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P. LEIFHEIT
ICE WARNING DEVICE

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2 Sheets-Sheet 1

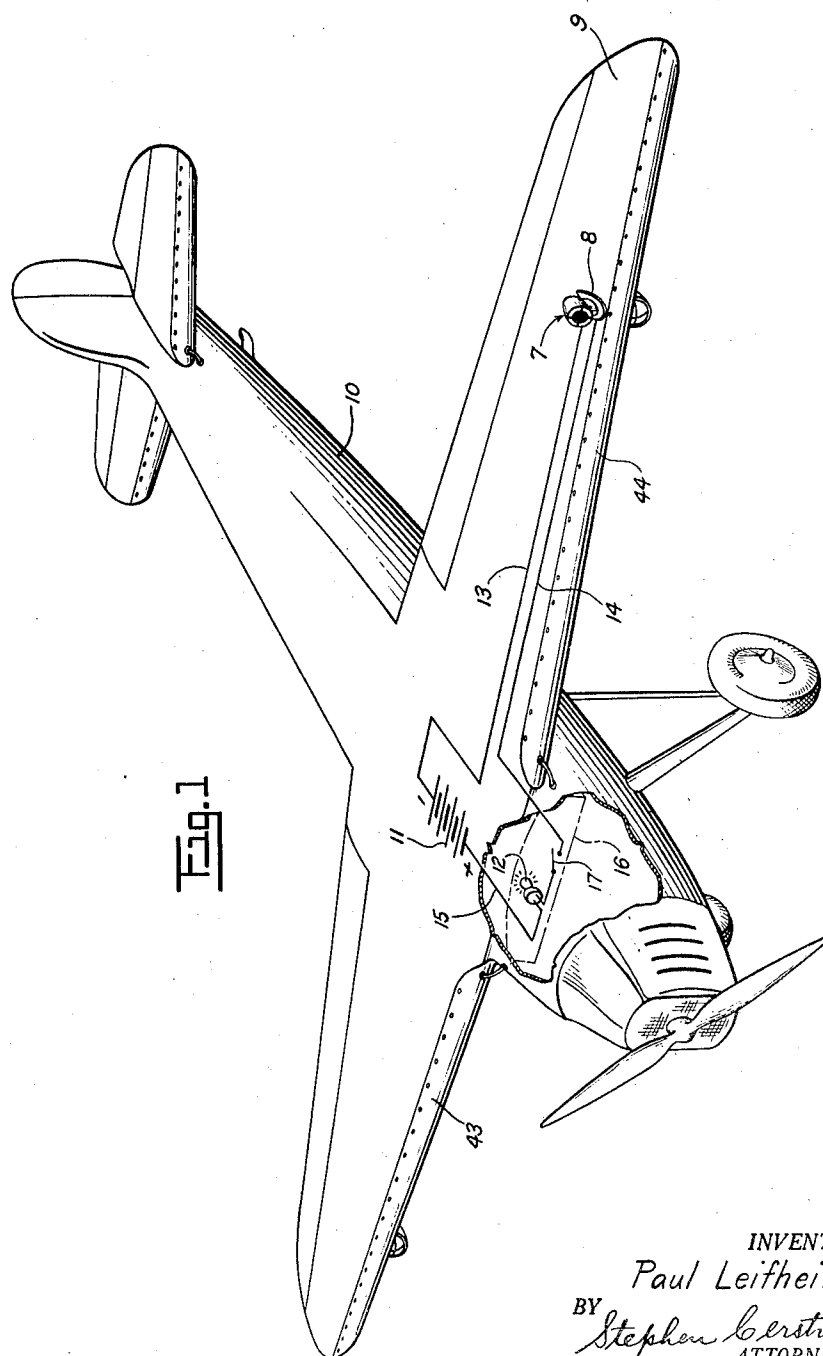


Fig. 1

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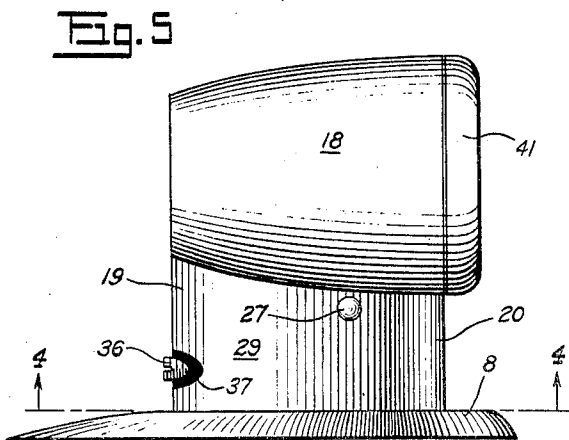
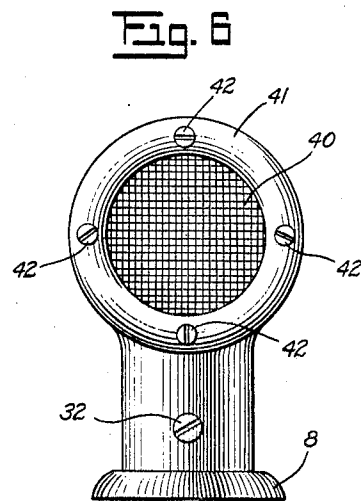
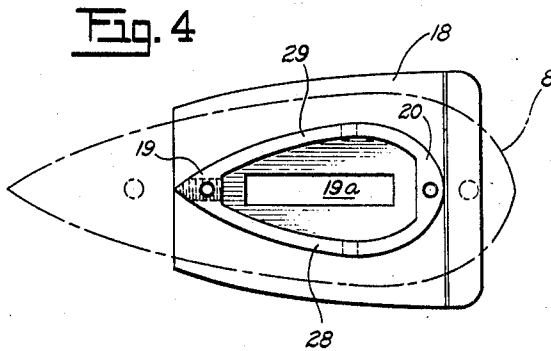
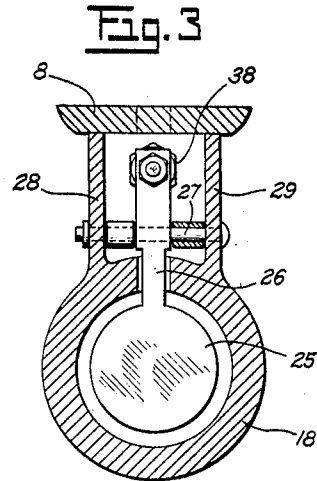
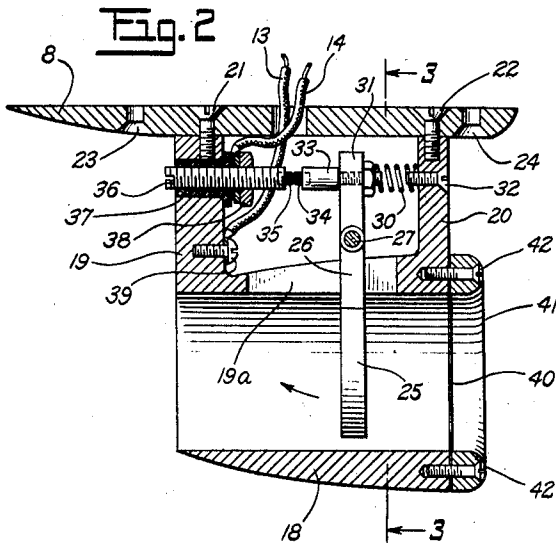
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,127,823

ICE WARNING DEVICE

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7 Claims. (Cl. 177—311)

The present invention relates to devices for giving a warning when ice forms in the vicinity thereof and more particularly to a device adapted for use on aircraft to indicate when ice forms on the surface of the craft or any part thereof.

One of the objects of the invention is to provide novel means whereby a warning signal is given at a remote point when ice forming conditions occur at or in the vicinity of said means.

Another object is to provide a novel ice warning device for aircraft and adapted to be placed on the exterior surface of the craft in a position in which it is subject to impact pressure of the air through which the craft is flying whereby, when moisture is present in the air and the temperature is at the freezing point, ice forms on the device, said device including means whereby a warning signal is given to the pilot of the craft when ice forms on said device so that the pilot may safely descend before the ice formation on the surface of the craft becomes dangerous for continued flight, or so that the pilot may manually actuate a switch or control knob to start the de-icing mechanism in operation if the craft be provided with such mechanism.

Still another object of the invention is to provide a novel device of the class described, including electrical contact means rendered effective, upon formation of ice at the device, to operate an electrical circuit which controls a remote indicator such, for example, as a warning light located on the instrument panel of an aircraft, whereby the pilot of the craft is immediately warned that ice is forming on the craft.

A still further object of the invention is to provide a novel combination including signalling means and means effective when ice forms thereon for operating said signalling means whereby a warning is given of the fact that ice forming conditions prevail.

The above and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows taken together with the accompanying drawings wherein one embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

The invention consists substantially in the construction, combination, location and relative arrangement of parts for obtaining the results desired in accordance with the foregoing objects,

as will be more fully hereinafter set forth in the specification, as shown in the drawings by way of example, and as finally pointed out in the claims.

In the drawings wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a perspective view of an airplane having a device embodying the invention mounted on the wing thereof, a portion of the cowl of the airplane being broken away to show the signalling means operated by the device and mounted on the instrument panel;

Fig. 2 is a longitudinal section of the device per se;

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a view looking at the device from the line 4—4 of Fig. 5, with the mounting bracket and operating mechanism of the device removed;

Fig. 5 is a side elevation of the device; and

Fig. 6 is a front elevation of the device as viewed from the right of Fig. 5.

In accordance with the invention, a device is provided which when used on an airplane is mounted on the wing thereof in the path of the slip stream so that air may pass through the device as the aircraft flies through the air. The rush of air through the device is utilized to operate, in the present instance, an electrical contacting mechanism for controlling an electrical circuit having a signal device connected therein, said signal device being mounted on the instrument panel of the aircraft. Means are then provided whereby when ice forms at the front opening of the device the rush of air therethrough is stopped and the contact mechanism is actuated to operate the electrical circuit and, hence, the signal device connected therein.

Referring to the drawings and more particularly to Fig. 1 the device of the invention is shown at 7 mounted by means of a stream-lined mounting bracket 8 at or near the leading edge of the left wing 9 of an airplane 10. The device 7 is electrically connected in series with a suitable source of current, such as a battery 11, and a signal device, such as a lamp 12, by means of wires 13, 14 and 15, the lamp 12 being mounted on the instrument panel shown in dotted lines at 16. A manually operated switch 17 is provided for opening the electrical circuit when the device 7 is not in use.

Referring to Fig. 2 of the drawings the device per se comprises a stream-lined tubular member 18 merging into a separate stream-lined

compartment formed by a tapered end 19 and a blunt front end 20 facing the direction of travel of the airplane, and also by side walls to be described hereinafter, said end portions 19 and 20 being secured to the stream-lined bracket 8 by suitable fastening means such as screws 21 and 22 whereby the device may be mounted on the aircraft by other suitable fastening means such as screws which are adapted to pass through the screw holes 23 and 24 provided for this purpose in the mounting bracket 8.

The device may be mounted or attached to the lower surface of the wing of the airplane so that it would be in the position shown in Fig. 2 or, as in the present instance, it may be mounted on the upper surface of the wing as shown in Fig. 1 so that it is in the position shown in Fig. 5. The device is mounted so that the right end thereof, as viewed in Figs. 2 and 5, faces in the direction of travel of the aircraft thus causing the air to enter the tubular member 18 at the right or front end and pass therethrough and out of the left or rear end of said member as viewed in said figures. An opening 19a is provided between the tubular member 18 and the auxiliary compartment for a purpose which will appear later.

Within the tubular member 18 and in the path of the air passing therethrough there is provided a member in the form of a paddle having a circular portion 25 and an integral arm 26 which projects through the opening 19a and is pivoted on a shaft 27 the ends of which are secured in side walls 28 and 29 (Fig. 3) of the auxiliary compartment so that as air rushes through the tubular member 18 the circular portion 25 of the paddle is moved in the direction of the arrow shown in Fig. 2 against the compression of a coil spring 30 one end of which abuts the end 31 of the paddle arm 26 and the other end of which is fastened to a screw 32 in the front wall 20 of the auxiliary compartment. On the opposite side of the paddle arm 26 there is provided a contact finger 33 carrying a contact 34 which is adapted to cooperate with a relatively fixed or stationary contact 35 carried by an adjusting screw 36 secured in and passing through the rear end 19 but insulated therefrom by means of an insulating bushing 37.

The contact 35 is connected to the wire 14 by means of a terminal lug secured to the adjusting screw 36 by means of a nut 38. Contact 34 is grounded by virtue of its connection to the finger 33 and arm 26 which for this purpose are made of metal as is the shaft 27 and the tubular member 18 with its walls 28 and 29. The wire 13 is grounded by its connection to the arm 19 by means of a screw 39.

The coil spring 30 tends to urge the end 31 of the arm 26 to the left as viewed in Fig. 2 to cause the contact 34 to engage contact 35 thereby tending to close the circuit to the lamp 12 when the manually operated switch 17 is closed. Normally, however, when the device is mounted on the surface of the aircraft, the rush of air through the tubular member 18 urges the circular portion 25 of the paddle in the direction of the arrow as shown in Fig. 2 against the compression of the spring 30 thereby maintaining the contacts 34 and 35 normally open.

Means are now provided whereby the rush of air through the tubular member 18 is prevented when ice forming conditions exist. In the form shown, said means comprise a fine wire mesh screen 40 placed over the front end of the tubular

member 18 and securely held in place by means of a clamping ring 41 secured to the tubular member 18 in any suitable manner as by means of screws 42. Thus, as sleet and/or ice form on the screen 40, the passage through the tubular member 18 becomes blocked either partially or entirely whereby the air pressure on the circular portion 25 of the paddle is reduced or eliminated so that the coil spring 30 urges the contact 34 into engagement with the contact 35 to close the electrical circuit to the lamp 12, causing the latter to become illuminated on the instrument panel 16. When the lamp is illuminated, the pilot is immediately apprised of the fact that ice forming conditions exist and ice is forming on the wings of his craft so that he may immediately start his de-icing mechanism (not shown) in operation to inflate the rubber overshoes 43 and 44 (Fig. 1) provided on the leading edges of the wings of the airplane; or, if the aircraft is not provided with de-icing mechanism, the pilot may descend and land his craft safely before it becomes over-weight due to ice formation on its wings and other surfaces.

There is thus provided a novel apparatus including a device exposed to the atmosphere for operating a remote signalling device to give a warning when ice forming conditions exist and ice begins to form at or near the device exposed to the atmosphere, and more particularly a novel ice warning device adapted for use on aircraft to warn the pilot when ice begins to form on the wings or other surfaces of the craft.

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. An ice responsive device for aircraft comprising means providing a passage for a fluid, means in said passage for actuation in one direction by said fluid, means at the entrance of said passage upon which ice is collected when moisture is present in said fluid at freezing temperatures whereby said entrance becomes blocked by the ice formation and the passage of the fluid is cut off, and means for actuating the second-named means in the opposite direction when the passage of fluid is cut off by the ice formation on said third-named means.

2. An ice responsive device for aircraft, comprising means forming a passage-way for producing a current of air in said passage-way upon movement of said aircraft through the atmosphere, pivoted means mounted in the path of said current and actuated by said current in one direction, compressible means urging said pivoted means in the opposite direction, a make and break circuit device operated by said pivoted means, and means upon which ice is formed during ice forming conditions upon passage of said current therethrough to thereby block the flow of said air current to said pivoted means whereby said compressible means operates said make and break device.

3. An ice responsive device for aircraft, comprising means forming a passage-way for producing a rectilinear current of air through said passage-way upon movement of said aircraft through the atmosphere, means in the path of said current responsive to said current, a circuit operat-

ing device operated by said responsive means, and means upon which ice is formed by said current during ice forming conditions, to thereby block the passage of said air to said responsive means.

4. An ice responsive device for aircraft, comprising means forming a passage-way for producing a current of air through said passage-way upon movement of said aircraft through the atmosphere, means intersted with said means to substantially intercept all of said current and moved thereby in one direction, means actuating said intersted means to oppose the movement due to said current, and means providing a support for ice formation by said current whereby said current of air upon said ice formation is prevented from moving against said intersted means and a circuit actuating means operated by said intersted means.

5. In combination, an aircraft, an ice warning indicator on said aircraft comprising a device responsive to ice-formation having a part on which ice forms when ice-forming conditions prevail, means in said device adapted to be actuated when ice forms on said part, electrical contact means in said device adapted to be actuated by

said last-named means, electrical signaling means remote from said ice-responsive device for giving a warning signal when ice-forming conditions prevail, and an electrical circuit including said contact means and said signaling means.

6. In combination, an aircraft having a space for a pilot, signaling means located in said pilot's space, ice-formation responsive means on said aircraft but remote from said pilot's space and exposed to ice-forming conditions, including a part on which ice forms when ice-forming conditions prevail, and means connecting said signaling means and said ice-formation responsive means for operating said signaling means to give a warning signal to the pilot when ice forms.

7. An ice warning device for aircraft, comprising means for producing a current of air upon movement of said aircraft through the atmosphere, means responsive to said current, means upon which ice is formed by said current of air during ice forming conditions whereby said current is modified to actuate said responsive means, and ice warning signal means controlled by said responsive means.

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