Aug. 31, 1937. W. J. PERRIN 2,091,395

AERONAUTICAL DEVICE

Filed Feb. 20, 1935

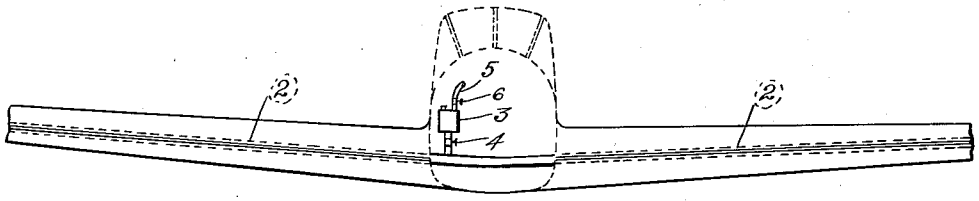


Fig. 1

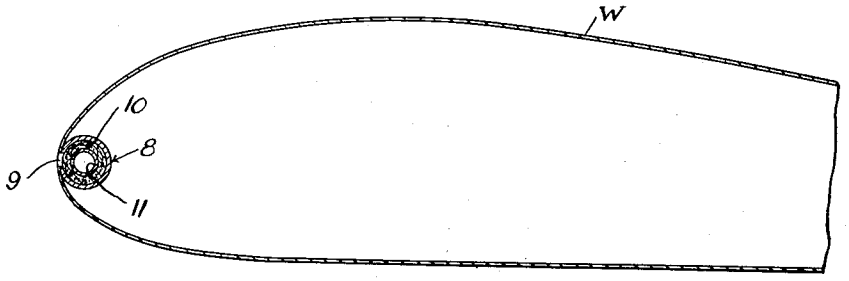


Fig. 2

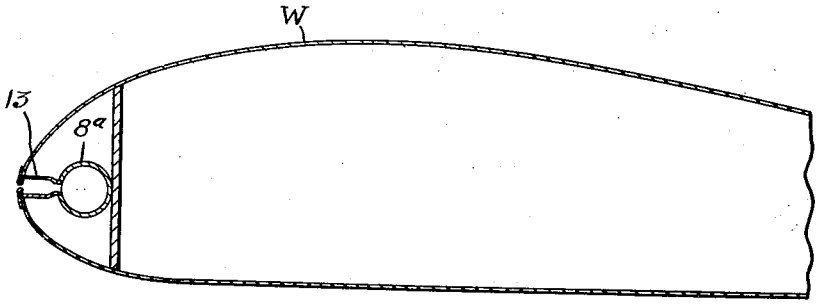


Fig. 3

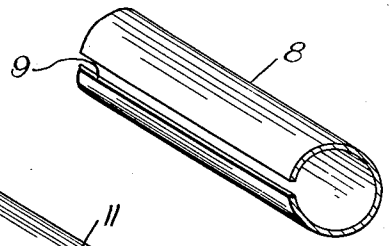


Fig. 4

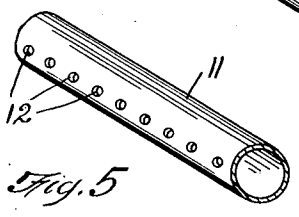


Fig. 5

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AERONAUTICAL DEVICE

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6 Claims. (Cl. 244—134)

In aeronautics, a source of difficulty and danger has been the tendency for ice to accumulate on exposed surfaces. Various mechanical scraping or ice displacing devices have been proposed, but such means have not afforded a feasible approach to the solution of the problem. Attempts have been made further to meet the difficulty by painting or swabbing a liquid of greasy or other suitable character on the plane wings just before flight, but the effect of this is too brief to be of value. A further suggestion has been the provision of sprayer nozzles mounted out in front of the plane so as to shower the wings with liquid of ice-melding character. The objection to such apparatus and any shower-means of applying liquid however, has prevented any realization of success by such means. Effective prevention of ice accumulation requires a means which can be brought into action at the proper time, and capable of being continued in action as long as necessary, and at the same time the normal contour of the air-encountering surfaces and their functioning must not be interfered with. In accordance with the present invention, it now becomes possible to meet the difficulty effectively and with uncomplicated means adaptable easily to new or old equipment.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:—

Fig. 1 is a semi-diagrammatic front elevational view of aeroplane structure embodying the invention, portions being broken away; Fig. 2 is an enlarged transverse section through the wing structure; Fig. 3 is a similar view of a modification; and Figs. 4 and 5 are fragmentary perspective views of details.

My invention contemplates application to aeronautical surfaces subject to ice-accumulation of a capillary supply of a liquid repellant to ice, the supplying of the liquid being continuous as long as required. The liquid-supply means is arranged relative to the surfaces to be supplied, such that capillary exudation carries the liquid out to the surface along its leading portion, and the film of liquid so fed is continuously carried along back over the surface, advantage being taken of the air-draft force for furthering the progressive spread of the liquid. As shown in Fig. 1, this means may take the form of a supply conduit 2 at the forward portion of each wing, and having capillary orifice communication onto the wing surface. The conduit may be extended along the wing to its taper, or as far as requisite for practical purposes. While the feed of liquid may be directed to both upper and lower surfaces of the wing, experience shows that regions of wing surface which are particularly important in the matter of ice accumulation are those areas of surface which are above and on the portions of the wing toward the fuselage. By positioning the feed-conduit along the leading edge of the wing, the supply of liquid is introduced to the surface in a manner promoting uniformity of distribution to the areas most concerned, and the conduit may be placed slightly above the lowest line of the wing so as to promote the action of the air draft force in furthering the flow back over the top surface particularly. With the supply-conduit positioned longitudinally in the advance edge of each wing, each conduit may have its own supply-reservoir, or preferably a reservoir in common may be connected to both conduits. As illustrated in general terms in Fig. 1, a supply-reservoir 3 at a convenient point high or low may be connected to the wing-conduits 2, a control-valve 4 of conveniently actuable form and location being provided for the operation by the pilot as needed. The feed of liquid from the reservoir to the conduits is furthered in convenient manner, by pressure-pump, or desirably by air-pressure, as supplied for instance to the reservoir by a compressed-air pipe 5 from a suitable source, a control valve 6 of desired form and location being provided.

The detail of the capillary feed from the conduit to the wing surface may vary somewhat according to circumstances. A desirable form, as illustrated in Figs. 2, 4, and 5, comprises a tube 8 extending longitudinally in the leading edge of the wing and having a fine slot opening 9 communicating directly with the wing-surface. Within the tube 8 is a fibrous wicking. This promotes uniform distribution in capillary manner. While the wicking may be of a character to more or less fill the conduit, in practice a tubular conformation 10 is desirable, and an interior metal tube 11 therewithin is further advantageous. The latter tube is provided with suitable openings 12 opposite the external opening 9 in the outside tube. The wicking material is of any suitable character, desirably however, a wool felt is employed.

As shown in Fig. 3, the conduit 8a may have a series of small spaced-apart outlets 13, instead of one continuous slot as foregoing. The outlets 13 again however, communicate in general flush relation directly onto the surface of the wing, and in either case there is an absence of external structure on the wing surface. At the same time however, the supply-conduit is in a location particularly effective, and free from interfering with structural features of the wing.

The liquid supplied to the surfaces through the supply-conduits is desirably glycerine, although in some instances such materials as glycols, alcohols, or non-corrosive saline solutions may be employed.

With the use of air pressure on the reservoir, it is ordinarily sufficient to apply a pressure of 5 pounds or more per square inch, the size of the ports, the density of the felt wicking where used, and other structural features of the conduit affecting results somewhat. With an average transport plane, a feed of liquid at the rate of less than ½ pint per hour per linear foot of leading edge gives satisfactory results. The pilot by control of the valve governing the supply of liquid to the wing-conduits may use the feed when occasion requires, and may regulate the feed-rate by extent of valve-opening, or by modifying the pump pressure or air pressure as may be preferred. The glycerine or the like exudes from the small openings onto the forward face of the wing surface, and the air-draft forces the liquid thence back up over the wing-surface with effective film feed, and ice formation becomes impossible. If ice be present when the liquid-feed is started, the liquid acts upon such ice, causing its disappearance.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features set forth in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. An aeronautical surface subject to ice-accumulation, having a conduit within the general confines of said surface and longitudinally along the leading portion thereof and opening to the surface, and a fibrous wicking in said conduit.

2. An aeronautical surface subject to ice-accumulation, having a conduit within the general confines of said surface and longitudinally along the leading portion thereof and opening to the surface, and a tubular wicking in said conduit.

3. An aeronautical surface subject to ice-accumulation, having concentric tubes longitudinally along the leading portion thereof, each with forwardly directed openings toward the surface, and a tubular wicking between said tubes.

4. An aeronautical surface subject to ice accumulation, having a conduit longitudinally along the leading portion thereof and opening to the surface, and means within said conduit for capillarily passing an ice-repellant liquid out of said conduit and to said surface, the opening being arranged such that the direction of flow of the ice repellant liquid will be the same as the direction of movement of said surface.

5. An aeronautical surface subject to ice accumulation having a conduit longitudinally along the leading portion thereof and within the general confines of said surface, said conduit having outlet openings, and a tubular wicking surrounding said conduit and arranged to capillarily flow an ice repellant liquid supplied to said conduit to said surface.

6. In combination with an aeronautical surface having a leading portion subject to ice accumulation, and means for capillarily feeding an ice repellant liquid to said leading portion of said surface, said means comprising a conduit within the general confines of said surface and extending longitudinally along said leading portion and having an opening for the passage of said fluid from said conduit to said surface, and a fibrous wicking in said conduit.

WILLIAM JOSEPH PERRIN.