F. W. SCHROEDER.

AERIAL SHIP.

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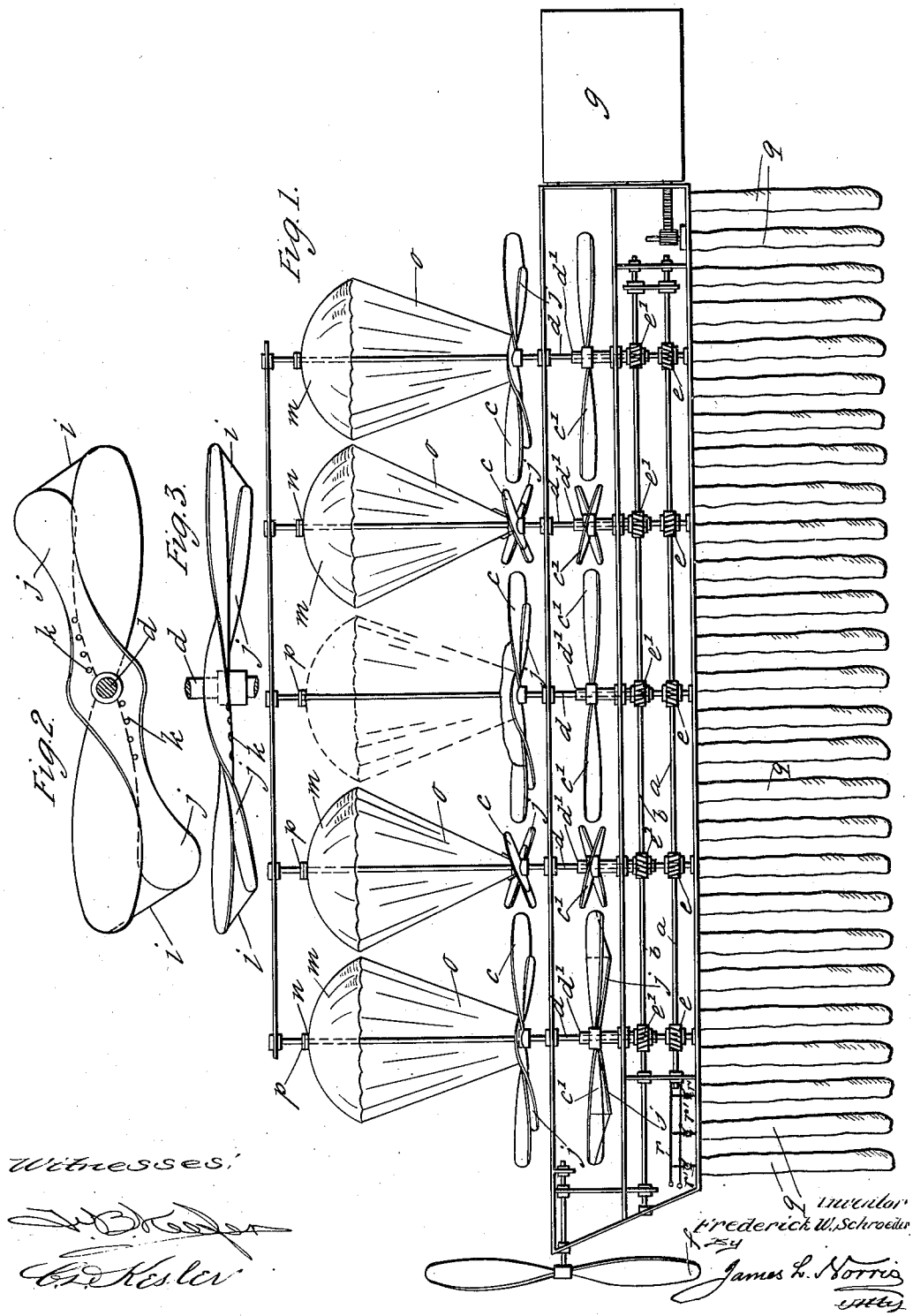
959,266. Patented May 24, 1910.



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AERIAL SHIP.

959,266. Specification of Letters Patent. Patented May 24, 1910.

Application filed November 4, 1909. Serial No. 526,242.

To all whom it may concern:

Be it known that I, FREDERICK WILLIAM SCHROEDER, a subject of the King of Great Britain, residing at 28 The Oval, Kennington, in the county of London, England, engineer, have invented certain new and useful Improvements in Aerial Ships, of which the following is a specification.

This invention relates to the air ships in which the lifting power of airships is supplied by a series of rotating air vanes, propellers or helicopters which are mounted in one or more rows, longitudinally of the ship, and in pairs to rotate in opposite directions about a common vertical axis, but according to this invention the direction of rotation of successive pairs is arranged to alternate so as to neutralize any horizontal turning movements that may be applied to the hull of the ship by the rotation of the vertical shafts and helicopters. Successive vertical shafts may be placed a distance apart equal to the diameter of the helicopters or they may be placed at a less distance apart and at the same level, in which case corresponding helicopters on adjacent shafts will be oriented relatively to each other so that horizontally adjacent blades rotating in opposite directions may clear each other in rotating. One convenient method of driving the helicopters or lifting propellers in the required manner is by two oppositely rotating longitudinal shafts driven by a suitable motor or motors. One of the two driving shafts may be arranged to drive all the lower helicopters with oppositely cut worm gear on successive shafts, while the other driving shaft is similarly geared with the upper helicopter shafts. The shafts are suitably guyed and braced to each other and to the frame of the hull and the helicopters may be provided with reinforcing arms extending outwardly below the blades, the tips of which are braced or tied to the ends of these arms. These arms may themselves be in the form of smaller subsidiary blades lying across the main blades at a small angle and rigidly connected therewith along their inner portions. In the case of the upper helicopters these inner portions of the reinforcing blades are formed to receive collapsed parachutes of suitable shape, the upper ends of which are attached to rings which slide on the vertical shafts. These parachutes are designed to check the speed of the descent in the event of an accident or stoppage of the motor by the air rushing into them through holes provided in the inner parts of the blades for this purpose and expanding the envelop, the rings on the upper ends sliding up to the top of the shafts where they are arrested by a cap or collar. The collapsed and folded parachutes may be secured on the top of the upper helicopters by a suitable spring catch which engages the parachute rings and are adapted to yield under any considerable upwardly acting force, and by a number of bunt-lines or the like securing the parachute to the helicopter and adapted to fetch away under any considerable upwardly acting force.

The means provided for propelling the vessel horizontally are of the ordinary character and may consist of a stern propeller or propellers or of a forward propeller or propellers or of both kinds.

To provide against undue shock on impact with ground the hull is provided on its underside with a series of compressed air cushions or equivalent pneumatic or other elastic check.

In the accompanying drawings Figure 1 is a general view of an airship constructed according to the present invention, and Figs. 2 and 3 are a plan view and an elevation on an enlarged scale of one of the lifting propellers or helicopters, the blades of which are designed for right-handed rotation viewed from above.

As therein illustrated, the longitudinal shafts *a*, *b* are both rotated at the same speed and in the same direction through suitable gearing from the main engine which is not shown in the drawing. Five pairs of helicopters are shown ranged in a line, the upper row *c* of helicopters being fixed on the five vertical shafts *d* which are driven through worm gearing *e* from the longitudinal shaft *a*, the worms and worm wheels being cut so that successive vertical shafts are rotated in opposite directions. The lower helicopters *c'* are fixed on vertical tubular shafts *d'* encircling the shafts *d* and driven from the other longitudinal shaft *b* through worm gearing *e'* which is cut so that each of the shafts *d'* rotates in the direction opposite to the direction of rotation of the shaft *d* on which it is mounted. Suitable ball bearings are interposed between the shafts *d*, *d'*, and both sets of shafts are also provided with suitable thrust bearings carried by the frame of the ma-

chine. The shafts *d d'* may be at a distance apart equal to the full diameter of the helicopters so that these may be rotated as described without necessarily being in any definite phase relation, or they may be spaced as shown, in which case the phases of the helicopters on successive shafts differ by 90° so as to enable the vanes to clear each other.

Any suitable motor may be used to drive the helicopters and the same or a separate motor to drive the propeller *f*. In the drawings the propeller *f* is geared to one of the horizontal shafts, but preferably it would be driven either by a separate motor or else geared to the same motor as the helicopters but in such manner that the speeds of the propeller and the helicopters may be varied independently. The altitude of the machine is primarily varied or maintained constant by rotating the helicopters at an appropriate speed, although tilting aeroplanes or elevating rudders of known construction may be used to supplement the action of the helicopters. As shown in the drawing a single stern propeller *f* and a bow steering rudder *g* are fitted, but these may obviously be transposed or duplicated.

As shown more particularly in Figs. 2 and 3, the helicopters are of the character of two blade propellers, the blades of the various helicopters being set, according to the direction of rotation of the shafts on which they are mounted, to tend to lift the machine when they are rotated. The blades are of any suitable construction and material, and being preferably as light as possible they are tied against upward flexure by tension wires *i* or the like connecting the blades with a stiff bar or yard *j* lying below and across the main blades at a small angle and rotating therewith. The ends of these yards are shaped as auxiliary lifting vanes and the central portions of the main and auxiliary blades are in the case of the upper helicopters dished or otherwise shaped to accommodate the collapsed parachutes. Holes *k* in this central portion are provided to enable the air, when the machine begins to descend at any considerable speed, to rush into the parachutes, causing the retaining devices previously mentioned to break away or yield so as to enable the parachutes to expand as shown at *m* in Fig. 1. As therein shown the parachutes *m* are fitted with central openings or rings *n* which slide on vertical poles which are preferably extensions of the shafts *d* when as shown the cords *o* of the parachute are attached to the central portion of the helicopter. A stop *p* on the vertical shafts arrests the rings *n* at the appropriate points. The poles or shafts are suitably guyed or otherwise braced to the frame of the machine.

Carried below the frame of the machine is a series of cushions consisting of a great number of tubes *q* made of balloon or other suitable light and impervious material, which tubes, when inflated with air or other gas, serve to reduce shock on impact with the ground and when filled with a gas lighter than air give a certain buoyancy to the apparatus. These tubes vertically disposed are arranged in longitudinal rows and are filled with gas from correspondingly placed distributing pipes *r*, the branch pipes *r'* to each bag being provided with a suitable valve or stop cock. These valves may be arranged to be opened or closed simultaneously or in groups by any suitable mechanism which can be operated from the driving or steering platform. The tubes are of sufficient length to be effective on uneven ground or for an uneven keel in coming to ground.

I am aware that it has been proposed to provide beneath the car of air machines three or more grounding pneumatic buffers consisting of an envelop of rubbered fabric, but

What is claimed as new is:

1. In an air ship, a plurality of shafts having lifting propellers or helicopters arranged in coaxial and oppositely rotating pairs thereon, auxiliary lifting vanes lying below and across the main blades of the helicopters at a slight angle and connected therewith, and means for rotating each helicopter in a direction opposite to adjacent helicopters.

2. In an air ship, a plurality of lifting propellers or helicopters arranged in coaxial and oppositely rotating pairs, auxiliary lifting vanes lying below and across the main blades of the helicopters at a slight angle, ties connecting the main blades of the helicopters with the auxiliary vanes to prevent them from bending, and means for rotating each helicopter in a direction opposite to adjacent helicopters.

3. In an air ship, a plurality of lifting propellers or helicopters arranged in upper and lower positions and in coaxial and oppositely rotating pairs, means for operating the helicopters, and a series of parachutes normally collapsed and resting upon the upper surfaces of the upper helicopters and adapted to expand automatically when the ship acquires any considerable downward velocity.

4. In an air ship of the character specified, a frame, a plurality of lifting propellers or helicopters arranged in coaxial and oppositely rotating pairs on the frame, means for operating each helicopter to rotate the same in a direction opposite to adjacent helicopters, and a series of vertically disposed gas bags carried below the frame of the ship.

5. In an air ship of the class specified,

the combination of a frame, a longitudinal row of vertical shafts arranged on the frame, upper and lower lifting propellers or helicopters arranged in coaxial and oppositely rotating pairs, means for rotating each helicopter in a direction opposite to adjacent helicopters, auxiliary lifting vanes lying below and across the main blades of the helicopters at a slight angle and connected to said blades, a series of parachutes normally collapsed and resting upon the upper surfaces of the uppermost helicopters and adapted to expand automatically when the ship acquires any considerable downward velocity, and a series of vertically disposed gas bags carried below the frame of the ship.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

F. W. SCHROEDER. [L. S.]

Witnesses:

EDWARD GARDNER,

WALTER J. SKERTEN.