March 27, 1934. J. H. McKEE 1,952,086

METHOD OF ADDING METAL TO FINISHED PROPELLER BLADES

Filed April 1, 1932

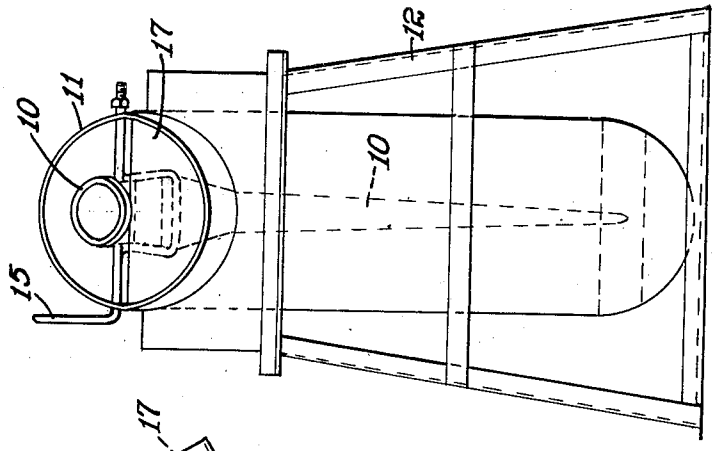


Fig. 2.

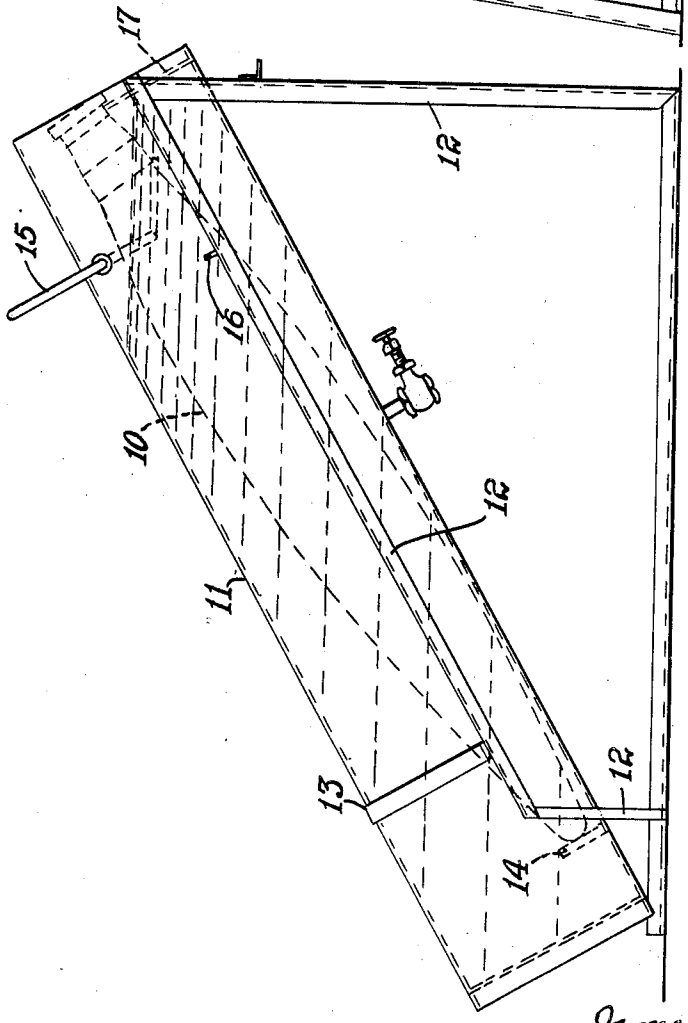


Fig. 1.

INVENTOR
James H. McKee
BY Green & McCallister
His ATTORNEYS

Patented Mar. 27, 1934

1,952,086

UNITED STATES PATENT OFFICE

1,952,086

METHOD OF ADDING METAL TO FINISHED PROPELLER BLADES

James H. McKee, Pittsburgh, Pa., assignor to Pittsburgh Screw & Bolt Corporation, a corporation of Pennsylvania

Application April 1, 1932, Serial No. 602,543

4 Claims. (Cl. 219—10)

This invention relates to aeronautical propeller blades, and more particularly to a method for securing static and dynamic balance in detachable hollow steel propeller blades.

It is very important in the manufacture of detachable propeller blades that each blade be in static and dynamic balance. To secure static balance the blades are so constructed that the center of gravity of all the transverse sections of each blade fall on a single line through the blade at right angles to the axis of rotation of the propeller. Blades so constructed are inherently in dynamic balance since the center of gravity of any section of one blade always balances the corresponding section of an opposite blade and, as a result of this dynamic balance, will operate without an appreciable amount of vibration at high speed and under load of air pressure.

Heretofore the detachable propeller blades most commonly used were of solid construction and to secure static balance therein a hole was bored in the shank end of the blade, which was filled with a sufficient amount of metal heavier than that of which the blade was constructed to increase the weight of the blade the required amount. With hollow steel propeller blades the problem of adding metal to the blade to secure static balance therein is more complex, due primarily to the construction of the blade itself. Such blades are made of a very fine alloy steel, heat treated and hardened to secure a definite metallurgical structure which will withstand the various forces acting on a whirling propeller, and plated with a hard coating to prevent erosion and to protect the blade from the effects of rain, sleet and the like. To secure accurate static balance it is generally necessary to add metal to the blade after the heat treating and plating operations, due to the unevenness of the plating. While it is obvious that the metal necessary to secure static balance in the blade may be readily added to the interior of the blade, since there is no useless central core in a hollow steel blade, it is also apparent that this metal must be deposited on the blade in such a way that the metallurgical structure and the exterior finish or plating of the blade will not be affected thereby. Otherwise the structure of the blade will be weakened at the point where the metal is added or the plating will be so affected that it will tend to chip off, thereby necessitating a replating of the blade.

The principal object of my invention is to provide a method for balancing hollow steel propeller blades whereby metal may be added to the interior of the blade without affecting the structure of the blade secured by the heat treatment.

Another object is to provide a method for depositing metal in a hollow steel propeller blade after the blade has been heat treated and plated or finished.

A further object is to provide a practical method for depositing metal to the interior of a hollow propeller blade to secure static and dynamic balance which is simple to perform, does not require any considerable amount of time, and does not add materially to the cost of the blade.

These and other objects which will be obvious to those skilled in this particular art, are accomplished by means of this invention, one embodiment of which is described in the following specification and illustrated in the accompanying drawing, wherein:

Figure 1 is a view in side elevation of the apparatus used in carrying out my invention, and

Fig. 2 is an end view of the apparatus.

In carrying out my improved method I take a hollow steel propeller blade designated as 10 to which metal is to be added to give it static and dynamic balance and position it in a tank 11 supported in an inclined position on a suitable frame 12 to which it is secured by suitable strap members 13. The blade is so positioned in the tank that the tip end thereof bears against a member 14 adjacent the end of the tank and forms a stop for limiting the inward movement of the propeller blade 10, while the shank end of the blade is supported on a movable fork 15 so that the open end of the blade may be held in the proper and desired position to permit access to the interior of the blade. The blade 10 is also so supported on the fork 15 that it may be readily turned about its longitudinal axis, the purpose of which will more fully appear.

When the blade 10 has been so positioned in the tank 11, a suitable electric arc welding torch (not shown) is inserted into the interior of the blade and metal is applied to those portions thereof where it is necessary to affect the balance of the blade. The circuit for the arc welding torch may be completed by securing one of the conductors to a suitable member as 16 extending from the frame 12. In order to prevent the temperature to which the blade is raised during the welding operation from injuring the metallurgical structure of the propeller blade secured by the

heat treatment and weakening the blade at that point and also to prevent the plating on the exterior of the blade from peeling, the tank 11 which has the end partially closed as at 17, is filled with water or some other cooling medium so that the blade 10 is practically submerged therein.

When metal is to be deposited on the interior of the blade, the blade is turned about its longitudinal axis so that the portion of the blade to which the metal is to be applied is located below the level of the water or cooling medium in the tank. By so submerging these portions of the blade in a cooling medium the heat created by the welding process is rapidly carried away from the blade whereby the temperature of the blade at that point is prevented from being raised to such a degree that if the blade has been heat treated or plated, it would affect the metallurgical structure of the blade or the finish on the exterior of the blade.

It is apparent from the foregoing description that I have provided a novel method for welding metal on the interior of a hallow propeller blade whereby the wall of the blade is cooled during the welding process and weak spots in the blade resulting from injury to the structure of the steel secured by the heat treatment are avoided.

It is also apparent that with my method for depositing metal to the interior of a hollow steel propeller blade it is possible to manufacture perfectly balanced propeller blades since the metal for giving the static and dynamic balance to the blade may be added thereto after the plating or finishing process, and the uneveness of the plating on the exterior surface is successfully overcome.

It is understood that certain changes, modifications and substitutions may be made herein without departing from the spirit of my invention, or the scope of the appended claims.

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

1. The method of adding metal to hollow plated propeller blades to statically balance the same, which consists in immersing the blade, tip end first, in a cooling liquid and depositing metal on the interior surface of the blade by welding, while it is so immersed at a point below the level of the cooling liquid.

2. The method of adding metal to the interior of a hollow steel propeller blade having a plated exterior surface to increase the weight thereof which consists in positioning the blade, tip end first, in a tank filled with a cooling medium, inserting a welding torch into the interior of said blade and welding the required amount of metal on the interior surface thereof at a point below the level of the cooling medium in the tank, whereby the heat generated during the welding process will be rapidly carried away to prevent injury to the plating and metallurgical structure of said blade.

3. The method of adding metal to the interior of a hollow steel propeller blade to increase the weight thereof which consists in positioning the blade, tip end first, in a tank filled with a cooling medium, inserting a welding torch into the interior of said blade and welding the required amount of metal on the interior surface thereof at a point below the level of the cooling medium in the tank, whereby the heat generated during the welding process will be rapidly carried away to prevent injury to the metallurgical structure of said blade.

4. The method of adding metal to hollow propeller blades to statically balance the same, which consists in immersing the blade, tip end first, in a cooling liquid and depositing metal by welding, at a point below the level of the cooling liquid and on the interior surface of the blade while it is so immersed.

JAMES H. McKEE.