H. H. GRIDLEY.

HELICOPTER.

APPLICATION FILED NOV. 16, 1910.

1,012,631.

Patented Dec. 26, 1911.

3 SHEETS—SHEET 1.

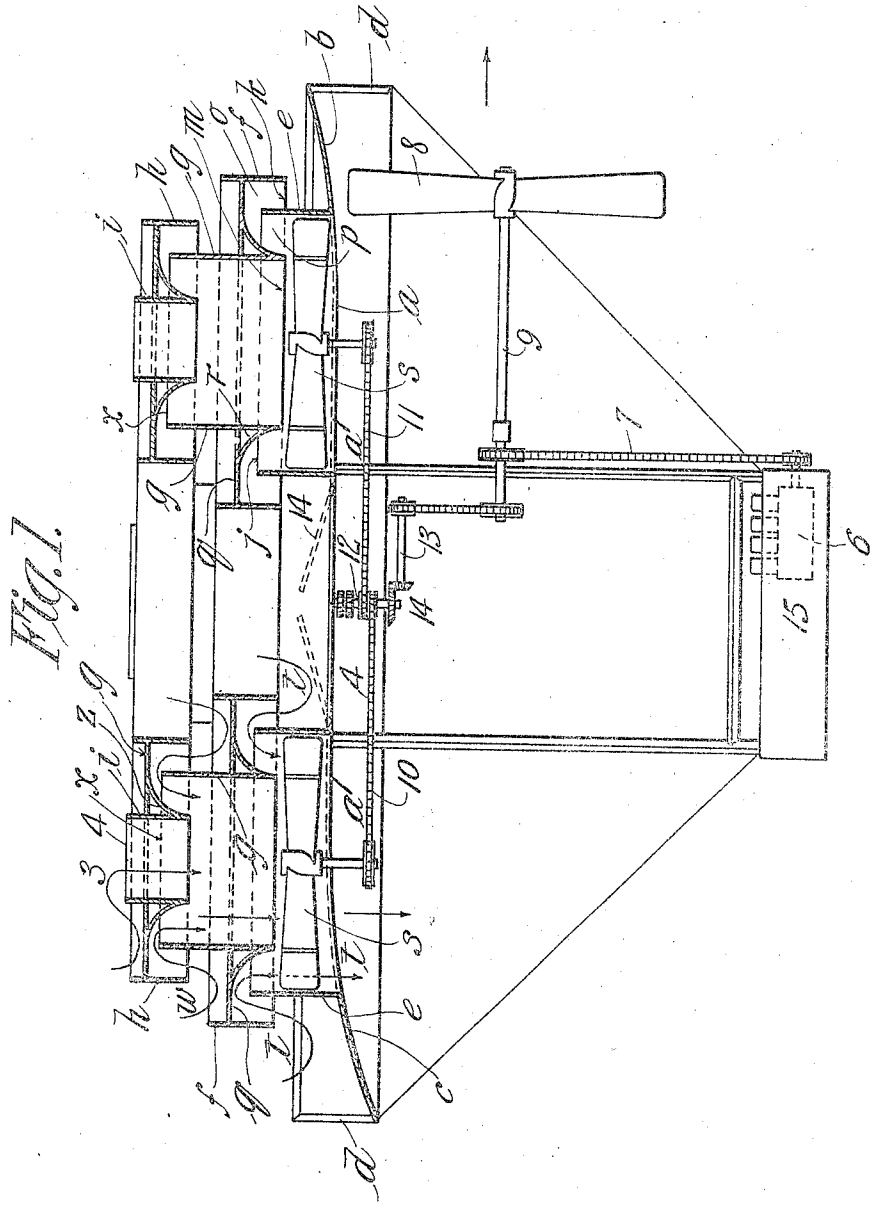

Fig. 1.

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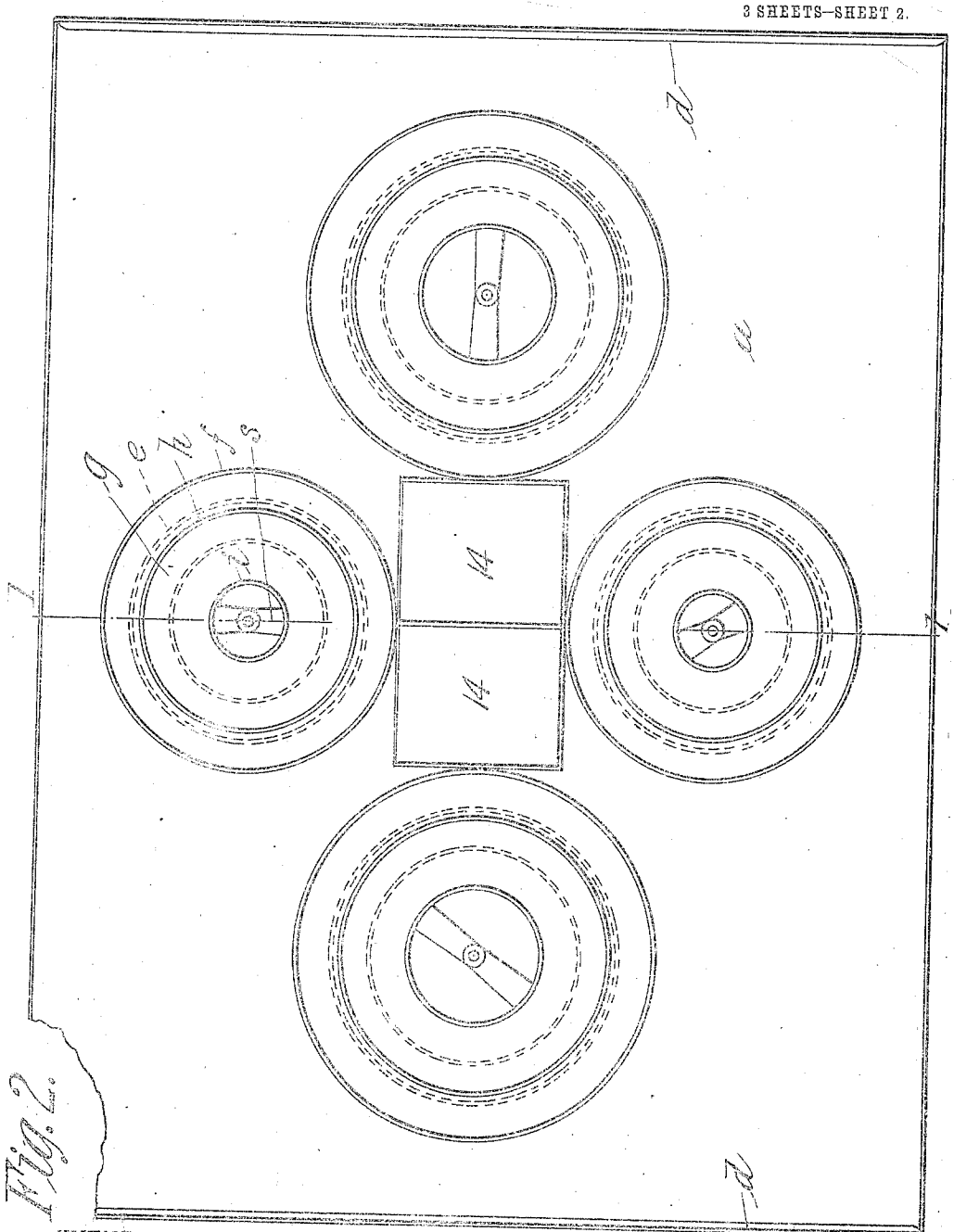

Fig. 2.

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3 SHEETS—SHEET 3.

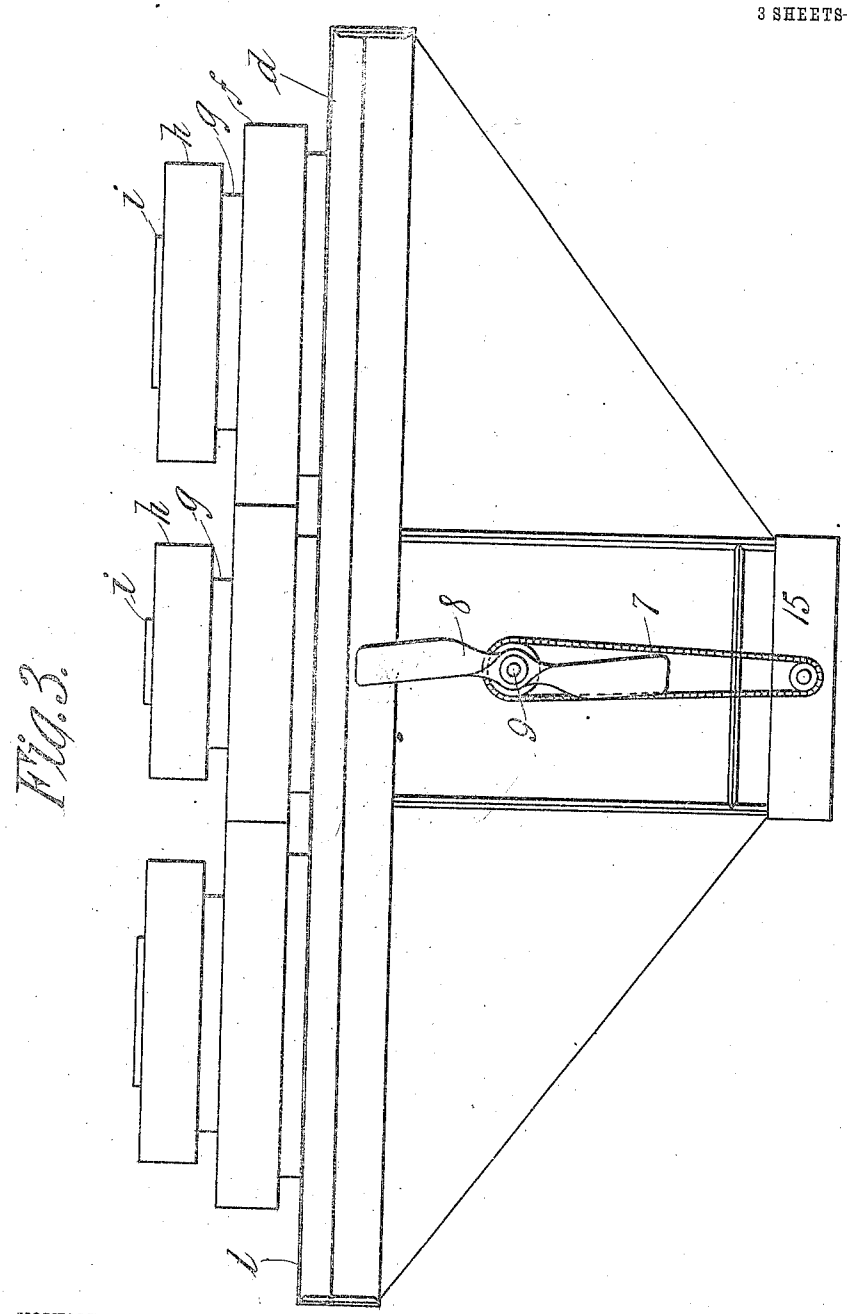

Fig. 3.

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HELICOPTER.

1,012,631. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed November 16, 1910. Serial No. 592,677.

To all whom it may concern:

Be it known that I, HENRY H. GRIDLEY, a citizen of the United States of America, residing at Holyoke, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Helicopters, of which the following is a specification.

This invention relates to improvements in helicopters, or which are commonly known as flying machines.

The machines of this class are designed to be driven through the air by means of suitable screw propellers and are provided with suitable means, comprising suitable propeller or lifting blades, for maintaining them in the air.

Broadly considered my invention consists in providing a supporting plane or aerofoil member having openings therethrough, and placing above this plane member and in or over the opening a suitable number of open ended tubular members; the lower part of the tubular members having propellers or lifters located therein which, preferably, revolve in a horizontal plane whereby a lifting effect is produced to maintain the machine in the air. Suitable propellers or tractors adapted to revolve in a vertical plane are also employed to drive the machine forward.

Referring to the drawings forming part of this application,—Figure 1 is a longitudinal, vertical, sectional view on the line 1—1, of Fig. 2, clearly illustrating the shape and position of the supporting plane; the construction and location of the tubular members with the lifting propellers located therein, and the vertically arranged driving propellers. Fig. 2 is a top plan view of the machine. This view being considered as looking down on Fig. 3 and illustrating the positions of the tubular members. Fig. 3 is an end elevation looking from the right-hand end of Fig. 1 and clearly showing the ribs at the edge of the supporting plane.

Referring to the drawings in detail, *a* designates the supporting plane, the forward edge of which is preferably slightly upturned, as indicated at *b*, and the rear part is preferably downturned as shown at *c*. The purpose of these upturned and downturned portions *b* and *c* is to cause the machine to assist in lifting itself when being driven through the air. Or, in other words the curved part *b* glides upon, and forces downward, the mass of air coming in contact with it and so receiving the upward lift of the reaction of said mass of air lessens the resistance of the passage of the supporting plane; similarly the portion *c* in its forward motion pushes down still farther the mass of air acted upon by the portion *b* and receives a like uplifting force. The curved construction of the portions *b* and *c* also helps to stiffen the plane *a* laterally between the rims *d*. The extent and degree of curvature of this part of the plane is merely illustrative as the same may be varied as desired.

d designates vertically arranged side rims, that are secured to opposite edges of the plane *a*. These rims permit a trussed construction in themselves to stiffen the plane *a* longitudinally, or from front to rear. The portions of the rims *d* that are below the plane *a* serve to prevent the lateral escape of the denser air below the plane *a*, and will have a very considerable parachute effect when the plane *a* is gliding downward and the propellers are not running.

It will be observed that the entire construction avoids the downward pressure of any current of air on the upper surface of the machine. The rims *d* further act as keels to give stability and maintain a straight and steady course through the air.

Located above the plane *a* are a number of open ended cylindrical tubular members *e*, *f*, *g*, *h*, and *i* which are placed over openings a^1 in the plane *a* and are nested together, as shown, and necessarily, of different diameters. The member *e* has its lower edge in engagement with the upper surface of the plane *a* and its upper edge *j* above the lower edges *k* and *m* of the members *f* and *g*.

It will be observed that the diameter of the member *e* is intermediate that of the members *f* and *g* whereby annular spaces *o* and *p* are provided on each side of the upper portion *j* of the member *e*.

Located above the upper edge *j* of the member *e* and extending from the members *f* and *g* is an annular plate or diaphragm *q* preferably provided with a curved part *r*. This plate *q* serves the purpose of deflecting the currents of air as they are drawn through the annular spaces *o* and *p* downward by the propellers *s* which are located in the lower part of the tubular member *e* and over the openings a^1 when the same are rotated, as shown by the arrows *t*. The curved part *r*

of the plate q is to give a smooth and easy flow to the air currents, thereby lessening their friction and increasing their velocity. These currents of air, during their passage, will strike against the under side of the plate q and its curved part r causing or effecting a lifting effect on the machine. It should be particularly noticed that these currents of air will cause a rarefaction or lessening of the density of the air pressure above the plane a with the result that the atmospheric pressure above the supporting plane is very much lessened. The air pressure below the plane a is, of course, greater than the ordinary atmospheric pressure, the resultant effect being to cause the machine as a whole to rise.

What has been said with reference to the air currents which are designated by the arrows t and drawn downward through the tube e is equally true with regard to the currents which are drawn downward through the tubes g and i. The currents represented by the arrow w would cause a rarefaction of the atmospheric pressure on the upper side of the plate q, and as they pass over the upper edge x of the tube g they would strike the under side of the plate y and its curved part z.

The arrow 3 illustrates the path of the current of air above the plate y and downward through the tubes i, g, and e. The currents of air drawn downward through the tubular member i do not exert its momentum on a plate member as do the currents passing through the members e and g, and therefore exert less lifting power, but it will be readily seen that the tubular member i might have a tight cover, and the spaces between the edges of members e and g, and plates q and i be so proportioned as to pass all the air that the propeller s could drive through the opening a^1 in the plane a.

The propellers s, it will be observed, are located above the openings a^1 in the supporting plane a so that the various streams of air will be discharged below this plane to assist in effecting an upward pressure below the same.

The propellers s are operated from any suitable source of motive power, as indicated at 6, and operatively connected to this motive power by means of the drive-chain 7 are driving propeller blades 8 which are connected to the shaft 9. The propellers s are operatively connected to the shaft 9 so as to rotate in unison with the blades 8 by means of drive-chains 10 and 11, and the shafts 12 and 13, which are geared together, as shown at 14. The driving connections between the motive power 6 and the propeller blades s and 8 is merely illustrative.

The plan view in Fig. 2 shows four sets of nested tubular members, but I do not limit myself to any particular number, although the number should preferably be so chosen or proportioned as to always produce a balanced effect on the plane a.

In order to permit the escape of the air below the plane a, should any sudden wind pressure become too great, I provide wing or trap door members 14 which are adapted to open upward, as shown in Fig. 1.

15 designates the car part of the machine which is suitably suspended from the glider plane, as shown.

The various elements for supporting the car, motive power, etc., form no part of the present invention and are merely illustrative.

What I claim, is:—

1. A helicopter having in combination with a supporting plane, a plurality of open ended tubular members, diaphragms or plates between said members, propeller blades to draw air through the members to lessen the atmospheric pressure on said plates and increase the pressure below the plane.

2. A helicopter having in combination with a supporting plane, a plurality of open ended tubular members nested together and above said plane, the upper edge of some of the said members being above the lower edge of an adjacent member, a plate extending parallel with said edges, means for drawing the air through said members and against the plate and discharging the same below the supporting plane.

3. A helicopter having in combination with a supporting plane provided with an upturned forward portion and a downturned rear portion, the plane having openings therethrough, a series of tubular members communicating with the openings, a propeller, the tubular members being axially and laterally spaced to permit the propeller to effect a rarefaction of the air pressure above said plane and increase it below the same.

4. In a helicopter, the combination with a supporting plane provided with laterally located rims extending both above and below the said plane, the plane having an opening therein, a tubular member over the opening, and a lifting propeller in said member.

5. In a helicopter, a supporting plane having openings therethrough, a tubular member located above said plane and over the openings, a second tubular member spaced from the first tubular member and provided with a plate element, the edges or ends of said members adjacent the plate being in different planes, and a propeller element in one of the tubular members, and means for operating the propeller.

6. A helicopter having in combination with a supporting plane provided with an opening therethrough, a series of tubular

members over the opening, the members being of different diameters and having their upper and lower edges or ends nested to permit currents of air to flow over one edge of one member and below or under the edge of an adjacent tubular member, plates located adjacent said edges, a propeller over the opening, and in the lowermost member, and means for operating the propeller.

7. A helicopter comprising a plane member of greater width than its length, ribs secured to its lateral edges thereof, the plane member, a series of open ended tubular members of different diameters located on the upper surface of the plane and over an opening in the plane, a propeller for drawing air through the annular spaces between the tubular members and delivering it to the opening in the plane, and plates to cause the air to flow in a curved path.

8. A helicopter comprising a supporting plane member having an opening therein, a lifting propeller located above the opening, a tubular member surrounding the propeller, and a plate arranged above the open end of the tubular member whereby when the propeller is operated the air will be drawn against the plate and downward through the tubular member, and a lifting effect exerted by the current of air on the plate, as described.

9. The combination with the lifting propeller of a flying machine, tubular members spaced from each other and located above said propeller, a horizontally arranged plate in the space between the members and against which the current of air strikes when the propeller is operated, whereby a lifting effect is produced.

10. In a helicopter, the combination with a supporting plane or aerofoil having an upturned forward portion and a downturned rear portion and provided with laterally located rims extending both above and below said plane, means to lift the plane, and means to propel the same as desired.

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Witnesses:
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