

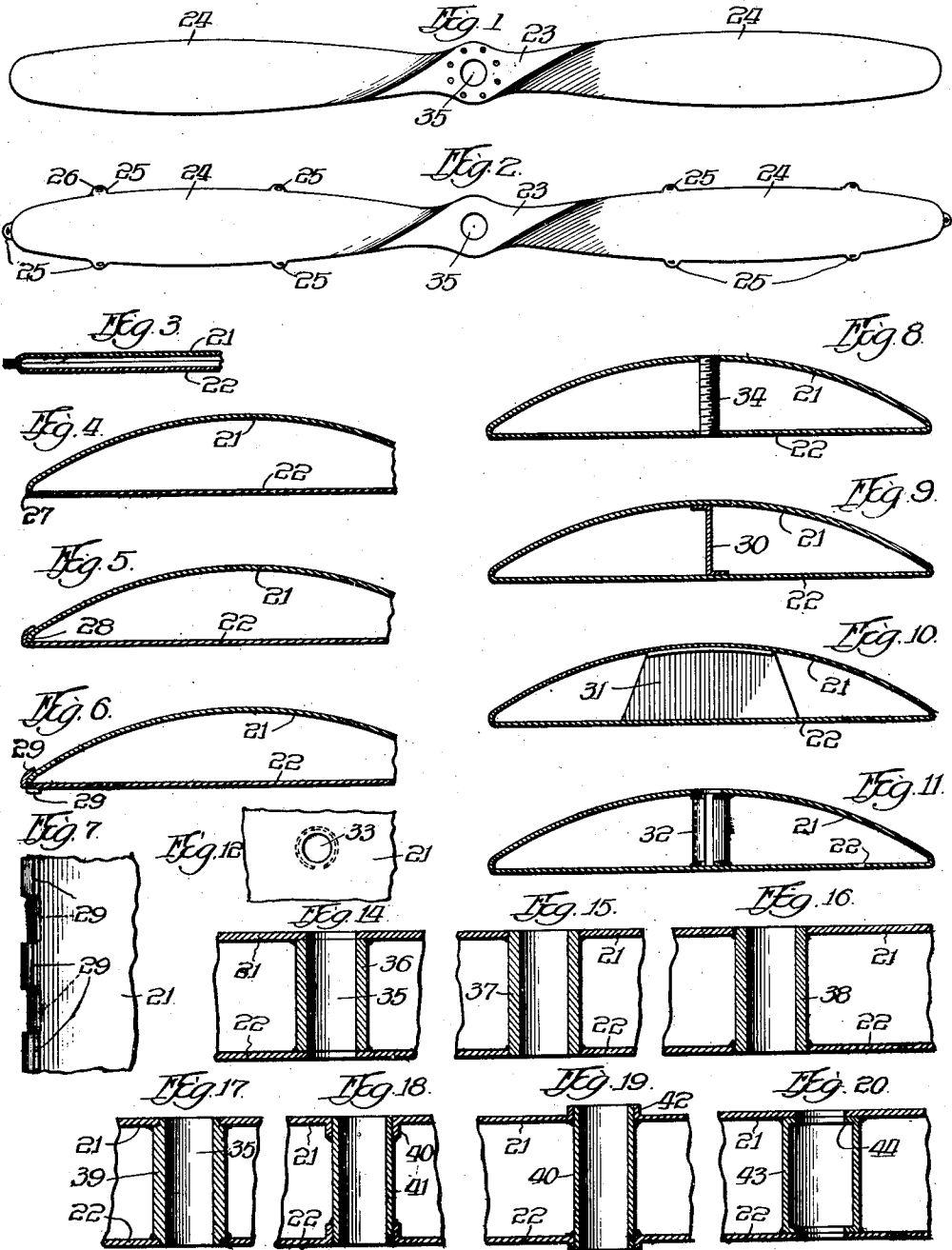
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LE ROY KRAMER

PROPELLER

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Witness:

Ed. Brown

Fig. 13. 33

By Cromwell Breit Warden

Inventor

Le Roy Kramer

Atty.

UNITED STATES PATENT OFFICE.

LE ROY KRAMER, OF CHICAGO, ILLINOIS.

PROPELLER.

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To all whom it may concern:

Be it known that I, LE ROY KRAMER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Propellers, of which the following is a specification.

My invention relates to the manufacture of propeller blades and like hollow bodies of pressed steel, and particularly to features of construction pertaining to the joining together of the two sheets along their edges, the formation of the hub, the interior spacing and stiffening against compressive and expansive strains, and the obtention of exact balance.

The manufacture of airplane propellers from sheet metal has not been found to be practicable, due to imperfections in the particulars above enumerated, wood being retained as the material of their manufacture because of its freedom from these difficulties, notwithstanding its many inherent shortcomings such as its ease of breakage, its susceptibility to swelling, drying out, cracking and splitting of the laminations, and of the wood itself under exposure to weather, the need of constant treatment to preserve a proper surface, etc.

Being solid, there is with wooden construction no problem as to edge union aside from the gluing together of the laminations; no collapsing strains incident to air pressure on the front side of the blade or bursting strains due to vacuum at the rear of the blade; balance is reached by the cut-and-fit method, shaving off a little here and a little there until approximate balance is obtained.

The sheet metal propeller, on the other hand, has many advantages over that made of wood, such as imperviousness to weather, resistance to breakage, permanency of surface finish, and strength; and except for difficulties in manufacture, should supersede the other. However, the edges of the side plates must be perfectly welded throughout, with no chance of disunion; the tremendous disruptive, compressive and expansive strains must be provided for; and the exact balance attained by additions here and there rather than by subtraction.

My invention has for its object the solving of these various problems, thus obvi-

ating the recognized difficulties and removing the known disadvantages while retaining all the well recognized advantages of sheet metal propellers.

In order that the invention may be readily understood, in the accompanying drawings and in the following details of description I have set forth preferred and modified embodiments thereof, it being readily understood that the invention as set forth is susceptible of further modification without departure from the spirit and essence of the same; wherefore the drawing and description are to be taken in an illustrative and not unnecessarily limiting sense.

In the drawings, Fig. 1 is a front elevation of a finished propeller blade;

Fig. 2 is a similar view after assemblage but before the final finishing touches have been placed thereon;

Fig. 3 is a fragmentary, longitudinal section through the outer end of one of the blades, substantially in the general plane thereof;

Figs. 4, 5, and 6 are transverse sections through one of the blades of the propeller illustrating methods of securing the edges together;

Fig. 7 is a fragmentary plan view of the edge of the propeller blade joined as shown in Fig. 6;

Figs. 8, 9, 10, and 11 are transverse sections through the propeller blade illustrating several forms of interior spacing, stiffening and balancing members;

Fig. 12 is a fragmentary top plan view of the central portion of Fig. 11;

Fig. 13 is a detailed perspective view of the spacing thimbles shown in Figs. 11 and 12, and

Figs. 14 to 20 inclusive, represent in fragmentary, vertical sections a number of forms of hub construction.

Having reference to the drawings, it will be observed that the sheet steel propeller, constructed in accordance with my invention, possesses all the characteristics of the usual wooden propeller in so far as shape superficial appearance is concerned. Instead of being solid, however, being made up of layers of wood or laminations, it is hollow and the meeting edges of the steel blades from which it is formed are so intimately united by welding as to effectually seal the interior against the entrance of moisture,

air or gases and to prevent corrosion or other impairment of the construction.

The propeller is formed of two metal sheets 21 and 22 shaped in known manner by pressing to the contour of standard propeller blades, having a central hub portion 23 from which the blades 24 extend with proper curvature both transversely and longitudinally to obtain the best results from the action of the air.

The plates 21 and 22 having been properly shaped are superposed and the meeting edges of the two sheets require to be welded in order to provide a close union and prevent separation in any degree. It will be observed, having particular reference to Figs. 2 and 3, that, for the purpose of facilitating the process of welding the steel sheets may be provided with projecting lips 25 at intervals of their extent, the lips of the sheet 21 overlying the lips of the sheet 22 when the sheets are superposed, whereupon the superjacent lips are spot-welded together as indicated at 26. This constitutes a means for temporarily holding the sheets in position for welding.

While the sheets are held firmly in position by the welded temporary lips 25 the meeting edges of the sheets are permanently welded in any one of several ways, as for instance by butt-welding as indicated in Fig. 4 at 27; or by a lap-weld, the edge of the sheet 22 overlying the edge of the sheet 21 as indicated at 28 in Fig. 5; or, as indicated in Figs. 6 and 7, the sheets 21 and 22 may be provided with alternately arranged lips 29, each two lips of one sheet being spaced apart a sufficient distance to accommodate the lips of the other sheet, the projecting lips of each sheet being bent around the adjacent lips of the other sheet and secured thereto by welding.

After the permanent welding together of the edges of the sheet forming the two surfaces of the propeller the temporary holding lips 25 are removed by shearing or grinding, leaving a smooth edge such as indicated in Fig. 1 as compared with Fig. 2.

By reason of the tremendous atmospheric strains, both compressive and expansive, due to the action of the air upon the front and rear faces of the blades, it is highly important to support the walls of the propeller interiorly both against collapsing and against spreading or expanding. This can be done by inserting within the blade prior to welding the edges, spacing elements of a channel shape or Z-shape as indicated at 30 in Fig. 9, or an L-shape as indicated at 31 in Fig. 10, or cylindrical shape as indicated at 32 in Fig. 11; the several interiorly disposed spacing elements or struts acting as compression members to prevent collapse and, when welded to the sheets at the points of contact, serving as tension members to prevent outward spreading or bursting.

The other form of spacing element shown in Fig. 11 as a split ferrule may be inserted after the sheet walls of the propeller have been assembled, by providing an aperture in one of the walls as indicated at 33 in Fig. 12, contracting the ferrule and inserting the same through the aperture and then permitting it to expand within the body of the propeller with its ends in contact with the wall about the aperture and then welding the ends of the ferrule to the propeller walls as previously noted.

A difficulty which is liable to cause considerable trouble in the manufacture of sheet metal propellers is connected with the securing of proper balance in the different portions of the blades about the central hub or axis. I solve this problem by utilizing means having the double function of attaining balance and at the same time spacing and stiffening the blade walls. Metal ferrules, such as heretofore described and illustrated at Fig. 13 may be so distributed in the blade as to secure this balance or I employ staybolts or like devices as indicated at 34 in Fig. 8. Such devices, arranged here and there and connected with the walls by threading, riveting or welding, can be utilized to stiffen the construction, conferring additional rigidity while so distributing the weight as to secure perfect balance about the central axis or hub 35 of the propeller.

The hub construction itself presents some difficulties in the securing of the requisite strength and rigidity while maintaining the weight at a minimum. According to my invention, the hub construction embodies the shaft-receiving aperture about the axis 35, the walls about the aperture being reinforced and supported against strains exerted both inwardly and outwardly by a thimble which may have a length over all equal to the space separating the blade walls as indicated at 36 in Fig. 14, the ends of the thimble abutting the inner face of the sheets 21 and 22 about the aperture and suitably united therewith by spot or butt welding; or the aperture being slightly larger as indicated in Fig. 15, the thimble 37 is made sufficiently long to extend into the same at each end forming a lining therefor, and being suitably united to the propeller walls as by butt welding; or a thimble of similar dimensions but provided at its ends with screw threads, as indicated in 38 in Fig. 16, may be threaded into the two sheets 21 and 22, and thereafter permanently fixed by welding, if desired; or the thimble 39, Fig. 17, may have its ends shouldered so as to underlie the walls 21 and 22 marginally of the aperture; or the walls 21 and 22 may be inwardly flanged as indicated at 40 in Fig. 18, to surround the ends of the thimble 41, the portions in contact being united by welding; or, as shown in Fig. 19, the walls 21 and 22

may be outwardly flanged as indicated at 42 and welded to the contacting ends of the thimble 40; or, as shown in Fig. 20 the thimble 43 may have its end walls inwardly or outwardly flanged as indicated at 44 to underlie walls 21 and 22 about the aperture, thus supporting the same against inward strains and when welded along the contacting surfaces support the walls against separation.

From the foregoing it will be apparent that by my improved method of construction, a metal propeller blade has imparted thereto many advantageous features of strength, rigidity, balance and durability not present in the same degree in propellers of wood. Furthermore, propellers of more than two blades may be formed of metal without the weakness at the hub necessarily inherent in wooden construction, the parts being welded together and joined by the inner steel hub in any of the forms in Figs. 14 to 20 inclusive.

I claim:

1. A sheet metal propeller or like hollow metal body composed of cupped sheets arranged in opposed relation, each of the sheets provided with projecting marginal lips overlapping and embracing the edge of the other sheet, and the two sheets marginally welded throughout their extent.

2. A sheet metal propeller or like hollow metal body composed of cupped sheets arranged in opposed relation, each of the sheets provided with marginal lips overlapping and embracing the edge of the other sheet, the lips of the two sheets arranged in alternation substantially in edge contact with each other, and the two sheets marginally welded throughout their extent.

3. A propeller of sheet metal formed of shaped sheets cupped to space the same apart and with their edges in juxtaposition, the two sheets having marginal alternately disposed lips overlapping and embracing the edge of the other sheet and welded thereto.

4. A sheet metal propeller formed of shaped sheets arranged in opposed relation to form a hollow construction, the edges welded and the transverse axis apertured to receive the propeller shaft, a metal thimble disposed within the propeller in register with the aperture to form a hub, the ends of the thimble flanged in bearing contact with the inner marginal portions of the sheets about the aperture and permanently secured thereto by welding.

5. The method of spacing and stiffening sheet metal propellers and similar hollow metal bodies which consists in providing an aperture in one wall thereof, contracting a spring metal ferrule and inserting the same through the aperture and expanding it within the body with its ends in abutting contact with the inner walls thereof about the aperture.

6. The method of spacing and stiffening sheet metal propellers and similar hollow metal bodies which consists in providing an aperture in one wall thereof, contracting a spring metal ferrule and inserting the same through the aperture and expanding it within the body with its ends in abutting contact with the inner walls thereof about the aperture, and then securing the ferrule ends to the walls of the body by welding.

In testimony whereof I have hereunto signed my name.

LE ROY KRAMER.