Nov. 19, 1935. E. WARNER 2,021,438

FLYING MACHINE

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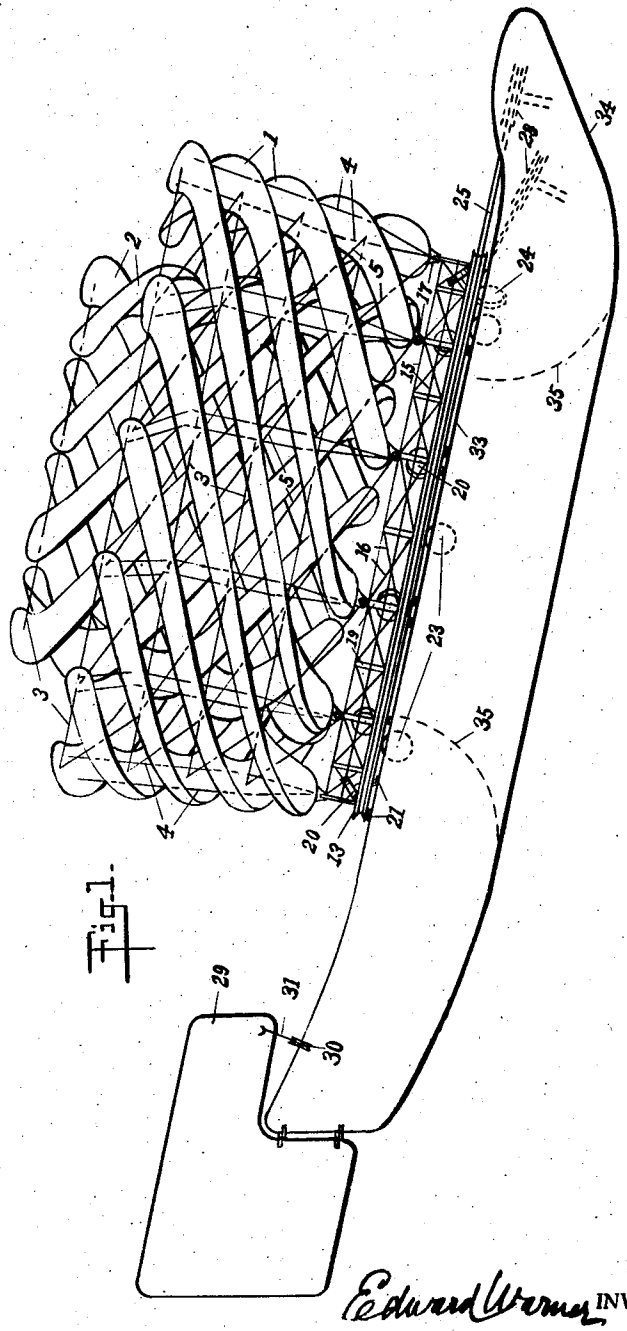



Fig. 1.

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Fig. 3.

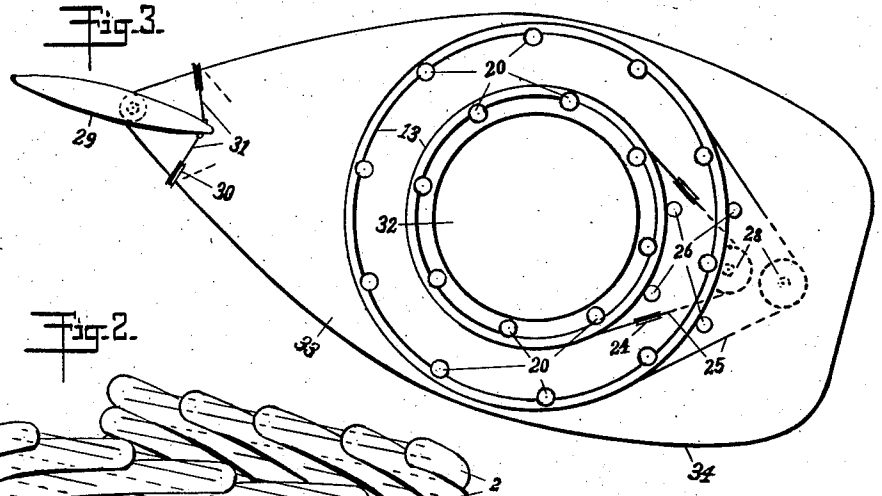



Fig. 2.

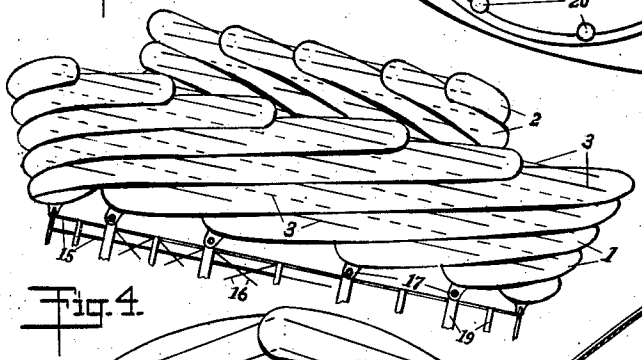
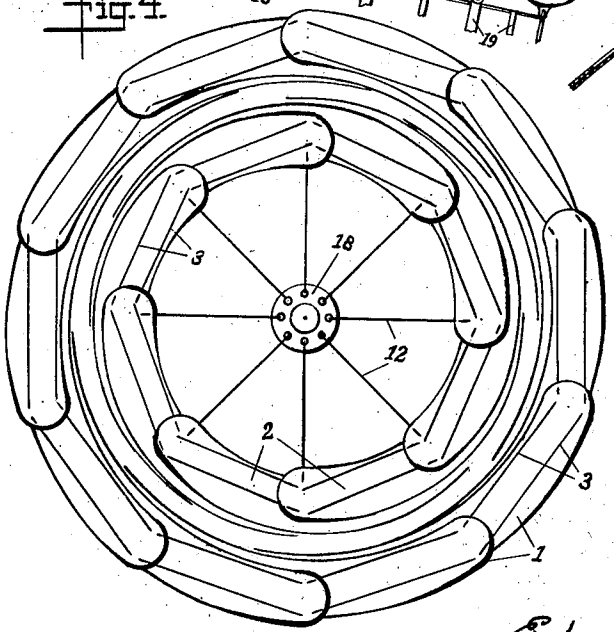



Fig. 4.



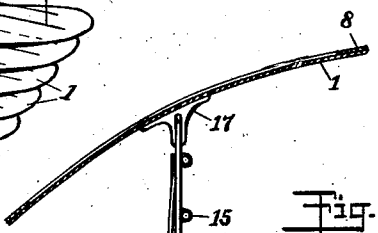
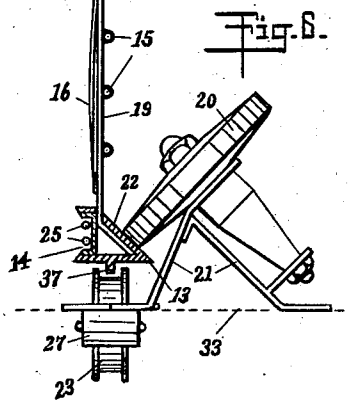




Fig. 6.




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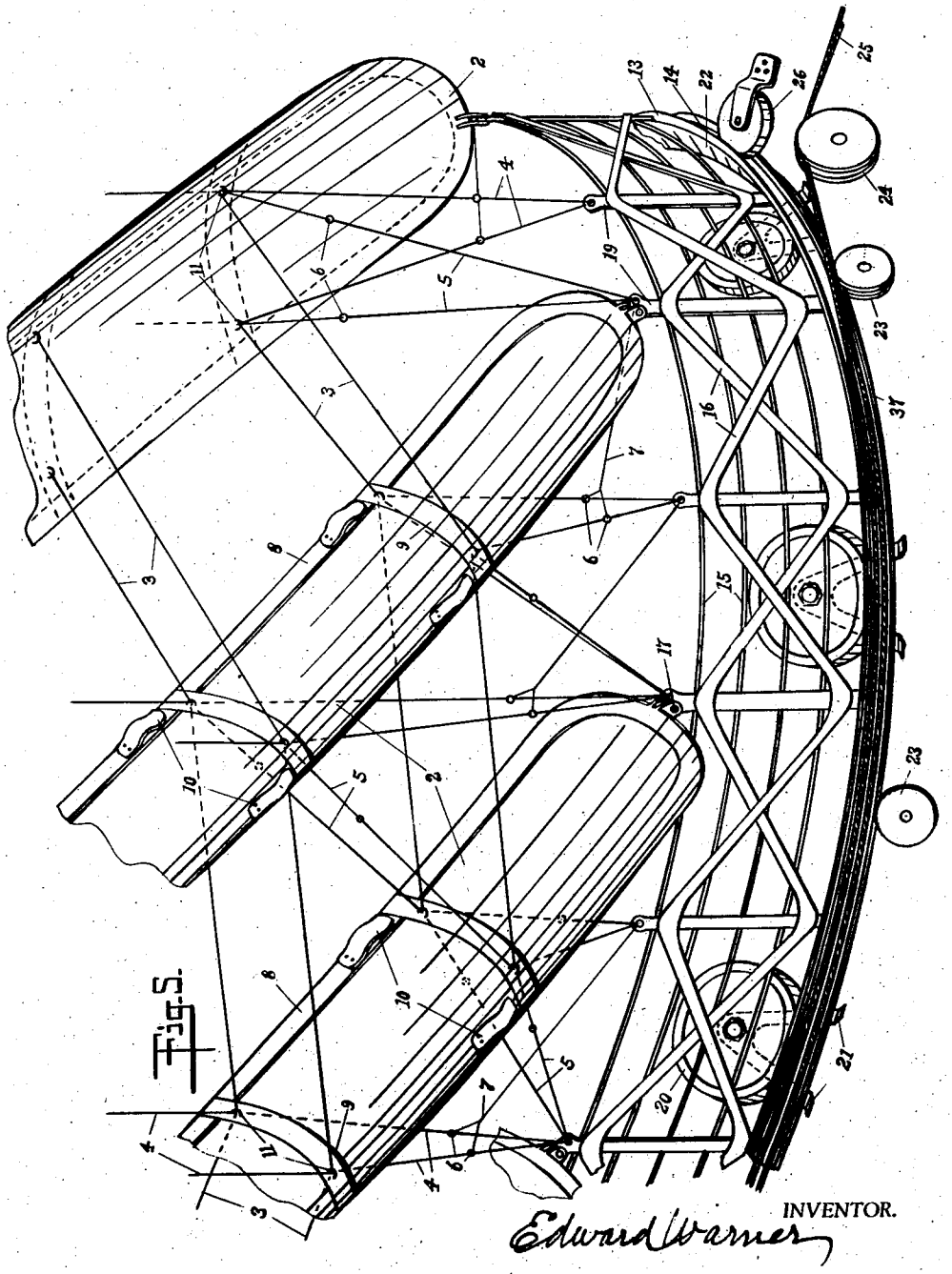



Fig. 5.

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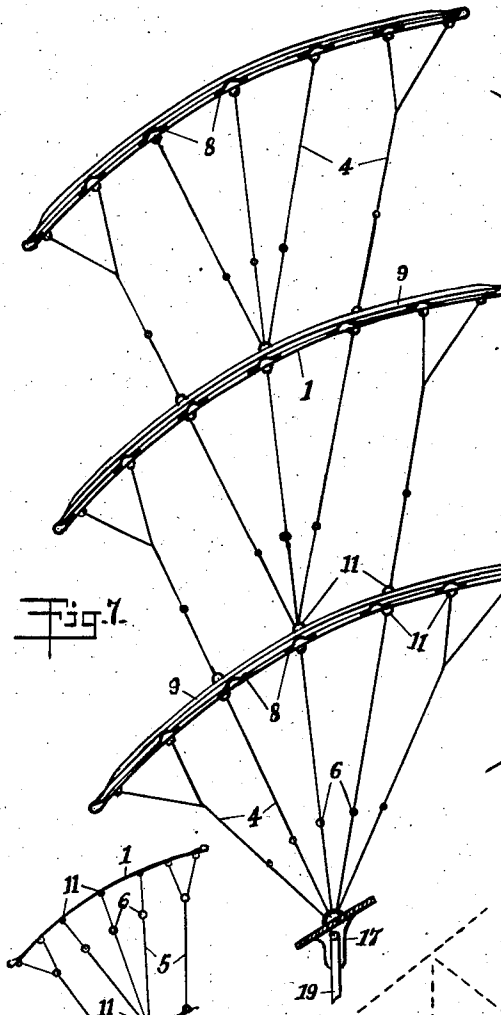



Fig. 7.




Fig. 8.

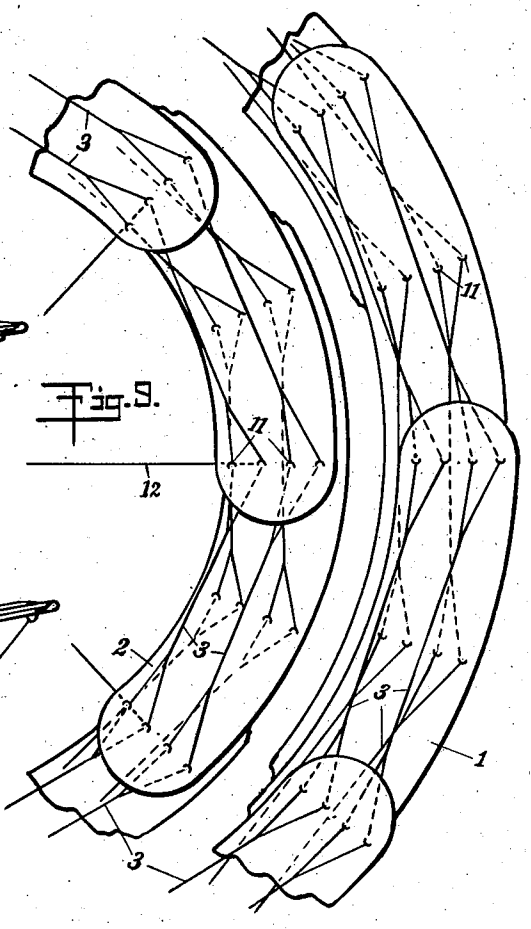



Fig. 9.




Fig. 10.

Edward Warner INVENTOR.

Patented Nov. 19, 1935 2,021,438

# UNITED STATES PATENT OFFICE

2,021,438

## FLYING MACHINE

Edward Warner, Jersey City, N. J.

Application February 7, 1935, Serial No. 5,366

6 Claims. (Cl. 244—19)

This flying machine is of the direct lift character its lifting means being capable also of forward flight; and it is premised on the contention; that engine energy and especially great energy, employed in the production of transportational results through the atmosphere should be exerted directly on a flange on the atmosphere of an area sufficient to translate the said energy into its full transportational potentiality; and, that it requires such adequacy of flange, directly acted on, to so translate it. This implies, the further contention, that this adequacy of flange can be attained only in a structure of large dimensions, capable of dealing with the atmosphere in very large volume. To get this extent of flange, or potential bed on the atmosphere, in this machine, a type of helicopter is employed, that is vertically expandible and collapsible, much like a circular trellis, without central columnar connection. This mechanism is so wide a departure from any hitherto employed for the same purpose, that in order to convey, not only an understanding of its principles, but also a conception of its mechanical solvency and practicability; an empirical construction of the machine will be employed, as an aid in its description. It will, however, not be of a size, as large as it is possible to build on its plan; but one of medium dimensions. Its weight is 90 tons, of which 40 is apportioned, to the helicopters, and 50 to the hull, or marine float, which is at the base of the machine. The said hull is 180 ft. long and 112 ft. wide; straight across at its prow and tapered at its rearward end. A circular opening, which passes down through its center is 84 ft. in diameter. The bases of the helicopters are rings or circular trusses that have grooves at their outer lower margins wherein cable drive belts may run; and at their inner sides they have deflectively bevelled flanges constituting circular treadways; these circular bases are positioned one circumscribing the other on the deck of the hull about the circular opening thereof and centered with the same. Circular runways composed of wheels let into the deck and secured thereto; intervene between the hull and the circular bases; and on these the latter run at their starting; and when they are brought at rest. Other runways made up of brackets secured to and rising from the deck of the hull about the inner margins of the bevelled treadways; and wheels pivoted to them that overlap the said treadways; are the means that connect and interlock the circular bases with the hull in rotative relation thereto.

The lifting planes of the inner helicopter are 11 helical vanes, 9 ft. wide and 100 ft. long that are equally spaced apart and hinged at their lower ends to the inner circular truss. The lower circumference of the inner helicopter is 300 ft. and that at its top is 270 ft.

The helical vanes on the outer truss are mounted the same as those on the inner one but are pitched oppositely to them; they are 14 in number, with a length of 72 ft. by 10 ft. wide, which makes the total sail spread of the helicopters approximately, 20,000 sq. ft. of which each has more or less nearly half. The lower circumference of the outer helicopter is 370 ft. and at its top it is 400 ft.; from this it will be seen that there is an ascensional divergence of the helicopters making the space between them wider at their tops than at their bases; this keeps them from coming in collision in their rotation.

The vanes are deflectively curved to their outer edges; and are made of sheet metal averaging $\frac{1}{20}$ of an inch in thickness and weighing 2 lbs. per sq. ft.; they are made somewhat thinner at their tops and thicker at their bases where the greater stanchness is required.

To further assure their stanchness, they have braces reinforcing them along their length and across their webs; and are held in their symmetrical spiral positions in the helicopters by interconnecting lines that function in three different ways.

The first interconnect them in complete circles, restraining them, circumferentially, which means also, diametrically in planes paralleling their bases. The second interconnect them altitudinally, as suspender lines, which also regulate their angle of incidence and connect them with their circular truss. The last are traction lines that interconnect the vanes obliquely and them with their circular truss; these are effectual also when the vanes function in the air in translating their compression stresses into those of a tensile character which are much more easily borne.

The interconnecting lines, which are employed in sufficient number to give the vanes adequate support; have flexible connections with them, and are adapted to fold in between them in the collapse of the helicopters: these lines, the braces on the vanes, and their circular bases, make up the remainder of the 40 tons apportioned to the weight of the helicopters. The driving power of the latter is applied to them individually by motors of equal power with drive wheels mounted in the forward section of the

hull; cable belts, running in the groove, of the circular base of each of the helicopters, and its respective drive wheel; complete the means of their propulsion in the direction of the pitch of their helical vanes.

The two principles of equal oppositely potential sail spread in the helicopters; energized with equal power completely neutralizes the torsional stress of their motivation.

The circumferential areas of the helicopters are potential in the tridimensional sense; the vanes which are 25 ft. apart on their circular trusses do not crowd each other, and in this way detract from the efficiency of each other; they overlap each other, about ⅔ of their length; and equal in most helicopters, 3 unbroken circles; this, with their width, and their circumferential interconnecting ties, gives coherent circular unity to them and great combined strength. Due to their deflective curvature, the vanes primarily function to attract the air centripetally, and obliquely from the remote surrounding space; their interstices being as aerial entrance ports: secondarily; they subject the air to downward pressure, while it passes through them, into the vacancy at the center of the helicopters; which is, as an exhaust chamber.

The course of the air from their exterior into their interior is continuous, when the posture of the helicopters is vertical, and exert a straight upward lift; when this is the case, the emergence of the air will be mostly downward through the circular opening of the hull; the quantity thereof depending upon the speed of the ascent of the flying machine which in turn is dependent on the speed at which the helicopters are driven. The application of power may be adjusted so as to hold the craft stationary in the air, except as air currents may cause it to drift.

The normal line of the center of gravity of the flying machine is not through the center of the helicopters, but is placed in advance of it by the superweighting of the forward section of the hull and employing it for carriage purposes almost, to the exclusion of the rearward section. It is made larger in cubic area and is stronger built and consequently made heavier than the rearward section for the special purpose of giving the helicopters a forward inclination so that their rise when set in motion will not be straight upward, but in an oblique line forward, which through the increasing momentum of the flying machine, will straighten out to the horizontal. In this condition the centripetal attraction of the air of the rearward sides of the helicopters is negatived; because their vanes thereat are transversely nearly at a level, and these sides become aerial exhaust ports, the vanes exerting only downward pressure on the air passing through them in this section. The factor of momentum in this machine and its capacity of resolving itself into a projectile force is very important. The weight of 80000 lbs. localized in the rims of the helicopters, making them fairly analogous to fly wheels, when given their most efficient momentum represents an amount of stored up energy available for overcoming gravity and the attainment of progressive flight that cannot but have a most efficient resultant, in those objects. The empirical structure here employed, to illustrate this invention can have its parts constructed within their allotted weights. The 50 tons allowed for the hull, which is intended to include machinery, fuel, and all other things necessary to it, is not only ample, but might be made less by reducing its dimensions, if necessary, which will not be the case, as its weight might be considerably increased without overtaxing the helicopters, upon which the entire craft imposes only 9 lbs. per sq. ft. of their flanges, which is far from the limit of their capacity to lift. The helicopters of this machine might more properly be called positive wings. Gyroscopically projected by their great circular bases through the air their helical vanes are raised by the infiltration and pressure of the air, between and beneath them; with the intensification of this air pressure, due to the speed of their travel, the helicopters are fully expanded. Initially, the vanes are 100% projected; when, however, the momentum of their great weight is developed, they are more than 90% drawn, and less than 10% of the power required in their gyration is projectively applied at their hinged connections with their circular bases: the traction and suspender lines, then, do most of the work in their movement; and they tie in the great atmospheric bed on which the flying machine is sustained and suspended. It is an elusive bed, that the vanes, through their suctional and compressive capacity, have been empowered to make for themselves; and the maintainance of which, requires their continued propulsion by the motors. It is in the faculty, to retard the elusiveness of the atmosphere, and to prolong the interval that the air is under pressure by the helical vanes; that the success of the flying machine is determined; and it is this, that the vanes, through their form, dimensions, spacing, and speed, is intended to attain, and conserve.

The helical vanes, may also be compared to kites; and their traction lines to kite strings; while these do not pull in the straight away manner of kite strings; there are elements accompanying their pull that makes it equivalent to straight; and these are the restraint of their circumferential lines, and the centrifugal impulse of the vanes; these offset the amount of centripetal pull there is in their lines. When travelling at their effective speed, the vanes are more swung than projected, in their circuit. This flying machine, is innately adapted to meet all of the needs arising in the work it is designed to do. It is at home in the air; finding its bed in it, and making its way in it. It offers only its edges to the most violent storms; and its planes, turn their currents to useful account. To every attacking current, it makes a more vigorous counter attack; being able to carry engine energy enough to retain its mastery in any situation aloft.

Its structure is semirigid, and tough, and capable of elastically taking every shock. Its progress may be retarded; but it can be built proof against wreckage. It is free from the danger of interior collapse, since all of the impulsions of its helicopters are centrifugal; and proper provision in its interconnecting lines can make it safe, against external disruption.

A description in full detail of this invention is given in the following; wherein reference is made to drawings accompanying this application; which include 10 figures, the parts of which, bear the same numbers, in whichever figure they appear: Fig. 1 is a side view of the flying machine with its helicopters expanded: Fig. 2 shows the helicopters only, in collapsed condition; Fig. 3 is a plan of the deck of the hull with its rudder and the opening through its center: and symbols showing the disposition on the deck of the run-

ways, circular trusses, and drive mechanism: Fig. 4 is a top view of the helicopters and the interconnecting lines holding them in circumferential restraint: Fig. 5 is a fragmentary perspective view of the inner helicopter mounted in its runways: Fig. 6 is a side view of a section of a truss engaged in its runways; that may serve for both helicopters: Fig. 7 is a radial section of a helicopter including its altitudinal interconnecting lines: Fig. 8 illustrates the jointing of the traction lines: Fig. 9 is a fragmentary top view of the helical vanes with circumferential interconnecting lines for those of larger width: and Fig. 10 is a diagram which shows the manner of folding up of the interconnecting lines between the helical vanes. In the drawings above referred to, there has been employed as many lines as would render them intelligible; and where any have been omitted, it has been to conserve this intelligibility.

In Figs. 1 and 3 is shown the hull **34** or float, which is the base of the flying machine, it has an opening **32**, passing down through its center, wherethrough, the inwardly attracted air, that does not issue out at the rear of the helicopters; may pass and escape. This accords to the helicopters greater freedom in, and less resistance to, their intake of the air; and because of the smaller quantity of material that is required in the construction of the machine because of this vacancy, its weight is made less. About the said opening **32** on the deck **33** of the hull **34**; in an inner and an outer circle thereon is sunk and secured the wheels **23** mounted in the frames **27** forming two circular runways upon which the helicopters rest and are initially started in their rotary movement and upon which they roll before they finally come at rest. Upon these runways are imposed; the rings **13** shown in Figs. 3 and 5, which are bases of circular trusses, themselves, the bases of the expandible helicopters. The rings **13** are made hollow, so that they will be fairly rigid, and the truss upper structure of each, is formed by the uprights **19**, whose lower ends are secured to the rings **13**, about which they are, in sufficient number, evenly disposed. The uprights **19** are bound together by a number of other rings **15**, as shown in Figs. 5 and 6, which are secured to them. The rings **15** are made of spring rod; and the whole is given vertical stiffness, by the crossed braces **16**, between the uprights **19**, to the ends of which they are fastened. Laterally these trusses, because of their spring rings **15** have a certain flexibility and resilience that eases the strains that they are subjected to. On their outer rims, each of the rings **13** has a groove **14**; and a bevelled flange **22**, facing upwardly towards its center, forms the inner rim of each of the rings **13**. An upper runway above each of the ones described; against which the helicopters suspendedly and rotatively run are made up of the brackets **21**, see Figs. 5 and 6, that are secured to the deck **33**, of the hull **34**, conveniently adjacent, about the inner circles of the flanges **22**, of the rings **13**, for the wheels **20**, that are pivoted on the brackets **21**, to overlap the flanges **22**, and securely interlock the circular trusses with the hull **34**. A little excess space is allowed between the lower and upper runways so that the rings **13** will run on them alternately; and not be in contact with both of them at the same time. The inversely coned treadways of their circular trusses effectually hold the helicopters true centered or practically true in their rotative movement. On the under face of each of the rings **13** is a lower annular projection **37**, which engage grooves in the wheels **23** for the purpose of arresting any undue rocking of the helicopters in their rotation. The Figs. 5 and 6, are illustrative of both the inner and outer runways.

In Fig. 1, the helical vanes **1** and **2** of the outer and inner expanded helicopters are shown in their opposite spiral relation to each other; with their curvo deflected outer rims; shown also, in Fig. 7. The said vanes, **1** and **2** are hinged at their lower ends at the points **17** to the uprights **19** of the circular trusses; and upon the hinges **17** they rise and fall with perfect freedom; being held in their normal form and positions by interconnecting lines to be referred to hereinafter. Their webs, will in most cases, be made of thin sheet metal the gauge of which may be made gradually thicker on the way from their tops to their lower ends, in order to give greater strength to them, as it is required, approaching their bases. Along their length, the vanes **1** and **2**, are braced by the members **8**, shown in Figs. 5 and 7, these, while differing in form and position serve the same purpose of giving longitudinal strength to the vanes **1** and **2**. The braces **9**, which also reinforce the vanes laterally, occur as frequently as there is need for them. The helical vanes **1** and **2**, may also be made of cotton duck or other woven fabric, reinforced in their length, with spring wire or rod and with cross braces, rendering them suitably rigid for the service required of them. On their upper and under sides the vanes **1** and **2** are provided with the lugs **11**, shown in Figs. 7, 8 and 10, and in these are linked interconnecting lines made either of wire cables or sections of linked wire or rod. There are three types of these lines, and the first are indexed **3**, and are best illustrated in Figs. 4, 5 and 10; their forward ends are flexibly secured in the lugs **11** at the tops of the vanes and their rearward ends in the lugs **11** on their under sides in this manner forming mechanical chords of polygons; distributed along the length of the vanes as frequently as necessary; parallel with the circular bases of the helicopters. The lines **3** hold the vanes **1** and **2** in circumferential restraint, which is, in effect also diametral restraint. Two other types of suspender and traction lines, numbered respectively, **4** and **5**, interconnect the vanes **1** and **2** altitudinally and obliquely and likewise, the vanes of a helicopter, with its circular truss; these lines also regulate the angle of incidence and the deflexion of the rims of the vanes. The lines **4** and **5**, when made of single wires or rods, are in sections having two parts that are linked together in order that they may fold in between the vanes and in consonance with them in their collapse. These joints are indicated by the small circles marked **6**. The shorter parts of the sections **4** are at their lower ends, as shown, in Figs. 7 and 10, and in the case of the sections **5**, they are at their upper ends, as shown in Fig. 8. In the diagram, Fig. 10, is shown how the vanes and their interconnecting lines interfold together upon their truss in the collapse of the helicopters.

The inner helicopter is diametrally restrained by the lines **12**, see Fig. 4, that radiate from the center piece **18** and have their outer ends secured to the vanes **2** near the tops of the same. The lines **3** show a difference in style in Figs. 4 and 9, that of the latter being adapted for use on vanes of the larger widths. On the upper sides of the vanes **1** and **2** cushions **10** are appropriately positioned and secured to deaden the contact of their collapse and to hold them apart the space required by the interconnecting line when

folded between them. The helicopters may vary in the number and the dimensions of their vanes, but their total area will be substantially equal in each. When expanded, they describe conic frustums, the inner one receding toward its top and the outer one expanding in a flare at its top. This widens the space between them at their upper bases and insures their safety against collision in their opposite rotation.

A drive wheel on a shaft **28**, to which equal motive power is applied, is mounted in the forward part of the hull **34**, for each of the helicopters, see Figs. 1 and 3. These are connected with their respective helicopters by the cable belts **25**, the latter running in the grooves **14** of the circular trusses. The belt **25** of the inner helicopter, which must run beneath the outer one to connect with its drive wheel **28**, does so by running deflectively over the wheels **24** that are suitably mounted in the hull **34** for that purpose. The wheels **26**, mounted on the deck **33** to bear against the rings **13** in their grooves **14** at the forward sections of their circuits, serve to counteract the belts **25** from pulling the helicopters in their rotation out of their true courses. This invention lies in its novel combination of engineering principles and methods. They are applicable to small sized craft and to craft of expanded dimensions adapted to meet the requirements for the largest flying machines. Where so great a range in size is liable some latitude in adaptation of the minor parts of this machine will be permissible that do not transcend the spirit of this invention. The claims made with reference to this invention herewith follow.

I claim:

1. A flying machine, comprising two expandible and collapsible helicopters, one circumscribing the other and mounted to rotate oppositely of each other, describing when expanded conic frustums, the inner one having its larger base and the outer one its smaller base at the bottom, each helicopter composed of a ring or circular truss with a groove at its lower outer edge and a bevelled flange facing centrally upwards at its lower inner edge, a plurality of helical vanes deflectively curved to their outer edges hinged at their lower ends to the circular truss equally spaced apart and spirally pitched in the direction of the movement of its circular truss, latitudinal lines flexibly and circumferentially interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the helical vanes and the latter with the truss, the said altitudinal and oblique lines consisting of sections in two parts jointed together, that fold in between the vanes, and the truss and them with the collapse of the helicopters, a hull or marine float with a circular opening passing down through it, centered with the said circular opening, an inner and an outer circular runway each composed of wheels secured to the deck of the said hull, the trusses of the inner and outer helicopters respectively imposed on the inner and outer of the said runways to rotate thereon, secured to the deck of the hull to coincide with each of the said runways, an upwardly extending runway, each including wheels overlapping the bevelled flanges of its surrounding truss and securely interlocking the same with the hull, secured in the forward part of the hull power and drive mechanism for each helicopter, drive belts running in the aforementioned grooves of the circular trusses and connecting each with its respective drive mechanism, wheels suitably mounted on the deck of the hull to bear on each of the circular trusses to counteract the pull of their drive belts, a rudder hinged at the rearward end of the hull with means on and in the same for its operation.

2. In a flying machine, two expandible and collapsible helicopters, one of them circumscribing the other and mounted to rotate oppositely of each other about a common center, each composed of a ring or circular base, a plurality of helical vanes equally spaced apart about the said circular base spirally pitched in the direction of its movement and hinged at their lower ends thereto, lines circumferentially and flexibly interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the helical vanes and the latter with the circular base, the said lines being adapted to fold in between the said vanes in the collapse of the helicopters, a hull or marine float with a circular opening passing down through it, means at the base of each of the circular bases of the helicopters connecting them in rotatable relation with the deck of the said hull about the circular opening thereof, secured in the forward section of the hull motor means for each helicopter, drive belts suitably engaging and connecting each of the circular bases of the helicopters with its respective motor means, wheels bearing on each of the circular bases to counteract the pull of its drive belt suitably secured to the deck of the hull, a rudder hinged at the rearward end of the hull with means on and in the hull for controlling the same.

3. In a flying machine, two expandible and collapsible helicopters, one of them circumscribing the other, and mounted to rotate oppositely of each other, each of them composed of a circular truss with a lower ring, with a grooved outer rim and with an inner bevelled rim facing upwardly toward its center, a plurality of uprights equidistant apart secured to the said ring, two or more other rings that divide the upper lengths of the said uprights and are secured to them, crossed struts interconnecting the uprights and giving rigidity to the truss, a plurality of helical vanes equally spaced apart hinged at their lower ends to the circular truss and spirally disposed in the direction of its movement, lines circumferentially and flexibly interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the said helical vanes and likewise them and the truss, means whereby the said interconnecting lines may fold in between the helical vanes with the collapse of the helicopters, a hull or marine float with a circular opening passing down through it, centered with the said circular opening and positioned round about it an inner and an outer circular runway, each composed of wheels secured to the deck of the said hull, the trusses of the inner and outer helicopters respectively imposed on the inner and the outer of the said runways to rotate thereon, secured on the deck of the hull coinciding with each of the said runways an upwardly extending runway each including wheels overlapping the bevelled inner rim of its surrounding circular truss and securely interlocking the same, mounted in the forward section of the hull motors with drive wheel for each of the helicopters, drive belts runnning in the aforenamed grooves of the circular trusses and

connecting each with its respective drive wheel, wheels mounted on the deck of the hull and bearing on the circular trusses to counteract the pull of the drive belts, a rudder hinged at the rearward end of the hull with means on and in the hull for operating the same.

4. In a flying machine, an expandible and collapsible lifting structure, composed of a ring or circular base, a plurality of helical vanes deflectively curved to their outer edges spirally disposed and equally spaced apart and hinged at their lower ends to the said circular base, lines circumferentially and flexibly interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the helical vanes and the latter with the circular base, the said lines consisting of sections in two parts jointed together that fold in between the vanes and the circular base and them with the collapse of the lifting structure, cushions affixed to the upper sides of the helical vanes to moderate the impact in their collapse, a lower carrying structure, roller means intervening between the said carrying structure and the circular base connecting them together and giving to the latter a rotatable relation to the former, mounted in the forward part of the carrying structure motor and drive mechanism, belts suitably connecting said drive mechanism with the circular base, means neutralizing the operative torsion in the flying machine, a rudder hinged at the rearward end of the carrying structure, with means in the same for operating the said rudder.

5. In a flying machine, an expandible and collapsible helicopter, composed of a ring or circular base, a plurality of helical vanes deflectively curved to their outer edges, with their webs made of thin sheet metal reinforced with longitudinal and lateral braces, the said helical vanes hinged at their lower ends to the circular base equally spaced apart, lines circumferentially and flexibly interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the helical vanes and the latter with the circular base, the said lines consisting of sections in two parts jointed together that fold in between the vanes, and the circular base and them, with the collapse of the helicopter, cushions affixed to the upper sides of the helical vanes to moderate the impact of their collapse, a lower carrying structure, roller means intervening between the said carrying structure and the circular base connecting them together and investing the latter with a rotatable relation to the former, mounted in the carrying structure motor and drive mechanism providing rotary movement to the circular base and the helicopter, means neutralizing the operative torsion in the flying machine, a rudder hinged at the rearward end of the carrying structure with means in the same for operating the said rudder.

6. In a flying machine, an expandible and collapsible helicopter composed of a plurality of helical vanes deflectively curved to their outer edges rising spirally and equally spaced apart in a circle and hingedly connected to a circular structure at their lower ends, lines flexibly and circumferentially interconnecting the said helical vanes with the necessary frequency, altitudinal lines and oblique lines flexibly interconnecting with the necessary frequency the helical vanes and the latter with the said circular structure, all of the interconnecting lines adapted to fold in between the helical vanes in their collapse, a lower carrying structure, roller means intervening between the said carrying structure and the circular structure at the base of the helical vanes connecting it to and investing it with a rotatable relation to the carrying structure, means for the rotative propulsion of the helicopter, means neutralizing the torsion in the propulsion of the helicopter.

EDWARD WARNER.