F. G. DONNER.

PLANE FOR AEROPLANES.

APPLICATION FILED DEC. 1, 1911.

1,038,317.

Patented Sept. 10, 1912.

2 SHEETS—SHEET 1.

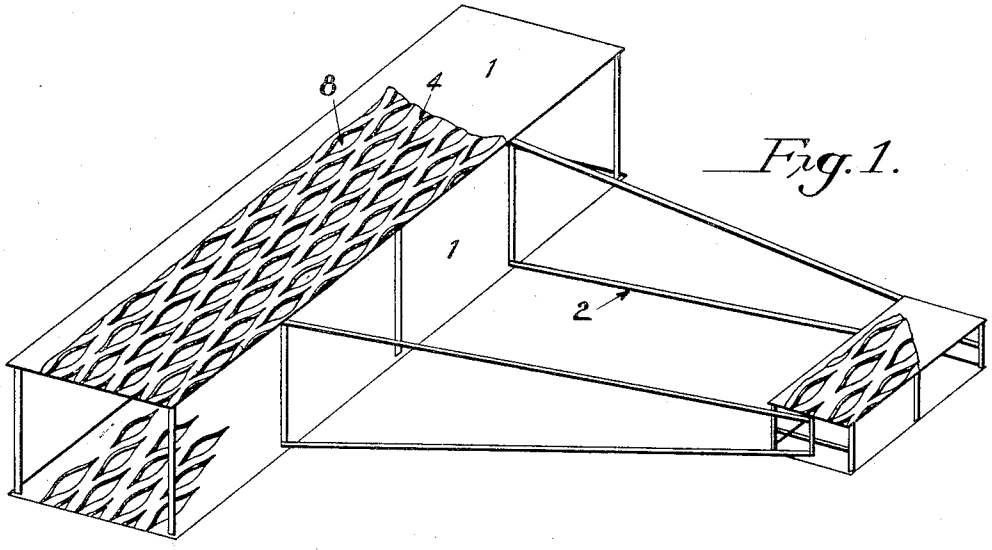


Fig. 1.

Fig. 5.

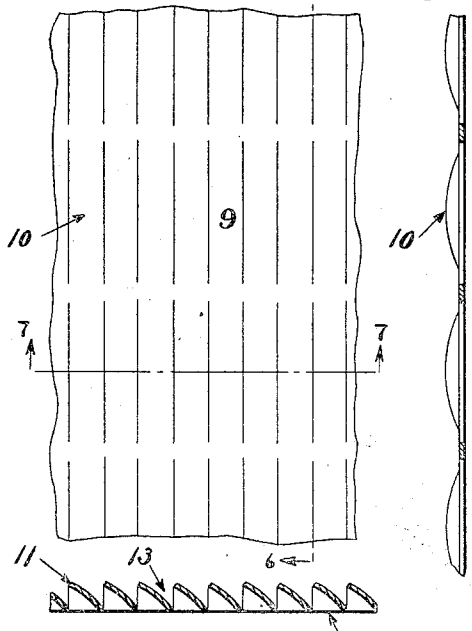


Fig. 6.

Fig. 7.

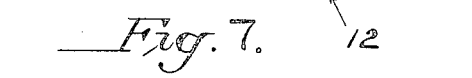


Fig. 11.

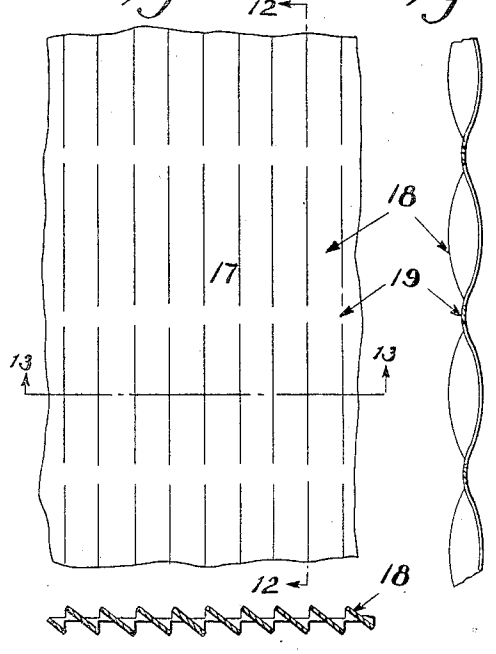


Fig. 12.

Fig. 13.

WITNESSES

Wm. E. Seifing.

E. L. Hyde

INVENTOR

Frederick Gregory Donner.

By Fredk W. Vinal

Attorney

F. G. DONNER.

PLANE FOR AEROPLANES.

APPLICATION FILED DEC. 1, 1911.

1,038,317.

Patented Sept. 10, 1912.

2 SHEETS—SHEET 2.

Fig. 2.

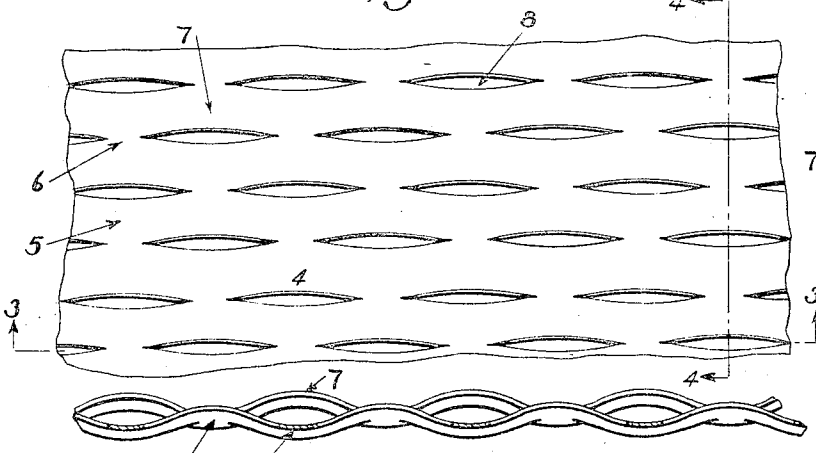


Fig. 3.

Fig. 4.

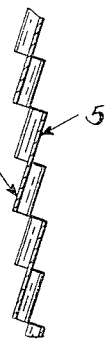


Fig. 8.

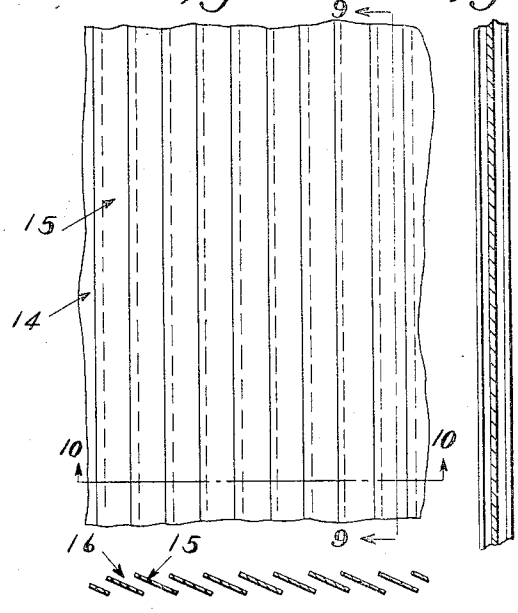
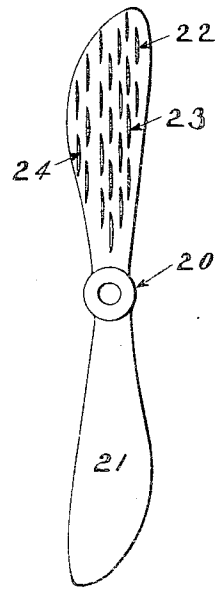


Fig. 10.

Fig. 9.

Fig. 14.



WITNESSES

Wm. E. Seifriz.

E. L. Hyde.

INVENTOR

Frederick Gregory Donner,

By Fredk W. Wenzel,

Attorney.

UNITED STATES PATENT OFFICE.

FREDERICK GREGORY DONNER, OF PITTSBURGH, PENNSYLVANIA.

PLANE FOR AEROPLANES.

1,038,317. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed December 1, 1911. Serial No. 663,413.

To all whom it may concern:

Be it known that I, FREDERICK G. DONNER, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Planes for Aeroplanes, of which the following is a specification.

This invention relates to heavier-than-air flying machines or aeroplanes.

It is particularly directed to improvement in the supporting planes or wings thereof or to the vanes of the screws or propellers and is adapted for use in connection with air propellers, air screws, beating wings, mono-planes, bi-planes, multi-planes and kites.

The object of the invention is to provide an improved construction of aeroplane, or of wings, planes or vanes therefor, which will have greater lifting power than aeroplanes, wings or vanes formed of continuous material of the same area.

A further object of the invention is to provide a construction of aeroplane or wing therefor which will be more stable and less easily overturned than those now in use, by reason of the fact that the variation in the position of the center of air pressure during variation in the inclination to the horizontal of the improved plane or wing as a whole, will occur within considerably narrower limits than when the plane or wings are of continuous material.

A further object of the invention is to provide an improved construction of aeroplane or plane therefor in which the angle of inclination of separate sections or segments of the plane to the horizontal will always be different from that of the plane or aeroplane as a whole, thereby increasing the soaring and gliding ability of the plane or aeroplane.

As an illustration of a few of the many forms in which my invention may be carried out in practice, reference is had to the accompanying drawings in which like reference numbers represent like parts throughout the several views and in which—

Figure 1 represents a diagrammatic perspective view of an aeroplane equipped and constructed according to my invention; Fig. 2 is a top view of a portion of one of the planes or wings thereof; Figs. 3 and 4 are cross sectional views, on the lines 3—3, 4—4, Fig. 2; Fig. 5 is a view, corresponding to Fig. 2, of another form of the invention; Figs. 6 and 7 are cross sectional views of the same on the lines 6—6 and 7—7, Fig. 5; Fig. 8 is a top view of another modification; Figs. 9 and 10 are cross sectional views of the same on the lines 9—9, 10—10, Fig. 8; Fig. 11 is a top view of another form; and Figs. 12 and 13 are cross sectional views of the same on the lines 12—12, 13—13, Fig. 11; and Fig. 14 is a diagrammatic view of a propeller constructed according to my invention.

In Fig. 1 I have shown my invention as applied to a bi-plane of the well known Wright type. It may, however, be applied with equal facility to other types of aeroplanes and to any construction in which a supporting plane is used, or to propellers, where it may be used for the wings or blades thereof. The bi-plane illustrated consists of upper and lower main supporting wings or planes 1, which are alike in all details of construction, and which are connected together by a frame work 2 consisting of struts and tension members in the form of bars, tubes or wires in the ordinary manner. At the forward end of the frame 2 are provided the usual auxiliary guiding planes which are utilized for controlling the rise, fall and direction of the aeroplane in the air. The auxiliary planes may, if desired, be constructed in the same manner as the main supporting planes 1 and according to my invention, but this is not necessary. The frame will also support the necessary machinery, motor and controlling levers. As these form no part of the present invention, they are not illustrated or indicated, and are to be understood as being of any of the ordinary or preferred constructions and arrangement.

Referring now to Figs. 2, 3 and 4, which represent views of a limited portion of one of the wings or planes illustrated in connection with and embodied in the aeroplane shown in Fig. 1, the wing or plane 1 is shown as provided with or consisting of a plurality of arched or curved segments or sections 4, which as shown in Fig. 1, are connected together at their ends and extend in a line laterally over or across the aeroplane. The segments or sections 4 are shown as strips or bands of canvas, but may be formed of thin sheet metal or any other light and strong material. As shown in Fig. 2, each two adjacent segments or sections of the supporting material of the aeroplane which

are connected together at their ends 5 are also coupled or connected together at regular intervals or spaces on one side, as at 6 with the middle portion 7 of one of the segments 4 of the adjacent line or row of segments. Furthermore, the connections between one line of segments and the adjacent line or row on the one side thereof are arranged in staggered or alternate relation with respect to the connections to the adjacent line of segments on the other side thereof. The wing frame is provided with supporting strips or ribs to furnish stiffness to the entire structure and retain the various segments or sections of the supporting plane in proper and permanent position. As shown in the drawings each segment 4 of the supporting wing or plane 1 has its surface inclined at an angle to the general surface of the supporting wing or plane 1 at that point. As shown in Fig. 3 this inclination is in a direction forwardly and upwardly. As a consequence of the fact that the several lines of segments of the supporting wing or plane are each inclined forwardly and upwardly, each segment 4 is attached at the rearward edge of its middle portion 7 to the connections between the ends 5 of the segments 4 of the next line of segments in rear thereof, as stated. Furthermore, the manner of attachment stated results in the provision between the rows or lines of segments 4 of the supporting plane or wing, of a plurality of apertures or openings 8 therein. These openings, as shown in Fig. 2, are staggered with relation to each other and each is directly forward of the under surface of one of the segments or sections 4. It will be noted by examination of Fig. 3 that all of the several connections between the various segments or sections 4 and adjacent segments in the same or adjacent lines of the plane are in a common plane, which may be said to constitute the general plane of the entire supporting wing or plane. The middle portions 7 of segments or sections 4, as illustrated, project forwardly above the general plane of the supporting wing and the connections between the ends of adjacent segments of the same are depressed rearwardly below the same general plane. Although in the drawings I have shown the side edges of each line of segments as in line or flush with the edges of the adjacent segments of the next line or row, I wish it understood that I do not limit myself to such construction, as I may also so shape and arrange the arched or curved segments or sections of one line as to have their edges lap or project over or under those of the next line or row or even spaced apart therefrom, if so desired.

In the form of plane or wing illustrated in Figs. 5, 6 and 7, the wing or plane 9 is shown as comprising or being provided with a plurality of segments or sections 10, each of which is curved or warped in the manner shown in Fig. 7. As illustrated, each of these segments or sections 10 has a curved upwardly standing forward edge 11 and the curved or arched surface thereof merges rearwardly into a straight horizontal rear edge 12. The edges 11 and 12 of the adjacent segments or sections 10 thus provide openings or apertures 13 leading through the material or body of the plane or wing 9. In this form of the invention the several segments or sections are not arranged in staggered relation to each other as in the preferred form described above. For this reason it is possible to provide in the ends of the several segments or sections, additional supporting strips or bands of stiff material extending in the same direction as that of the travel of the aeroplane and transversely to the openings 13. It is to be understood in connection with this form of the invention that the material of the plane or wing shall be of thin flexible or rigid material supported and reinforced by strips or ribs of stiff material to preserve the shape of the segments or section and their relation to each other.

The plane or wing 14 illustrated in Figs. 8, 9, and 10 comprises or is provided with a plurality of divisions, sections or segments 15, each of which is shown as a single continuous flat strip or band of any preferred material, inclined in a direction with that of the travel of the aeroplane. These various divisions or segments of the supporting plane or wing 14 are arranged somewhat after the manner of the bars of a window shutter, as illustrated in the end view, Fig. 10, and provide a plurality of slots or openings 16, each of which extends, except for its interruption by the necessary supporting ribs, for the full width of the supporting wing or plane 14 and is directly forward of the under inclined surface of a division 15.

In Figs. 11, 12 and 13, I have illustrated a fourth form or modification of the invention which is constructed somewhat after the manner illustrated in Figs. 1 to 4, *i. e.* with rows or lines of segments or sections 18 each of which is of curved or warped form extending from side to side of the aeroplane. The segments or sections 18 of the various warped rows 17 are not, however, coupled or connected together in staggered relation, but are arranged in rows transverse to the direction of the segments and in line with the travel of the aeroplane. The connections 19 between adjacent rows 17 of the plane or wing shown in this form are similarly arranged in alinement after the manner of the construction illustrated in Figs. 5 to 7. Each row 17 of segments 18 of the plane or wing shown in this form of the invention is constructed with opposite edges

thereof respectively elevated and depressed. In other words, as shown in Fig. 13, the body of each section or segment 18 is shaped as though it had been twisted between the spaced points of attachment of each row 17 and its adjacent row.

I have illustrated in Fig. 14 an end view of a screw propeller equipped and arranged according to my invention. This screw or propeller 20 is formed of a plurality of wings, vanes or blades 21, each of which may be arranged with its general plane or surface in the same place as that of the plane of rotation of the screw or propeller, but if desired, may be slightly inclined thereto. Each wing, plate or vane may have its surface formed of a plurality of separate divisions, sections or segments according to any of the forms of the invention referred to and described above in connection with the wing or supporting plane of an aeroplane. As illustrated, the wings or vanes 21 are formed according to the form of the invention illustrated in Figs. 1 to 4, *i. e.*, they each consist of a plurality of rows of segments or sections 22, 23, respectively staggered with relation to each other and having openings 24 therebetween.

I desire to state that the inclination of the various segments, sections or divisions of the wings or planes illustrated in the drawings is shown in exaggerated condition, *i. e.* to say, the inclination there shown is considerably greater than that which would commonly be used in practice. In practice, the inclination of the small sections or segments relative to the plane as a whole would probably never exceed 3° and varies from this point down to nearly parallelism with the plane itself.

It is well known that in a flat supporting plane or surface moving through the air, the point of air pressure always occurs and is located somewhat forward of the true geometric center of the plane itself, its exact location depending upon the inclination of the plane to the horizontal. In other words, as the inclination of the plane as a whole varies, the center of pressure occurs at different points along the direction of movement of the plane or surface through the air. At this point is concentrated the force tending to turn the plane over and disturb its equilibrium. In the usual forms of aeroplanes provided with continuous flat wings or planes, the tendency to overturn is a serious feature and one to be constantly contended with.

It will be observed that with my improved construction, I have formed the entire supporting surface of the aeroplane of a plurality of small segments or sections, each of which is capable of supporting its own share of the entire load and which, though connected to all of the other segments or sections, acts in some respects as though it were independent thereof. With my improved construction of supporting plane, the center of pressure does not advance from the geometric center a distance equal to a certain definite proportion of the dimension of the entire supporting surface but, on the contrary, merely advances the same proportion of the dimension of any one of the several segments or sections. The multiplication of such segments or sections in a supporting plane or the division of such a plane into a large number thereof consequently causes an ultimate advance of the center of pressure from the true geometric center of the plane which is quite inconsiderable with respect to the dimensions of the supporting plane as a whole. As a result, the tendency of an aeroplane equipped with my improved supporting planes or wings to tip or turn over and have its equilibrium disturbed, is far less than with planes constructed with continuous surfaces. Moreover, the gliding or soaring ability of an aeroplane is dependent in a great measure upon the amount of air which passes underneath or in contact with the lower surface of the supporting plane. With my improved construction, each supporting plane of the aeroplane is provided with a plurality of apertures or openings leading from top to bottom thereof, in rear of each of which is an inclined downwardly directed surface. These openings or apertures, therefore catch or pocket a certain amount of air which thereupon rushes through the body of the plane or wing and is directed downward thereby. At the same time, the air rushing past the lower side of the plane or wing causes a rarefication of the atmosphere at this point and a tendency for the air above the plane to be sucked in or drawn through the apertures or openings therein. As a consequence, a larger amount of air passes beneath the lower surface of the supporting plane or wing than with other constructions, and the gliding or soaring ability of aeroplanes constructed with such planes or wings is greatly increased. In addition to what has just been stated, it is well known that the soaring, gliding and sustaining ability of an aeroplane is dependent to a great extent upon the angle of incidence or inclination of its planes to the horizontal. In all aeroplanes moving horizontally through the air, the planes are inclined forwardly and upwardly. It will be noted that in each of the forms of my invention herein described every section or segment of the wing or plane is inclined forwardly and upwardly with relation to the general plane of the wing itself. As a consequence of this fact, to obtain the same effect, it it not necessary, in an aeroplane equipped with my improved planes, to tilt or incline the same to the

horizontal to the same degree as in planes as heretofore constructed, or, if the plane is so inclined greater lifting, sustaining, soaring and gliding ability will be obtained.

Planes or wings constructed according to my invention may be arranged with the segments or sections uniform in size or shape and according to any one of the modifications described, or if desired, a single plane or the several planes of an aeroplane may be arranged with combinations of segments or sections of different modifications or even with part of the surface unbroken or continuous. They may be varied in size and shape according to their location in the plane and may be uniform or varied in the amount of curvature and inclination of their surfaces.

What I claim is:—

1. A wing or plane for aeroplanes, said wing or plane being provided with a plurality of supporting sections connected together and so inclined to the general plane of the wing or plane as to cause passage of air downwardly through the wing or plane.

2. A wing or plane for aeroplanes, said wing or plane being provided with a plurality of warped or curved supporting sections, the sections being connected together and each so inclined to the general plane of the wing or plane as to cause passage of air downwardly through the wing or plane.

3. A wing or plane for aeroplanes having a plurality of openings therethrough, and being provided with inclined surfaces adjacent said openings and arranged to deflect the air downwardly therethrough.

4. A wing or plane for aeroplanes, said wing or plane being provided with a plurality of supporting sections, the sections having spaced connections therebetween providing a plurality of openings through the wing and each section being inclined and adapted to deflect air downwardly through one of said openings.

5. A wing or plane for aeroplanes comprising a plurality of rows of segments, said rows being each inclined to the general plane of the wing or plane, and spaced connections between adjacent rows providing a plurality of openings through the wing or plane and inclined supporting surfaces adjacent thereto and adapted to deflect air downwardly through the wing or plane.

6. A wing or plane for aeroplanes comprising a plurality of rows of segments, each row being of sinuous or wave-like form and inclined to the general plane of the wing or plane, and spaced connections between the rows, said connections being staggered and providing a plurality of supporting surfaces and openings through the plane.

7. A wing or plane for aeroplanes provided with a plurality of segments or sections, said segments being arranged in staggered relation to each other and each inclined to the general plane of the wing or plane.

8. A wing or plane for aeroplanes provided with a plurality of arched or curved segments, said segments being arranged in line with each other and connected together at their ends, the wing or plane being further provided with apertures therethrough, said segments being so constructed and arranged as to deflect air downwardly through said apertures.

9. A wing or plane for aeroplanes, said wing or plane being provided with a plurality of openings therethrough and with a curved supporting surface in rear of each of the openings, the surfaces being inclined and each adapted to deflect air downwardly through its corresponding opening.

10. A wing or plane for aeroplanes comprising a plurality of supporting sections, said sections being connected together at their ends to form rows, each row being of wave-like or sinuous form and inclined to the general plane of the wing or plane, and the sections of successive rows being in staggered relation to each other.

11. A wing or plane for aeroplanes comprising a plurality of supporting sections, and connections between the several rows of sections, said connections being arranged in staggered relation to each other and providing an opening through the plane below each of said sections, said sections being each formed to deflect air downwardly through its opening.

In testimony whereof, I have hereunto set my hand.

FREDERICK GREGORY DONNER.

Witnesses:
E. L. HYDE,
MARY E. CAHOON.