

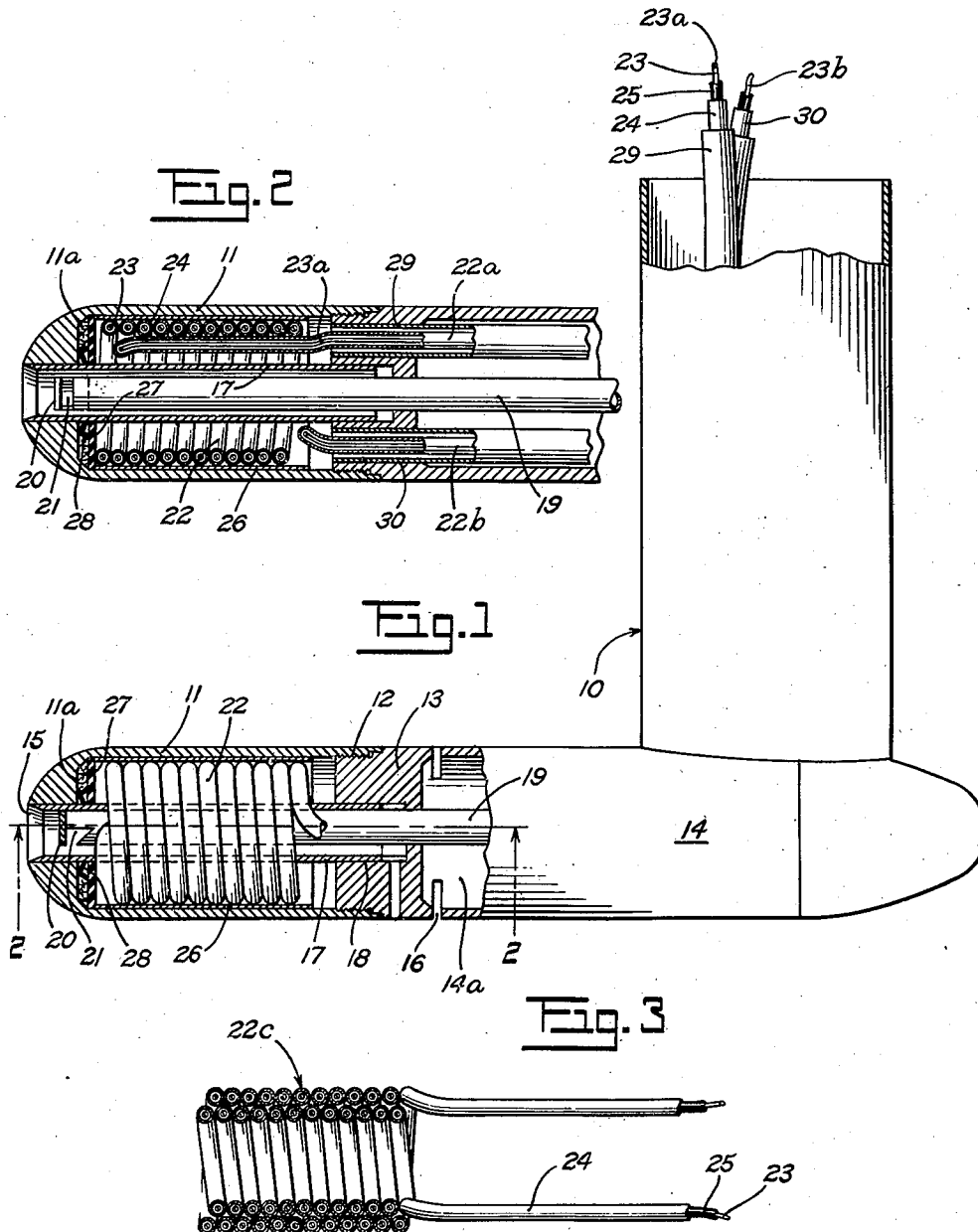
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W. A. REICHEL

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PITOT-STATIC TUBE

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INVENTOR.
Wladimir A. Reichel
BY Stephen Berstrik
ATTORNEY.

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PITOT-STATIC TUBE

Wladimir A. Reichel, Bellerose, N. Y., assignor to
Bendix Aviation Corporation, South Bend, Ind.,
a corporation of Delaware

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The present invention relates to Pitot-static tubes and more particularly to Pitot-static tubes for use on aircraft in conjunction with indicating or control devices.

The invention embodies a novel combination of a Pitot-static tube and means for maintaining said tube free of sleet, snow, ice or other impedimenta.

More specifically the means embodying the invention are provided for the purpose of heating a Pitot-static tube in a novel manner whereby high heating efficiency is produced and the Pitot-static tube is maintained in perfect operating condition under all climatic conditions.

Similar devices of the prior art have been utilized but they have had a low heating efficiency, failing, therefore, to produce a proper operating status under all climatic conditions.

Moreover, such prior art devices have been subject to deterioration due to moisture or other conditions accompanying climatic changes, whereby the efficiency and operation of the device have been impaired.

In view of the above-mentioned disadvantages prevailing in the prior art devices, one of the objects of the present invention is to provide a novel heated Pitot-static tube whereby such disadvantages are eliminated.

Another object is to provide a novel electrically heated Pitot-static tube device whereby sleet, snow, ice formation or other impedimenta to the free operation of the device are prevented.

Still another object is to provide a novel electrically heated Pitot-static tube comprising an electric heating element completely sealed against moisture.

A further object is to provide a novel electrically heated Pitot-static tube, comprising a heating wire covered with electrical insulation and completely sealed in a waterproof shell, said wire and shell being wound into a heating coil with the adjacent turns thereof soldered or brazed together to form a unitary heating element.

Still another object of the present invention is to provide a novel electrically heated Pitot-static tube, comprising a heating wire, a heat conducting sheath providing a moisture proof covering for said wire and electrical insulating means between said wire and sheath, said wire and sheath being formed into a coil with a section of the wire and sheath extending away from said coil, whereby heat distributing means are provided remote from said coil proper.

The above and further objects and advantages of the invention will appear more fully herein-

after from a consideration of the detailed description which follows, taken together with the accompanying drawing wherein a plurality of embodiments of the invention are illustrated. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only and is not designed as a definition of the limits of the invention, reference being primarily had for this purpose to the appended claims.

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

Fig. 1 is an elevation, partly in section, illustrating one form of the novel Pitot-static tube embodying the present invention;

Fig. 2 is a section taken on a line 2—2 of Fig. 1; and

Fig. 3 is a view, in cross-section, illustrating another embodiment of the invention.

Referring to the drawing, and more particularly to Fig. 1, the invention is shown in the present instance as applied to a Pitot-static tube comprising a metal tubular section 11 having a threaded portion 12 attached to a threaded portion 13 of the tube casing 14, the latter casing being provided with a suitably tapered end.

The tubing 11 is provided with an opening 15 and constitutes the velocity-pressure end of the Pitot-static tube for transmitting pressures due to velocity-head to an airspeed indicator, for example. Casing 14 is provided with a plurality of apertures 16 in the walls thereof utilized for transmitting pressures due to static or pressure-head. Coinciding with the opening 15 at the end of tube 11 and extending within the latter is a tube 17 mounted in a bore 18 formed in the threaded portion 13.

Mounted within tube 17 is another tube 19 provided with a baffle 20 and a notched-out opening 21. The notched-out opening 21 and baffle 20 combine to provide means for conveying the velocity-head to the device to be actuated, baffle 20 preventing entrance of any foreign matter into the tube 19. Similar means in the form of a tube or chamber 14a are provided whereby the static or pressure head is likewise conveyed to the device to be actuated.

When an aircraft on which the Pitot-static tube is mounted is flying at high altitudes in which very low temperatures are prevalent, or when flying during inclement weather, ice tends to form or snow tends to pack at the openings 15 or 21 or within the interior of the velocity-tubing 19, thereby clogging the same or completely clos-

ing it and rendering the Pitot-static tube inoperative. It is, therefore, desirable to prevent such ice formation, and for this purpose means are provided whereby the velocity-tubing may be efficiently heated, thus preventing ice and snow from adhering to the tubing under all climatic conditions. In the form as shown in Figs. 1 and 2, such means comprise an electric heating coil 22 which may be connected in an electrical circuit by its extremities or by a "single-wire-ground-return-system," including a source of electrical current (not shown) whereby the coil may be heated.

In the present embodiment, coil 22 comprises an electrical heating wire 23 surrounded by or protected from a metal casing or sheath 24 by heat resisting insulation 25 which may be, for example, felted asbestos placed around the wire 23, or a series of minute porcelain beads separating the wire 23 from casing 24. Casing 24 may comprise a copper, steel, or other highly heat-conducting metal which may, if desired, be drawn over the wire 23 and insulation 25 or wire 23 and insulation 25 may be inserted therein, thereby producing a compact structure insuring greater heat propagation. The complete assembly of wire 23, insulation 25, and sheath 24 is then formed into a coil by winding the complete wire assembly about a section 23a for example, of said assembly wire as a base, as shown in Fig. 2, or the assembly may be formed into any desired geometrical shape.

Coil 22 is surrounded by a metal sleeve 26 located between coil 22 and the metal tube 11 and in contact therewith. A perforated disc of insulation 27 mounted on tube 17 closes the end of the metal sleeve 26 and is held in abutting relation therewith by resilient ring 28 abutting a wall 11a of the tube 11. The sleeve 26, in the present instance, is of highly heat-conductive metal such as beryllium copper, for example, so that heat from coil 22 is conducted readily to tube 11.

The extremities 22a, 22b of coil 22 extend into conduits formed by metallic tubes 29 and 30 respectively, mounted in the casing 14. Said extremities extend through the static chamber 14a formed within the casing 14 and thereby provide means for distributing a portion of the heating effect of coil 22 into the chamber 14a and about the velocity-tubing leading to the device to be operated, so that any moisture from the melted ice or snow is prevented from forming any obstruction within the velocity-tubing. The ends 23a and 23b of heating wire 23 are connected to suitable binding posts (not shown) which in turn may be both connected to the terminals of a suitable source of electrical energy or one end may be grounded to the Pitot-static tube casing when it is desired to utilize a "single-wire-ground-return-system."

In Fig. 3 there is illustrated another embodiment of the present invention, in which the composite wire comprising heating wire 23, insulation 25, and casing 24 is wound into a double layer coil 22c, thereby providing a highly efficient heating element capable of preventing obstruction of the Pitot-static tube under any climatic conditions.

In the embodiment as illustrated in Figs. 1 and 2, the adjacent layers may be soldered or brazed together, whereby a unitary heating element is produced of very high efficiency, while in the embodiment illustrated in Fig. 3, the superimposed layers and the adjacent layers may also be

soldered or brazed together to provide a highly efficient unitary heating element.

In the operation of the device, the heating unit comprising several turns of the composite wire, provides a large radiating surface due to the larger circumference of the sheet 24, whereby the heating effect of wire 23 is efficiently distributed to the velocity-pressure conducting tubing and the wire 23 is further completely encased in a waterproof sheath whereby deterioration or short-circuiting of the heating element due to penetration of moisture is completely obviated.

There is thus provided a novel heated Pitot-static tube structure, whereby the heating effect of the heating element is efficiently conducted to the velocity-pressure tubing, and distributed throughout the length thereof and whereby deterioration of the heating element is prevented.

Although only two embodiments of the invention have been illustrated and described, various changes and modifications in form, materials, and relative arrangement of 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. A Pitot-static tube comprising a tubular metallic hollow body having its rear end tapered and closed and its front end open for receiving the impact of dynamic pressure, a wall dividing said tubular body into front and rear compartments, said rear compartment having static openings in its wall and constituting a static pressure chamber, a dynamic pressure tube extending through said rear compartment into said front compartment through said dividing wall with the open end of said pressure tube positioned at the open front end of said tubular body to receive the impact of dynamic air pressure, an electrical heating coil located in the front compartment of said tubular body and surrounding said pressure tube in heat conducting relation therewith to heat the air passing therethrough, and a pair of heat conducting metal tubes sealed in a pair of openings in said dividing wall and projecting from said wall rearwardly along said static chamber, said coil being made of wire having a heat conducting metal sheath covering the same but electrically insulated therefrom, and the ends of said coil passing through the metal tubes in said dividing wall whereby the heat produced by said coil is conducted to said static chamber to heat said chamber which is also heated by the heat of the heated air passing through said pressure tube.

2. A Pitot-static tube comprising a tubular metallic hollow body having its rear end tapered and closed and its front end open for receiving the impact of dynamic air pressure, a wall dividing said tubular body into front and rear compartments, said rear compartment having static openings in its wall and constituting a static pressure chamber, a dynamic pressure tube extending through said rear compartment into said front compartment through said dividing wall with the open end of said pressure tube positioned at the open front end of said tubular body to receive the impact of dynamic air pressure, an electrical heating coil located in the front compartment of said tubular body and surrounding said pressure tube in heat conducting relation

therewith to heat the air passing therethrough, and at least one heat conducting metal tube sealed in an opening in said dividing wall and projecting from said wall rearwardly along said static chamber, said coil being made of wire hav-
5 ing a heat conducting metal sheath covering the same but electrically insulated therefrom, and

said coil having at least one end thereof passing through the metal tube in said dividing wall whereby the heat produced by said coil is conducted to said static chamber to heat said chamber which is also heated by the heat of the heated air passing through said pressure tube.

WLADIMIR A. REICHEL.