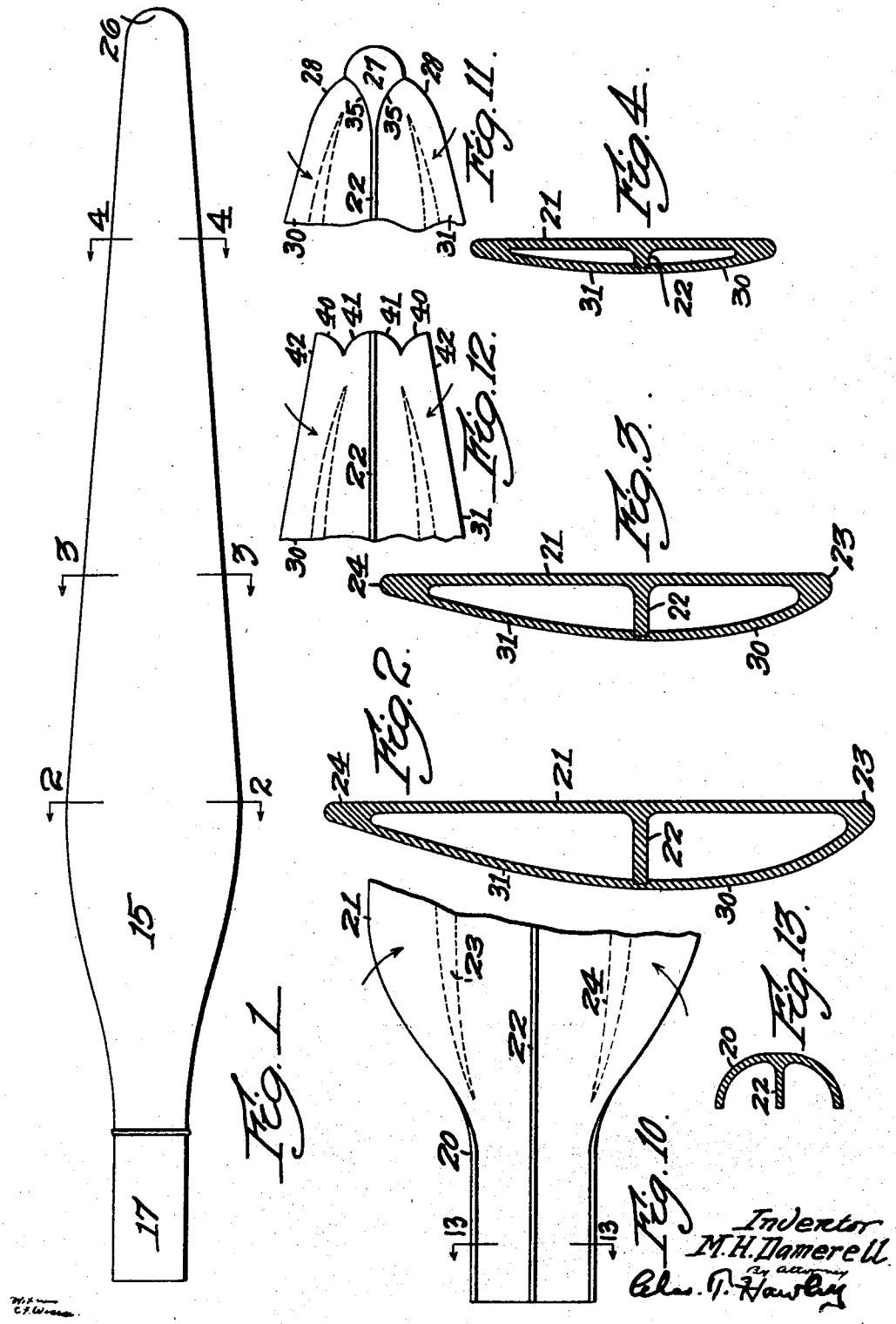
Feb. 11, 1941. M. H. DAMERELL 2,231,750

PROPELLER BLADE

Original Filed Jan. 10, 1938 2 Sheets-Sheet 1



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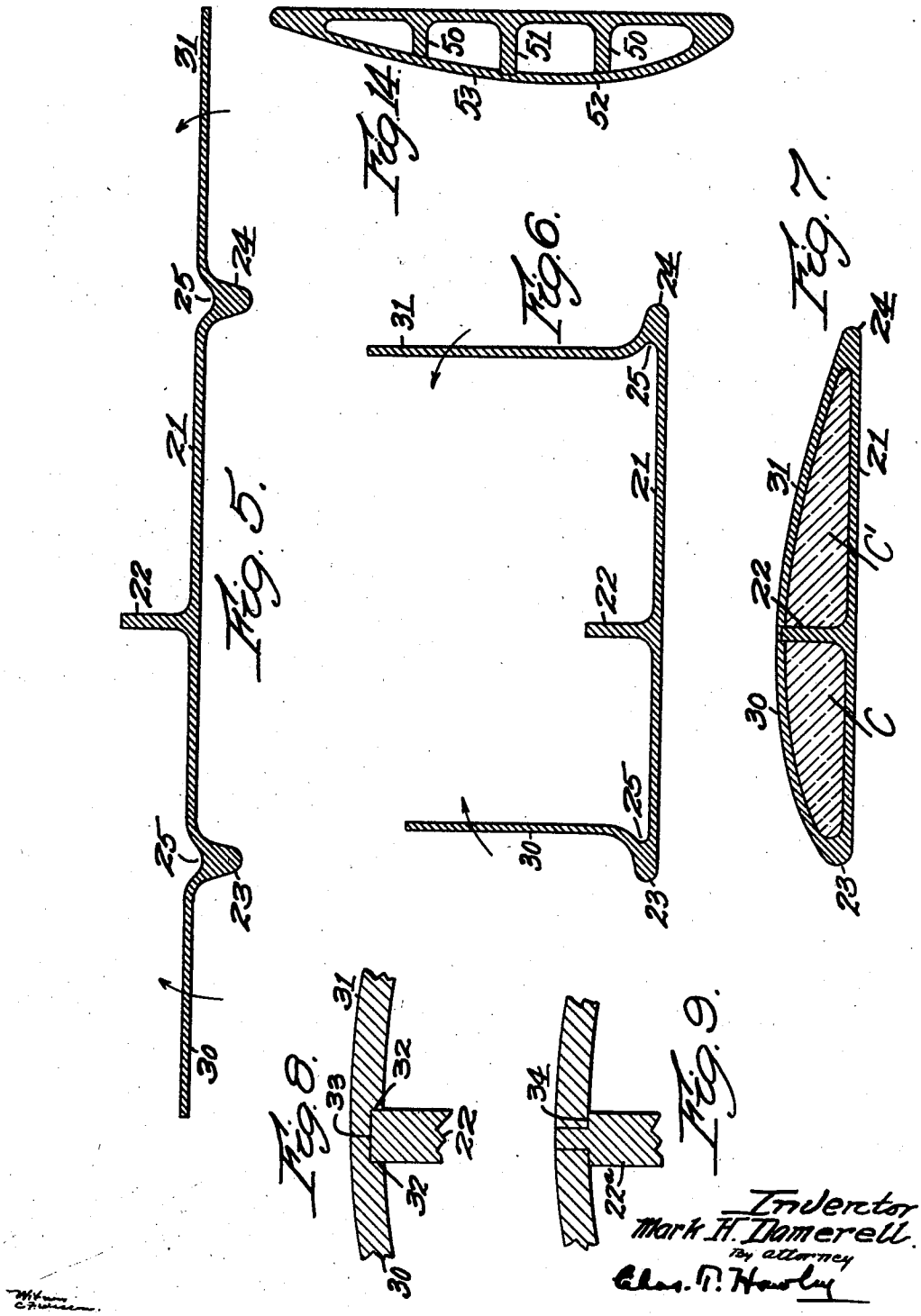

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2,231,750

PROPELLER BLADE

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Original application January 10, 1938, Serial No. 184,205. Divided and this application June 23, 1938, Serial No. 215,371

1 Claim. (Cl. 170—159)

This invention relates to metal propeller blades for aircraft engines and more particularly to steel or alloy blades formed in part by forging operations, and is a division of my prior application Serial No. 184,205, filed January 10, 1938.

It is the general object of my invention to provide a hollow metal propeller blade which is longitudinally and integrally reenforced in a novel and effective manner.

A further object is to provide a propeller blade which may be conveniently manufactured by one or more forging operations.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claim.

Throughout the specification and in the claim, the term "metal" is to be understood to include steel and also ferrous or other alloys having similar characteristics.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a plan view of my improved propeller blade;

Figs. 2, 3 and 4 are sectional views, taken along the lines 2—2, 3—3 and 4—4 in Fig. 1 respectively;

Fig. 5 is a transverse sectional view of a blank from which my improved propeller blade may be formed;

Figs. 6 and 7 are sectional views showing certain steps in the formation of the propeller blade;

Fig. 8 is an enlarged detail sectional view to be described;

Fig. 9 is a similar view of a slight modification;

Fig. 10 is an enlarged partial plan view of the shank or hub portion of the blank shown in section in Fig. 5;

Fig. 11 is a similar view of the tip of the blade blank;

Fig. 12 is a partial plan view similar to Fig. 11 but showing a slight modification;

Fig. 13 is a detail sectional view, taken along the line 13—13 in Fig. 10; and

Fig. 14 is a transverse sectional view of a modified construction of blade.

Referring to the drawings, I have shown my invention as embodied in a steel propeller blade 15 of conventional external form but of hollow construction and provided with a longitudinally extending reenforcing rib. The cross section of the blade is progressively reduced toward the tip of the blade, as indicated by the successive sections in Figs. 2, 3 and 4 respectively, and the height of the reenforcing rib is correspondingly and gradually reduced toward the tip. The blade 15 has a shank or hub portion 17 of reenforced circular section.

Referring to Figs. 5, 10 and 11, I preferably form my improved propeller blade from a steel billet, forged to a blank of the general shape indicated in said figures, with a double grooved hub portion 20 at one end, and with a broad flat portion 21 having a rib 22 extending longitudinally thereof on one side and having additional ribs 23 and 24 formed on the opposite side of the blank and opposed to longitudinal grooves 25.

The tip portion 26 (Fig. 1) of the blank has a full thickness middle end portion 27 (Fig. 11) formed as a continuation of the rib 22 and has single-thick side end portions 28 adapted to be folded over in hollow form, as will be described.

The blank is then accurately machined and outlined, and the edges of the outer portions 30 and 31 are preferably recessed as shown at 32 in Fig. 8 to receive the top edge 33 of the rib 22.

A slight variation of this construction is shown in Fig. 9, in which the edges of the outer portions are left square and the top of the rib 22^a is recessed at the edges, as shown at 34.

The machined blank is then bent to the form shown in Fig. 6, after which soft alloy cores C and C' (Fig. 7) may be placed in position, with their upper faces accurately contoured. The parts 30 and 31 are then bent down against the alloy cores C and C' and the ribs 23 and 24 thereafter constitute integral strengthened longitudinal edge portions for the blade.

After the blank has thus been accurately brought to the desired internal and external shape, the temperature is raised sufficiently to melt the alloy cores C and C', and the core metal is drained off through the opening in the hub portion of the propeller blade.

The edges of the parts 30 and 31 are then firmly joined to the upper end of the rib 22, also to each other, preferably by welding or brazing. The edges of the hub portion 20 are similarly joined. After this operation, the part 22 constitutes a longitudinally extending reenforcing rib which is an integral part of one face of the propeller blank. The exterior surface of the blade is then ground, polished and otherwise finished as desired.

In the form shown in Fig. 11, the edge portions 28 of the tip are folded over and secured to the thicker tip portion 27 along the curved outlines 35 thereof, while in the modification shown in

Fig. 12 the curved edge portions 40 and 41 are secured to each other and the straight outer edges 42 are secured to the rib 22 for the whole length of the blade.

After the formation of the blank as shown in Figs. 5, 10, and 11, a further forging or bending operation brings the outer edge portions 30 and 31 of the blank to the position shown in Fig. 6. After this operation, the upper face of the middle portion of the blank (as viewed in Fig. 6), the inner faces of the edge portions 30 and 31, and the sides and upper edge of the rib 22 are machined, milled, ground or otherwise brought to a carefully finished and uniform surface.

Cores C and C' (Fig. 7) of low melting alloy are then placed on the blank at each side of the finished longitudinal rib 22 and the blank and cores are heated to a temperature at which the blank can be forged or bent but at which the alloy cores will not melt. The portions 30 and 31 are then folded downward over the cores C and C' and the blank is then subjected to forging or pressing operations to bring it to the finished section shown in Fig 7.

It will be noted that the edges of the parts 30 and 31 (Fig. 8) are cut away to provide recesses 32. These recessed edges engage the end of the rib 22, which thereby positions and supports said parts 30 and 31, with a line 33 only appearing on the outside of the blade.

The blade may be twisted to give it the desired helical pitch at some intermediate point in the process, preferably before the edges are welded or brazed to the rib 22.

I am thus able to provide a hollow propeller blade formed of steel or a strong weldable ferrous or other alloy, which propeller blade is formed with an integral reenforcing rib and with a single longitudinal line joint. There are no separate and possibly displaceable parts and the reenforcing rib is forged with the blade, as are also the reenforced edge portions. Consequently my improved hollow propeller blade possesses very great strength, and the possibility of failure due to internal defects is substantially eliminated.

In Fig. 14 I have shown a construction which may be desirable for very long and correspondingly wide propellers. The construction is the same as previously described, except that additional longitudinal reenforcing ribs 50 are provided at one or both sides of the mid-rib 51. The side portions 52 and 53 of the curved face wall will be firmly secured to the ends of the additional ribs 50 by welding, brazing or other suitable method.

The phrase "integral and unitary" as used in the claims designates a construction in which connected parts so described are initially formed in one piece and without joint or seam, welded or otherwise.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claim, but what I claim is:

A hollow propeller blade formed entirely of a single piece of metal with one continuous wall and one two-part wall, said blade having integral strengthened longitudinal edge portions and having a longitudinally extending reenforcing rib between said edge portions, said rib being integral and unitary at one edge with the continuous wall of said blade, and the inner adjacent edges of the two parts of the other wall of said blade being permanently united to the other edge of said rib, and said blade having additional longitudinal reenforcing ribs positioned at both sides of said first-named rib and integral at one edge of each rib with said continuous face and each secured at its other edge to one part of the two-part wall and thus additionally uniting the two walls of said blade.

MARK H. DAMERELL.