Jan. 27, 1931. W. E. GWALTNEY 1,790,213

COATING PROCESS

Filed Aug. 13, 1927

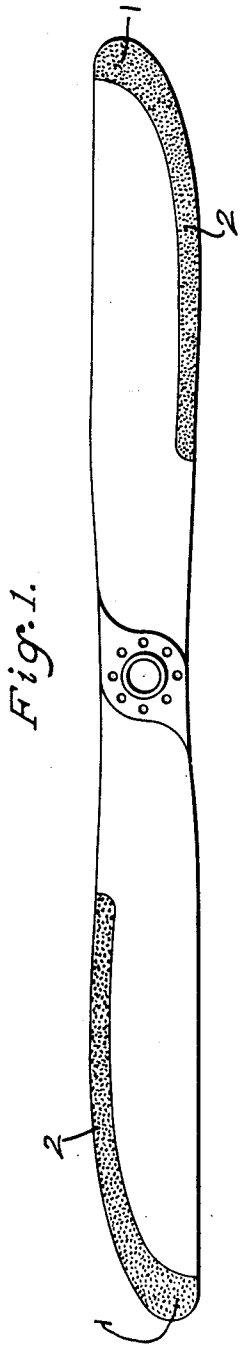


Fig. 1.

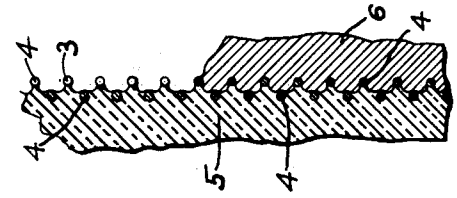


Fig. 5.

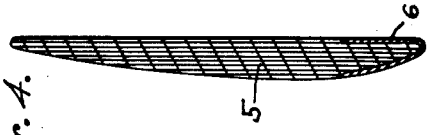


Fig. 4.



Fig. 3.

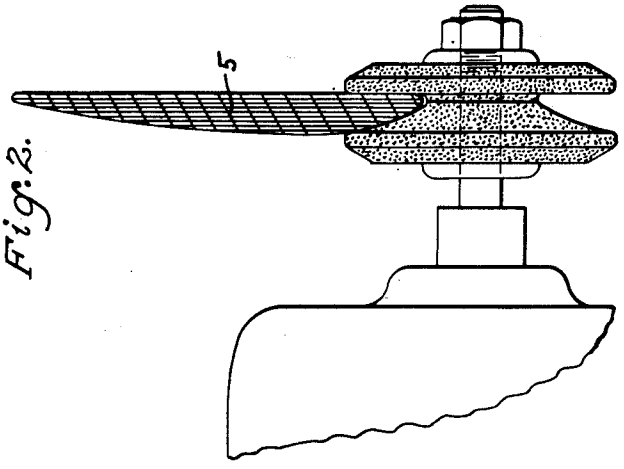


Fig. 2.

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UNITED STATES PATENT OFFICE

WILLIAM E. GWALTNEY, OF TURTLE CREEK, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

COATING PROCESS

Application filed August 13, 1927. Serial No. 212,645.

My invention relates to propellers and has particular relation to propellers employed in the propulsion of airplanes.

Propellers on modern airplanes revolve at relatively high speeds and the tips of the propellers, therefore, travel at such high peripheral speeds that, if plant growth, rain or hail come into contact with the rapidly revolving propellers, the end of the propellers, particularly the tips and leading edges are likely to be damaged and destroyed.

A non-metallic propeller is desirable because of its flexibility and adaptability to streamlining. It is also desirable to protect the leading edge and the tip by a metallic plate or coating in order to protect the more exposed portions of the propeller. The propeller tips of the prior art have been found to be susceptible to destruction because of the bending of the propeller blades and the high speed at which the tips pass through the air. My method of tipping propellers provides a metallic surface which is united with the material of the non-metallic surface in such a manner that the tip constitutes a unitary part of the propeller blade and, therefore, cannot be ripped off by action of the air currents, water and the like.

My invention may be better understood by reference to the accompanying drawing, in which like figures indicate like parts.

Figure 1 is an elevational view of a propeller tipped according to my process.

Fig. 2, Fig. 3 and Fig. 4 show different stages in the process of coating the propeller.

Fig. 5 is an enlarged sectional view of the surface of an article, a portion of which has been coated according to my process.

Although my process may be used on any non-metallic surface, it is particularly well adapted to be utilized for coating articles made of molded laminated material, such as the propeller shown in Fig. 1, in which fabric treated with a phenolic condensation product has been molded under heat and pressure.

Referring to the drawing, the surface of the propeller which is to be coated, as, for example, the tip 1 and leading edge 2 are ground by a grinding stone shaped to conform to the leading-edge surface as shown in Fig. 2. If desired, a cylindrical form having sand-paper on its peripheral surface may be used, or two stones or sand-paper surfaces driven by separate motors mounted at a slight angle may be used to grind the surface of the propeller.

The action of grinding causes the bits of grit from the sand-paper or stone to be driven into the surface of the molded laminated material and withdrawn, thus pulling out the binder material between the threads of the fabric to form innumerable small recesses. These recesses are likely to be larger at the base than near the surface because of the weave of the cloth (Fig. 5).

Sand blasting was found to provide a roughened surface but the grinding method seems to be the more desirable. If desired, a strip of untreated material may be introduced in the process of molding the propeller at portions to be coated. This strip unites with the molding material and provides a roughened untreated surface having recesses therein well adapted to receive a metallic coating.

If desired, the leading-edge 7 may be under-cut (Fig. 3) sufficiently so that, when the metallic coating 6 is applied, its outer surface will be flush with the outer surface of the propeller blade (Fig. 4). Metal is applied to the prepared surface by the process of spraying. This process comprises providing a wire of the metal, melting the wire under heat, and blowing it on the surface which is to be coated, by means of a wholly or partially non-oxidizing air blast. Other processes of mechanically depositing the metal on the propeller surface may be utilized, such as melting powdered metal and spraying the molten metal. I preferably use copper, phosphor bronze or chromium for the coating metal, but other metals which lend themselves to my process may be used. The chromium is desirable because of its hardness.

The sprayed metal penetrates the prepared recesses 3 between the fibers or threads 4 of the molded laminated material, as shown in Fig. 5, and forms an interlock joint between the surface layer 5 of the laminated material

and the coating metal 6. The coating material 6 is locked to the laminated material by this action to form a unitary structure and cannot be torn away.

In addition, the propeller may readily be balanced statically and dynamically by depositing more metal on the lighter blade of the two.

If the deposited metal is worn off in spots, it may be readily replaced in the same manner as it was originally deposited.

The result is a propeller blade provided with a metallic coating about the edge or portion of the propeller which is desired to be protected. If copper or phosphor bronze is used for a coating, chromium may be deposited on such a metallic surface, by electroplating methods or by mechanical deposition, to provide a still harder surface. The metallic coating may be provided to cover any portion of the propeller which is to be protected, as, for example, the entire surface of the propeller or only the leading edge and the tip, as shown.

My method of coating may be used on any fibrous non-metallic material where the surface may be ground or abraded sufficiently to form a bond between the metallic and non-metallic portions.

Although I have described a specific method and a specific device, such modifications as may occur to those skilled in the art may be made without departing from the spirit and scope of my invention as defined in the appended claims.

I claim as my invention:

1. The method of coating a fibrous non-metallic article having a plurality of constituents and having a normally smooth and non-porous surface which comprises grinding the surface to pull out one of the constituents to form counter-sunk recesses and mechanically depositing metal on the prepared surface.

2. The process of coating an article comprising a fibrous material bound with a binder, and having a normally smooth and non-porous surface, which comprises grinding the surface of the article to pull out portions of the binder, and mechanically depositing metal in the openings left by the removal of portions of the binder, and on the surface to provide a closely engaged metal coating on the article.

3. The process of coating an article comprising a fibrous material bound with a heat hardened binder, and having a normally smooth and non-porous surface, which comprises grinding the surface of the article to pull out portions of the binder and mechanically depositing metal in the openings left by the removal of portions of the binder, and on the surface to provide a closely engaged metal coating on the article.

4. The process of coating an article comprising a laminated fibrous material bound with a heat hardened binder, and having a normally smooth and non-porous surface, which comprises grinding the surface of the article to pull out portions of the binder and mechanically depositing metal in the openings left by the removal of portions of the binder, and on the surface to provide a closely engaged metal coating on the article.

5. The process of coating a propeller comprising a fibrous material bound with a binder, and having a normally smooth and non-porous surface, which comprises grinding the surface of the article to pull out portions of the binder and mechanically depositing metal in the openings left by the removal of portions of the binder, and on the surface to provide a closely engaged metal coating on the propeller.

In testimony whereof, I have hereunto subscribed my name this 3rd day of August, 1927.

WILLIAM E. GWALTNEY.