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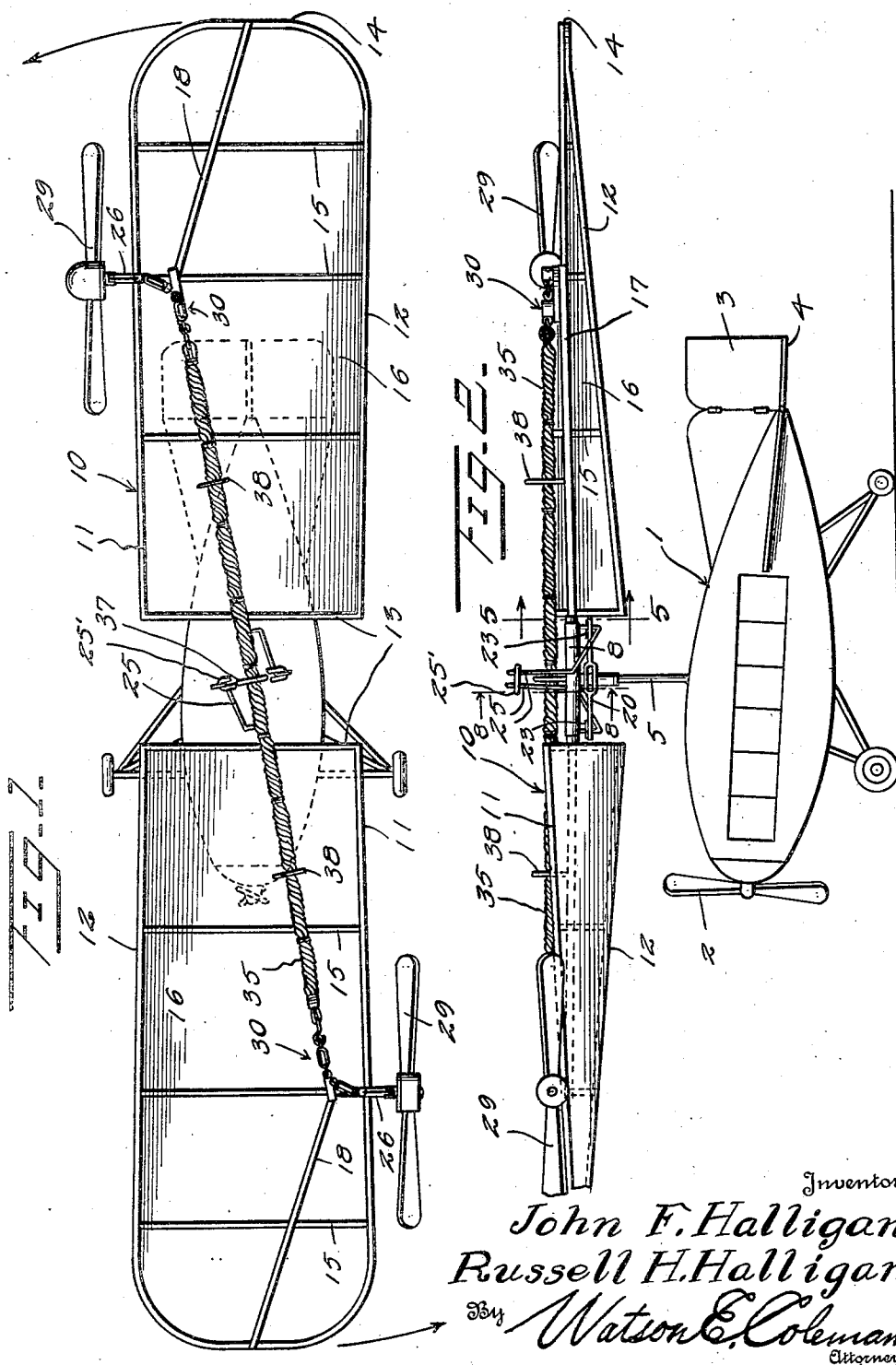
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VERTICALLY RISING FLYING DEVICE

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2 Sheets-Sheet 1



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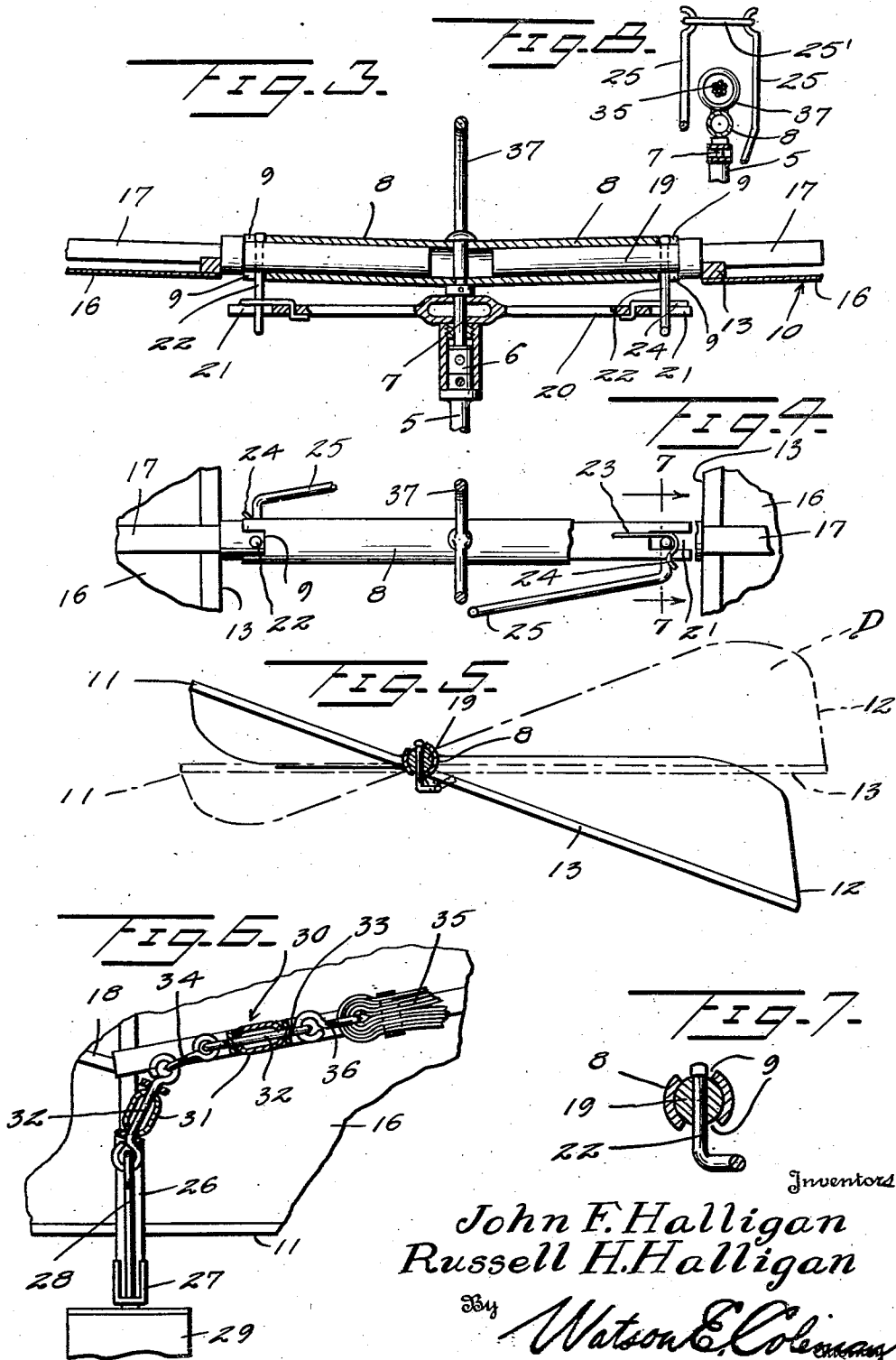
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UNITED STATES PATENT OFFICE

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VERTICALLY RISING FLYING DEVICE

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12 Claims. (Cl. 46—75)

This invention relates generally to improvements in flying devices and pertains particularly to a model or toy type of such device which is designed for direct vertical ascent and descent.

A primary object of the present invention is to provide an improved flying device which is designed to rise or descend vertically by the provision of wing sections which are mounted upon or connected with the fuselage of the plane to rotate above the fuselage, thereby substantially functioning as an air screw, the said wing sections being caused to move through the air by propeller units rotatably mounted thereon and driven from a source of power which turns with the wings and which is supported on the axis of rotation thereof, so that a balanced condition will be maintained and the effects of centrifugal force will be reduced to a minimum.

Another object of the invention is to provide a vertically ascending or descending flying device propelled in the manner above stated wherein the wing sections by which the ascent and descent of the device is effected are oscillatable on axes perpendicular to the axis of rotation to facilitate the adjustment of such wing sections to any desired angle of attack within a prescribed range.

A further object of the invention is to provide a flying device of the character stated wherein the axis of oscillation for the wing sections is at an oblique angle to the length of the sections thereby facilitating the adjustment of the angle of attack and at the same time facilitating the transmission of power to air screws rotatably mounted upon the leading edges of the sections.

A still further object of the invention is to provide in a flying device of the character stated, a coupling between the pivotally or oscillatably mounted wing sections which produces an equalization of adjustment of the sections through torque strain applied to the sections upon the operation of and by the power mechanism by which rotary motion is transmitted to the air screws mounted upon the leading edges of the wing sections.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from

the salient features of the invention as expressed in the appended claims.

In the drawings:

Fig. 1 is a view in top plan of model or toy type of flying device constructed in accordance with the present invention.

Fig. 2 is a view in side elevation of the same showing the rotatable wing sections in fore and aft position.

Fig. 3 is a sectional view taken on a vertical plane longitudinally of the central rotary unit which is located between the wing sections.

Fig. 4 is a view in top plan of the structure shown in Fig. 3, parts being broken away and in section.

Fig. 5 is a sectional view on the line 5—5 of Fig. 2.

Fig. 6 is a view on an enlarged scale partly in top plan and partly in horizontal section of the power transmitting coupling between the prime mover and an air screw.

Fig. 7 is a sectional view on the line 7—7 of Fig. 4.

Fig. 8 is a sectional view on the line 8—8 of Fig. 2.

Referring now more particularly to the drawings, the numeral 1 generally designates a fuselage structure of a conventional design, such structure being equipped with an air screw 2 at its forward end to facilitate horizontal or forward flight movement of the structure and with vertical and horizontal rudders 3 and 4 for controlling the horizontal direction of movement. No details of construction of the fuselage are shown as this forms no part of the present invention. Any suitable fuselage or body structure may be made use of so long as the same is equipped at its center of gravity with a vertical post or mast 5 upon the upper end of which the wing structure is mounted.

In accordance with the present invention there is provided upon the upper end of the mast 5, a step bearing 6 in which is supported for rotation the vertical axle 7. Fixed to the upper end of this axle 7 are the two opposite and radially directed sockets 8, each of which at its outer end is provided with the oppositely disposed notches 9 which are in a vertical plane, as shown in Fig. 7.

The wing structure for the present flying device is made up of two wing bodies, each of which is indicated generally by the numeral 10. Each of these wing bodies or members is of elongated form having the front and rear longitudinally extending frame bars or rails 11 and 12, re-

spectively, which are joined together by the inner and outer bars 13 and 14, respectively. Cross arms or braces 15 connect the front and rear bars of the wing frame and the frame is covered by a suitable covering material or fabric 16.

Each wing body or member is shaped so that the front and rear bars or edges, while substantially equidistantly spaced throughout their lengths, are angularly related, thus giving to the wing a slight twist on its long axis with the result that when the wing members are set for the ascent of the device, as shown in Figs. 1 and 2, the outer portions of the wings will be substantially horizontal while the inner portions will have the leading edge at an elevation above the trailing edge. When the wing members are set for descent of the device, as hereinafter described, then the inner end portions of the members will be substantially in a horizontal plane and the outer end portions will be at an angle to the horizontal, the leading edge at the outer end portion being at a lower elevation than the trailing edge.

Secured to the frame of each wing member is a spar 17 which extends obliquely of the wing from adjacent the longitudinal center at the inner end thereof toward the leading edge of the wing. The outer end of each spar is braced to the outer cross bar 14 of the wing by the oblique brace bar 18.

The inner end of each spar 17 extends beyond the inner end of the wing member to which it is attached forming the supporting foot 19 which is designed to position in a socket 8. By this means the wing members are coupled with the rotating vertical axle 7 supported upon the mast 5.

Disposed beneath the sockets 8 and extending substantially parallel therewith is an equalizing bar 20 which is freely pivoted on the axle 7 substantially midway of its ends and at each outer end of this bar, a slot 21 is formed.

The foot portion 19 of each spar carries a transversely extending pin 22 which, when the foot is placed in the socket, engages in the slot 21 in the adjacent end of the equalizing bar 20. The notches 9 in the ends of the sockets 8 are of sufficient width to receive the pins 21 and to permit limited turning movement of the foot in the socket, but the pins are relatively tightly held in the slots 21 of the equalizing bar and thus it will be apparent that when a wing member 10 is oscillated, the pin 22 connected therewith will swing in a manner to cause the equalizing bar 20 to turn slightly on the axle 7, and this turning movement will impart corresponding swinging of the opposite pin 22 and a corresponding oscillation of the other wing member. Consequently the wing members will always be maintained in the same relative angular disposition and when the angle of one wing member alters, it will automatically alter the angle of the other member.

Adjacent each of the slots 21 of the equalizing bar, there is fixed to the equalizing bar a latching finger 23, which has a hook 24 adapted to engage across the adjacent pin 22 for the purpose of holding the pin and the wing member with which it is connected from shifting outwardly or lengthwise of the adjacent socket.

The pin members 22 are connected with upwardly extending arms 25 which are disposed upon opposite sides of the rotary center of the wing members and the upper ends of these arms are suitably formed to facilitate the attachment

thereto of a contractile strand 25' which normally functions to urge the wings to oscillate to the descending position. Obviously when the plane is in motion and the wings are being rotated under the action of the air screws 29, the twist or torque action imparted to the wings along the lines of oscillation therefor will cause the wings to oscillate to the ascending position. Obviously the strand 25' will not be of such strength as to prevent the torque action of the twisted rubber stand 35 from oscillating the wings to such ascending position.

Adjacent to or slightly outwardly from the transverse center of each wing member, there is mounted upon the top of the wing, a base or bracket plate 26 supporting the bearing 27 in which is mounted a shaft 28. Upon the forward end of the shaft 28 there is mounted the air screw 29 which is set forwardly of the leading edge of the adjacent wing member to rotate on an axis extending transversely of the member. Inwardly of each air screw shaft 28 there is supported upon the bracket 26, a rotary power transmitting unit which is indicated generally by the numeral 30 and which is here illustrated as consisting of a number of bearing posts 31, through each of which extends the rotatably supported stub shaft 32, each end of which is formed to provide an eye 33 which constitutes one element of a universal coupling. Between the stub shafts the adjacent eyes 33 are connected by a link 34, which forms the other element of the universal coupling and the shaft 28 is connected with the eye of the stub shaft 32 nearest thereto, as is clearly shown in Fig. 6.

As has previously been stated, a principal object of the present invention is to provide a rotatable wing structure in which the driving means for the air screws and for the wing sections or the prime mover, is mounted together with the other parts in such manner that the weight of the parts will be distributed so as to prevent undesired strains being developed as a result of centrifugal action or, in other words, the weight of the parts is equalized and the power means or prime mover is mounted to turn with the air screws and the wing members and to be disposed above the latter so that all of the weight will be distributed above the wings and evenly with respect thereto.

As a means for effecting the turning of the air screws 29 and the rotation of the wing members on the center of the axle 7, there has been illustrated a rubber strand, which is indicated generally by the numeral 35. This strand has connected with each of its ends, a hook 36 which is designed to be engaged through an eye 33 of the innermost one of the stub shafts 32. This strand extends obliquely across the two wing members or the wing structure and extends over the upper end of the axle 7, being above and parallel with the aligned spars 17 of the two wing members. The sockets at their joined ends support a guide ring 37 and this is aligned with other guide rings 38 which are supported upon the spars of the wing members. These guide rings have the resilient or rubber strand 35 extended therethrough and they function to prevent the strand, when it has been twisted so as to build up the necessary power to effect the rotation of the air screws with which it is connected, from imposing an upward pull upon the wing members which would place undesired strains upon the same.

The twisted rubber strand 35 will function

effectively to turn the air screws 29 at a suitable speed to cause them to pull the wing members around on the axle 7 so as to thereby lift the craft into the air vertically. When this is occurring, the torque strain which will be applied to the spars and consequently to the wing members will tend to raise the advancing edges 11 of the wing members and since the wing members are coupled together by the equalizing bar 20, the degree of pitch which the wing members will assume will be the same. Fig. 5 shows the appearance of one wing member when looking lengthwise thereof from adjacent the rotary center of the wing structure, when the wing member is pitched for ascent. In this view it will be seen that the leading edge 11 at the inner end is raised while the trailing edge 12 is depressed and the outer end portion of the wing member is substantially horizontal. The dotted outline D of this figure illustrates the position of the wing member when it has been shifted to the descent position where it will be noted that the inner transverse edge or bar 13 is substantially horizontal and consequently the inner end portion of the wing member is horizontal while the outer end portion is on a slope, the leading edge 11 being depressed while the trailing edge 12 is raised. This shift in the positions of the wing members may be brought about by a yieldable or a contracting connection between the arms 25, which are connected with the equalizing pins 22 or it will occur in the following manner. When the craft is ascending, the torque exerted upon the wing members by the tensioned and untwisting or turning rubber strand keeps the advancing edges of the wing members elevated as previously stated. However, when this torque strain relaxes or ceases to exist, the pressure of the air against the under face of each wing member adjacent the trailing edge and adjacent the inner ends of the members will tend to force the trailing edge of each wing member upwardly so as to dispose the inner ends of the wing members in the same horizontal plane. As a result, the outer end portions of the wing members will turn so that the leading edges 11 will be depressed to an elevation below the trailing edges 12. When this occurs, the wing members which previously had functioned as a screw to raise the aircraft, will now function as a screw to move the aircraft downwardly or allow it to descend. While there has been here illustrated a prime mover or power unit in the form of a twisted rubber strand, it is to be understood that the invention is not to be limited to the use of this specific form of power developing means as it is possible to employ other forms of prime movers supported to turn with the wing members upon the axis of rotation therefor and, therefore, it is to be understood that in the appended claims, the use of the term "power generating means" or "prime mover" is intended to cover any and all suitable types of mechanisms for operating the air screws.

A particularly important feature of the invention is the provision of power delivering means for the propellers which results in the propellers being differentially driven. This will be apparent when it is considered that the twisted rubber strand will naturally deliver the most power to the propeller offering the least resistance. This helps to equalize the power on the air screws at all times facilitating stability in the flying device which, as will be readily realized, is of utmost importance.

While in the illustration and description of the invention the prime mover for the air screws, here shown as being in the form of a twisted rubber strand 35, has been shown and described as lying above the wings, it is to be understood that the invention is not to be limited in respect to this location of the air screw driving means as it is contemplated to place the prime mover or driving means for the air screws beneath the wings or in the case where wings of the airfoil type may be employed, the strand may extend through the wings or, in other words, may lie between the top and bottom surfaces thereof. In the placement of the strand 35 beneath the wings, it will, of course, be understood that the stabilizing bar 20 will be disposed above the sockets for the ends of the wing spars and the rotating part of the shaft of which the sockets form a part will be provided with a ring or an eye through which the strand may pass. In other words, the parts as now illustrated would be merely reversed so that the strand 35, the air screws and the driving connection between the ends of the strand and the air screws will be disposed upon the underside of the wing sections instead of upon the top thereof.

It is also to be understood that whereas the device as herein illustrated obviously constitutes merely a toy or a model of an aircraft, by the use of other types of prime movers for effecting the rotation of the air screws, the structure may be built of a size to be suitable for commercial and other uses.

What is claimed is:

1. A vertically rising model type flying device of the character described, comprising a fuselage, a wing structure disposed above the fuselage and comprising two wing members in end to end relation, a unit rotatably supported on the fuselage for turning on a vertical axis intersecting the longitudinal axis of the fuselage, coupling means between said wing members and said unit facilitating the oscillation of the wing members on axes extending perpendicular to the axis of rotation, an air screw pivotally supported upon each wing member at the leading edge thereof, a prime mover supported above the wing structure and said unit to turn with the wing structure and operatively coupled with said air screws to effect the rotation of the same, and means connecting the adjacent ends of said wing members for effecting automatic equalization of oscillation of the same about the second-mentioned axis.

2. A vertically rising model type flying device of the character described, comprising a fuselage structure, a mast carried by the structure and extending upwardly therefrom, a wing structure, comprising two elongated wing members, a pivotal connection between said wing structure and the upper end of said mast facilitating turning of the structure about the axis of the mast, a pivotal connection between the wing members facilitating their relative oscillation on an axis perpendicular to the mast axis, each of said wing members having a leading edge and a trailing edge, the said edges of each wing member having an angular relation to one another, a stabilizing connection between the pivoted ends of the wing members for effecting simultaneous oscillation of the same for the disposition of the leading edges in positions to effect the ascent or descent of the craft, an air screw pivotally supported at the leading edge of each wing member, and a power source mounted to rotate with said wing structure upon the axis of said mast and operatively coupled with said air screws to effect the rotation of the same.

3. A vertically rising model type flying device of the character described, comprising a fuselage, a wing structure disposed above the fuselage and including two elongated wing members disposed in end to end alined relation, a vertical pivot connected with said wing structure between the ends of the members thereof and connecting the structure with the fuselage, a pivotal connection between the adjacent ends of the wing members and the vertical pivot facilitating oscillation of the members on an axis perpendicular to the vertical pivot, said wing members being shaped so that the adjacent end portions will be disposed in planes oblique to one another when the remote end portions are in parallel planes, an air screw rotatably supported upon each wing member at the leading edge thereof, a power means supported above the wing structure for rotation on the axis of the vertical pivot and operatively coupled with said screws, and a stabilizing connection between the adjacent ends of the wing members for effecting simultaneous oscillation of the members on their long axes.

4. A vertically rising model type flying device of the character described, comprising a fuselage, a wing structure disposed above the fuselage and including two elongated wing members disposed in end to end alined relation, a vertical pivot connected with said wing structure between the ends of the members thereof and connecting the structure with the fuselage, a pivotal connection between the adjacent ends of the wing members and the vertical pivot facilitating oscillation of the members on an axis perpendicular to the vertical pivot, said wing members being shaped so that the adjacent end portions will be disposed in planes oblique to one another when the remote end portions are in parallel planes, an air screw rotatably supported upon each wing member at the leading edge thereof, a power means supported above the wing structure for rotation on the axis of the vertical pivot and operatively coupled with said screws, and a stabilizing connection between the adjacent ends of the wing members, comprising a bar supported for free turning on said vertical pivot, a pin member connected with the inner end of each wing member and extending radially from the axis of oscillation thereof through a recess in an adjacent end of the bar, and means for limiting the movement of each pin member about the axis of oscillation for the wing with which it is connected.

5. A vertically rising model type flying device of the character described, comprising a fuselage, a mast carried by and extending upwardly from the fuselage, a unit rotatably supported on the mast and including two oppositely directed bearing sockets, a bar member supported for turning movement about the pivotal axis for said unit, a wing structure comprising two elongated wing members each having a spar extending substantially lengthwise thereof and projecting beyond one end to form a supporting pivot foot, each of said pivot feet being disposed within a bearing socket whereby each wing member is supported for oscillation on its long axis, a pin member carried by each pivot foot and engaging in a notch in the adjacent socket, each of said pin members being loosely connected with an end of said bar, said notches being of a width to permit a limited degree of oscillation of the pin member, an air screw rotatably supported at the leading edge of each wing member, and a power means supported above the wing structure and operatively coupled with the air screws to effect the rotation of the same.

6. A vertically rising model type flying device of the character described, comprising a fuselage, a mast carried by and extending upwardly from the fuselage, a unit rotatably supported on the mast and including two oppositely directed bearing sockets, a bar member supported for turning movement about the pivotal axis for said unit, a wing structure comprising two elongated wing members each having a spar extending substantially lengthwise thereof and projecting beyond one end to form a supporting pivot foot, each of said pivot feet being disposed within a bearing socket whereby each wing member is supported for oscillation on its long axis, a pin member carried by each pivot foot and engaging in a notch in the adjacent socket, each of said pin members being loosely connected with an end of said bar, said notches being of a width to permit a limited degree of oscillation of the pin member, an air screw rotatably supported at the leading edge of each wing member, said spars extending obliquely of the wing members, and a power means for rotating said air screws, comprising an elongated strand of rubber supported above and parallel with the spars and extending across the vertical pivot for the wing structure and having operative connection at its ends with the screws.

7. A vertically rising model type flying device of the character described, comprising a fuselage, a mast carried by and extending upwardly from the fuselage, a unit rotatably supported on the mast and including two oppositely directed bearing sockets, a bar member supported for turning movement about the pivotal axis for said unit, a wing structure comprising two elongated wing members each having a spar extending substantially lengthwise thereof and projecting beyond one end to form a supporting pivot foot, each of said pivot feet being disposed within a bearing socket whereby each wing member is supported for oscillation on its long axis, a pin member carried by each pivot foot and engaging in a notch in the adjacent socket, each of said pin members being loosely connected with an end of said bar, said notches being of a width to permit a limited degree of oscillation of the pin member, an air screw rotatably supported at the leading edge of each wing member, said spars being disposed obliquely of their respective wing members and having end opposed alined relation, each of said air screws having a supporting shaft directed transversely of the adjacent wing member, means for transmitting rotary power to the shaft of each screw through a curved path, one end of which is directed longitudinally of the alined spars, and an elongated rubber strand extending parallel with and above the alined spars and connected at its ends with said last-mentioned means for transmitting rotary motion through the last-mentioned means to the air screw shafts.

8. A vertically rising model type flying device of the character described, comprising a fuselage, a wing structure disposed above the fuselage and comprising two alined wing members, means coupling the wing members together for independent turning on a common axis, means supporting said coupling means and connecting the same to the fuselage for turning the wings together on a vertical axis intersecting the longitudinal axis of the fuselage, an air screw rotatably mounted upon each wing member at the leading edge thereof, means urging turning of each of the wings in one direction on said common axis, and a prime mover supported above the wing structure and operatively coupled with said air screws to effect simultaneous rotation of the same, said prime

mover being constructed and arranged to transmit rotary power along a line extending obliquely of said common axis to said air screws and transmitting a torque to the wings in a direction to turn the same on said common axis oppositely to the said one direction whereby to pitch the wings for rising when turned in one direction about the vertical axis.

9. A vertically rising model type flying device comprising a body, a vertical standard carried thereby, a unit supported on said standard for turning on a vertical axis, a pair of elongated wings each attached at one end to said unit for turning on an axis extending lengthwise of the wing, said wings being shaped to have their inner ends oblique to one another when the outer ends are in the same horizontal plane whereby the leading edge of each wing is above the trailing edge, an air screw mounted for rotation on the leading edge of each wing, power means for carrying rotary motion obliquely of the turning axes of the wings to said screws and functioning to rotate the screws and turn the wings to lift the leading edges, and means tending to depress said leading edges when said power means is inactive.

10. A vertically rising model type flying device

as set forth in claim 9 in which said power means comprises an elongated body of highly elastic material which is twisted to a high degree and connected at its ends with said screws to rotate the screws by its tendency to untwist.

11. A vertically rising model type flying device as set forth in claim 9 in which said unit includes a pair of sockets and said wing attaching means comprises a foot piece on each wing rotatably mounted in a socket, and coacting means between each foot and socket limiting the turning of the foot in the socket.

12. A vertically rising model type flying device as set forth in claim 9 in which said unit includes a pair of sockets and said wing attaching means comprises a foot piece on each wing rotatably mounted in a socket, coacting means between each foot and socket limiting the turning of the foot in the socket, and said means tending to depress the leading edges comprising an arm coupled with each foot and a contractile coupling between said arms constantly tending to draw the same together.

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