No. 706,832. Patented Aug. 12, 1902.

I. LANCASTER.

COVERING FOR AEROPLANES.

(Application filed Nov. 26, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

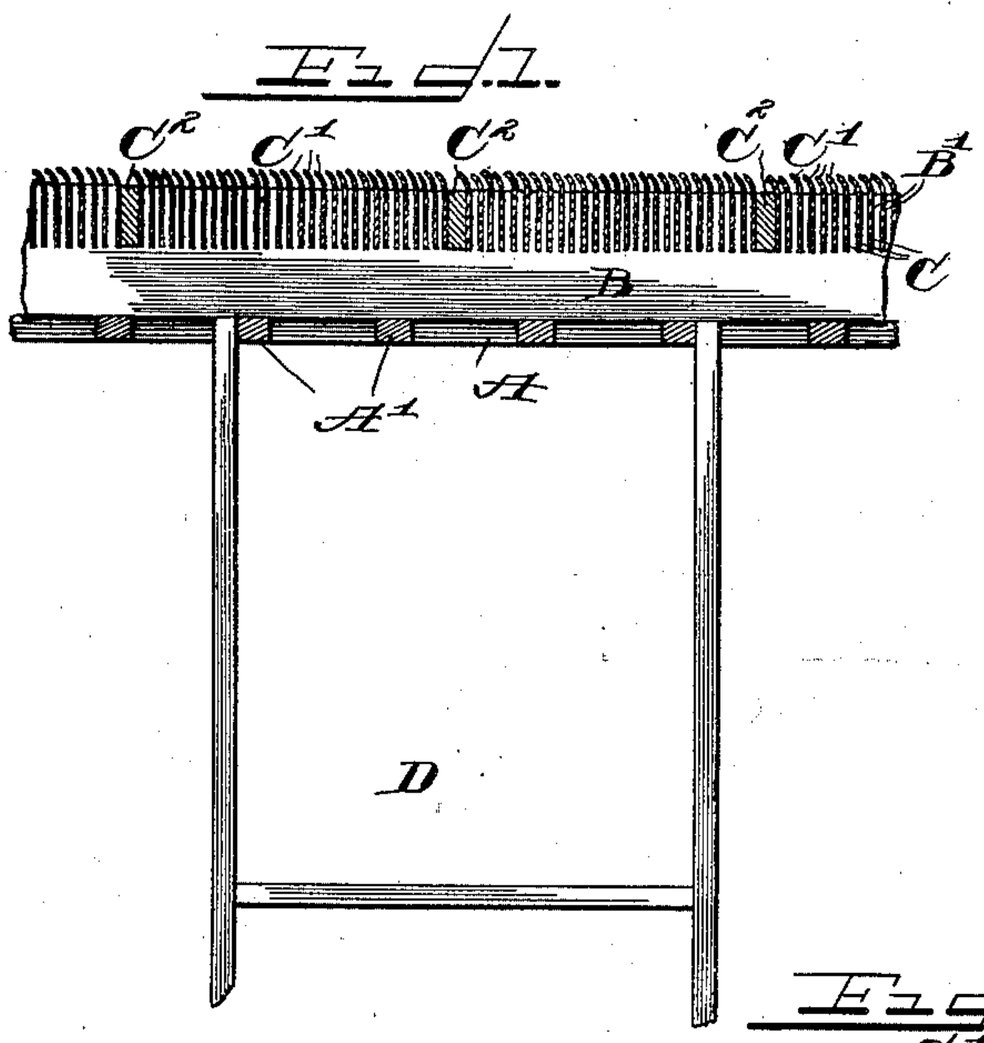


Fig. 2.

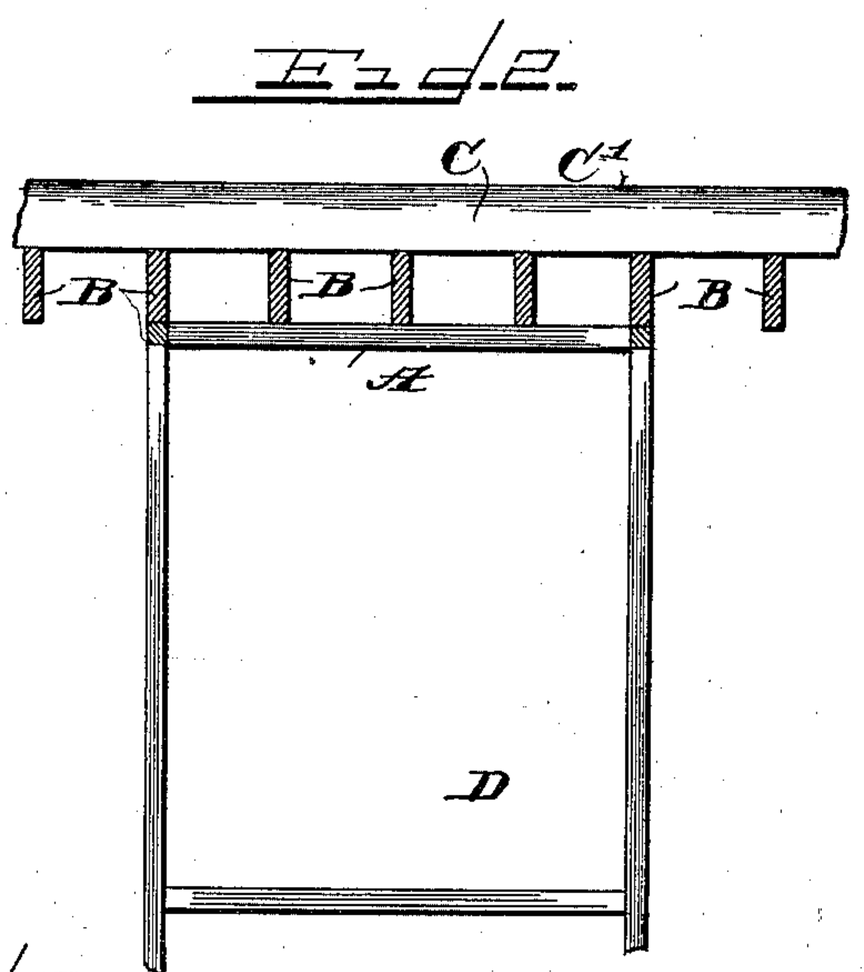


Fig. 3.

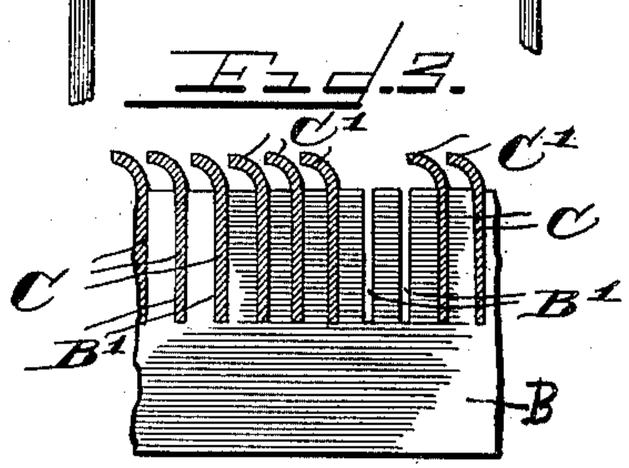
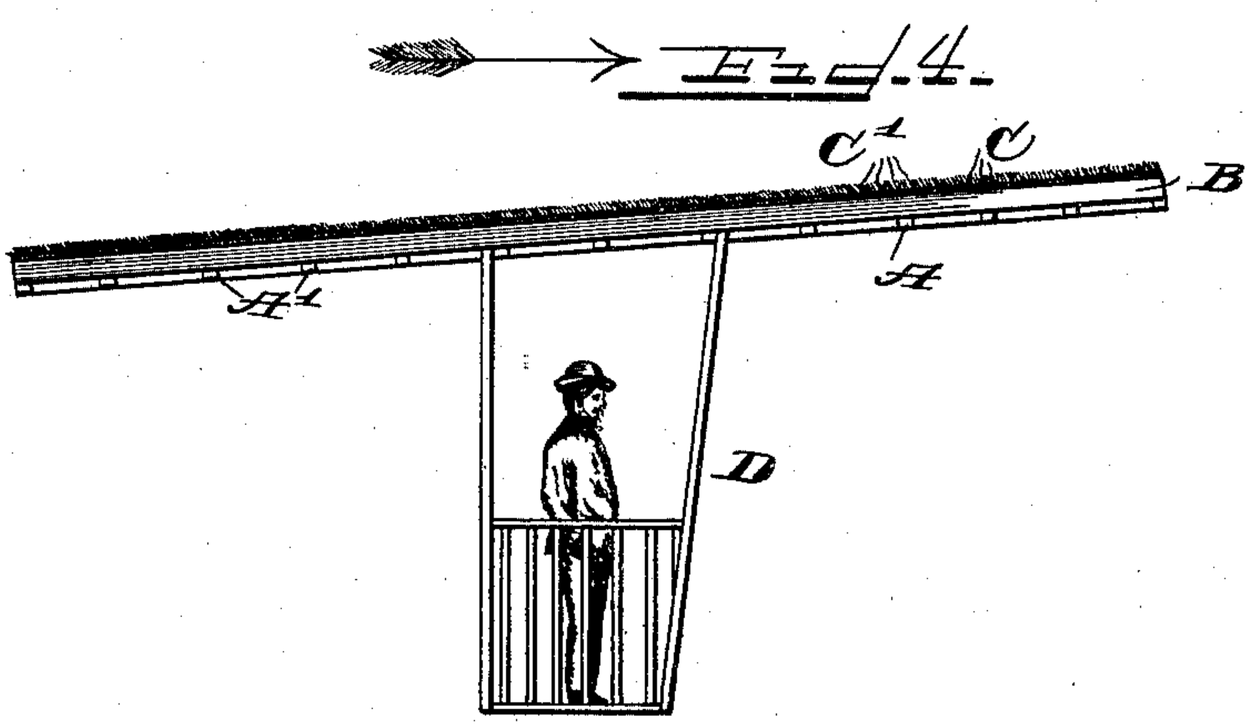


Fig. 4.



Witnesses.

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No. 706,832. Patented Aug. 12, 1902.

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COVERING FOR AEROPLANES.

(Application filed Nov. 26, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 5.

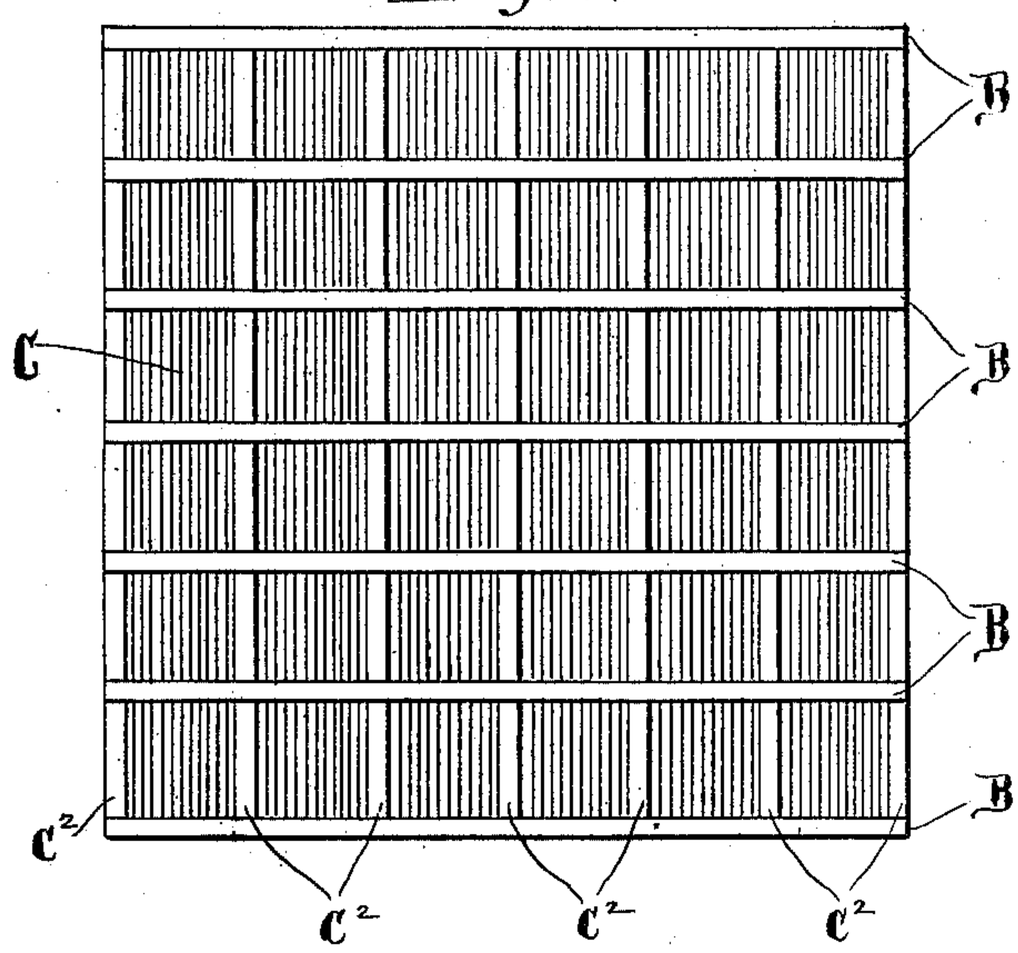
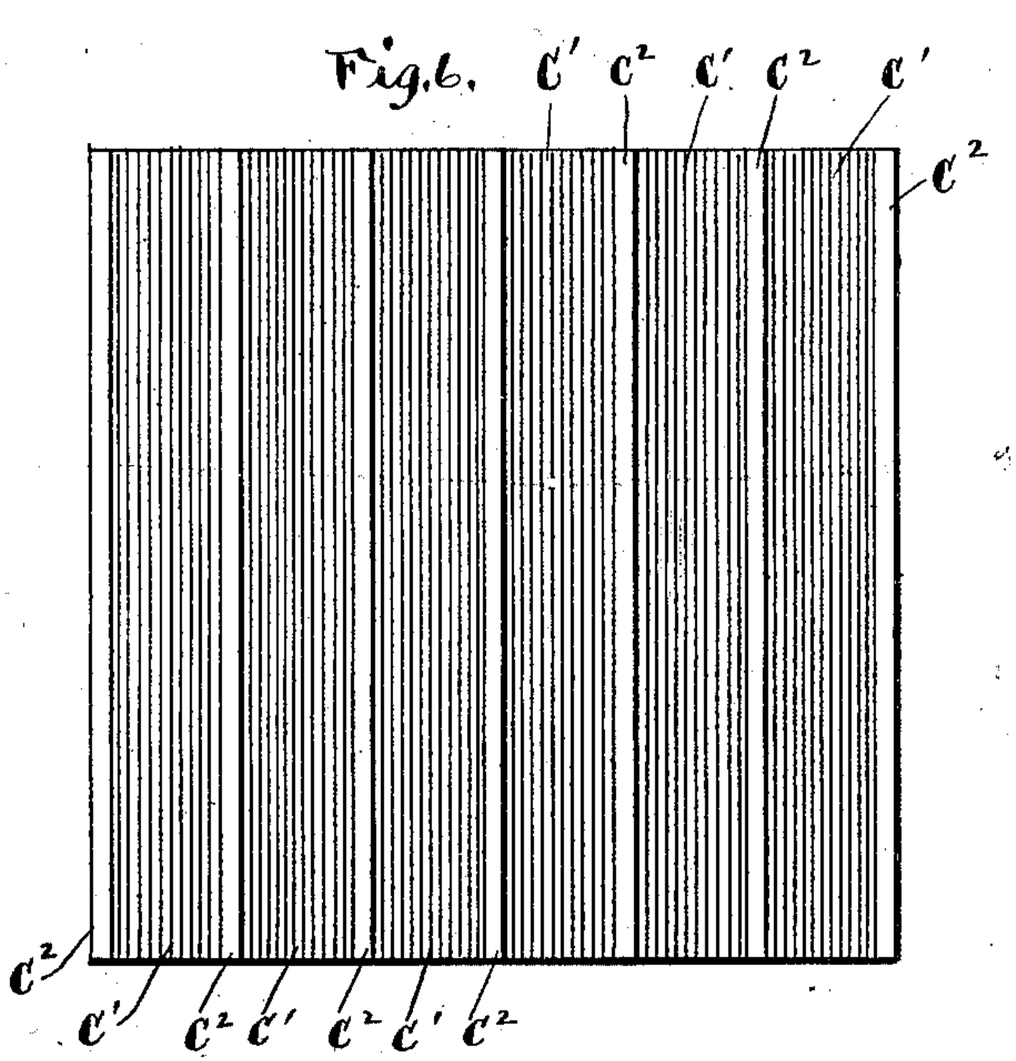


Fig. 6.



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UNITED STATES PATENT OFFICE.

ISRAEL LANCASTER, OF CHICAGO, ILLINOIS.

COVERING FOR AEROPLANES.

SPECIFICATION forming part of Letters Patent No. 706,832, dated August 12, 1902.

Application filed November 26, 1901. Serial No. 83,811. (No model.)

To all whom it may concern:

Be it known that I, ISRAEL LANCASTER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Covering for Aeroplanes, of which the following is a specification.

The invention relates to a thin surface for aeroplanes—such as kites, gliding devices, and blades of windmills—that move in free air, deriving their movement from the pressure or force of the wind or otherwise, the thin surface furnishing a resistance to the air-pressure on the under surface, by which a motive power results for driving the aeroplane edgewise or parallel to itself.

The principal object of the present invention is to increase the production of the driving energy or motive power from the difference in pressure on the two sides of the aeroplane, which result is accomplished by the covering constituting the essential feature of the invention in its construction and arrangement; to pass the air or pressure from the underside or face of the aeroplane through the covering therefor with a deflection rearwardly, which acts to force or drive forward the aeroplane in the line of its travel; to cause the pressure of the air passing through the meshes or interstices of the covering from the side of high pressure to the side of low pressure of the aeroplane to act with a propelling force and drive the aeroplane edgewise or parallel to the body thereof; to escape a film of air through the several meshes or interstices of the covering for the aeroplane under a deflection to the rear, giving a resultant propelling force along the surface of the aeroplane in the direction of the front thereof; to graduate the propelling force exerted by the deflected films of air rearwardly and escaping through the interstices or meshes of the covering of the aeroplane by employing strips, sheets, or plates having varying thicknesses, by which the film of air will be deflected to a greater or less extent, so as to escape practically parallel with the surface of the aeroplane or in a direction of perpendicularity to such surface; to form the covering for the aeroplane, which constitutes the acting surface thereof, of thin strips, sheets, or plates set edgewise in a support for the upper ends of the thin strips, sheets, or plates to rise above the top plane of the support with a rearward curve for deflecting or turning the air rearwardly to give as a resultant a forward-propelling action on the aeroplane, and to improve generally the construction, arrangement, and operation of the aeroplane as a whole.

The invention consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings in order to properly represent the construction the figures are enlarged as to the sizes of the pieces for the body or support and the strips, sheets, or plates for the covering.

Figure 1 is a sectional side elevation showing the aeroplane of the invention in connection with a frame and a carrier or basket, the aeroplane having the covering therefor and the frame broken off at both ends; Fig. 2, a sectional end elevation of the parts shown in Fig. 1 with the covering and frame broken off on both sides; Fig. 3, a detail in side elevation, showing the manner of inserting and holding the strips, sheets, or plates for the covering in the longitudinal or fore-and-aft bars of the support; Fig. 4, a side elevation, on a reduced scale as to Figs. 1 and 2, showing the aeroplane complete and its application for use with a gliding device or appliance; Fig. 5, a plan view of the under side of the aeroplane-covering complete, and Fig. 6 a plan view of the upper side of the aeroplane-covering complete.

The aeroplane of the invention in its form of application illustrated is located on a frame or bed consisting of longitudinal bars A and cross-bars A′, from which is suspended in the arrangement shown a carrier or basket D, which may be the body of a gliding device or appliance, as in Fig. 4. It is to be understood, however, that the invention proper pertains to the construction of an aeroplane, and especially to the covering of an aeroplane.

The support or body of the aeroplane is formed of a series of bars B, preferably of aluminium. A practical dimension for these bars is one-eighth of an inch thick and one-fourth of an inch wide, and for useful results they can be arranged over the entire width of the aeroplane-surface, extending from front

to rear of the surface and set apart a distance of a quarter of an inch. Each bar is milled through half of its width, or thereabout, forming cuts, slits, or slots B′. This milling can be such as to have from ten to forty cuts or slits to each inch in length of the bar, and all of the bars are to be milled uniformly, so that the several bars will have extending thereinto cuts or slits of a uniform depth and width.

The longitudinal or fore-and-aft bars of the aeroplane-surface have entered into their cuts or slits strips, sheets, or plates C, which strips, sheets, or plates extend across the entire width of the aeroplane and constitute the covering or acting face for the aeroplane, against which the force of the air-pressure operates to move or drive the aeroplane edgewise or in parallel lines. The strips, sheets, or plates forming the covering for the aeroplane are preferably of metal, and as to size a proper dimension for each strip, sheet, or plate is an eighth of an inch wide and one five-hundredths of an inch thick. The strips, sheets, or plates have their bodies entered into the cuts or slits in the upper edge of the longitudinal or front and rear bars, and the upper edge of each strip, sheet, or plate extends above the upper plane of the bars, and the edges are rearwardly curved, presenting a plane of curved edges C′, each edge curving in the direction of the rear end of the aeroplane, with the line of curvature the same for all of the edges, setting the edges parallel one with the other. The degree of curvature for the projecting edges can be greater or less, according as to whether it is desired to have the projection of the passed air operate along the surface of the aeroplane and essentially parallel therewith or in the direction having a perpendicularity to the surface of the aeroplane.

The support or body for the aeroplane in the construction shown is completed by cross-bars C^2, running parallel with the strips, sheets, or plates of the covering and entered into slots therefor in the upper edge of the longitudinal or fore-and-aft bars, which slots are of a depth for the top edges of the longitudinal or fore-and-aft bars and the cross-bars to be in the same level plane. These cross-bars C^2 serve the purpose of holding the longitudinal or fore-and-aft bars in proper relation and parallel with each other and also act to close a portion of the surface area of the aeroplane to the passage of air. The cross-bars C^2 for practical use may be an eighth of an inch square and can be set apart a quarter of an inch, corresponding to the distance apart of the longitudinal or fore-and-aft bars, dividing the support or body at its upper portion into squares of a quarter of an inch dimensions. The longitudinal or fore-and-aft bars, the cross-bars, and the cross strips, sheets, or plates when brought together are rigidly fastened in place by soldering, cementing, riveting, or otherwise securing the parts firmly together, and when completed the whole forms the covering for an aeroplane, of which the deflecting strips, sheets, or plates constitute the essential and important element.

The covering on the plan and employing the dimensions given will be about one-fourth of an inch thick, with an upper portion for the support or body having rectangular meshes a quarter of an inch square and a filling for each mesh by the cross strips, sheets, or plates, leaving spaces or interstices between the strips, sheets, or plates for the passage of air from the under side of the covering as a whole to the under side thereof, and a deflection of the passed air through the medium of the curved projecting edges of the strips, sheets, or plates. The surface of the aeroplane-covering has about one-third of the surface area filled with the strips, sheets, or plates, and the strips, sheets, or plates should be evenly distributed over the entire surface, leaving about two-thirds of the entire surface area impervious to air, which area of surface impervious to air is found to be the best for maintaining and preserving the maximum buoyancy of the aeroplane.

It is to be understood that the intent of the invention is not to produce pressure against the surface of the aeroplane, but to utilize a part of the pressure against the surface by passing the air through the interstices or spaces instead of piling the air up under or against the lower surface of the aeroplane to form a dead-cushion and have the passed air projected with a resultant impact or action forwardly, that will cause the aeroplane to pass up the plane of air-pressure, assisting whatever force is used to obtain motion, whether the force be wind, as in driving a windmill, or other force to give a driving pressure for the aeroplane. The action is somewhat on the principle of a sail having holes therein, which is set at an angle oblique to the direction of the wind, with the wind abeam, receiving when thus set a constant pressure, which pressure is exerted on the sail regardless of the velocity of the wind, giving an increased sailing speed from the fact that the wind instead of piling up and producing a dead-cushion within or against the sail is permitted to run out or escape through the holes or openings of the sail, thereby constantly renewing the pressure of live air against the sail and doing away with the dead-cushion, which would be formed by the air and pressure if not relieved. The air on the under side or surface of the aeroplane rushes through the interstices or spaces of the meshes, and in so doing it strikes or impinges against the under faces of the rearwardly-curved edges of the strips, sheets, or plates, with the result of causing the impact to produce a forward thrust or projection in the direction of motion somewhat on the principle of the action of the wind on the blades of an ordinary windmill, but differing from that action in not being derived from direct wind-pressure, but

from the pressure produced by the aeroplane-surface.

The propelling strips, sheets, or plates for the best results should be thin and numerous in order to prevent loss of buoyancy by reason of air passing through the surface in too great a quantity. The greater the number of strips, sheets, or plates to the inch and the thinner the metal or material from which they are made the better the effect, and, as a matter of fact, coarse construction will be entirely useless. The film of air passing through the interstices or spaces between the propelling strips, sheets, or plates if very thin will have the entire quantity of air passed deflected rearwardly and escaping almost entirely along the upper surface of the aeroplane-covering, which will give, by the impingement or impact, an almost direct forward projection or thrust toward the front; but if the film of air passing through the interstices or spaces of the strips, sheets, or plates be thick the passed air will not be so decidedly deflected, as it will have a direction upwardly from and more perpendicular to the surface of the aeroplane, with the result that the consequent projection or thrust forward or toward the front will not be in the direction of parallel motion to the front, as in the case of a thin film, but will be farther away from the direction of motion.

The strips, sheets, or plates are to be set in such relation as to leave the requisite amount of interstice or space between two adjoining strips, sheets, or plates, and the arrangement in conjunction with the curvature of the upper ends should be such as to present a free passage for the pressure without obstruction to the flow that would create a choking or stoppage, it being a requisite that the flow of air should be free in order to secure the necessary impact where the air or pressure contacts the curve, which impact produces a resultant projection or thrust forward. It is also desirable that as many strips, sheets, or plates be used to the inch as possible without interfering with the free flow of the air or pressure from the under side to the upper side of the covering under conditions for the production of the impact, and at least twenty strips, sheets, or plates to the inch should be employed, and more than twenty will secure better results, for the reason that an interstice or space of, say, one thirty-second of an inch wide would approximately be twice as effective as an interstice or space of one-sixteenth of an inch wide; but care must be taken not to have too much or an excess of open surface, and when properly constructed with the open surface in proportion such open surface will not lessen the pressure under the aeroplane, but will increase the pressure, owing to the release of the cushion of dead air, so to speak, and the eddies produced in the escape or passage of the air from the under side to the upper side of the aeroplane. The covering of this invention applied to a windmill, as an illustration, will double, approximately, the working power of the mill in low-wind velocities— that is, with a wind of three miles per hour the intersticed or spaced covering will make the mill as effective for operation as a windmill of the ordinary construction with a wind having the velocity of six miles per hour. This increase of effectiveness with the aeroplane-covering of the invention will hold good in reference to a windmill up to where the wind has a velocity of ten miles per hour, or thereabout; but with an increase of velocity over ten miles there will be a gradual falling off in working results, and with a very high wind of twenty-five miles an hour and upward the effectiveness as to increased results with a low velocity will pertain to the aeroplane-covering of the invention whether the force be the wind or a force produced by mechanical means or appliances, and the increased effectiveness arises from the release of the pressure on the under side of the aeroplane-covering to flow through the interstices or spaces and cause the impact on the curved faces of the strips, sheets, or plates to give a resultant projection or thrust in a forward direction.

What I regard as new, and desire to secure by Letters Patent, is—

1. A covering for an aeroplane having a reticulated body and an acting surface, the acting surface formed of thin material set edgewise, leaving interstices or spaces and having a curved rearwardly-deflecting edge, for pressure to pass through the interstices or spaces and give a forward thrust or projection in the direction of the front of the aeroplane, substantially as described.

2. A covering for an aeroplane having its acting surface formed of thin material set edgewise with interstices or spaces, the edgewise-set thin material having a plane of curved rearwardly-deflecting edges, for pressure to pass through the interstices or spaces and give a forward thrust or projection in the direction of the front of the aeroplane, substantially as described.

3. A covering for an aeroplane consisting of longitudinal or fore-and-aft bars and cross-bars set into the upper edges of the longitudinal or fore-and-aft bars, and strips, sheets or plates of thin material set edgewise in the longitudinal or fore-and-aft bars and cross-wise of the aeroplane with upwardly and rearwardly curved edges above the plane of the top surface of the bars, substantially as described.

4. A covering for an aeroplane having longitudinal or fore-and-aft bars and cross-bars set into the upper edge of the longitudinal or fore-and-aft bars forming a meshed body or support, and thin strips, sheets, or plates set edgewise in the longitudinal or fore-and-aft bars between the cross-bars, forming a filling with interstices or spaces for the meshes of the support or body and extending above the

upper plane of the support or body with their extended edges rearwardly curved for rearwardly-deflecting pressure passing through the interstices or spaces and have the impact give a thrust or projection forward in the direction of the parallelism of motion for the aeroplane, substantially as described.

5. A covering for an aeroplane having a series of longitudinal or fore-and-aft bars and a series of cross-bars set into the upper edge of the longitudinal or fore-and-aft bars, forming a support or body with square meshes, and thin strips, sheets or plates set edgewise in the longitudinal or fore-and-aft bars between the cross-bars forming a filling with interstices or spaces within the square meshes and extending above the upper plane of the body, with the extending edges rearwardly curved for rearwardly-deflecting pressure passing through the interstices or spaces and have the impact give a thrust or projection forward in the direction of the parallelism of motion for the aeroplane, substantially as described.

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