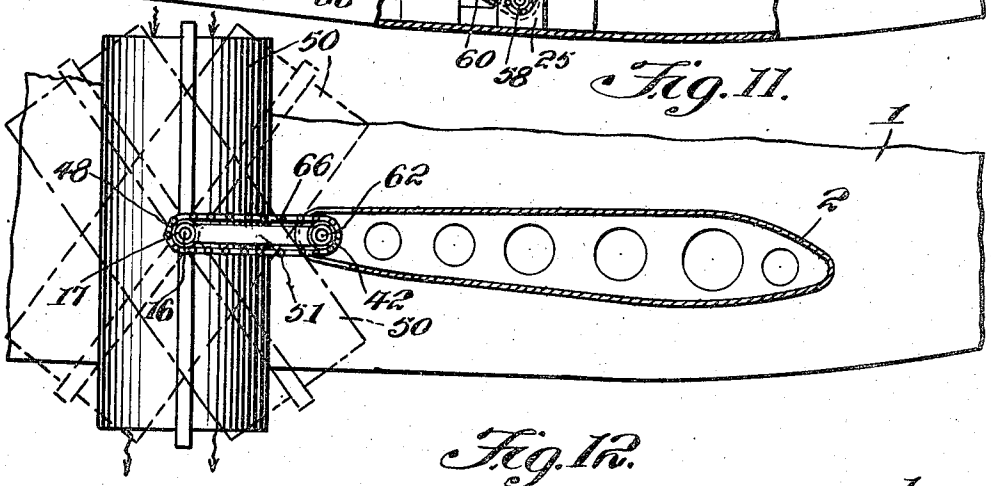
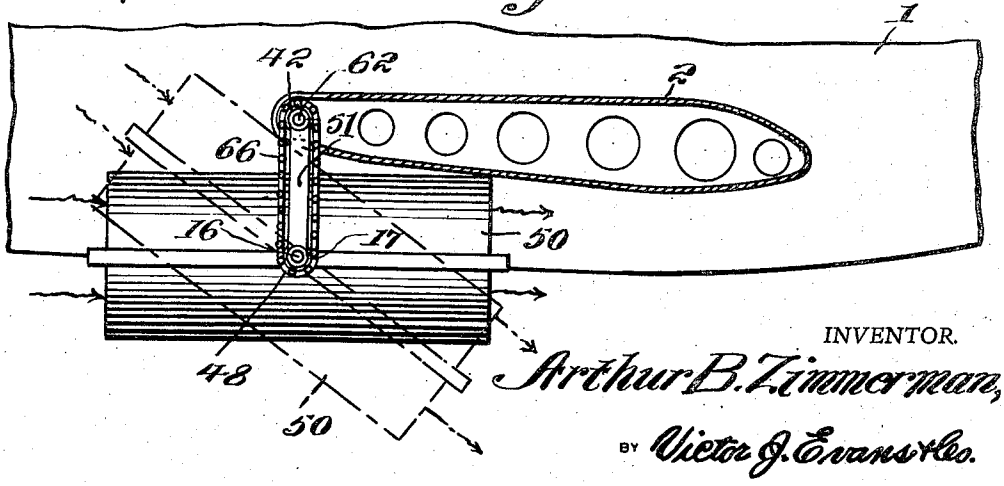


Fig. 12.



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Patented Oct. 5, 1948

2,450,821

UNITED STATES PATENT OFFICE

2,450,821

TILTING BALANCED DUPLEX PROPELLER

Arthur B. Zimmerman, Los Angeles, Calif.

Application August 2, 1945, Serial No. 608,505

4 Claims. (Cl. 244—12)

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My present invention, in its broad aspect, has reference to improvements in propellers and means for controlling and operating the same for aeroplanes, and among the most important objects of my invention is to provide an improved double screw, variable pitch, tubular propeller which is characterized by greater efficiency than others of which I am aware, and has an improved means for mounting the propellers one each side of the fuselage and between the wings, and tilting or rotating the same to assist in the attainment of a practical, effective and efficient control of the aeroplane and the speed and directional movement of the same. My spiral blades are set in tubular casings and are independently rotated and controlled, and tiltable with the tubular casings about 360 degrees or any lesser number of degrees desired. The portions of the wings adjacent the fuselage receive the propeller assemblies and are angularly cut away, assist in the tilting operation, the accommodation of the propellers, and the operation thereof. My operating and control mechanism is carried in the fuselage, and each propeller is independently controlled, and there are change speed gears, separate tilting levers and separate clutch controls for each propeller. My device is characterized by simplicity, efficiency, reduction and elimination of intricate parts to a minimum, and practicability for the purpose for which intended.

Other and equally important objects and advantages of my invention will be apparent from the following description and drawings, but it is pointed out that changes in form, size, shape, materials, and construction and arrangement of parts is permissible and within the purview of my broad inventive concept and the scope of the appended claims.

In the drawings, wherein I have illustrated a preferred embodiment of my invention:

Figure 1 is a side view of an aeroplane, with the wing in section to show my propellers;

Figure 2 is a longitudinal section;

Figure 3 is a graphical development of the blades of the forward propellers, showing the pitch of the same at their periphery;

Figure 4 is a longitudinal section through a forward propeller, and shows angles of the variable pitch at the junction of their periphery and the casing to which they are attached;

Figure 5 is an end view;

Figure 6 is a graphical development of the blades of the rear propellers, on one side of the fuselage, showing the pitch of the same at their periphery;

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Figure 7 is a longitudinal section through a rear propeller, and shows the angles of the variable pitch at their periphery;

Figure 8 is an end view;

Figure 9 is a transverse section through the fuselage, propeller assemblies and casings and shows details of a modified form of the same and the control and drive mechanism;

Figure 10 is a side view, partly in section of a modified form of my device in which the position of the propeller assemblies may be changed with reference to the trailing edge of the wings, and wherein certain other details are also modified, and the propeller assemblies are above and in parallel relation with the upper surface of the wing;

Figure 11 is a side view wherein the propeller assemblies are shown at right angles to the rear edge of the wing;

Figure 12 is a side view with the propeller assemblies below the wing and in parallel relation with the under surface of the wing.

In the drawings, wherein like characters of reference are used to designate like or similar parts:

The numeral 1 designates the fuselage of my aeroplane, and 2 the wings. Mounted in openings 3 of the form shown in Figure 1 provided therefor on each wing on each side of the fuselage are varying pitch double screw propeller tubular assemblies or sleeves 4 and 5, the forward propeller blades are designated 6 and the rear propeller blades by 7. The forward and rear propeller blades are contianed in tubular cylindrical casings 8, which are reinforced by bands 9. The edges of the forward and rear blades where they contact the casings may be welded thereto as at 10 and the forward and rear blades respectively have hubs and shafts 12 and 11 mounted on bearing arms 13 and on the inner opposed ends of which are beveled gears 14 each meshing with a beveled drive gear 15 on the shaft 16 extending at right angles to the shafts 11 and 12 and connected with the power mechanism which will be hereinafter described. Each shaft has a sleeve 17 connected with the propeller assemblies to rotate or tilt the same as will be hereinafter described. Graphical developments of the forward and rear propellers are shown in Figures 3 and 6 respectively and show stages in the variable pitch, and Figures 4 and 7 respectively carry indications of those stages for both the forward and rear propellers respectively. It has been found that propeller assemblies fashioned after the manner herein shown and described give a maxi-

mum efficiency, and in both Figures 3 and 6, a circle has been projected into twelve equal parts for sinusoidal purposes longitudinally and six equal parts vertically for the same purpose which are depicted on the graphs as at 18 and 19 and which carry the pitch angles 20, while Figures 4 and 7 show three sinusoidal variations in connection with the blades. Each of the shafts 16 carry on their ends extending within the fuselage the sprockets 22, over which are trained drive chains 23 from the sprockets 24 of each of the variable speed gear boxes 25 and 26, respectively, for the propeller assemblies, which variable speed gears are controlled independently by hand levers 27. Each variable speed gear box has a driven sprocket 28 over which is trained a chain 29 from the sprocket 30 on the respective stub shafts 31 and 32 journaled in bearings 33 carried in the fuselage, and beveled gears 34 meshing with a beveled drive gear 35. The gear 35 carries one element of a clutch 36 on a drive shaft 37 from the power plant 38 and the clutch is controlled by a clutch lever 39 extending transversely through the clutch mounting 40 on the fuselage.

A transverse shaft 41 carries twin sprockets 42 adjacent its ends and a segmental rack 43 engaged by a dog 44 on a tilting lever 45. The dog has an operating hand grip 46 on the lever 45 and a rod 46' to release and attach the same. The respective twin sprockets 42 have trained thereover chains 47 trained about sprockets 48 on the sleeve 17 about the shaft 16 with which the bevelved drive gear 15 on the shaft 16 meshes. Thus, when it is desired to tilt the units the dog 44 is released and the tilting levers are turned to move the unit or units in the proper angles, whereupon the dogs are set to retain them in position. As shown in Figure 1, the units may be adjusted to any desired position between the horizontal and the vertical, and this may be done independently with respect to the units.

In Figures 9, 10, 11 and 12 are shown some modifications of my device, and it will be noted that the propeller assemblies 4 and 5 including the sleeves are mounted in elongated cylindrical housings 50 mounted to be changed with respect to position from positions above, in rear of and below the wings. The sleeves of the propeller drive shaft has the previously described sprocket and chain connections, but the propeller drive shaft has arms 51 which extend to the transverse shaft and by which the entire assembly may be swung to have its position changed through manipulation of change lever 52. The tilting lever and assembly are retained, but the power plant 38 is set between the independent control device in the fuselage so that the shaft 37 is at the front of the power plant. In this instance, the shafts 31 and 32 are replaced by longer shafts 54 and 55 to compensate for the width of the power plant 38, journaled in bearings 56 and 57 carried in the fuselage. The inner ends of the shafts 54 and 55 carry the beveled gears 34 which mesh with the beveled drive gear 35 on the shaft 37. The gear 35 carries one element of the clutch 36 on the drive shaft 37 of the power plant 38 and the clutch is controlled by a clutch lever 39 extending through the clutch mounting 40. This is the construction previously described.

Sprockets 39 on the shafts 54 and 55 are connected to sprockets 58 on the variable speed gear boxes 25 and 26 by chains 59; as explained previously the gear boxes are controlled by hand levers 27.

The change speed gears 24 of the boxes 25 and 26 are connected by a chain 60 to the sprocket 61 mounted on the end of the transverse shaft 62 formed in bearings 63 and 64 and arms 51 on the propeller drive shaft 16. Sprockets 42 are connected to sprockets 22 on shaft 16 by a chain 65 and sprockets 48 on the sleeve 17 about the shaft 16 by chains 66. Each change speed connection drives forwardly to the propeller assembly drive shaft, and the change lever 52 and tilt lever 45 are mounted on a common shaft 53. The shaft 53 is journaled in bearings 67 and sprockets 68 thereon are connected by chains 69 to sprockets 70 on the shaft 62. The shaft 53 carries the segmented racks 43 engaged by the dog 44 of the lever 45 and the dog 71 of the lever 52, dog 44 being controlled by rod 46 and dog 71 by rod 72.

This construction permits the shifting of the housing to positions above to the rear of and below the surface of the wing, as shown in Figures 10 to 12 inclusive, as well as permitting tilting of the housing as shown in dotted lines of the same figures.

From the foregoing, it is believed that the operation and advantages of my invention will be apparent, but it is again pointed out that interpretation of the scope of my invention should only be conclusive when made in the light of the subjoined claims.

I claim:

1. In an airship having a fuselage and wings, tubular housings positioned at the sides of the fuselage, means pivotally mounting said tubular housings on opposite sides of the fuselage at points intermediate of the lengths of the housings, sleeves having spirally positioned vanes therein providing double screw propellers positioned in the said housings, means rotatably mounting the sleeves in the housings, a motor positioned in the fuselage, means operatively connecting the sleeves to the motor for rotation of said sleeves, and means tilting the said tubular housings with the propellers therein from the interior of the fuselage.

2. In an airship having a fuselage and wings with openings through the wings, tubular housings positioned above the openings in the wings, means pivotally mounting the said tubular housings on opposite sides of the fuselage at points intermediate of the lengths of the housings, sleeves having spirally positioned vanes therein providing double screw propellers positioned in said housings, each of said housings containing a plurality of said propellers, means rotatably mounting the sleeves forming the propellers in the housings, a motor positioned in the fuselage, means operatively connecting the sleeves to the motor through the pivotal mounting of the housings for rotation of said propellers, and means tilting the said tubular housings in the openings of the wings from the interior of the fuselage.

3. In an airship having a fuselage and wings with openings through the wings, tubular housings positioned above the openings in the wings, means pivotally mounting said tubular housings on opposite sides of the fuselage at points intermediate of the lengths of the housings and wherein the housings rotate about the pivotal mounting thereof in the openings in the wings, a plurality of sleeves having spirally positioned vanes therein providing double screw propellers positioned in said housings with the sleeves in axial alignment providing leading and trailing propellers in each housing, the vanes of the leading propellers having more turns per unit of length than the vanes of the trailing propellers, means rotatably mount-

ing the sleeves in the housings, a motor positioned in the fuselage, means operatively connecting the sleeves to the motor through the pivotal mounting of the housings, and means tilting the said tubular housings from the interior of the fuselage.

4. In an airship having a fuselage, wings with openings therethrough, and a motor positioned in the fuslage, the combination, which comprises, tubular housings positioned above the openings of the wings, arms positioned at the sides of the fuselage carrying the tubular housings at the outer ends thereof, means pivotally mounting the said arms on the sides of the fuselage, a plurality of axially aligned sleeves having double thread screws therein providing propellers positioned in said tubular housings, means rotatably mounting the propellers in the said tubular housings, means operatively connecting the propellers to the motor, means tilting the tubular housings in the openings in the wings from the interior of the fuselage, and means actuating the arms to raise and lower the said tubular housings from the interior of the fuselage.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
928,524	Lake	July 20, 1909
1,190,149	Golder	July 4, 1916
1,304,654	Boughton	May 27, 1919
1,659,098	Hall	Feb. 14, 1928
1,672,985	Martin	June 12, 1928
1,789,252	O'Toole	Jan. 13, 1931
1,857,473	Oberstag	May 10, 1932
1,868,975	Hall	July 26, 1932
1,928,578	Turrell	Sept. 26, 1933
2,229,564	Hagan	Jan. 21, 1941

FOREIGN PATENTS

Number	Country	Date
10,556	Great Britain	A. D. 1912