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MEANS FOR SUPPLYING AN INFLAMMABLE ANTIFREEZE FLUID FOR USE ON AEROFOIL SURFACES SO AS TO PREVENT EXPLOSION OF THE FLUID

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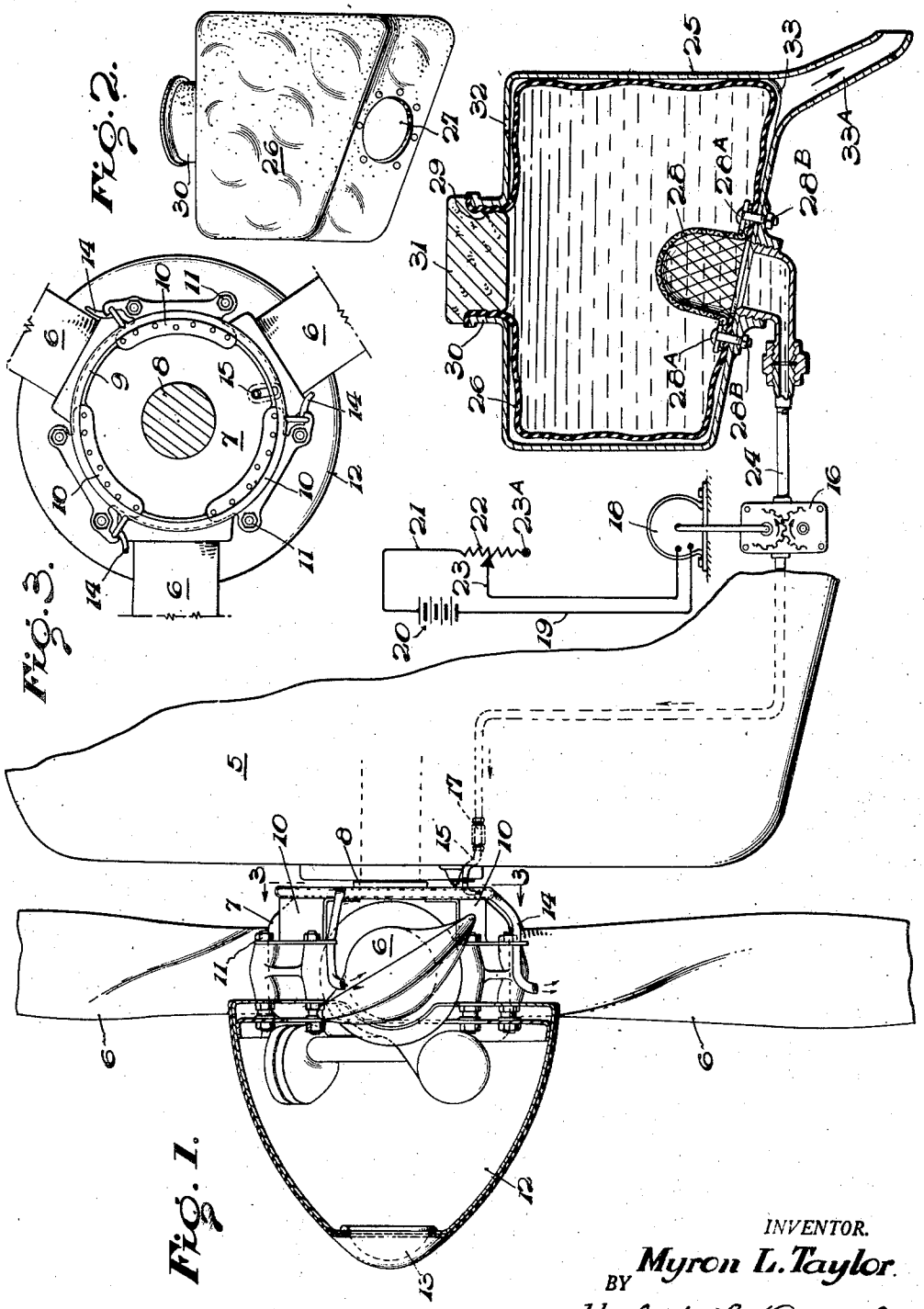

Fig. 2.

Fig. 3.

Fig. 1.

INVENTOR.
Myron L. Taylor
BY
Herbert L. Davis, Jr.
Attorney

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MEANS FOR SUPPLYING INFLAMMABLE ANTIFREEZE FLUIDS FOR USE ON AIRFOIL SURFACES SO AS TO PREVENT EXPLOSION OF THE FLUID

Myron L. Taylor, Ridgewood, N. J., assignor to Bendix Aviation Corporation, Bendix, N. J., a corporation of Delaware

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This invention relates to systems and devices for supplying anti-freeze fluids to airfoil surfaces and more particularly to means for lessening the fire hazard which ordinarily accompanies the use of inflammable fluids in the elimination of ice formations from airfoil surfaces.

In the past, inflammable anti-freeze solutions such as denatured ethyl alcohol have been fed over the surfaces of propeller blades for preventing and eliminating ice formations thereon. Such solutions are relatively inexpensive and highly efficient in the removal of ice formations. However, under combat conditions, it has been found that the vapor formed above such anti-freeze solutions in a partially filled tank, upon mixing with atmospheric air oxygen, constitutes a serious fire hazard. Thus explosions in the supply tanks under such conditions have often resulted when enemy projectiles passed through the same.

Recognition of this fire hazard has in many cases caused the drainage of the anti-freeze fluid from the supply tanks of combat planes so as to avoid the dangers incident thereto. Such removal of the anti-freeze fluid, however, leaves the plane exposed to the hazards of ice formation.

It is therefore, an object of my invention to provide novel means for supplying such anti-freeze solution to the airfoil surfaces of a plane in such a manner as to appreciably lessen the chances of explosion from enemy projectiles by eliminating the presence of such explosive vapor.

Another object of my invention is to provide novel storage means for the anti-freeze solution whereby the solution may be sealed in a storage container free from air oxygen. Thus, the anti-freeze solution may be carried so as not to explode upon the passage of an explosive projectile through the storage container due to the lack of oxygen therein for supporting such combustion.

Another object of my invention is to provide a novel collapsible sealed bladder for carrying the anti-freeze fluid and rigid mounting means for supporting the bladder under atmospheric pressure. Thus the inflammable fluid may be sealed within the bladder from air oxygen so as to lessen the dangers of explosion.

Another object of my invention is to provide means for draining the anti-freeze fluid rapidly from the plane in the event of the puncture of the supply bladder.

Another object of my invention is to provide suction means for drawing the fluid anti-freeze from the storage bladder without permitting the ingress of air oxygen into the bladder.

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Another object of my invention is to provide means for distributing the anti-freeze fluid thus drawn from the bladder to the propeller blades of a plane without permitting the ingress of air oxygen to the anti-freeze fluid supply line and storage bladder.

Another object of my invention is to provide a simple, safe, and efficient arrangement for storing and distributing fluid anti-freeze under combat conditions.

Another object of my invention is to provide means to eliminate the collection of inflammable vapor over an anti-freeze fluid supply.

A further object of my invention is to provide adjustable means for varying the rate of suction applied to the bladder so as to control the amount of fluid drawn therefrom for distribution to the propeller blades.

Other objects and advantages of this invention are set forth in the following description, taken with the accompanying drawing and the novel features thereof are pointed out in the appended claims. The disclosure, however, is illustrative only and I may make changes in detail, especially in matters of shape, size, and arrangement of parts within the principle of the invention to the full extent indicated by the meanings of the terms in which the appended claims are expressed.

In the accompanying drawing which forms a part of this specification like characters of reference indicate like parts in the several views wherein:

Figure 1 is a diagrammatic view illustrating the novel system as applied to the propeller of an airplane with certain of the parts broken away so as to better illustrate the invention.

Figure 2 is a perspective view of my novel anti-freeze fluid supply bladder.

Figure 3 is a sectional view taken along the lines 3—3 of Figure 1 and looking in the direction of the arrows.

Referring to Figure 1 the invention is illustrated as applied to an aircraft having an engine cowl 5, a propeller of the three blade type having blades 6 is mounted on a hub 7, which is secured to a crank shaft 8 of a motor not shown. A grooved slinger ring 9 is mounted by means of brackets 10 on the back of the propeller hub 7. The brackets 10 are fastened to the hub 7 by means of bolts 11 which also secure at the forward side of the hub a spinner cap 12. The spinner cap 12 fits over the propeller hub 7 and has provided a snap in nose cap 13.

An anti-freeze liquid solution such as de-

natured ethyl alcohol is fed over the surfaces of one propeller blades by means of tubes 14 leading from the grooved portion of the slinger ring 9.

The opposite open ends of the tubes 14 are positioned along the propeller blades within the radius extended of the spinner cap 12, so as to be protected from the airflow. The open ends of tubes 14 are further positioned in relation to the entering edges of the propeller blades 6 so that the anti-freeze fluid from the tubes 14 will flow onto the leading edges of the blades 6. The anti-freeze fluid spreads from this position over both the thrust and convex sides of the blades.

The anti-freeze solution is fed into the slinger ring 9 through a tube 15. Under the centrifugal force generated by the rotation of the slinger ring 9, the anti-freeze solution passes from the slinger ring 9 through the tubes 14 and exudes from the open ends thereof onto the propeller blades 6 as previously described.

The tube 15 leads from the outlet of a suitable gear pump 16. A check valve 17 is connected near the outlet of the tube 15 into the slinger ring 9 and is arranged to open only upon a predetermined pressure of the anti-freeze fluid under force of the gear pump 16 so as to thereby prevent the ingress of air oxygen into the supply tube 15.

The gear pump 16 is driven by a suitable electric motor 18. One terminal of the electric motor 18 is connected by a conductor 19 to one terminal of a suitable source of electrical energy 20. The opposite terminal of the source of electrical energy 20 is connected by a conductor 21 to a variable resistor 22 having a rheostat arm 23 for controlling the resistance of the resistor 22. The rheostat arm 23 is connected by an electrical conductor to the other terminal of the motor 18. It will be readily seen that by varying the resistance of the resistor 22 through the arm 23 the speed of rotation of the motor may be varied and accordingly the speed of the gear pump 16. Further the resistor arm 23 is arranged to open the circuit to the motor 18 by opening contact 23A if desired.

An inlet tube 24 leads to the gear pump 16 from container 25 formed of suitable rigid material in which is held a bladder 26. The bladder 26 is formed of a suitable flexible resilient material such as rubber having formed at the bottom thereof a suitable aperture 27 as shown in Figure 2. A convexed wire screen member 28 is positioned within the bladder 26 and mounted over the aperture 27.

The convexed screen member 28 and the bladder 26 are affixed to the bottom of the container 25 by the fastening bolts 28A which pass through screen 28, the bottom of the container 25 and bladder 26 and are secured at the opposite side of the container 25 by suitable fastening nuts 28B as shown in Figure 1. Thus the convexed screen member 28 is arranged so as to prevent the bladder 26 from being drawn into the tube 24 by the suction force of the gear pump 16 upon the evacuation of the bladder 26.

The bladder 26 has further provided an open end neck portion 29 which is positioned in a neck 30 of the rigid container 25. A sealed filler 31 is removably positioned in the open end of the neck portion 29 so as to seal the inner portion of the bladder 26 from atmospheric air oxygen.

A vent 32 is positioned in the upper side of the container 25 so that the outer surface of the bladder 26 is subjected to atmospheric pressure. The bottom of the container 25 has preferably

formed therein an opening 33 leading into a suitable overboard conduit 33A so as to provide means whereby the anti-freeze fluid may be immediately drained from the container 25 and out of the plane in the event the bladder 26 should be punctured.

In the operation of the system it will be readily apparent that under icing conditions operation may be initiated by closing the electrical circuit for the motor 18 through the rheostat arm 23 contacting the resistor 22, whereupon the motor 18 will rotate the gears of the gear pump 16 in the direction indicated by the arrows in Figure 1, so as to exert a suction on the inlet tube 24 leading from the bladder 26 in which is placed the anti-freeze fluid. The anti-freeze fluid will be drawn by the suction generated by the gear pump 16 into the gear pump 16 and out under pressure through the outlet tube 15 to a check valve 17, which opens upon a predetermined pressure so as to permit the fluid to pass into the slinger ring 9. The anti-freeze fluid carried by the slinger ring 9 will then under the centrifugal force generated by the rotation of the slinger ringer 9, pass through the tubes 14 and exude onto the blades of the propeller 6. The suction exerted within the bladder 26 and accordingly the amount of the anti-freeze fluid conveyed to the blades of the propeller 6 may be conveniently controlled by varying the speed of rotation of the gear pump 16 through the rheostat control arm 23.

It will be noted that in my novel system, I have provided means for preventing the anti-freeze fluid supply from contacting the air oxygen within the atmosphere until the time of its actual use, so that the conditioning of the anti-freeze supply fluid into a state for supporting combustion is substantially prevented so as to materially reduce the chances of explosion resulting from its ignition by enemy fire.

Although only one embodiment of the invention has been illustrated and described, various changes in the form and relative arrangement of the parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention. Reference is therefore, to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In means for preventing accumulation of ice on an aircraft propeller, the combination, comprising centrifugally actuated means associated with the propeller and adapted for rotation therewith to discharge an anti-freeze fluid onto the propeller to remove ice from the propeller, a resilient bladder for carrying a supply of anti-freeze fluid, a relatively rigid container for supporting said bladder, said bladder arranged so as to seal the anti-freeze fluid carried therein from atmospheric oxygen so as to prevent the explosion thereof, a port leading into the interior of said container so as to subject the exterior of said bladder to atmospheric pressure, a conduit leading through said container into said bladder for conducting the anti-freeze fluid carried therein to the centrifugally actuated discharge means, pump means connected to said conduit so as to apply a suction force for draining said anti-freeze fluid from the interior of said bladder and exerting a pressure force so as to expel such anti-freeze fluid into the discharging means.

2. In means for supplying an anti-freeze liquid to an airfoil surface, the combination, compris-

ing a collapsible bladder for storing said anti-freeze liquid, said bladder formed of a rubber-like material, a relatively rigid housing for said bladder, a port leading into said housing from the atmosphere, the interior of said bladder sealed from the atmospheric air oxygen, said housing and said bladder each having formed therein an opening leading into the opening of the other, a convexed shaped apertured member positioned within said bladder and over said opening in said bladder for preventing said bladder from being drawn into said opening, means fastening said member to said housing, and an outlet conduit fastened to said housing at the exterior thereof and leading from the opening formed in said housing.

3. In means for preventing accumulation of ice on an aircraft propeller, the combination, comprising centrifugally actuated means associated with the propeller and adapted for rotation therewith to discharge an anti-freeze fluid onto the propeller to remove ice from the propeller, a resilient bladder for carrying a supply of anti-freeze fluid, a relatively rigid container for supporting said bladder, said bladder arranged so as to seal the anti-freeze fluid carried therein from atmospheric oxygen so as to prevent the explosion thereof, a port leading into the interior of said container so as to subject the exterior of said bladder to atmospheric pressure, said container and said bladder each having formed therein an opening leading into the opening of the other, a convexed shaped apertured member positioned within said bladder and over said opening in said bladder for preventing said bladder from being drawn into said opening, means fastening said member to said container, and an outlet conduit fastened to said container at the exterior thereof and leading from the opening formed in said container, pump means connected to said conduit so as to apply a suction force for draining said

anti-freeze fluid from the interior of said bladder and exerting a pressure force so as to expel such anti-freeze fluid into the discharging means.

4. In means for preventing accumulation of ice on an aircraft propeller, the combination, comprising centrifugally actuated means associated with the propeller and adapted for rotation therewith to discharge an anti-freeze fluid onto the propeller to remove ice from the propeller, a resilient bladder for carrying a supply of anti-freeze fluid, a relatively rigid container for supporting said bladder, said bladder arranged so as to seal the anti-freeze fluid carried therein from atmospheric oxygen so as to prevent the explosion thereof, a port leading into the interior of said container so as to subject the exterior of said bladder to atmospheric pressure, said container and said bladder each having formed therein an opening leading into the opening of the other, a convexed shaped apertured member positioned within said bladder and over said opening in said bladder for preventing said bladder from being drawn into said opening, means fastening said member to said container, and an outlet conduit fastened to said container at the exterior thereof and leading from the opening formed in said container, pump means connected to said conduit so as to apply a suction force for draining said anti-freeze fluid from the interior of said bladder and exerting a pressure force so as to expel such anti-freeze fluid into the discharging means, a check valve arranged between the discharge end of said conduit and said pump for controlling the opening of the discharge end of said conduit, and an outlet conduit leading from the interior of said container so as to drain the anti-freeze fluid therefrom in the event the bladder be punctured so as to prevent combustion of the inflammable anti-freeze fluid.

MYRON L. TAYLOR.