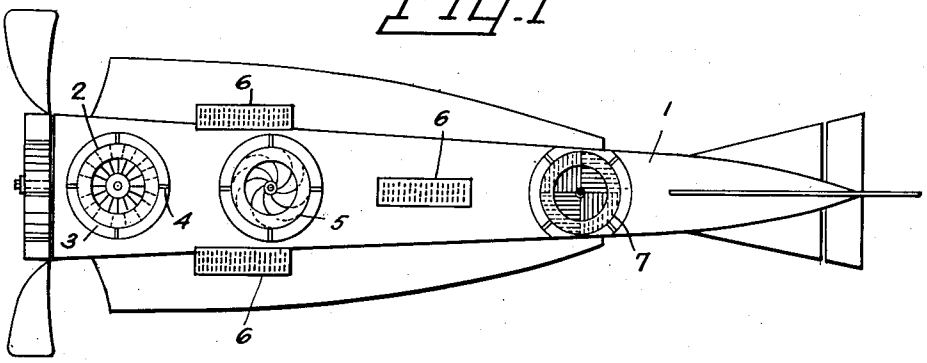
July 17, 1934. O. K. QUAST 1,966,461

ROTARY VACUUM WING OR PROPELLER FOR USE ON AIR, LAND, AND WATER VEHICLES

Filed Feb. 4, 1933 4 Sheets-Sheet 1

Fig. 1



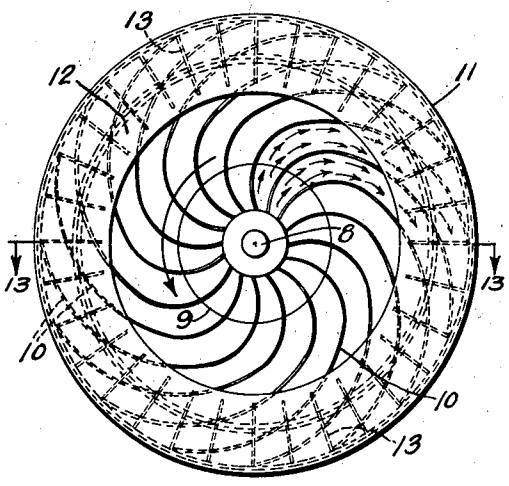


Fig. 12

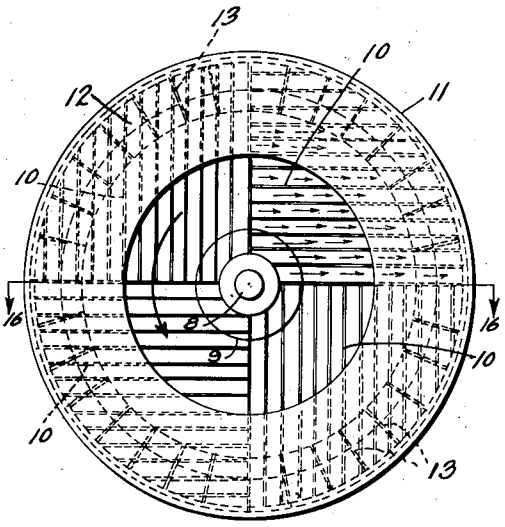


Fig. 15

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July 17, 1934. O. K. QUAST 1,966,461

ROTARY VACUUM WING OR PROPELLER FOR USE ON AIR, LAND, AND WATER VEHICLES

Filed Feb. 4, 1933 4 Sheets-Sheet 2

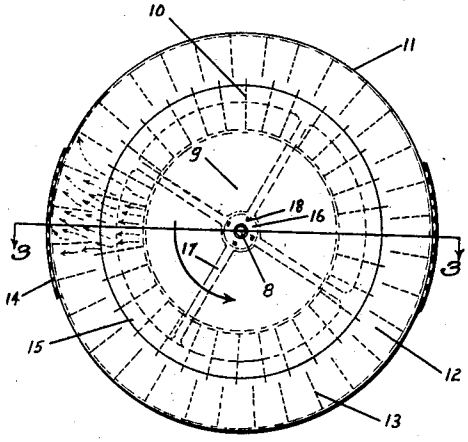

Fig. 2

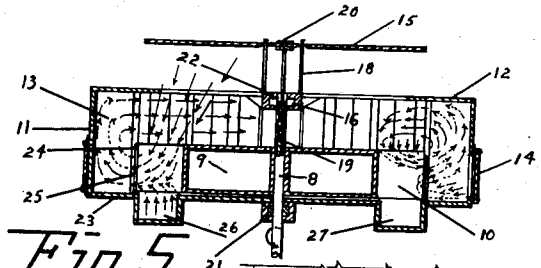

Fig. 5

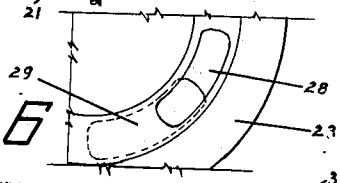

Fig. 6

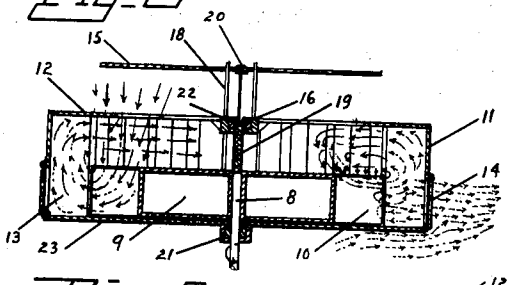

Fig. 3

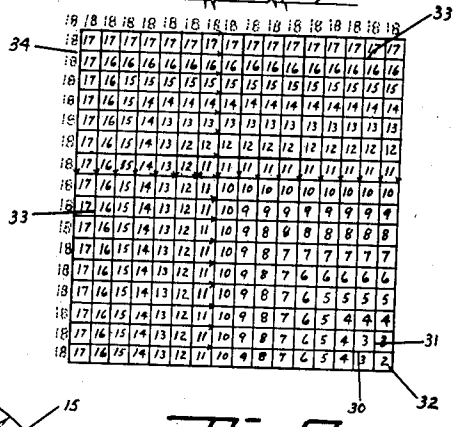

Fig. 7

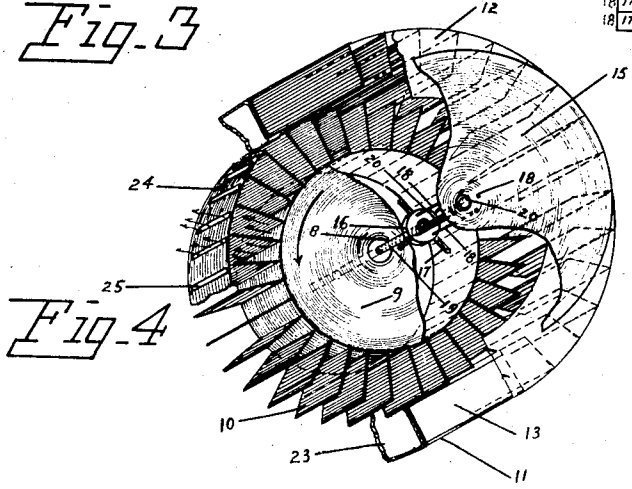

Fig. 4

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ROTARY VACUUM WING OR PROPELLER FOR USE ON AIR, LAND, AND WATER VEHICLES

Filed Feb. 4, 1933 4 Sheets-Sheet 3

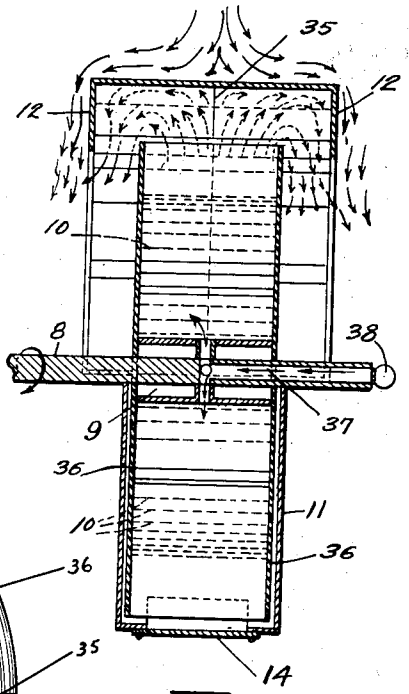

Fig. 9.

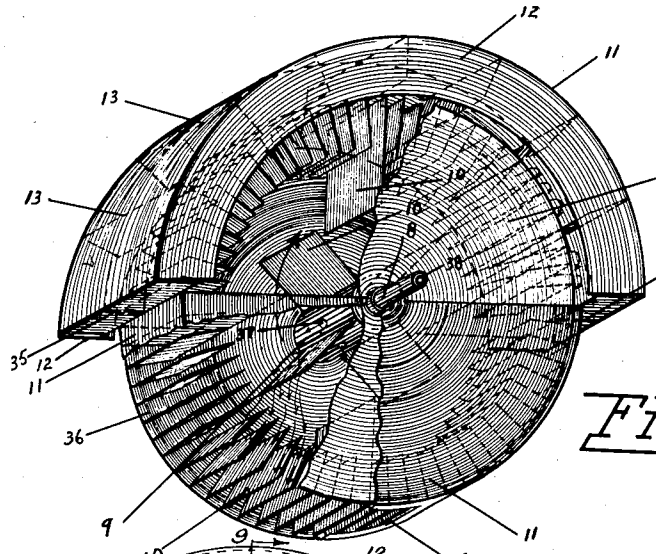

Fig. 10

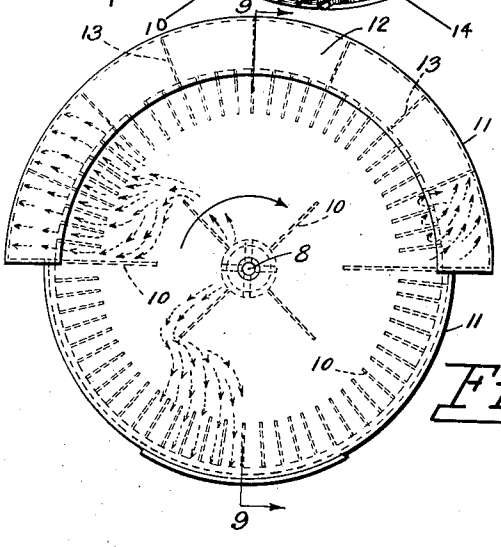

Fig. 8.

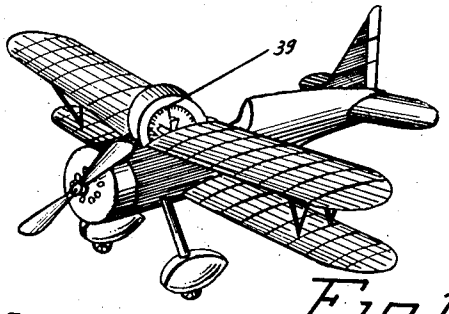

Fig. 11.

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July 17, 1934. O. K. QUAST 1,966,461

ROTARY VACUUM WING OR PROPELLER FOR USE ON AIR, LAND, AND WATER VEHICLES

Filed Feb. 4, 1933 4 Sheets-Sheet 4

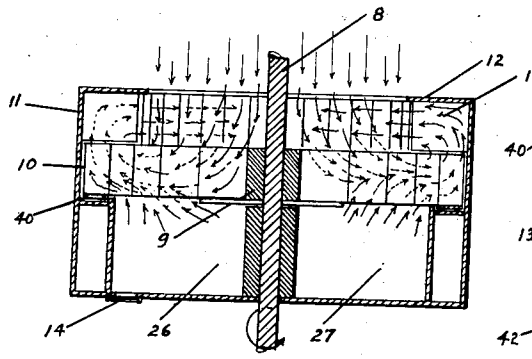

Fig. 13

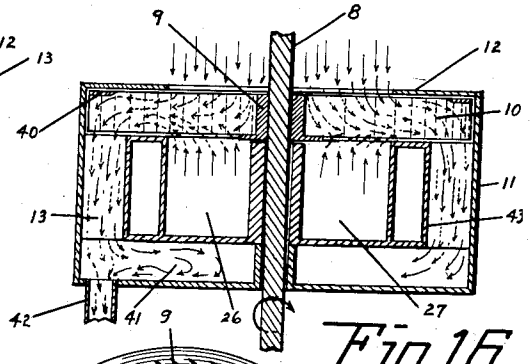

Fig. 16

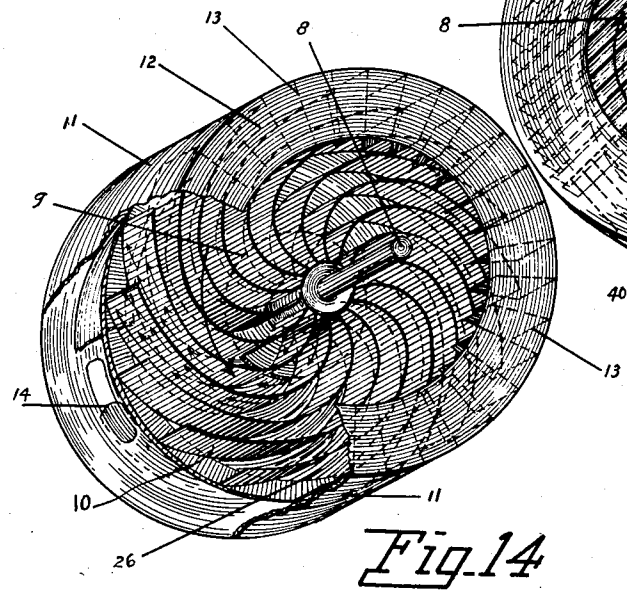

Fig. 14

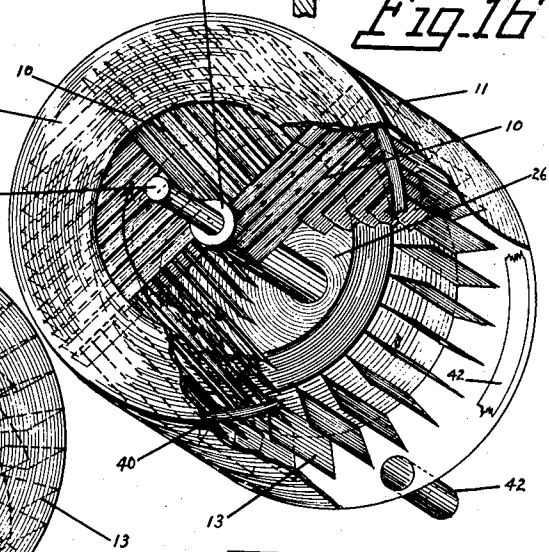

Fig. 17

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Patented July 17, 1934

1,966,461

UNITED STATES PATENT OFFICE

1,966,461

ROTARY VACUUM WING OR PROPELLER FOR USE ON AIR, LAND, AND WATER VEHICLES

Otto Karl Quast, Spokane, Wash.

Application February 4, 1933, Serial No. 655,197

5 Claims. (Cl. 170—159)

One object of the present invention is to provide a rotary vacuum wing or propeller of comparatively small design, designed to lift or to elevate heavy loads vertically in a fluid and in a gas medium.

Another object of the present invention, applying same especially to air vehicles, is to provide a rotary vacuum wing or propeller designed to ascend and to descend vertically and also by means of which to hover at will at any desired height above the ground.

And a still further object of the present invention is to provide a rotary vacuum wing or propeller for propulsion over land, or through a fluid or gas medium.

With the above and other objects in view, the invention consists in the novel construction, arrangement and formation of parts, as will be hereafter more especially described, and claimed, and in the accompanying drawings, by which several embodiments of the invention are diagrammatically illustrated, by way of example.

Figure 1 is a general top view of an air-craft showing in outline a plurality of rotary vacuum wings or propellers installed on same;

Figure 2 is a top plan view of a rotary vacuum wing or propeller proper operating on a horizontal plan;

Figure 3 is a view in section of Figure 2 taken on line 3—3 thereof.

Figure 4 is an isometric projection view of Figure 2 and of Figure 3.

Figure 5 is a view in section of Figure 2 taken on line 3—3 with sump and vent added;

Fig. 6 is a top plan view of the bottom of sump of Fig. 5 showing the vent and shutter thereof;

Fig. 7 is a view of a blade 10 of Fig. 3 showing tabulation of calculations of centrifugal air expulsion and displacement;

Fig. 8 is a view in side elevation of a modified rotary vacuum wing or propeller of Fig. 2 operating on a vertical plane;

Fig. 9 is a view in section taken on a line 9—9 of Fig. 8;

Fig. 10 is an isometric projection view of Fig. 8 and Fig. 9 with broken lines;

Fig. 11 is a top plan view of a conventional aircraft showing in outline a rotary vacuum wing or propeller of Fig. 8, Fig. 9 and Fig. 10 installed on it;

Fig. 12 is a top plan view of a modified rotary vacuum wing or propeller of Fig. 2;

Fig. 13 is a view in section of Fig. 12 taken on line 13—13 thereof;

Fig. 14 is an isometric projection view with broken lines of Fig. 12 and of Fig. 13;

Fig. 15 is a top plan view of a modified rotary vacuum wing or propeller of Fig. 2 and of Fig. 12;

Fig. 16 is a view in section of Fig. 15 taken on line 16—16 thereof;

Fig. 17 is an isometric projection view with broken lines of Fig. 15 and of Fig. 16.

Referring more particularly to the drawings throughout which like reference numerals designate like parts, the numeral 1 Fig. 1 indicates the body of the aircraft, with 2 a rotary vacuum wing or propeller of Fig. 2 in place on craft, surrounded by open space 3 to allow the atmospheric pressure to exert itself under the bottom of the rotary vacuum wing's stationary housing 11 in an upward direction, whereas the gravitational pull of the craft's load in a downward direction tends to automatically stabilize the aircraft and braces 4 connect housing 11 with the hull of the craft in a manner to form a stationary part thereof; and 5–6 and 7 of Figs. 8–12 and 15 modifications of Fig. 2, are likewise shown installed in proper manner.

In the construction of rotary vacuum wing or propeller Fig. 2, a drive shaft 8 operates in a top bearing 16 held in position by braces 17 connected to reflector flange 12, and the bottom end of said drive shaft operates in bearing 21 shown in Fig. 3, and a hub or center part 9 is keyed to said drive shaft 8 and with blades 10 that radiate from said hub makes up, as a whole, the lifting device's rotatable body or air-eliminator that revolves over surface 23 of bottom in stationary housing 11 Figs. 2–3 and 4, of which blades 10 as is shown in Fig. 5 here revolve or sweep over sump 26—27 located in said stationary housing 11, and engage the air between them and expel it centrifugally in a transverse direction into compartments that are formed by guide blades 13, whence it is forced upward and thereafter is directed by a reflector flange 12 to flow above the speeding air-eliminator in the form of a blanket centerward. Arrows in said sump 26—27, and also arrows indicating air in motion above it, indicate a slow air-eliminator speed and commencing of the removal of the atmospheric pressure from the air in sump part 26 thereof, and the self expulsion of said air therefrom by expansion. In 27 part of sump 26 it is indicated as shown by arrows that because of a greater speed of the air-eliminator full expansion and air outflow from the sump has taken place and that the low

pressure here in this area has furthermore risen far up in between blades 10 of the air-eliminator.

To explain more specifically the process involved to build or to create the above said low pressure in area above the inner surface of bottom 23 stationary housing 11 upward in between air-eliminator blades 10 Fig. 3, and the forming of the low pressure in area in sump 26—27 and in between blades 10 above same as in Fig. 5, the following computations are offered:

All weight expels centrifugally from center, and as air has weight, it will therefore expel likewise the same; and as the speed of weight falling in a vacuum amounts to sixteen feet a second for its first foot fall therein, a piece of lead and a feather falling therein at a same rate of speed, air will in that respect behave relatively the same as all other weight; which, when adopting an air-eliminator with an approximate diameter of six feet with blades of one square foot area spaced one foot apart (taking said size of air-eliminator, its depth of blades and the width of their spacing as the root or rudiment to calculate by), there will then be expelled by each blade, by its discharge face sixteen feet of air per second with one revolution per second air-eliminator speed, which in turn causes the air to fall or to flow into the area located immediately behind the speeding blades at a rate of sixteen feet a second also, as will be understood by that which is given above.

Now as at the second revolution per second air-eliminator speed the blades have attained a speed of thirty-two feet per second, the following blades will therefore have come into the position of the ones that precede them before the ingoing air has fallen or has entered to a greater depth than that of fifteen sixteenths of one foot, or one sixteenth of one foot short of the air in sump 26—27 Fig. 5, when it is swept out again, and the air enters likewise with a like speed into the wake of the speeding blades from the outer circumference of the air-eliminator centerward, at said two revolutions per second air-eliminator speed to line 31 Fig. 7, which compared with its vertical fall to line 30, will leave square 32 the nucleus of the low pressure that is built in the area in spaces between blades 10 throughout, so that, for example, at seventeen revolutions per second air-eliminator speed, giving a 288 foot per second blade speed, the low pressure in the area between blades 10 will then have risen or will have increased to lines 33—33, and at 18 revolutions per second air-eliminator speed giving a 304 foot second blade speed, the speed of the blades will then have surpassed the speed of the air as is shown by 34, which numerals 18 thereof indicate a wall of air surrounding the low pressure that has been created in the area in spaces between blades 10, and which full elimination of the air from between said blades may be called zero air elimination or the point of full slippage, and the blades 10 from this point on will engage and expel air again, only when the craft, by force of the atmospheric working pressure retained intact under housing 11 of the lifting device is allowed to rise, thereby allowing said blades to dip into said wall of air above them.

The rising speed of the craft may be kept under full control as is given hereinafter, and any desired temporary ceiling as will be seen may be determined at will, but a permanent ceiling is attained whenever the load of the craft and the atmospheric working pressure under housing 11 of the lifting device counterbalance each other; although, a full slippage does exist at either ceiling.

Further, when spacing blades 10 one half foot or less apart instead of one foot, as is given above, that by said closer spacing of said blades zero air elimination or the point of full slippage will be maintained at half or less the air-eliminator and blade speeds also, as the lessening of the distance between the blades tends to discharge the air between them at more frequent intervals.

To control ascending at will, the device is fitted with vents and shutters 14, letting the air pass through said vents in wall of housing 11 as indicated by arrows vent 14 Fig. 3, the blast of air that is thus allowed to pass through said vents tends, by suction, to destroy part of the static atmospheric working pressure underneath the said housing; therefore, when desiring to rise slowly the vents in the wall of housing 11 are then closed more slowly during rising, to rise faster, the vents are then closed faster, in this manner regulating the rising speed of the craft from its point of take-off up to its permanent ceiling; and when discontinuing the closing of these vents during rising, leaving them part open regulates or allows one to maintain any temporary ceiling desired.

To lower the craft, either cover 15 must be lowered, or otherwise the vent 28 Fig. 6, in bottom underneath the sump 26—27 Fig. 5 in housing 11 must be opened, because the opening of these vents in the wall of housing 11, that regulates the ascent, will not effect a descent without a slowing up of the air-eliminator to a speed below that of zero air elimination or the point of full slippage, thereby allowing air speed to exceed blade speed; but as the latter requires varying the speed of the air-eliminator, it is therefore not desirable.

The operating of the shutters, closing the vents in wall of housing 11 for gradual rising, is also provided for the purpose to determine the amount of horsepower that it requires for the taking up of greater or lesser loads; for example, when allowing the craft to rise at a rate of sixty feet per minute, calculated at one foot per second per horsepower, one horsepower will then be sufficient to handle five hundred and fifty pounds at said rising speed; but when these vents are closed faster so that craft rises one hundred and twenty feet per minute instead, then two horsepower will be required for the lifting of the same amount of weight given above, accounted for by allowing the blades of the air-eliminator in the latter case to penetrate to a greater or to double the depth the wall of air 34 Fig. 7 above them, which requires therefore the greater amount of horsepower to expel double the amount of air in a like space of time.

All these facts are stated because it is well known that the decrease of atmospheric pressure obtained above the wing of a conventional type aeroplane amounts at the most to not more than eight pounds per square foot wing area, whereas, as is also well known, our atmospheric pressure at sea level available for lift, amounts to two thousand one hundred and twenty-one pounds to one square foot area, and whereas my invention is adapted to make use of the greater percentage thereof.

To descend, as stated above, vent 28 Fig. 6

is opened by operating shutter 29 and letting air into sump 26—27 Fig. 5 destroying the low pressure maintained therein.

Another means of controlling the craft's descent is found in cover 15, Figs. 2–3 and 4, because the lowering of said cover shuts off the area of low pressure maintained in housing 11 from open atmosphere so an equal pressure will result from all points towards it; and guidebars 18 hold cover 15 in place on its upward and downward movements, facilitated by spring 19 in drive shaft 8 and plunger 20 and compressed air, intake 22.

Having found that the air also enters centerward behind the speeding blades 10, a stayband 24 with vents 25 therein is provided to help maintain the low pressure in the area between said blades more readily and in Fig. 5 it prevents the air from entering from this direction into sump 26—27.

In construction of rotary vacuum wing or propeller Fig. 8, the blades 10 are fitted between disks 36, the innermost of said blades radiating from a hub 9 as will be seen best in Fig. 10, and the remaining blades are arranged to point centerward, with some of their number to a greater depth; and a drive shaft 8 enters through said disks 36 and hub 9 to which latter it is keyed, and an air intake 37 leads through said drive shaft 8 and hub 9 and is fitted with a shutter 38 to open and to close it, and these make up as a whole the lifting device's rotatable body or air-eliminator; and a stationary housing 11 with vent 14, reflector flanges 12, guideblades 13 and center guide flange 35, surround the said rotatable body or air-eliminator.

Now it will readily be understood that when the air-eliminator is set rotating, the air contained therein between disks 36 is then expelled by blades 10 centrifugally, indicated in Fig. 8 by arrows when air elimination sets in, and indicated by arrows when elimination of air is nearly complete, forming and maintaining in said manner a low pressure in the area between said disks 36, and which area of low pressure is shut off from open atmosphere by the close-fitting lower half of said stationary housing 11, and is left open to free atmosphere on the upper half where the housing 11 extends away from the said air-eliminator, and at which point the exhausting air is split by the said guide flange 35, is kept from whirling by guide blades 13, and is directed by guide flanges 12 to follow a course downward as indicated by arrows in Fig. 9 to exert a pull on the air above the upper half of the housing which is a benefit, thereby leaving intact the atmospheric working pressure under the lower half of the said housing which is most essential.

It may be stated here that the directing of the outflowing air currents, controlled by reflector flange or flanges 12 and guide blades 13, throughout the varying constructions as given by drawings, combined with the rest thereof, incorporates or stands for one of the greatest features of my invention.

The ascending and descending is here governed by vent and shutter 14, or also by the letting of air into the low pressure in the area in air-eliminator through air passage 37, regulated by shutter 38; and in Fig. 11 the device is indicated in place at center of gravity on a conventional type aeroplane.

In construction of lifting device Fig. 12, a hub or centerpart 9 is keyed to a drive shaft 8 and curved blades 10 fitted to said hub with an annular stayband 40 fitted to said blades underneath them close to their outer circumference, the whole of which forms the device's rotatable body or air-eliminator. The arrangement of said blades 10 in this construction follows in curvature that of an Archimedes spiral provided for a uniform spacing from their base to their outer circumference, and which uniform distance between blades 10 is most desirable; and the blades so arranged sweep over sump 26—27 and remove the atmospheric pressure from the air contained therein, which latter will then expand upwards, and is expelled by the moving blades leaving an area of low pressure in said sump in stationary housing 11 open to the surrounding atmosphere on top and shut off therefrom on the bottom. Unlike as in construction of device Fig. 2, in this device the guide blades 13 extend downward to a less depth, and said blades 10 extend here close to the wall of said stationary housing 11 so the outflowing air is forced directly from between said blades up to reflector flange 12. Opening vent 14 Fig. 13 letting air into sump 26—27, thereby lowering the low pressure therein, will regulate the ascending and descending of the craft.

In construction of lifting device Fig. 15 a hub or centerpart is keyed to a drive shaft 8, and blades 10, in quadrant groups, allowing a uniform spacing, are fitted to said centerpart and an annular stayband 40 is fitted, sunken flush, to the upper side of said blades 10 close to their outer circumference, the whole forming the device's rotatable body or air-eliminator. In this construction the air-eliminator blades make close contact with the wall of stationary housing 11, and above make close contact with reflector flange 12, so that when in motion they will force the exhausting air downward between wall housing 11 and wall 43 of sump 26—27 into air chamber 41 causing it to pass out through vents 42, forming in this manner a low pressure in said sump 26—27 that is exposed, open, on top to the surrounding atmosphere and shut off therefrom on the bottom.

Having thus described my invention, it being understood that appropriate changes may be resorted to in its construction without departing from its scope and spirit, what I claim and desire to secure by Letters Patent of the United States is:—

1. A rotary vacuum wing or propeller for use in a fluid medium comprising a rotatable body having a drive shaft, a hub or centerpart keyed to said drive shaft, blades radiating from said centerpart, a stationary housing with a closed bottom and an open top surrounding said rotatable body, said drive shaft entering through said stationary housing's closed bottom, an annular reflector flange encircling inwardly the upper rim of said stationary housing, guide blades arranged extending inwardly from the inner side of the wall of said stationary housing, vents in the wall of the said stationary housing, shutters to open and to close the said vents in the wall of said stationary housing, a shutter or cover for said open top of the said stationary housing, means to operate the said shutter or cover of the said open top of the said stationary housing, and the whole operating in a manner removing mechanically part of the static atmospheric

pressure from one side of a solid and retaining the same intact on the counter side thereof.

2. Device as claimed in claim 1 comprising a stayband surrounding said blades of said rotatable body, vents in said stayband, an annular sump in the said closed bottom of said stationary housing, a vent in the bottom of said sump, a shutter to open and to close said vent of said sump.

3. Device as claimed in claim 1 wherein the rotatable body functions on a vertical plane with blades radiating from its center fitted between two disks, a vent or air intake in said drive shaft, a shutter to open and to close the said vent or air intake in said drive shaft, a stationary housing with its lower half closed at sides and bottom and its upper half open or extending away from the said rotatable body, an annular reflector flange encircling inwardly the outer rim of each side of the upper half of said stationary housing, an annular center guide flange encircling inwardly the upper half of said stationary housing, guide blades between the said center guide flange and the said outer reflector flanges of said stationary housing.

4. Device as claimed in claim 1 comprising curved blades radiating from said hub or centerpart.

5. Device as claimed in claim 1 comprising blades arranged in quadrant groups fitted to said hub or centerpart, guide blades between the wall of said sump and the outer hull of said stationary housing, an air chamber between the bottom of the said sump of said stationary housing and the bottom proper of said stationary housing, an exhaust leading from the said air chamber of said stationary housing.

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