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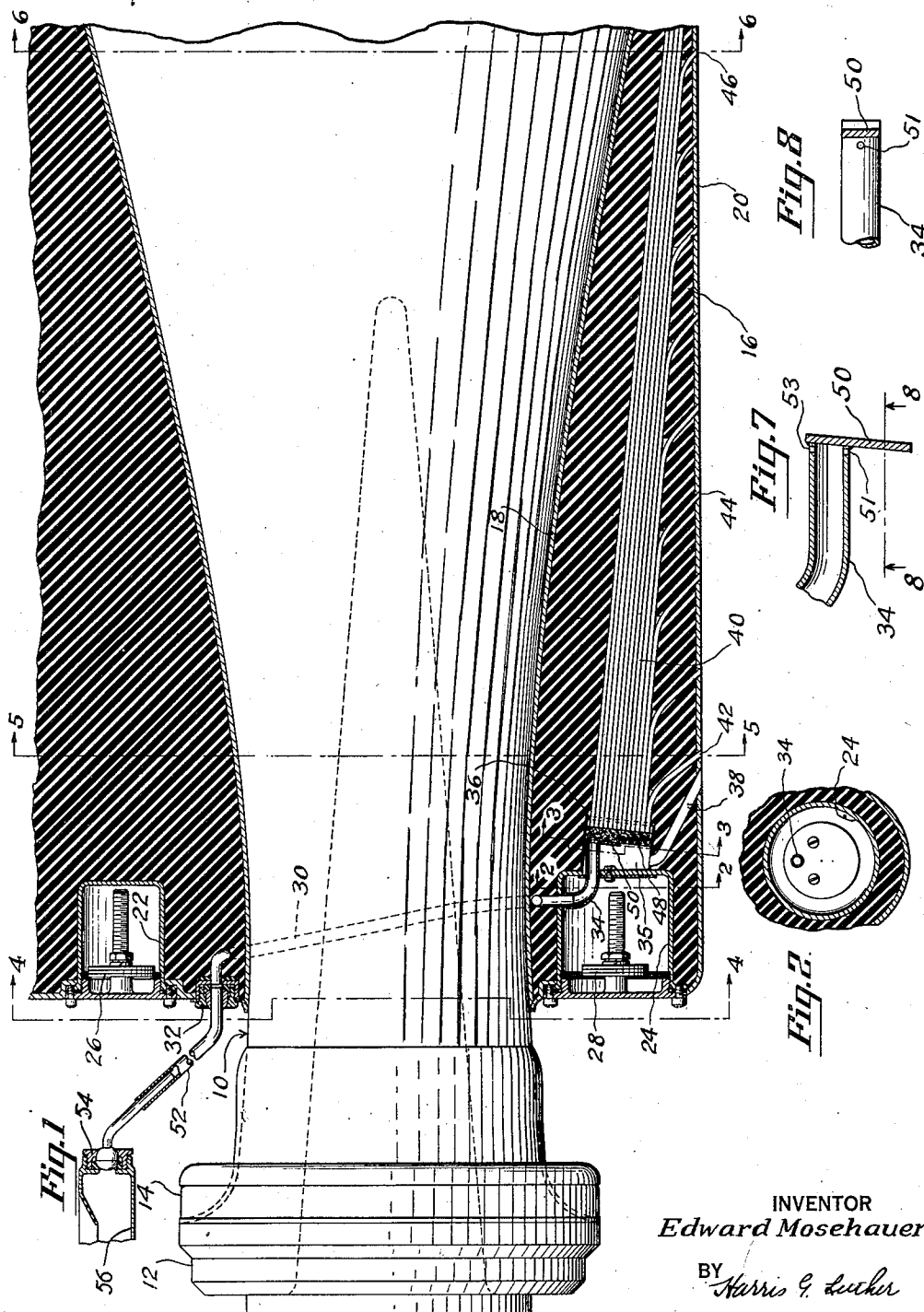
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DEICER FLUID DISTRIBUTOR

Filed Dec. 27, 1940

2 Sheets-Sheet 1



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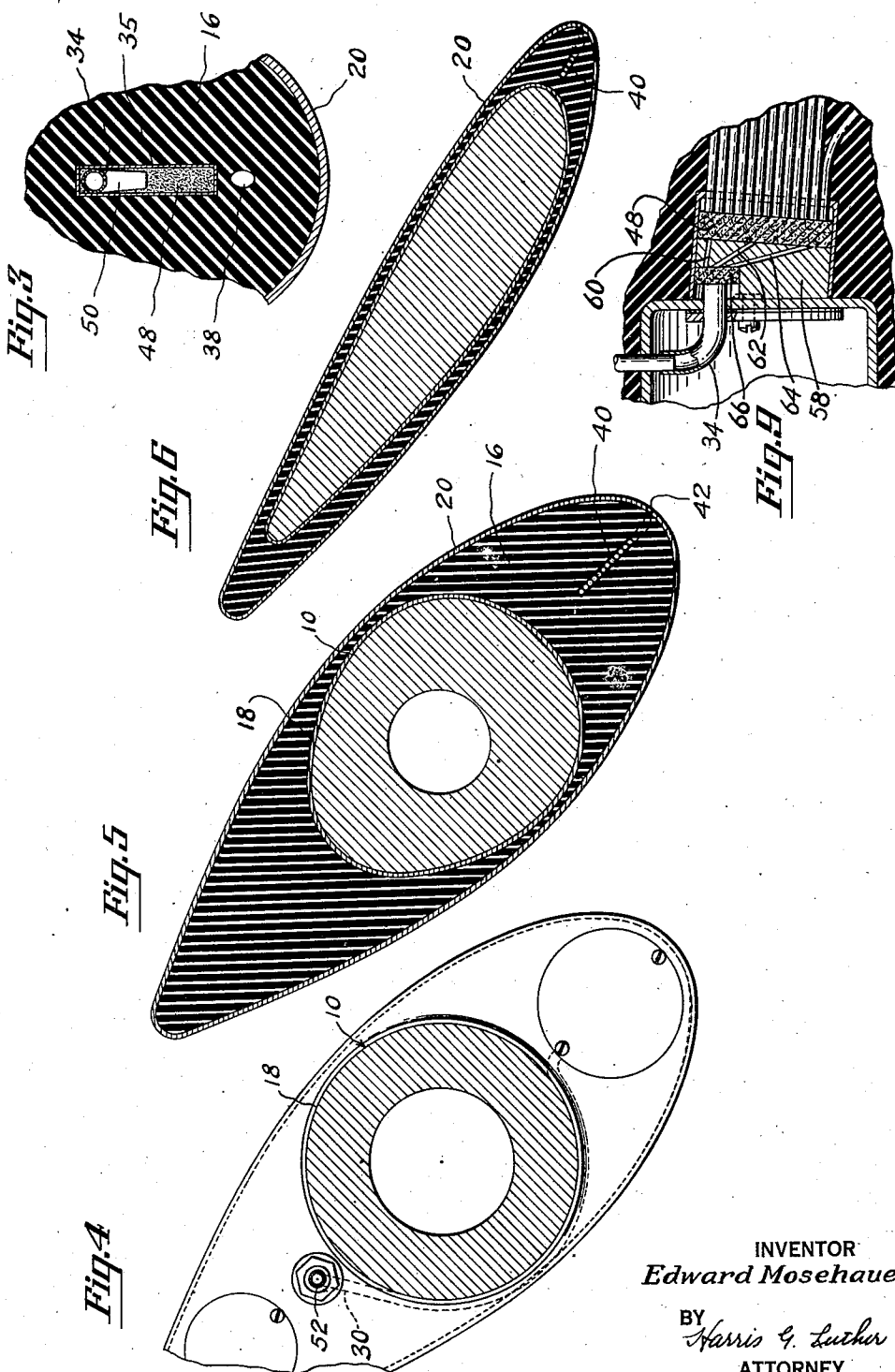
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DEICER FLUID DISTRIBUTOR

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8 Claims. (Cl. 244—134)

This invention relates to improvements in aeronautical propellers and has particular reference to an improved arrangement for carrying de-icing fluid to the blade surfaces of such a propeller.

An object of the invention resides in the provision of an improved de-icing fluid distributor for a propeller blade, incorporated entirely within the structure of the blade.

A further object resides in the provision of an improved de-icing fluid distributor of the character indicated which will distribute de-icing fluid evenly along the length of the blade while the fluid is being subjected to centrifugal forces incident to rotation of the propeller.

A still further object resides in the provision of a de-icing fluid distributor of the character indicated which will regulate the flow of the de-icing fluid to various portions of the blade along the blade length and provide a reasonably uniform distribution of such fluid over the entire portion of the blade on which ice is likely to form.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the accompanying drawings, in which like reference numerals are utilized to designate similar parts throughout, there is illustrated a suitable mechanical embodiment for the purpose of disclosing the invention. The drawings, however, are for the purpose of illustration only and are not to be taken as limiting or restricting the invention since it will be apparent to those skilled in the art that various changes in the illustrated construction may be resorted to without in any way exceeding the scope of the invention.

In the drawings, Fig. 1 is a longitudinal sectional view of a fragmentary portion of a propeller blade showing a de-icing fluid distributor, constructed according to the invention, applied thereto.

Fig. 2 is a transverse sectional view of a fragmentary portion of the propeller blade and de-icing fluid distributor taken on the line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view of a fragmentary portion of the propeller blade and the de-icing fluid distributor taken on the line 3—3 of Fig. 1.

Fig. 4 is a transverse sectional view of the propeller blade and de-icing fluid distributor taken on the line 4—4 of Fig. 1.

Fig. 5 is a transverse sectional view of the

propeller blade and de-icing fluid distributor taken on the line 5—5 of Fig. 1.

Fig. 6 is a transverse sectional view of the propeller blade and de-icing fluid distributor taken on the line 6—6 of Fig. 1.

Fig. 7 is a sectional view on an enlarged scale of certain of the elements shown in Fig. 1.

Fig. 8 is a sectional view on the line 8—8 of Fig. 7, and

Fig. 9 is a sectional view of a fragmentary portion of a propeller blade showing a modified form of de-icing fluid distributing means.

Referring to the drawings in detail, the numeral 10 generally indicates a propeller blade having a rounded shank portion which fairs at one end into the blade form and is terminated at the other end by a retaining flange 12 which provides a seat for an anti-friction thrust bearing 14 for retaining the blade in a propeller hub. The shank portion of the blade is encased in a shank fairing cuff 16. This cuff is shaped to extend the streamlined or airfoil contour of the blade over the rounded shank portion thereof and is preferably formed of some light weight material such as a closed cell expanded rubber composition or a composition of thermoplastic material and granulated cork or some other suitable light weight material. This cuff may be bonded to the surface of the blade shank by a layer 18 of bonding material such as rubber or synthetic rubber or thermoplastic material and may have an exterior coating 20 of some suitable material which will give a smooth comparatively hard exterior finish to the cuff.

In the construction illustrated, the cuff is cut off at its inner end along a plane substantially perpendicular to the longitudinal axis of the blade and is provided with two weight containers 22 and 24 located one at each side of the propeller blade in the trailing and leading edge portions of the cuff respectively. Each of these containers may conveniently comprise a cup shaped metal member imbedded in the cuff and a cover for the open end of the member having a threaded stem projecting into the cup and carrying a plurality of weight discs, as indicated at 26 and 28.

These weight discs may be adjusted to balance the opposite edges of the individual propeller blades and may also be adjusted to provide a condition of static balance of the entire propeller.

A conduit in the form of a metal tube 30 leads from a universal joint connection 32, set into the end portion of the cuff adjacent the blade shank

preferably immediately at the rear of the blade shank, into the inner end of the cup member 24 through a screw or strainer indicated at 33. From the end of the tube 30 within the cup member 24 a bent tubular conduit 34, which may be integral with the tube 30 or separate therefrom as convenience in manufacture and assembly may require, leads through the bottom of the cup member 24 and into a small chamber 35 of elongated rectangular shape, as is particularly shown in Fig. 3. This chamber has its major dimension in a direction chordwise of the blade and is preferably bounded by a thin metal wall sealed at one end to the bottom of the cup member 24 and provided at its opposite end with an end closure in the form of a tube sheet 36 so that any fluid introduced into the chamber through the tubes 30 and 34 will be retained in the chamber and not permitted to leak into the material of the cuff surrounding the chamber.

A tube 38, of relatively large diameter, leads from the leading edge end of the chamber 35 from a location near the end of the cup 24 to the exterior of the leading edge of the cuff at a location near the inner end of the cuff to drain any excess accumulation of de-icing fluid and a plurality of tubes 40, of relatively small diameter, extend through the tube sheet 36 to which they are sealed against leakage of de-icing fluid, to positions spaced along the leading edge of the cuff outwardly from the end of the tube 38, some of these positions being indicated by the numerals 42, 44 and 46. It is to be noted that each of the small tubes 40 leads from the interior of the chamber 35 through the tube sheet 36 and to its respective position in the leading edge of the cuff thus providing a continuous smooth channel from each fluid outlet in the leading edge of the cuff to the interior of the chamber 35, and that the tube nearest the leading edge of the cuff leads to the position nearest the inner end while successive tubes positioned in a direction away from the leading edge of the cuff lead to positions located successively outwardly along the leading edge. In the arrangement illustrated the tubes are arranged in a single row, as is particularly shown in Fig. 5, and open into the elongated chamber 35 in a line extending substantially chordwise of the blade. These tubes may be molded into the material of the blade cuff during formation of the cuff or may be located in a slot provided in the cuff member, the slot being afterwards filled with a suitable plastic material, and may be arranged in other ways than the single row mentioned above. For example, two or more rows or circles may be used if found convenient or desirable. The tube 34 leads into the chamber 35 at the end thereof adjacent to the blade shank and terminates short of the tube sheet 36 at the outer end of the chamber. Between the chamber included ends of the tubes 40 and the open end of the tube 34 there is disposed a fluid distributing member 48, in the form of a wick, pad, or block of porous material such as felt, screening or ceramic material, and between the end of the tube 34 and the adjacent surface of the pad 48 there is disposed a small baffle member 50 for evenly distributing fluid over the adjacent surface of the wick member 48. The end of the tube 34 may conveniently be soldered to the adjacent surface of this baffle member to firmly support the baffle, and one or more apertures, as indicated at 51 and 53 may be provided in the tube wall near the baffle to permit fluid to flow

evenly out of the tube and along the surface of the baffle member and spread uniformly towards the end of the chamber opposite the end at which the tube 34 is located. The baffle 50 is slightly tapered so that some fluid can flow over at least one edge thereof to the pad 48 while the remaining fluid will be forced by the baffle to move towards the above mentioned end of the chamber. This arrangement provides a substantially uniform distribution of de-icing fluid over the inner surface of the pad 48 and the pad then distributes the fluid in substantially uniform quantities to the various tubes 40 so that there will be substantially equal amounts of de-icing fluid flowing from the substantially equally spaced fluid outlets 42, 44, 46, etc. in the leading edge of the cuff. The pad 48 preferably rests on the ends of the tubes 40 projecting within the container 35 to provide a small fluid reservoir between the pad and the tube sheet 36 to assist in the proper distribution of the de-icing fluid to the tubes 40.

The universal joint connection 32 receives one end of a tubular conduit 52 comprising two telescoping members, the opposite end of which is secured in a universal joint 54 carried by a fluid reservoir or slinger ring 56. This arrangement provides a flexible fluid tight connection between the inertia of the ring 56 and the fluid receiving end of the tube 30.

In the arrangement shown in Fig. 9 the baffle plate 50 is omitted and the de-icing fluid is distributed to the porous member 48 through a suitable member 58 disposed within the receptacle 35. This member may be a solid block provided with apertures, as indicated at 60, 62 and 64, leading from the end of the tube 34 to properly spaced locations along the porous member 48. If desired, a space may be provided in the member 58 at the end of the tube 34 and a second porous member 66 may be disposed in this space to facilitate the proper distribution of the de-icing fluid to the apertures 60, 62 and 64.

Other means may be utilized for distributing the fluid to the porous member adjacent the tube sheet as may occur to those skilled in the art, and in some cases a satisfactory distribution of fluid from the end of the fluid conduit 34 may be obtained without the introduction of any intermediate means between the end of this tube and the porous member.

While a suitable mechanical embodiment for the purpose of disclosing the invention has been hereinabove described and illustrated in the accompanying drawings, it is to be understood that the invention is not limited to the particular embodiment so illustrated and described, but that such changes in the size, shape and arrangement of the various parts may be resorted to as come within the scope of the subjoined claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. In a propeller blade having a rounded blade shank surrounded by a shank cuff, a de-icing fluid distribution system comprising, a fluid receptacle, a plurality of conduits leading from said receptacle to different stations along the leading edge of said cuff, and means including a body of porous material in said receptacle for providing a desired distribution of de-icing fluid between the individual conduits leading from said receptacle.

2. In a propeller blade having a rounded blade

shank surrounded by a shank cuff, a de-icing fluid distribution system comprising, a fluid receptacle, a plurality of fluid conduits leading from said receptacle to different stations along the leading edge of said cuff, and means within said receptacle for providing a desired distribution of de-icing fluid between the individual conduits leading from said receptacle, one of said conduits being larger than the other conduit and leading from the space within said receptacle ahead of said fluid distribution means to the fluid outlet station nearest the hub end of said cuff.

3. In a propeller blade, a de-icing fluid system comprising, a fluid receptacle, a plurality of fluid ducts leading from said receptacle to different stations along the leading edge of said blade, and means within said receptacle for providing a desired distribution of de-icing fluid between the individual ducts leading from said receptacle, said distributing means comprising a body of fluid permeable material in said receptacle.

4. In a propeller blade, a de-icing fluid distribution system comprising, a fluid receptacle, a plurality of fluid conduits leading from said receptacle to different stations along the leading edge of said blade, at least a portion of said conduits being secured adjacent their ends in a tube sheet constituting one end of said receptacle, and a body of fluid permeable material in the tube sheet end of said receptacle to distribute fluid to said conduit.

5. In a propeller blade, a de-icing fluid distribution system comprising, a fluid receptacle within said blade, a plurality of fluid ducts extending along said blade from said receptacle to different stations along the leading edge of said blade, at least a portion of said conduits being secured adjacent their ends in a tube sheet constituting one end of said receptacle, a body of fluid permeable material in the end of said receptacle adjacent said tube sheet to distribute fluid to said conduits, and a conduit extending from a source of fluid supply leading into said receptacle along one side thereof and terminating adjacent to the inner surface of said body of fluid permeable material.

6. In a propeller blade, a de-icing fluid system comprising, a fluid receptacle extending in the

direction of the width of said blade and having the end thereof toward the blade tip inclined at an angle diverging toward the blade leading edge and the shank end of the blade from a line perpendicular to the longitudinal axis of said blade whereby the action of centrifugal force on de-icing fluid in said receptacle will create substantially equal fluid pressures along the extent of said receptacle and, a plurality of fluid ducts leading from said end of said receptacle to different stations along the leading edge of said blade, and means within said receptacle for providing a desired fluid distribution between said ducts, said means including a body of fluid permeable material in said receptacle.

7. In a propeller blade, a de-icing fluid system comprising, a fluid receptacle, a plurality of fluid ducts leading from said receptacle to different stations along the leading edge of said blade, and means within said receptacle for providing a desired distribution of de-icing fluid between the individual ducts leading from said receptacle, said distributing means comprising a body of fluid permeable material in said receptacle and means carrying de-icing fluid into said receptacle and depositing said fluid along the surface of said body of fluid permeable material opposite the surface thereof adjacent to said ducts whereby centrifugal force incident to propeller rotation will cause said fluid to spread along said first mentioned surface of said body and pass through said fluid permeable material to said ducts.

8. In a propeller blade, a de-icing fluid distribution system comprising, a fluid receptacle, a plurality of fluid conduits leading from said receptacle to different stations along the leading edge of said blade, at least a portion of said conduits being secured adjacent their ends in a tube sheet constituting one end of said receptacle, and a body of fluid permeable material in the end of said receptacle adjacent said tube sheet to distribute fluid to said conduit the ends of said conduits extending inwardly through said tube sheet to provide between said tube sheet and said body of permeable material a space for the accumulation of a small quantity of de-icing fluid.

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