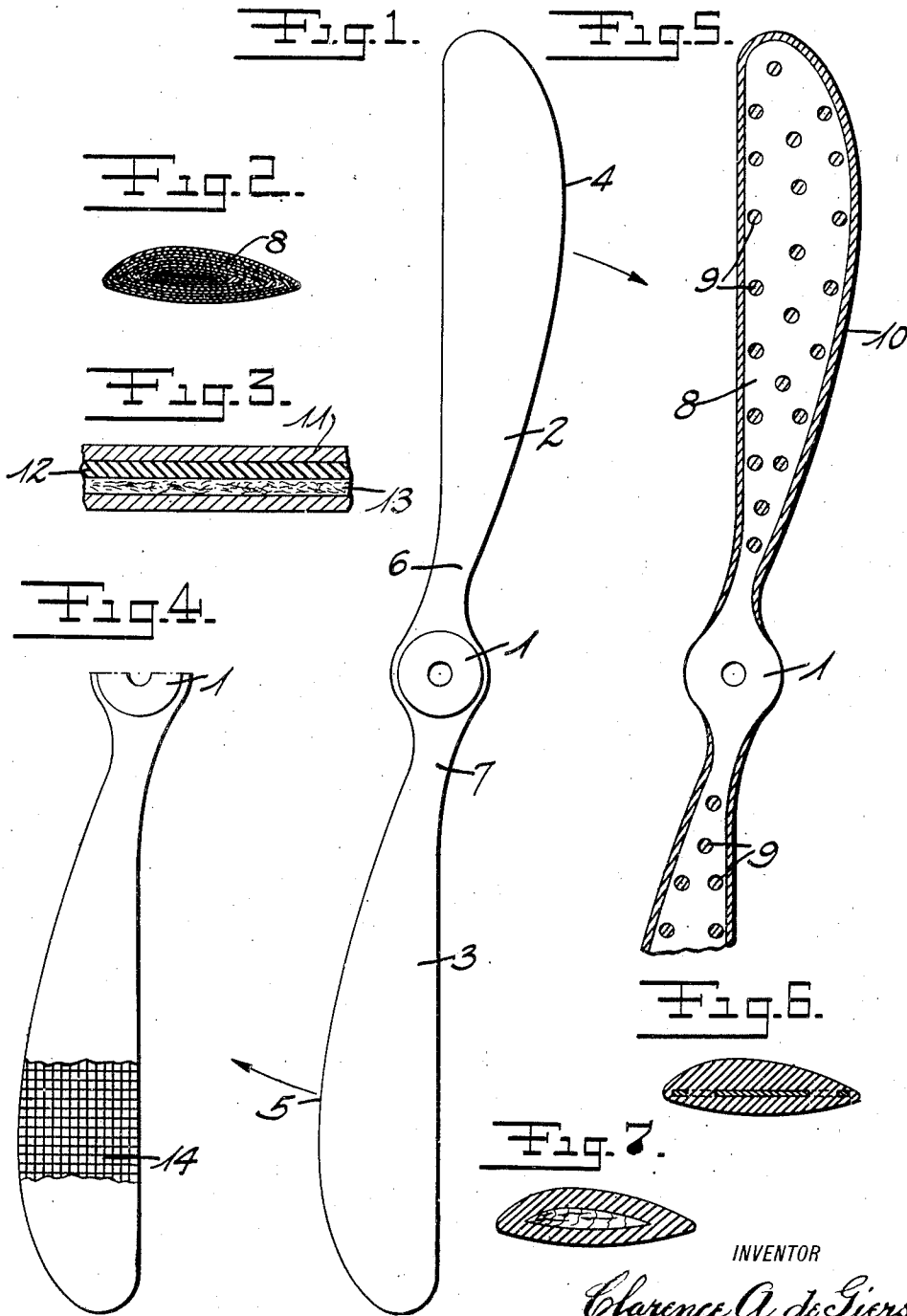


C. A. DE GIERS.
AIRPLANE SCREW.
APPLICATION FILED OCT. 23, 1917.

1,384,308.

Patented July 12, 1921.



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AIRPLANE-SCREW.

1,384,308.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CLARENCE A. DE GIERS, a citizen of the United States, and a resident of Keyport, in the county of Monmouth, and State of New Jersey, have invented certain new and useful Improvements in Airplane-Screws, of which the following is a full, clear, and exact description, whereby any one skilled in the art may make and use the same.

The invention relates to so-called airplane screws or propellers to be made in composite form and as a single unit structure to overcome existent objections to the wood or metal propellers in common use.

The object of the invention is to provide a composite structure which, from blanks, may be assembled and molded by heat and pressure into a finished unitary structure.

In a co-pending application, Serial No. 198,018, filed October 23rd, 1917, I have described and claimed a propeller, of the general character herein referred to, which is formed in a mold from a vulcanizable material as a unit structure.

The present invention is directed to providing a unitary structure through the agency of vulcanization, but with certain features of armoring and filling to enhance the value of such a structure, at the same time reducing the cost of construction and providing for lightness and stability.

Referring to the drawings:

Figure 1 is a view in elevation showing an outline of a propeller.

Fig. 2 is a cross-sectional view.

Fig. 3 is a fragmentary view on a much enlarged scale as compared with Fig. 2, showing the structural formation.

Fig. 4 is a fragmentary view illustrating the laying of reinforcing materials.

Fig. 5 is a sectional view adjacent to the fillet.

Fig. 6 is a cross-sectional view through the form of Fig. 5.

Fig. 7 is a cross-sectional view illustrating a modified form of fillet.

Wood propellers are well known and in common use for air and sea planes and, in fact, are almost universally employed in preference to metal screws or propellers.

It has been found that the metal propeller cannot be depended upon, owing to disintegration of the metal due to flexing, vi-

bratory actions, etc., which cause early and almost complete disintegration of the metal.

Wood propellers have been successfully used, but their life is extremely short and there is an element of danger in their use. In the construction of wood propellers, they are formed from laminated wood, usually mahogany and oak which are glued together to form a blank. This blank is then turned and carved to form and requires a great amount of hand labor to secure accurate dimensions, surfacing, etc. It is, of course, "filled," varnished, and rubbed down to give it the proper surface.

Such propellers, in service and when subjected to the extremely high duty imposed upon them, soon wear and chip at their entering edges and, due to sand and water spray, are chipped at the entering edge and worn on the surfaces by the abrasive actions of sand and water spray. Obviously, as soon as the finish of the edge or surface is broken, they rapidly deteriorate as they are then subject to all the conditions of warpage and deterioration due to climatic changes and entrance of moisture to the structure. There is also great danger in use of said propellers from splitting and flying apart. It takes comparatively little to destroy a wooden propeller. It becomes brittle and unfit for use in a short time due largely to the fact that it is impossible to build up a structure having perfectly matched grain- ing of the wood, free from sap grain, dry rot, and other faults. Such faults are hardly distinguishable, even in the comparatively thin laminae of material, and it is almost a physical impossibility to insure perfect gluing of the parts.

Furthermore, the compression of the fiber at the hub when such propellers are applied distorts the fiber and as such a propeller is constantly under enormous strains, both torsionally and through its flexing to say nothing of the centrifugal action, this distortion of the fiber at the hub re-acts on the fiber throughout the structure, causing numerous breaks of the blades adjacent to the hub. This breakage has, by some, been attributed to the centrifugal action which throws the inherent life-giving moistures and saps of wood fiber away from the hub and away from the shanks of the blades, causing them to become brittle.

To overcome the objections hereinbefore noted, the present invention contemplates the formation of a propeller finished as to its exterior with a vulcanizable material and having said material arranged about and inclosing a core or fillet. This construction gives the advantage of providing propellers at a minimum cost, as regards finishing of the article; gives uniformity; and provides a surface and material which will not split, run in fractures, or disintegrate, even though its entering edges and surfaces are chipped or abraded.

Referring to the drawings, the numeral 1, denotes the hub; 2, 3, the blades of the propeller, which blades have entering edges 4, 5, and shanks 6, 7.

The interior or central portion of the propeller consists of a blank 8, having the general contour of the blades and hub and preferably perforated to permit a joining of the covering material at points throughout the structure.

As illustrated in Fig. 5, there are series of perforations 9, formed through the fillet piece 8, which, as illustrated, is of a thin web-like structure which may be of metal or other material to give stiffness and stability to the propeller and yet be sufficiently flexible to perform its usual functions when the propeller is under duty and is flexed. About this fillet 8, is arranged a vulcanizable material 10, which may be varied as to its form and arrangement so long as it provides a sufficiently hard finished surface for the propeller.

In practice, the vulcanizable material is laid into the mold about the fillet and the whole is then put under compression and vulcanized in the usual manner by applying heat until said vulcanizable material takes the form of the mold and is hardened about the fillet.

It is obvious that the material under vulcanization will extend through the perforations or openings of the fillet piece and form a firm structure, united by such portions as extend through the fillet. This arrangement has the advantage of preventing breaking away of the vulcanizable material from the fillet except in restricted areas. For instance, propellers which are under gunfire might be struck and chipped, but there would be no considerable breaking down of the total structure.

In Figs. 2 and 3, there is illustrated an arrangement of securing a very efficient covering for the fillet in which the fillet 8, is completely surrounded and vulcanized into a covering formed of strata of material of different characters. For instance, there may be a hard rubber compound 11, for the exterior; a softer compound 12, intermediate the hard compound; and a fabric 13. This may be alternated to give a composite

structure which will readily vulcanize to the desired hardness.

In Fig. 4, there is illustrated at 14, an inlaying of cording or metallic wiring which, when vulcanized in as a layer of inclosing material, will tend to stiffen and strengthen the structure and overcome the danger of breakage through the action of torsional and warping strains.

A comparatively lightweight metal may be employed as a fillet, but the fillet piece may be of fiber or wood, as illustrated in the section of Fig. 7. In such case, the wood fillet merely serves as an interior form, giving all the required stiffness and flexibility of the ordinary wood propeller, but armored by the resilient vulcanized covering so that it will not deteriorate as the cutting edges and surfaces of the blades are abraded or pitted from the many causes which affect propellers.

In other words, the wood fillet is completely and perfectly concealed in and protected so that its glued-up portions (if it be made of laminated wood) will not break loose, and there will be no opportunity for it to splinter and shatter.

The life of such propeller, even with a wood fillet, is much greater than that of the ordinary wood propeller, and it has the advantages of resisting the hard conditions of wear and will not split and fly apart.

The covering may be arranged over the fillet in any desired manner, although the preferred method is to arrange blanks of the material cut to proper form which will be imposed one upon the other in the mold and the blanks are then vulcanized together.

As is described in my co-pending application, Serial No. 198,018, filed October 23, 1917, the propellers may be formed by providing a mold approximately the size and shape of the propeller, which mold is provided with a soft metal lining capable of being scraped to give the exact form and finish required on the finished article. The blanks are of vulcanizable material, and the fillet pieces are then laid into the mold and the whole is compressed and subjected to vulcanizing heat.

The arrangement herein described provides a safeguard against pitting, breaking, or shattering at the shanks of the blade, and yet permits formation of a single piece structure from a mold without requiring a tremendous amount of hand labor and finishing upon the individual devices.

What I claim as my invention and desire to secure by Letters Patent is:

1. An aeronautical propeller, consisting of a complete finished structure comprising a "fillet" completely inclosed in a shell of vulcanizable material.
2. An aeronautical propeller, consisting

of a complete finished structure comprising a "fillet" completely inclosed in a shell of vulcanizable material and means permitting portions of the vulcanized material to become embedded in the "fillet" for securing such material and the "fillet."

3. A propeller formed as a complete structure from a vulcanizable material vulcanized about a fillet, said fillet having the general contour of the finished propeller and provided with openings, said vulcanizable material extending through said openings to form areas of homogeneous material through the finished propeller.

4. A complete propeller consisting of a fillet having the general outlines of the finished propeller and a vulcanizable covering surrounding said fillet and vulcanized thereupon and joined at intermediate points through said fillet, the fillet having open-

ings to permit the passage of the vulcanizable material.

5. A propeller consisting of a fillet having the general contour of the finished propeller, and laminae of vulcanizable material completely inclosing said fillet and vulcanized thereto and therethrough.

6. An aeronautical propeller comprising a core of relatively light and strong fibrous material and an inclosing shell of rubber vulcanized to and integrally united with said core.

7. An aeronautical propeller comprising a core of laminated wood and an inclosing shell of hard rubber vulcanized to and integrally united with said core.

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Witnesses:

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