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# UNITED STATES PATENT OFFICE

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## AIRPLANE PROPELLER

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This invention relates to improvements in airplane parts and more particularly to airplane propellers.

As is known, it has been the custom in the past to construct airplane propellers of laminated wood strips. This process is both protracted and costly inasmuch as it involves the choice of specific types of wood followed by an extended curing period and a very careful assemblage. To eliminate some of the disadvantages involved in this older type of structure, it has been proposed to construct an airplane propeller of a suitable metal. A variety of such structures has been proposed and it is to this type that the present invention is directed.

It is an object of this invention to provide an airplane propeller composed of a formable metal having high strength and corrosion resistance properties.

Another object is to provide an airplane propeller constructed of a high strength heat treated alloy.

A further object is to provide an airplane propeller of a metal having a desirable low specific gravity and high tensile properties.

A further object is to provide an airplane propeller of light weight, high strength and resistance to corrosion.

With these and other objects in view, the invention comprises the provision of an airplane propeller composed of a light weight beryllium alloy.

It has been found that high strength alloys may be obtained by combining beryllium with aluminum and or with other constituents to form binary, ternary and other complex alloys. These materials present a relatively high tensile strength combined with such desirable factors as low weight and low susceptibility to corrosion.

In accordance with the present invention, an airplane propeller may be made up by utilizing such materials. In the preferred form, an alloy of aluminum and beryllium with or without other alloying constituents may be first formed up into the desired shape. Thereafter the element may then be treated to increase its tensile strength and hardness so as to improve it for the intended use. This treatment in general consists of a heat treatment followed by a rapid quench in a manner generally similar to that employed for the heat treated aluminous alloys of the duralumin type.

More specifically, this treatment comprises raising the alloy to a temperature slightly below the melting point of the lowest melting constituent of the aluminum beryllium alloy. If ternary or other alloys are employed the temperature to which the material is raised should be slightly below that of the most fusible constituent. This temperature, which may range from approximately 550° to 650° C. more or less, is continued for a period of time sufficient to effect the solution of the undissolved beryllium.

After such a heat treatment, the material is quenched, in the well known manner, and is then permitted to age. While desirable enhancement of the physical properties of the material may be secured at normal aging under atmospheric temperature conditions, it is preferable to accelerate such aging. This may be done by raising the temperature of the alloy, in a manner comparable to the accelerated aging of duralumin. This aging temperature may, for example, consist of heating the material to 150° C. more or less. This aging at elevated temperatures accelerates the tempering which is generally considered to consist of a precipitation of the alloying constituents from the solid solution in the form of very small particles. Such a treatment, in the case of beryllium aluminum alloys, effects a very material increase in the hardness and tensile strength of the alloy and renders it peculiarly useful in airplane structures.

Aluminum beryllium alloys, like duralumin, immediately after quenching show no appreciable increase in strength or hardness. Hence, if desired, the metal may be formed in the desired shape immediately after the quenching operation while the material is in its relatively soft state. After such a formation, the aging may be allowed to proceed either under ordinary or under accelerated conditions.

It has been found that alloys of a very

high tensile strength and hardness may be obtained by additions of copper and magnesium to the binary aluminum beryllium alloy. For example, it has already been shown that improved results are obtained by adding beryllium to aluminum base alloys which contain magnesium copper and silicon and magnesium and copper. Such addition imparts to the base alloy improved hardening and tensile properties and results in a product having a higher hardness and tensile strength. It has been disclosed heretofore that the addition of approximately .05 of beryllium to an aluminum copper alloy containing 4% of copper increases the hardness and tensile strength of the resulting alloy very materially. Likewise, if such materials are tempered or aged under elevated temperatures a further improvement in hardness and tensile strength results.

The present invention therefore contemplates the utilization of such materials for the manufacture of airplane parts such for example as the propeller hereinbefore described. These parts may be made up by either forming before the heat treatment or by forming after the heat treatment and before the hardened reaction has initiated or appreciably commenced. The resulting article provides a member which is of very low weight and a high tensile strength. These physical characteristics, particularly in conjunction with the relatively high resistance to corrosion, render the material efficacious for use in airplane structures which are, as known, subject to active corrosion conditions and more particularly to intercrystalline corrosion.

While specific embodiments of the invention have been described, it is to be understood that these are given merely as by way of example and as explaining the underlying principles, namely the utilization of light metal alloys containing beryllium for the construction of airplane parts.

I claim:

1. An airplane propeller consisting of an alloy of aluminum containing berryllium and silicon.

2. An airplane propeller consisting of an alloy containing aluminum and berryllium which is heat treated and aged at elevated temperatures.

3. An airplane propeller consisting of a heat treated alloy containing aluminum, magnesium and beryllium.

In testimony whereof I affix my signature.

RAYMOND J. NORTON.