PATENT SPECIFICATION

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768,190

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International Classification:—B64c, d.

COMPLETE SPECIFICATION

Improvements in Flying Machines for Vertical and Horizontal Flight

We, MINISTERIO DA AERONAUTICA, DIRETOR DO MATERIAL AEROPORTO SANTOS-DUMONT, RIO DE JANEIRO, BRAZIL, a Brazilian Government Department, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to an improved flying machine of the type which is adapted to be transformed from a condition for vertical or substantially vertical flight into a condition for rapid forward flight and vice versa, by swinging the axes of the propellers about an axis transverse thereto and to the longitudinal axis of the machine, and in which the wings are arranged to swing in unison with the propeller shafts during such transformation.

In a machine of this type, the propeller(s) is or are provided with adjustable blades and in effecting the transformation of the machine from one condition into the other, the means for adjusting the blades has to be operated in the sense of an increase of the propeller pitch when changing over to the condition for rapid forward flight and in the sense of a decrease of such pitch when swinging the propellers in opposite direction.

It will be understood, that the correct and simultaneous execution of these two actions, i.e. the swinging of the propellers about said transverse axis and the operation of the blade adjusting means, puts very high demands upon the attentiveness and reaction capacity of the pilot and it is for this reason, that the present invention has for its object to relieve the pilot at least partially of this task.

To this end, according to the invention, the pitch adjustment is put automatically in dependence on the swinging movement of the propellers, in that the means for operating the blade adjusting mechanism are coupled with elements of the flying machine, between which and the corresponding operating means, during the swinging movement of the propellers, a relative movement occurs, such that the said operating means are controlled in the exact, required manner.

The invention will hereinafter be described with reference to the accompanying drawing and as applied to a transformable flying machine of the kind described in Patent Specification No. 757,279.

In the drawing

Fig. 1 shows a general diagrammatical side elevational view partly in section through a motor nacelle of a flying machine of this kind, incorporating the invention and represented in the condition for rapid forward flight.

Fig. 2 is a perspective view of a portion of a wing/motor assembly showing structural details of the means for making the blade adjustment dependent on the angular displacement of the propeller axis for transforming the machine from one condition into the other.

Fig. 3 is a partly sectional detail view of the blade adjusting means on a somewhat enlarged scale.

In the embodiment shown in Figure 1 by way of example only, the wings 1 of the machine, in common with the nacelles 2 and the propeller 3, are adapted to be swung about a fixed axis or spar 4 extending transverse to the centre line of the respective propeller axes and transverse to the longitudinal axis of the fuselage 5 of the flying machine, for transforming the machine from the condition for use as a helicopter in that for rapid forward flight and vice versa.

[*Price 3s. 0d.*]

As schematically shown for one of the propellers 3 a lever element 6 of the usual mechanism for adjusting the propeller blades, is pivotably connected by a rod 7 to a stationary point of the machine located outside the swingable system, in this case a point 8 of the spar 4, so that upon swinging such system about said axis, a relative movement occurs between this point 8 and the point of attachment of the rod 7 to the lever 6, such movement being so chosen, that the propeller blades are adjusted for the required pitch variation.

Referring to Figures 2 and 3, 9 represents a portion of a wing, of the usual construction, comprising transverse ribs 10 and longitudinal supplementary spars 11 and having a nacelle 12 attached thereto enclosing the motor block 13. In these figures, the contours of the wing and motor casing or nacelle, are shown in dotted lines to better show the interior constructions.

As appears from fig. 2 a spar 14 extending at right angles to the longitudinal axis of the flying machine, is non rotably mounted within the fuselage (not shown) by means of lugs 15 welded to said spar and being bolted at 16 to supports 17, such spar having rotatably mounted thereon on either side of said fuselage, a wing 9. To this end, the outboard extremity of the spar 14 has rotatably mounted thereon a sleeve 18, welded at one end to a transverse rib 10 as shown, whilst a second sleeve 19 is freely mounted on a portion of the spar 14 adjacent the fuselage, such second sleeve projecting into the wing and being welded to two successive ribs 10.

In this manner the wing/motor assembly is adapted to be swung around the spar 14, which itself is non-rotatable with respect to the fuselage of the flying machine.

To effect such swinging movement, the sleeve 19 has secured thereto at its free end, a crank 20, of which the arm 21 is somewhat bent laterally to bring it in register with the forked head 22 of the plunger 23 of a well known hydraulic jack 24 arranged within said fuselage, the cylinder 25 of such jack being pivotably attached at 26 to a fixed support 27. Oil ducts 28, 29 are connected to said cylinder for operating said plunger 23 in the ordinary manner, for swinging the plane 9 with the sleeves 18, 19 about the spar 14.

As said above, attached to the wing 9, is the nacelle 12 containing the motor block 13, suspended by four studs 30 from two spaced parallel cantilevers 31, each integrally formed with a transverse rib 10 as shown. As is more clearly to be seen in figure 3, said motor block 13 is provided at its forward end with a tubular extension 32 for rotatably supporting the projecting end of the propeller shaft 33, on which a hub 34 is secured, having mounted thereon, in the usual manner, three propeller blades 35 (one being shown only) in a manner to be each rotatable about a center line for varying the pitch of the propeller.

For effecting such rotation or angular displacement of the blades a collar 36 integral with the root portion 37 of each blade 35 is provided with spaced parallel and radially extending lugs 38, carrying a bolt 39 serving as a pivot pin for the head 40 of a rod 41 having at is opposite end a second head 42 with which it is pivotably mounted on a pin 43 radially projecting from a cylindrical cup shaped housing 44, such housing having of course three of such radial pins, one for each propeller blade.

This housing 44, by means of a spline 45 and groove 46 (fig. 3) is slidably but non-rotatably mounted on the propeller shaft 33 so that it will rotate therewith whilst being adapted to be displaced lengthwise of said shaft.

Inside said housing there is arranged a ring 47 rotatably mounted by means of a ball bearing 48 on a tubular inwardly directed extension of the housing 44 surrounding the propeller shaft, such ring being laterally supported by two further ball bearings 49, 50 arranged on either side of an annular flange 51 formed on said ring and bearing respectively against the inner face of the end wall of said housing and against a ring 52 fitting the housing and being held in place by means of a cap nut 53 screwed on the open end of said cup-shaped housing 44.

This ring 47 at two diametrically opposite points of its inner circumferential edge, has integrally formed therewith two axially extending forked projections or arms 54 of which the forked ends, each by means of a pivot pin 55 are pivotably attached to a ring-shaped lever 56 freely surrounding the above mentioned tubular shaft supporting extension 32 and having two radial biffurcated upper and lower projections 57, 58 respectively, of which the lower one by a link 59 is pivotably connected to a lug 60 formed on the front of the motor block 13.

To the upper projections 57, by means of a pivot pin 61, a rearwardly extending rod 62 is pivotably attached, having its opposite end, by means of a pivot pin 63 pivotably connected to spaced projecting lugs 64 welded to a portion of the spar 14 between the sleeves 18 and 19, this spar, as already stated, being stationary with respect to the fuselage of the flying machine.

From the above it will be understood that, if by operating the hydraulic jack 24, the pilot causes the bearing plane-motor assembly to swing about the spar 14 for transferring the flying machine from one condition of flight into the other, a relative movement occurs between the points of attachment of the rod 62 causing the ring shaped lever 56 to be swing forwardly or backwardly as the case may be, which through the arms 54

causes the ring 47 to be displaced axially of the propeller shaft 33 and with it the housing 44, so that through the rods 41 and collars 36 the propeller blades 35 are angularly displaced to thereby adjust the propeller blades for varying the propeller pitch in the required manner. In this connection, it will be observed that on account of the design shown, the housing 44 is adapted to be axially displaced for adjusting the propeller blades, whilst freely rotating with the propeller shaft.

It will be understood, that the construction herein described and shown in the accompanying drawings, is given by way of example only and that the principle of the invention is capable of various different modes of relalisation within the scope of the appended claims.

What we claim is:

1. A flying machine of the type referred to characterized in that the propeller blades are adjustable for pitch and for the or each propeller, an element of the blade adjusting mechanism is coupled to a stationary point of the flying machine, so arranged outside the respective swingable system, that—upon swinging such system about said transverse axis—a relative movement occurs between such point and said element of the blade adjusting mechanism, effecting the required adjustment of the propeller blades.

2. A flying machine of the type referred to comprising wings each mounted for angular movement about a spar extending lengthwise thereof and non-rotatably mounted within the body of the machine, means for effecting such angular movement, at least one motor assembly rigidly secured to each bearing plane and comprising a propeller shaft carrying a propeller having adjustable blades, a mechanism mounted on said motor assembly for adjusting such blades to effect pitch variation of said propeller such mechanism comprising a control element, and a rod coupling said element to said stationary spar so that upon angular movement of the wing about said spar, said control element is operated to adjust the propeller blades in a manner to effect the required pitch variation.

3. A flying machine of the type referred to comprising wings each mounted for angular movement about a spar extending lengthwise thereof and non-rotatably mounted within the body of the machine, means for effecting such angular movement, at least one motor assembly rigidly secured to each bearing plane and comprising a propeller shaft carrying a hub, propeller blades radiating from said hub and each arranged for angular movement with respect to said hub about a line extending in the direction of its length, a member slidably mounted on said propeller axis but non-rotatable with respect thereto, links connecting said member to said propeller blades in a manner to transform sliding movements of said member into angular movement of said blades, lever means coupled to said sliding member in a manner to permit rotation thereof together with said propeller shaft and a rod pivotably connecting said lever means to a point of said stationary spar, so that upon angular movement of said wing about said spar said sliding member whilst rotating with said propeller axis and said propeller blades causes said blades to be adjusted for varying the pitch of the propeller.

4. A flying machine of the type referred to comprising wings each mounted for angular movement about a spar extending lengthwise thereof and non-rotatably mounted within the body of the machine, means for effecting such angular movement, at least one motor assembly rigidly secured to each bearing plane and comprising a propeller shaft, carrying a hub, propeller blades radiating from said hub and each arranged for angular movement with respect to said hub about a line extending in the direction of its length, a member slidably mounted on said propeller shaft but non-rotatable with respect thereto, links connecting said member to said propeller blades in a manner to transform sliding movements of said members into angular movement of said blades, a ring arranged within said sliding member for axial movement therewith but permitting free rotation of said member with said propeller shaft, a connecting member pivotably connecting said ring to a lever adapted to swing in the direction longitudinally of said propeller shaft and a rod pivotably connecting said lever to a point of said stationary spar, so that upon angular movement of said bearing plane about said spar said sliding member whilst rotating with said propeller axis and said propeller blades causes said blades to be adjusted for varying the pitch of the propeller.

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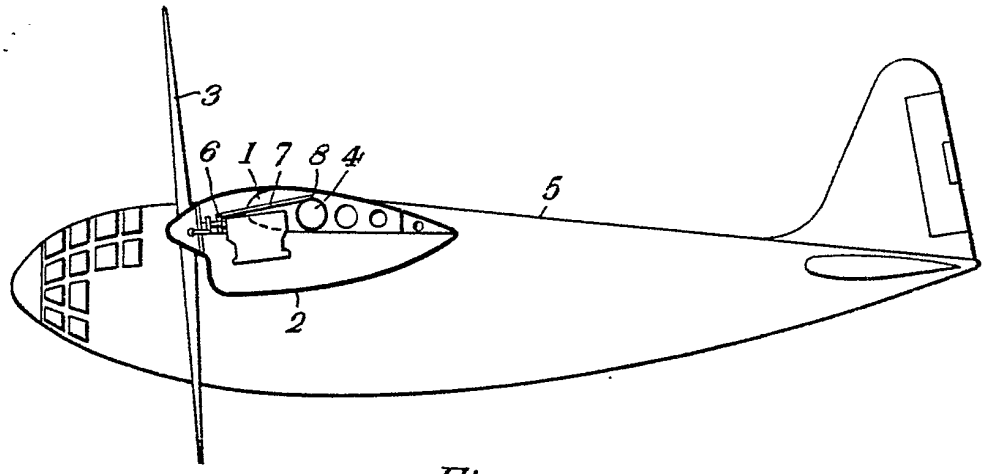
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Fig. 1.

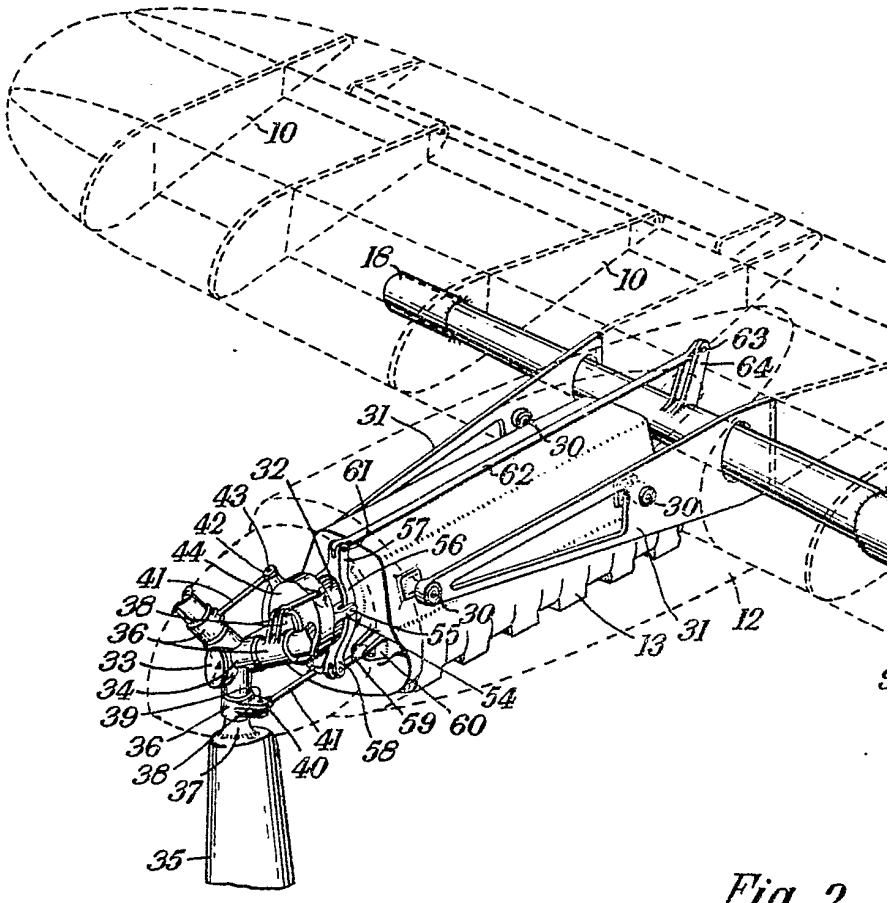
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Fig. 2.

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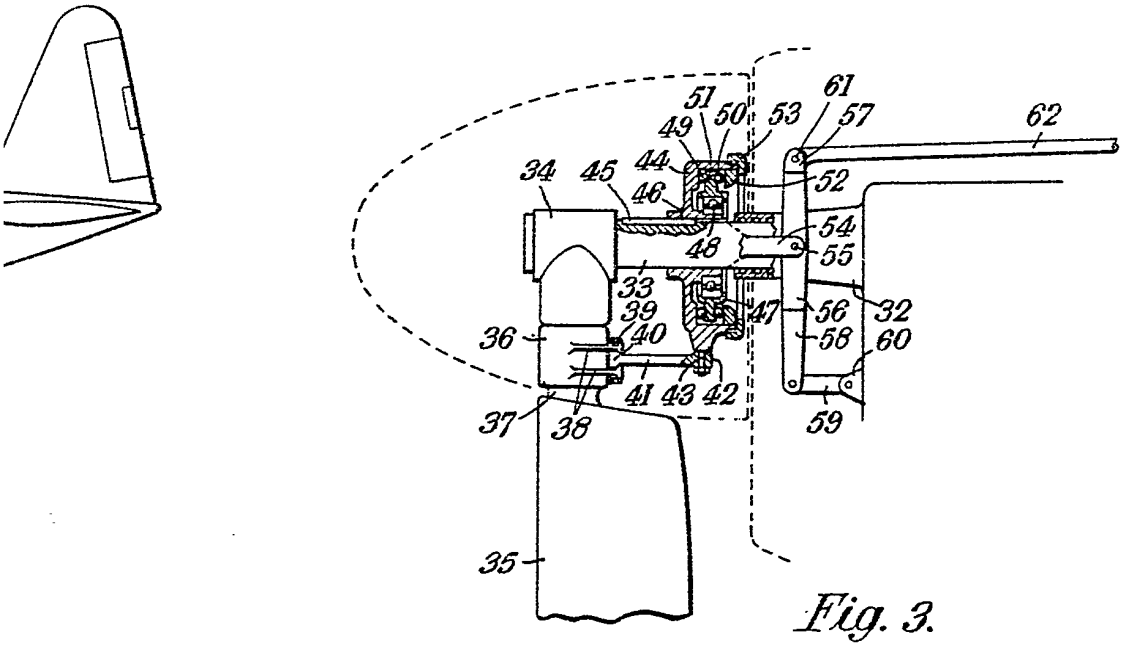

Fig. 3.

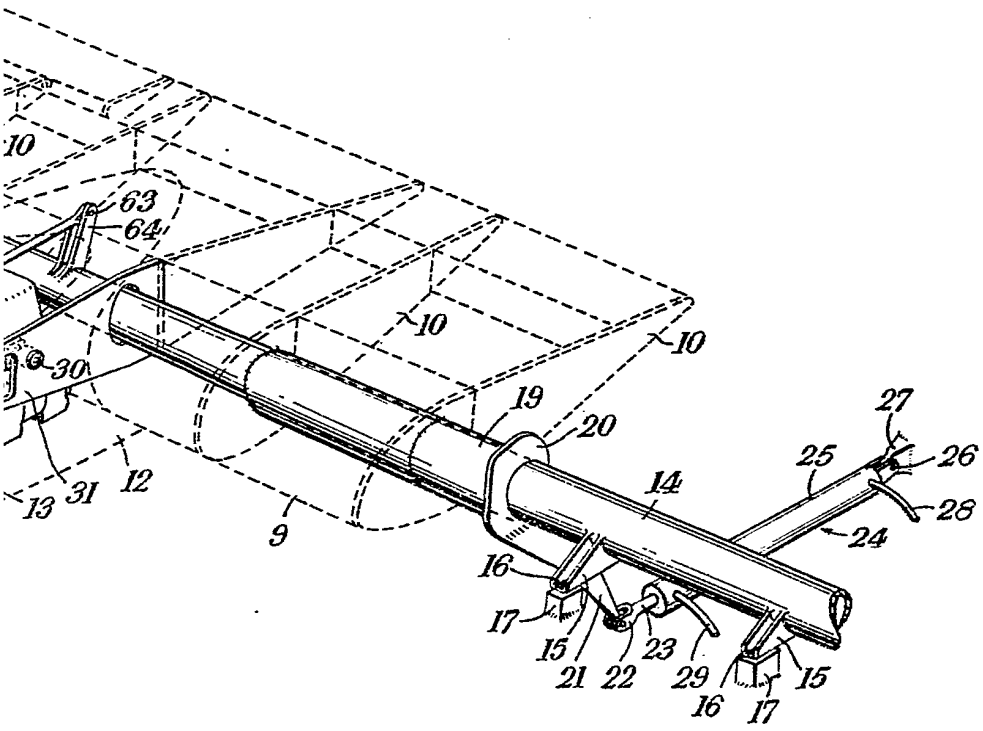

Fig. 2.

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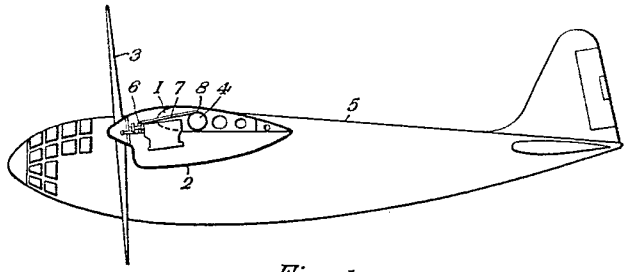

Fig. 1.

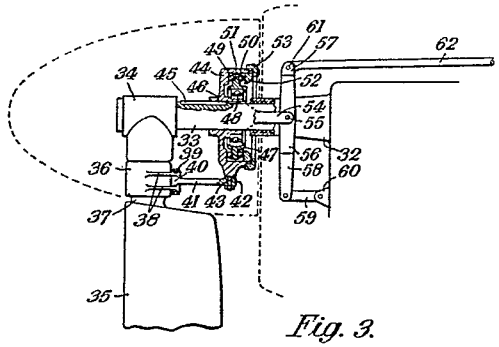

Fig. 3.

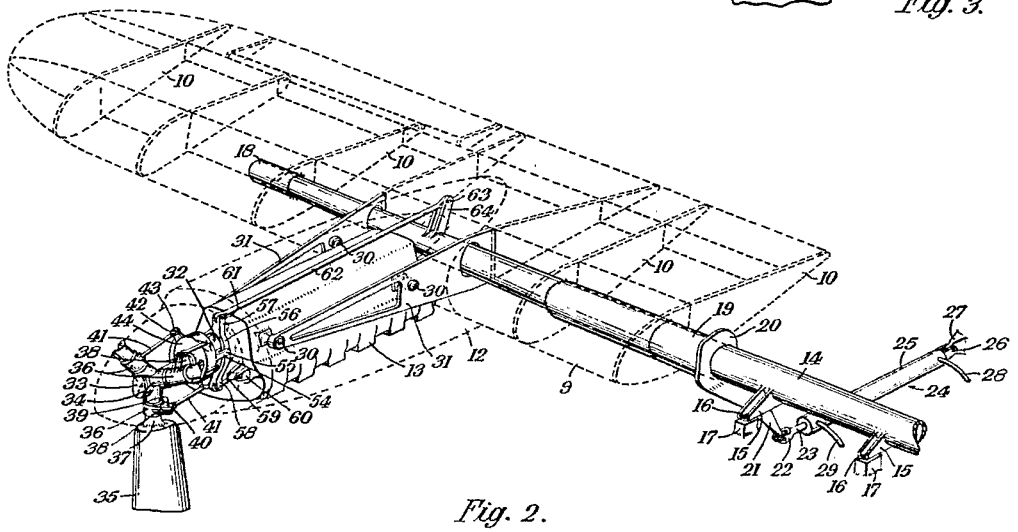

Fig. 2.