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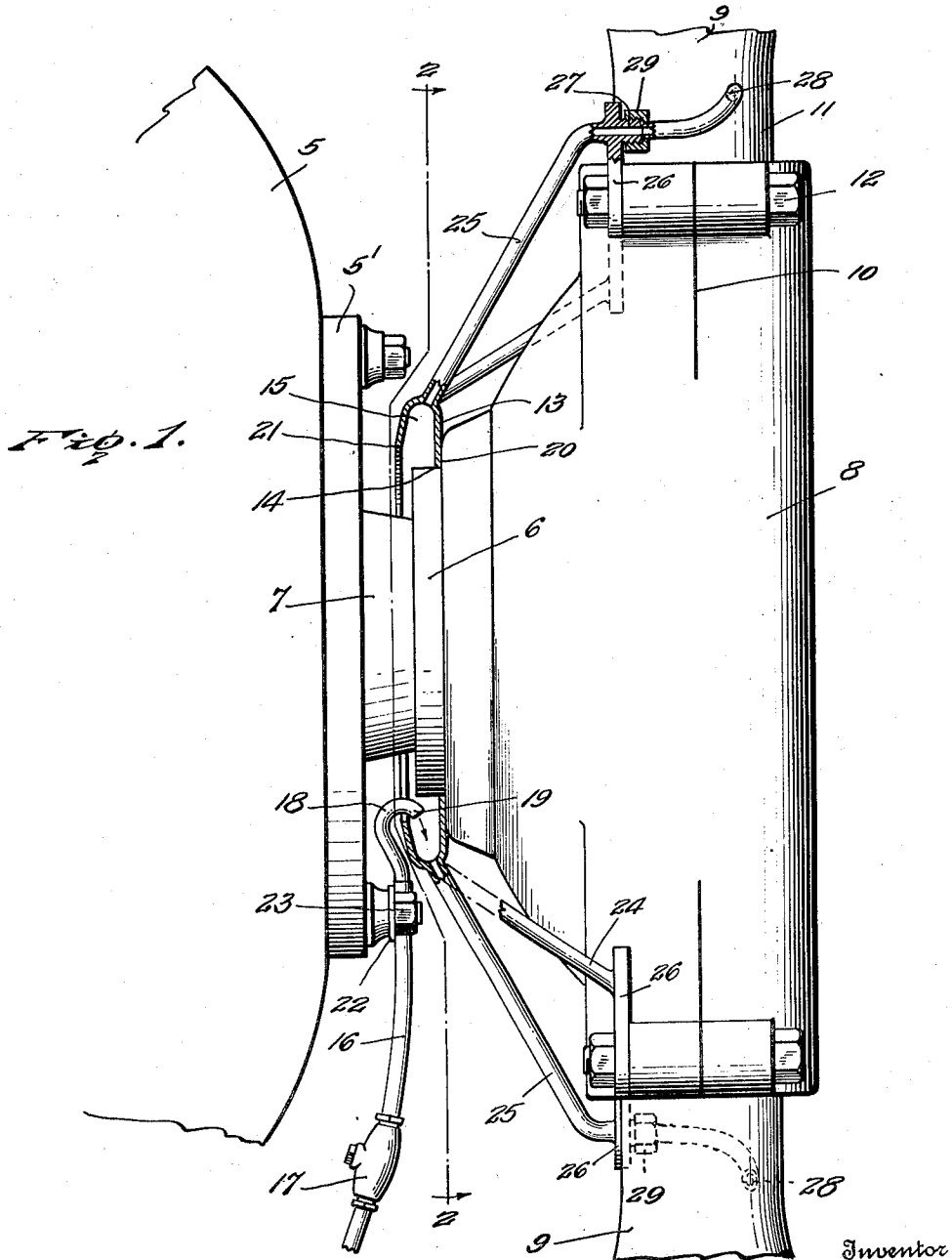
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DEICING ATTACHMENT FOR AIRPLANE PROPELLERS

Filed Aug. 31, 1937

2 Sheets-Sheet 1



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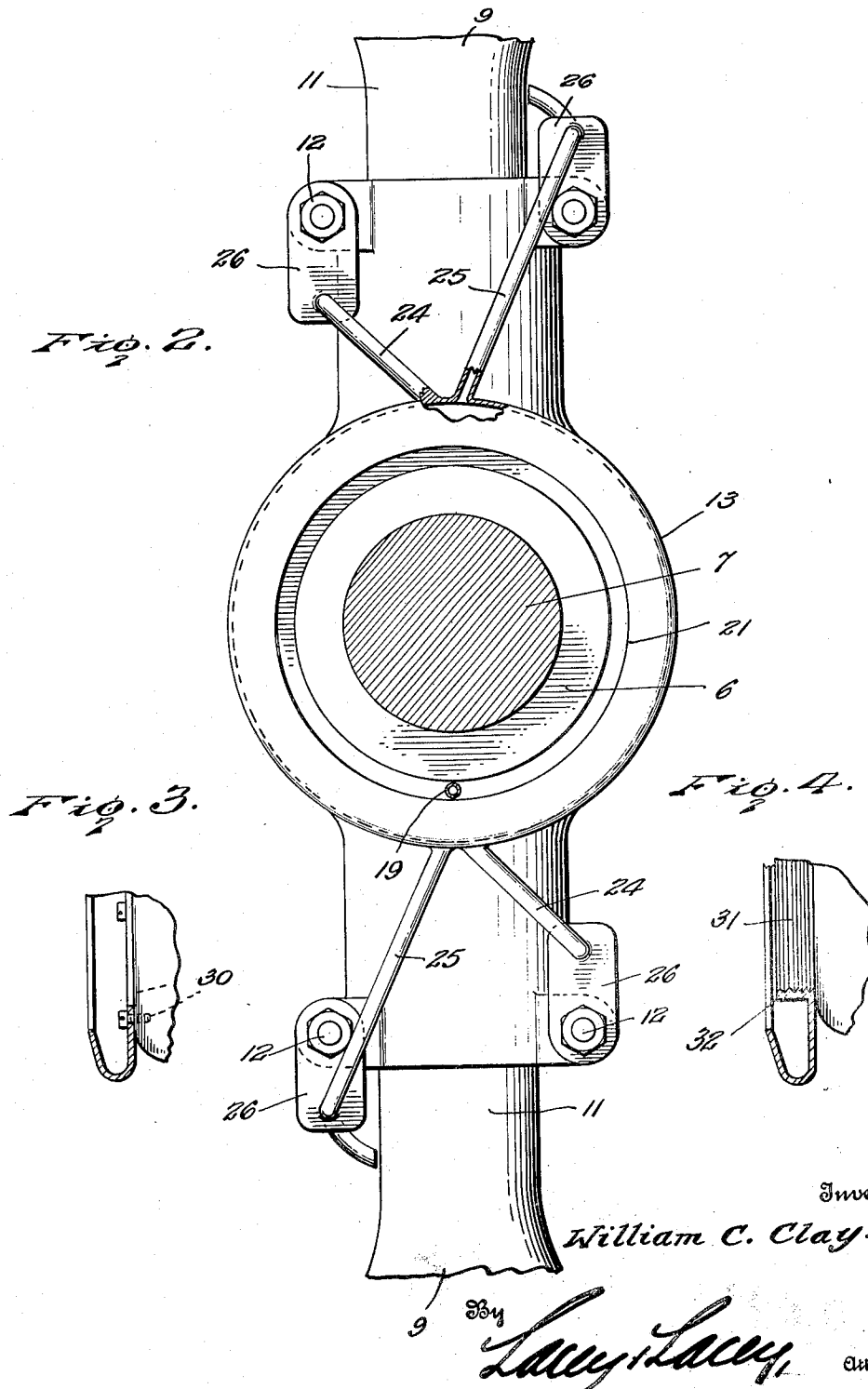
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UNITED STATES PATENT OFFICE

2,129,565

DEICING ATTACHMENT FOR AIRPLANE
PROPELLERS

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Application August 31, 1937, Serial No. 161,852

11 Claims. (Cl. 244-134)

This invention relates to airplanes and more particularly to a de-icing attachment for the propellers thereof.

It is a well-known fact that travel by airplane under ice-forming conditions, such as flying through clouds in cold weather, is dangerous due to the formation of ice on the propeller blades which retards the speed thereof and otherwise interferes with the proper functioning of the airplane.

Moreover, centrifugal force incident to rotation of the propeller tends to dislodge and throw off lumps of ice from the blades at frequent intervals which often strike the fuselage and adjacent parts of the plane with such force as to damage the fuselage and cause serious discomfort to both pilot and passengers. Furthermore, this formation of ice on the blades and the unequal expulsion or throwing off of the ice therefrom causes severe vibrations due to unbalanced propeller forces.

Attempts have heretofore been made to prevent the formation of ice on the propeller blades of airplanes by the application of an anti-freezing mixture thereto, but all such attempts, as far as I am aware, have resulted in very inefficient use and needless waste of the liquid mixture due to the fact that the circulatory air currents back of the propeller hub produced by the rotation of the propeller blades together with high peripheral speed of the distributing ring displaces the source of supply of the anti-freeze mixture and broadcasts said mixture promiscuously instead of directing the anti-freeze mixture onto the leading edge of the propeller blade where it is needed.

Furthermore, devices of this character should be so positioned on the hub of the propeller blade as to permit easy access to the bolts of the thrust bearing plate so that any necessary repairs may be made without the necessity of detaching the propeller.

One object of the present invention, therefore, is to overcome these objectionable features and to provide a de-icing attachment which will positively direct an anti-freeze mixture onto a propeller blade and uniformly distribute the fluid over that portion of the blade where the ice tends to form so that accretion of ice on the propeller blades is positively prevented under all conditions of service.

A further object of the invention is to provide a de-icing attachment which is simple and inexpensive in construction and may be quickly attached to the hub of an airplane propeller without necessitating any structural changes therein,

the parts being so arranged as to prevent promiscuous spraying or broadcasting of the anti-freezing mixture when the device is in use.

A further object of the invention is to provide a de-icing attachment adapted to fit around and over the rear cone assembly of a propeller hub against a blanketing surface associated therewith, said attachment constituting a distributing ring, and comprising an annular liquid-receiving trough into which an anti-freeze mixture is fed and automatically delivered to the leading edge of a propeller blade when the plane is traveling in cold or inclement weather.

A further object is to provide an attachment of the class described which is always under the control of the navigator so that the anti-freezing mixture may be quickly applied to the propeller blade when needed without danger of waste of the fluid, thereby increasing the efficiency of the device while at the same time effecting a conservation of anti-freezing mixture.

A still further object of the invention is generally to improve this class of devices so as to increase their utility, durability and efficiency.

In the accompanying drawings forming a part of this specification and in which similar numerals of reference indicate corresponding parts in all the figures of the drawings:

Figure 1 is a side elevation of a portion of an airplane power unit showing the de-icing attachment in position thereon, parts of the device being shown in section,

Figure 2 is a vertical sectional view taken on the line 2-2 of Figure 1,

Figure 3 is a detail sectional view showing a modified form of the invention, and

Figure 4 is a similar view showing another modification.

The improved de-icing attachment forming the subject-matter of the present invention may be installed on airplanes equipped with propellers having any number of blades, and by way of illustration is shown applied to an airplane having a two-bladed propeller, in which 5 indicates the engine crank case, 5' the thrust bearing cover plate, 6 the rear cone seat for the propeller shaft 7, and 8 the hub forging carrying the propeller blades 9. The opposite ends of the hub forging are split longitudinally at 10 and formed with seats for the reception of the roots or shanks 11 of the propeller blades 9, the parts being firmly clamped together by means of securing bolts 12, as shown.

The device comprises a distributing ring 13 adapted to fit over and closely around the rear

cone seat 6 with its inner edge in contact with said cone seat, as indicated at 14, so as to center the ring thereon and assist in preventing displacement thereof. The distributing ring is provided with an annular feed trough 15 adapted to receive a supply of anti-freeze mixture for delivery to the leading edges of the propeller blades 9. This anti-freezing mixture may be of any desired nature, but it is preferred to use a solution consisting of approximately eighty-five per cent alcohol and fifteen per cent glycerine as such a mixture has been found by actual tests to produce the best results. This mixture is stored in a tank on the airplane and is fed to the distributing ring 13 through a tube 16 provided with a check valve 17 and a terminal discharge nozzle 18, the curved end or bill 19 of which projects within the trough 15, as best shown in Figure 1 of the drawings.

The inner wall of the distributing ring bears snugly against a suitable flat or blanketing surface, preferably on the hub forging 8, for the entire circumference of the ring, as indicated at 20, so as to prevent circulatory air currents back of the propeller hub produced by rotation of the propeller blades from displacing the liquid in the trough 15. The outer wall of the distributing ring is preferably inclined or beveled, as indicated at 21, to provide sufficient clearance at the mouth of the trough to permit the proper feeding of liquid thereto through the nozzle 19. It will here be noted that the tip of the nozzle 19 terminates in a plane slightly above the inner edge of the inclined portion 21 of the distributing ring so as to permit removal and replacement of the hub forging and its associated parts when necessary without the necessity of disturbing the nozzle. The nozzle 18 is stationary and is supported on a plate 22 held in position by one of the nuts 23 of the crank case. Secured to or formed integral with the distributing ring 13 at diametrically opposite points on the periphery thereof are substantially V-shaped radial braces 24 and 25. The braces 24 are secured to attaching plates 26 mounted on the hub forging 8 and to which they are rigidly secured by the bolts 12. The braces 25 are somewhat longer than the braces 24 and are hollow so as to constitute exit tubes for conveying the anti-freeze mixture from the distributing ring to the leading edge of the adjacent propeller blade. The outer end of each exit tube 25 is attached to or formed integral with the adjacent attaching plate 26, the latter being provided on its outer face with a threaded nipple 27 on which is rotatably mounted a terminal nozzle 28 through which the liquid mixture is discharged onto the propeller blade. A nut 29 engages the threads on the nipple 27 so that by loosening said nut the discharge nozzle 28 may be adjusted to the desired position and in which position it may be secured by tightening the nut 29, as will be readily understood. It will thus be seen that the member 25 in addition to bracing the distributing ring and providing a means for attaching the ring to the hub forging also serves to deliver the anti-freeze mixture to the propeller blades. Particular attention is called to the fact that the distributing ring 13 is relatively small, that is to say, it falls within the locus or line of attaching bolts 23 of the crank case so that access may be readily had to said bolts when necessary without disturbing the distributing ring. Furthermore, by making the distributing ring only slightly larger than the rear cone seat 6, the peripheral speed or velocity of the distribut-

ing ring is reduced which prevents tearing the drop of liquid loose from the discharge end of the feed nozzle and permits the anti-freeze mixture to be fed into the distributing ring without any material waste thereof. Moreover, owing to the size of the distributing ring and the fact that it bears directly against the flat blanketing surface of the hub forging and/or directly around the rear cone seat, circulatory air flow radiating through the ring at this point is positively eliminated, thereby preventing broadcast distribution of the anti-freeze mixture and consequently preventing waste of fluid as the anti-freeze mixture is directed directly onto the propeller blade where it is needed. In certain types of propellers where the shape or construction of the hub forging is such as to prevent the distributing ring from contacting therewith throughout the entire circumference of the ring, the close engagement of the ring with the rear cone seat will serve to prevent radial flow of air currents through the ring. When the device is applied to a multiple blade propeller, a set of the braces 24 and 25 will be provided for each blade, as will be readily understood.

In operation the anti-freeze mixture is fed into the trough of the distributing ring through the nozzle 18 and as the propeller rotates the mixture will be discharged by centrifugal force through the exit tubes 25 and terminal nozzles 28 onto the root or shank of the adjacent propeller blade at the leading edge thereof, thereby preventing the formation or accretion of ice on said blades. If ice has already begun to form on the propeller blades, the application of the anti-freeze mixture thereto will melt and remove the same before the accretion of ice becomes so thick as to interfere with the proper functioning of the propeller.

In Figure 3 of the drawings, there is illustrated a modified form of the invention particularly designed for use on airplanes in which the rear cone seat does not project beyond the hub forging, in which event the distributing ring is secured to the adjacent flat blanketing face of the hub forging by means of bolts or similar fastening devices 30. If desired, the projecting end of the rear cone seat may be threaded, as indicated at 31 in Figure 4 of the drawings, and the distributing ring provided with an inwardly extended threaded flange 32 for engagement with the threads 31. It will be understood, however, that in all forms of the device the distributing ring fits around the rear cone seat of the propeller hub and/or in close contact with a blanketing surface so as to completely preclude the turbulent circulation of air radially through the ring. As the ring is relatively small in diameter, the peripheral speed thereof is such as to allow the anti-freeze mixture to enter the ring from the nozzle with practically no splash or turbulence and without waste of the mixture.

From the foregoing description, it is thought that the construction and operation of the device will be readily understood by those skilled in the art and further description thereof is deemed unnecessary.

Having thus described the invention, what is claimed as new is:

1. A de-icing attachment for airplane propellers comprising an annular trough of a diameter appreciably less than the maximum diameter of the hub of the propeller and adapted to fit the hub in close contacting engagement with a blanketing surface associated therewith throughout the entire circumference of the trough to

preclude turbulent circulation of air through said trough, means for supplying anti-freeze mixture to the trough, means for securing said trough against the blanketing surface, and conduits extending substantially radially from the periphery of said trough and secured to the propeller with their outer portions in position for delivering the mixture onto a propeller blade.

2. A de-icing attachment for airplane propellers comprising a circumscribing trough of a diameter appreciably less than the maximum diameter of the hub of the propeller and adapted to fit about an engine shaft in continuous contacting engagement with a blanketing surface associated with said propeller hub, means for delivering an anti-freeze mixture into the trough, arms attaching the trough to the propeller hub, and a conduit connected with the outer periphery of the trough for delivering the anti-freeze mixture onto a propeller blade.

3. The combination with an airplane motor including a crank case, a thrust bearing cover plate bolted near its periphery to the crank case, a motor shaft projecting from the cover plate and a propeller having its hub mounted upon the motor shaft, of a de-icing attachment for the propeller comprising an annular trough fitting about the motor shaft and bearing against the propeller hub for the entire circumference of the trough, said trough being of a diameter appreciably less than the cover plate to space its peripheral outer edge inwardly from the securing bolts of said cover plate, means for delivering anti-freeze mixture into said trough, and a tube extending substantially radially from the periphery of said trough for delivering the mixture onto a propeller blade.

4. In an airplane, the combination with an engine crank case, a propeller and rear cone seat, of a de-icing attachment comprising a distributing ring fitting closely over and around the rear cone seat, said ring being provided with a trough adapted to receive an anti-freeze mixture, spaced pairs of braces forming a connection between the periphery of the distributing ring and the hub of the propeller, one brace of each pair being hollow and constituting a feed tube, means for delivering an anti-freeze mixture into the ring, and a nozzle on each hollow tube for directing the mixture onto a propeller blade.

5. In an airplane, the combination with an engine crank case, propeller and rear cone seat, of a de-icing attachment comprising a distributing ring fitting over and around the rear cone seat and in close contact with the hub of the propeller, said ring being provided with a trough adapted to receive an anti-freeze mixture and being of a maximum diameter appreciably less than the diameter of said hub, a nozzle mounted on the crank case for feeding anti-freeze mixture within the trough, the terminal of the discharge end of said nozzle being disposed slightly above the plane of the open end of the trough to permit the trough to clear the nozzle when removing said trough, attaching plates secured to the hub of the propeller, spaced pairs of braces forming a connection between the distributing ring and the adjacent attaching plates, one brace of each pair being hollow and communicating with the periphery of the ring and constituting a feed tube, and a nozzle on the discharge end of each feed tube for directing the mixture onto a propeller blade.

6. In an airplane, the combination with an engine crank case, rear cone seat and propeller

hub including blade securing bolts, of a de-icing attachment comprising a distributing ring fitting over and around the rear cone seat in close contact with the hub of the propeller for the entire circumference of the ring, said ring being provided with a trough adapted to receive an anti-freeze mixture and being of a diameter less than the maximum diameter of the propeller hub, spaced sets of attaching plates held in position on the propeller hub by the securing bolts, one attaching plate of each set being provided with a nipple, a hollow tube forming a connection between the periphery of the trough and the nipple of the adjacent attaching plate, an adjustable discharge nozzle on each nipple, solid braces forming connections between the trough and the other attaching plates, and a stationary nozzle projecting within the trough for feeding an anti-freeze mixture thereto.

7. A de-icing attachment for airplane propellers comprising an annular distributing trough adapted to fit closely over the rear cone seat of an airplane propeller and receive an anti-freeze mixture, said trough being of a diameter appreciably less than the maximum diameter of the hub of the propeller and having one wall thereof straight and adapted to bear against the hub of the airplane and its other wall deflected laterally, diverging braces extending from the trough at diametrically opposite points for attachment to the hub of the propeller, certain of said braces being hollow and communicating with the trough at the periphery thereof to form conduits for delivering the mixture onto a propeller blade, and a stationary feed nozzle mounted on a fixed portion of the airplane and having one end thereof connected with a source of liquid supply for delivering the mixture into the trough.

8. A de-icing attachment for airplane propellers comprising a circumscribing trough of a diameter appreciably less than the maximum diameter of the hub of the propeller and adapted to fit about an engine shaft in continuous contacting engagement with the hub of said propeller throughout the entire circumference of the trough, means for delivering an anti-freeze mixture into said trough, and arms extending substantially radially from the outer periphery of said trough for attaching the trough to the propeller, certain of the arms being of tubular formation and constituting a conduit for delivering the anti-freeze mixture onto a propeller blade.

9. A de-icing attachment for airplane propellers comprising an annular trough of a diameter appreciably less than the maximum diameter of the hub of the propeller and having its outer peripheral portion closed and its inner peripheral portion open whereby anti-freeze mixture may be delivered into the trough while the trough is in motion, and arms extending from the outer periphery of said trough at intervals for attaching the trough to the propeller hub at said interval, certain of said arms extending substantially radially from the trough and being of tubular formation and constituting a conduit for delivering the anti-freeze mixture onto a propeller blade.

10. The combination with an airplane motor including a crank case, a thrust bearing cover plate bolted near its periphery to the crank case, a motor shaft projecting from the cover plate and a propeller having its hub mounted upon the motor shaft, of a de-icing attachment for the propeller comprising an annular trough of a

diameter appreciably less than the diameter of the propeller hub fitting about the motor shaft between the propeller and cover plate and having an open inner peripheral portion with one wall thereof deflected laterally in the direction of the crank case, means for delivering anti-freeze mixture into said trough at the open periphery thereof, and arms extending substantially radially from the outer periphery of the trough for securing the trough to the propeller, certain of said arms being hollow and constituting a conduit for delivering the mixture onto a propeller blade.

11. In an airplane, the combination with a

propeller, and rear cone assembly, of a de-icing attachment comprising a distributing ring disposed adjacent to and mounted to revolve with the propeller hub and fitting around the rear cone assembly in engagement with a blanketing surface associated therewith to preclude turbulent circulation of air through the distributing ring, means for feeding an anti-freeze mixture into the ring, and a conduit extending substantially radially from the periphery of said ring and secured to the propeller for delivering the anti-freeze mixture onto a propeller blade.

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