July 16, 1929. G. W. WILKIN 1,720,939

FLYING MACHINE

Filed Sept. 14, 1927 3 Sheets-Sheet 1

Fig. 1.

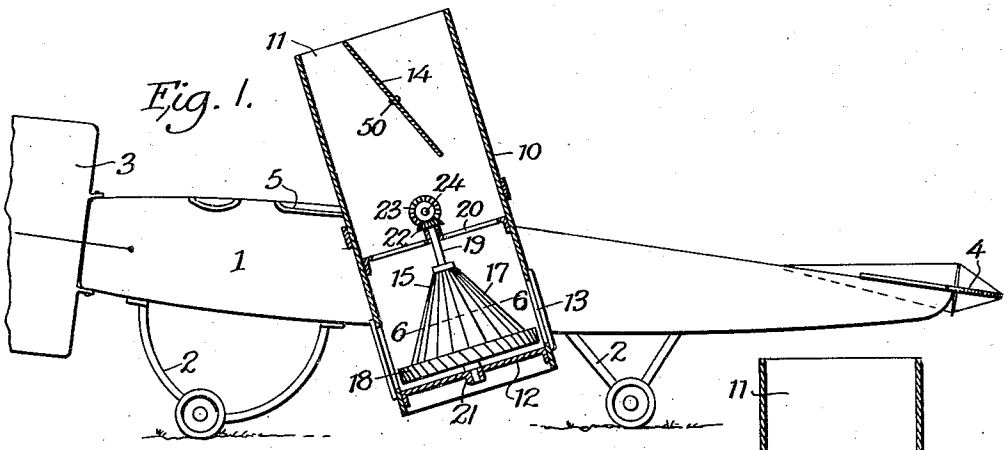


Fig. 4.

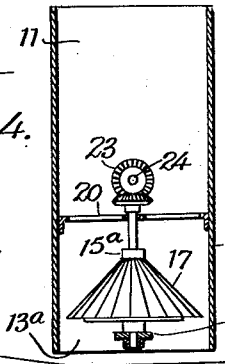


Fig. 2.

Fig. 6.

Fig. 5.

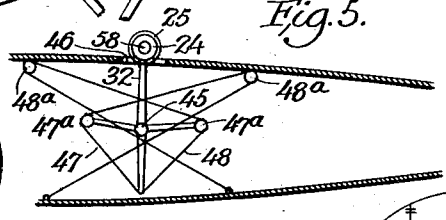


Fig. 3.

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FLYING MACHINE

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Fig. 7.

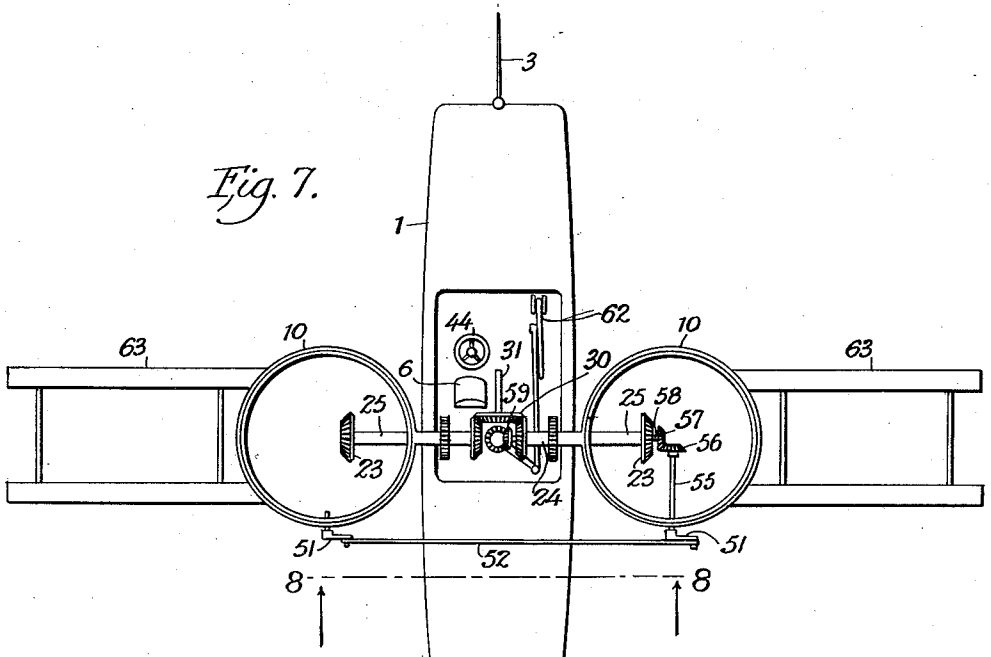
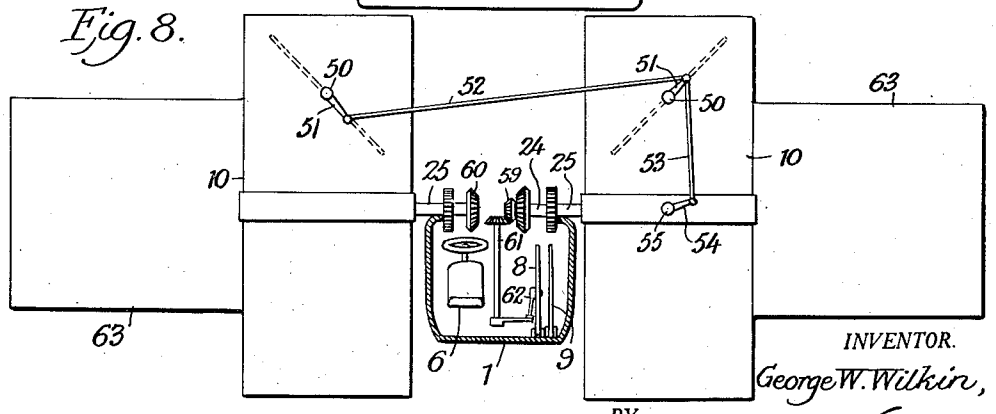


Fig. 8.



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FLYING MACHINE

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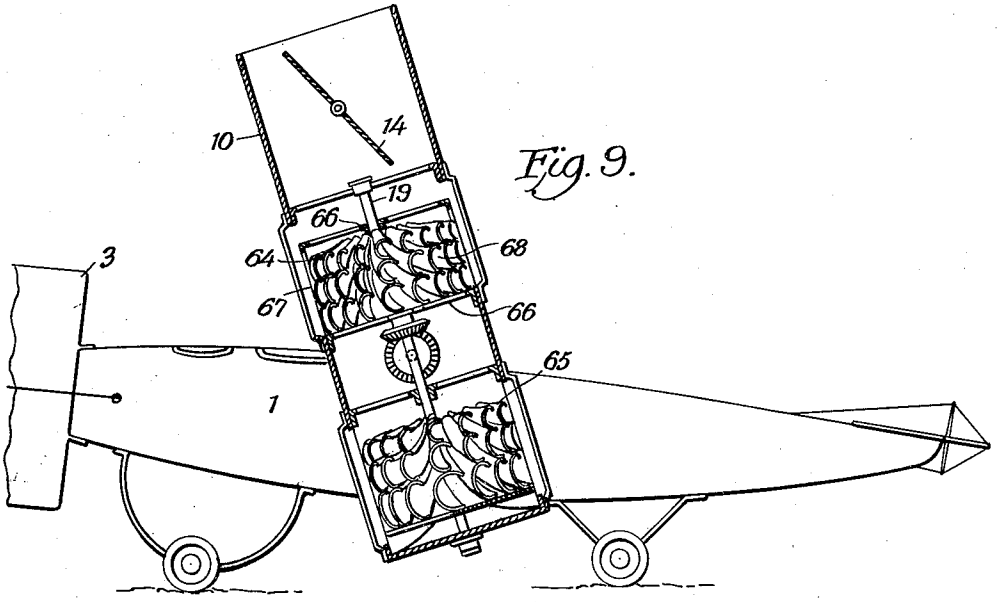


Fig. 9.

Fig. 10.

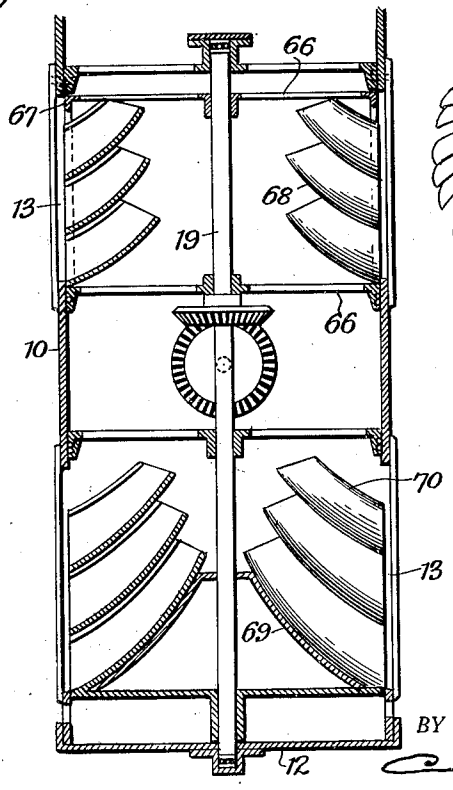


Fig. 11.

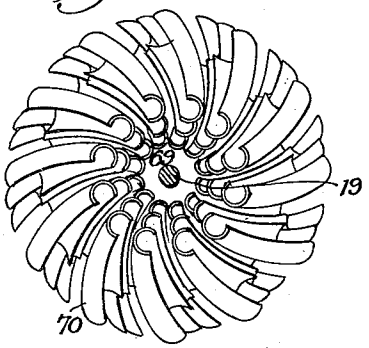
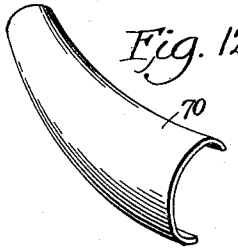


Fig. 12.



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Patented July 16, 1929. 1,720,939

UNITED STATES PATENT OFFICE.

GEORGE W. WILKIN, OF GRANGEVILLE, IDAHO.

FLYING MACHINE.

Application filed September 14, 1927. Serial No. 219,468.

This invention relates to flying machines, and its primary object is to provide a flying machine which may be as speedy in flight as desired and which may be launched and landed in a substantially vertical plane or at such angles between the vertical and horizontal as not to require lengthy take-off or landing runs, which may be made to hover over any given point, and which may be launched and landed at comparatively slow and safe speeds.

Another object of the invention is to provide novel means for propelling the machine by the action of rotary impellers for drawing air into and discharging it from wind tunnels or tubes in such manner as to utilize the combined forces of suction to draw the machine forward and compression and impingement of condensed jets or columns of air acting against the relatively still free air to give a propulsive effect.

Still another object of the invention is to provide a combined supporting surface and propulsion means comprising the impellers and wind tunnels which is adjustable to varying working angles or angles of incidence to change the action of the machine to one of helicopter type or one of gliding type under different conditions of service and as required in flight.

Still another object of the invention is to provide compensating means operative in the adjustment of the wind-tunnels for an equalizing action to maintain the longitudinal stability of the craft.

Still another object of the invention is to provide means for regulating the flow of air to the wind-tunnels and impellers in order that their working action and the speed of flight may be governed with or without change of speed of the impellers and in order to adapt the impellers to serve as wind-brakes for quick stopping or speed controlling action, as well as to regulate the volume and density of the air compressed by the impellers.

Still another object of the invention is to provide impellers of such form as to secure maximum power and efficiency, and to provide a controlling system whereby the pilot is given rapid and complete control of the machine to govern its equilibrium and its direction of movement.

With these and other objects in view, which will appear in the course of the subjoined description, the invention consists of the novel features of construction, combination and arrangement of parts hereinafter fully described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a side elevation of the machine showing the wind-tunnel at the near side in longitudinal section.

Figure 2 is a similar view but showing the fuselage partially broken away to disclose the motor and certain parts of the driving and controlling mechanisms.

Figure 3 is a top plan view with a part of the fuselage broken away to disclose interior parts and showing the wind-tunnels shifted to an extreme position for a helicopter action.

Figure 4 is a view of a wind-tunnel and impeller of modified form.

Figure 5 is a vertical longitudinal section through a part of the fuselage showing the sleeve bearing for one of the wind-tunnels and the equalizer associated therewith.

Figure 6 is a section on line 6—6 of Figure 1.

Figure 7 is a top plan view of the machine showing the wind-tunnels in the position illustrated in Figure 3.

Figure 8 is a vertical transverse section on line 8—8 of Figure 7.

Figure 9 is a view similar to Figure 1 showing a preferred form of impeller.

Figure 10 is a longitudinal section through the wind-tunnel and impellers shown in Figure 9.

Figure 11 is a face view of one of the impellers.

Figure 12 is a perspective view of one of the impeller blades.

In the exemplification disclosed, I have shown an aircraft body or fuselage 1 provided with suitable launching and landing gear 2, a vertical rudder 3, a tail stabilizer including a horizontal rudder 4, and a cockpit 5 containing one or more seats 6 for pilot and passengers, if any, and a driving motor 7. The rudders 3 and 4 are operative, through suitable connections, by control levers 8 and 9. The rudder 3 is shown as mounted upon the nose of the body, but may, if desired be mounted upon the tail of the body.

A supporting and propelling means is provided comprising duplicate wind-tunnels or tubes 10 disposed at opposite sides of the body 1. These tunnels may be of any suitable length and diameter, and each tunnel is

open or provided with an air inlet 11 at its forward end, is closed by an end wall 12 at its rear end and is provided adjacent to the latter-named end with lateral air discharge outlets 13. In the form of the invention disclosed in Figures 1 to 3, inclusive, each tunnel is provided adjacent to its forward end with a pivoted air inlet control damper 14 and adjacent to its rear end with a rotary impeller 15.

Each impeller 15 comprises a body 16 of conical form, having its apex facing forwardly and its base arranged in spaced relation and adjacent to the wall 12. The conical surface of the body of the impeller is provided with main blades 17 and the impeller terminates at its base in a circular portion provided with short auxiliary blades 18, the sets of blades being arranged in working proximity to the discharge outlets 13. Each impeller is mounted on a shaft 19 journaled at its forward end in a spider or cross-bearing 20 and at its rear end in a thrust bearing 21 in the wall 12. The shafts 19 of the impellers are provided with bevel pinions 22 which mesh with bevel gears 23 on the outer ends of transverse transmission shafts 24 extending through and journaled in bearing sleeves 25. At their inner ends, the shafts 24 are provided with bevel gears 26 meshing with bevel pinions 27 on the upper ends of intermediate shafts 28 having pinions 29 at their lower ends meshing with a bevel drive gear 30 on the drive shaft 31 of the motor 7. Through the system of gearing above described both impellers are driven in unison at the same rate of speed. The blades of the impellers operate in the rotation of the impellers to draw in air through the tunnel inlets 14, compress the air in the tunnels and discharge the air at an outward and rearward angle through the outlets 13, thus causing a propulsive motion through a combined suction effect and the impinging dynamic effect of the discharging currents of expanding compressed air against the relatively inert free atmospheric air, whereby a powerful propulsive force is obtained. The impeller construction above described is set forth merely as an example of one form which may be used, a preferred type of construction, being hereinafter described. In the structure shown in Figure 4 the tunnel is open at its rear end to provide an air outlet 13^a and the propeller 15^a is journaled at its rear end in a cross-bar 12^a and is devoid of the blades 18.

The sleeve bearings 25 are journaled to rotate in the upper bearing ends of levers 32 as a horizontal transverse axis on which the supporting and propelling means comprising the wind-tunnels and impellers may be swung or tilted from a horizontal to a substantially vertical position and vice versa, or to different intermediate positions, to vary the angular relation of the tunnels to the aircraft body and thereby vary the angle of incidence of the supporting and propelling means to the aircraft body. The tunnels and propellers thus may be arranged substantially parallel with or at a slight angle of incidence to the body for a direct propulsive action for straightaway flight, or more or less at right angles to the body for substantially straight vertical ascent or descent or for hovering purposes, governed by the lifting and impelling speed of the impellers, or at any intermediate angle for quick take-offs in making running starts or climbing or landing at any angle or compensating in flight for either nose-heaviness or tail-heaviness. As thus constructed, a helicopter type of machine is provided in which air turbines act, by reason of their inclosure, in wind-tunnels, to exert by both suction and dynamic forces, air reactions whereby great lifting power and speed may be obtained.

The means for adjusting the tunnels comprises gears 33 on the sleeves 25, meshing with gears 34 on a transverse shaft 35, on which is also a gear 36 meshing with a gear 37 on the upper end of a vertical shaft 38. Shaft 38 is provided at its lower end with a gear 39 meshing with a gear 40 on an operating shaft 41 provided with another gear 42 meshing with a gear 43 on a control shaft 44 provided with a hand wheel or the like whereby the adjusting gearing just described may be actuated to adjust the wind-tunnels to any of the desired working positions. Any suitable means for locking the gearing in any working position may be provided or the gearing may be one of self-locking type. The control shaft is arranged in such position that the pilot may at all times readily and conveniently operate it for regulating the action of the supporting and propelling means as desired or required.

In the shifting of the supporting and propelling means to varying angles of incidence undesirable changes in the center of gravity and lift would occur but for the fact that I provide compensating means for preventing such changes. To this end, the levers 32 are provided which are centrally pivoted, as at 45, to swing in a fore-and-aft direction, and the sleeve bearings are mounted on the upper arms of these levers, which arms of the levers are movable to a limited extent in guide slots 46 in the top of the body. Attached at one end to the lower arm of each lever is a pair of cables 47—48 which pass divergently upwardly and outwardly and over a pair of guide pulleys 47^a at the adjacent side of the body thence upwardly and inwardly in convergent relation and cross each other and pass over a second pair of guide pulleys 48^a at the top of the body, the cables thence extending downwardly in convergent and crossing relation and being fastened at their opposite ends, as at 49, to the bottoms of the body.

It will thus be seen that as the wind-tunnels are tilted in one direction or the other, the levers will tilt to an extent limited by the friction cables which equalize the forces on the upper and lower arms of the levers above and below the pivots 45, which form in effect the axis of motion of the tunnels, which axis is arranged, at a low point so related to the centers of gravity and pressure of the craft that notwithstanding the adjustment of the tunnels to different angles of incidence the longitudinal equilibrium of the craft will be maintained. This compensating action is provided in order to allow the horizontal rudder to be used normally and to automatically correct a condition which would otherwise result in longitudinal instability to a degree not susceptible of correction at all by adjustment of the horizontal rudder or, if so, would interfere with the normal use of such rudder for vertical trimming and steering actions. This compensating means is believed to be broadly new in combination with any tiltable or rockable supporting surface, such, for example, as rocking wings, and hence I do not limit this part of my invention to use in connection with the particular type of supporting and propelling means herein shown.

The dampers 14 are provided to regulate the amount of air to the wind-tunnels as conditions may require or to make the air supply suitable for any speed of the impellers. They are also adapted to serve the function of wind-brakes for governing, checking or accelerating the speed of the craft, when conditions require without the necessity of varying the speed of the impellers, although, obviously, a speed controlling action may be obtained by adjusting the dampers and simultaneously increasing or decreasing the speed of the impellers. These dampers are simultaneously adjustable and to this end are mounted on shafts 50 provided with cranks 51 coupled by a connecting rod 52, one of the cranks 51 being also coupled by a connecting rod 53 to a crank 54 on a shaft 55 extending into one of the tunnels. This shaft 55 carries a bevel gear 56 meshing with a bevel gear 57 on the outer end of a shaft 58 journaled in one of the shafts 24 and extending therethrough into the body 1. The end of the shaft 58 within the body carries a bevel gear 59 meshing with a gear 60 on the upper end of an upright shaft 61 having a crank and connecting rod, coupling with a control lever 62, whereby the pilot may conveniently operate the dampers.

Wings 63 may or may not be provided upon the wind-tunnels. Their use may be found desirable as an aid to stability and sustension and in permitting gliding landings to be made in the event of motor derangement.

In Figures 9 to 12, inclusive, I have shown an impeller organization and structure of preferred type. As shown therein the impeller shaft here extends forwardly and rearwardly of the pivotal axis of the wind-tunnel and carries a front conical impeller 64 and a rear conical impeller 65. The front impeller comprises a rotative body formed of spiders 66 fixed to the shaft, a cylinder or shell 67 carried by the spiders and blades 68 arranged within the shell and fixed to the walls thereof, while the rear impeller comprises a conical body 69 fixed to the shaft and carrying blades 70. In the case of each impeller, the blades are of helical curvature and longitudinally channeled and of restricted width at their forward ends and gradually increasing width toward their rear ends. The channeled sides of the blades face in the direction of rotation of the impeller and the rear delivery ends of the blades of each impeller face a set of discharge outlets 13 in the tunnel and discharge the air at an outward and rearward angle relatively thereto. The blades of each impeller, which are fixed to the impeller body and to each other, are arranged in concentric annular and radial rows, thus allowing a lage number of blades to be employed with resulting increased propulsive effect, and the sets of blades by being so formed and arranged work with a screw action on the air so as to secure the triple sustaining and propulsive effects due to suction, dynamic compression and screw travel. By the use of fore and aft propellers in each tunnel, one arranged in advance and the other in rear of its pivotal axis, which is normally coincident with the center of gravity, balancing lifting pressures and centers of lift are obtained which greatly add to the stability of the craft. In addition, much greater power is obtained. It will be noted that the wall of the body or shell 67 of the front impeller 64 is perforated for the discharge of the air from the blades therethrough, the rear ends of which blades are fixed to the shell and the blades of each row to each other.

From the foregoing description, taken in connection with the drawings, the construction, mode of operation and advantage of the invention will be readily understood by those versed in the art without a further and extended description. It is, of course, to be understood that the construction shown for carrying the invention into practical effect are merely exemplificative and may be modified at will within the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A flying machine comprising a body, a wind-tunnel mounted on the body and having an air inlet and an air exit, and a conical impeller in said tunnel having annular groups of spirally shaped channeled blades arranged

in radial rows for drawing air thereinto through the air inlet and discharging the air through the air exit.

2. A flying machine comprising a body, a wind-tunnel disposed over each side of the body and each having an air inlet and an air exit, means for tilting said wind tunnels in a vertical plane in unison, a damper in each tunnel for governing the amount of air entering through the inlet thereof, means for adjusting the dampers in unison and an impeller in each tunnel for drawing air thereinto through the air inlet and discharging the air through the air exit.

3. A flying machine comprising a body, a wind-tunnel at each side of the body, bearing sleeves carrying the wind-tunnels and journaled in the sides of the body, a rotary impeller in each tunnel, gearing including drive shafts journaled in said sleeves for driving the impellers, adjusting means in gear with the sleeves for rotating said sleeves about the shafts as axes of motion, regulating dampers in the air-tunnels and means for adjusting said dampers.

4. Supporting and propelling means for aircraft comprising a wind-tunnel having an inlet at its forward end and provided with front and rear sets of lateral air discharge openings, and front and rear conical and channel-bladed rotary impellers in said tunnel for drawing air through the air inlet and discharging the same through the respective sets of discharge openings.

5. Supporting and propelling means for aircraft comprising a wind-tunnel having an air inlet at its forward end, closed at its rear end and having lateral air discharge outlet near the latter-named end, a shaft in the tunnel having an end bearing in the closed end wall thereof, a rotary impeller carried by said shaft for drawing air through the air inlet and discharging the air through the lateral air outlets, and means for producing a counter pressure for counteracting the thrust pressure of the propeller on the said end bearing of the shaft.

6. Supporting and propelling means for aircraft comprising, in combination with an aircraft body, a wind-tunnel pivotally mounted for vertical swinging movement on a horizontal transverse axis at each side of the body, rotary impellers in the wind-tunnels, means for swinging the wind-tunnels in unison, and means for permitting shifting of the axes of the tunnels in the swinging movements thereof to compensate for weight displacements so as to maintain the longitudinal equilibrium of the craft.

7. An aircraft comprising a body, supporting means embodying supporting elements at opposite sides of the body, means for tilting said supporting means to different angles of incidence, and means compensatively operative for changes in the angularity of position of the supporting means with relation of the body to maintain the longitudinal equilibrium of the craft.

In testimony whereof I hereunto affix my signature.

GEORGE W. WILKIN.