Nov. 23, 1943. E. W. MORRIS ET AL 2,335,018

DEICING MEANS FOR PROPELLERS

Filed Dec. 9, 1939 2 Sheets-Sheet 1

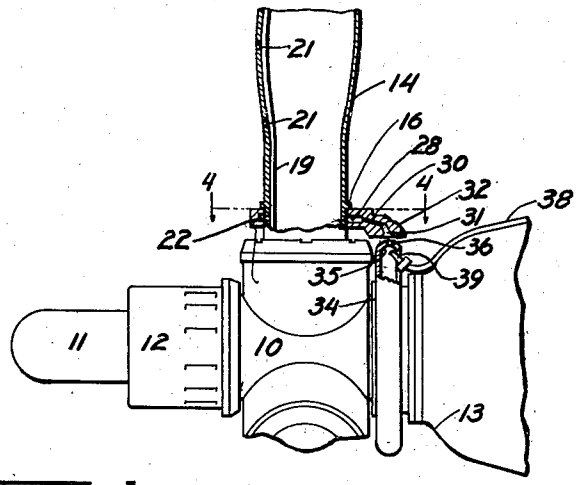


FIG. 1.

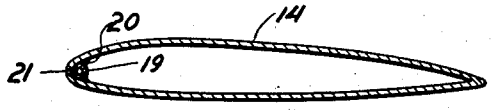


FIG. 2.

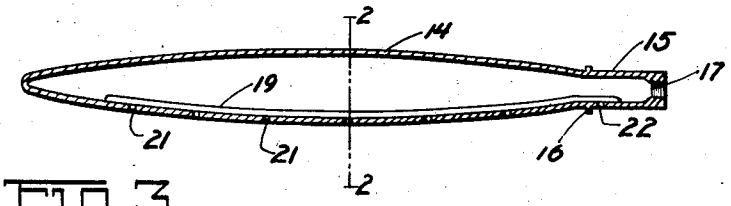


FIG. 3.

INVENTORS
EDWARD W. MORRIS & JACK H. SHEETS
BY
ATTORNEY

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Filed Dec. 9, 1939 2 Sheets-Sheet 2

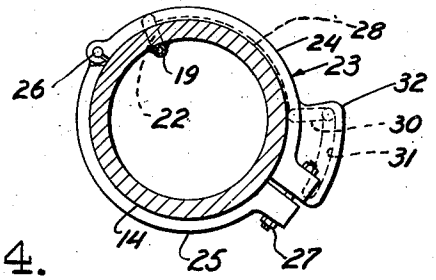


FIG. 4.

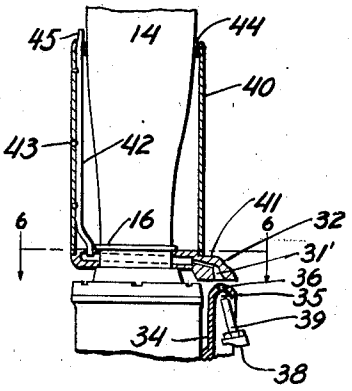


FIG. 5.

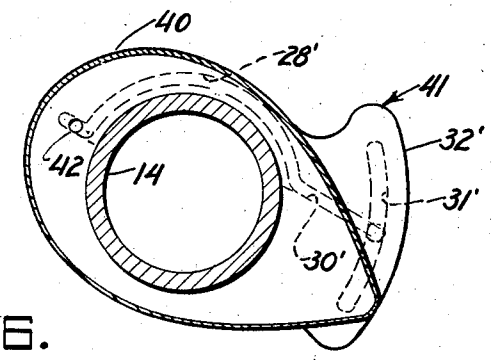


FIG. 6.

INVENTORS
EDWARD W. MORRIS & JACK H. SHEETS
BY Zev E. Black
ATTORNEY

Patented Nov. 23, 1943

2,335,018

UNITED STATES PATENT OFFICE

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DEICING MEANS FOR PROPELLERS

Edward W. Morris, Tipp City, Ohio, and Jack H. Sheets, Hawthorne, N. J., assignors to Curtiss-Wright Corporation, a corporation of Delaware

Application December 9, 1939, Serial No. 308,454

1 Claim. (Cl. 244—134)

This invention concerns aeronautical propellers, and in particular provides means for preventing the formation of ice on the blades of propellers whose pitch is adjustable during operation.

It is known that the problem of ice formation on propeller blades has been considered heretofore with particular reference to fixed pitch propellers. It is an object of this invention to provide de-icing means for controllable propellers, the invention providing for the feeding of de-icing fluid from stationary parts of the system to the rotating propeller in such manner that the fluid is fed regardless of the position of pitch adjustment. A further object is to provide a particular conduit construction for hollow propeller blades by which de-icing fluid is conducted to the leading edges of propeller blades. Still a further object is to provide means for feeding de-icing fluid to the leading edge of a cuff or fairing which embraces the root portions of a propeller blade.

Further objects will be apparent from a reading of the subjoined specification and claim, together with an examination of the accompanying drawings, in which:

Fig. 1 is a side elevation of a controllable pitch aeronautical propeller mounted upon the nose of an engine, the propeller incorporating the provisions of the invention;

Fig. 2 is a section through a blade of the propeller on the line 2—2 of Fig. 3;

Fig. 3 is a longitudinal section through one of the propeller blades;

Fig. 4 is an enlarged section on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary elevation of a mounted propeller blade showing a fairing cuff in section, and

Fig. 6 is an enlarged section on the line 6—6 of Fig. 5.

Referring to Fig. 1, a propeller hub 10 carrying a power unit 11 and a speed reducer 12 at its forward end, is drivably mounted upon a shaft extending from an engine nose 13, the elements 11 and 12 serving to selectively increase or decrease the pitch of the propeller blades, one of which is shown at 14, in a manner well known in the art. The blades are rotatably mounted in the hub on thrust bearings, also known to the art, and the particular type of blade shown comprises a hollow shell of steel or other suitable material, having a cross-section as indicated in Fig. 2. The root portion of the blade, shown at 15 in Fig. 3, is cylindrical in form and is provided with an integral flange 16 the butt of the blade being interiorly threaded as at 17 to receive a screw abutment which cooperates with the hub bearing assembly. Within the hollow of the blade 14, at its leading edge, a small tube 19 is secured as by brazing, the brazing fillet being indicated at 20. At spaced apart intervals along the blade leading edge small holes 21 are formed these being drilled through the leading edge of the blade and through one wall of the tube 19 to allow of the issue of fluid fed to the tube 19 at the blade butt to the outside of the blade surface for the purpose of dissolving ice which may form thereon during operation. A suitable fluid might comprise alcohol, glycerine or the like.

In order to feed de-icing fluid to the blade, an inlet drilling 22 is formed through the blade butt radially inward of the flange 16, and a fitting 23 is secured around the blade butt comprising elements 24 and 25 hinged at 26 and secured to the blade by a clamp bolt 27. The element 24 is provided with a segmental passage or conduit 28 communicating at one end with the drilling 22 and at its other end with a drilling 30 opening to an inwardly facing segmental trough 31 formed in a segmental boss 32 integral with the element 24. The segmental trough 31 is concentric with the butt portion of the blade and has an arc of embracement substantially equal to the angular pitch change in the blade which may be expected during operation. To the propeller hub and rotatable therewith is secured an annulus 34 having a catch slot 35 and provided with radially extending nozzles 36, each of which lies opposite one of the troughs 31. Secured to the engine nose is a pipe line 38 through which de-icing fluid is fed from a suitable reservoir, this tube terminating in a nozzle 39 directed into the catch slot 35.

In operation, when fluid is fed through the tube 38 it is delivered to the catch slot 35 whence it passes through the nozzles 36 into the grooves 31 of the propeller blades. Since the annulus 34 is rotating rapidly with the propeller hub, the de-icing fluid is thrown by centrifugal force through the nozzles 36 and into the grooves 31 whence it passes through the conduits described to the leading edge of the propeller blade.

In some types of propellers, the blades tend toward a circular cross-section at their root ends, and to endow them with greater aerodynamic efficiency, a sheet metal cuff or fairing may be clamped to the blades. Such a cuff is shown in Figs. 5 and 6 at 40. These cuffs extend possibly one-quarter of the blade length from the hub, and on propellers equipped with the cuffs effective de-icing may be attained by fitting a de-icing

fluid conduit to the leading edge of the cuff 40 whence de-icing fluid sprays substantially radially outward along the balance of the propeller blade to prevent the formation of ice thereon. In applying the invention to propeller cuffs, the conventional forging 41 which forms the base for the cuff replaces the assembly 23 above described and carries a segmental portion 32' having a segmental trough 31' for reception of de-icing fluid. A passage 28' in the forging 41 conducts de-icing fluid toward the leading edge of the cuff whence it issues to a tube 42 brazed to the inside of the leading edge portion of the cuff. Drillings 43 through the cuff and one wall of the tube permit the flow of fluid to the leading edge of the cuff for de-icing purposes. The cuff, incidentally, is rigidly secured to the forging 41 which may be passed over the cylindrical butt end of the propeller blade before assembly of the blade in the hub, the member 41 abutting upon the flange 16 to constrain it against displacement due to centrifugal force. The outer end of the cuff conforms in general to the profile of the propeller blade at that station, but is in clearance relation thereto, the clearance space being filled with a soft resilient material such as rubber or leather, such gasket being shown at 44. This gasket prevents abrasion of the polished surfaces of the propeller blade.

The tube 42 may be extended as at 45 through the outer cuff edge to form a nozzle to spray de-icing fluid along the leading edge of the blade 14 in addition to feeding fluid to the cuff leading edge. Although a sheet metal cuff has been shown, the invention is intended to cover de-icing provisions for cuffs and blades of any material.

The means for feeding the segmental trough 31' is the same as that shown in Fig. 1, comprising the annulus 34 having a catch slot 35 and nozzles 36, the catch slot being fed from a nozzle 39 at the end of the fluid conduit 38 secured to the engine.

While we have described our invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding our invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. We aim in the appended claim to cover all such modifications and changes.

We claim as our invention:

In a propeller blade having a substantially cylindrical butt end, a member embracing said end having a conduit therein extending from a point substantially alined with the blade leading edge to a point adjacent the extreme rear of the blade, means at said first point to convey de-icing liquid therefrom toward the blade leading edge, an open, inwardly facing recess at said second point to receive de-icing fluid, and a streamlined fairing secured to said embracing member and extending outwardly therefrom to embrace the cylindrical portion of the blade.

EDWARD W. MORRIS.
JACK H. SHEETS.