July 12, 1927. 1,635,840

J. HAW

METAL PROPELLER

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Fig. 1

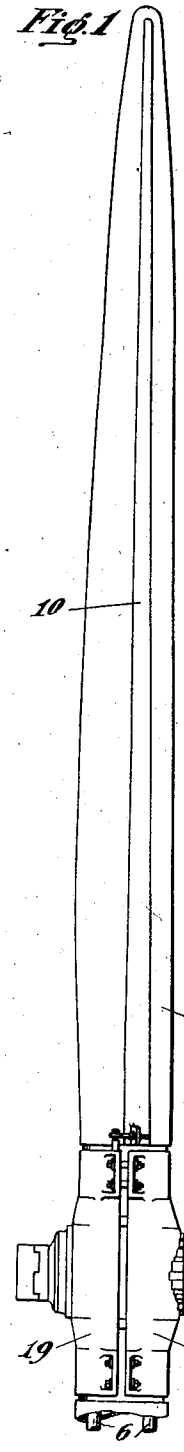


Fig. 2

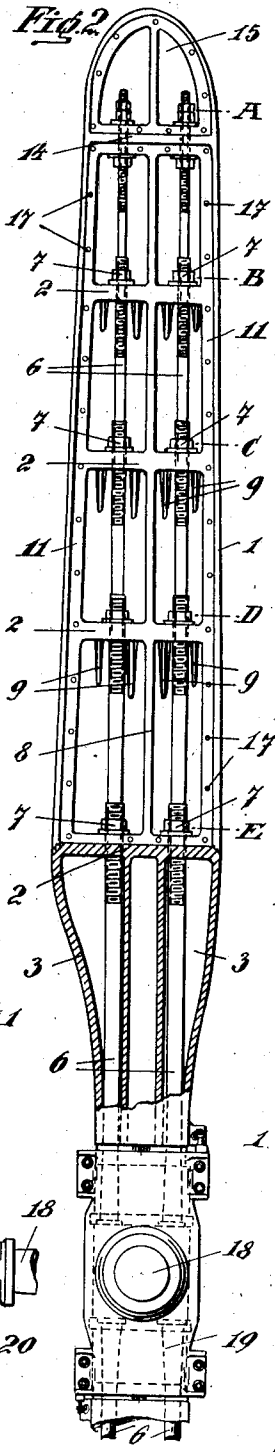


Fig. 3

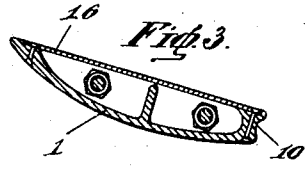


Fig. 4

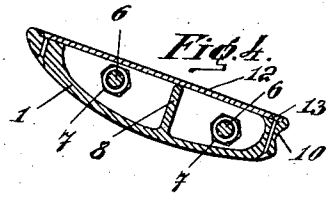


Fig. 5

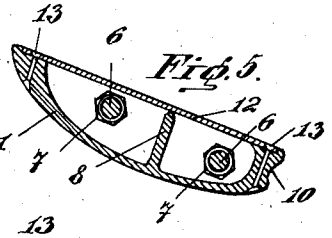


Fig. 6

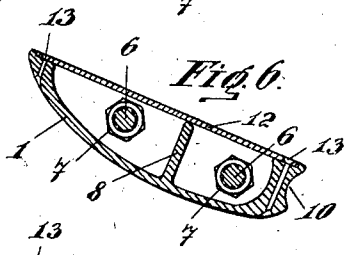
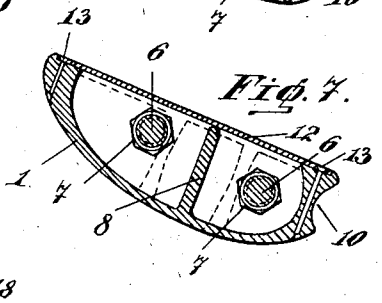


Fig. 7



Inventor:
Jakob Haw
by Wright Babcock & Son
Attorneys

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METAL PROPELLER

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Fig. 8.

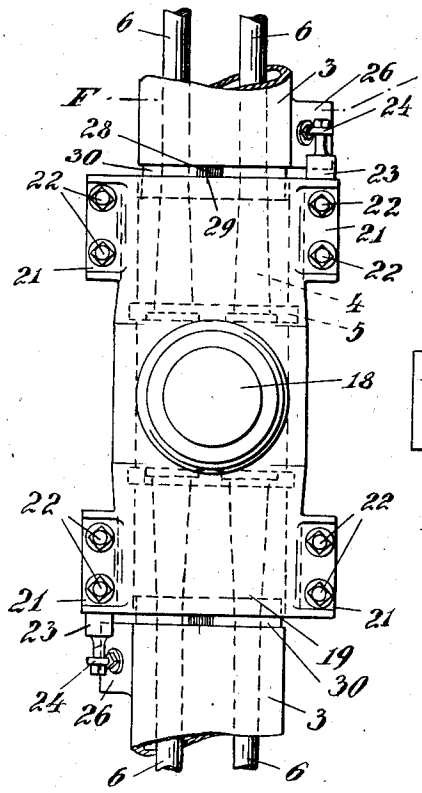


Fig. 9.

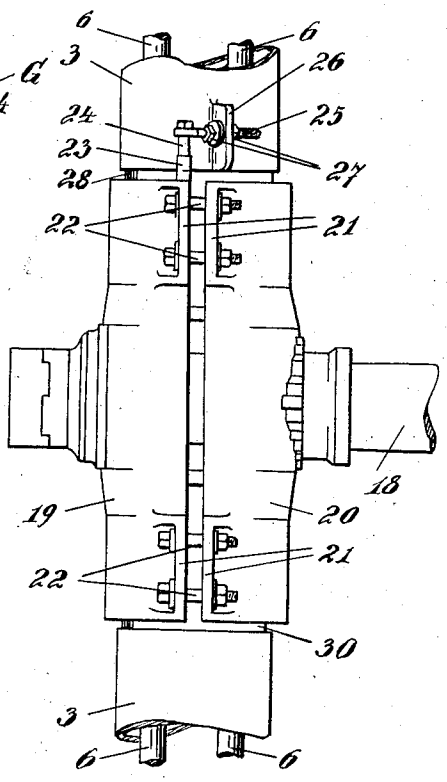
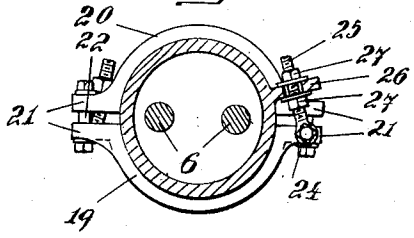


Fig. 10.



Inventor:
Jakob Haw
by Wm. H. Babcock & Son
Attorneys

Patented July 12, 1927. 1,635,840

UNITED STATES PATENT OFFICE.

JAKOB HAW, OF FRIEDENAU, NEAR BERLIN, GERMANY.

METAL PROPELLER.

Application filed January 15, 1925, Serial No. 2,584, and in Germany October 15, 1924.

This invention relates to metal propellers more particularly for use in aircraft.

One object of the invention is to provide a simple and practical construction of the metal blades and a connection of the blades with the propeller hub so that each blade can be turned about its longitudinal axis independently and thereby the blades given a greater or smaller pitch and each blade when adjusted can be fixed in this position.

In the propeller of the present invention each blade is formed of a disk shaped casting of aluminium or aluminium alloy, which is open towards the flat side of the blade and this open side is closed by a plate fixed on the shouldered edges of the casting, the under face of said plate resting on transverse and longitudinal ribs formed in the hollow interior of the casting and cast with the latter.

The inner end of the casting is closed over the entire periphery. Each blade is firmly secured by means of a pair of steel rods to a circularly turned steel foot and fixed together with this foot in the propeller hub. This hub consists of two halves connected together by screws so that after the screws have been slightly slackened, each blade can be turned about its longitudinal axis by means of a setting or adjusting device and when adjusted, secured in its position by tightening up again the screws of the propeller hub.

One example of construction of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is a view in elevation of a propeller hub with one blade.

Fig. 2 a view showing the open interior of the cast portion of the blade fixed to the foot by means of steel rods.

Figs. 3–7 are cross sections of the finished blade on lines indicated by A, B, C, D, E, of Fig. 2.

Fig. 8 is a front view and

Fig. 9 a side view of a propeller hub on an enlarged scale with the blade feet revolubly located therein.

Fig. 10 is a section of a blade on the line F—G of Fig. 8.

The dished part 1 of the casting forming the blade which may consist of aluminium or aluminium alloy, for example, duralumin, is provided with a plurality of cross members 2. The lower end 3 of said blade is entirely closed and rests with a circularly turned part 30 upon a circular foot 4 being mounted in the hub and engaging by means of a flange 5 in a corresponding annular groove in the hub.

Two or more steel rods 6 having tapered shanks are mounted in the foot 4. Said steel rods 6 are passed through all the cross bars 2 and screw nuts 7 are screwed on the steel rods at the cross bars, by means of which on the rotation of the propeller the tension exerted by centrifugal force on the material of the cast piece is transmitted to the steel rods. In order to enable the screw nuts to be firmly screwed against cross bars, the latter are stiffened by a continuous longitudinal rib 8 and also by short ribs 9.

The edge 11 of the dish shaped part 1 of the casting piece is shouldered and carries a cover plate 12 which is connected with the cast piece by screws or rivets 13 and bears externally on the shouldered edge 11 and also on the cross bars 2 and the longitudinal rib 8. Said plate 12 which covers the dished part 1 of the blade is preferably not carried continuously to the point of the blade but only up to the outermost cross bar connected with the steel rods 6. On this last cross bar a flange 14 is formed against which bears the front end of the cover plate 12. The result is that the centrifugal force on the plate set up by the rotation of the propeller is not taken by the screws or rivets 13 with which the plate 12 is secured to the edge 11 of the casting, but the plate bears directly against the flange 14 of the last cross bar so that the centrifugal force acting on the plate 12 is transmitted directly to the steel rods 6 by means of this cross bar. The point 15 of the blade is closed by a separate small cover plate 16.

The two edges of the dished part 1 of the casting are formed sufficiently thick to allow the perforations 17 necessary for the reception of the screws or rivets 13 to extend in thick material.

In order that the leading edge of the blade may not be too heavy, said edge of the blade is cast in the form of a hollow fluting 10 so that firstly a considerable saving of material is effected and secondly the noise of the propeller is reduced. This is effected because when the propeller is running, the air contained in this hollow portion forms a kind of air cushion so that the hard material of the leading edge of the blade no longer encounters the air, but the blade it-

self together with interpolation of the air cushion formed in the hollow fluting.

The hub mounted in the ordinary way on the propeller shaft 18 consists of two parts 19 and 20, four lugs 21 being provided on each half. Screws 22 are passed through the four pairs of lugs lying opposite one another on the two half hubs. By tightly screwing up these screws the round turned foot 4 of the blade is firmly secured in the hollow cylindrical ends of the hub.

If the pitch of the blades has to be altered, the two half portions of the hub 19 and 20 which grip the feet 4 of the blades are released by loosening the screws 22 so that the blades carried by the flange 5 in the hub can now be turned and re-adjusted to any desired pitch.

In order to allow of said adjustment of the blades to be effected with great exactness, an arm 23 is provided on each half hub. Said arm carries a screw pin 25 pivotally mounted thereon by means of an eyelet 24. A rib 26 is cast on the end 3 of the blade which is firmly connected with the foot 4. In this rib there is a slotted eyelet through which the screw pin 25 is passed. Screw nuts 27 are mounted on both sides of the rib 26 on the screw pins 25. When the screws 22 are loosened, the respective blade may be turned in one or other direction about its longitudinal axis as required by screwing back one nut 27 and tightening up the opposite nut 27.

In order to be able to determine exactly the extent of the rotation a scale 28 is provided on the blade foot opposite an indicating mark 29 formed on the end of the hub.

After the pitch has been adjusted the feet of the blades are again firmly gripped between the two halves 19 and 20 of the hub by tightening up the screws 22 and thus secured in their adjusted position.

I declare that what I claim is: —

1. A metal propeller for aircraft comprising a dished casting closed at the inner end over its entire periphery and formed with cross bars, flange means on the edge of said dished casting, cover plates secured to said flanges and said cross bars, a foot firmly connected with said casting, steel rods fixed to said foot and screw nuts mounted on said steel rods transmitting the stress exerted on said casting to said steel rods.

2. A metal propeller for aircraft comprising a dished casting formed with cross bars, flange means on the edge of said dished part an upwardly projecting flange on said outer cross bar, a cover plate extending from the inner end of said dished part to said upward flange and a plate covering the part of the dished casting extending outwardly of said upwardly projecting flange.

3. A metal propeller for aircraft comprising a dished casting closed at its inner end over its entire periphery and having its leading edge formed as a hollow groove, cross bars formed in the hollow interior of said casting supporting shoulders formed on the said dished casting and cover plates for closing said dished casting.

4. A metal propeller for aircraft comprising a hub provided with a longitudinally projecting stud, a blade formed of a dished casting, a foot firmly connected with said casting and rotatably mounted in the hub, a radially projecting arm at the foot of the casting, a threaded pin pivotally mounted on the projecting stud of the hub and engaging with an eyelet provided in the radial arm of the casting, and a pair of nuts screwed onto the threaded portion of the aforesaid pin for locking the blade in adjustment.

In testimony whereof, I have signed my name to this specification at Berlin, Germany, this 22nd day of December, 1924.

JAKOB HAW.