Nov. 29, 1932. S. E. HITT 1,889,477

SAFETY SURFACE FOR AEROFOILS

Filed Nov. 11, 1931 4 Sheets-Sheet 1

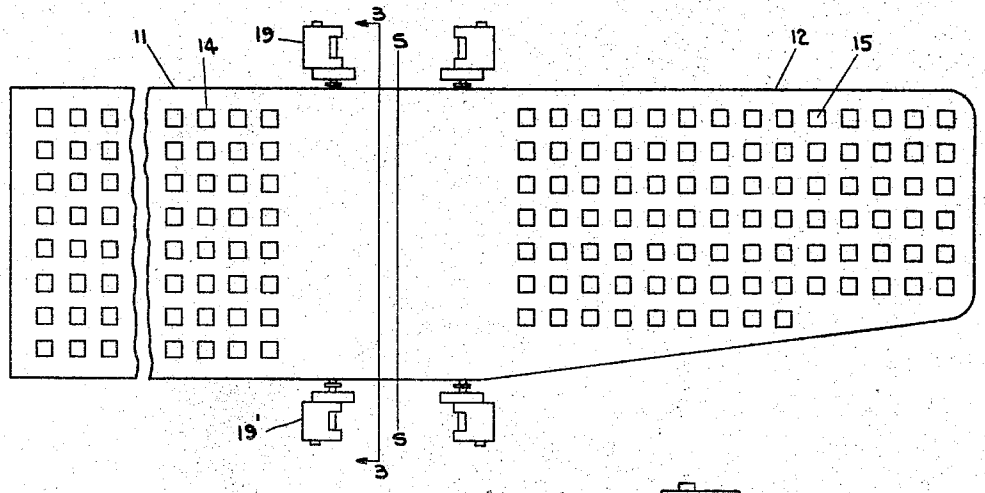


Fig. 1

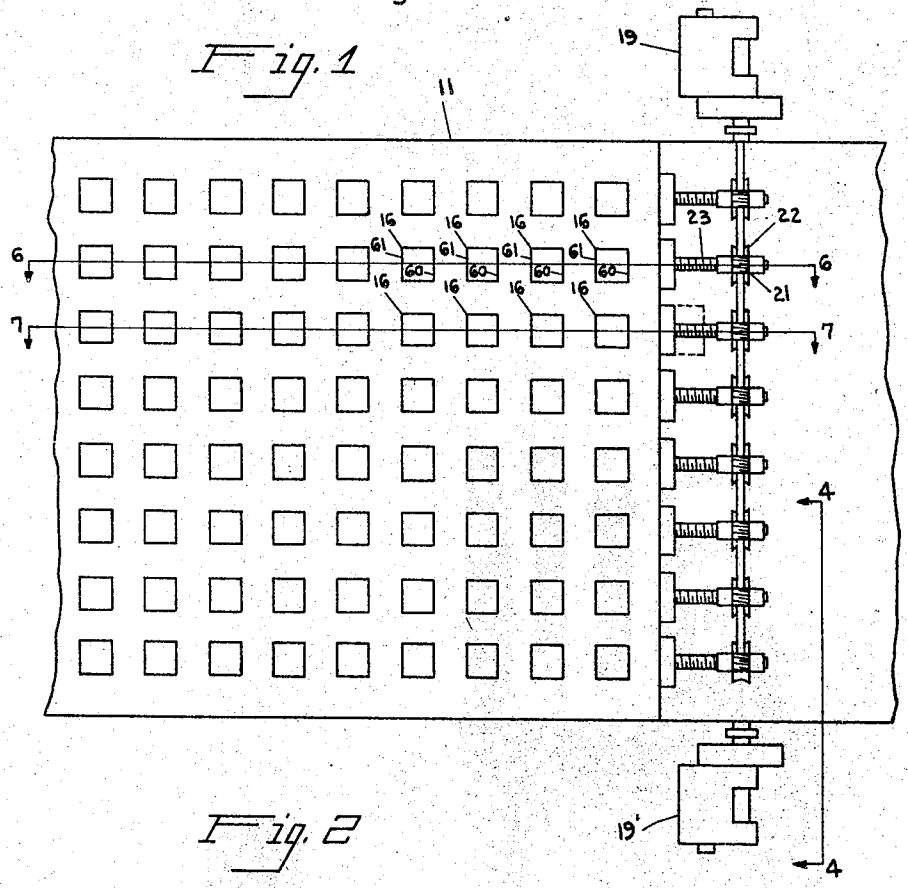


Fig. 2

WITNESS
Earle E. Weller

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SAFETY SURFACE FOR AEROFOILS

Filed Nov. 11, 1931 4 Sheets-Sheet 2

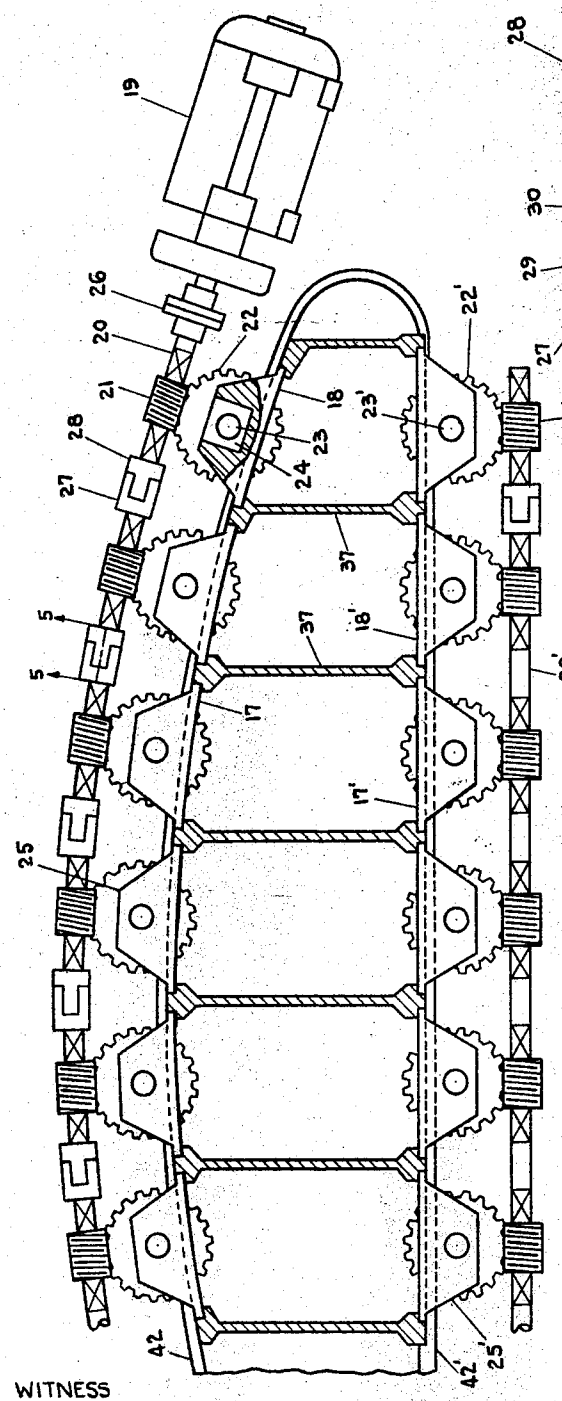


Fig. 3

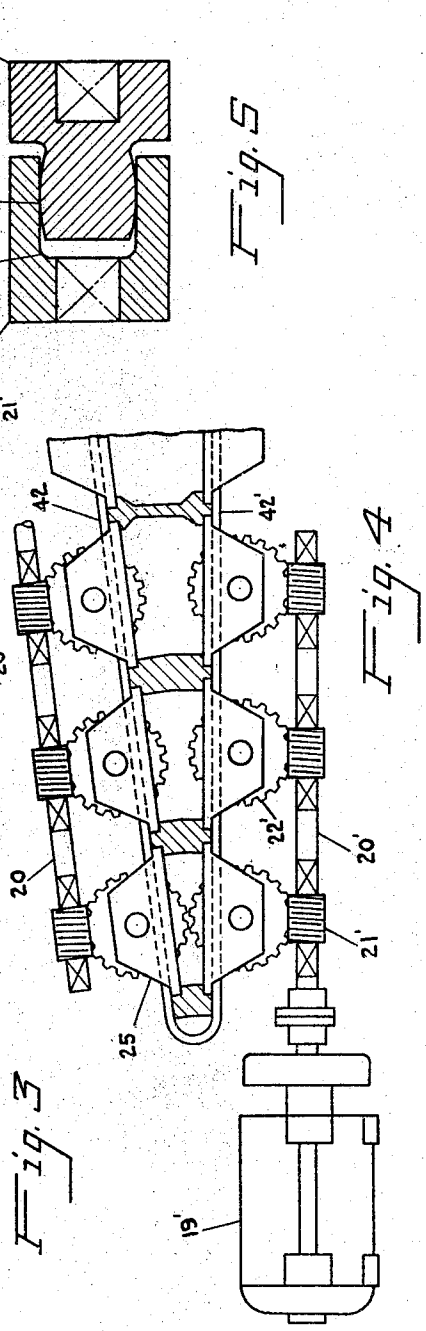


Fig. 4

Fig. 5

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SAFETY SURFACE FOR AEROFOILS

Filed Nov. 11, 1931 4 Sheets-Sheet 3

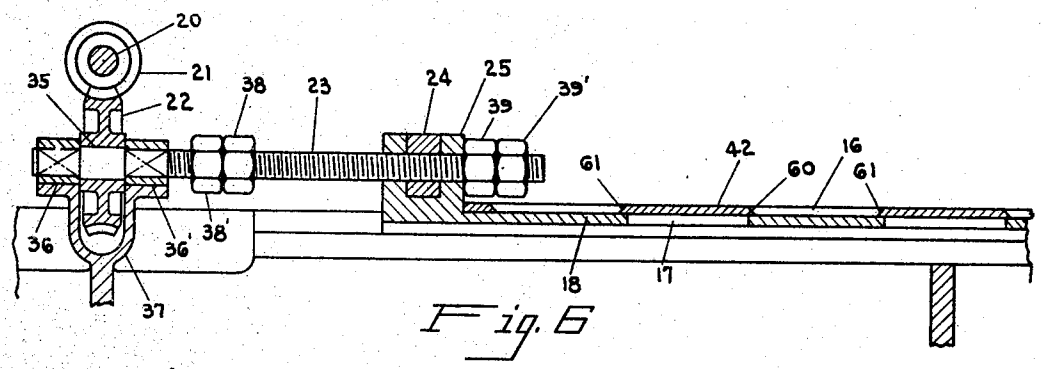


Fig. 6

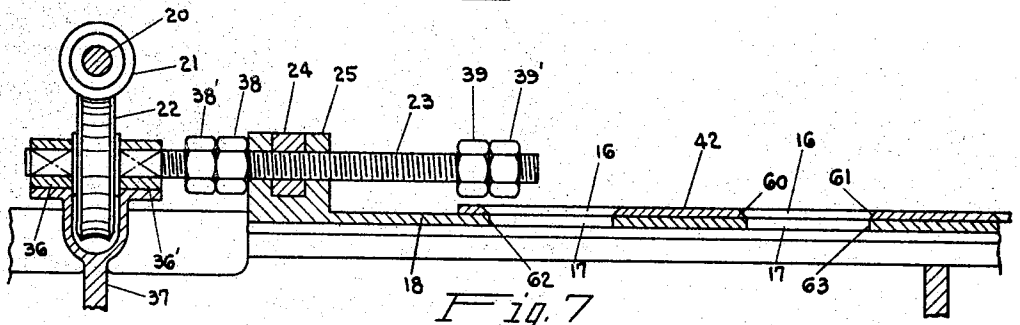


Fig. 7

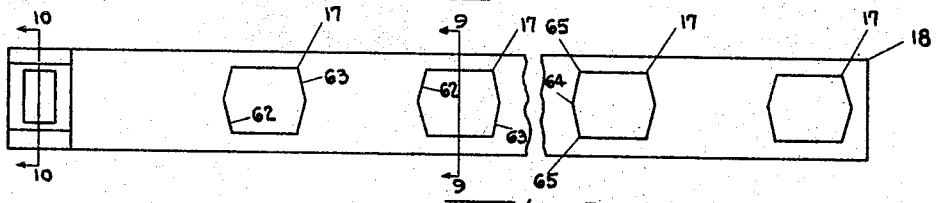


Fig. 8

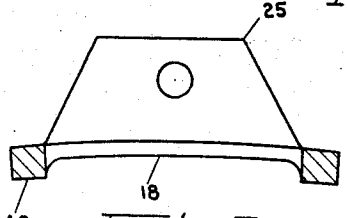


Fig. 9

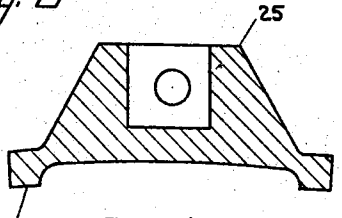


Fig. 10

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SAFETY SURFACE FOR AEROFOILS

Filed Nov. 11, 1931 4 Sheets-Sheet 4

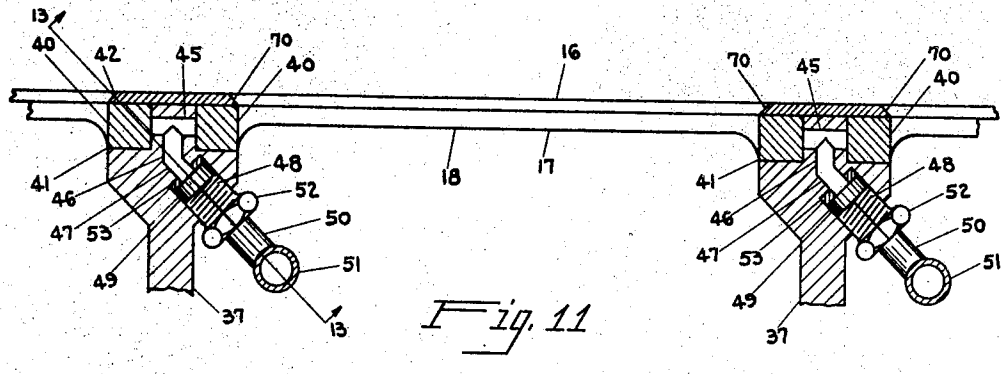


Fig. 11

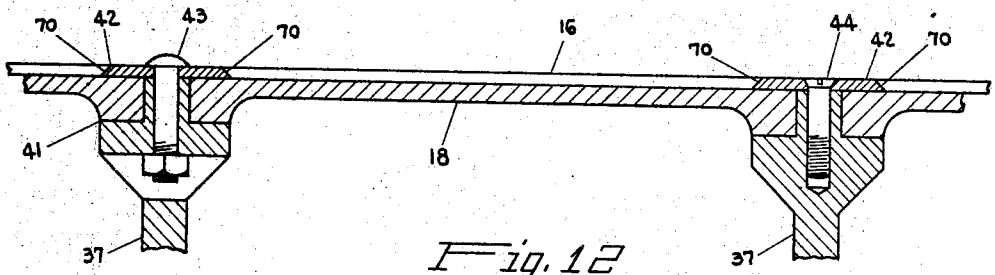


Fig. 12

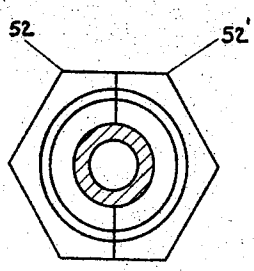


Fig. 14

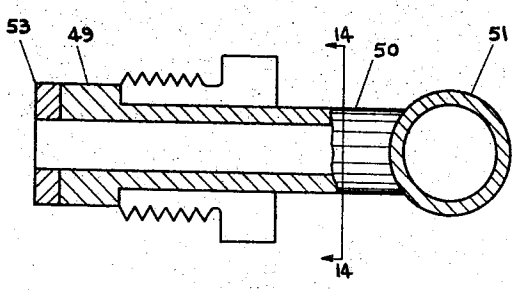


Fig. 13

WITNESS
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Patented Nov. 29, 1932 1,889,477

UNITED STATES PATENT OFFICE

SAMUEL E. HITT, OF ELYRIA, OHIO

SAFETY SURFACE FOR AEROFOILS

Application filed November 11, 1931. Serial No. 574,264.

My invention relates to aerofoils such as are adaptable to seaplanes and more particularly to my aeroship, which is intended to ride on the surface of the water or skip on the crest of waves, illustrated and described in my application, two hulled air and water craft, filed March 26, 1928, Serial No. 264,634, (allowed Sept. 31, 1931), aerofoils for aeroships, Aug. 11, 1931, No. 1,817,920, air valves for aerofoils, Nov. 10, 1931, No. 1,831,247, and others.

My aeroship carries a thousand passengers and the greatest concern is for their safety. Ordinarily, my aeroship making better than a hundred miles an hour will be able to circumnavigate a storm, whose center would travel at a much less speed, but going out of its course to avoid one storm the aeroship might encounter another or run into a fog and the low visibility might force the pilot to come to and cast anchor to ride out the storm. In this case the aerofoils are more or less at the mercy of the elements and if the wind is of a cyclonic nature might possibly get enough hold on the aerofoils to wreck the aeroship.

To overcome this hazard and make my aeroship safe against storms, my invention consists of an aerofoil with main supporting surfaces perforated, with all openings closed for normal running conditions, and opened when necessary to reduce the lifting power of the aerofoil sufficiently that it is impossible for the wind to do very much damage.

An object of my invention is to provide openings in the main supporting surfaces of an aerofoil to reduce their area by a third or a half and thereby reduce the lifting power of those surfaces by 70% to 80%.

An object of my invention is to close the openings or perforations in the main supporting surfaces without greatly increasing either the head or surface resistance.

An object of my invention is to provide perforated cover strips to slide inside of the main supporting surfaces to open and close the perforations in the said surfaces.

An object of my invention is to provide electric or other power and suitable mechanism to operate the cover strips.

An object of my invention is to provide a forced oil feed lubrication for the cover strips.

An object of my invention is to provide steam heating of the aerofoils for freezing weather to prevent accumulation of ice and to insure perfect operation of cover strips, even in bad weather.

An object of my invention is to space the perforations in groups, thus dividing the aerofoil into sections lengthwise to shorten the length of cover strips and also to locate the motors adjacent to the supporting framework.

An object of my invention is to provide perforated openings for my new barrel type aerofoil with a wing spread of about six hundred feet.

With the above and other objects in view, the invention further includes the following novel features and details of construction to be hereinafter more fully described, illustrated in the accompanying drawings and pointed out in the appended claims.

Fig. 1 is a half plan of aerofoil with perforated surfaces.

Fig. 2 is an enlarged plan of part of Fig. 1.

Fig. 3 is a part section of aerofoil on line 3—3 of Fig. 1.

Fig. 4 is a part section of trailing portion of aerofoil on line 4—4 of Fig. 2.

Fig. 5 is a section of jaw coupling on line 5—5 of Fig. 3.

Fig. 6 is a section on line 6—6 of Fig. 2, showing perforations closed.

Fig. 7 is a section on line 7—7 of Fig. 2, showing perforations open.

Fig. 8 is a part plan of one of the cover strips.

Fig. 9 is a section on line 9—9 of Fig. 8.

Fig. 10 is a section on line 10—10 of Fig. 8.

Fig. 11 is a general section through cover strip and frame showing method of oiling.

Fig. 12 is a general section through cover strip and frame showing method of mounting outside covering.

Fig. 13 is a section of a branch oil pipe on line 13—13 of Fig. 11.

Fig. 14 is a section on line 14—14 of Fig. 13.

Referring to the drawings in detail wherein like characters of reference denote corresponding parts, 11 is the central portion of my aerofoil between supports and 12 is one of the side wings, continuation of 11 and overhanging one of the supports on line S—S of Fig. 1. 14 is one of the two groups of perforations in the central portion 11 and 15 is a group of perforations in the covering of the overhanging wing 12. 16 are individual perforations of groups 14 in the upper covering of central portion 11 of aerofoil. 17 are corresponding perforations in the cover strip 18.

In Fig. 6, the perforations 16 are shown under cover by the cover strip 18.

In Fig. 7, the perforations 16 are shown opened when cover strip 18 moves to bring the openings 17 directly under the perforations 16.

The cover strip 18 is moved by the electric motor 19 or other power, driving shaft 20, worm 21, worm gear 22, threaded spindle 23 and nut 24 carried by the boss 25 of the cover strip 18.

Motor 19 drives shaft 20 through the slip gear coupling 26. Shaft 20 follows the curvature of the aerofoil surface and therefore carries the jaw couplings 27—28. Coupling 27—28 consists of a jaw 27 with slotted opening 29 and the tongue end 28 of gear tooth form 30 so that the jaw coupling acts as an oscillating one tooth gear to transmit the revolutions of the motor smoothly and at practically uniform speed through the numerous sections of shaft 20 wherever such sections 20 are at an angle with one another to follow the curvature of the top main supporting surface of aerofoil.

As shown in Fig. 6, worm gear 22 is mounted on an enlargement 35 of the threaded spindle 23, running between stationary bearings 36 and 36′ and therefore has only a rotative movement relative to the aerofoil frame 37. The threaded spindle 23 is provided with lock nuts 38 and 38′ at one end of the travel of the cover strip 18 and lock nuts 39 and 39′ at the other end of travel.

In Fig. 6 the boss 25 of cover strip 18 is shown in contact with lock nut 39 when cover strip 18 is moved out and in Fig. 7 boss 25 is shown in contact with lock nut 38 when cover strip 18 is moved in toward the driving gear.

As shown in Figs. 9 and 10, cover strip 18 is provided with side bars 40 which slide in guide grooves 41 in the frame 37 holding the cover strip 18 against the aerofoil covering 42. Covering 42 is held by bolts 43 and screws 44. Guide grooves 41 in frame 37 are provided with oil holes 45 connecting to oil holes 46 and 47. 47 is counterbored at 48 to receive collar 49 of the branch pipe 50 from the oil feed pipe 51. The counterbore 48 is tapped for the split nut 52—52′ which screws down on the collar 49 and washer 53. This construction is used to facilitate inspection and repairs at sea.

As shown in Fig. 2, perforations 16 in the aerofoil covering are square.

As shown in Fig. 8, openings in the cover strip 18 are V-shaped on line of travel, so that if any of the aerofoil cover edges 60 or 61, or the cover strip edges 62 or 63 should warp and have a tendency to jam when the openings 17 pass the openings 16, then the V-shaped edges 62 or 63 will be guided by the straight edges 60 and 61 from the centers 64 to the sides 65, or vice versa and no interference will occur.

In Figs. 6 and 7 the edges 70 of the openings 16 in the aerofoil covering 42 are shown beveled at 45°, to reduce air resistance. Edges 62 and 63 of the cover strips 18 are not beveled because they are not exposed to the stream line when perforations are uncovered or open as shown in Fig. 7.

Perforations 16′ in the bottom covering 42′ of the aerofoil are directly under the perforations 16 of the top covering 42. Likewise the openings 17′ in the bottom cover strip 18′ are similar to the openings 17 in the cover strip 18 above them.

On account of the lower covering 42′ being practically flat, only a few jaw couplings are required near the leading edge for the lower shaft 20′ and only one is shown. Otherwise the distribution of the lower perforations and their cover strips and the driving gear for the lower covering 42′ is similar to that for the upper covering 42 except that the lower motor 19′ is placed at the other end of the drive, mounted on the trailing edge of the aerofoil to balance the load as shown.

In the above description, the wording "main supporting surfaces" refers to the top covering as well as the bottom covering of the aerofoil.

Operation

Should my aeroship be brought to anchor to ride out a store and the pilot wishes to reduce the lifting power of the aerofoil, all upper motors 19 are cut in and all cover strips 18 are pulled in through the slip gears 26, shafts 20, worms 21, worm gears 22, threaded spindles 23, and nuts 24 engaging lugs 25 on the cover strips 18, the openings 17 in the cover strips 18 coming directly under or indexing with the openings 16 in the top covering 42, when the lugs 25 engage the lock nuts 38 and an electrical contact device shuts off the motors 19 at the same time or a little before.

In the same manner, the lower motors 19′ uncover the lower perforations 16′ in the bottom covering 42′ of the aerofoil, and the main supporting surfaces of the aerofoil become so reduced in area that no wind short of a cyclone does any damage.

After the storm has subsided, the motors 19 and 19′ are thrown in reversed and the cover strips are returned to their cover positions, putting the aerofoil again into normal condition and the aeroship gets under way.

While the arrangement and construction of the perforated coverings of the main supporting surfaces of my improved aerofoil as herein described and claimed, is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a seaplane, aeroship or similar craft, an aerofoil having a frame constructed with beam members parallel to the lateral axis and extending the full length of the aerofoil wing, upper and lower supporting surfaces carried by the said frame, the said surfaces having perforations disposed in rows parallel to the lateral axis and between the said lateral beam members, perforated cover strips to under-cover the said perforations in the upper surface, perforated cover strips to cover the said perforations in the lower surface, the said cover strips having side bars, the said lateral beam members having guides to suit the said cover strip side bars, and forced oil feed lubrication for contact surfaces of the said cover strip side bars and the said lateral beam guides.

2. In a seaplane, aeroship or similar craft, an aerofoil having upper and lower supporting surfaces spaced one above the other, the said upper surface having perforations disposed in rows parallel to the lateral axis, the said lower surface having perforations disposed in rows under the said rows of perforations in the upper surface, perforated cover strips to under-cover the perforations in the said upper surface, perforated cover strips to cover the said perforations in the lower surface, and separate means for sliding the said cover strips to open and close the perforations of the said upper and lower surfaces, each of the said means comprising a motor, spur gear reduction, slip gear, shafting with couplings, worm gear reductions, screw reductions, stop nuts on the said screw, a pocketed nut carried by a lug on the said cover strip to engage the said screw, the said lug on the said cover strip engaging the said stop nuts on the said screw to limit the travel of the said cover strip between the open and closed positions of the said cover strip, substantially as specified.

3. In a seaplane, aeroship or similar craft, an aerofoil having upper and lower supporting surfaces spaced one above the other, the said upper and lower surfaces having perforations disposed in rows parallel to the lateral axis, perforated cover strips to under-cover the perforations in the said upper surface, perforated cover strips to cover the perforations in the said lower surface, the said perforations in the said upper and lower surfaces having straight edges at right angles to the line of travel of the said cover strips, the said perforations in the said cover strips having V-shaped edges at right angles to the line of travel of the said cover strips, substantially as specified.

4. In a seaplane, aeroship or similar craft, an aerofoil having a frame constructed with beam members parallel to the lateral axis and extending the full length of the aerofoil, upper and lower supporting surfaces carried by the said frame, the said surfaces having perforations disposed in rows parallel to the lateral axis and between the said lateral beam members, the said rows of perforations arranged in groups laterally, perforated cover strips to under-cover each of the said groups of perforations in the said upper surface, means for sliding each group of said cover strips for the upper surface to open and close each of the said groups of perforations in the said upper surface independently, the said means comprising a motor mounted on the leading edge of the said frame, spur gear reduction, slip gear, shafting with couplings, worm gear reduction and screw reduction, substantially as specified.

5. In a seaplane, aeroship or similar craft, an aerofoil having a frame constructed with beam members parallel to the lateral axis and extending the full length of the aerofoil, upper and lower supporting surfaces carried by the said frame, the said surfaces having perforations disposed in rows parallel to the lateral axis and between the said lateral beam members, the said rows of perforations arranged in groups laterally, perforated cover strips to cover each of the said groups of perforations in the said lower surface, means for sliding each group of said cover strips for the lower surface to open and close each of the said groups of perforations in the said lower surface independently, the said means comprising a motor mounted on the trailing edge of the said frame, spur gear reduction, slip gear, shafting, coupling, worm gear reduction and screw reduction, substantially as specified.

6. In a seaplane, aeroship or similar craft, an aerofoil having a frame constructed with beam members parallel to the lateral axis and extending the full length of the aerofoil wing, upper and lower supporting surfaces carried by the said frame, the said surfaces having perforations disposed in rows parallel to the lateral axis and between the said lateral beam members, perforated cover strips to under-cover the said perforations in the upper surface, perforated cover strips to cover the said perforations in the lower surface, the said cover strips having side bars, the said lateral beam members having guides to suit the said

cover strip side bars, and forced oil feed lubrication for contact surfaces of the said cover strip side bars and the said lateral beam guides, and means for heating the said aerofoil, substantially as specified.

Signed at Elyria, in the county of Loraïn and State of Ohio, this 10th day of November, 1931.

SAMUEL E. HITT.