G. D. S. REECE.

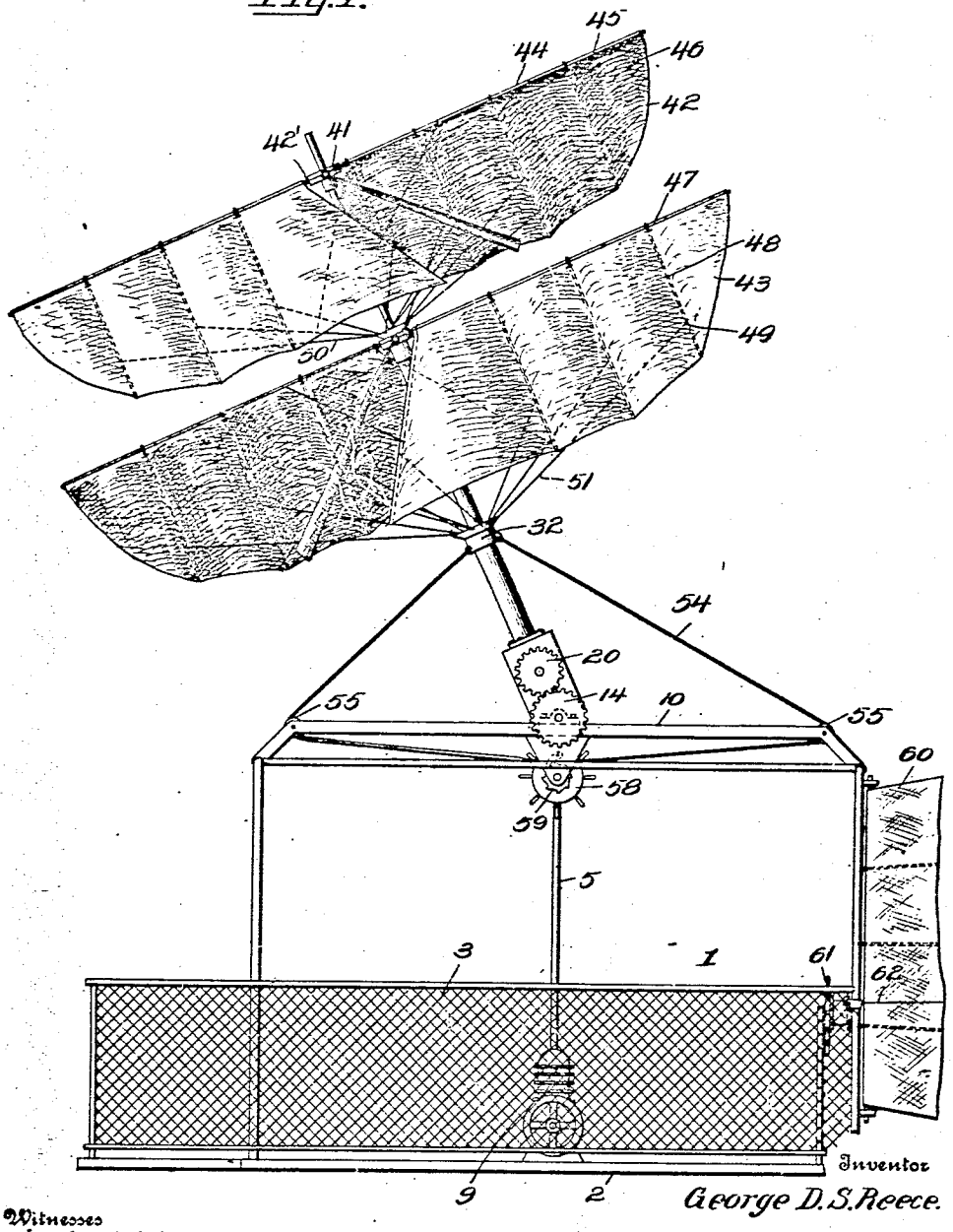
AIRSHIP.

APPLICATION FILED JUNE 10, 1908.

962,386. Patented June 21, 1910.

4 SHEETS—SHEET 1.

Fig. 1.




Witnesses

F. L. Gibson.

E. W. Gould.

Inventor

George D. S. Reece.

By Victor J. Evans

Attorney

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4 SHEETS—SHEET 2.

Fig. 2.

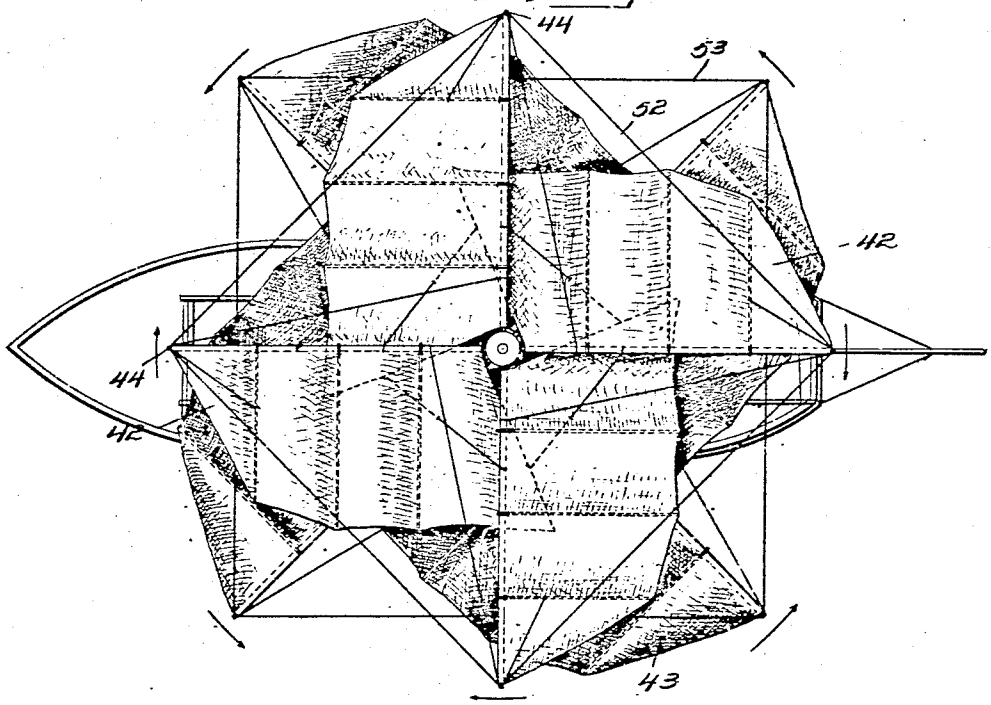
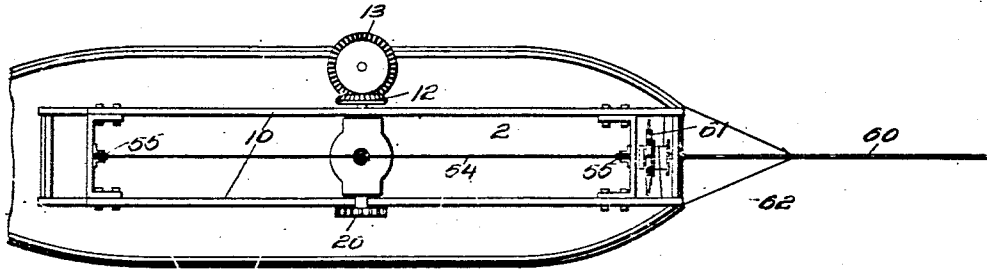



Fig. 3.




Inventor
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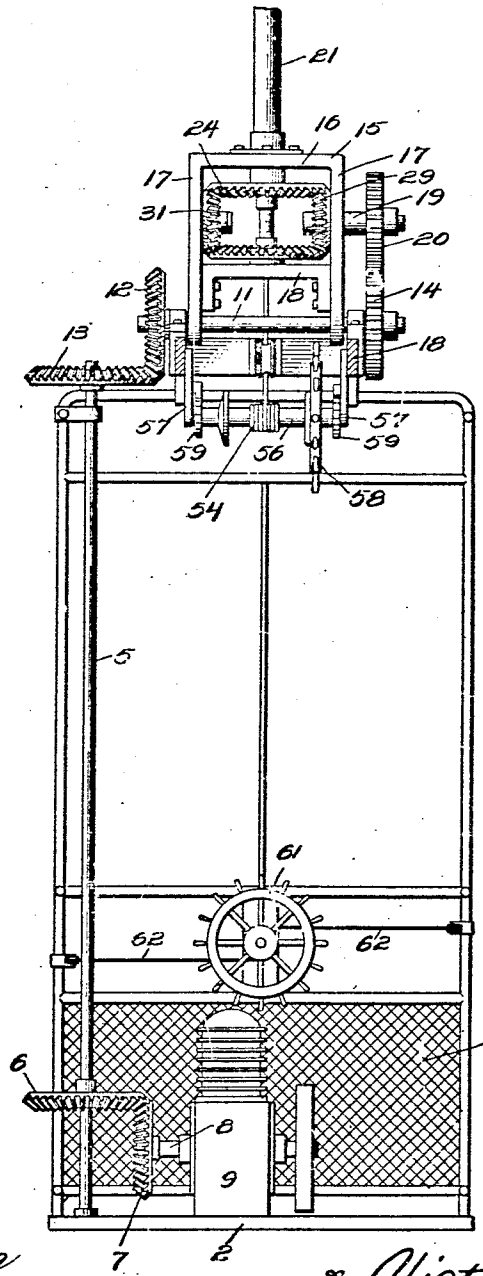
4 SHEETS—SHEET 3.

Fig. 4.

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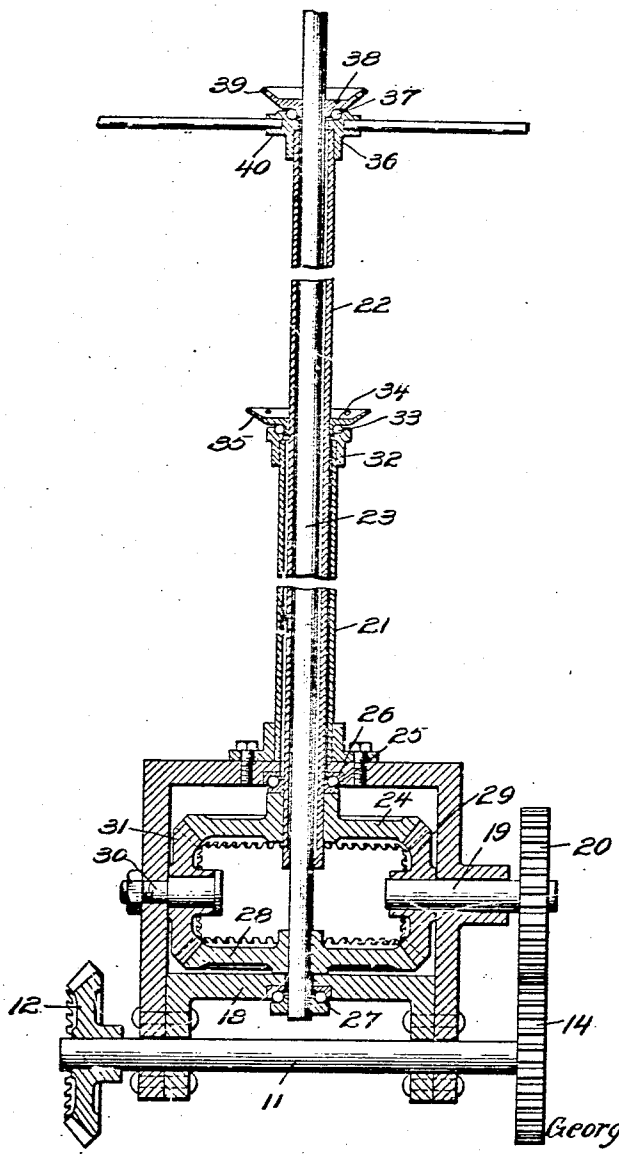
4 SHEETS—SHEET 4.

Fig. 5.

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Attorney

# UNITED STATES PATENT OFFICE.

GEORGE D. S. REECE, OF ST. LOUIS, MISSOURI

## AIRSHIP.

962,386. Specification of Letters Patent. Patented June 21, 1910.

Application filed June 10, 1903. Serial No. 437,739.

*To all whom it may concern:*

Be it known that I, GEORGE D. S. REECE, a citizen of the United States, residing at St. Louis, State of Missouri, have invented new and useful Improvements in Airships, of which the following is a specification.

The invention relates to an improvement in airships of the aeroplane type, and is particularly directed toward propelling and elevating means in the use of which the airship may be elevated to any desired degree and propelled or caused to travel in any desired direction.

The main object of the present invention is the production of propelling mechanism comprising independent sets of wings arranged in superimposed relation and operated in different directions by a suitable motor, the upper or directing set of wings being utilized to force the air current into contact with the underside or surface of the power or lower set of wings, whereby to materially increase the effect of said power wings.

The invention will be described in the following specification, reference being had particularly to the accompanying drawings, in which:—

Figure 1 is a view in elevation of my improved airship. Fig. 2 is a plan of the same. Fig. 3 is a section on line 3—3 of Fig. 1. Fig. 4 is an enlarged end elevation of the car and wing operating mechanism, one end of the car being removed. Fig. 5 is a vertical sectional view illustrating the construction whereby the respective sets of wings are driven in reverse directions.

The present invention is directed more particularly to the particular construction and arrangement of the directing wings and power wings, and in connection with this salient feature of the invention I have devised a simple means for operating the respective sets of wings in the reverse direction and for manually adjusting both sets of wings to vary their angular inclination relative to the car at will, whereby the power may be utilized to elevate the car in a direct line or to propel it in any direction from said direct line of elevation.

Referring particularly to the drawings my improved airship comprises a car 1, preferably of oval skeleton construction and made up of a series of interconnected light rigid rods. The relatively lower portion of the car is suitably inclosed by a bottom platform 2 and side and end walls 3 and 4, the former being preferably of solid construction while the latter are of wire cloth or similar openwork construction to provide desired lightness and avoid undue resistance to the air.

The power shaft 5 is arranged vertically within the car, being preferably positioned adjacent to and about midlength of one of the side walls 3, said shaft being mounted for rotation in suitable bearings fixed to appropriate parts of the car structure. Near the lower end the power shaft 5 is provided with a bevel gear 6, which intermeshes with and is directly driven by a power gear 7 fixed on a motor shaft 8 driven by a motor, as a gas engine 9, supported on the platform 2.

Arranged above and secured to the relatively upper part of the car 1 is an auxiliary frame structure 10, which is of a character and strength to properly support the operating mechanism to be described. Mounted in bearings alined transversely and centrally of the frame 10 is a drive shaft 11, which extends at one end beyond the adjacent portion of the frame 10 and is provided with a bevel gear 12 arranged to mesh at all times with a gear 13 fixed on the upper end of the power shaft 5. The opposite end of the drive shaft also projects beyond the adjacent portion of the frame 10 and is provided with a gear 14, for a purpose which will presently appear. A wing carrying frame 15 is mounted for independent pivotal movement on the drive shaft 11, said frame comprising an inverted U-shaped structure including an upper cross bar 16 and depending spaced arms 17, the lower ends of which arms are formed with openings to permit the passage of the drive shaft 11 by means of which the wing frame 15 is pivotally supported on the drive shaft.

Above the drive shaft the arms 17 of the wing frame are connected by a transverse brace 18, and above said brace one of the arms is formed with a bearing to receive a shaft 19 arranged transversely of the arm and carrying at its outer end beyond the arm a gear 20 arranged to mesh with the gear 14 of the drive shaft. Secured to and extending above the cross bar 16 of the wing frame is a tubular standard or upright 21, which is designed to guide and support the respective shafts for the wings. Disposed within the standard 21 is a tubu-

lar shaft 22 adapted to carry the drive wings, and hereinafter termed the drive-wing shaft, and arranged within the shaft 22 is a solid or rod-like shaft 23, designed to carry the directing wings, and hereinafter termed the directing-wing shaft. The drive-wing shaft 22 extends below the cross bar 16, projecting through an opening therein, and is terminally provided within the plane of the wing-frame with a bevel gear 24, the hub of the gear being provided adjacent the cross bar 16 with one member, as a cone 25, of a ball bearing. The relatively lower surface of the cross bar 16 is provided with the opposing member, as a cup 26, of the ball bearing, the usual balls being employed between said members to provide for free rotation of the drive-wing shaft. The directing-wing shaft 23 extends below the lower end of the drive-wing shaft 22, being supported at its lower end in the brace bar 18, and provided in connection with said brace bar with a ball bearing 27 including the usual parts. Immediately above the brace bar 18 the directing-wing shaft is provided with a bevel gear 28 similar in all respects to the gear 24 and arranged in opposition thereto, as clearly shown in Fig. 5. The shaft 19 mounted in one side bar 17 of the wing frame is provided on its inner end with a bevel gear 29 disposed between and arranged to at all times intermesh with the teeth of both the gears 24 and 28. The remaining arm 17 of the wing frame is provided with a stub shaft 30, on which is fixed a bevel gear 31, arranged to mesh with the gears 24 and 28 diametrically opposite the engagement of the gear 29 with said gears 24 and 28.

By the construction described it will be obvious that the gear 29, which is positively driven from the drive shaft 11 through the intermeshing gears 14 and 20, will operate to drive the gears 24 and 28 in relatively reverse directions, thereby imparting similar reverse movement to the respective wing shafts 22 and 23.

The upper end of the upright 21 is provided with a cap 32, formed in its upper surface to provide a cup member of a ball bearing to receive balls 33. The coöperating member of the ball bearing, as 34, is carried by the drive-wing shaft 22 and is further formed with an annular upwardly inclined edge flange 35 for a purpose which will presently appear. The upper end of the tubular drive shaft 22 is provided with a cap member 36, forming the cup section of a ball bearing to receive balls 37, the coöperating member of said bearing, as 38, being secured to the directing wing shaft 23, the member 38 being formed with an annular upwardly inclined edge flange 39 similar to the edge flange 35 of member 34. The cap member 36 is formed with a series of radiating socketed studs 40, and the relatively upper end of the directing wing shaft 23 is also provided with a cap member 41 having a series of socketed studs 42', the cap members 36 and 41 being practically identical.

The wing shaft 23 carries at the upper end a series of wings 42, hereinafter termed the directing wings, while the wing shaft 22 carries a series of wings 43 which will be hereinafter termed the propelling or drive wings.

The directing wings, of which there are preferably four in number, are of duplicate construction each comprising a frame including a rod 44, one terminal of which is seated in one of the sockets 42, and a series of bars 45 connected to and extending laterally from the rod 44. The frame thus provided is covered with suitable wing material, which, for the purposes of the invention, should combine lightness with the quality of resisting the passage of air, being preferably silk, as shown at 46.

The drive wings 43 are similar in construction to the directing wings, each comprising a rod 47 seated in one of the socket studs 40 and a series of arms 48 projecting laterally from the rod, the frame thus provided being covered by silk or other material, as at 49.

The respective directing wings are supported in the socketed studs so that the wings depend from the rod 44, the drive wings being similarly disposed in the socketed studs 40. The drive wings are of greater length and width than the directing wings and the lower edges of the latter are so spaced from the upper edges of the former as to just provide the necessary clearance in operation. The directing wings are each disposed at an angle to the plane of the wing shaft 23, approximately fifty-five degrees from the horizontal, while the drive wings are disposed at approximately the same or slightly less degree of angular relation, the angular relation of the respective sets of wings being, of course, relatively reversed with the inclination of each wing corresponding to the direction of movement of the respective sets of wings. To maintain the wings at the desired angular relation tie wires 50 unite the frame members of the respective directing wings to the flange 39 of the member 38 of the upper ball bearing, tie wires 51 similarly uniting frame members of the respective drive wings to the flange 35 of the member 34 of the lower ball bearing. The free terminals of the arms 44 of the directing wings are connected by tie wires 52, similar tie wires 53 uniting the free terminals of the rod of the drive wing frames. By means of these tie wires the respective wing frames are held in desired relative positions, it being understood that

I contemplate the use of additional tie wires should such be found necessary.

From the construction and operation of the wings described, it will be understood that the angular disposition of the direction wings will force a current of air to and into contact with the relatively lower surfaces of the drive wings, and thereby add materially to the lifting power of said drive wings. The directing wings thus create a force of air pressure which is directed against and beneath the drive wings, so that the directing wings tend to materially reinforce the power exerted by the drive wings by virtue of the pressure created by the directing wings which is so utilized as to tend in itself to exert a lifting power beneath the drive wings. In connection with this arrangement of the respective sets of wings, it is to be noted that the arm of each wing frame located immediately adjacent the shaft supporting the wing inclines toward and terminates beyond the respective shafts in a direction in opposition to the projection of the main rod of the frame carrying the wing. By this means an open space at the juncture of the wings with the supporting shaft is avoided, and the creation of a cross current obviated.

In addition to forcing the air against the drive wings, the movement of the directing wings tends to create a partial vacuum above the wings, thereby causing an air pressure toward the center of the wings from below, which acts to increase the lifting force of the wings.

The movement of the wing frame 15 is controlled through a cable 54 having its terminals connected to the cap member 32 and projected in opposite directions from said member to and around rollers 55 supported at the respective ends of the frame 10, the cable being beyond said rollers coiled about a drum 56 supported in hangers 57 depending from the frame 10. A hand wheel 58 for operating the drum and a pawl and ratchet mechanism 59 for maintaining the drum in adjusted position are provided, in the use of which hand wheel it will be obvious that the wing frame 15, and, therefore, the wing shafts and wings may be given any angular relation to the car, so that the force of the wings may be directed to propel the car in any desired direction through obvious appropriate adjustment. The car is also provided with a rudder 60 and with manually operable means, as a hand wheel 61 and cable 62 for directing the rudder as desired.

The particular material of which the wings are constructed is not of essential importance in the present invention, and it is to be further understood that the angular relations of the respective wings, either with regard to each other or with regard to their supporting shafts is to be in such degree as will best suit the particular conditions, the sole requirement being that the air pressure created by the directing wings must be forced against the under surfaces of the drive wings.

Having thus described the invention what is claimed as new, is:—

1. An airship including a set of wings, a shaft therefor, and means for operating the shaft, each of said wings comprising a frame including a rod radiating from the shaft and a series of arms projecting from the rod, and a covering for the frame, the arm depending from the rod adjacent the shaft inclining toward and beyond the shaft in opposition to the direction of projection of the rod, whereby the wing covering extends in both directions beyond the shaft.

2. An airship including a shaft, and a plurality of wings arranged in the same horizontal plane thereon, each of said wings including a rod projected at right angles from the shaft and a series of arms depending from the rod, a covering for the frame including the rod and arms, and connections between the arms and shaft below the rod, the arm of each frame immediately adjacent the shaft inclining rearwardly toward the free end of the rod of the diametrically opposed wings, whereby the rear portion of the wing covering vertically underlies the next adjacent wing.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE D. S. REECE.

Witnesses:

EDWARD E. AYER,

CORA SMITH.