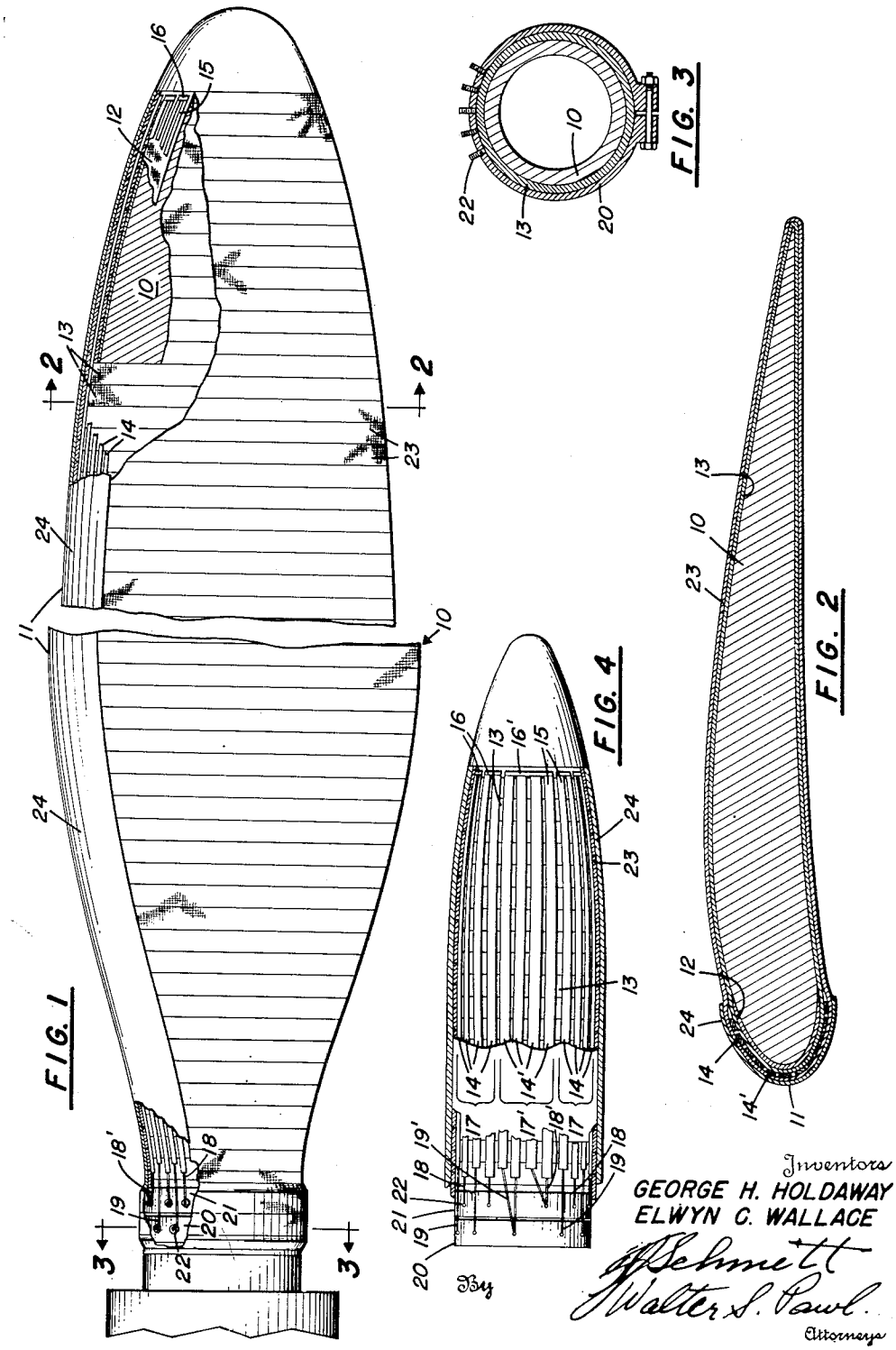
Jan. 5, 1954 G. H. HOLDAWAY ET AL 2,665,090

PROPELLER ICE-PREVENTION HEATING UNIT

Filed Aug. 3, 1950



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Patented Jan. 5, 1954

2,665,090

UNITED STATES PATENT OFFICE

2,665,090

PROPELLER ICE-PREVENTION HEATING UNIT

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Application August 3, 1950, Serial No. 177,546

2 Claims. (Cl. 244—134)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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The present invention relates to aircraft propellers and particularly to a deicing device for attachment to propellers.

De-icing devices commonly in use are subject to failure and fouling of the propellers due to the separation of the external heating element from the surface of the propeller by abrasive action of the air and water droplets encountered in flight and stones and other loose abrasive material encountered during engine run-up on the attaching covers or adhesives. Frequent failures have been noted as due to the shorting of the heating element on the metal propeller through wear and rupture of the insulating layer in which the heating element is fixed.

An object of the present invention is to provide a de-icer for an airplane propeller having a more durable thermal and electrical insulating layer to prevent shorting and heat loss through the propeller.

Another object of the invention is to provide such a de-icer for an airplane propeller that is readily applied to variously shaped propellers.

A still further object of the invention is to provide a de-icer which is protected against abrasion and one which closely adheres to the aerodynamic shape of the propeller without creating excessive drag.

The embodiment of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing in which:

Fig. 1 is a view in elevation and part section of a propeller blade with the de-icer secured thereon.

Fig. 2 is an enlarged view in section taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged view in section taken on line 3—3 of Fig. 1.

Fig. 4 is a slightly enlarged view of the outer portions of the heating elements.

Referring to the drawing in which like numerals indicate like parts throughout the several views, the propeller blade 10 is covered at its leading edge 11 with a first layer of a thermally and electrically insulating material suitably secured by cement or other means. Over the layer 12 is cemented a wrapped layer 13 of tape having electrically insulating properties, such as woven glass tape. Woven glass tape conforms readily to the contours of the propeller blade and may be laid without overlapping to completely cover any shape of blade.

Heating elements 14 and 14' are then cemented or otherwise bonded to the layer 13 and positioned along the leading edge 11 for a distance of approximately ten per cent of the chord length on each side. The heating elements 14, 14' are thin flat strips of resistance metal laid parallel approximately $\frac{1}{32}$ of an inch apart, and their ends 15 near the tip of the propeller are joined by short bus bars 16, and 16', each pair of elements 14 forming a heating unit 17, and elements 14', as shown in the arrangement of Fig. 4, are connected in series-parallel to form heating unit 17' having a greater heat dissipation than units 17. Unit 17' is positioned over the leading edge 11 where a greater heat is needed. The leads 18, 19, and 18', 19', of the heating units 17, 17', respectively, are connected one to each of the clamping collars 20 and 21 by studs 22. A source of current is connected to the collars 20, 21 in a conventional manner by means not here shown since they are not considered a part of the invention. As is shown in Fig. 4, two of the heating elements 14' in unit 17' are connected to one terminal collar 21, and two to the other terminal collar 20.

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A second layer of tape 23 is cemented and wound over the heating elements 14, 14', over the bus bars 16 and leads 18, 18', 19, and 19' and collars 20, 21. An abrasion resistant cap strip 24, such as Nichrome metal, is cemented over the leading edge 11 in order to protect the heating units 17, 17'. It has been found that woven glass tape of approximately .005 of an inch in thickness is adequate for layer 13, and one of .003 of an inch in thickness is suitable for layer 23, each of approximately ½ inch in width, and when applied in the manner described provides thermal and electrical insulation for the heating units and prevents undue heat loss through the blade.

Due to the arrangement of the heating elements 14' in unit 17', by connection in series-parallel, the heat dissipation over the leading edge of the blade will be approximately twice that of the heat dissipation from the areas adjacent.

Experiments have shown that a current dissipation of 9 watts per square inch for the area on each side of the leading edge and substantially twice that for the area of the leading edge is adequate for most icing conditions. The preferred material for the cap strip is Nichrome metal of .004 of an inch thickness and 2 inches width for the average width propeller blades.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made there-

in without departing from the spirit and the scope of the invention as set forth in the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In an airplane propeller, a propeller body having a leading and a trailing edge, a de-icer connected to said body and comprising, a strip of thermally insulating material extending spanwise of the body and disposed on said leading edge, said strip extending chordwise of said body a distance to substantially cover said leading edge, a layer of insulating material disposed on and secured to said body, said layer consisting of a strip of insulating material wound chordwise of said body and extending completely around said leading and trailing edges, a heating element fastened to said layer at the leading edge of said body, said heating element being juxtaposed to said strip of insulating material, a tape of insulating material extending around said leading and trailing edges and arranged to form a cover layer over the first mentioned layer and said heating element, and a capstrip at the leading edge of said body disposed over the portions of said layers on said leading edge, said insulating strip and said heating element.

2. The combination of claim 1 and; said heating element consisting of a plurality of flat bars in side-by-side relation, bus bars at the outer ends thereof connecting said flat bars, and lead conductors at the inner ends of said bars, collars connected to said body at the root thereof, and studs connected to one of said collars to which said lead conductors are connected.

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