

O. HÄBIG.
SCREW PROPELLER.

APPLICATION FILED JULY 19, 1911.

1,003,401.

Patented Sept. 12, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

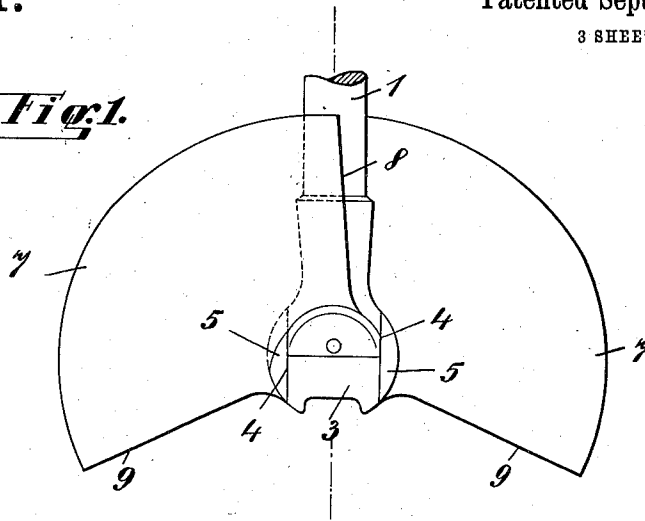


Fig. 2.

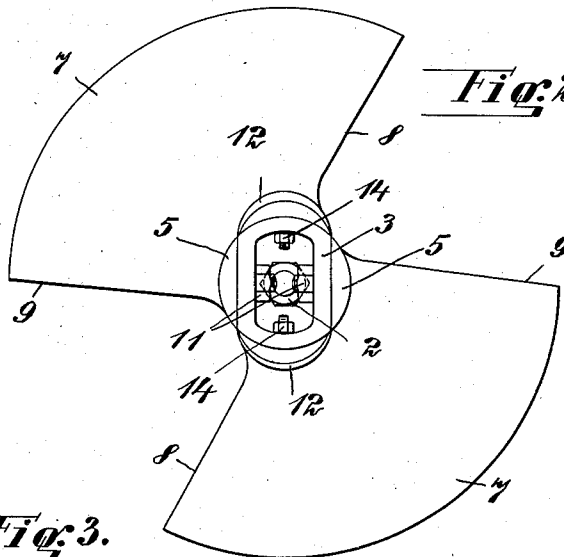
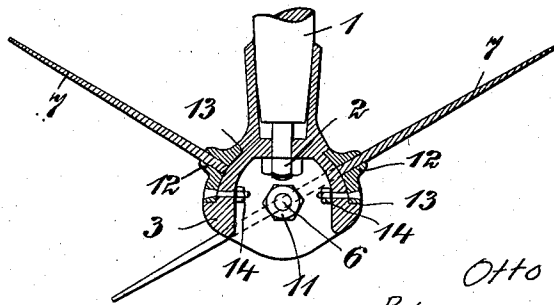


Fig. 3.



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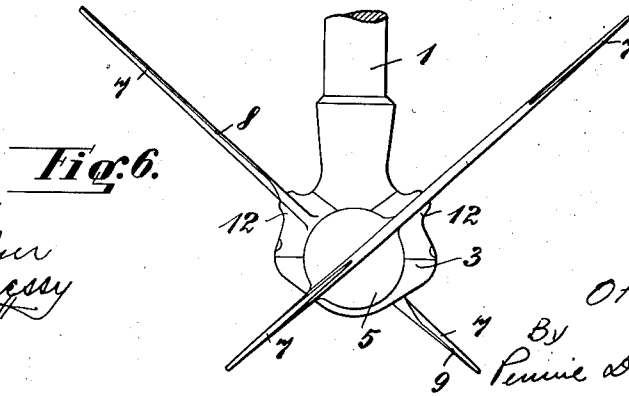
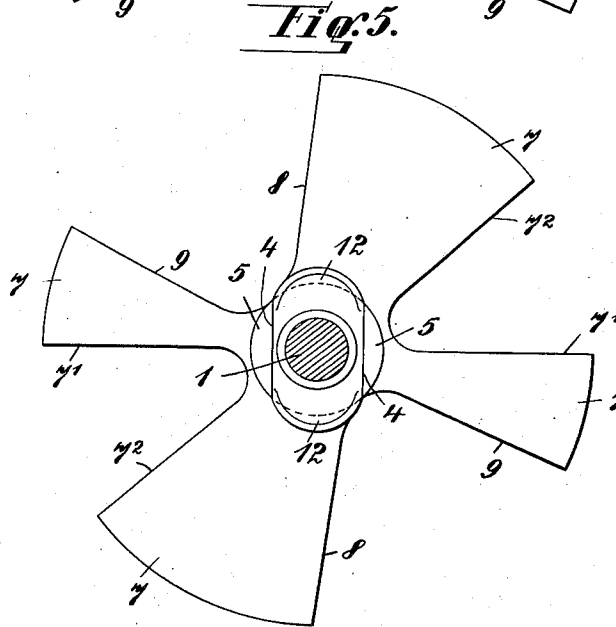
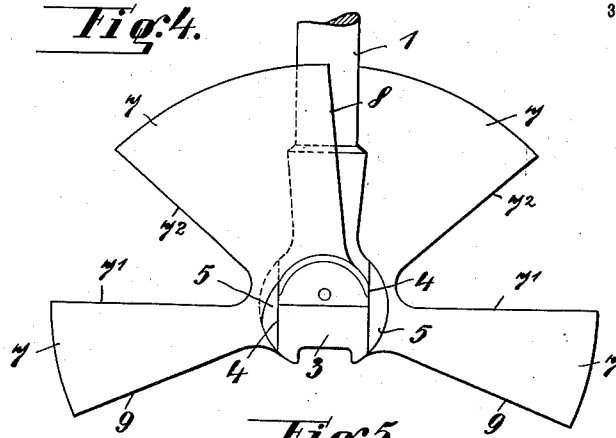
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 7.

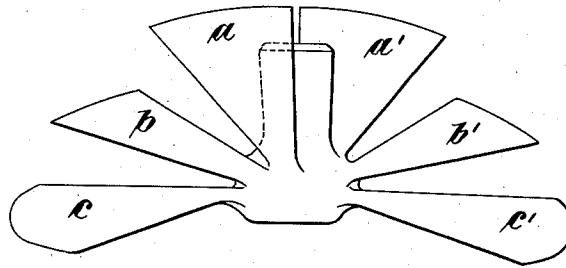


Fig. 8.

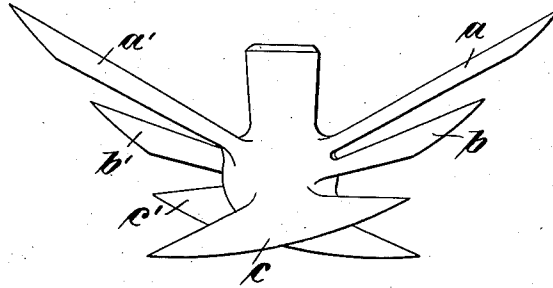
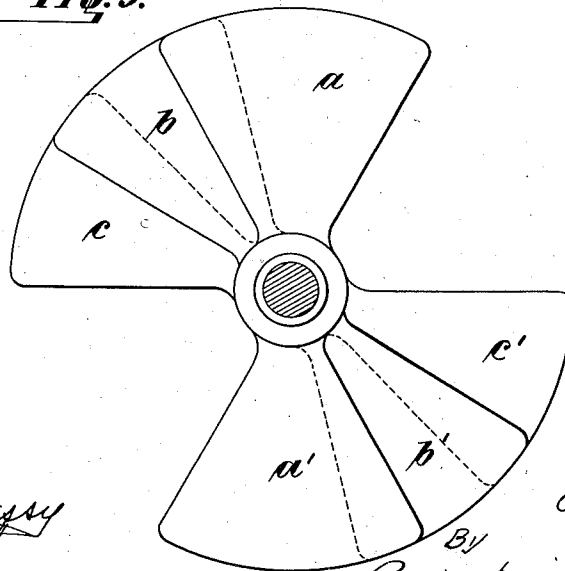


Fig. 9.



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UNITED STATES PATENT OFFICE.

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SCREW-PROPELLER.

1,003,401.

Specification of Letters Patent.

Patented Sept. 12, 1911.

Application filed July 19, 1911. Serial No. 639,312.

To all whom it may concern:

Be it known that I, OTTO HÄBIG, civil engineer, a citizen of the German Empire, and resident of Harburg, Germany, (whose post-office address is 2 Rathausstrasse, Harburg,) have invented certain new and useful Improvements in Screw-Propellers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in screw propellers for marine and aerial navigation and is especially adapted for the propulsion of ships although it may be used in other connections.

The invention has for one of its objects to improve and simplify the construction and operation of propellers so as to be comparatively easy and inexpensive to manufacture, of durable design, and effective in use.

A further object of the invention is the provision of a propeller whose blades have an extraordinarily great area and are so disposed with respect to the boss as to insure the greatest possible force of propulsion.

Another object of the invention is to construct the propeller boss in such a way that the blades can easily and securely be mounted thereon.

To these ends, the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is an elevation of one form of the improved propeller, the same being viewed laterally with reference to the shaft, Fig. 2 is a rear end elevation of the parts shown in Fig. 1, Fig. 3 is a longitudinal section of the propeller, Fig. 4 is a side view of a modified form of propeller, Fig. 5 is a front end elevation of the same with the shaft shown in section, Fig. 6 is a lateral elevation at right angles to Fig. 4, Fig. 7 is a side elevation of a third form of propeller, Fig. 8 is an elevation at right angles to Fig. 7, and Fig. 9 is a front end elevation of the propeller shown in Figs. 7 and 8.

Referring to Figs. 1, 2 and 3 of the drawings, 1 is the propeller shaft, 2 a screw threaded bolt extending longitudinally from the end of the shaft, 3 the boss se-

cured to the shaft by means of bolt 2. The boss is hollow and to the plane sides 4 thereof ball segments 5 are secured by means of screw threaded bolts 6 and nuts 11. Each segment 5 carries a blade 7 consisting of a plane plate with lateral edges 8 and 9 and a circumferential edge. The lateral edges and the circumferential edge define in conjunction an area corresponding approximately to a quarter ellipse. Each blade is set at an acute angle to the longitudinal axis of the boss and to the shaft, said blade extending forwardly from the rear end of the boss in the direction of the propeller shaft, between which and the adjacent face of the blade the aforesaid acute angle is defined, as shown in Fig. 3. The most effective pitch of the blades may be ascertained in every case by experiment, and the blades are so mounted on the boss as to facilitate their adjustment at the most effective pitch. By loosening the nuts 11 the blades may be turned on the boss and by tightening the nuts they may be fixed in any desired position. As appears from Fig. 2, the blades extend with a part of their inner portions beyond the faces 4 so as to partly embrace the boss, and the projecting portion of each blade is supported by blocks 12 movably located in recesses 13 in the face of the boss. After the most useful pitch of the blades has been ascertained, the blocks are fitted within the recesses and fixed in their final position by means of threaded bolts and nuts 14. After the most useful pitch of the blades has been ascertained and the nuts 11 and 14 have been tightened, the cavity of the boss may be filled with cement or molten metal, in order to insure a durable fixation of the blades on the boss. It will be noted from Fig. 1 that the blades are set obliquely with respect to the longitudinal axis of the boss, and this is an important feature of my invention, resulting in a marked increase of the efficiency of the propeller. By stating that the blades are obliquely set I mean to indicate that when the blades are viewed flatwise in a lateral direction, *i. e.*, from the side of the boss, as shown in Fig. 1, their median radii extend at angles of more than 45° to the longitudinal axis of the shaft and boss, while their rear lateral edges (9) define between them an angle of less than 180°, preferably more than 90°. By so arranging the blades, that portion of each which lies behind the blade radius perpen-

dicular to the boss axis (Fig. 1), exerts a powerful thrust, whereby the effective area of the blade is increased. As to the front or cutting edges, it will be observed that when viewed in the manner mentioned above they extend substantially to points over and under respectively the longitudinal boss axis, whereby the effective area is further increased, the effectiveness in cutting through the water being likewise increased by arranging the forward cutting edges at such an angle to the boss axis as to produce a shearing cut. By numerous satisfactory experiments I have been able to establish the fact, that a two-bladed propeller of this construction is more effective, as far as propulsion is concerned, than a four-bladed propeller with curved blades having the same total area. I have further found out by experiment, that, as the pitch of each blade of this propeller is greatest at the edge which cuts the water, *i. e.* at the edge 8 and is equal to zero at that part of the blade, whose radius is perpendicular to the axis of the shaft, this latter part of the blade rotates in a plane perpendicular to the axis of the shaft, so that it does not contribute to the propulsion, while on the rear face of this part of the blade a pressure is exerted, so that a retarding effect will result. I have therefore found it useful in certain cases to cut away that part of each blade which extends from the radius perpendicular to the shaft toward the foremost edge 8 as far as its pitch is smaller than the angle resulting from the speed of the ship during one revolution of the propeller. This modification of the invention is shown in Figs. 4 to 6. The general construction of the propeller is the same as that of the propeller shown in Figs. 1 to 3, and corresponding parts have received the same numerals. Each blade is provided with a cut-away portion having the border lines 7¹ and 7², the line 7¹ is perpendicular to the axis of the shaft 1 and the angular distance of the line 7² from the line 7¹ has the value stated above. The lateral edges of each blade in conjunction with the circumferential edge define, as before, an area corresponding approximately to a quarter ellipse, but of course, in this case the surface of the blade is interrupted to a certain extent, as above indicated. I have further ascertained by experiment, that with ships of small draft, especially trackers, where a propeller having the greatest possible area and the smallest possible diameter is required, it may be useful to construct each blade of my propeller in three parts, the different parts of each blade having a different pitch and lying in different planes. By so constructing my propeller I am able to increase the area of each blade, without altering the general conditions of this invention, by enlarg-

ing the parts of each blade beyond the backward edges. In this way I obtain a propeller with three pairs of blades, each pair having a different pitch and the blades of each pair overlapping the blades of the pair adjacent thereto. Figs. 7 to 9 show this modification of the propeller. Instead of two broad blades, as in the modifications described before, six narrow blades or sections *a*, *b*, *c* and *a'*, *b'*, *c'* are provided, three on each side of the boss. The blades *a* and *a'* overlap the blades *b* and *b'* respectively; and the blades *b*, *b'* overlap the blades *c*, *c'*. Each pair of blades has a different pitch, but the blades on each side of the boss cooperate exactly in the same way as the simple blades shown in Figs. 1 to 3, but with greater force, as their total area is increased. The construction of the boss and the way of mounting the blades thereon may be the same as has been described with reference to Figs. 1 to 3, or the blades may be made integral with the boss, as has been shown in the figures last described.

I claim:

1. A propeller comprising a boss, and blades of plane flat shape disposed oppositely with respect to the boss and inclined forwardly at an acute angle to the longitudinal axis of the latter, the front and rear edges of said blades diverging from the bases thereof to the outer circumferential edges and defining in conjunction with such edges areas approximating quarter ellipses the median radii of which extend at angles of more than 45° to the longitudinal axis of the boss when the blades are viewed flatwise in a lateral direction, the forward blade edges when so viewed extending substantially to points over and under respectively the boss axis and being arranged at such an angle as to produce a shearing cut, and the rear edges defining between them an angle of considerably less than 180°, substantially as described.

2. A propeller comprising a boss, and blades of plane flat shape disposed oppositely with respect to the boss and inclined forwardly at an acute angle to the longitudinal axis of the latter, the front and rear edges of said blades diverging from the bases thereof to the outer circumferential edges and defining in conjunction with such edges areas approximately quarter ellipses the median radii of which extend at angles of more than 45° to the longitudinal axis of the boss when the blades are viewed flatwise in a lateral direction, whereby the rear edges of the blades define between them an angle of less than 180°, there being an intermediate cut away portion in each blade having one side edge perpendicular to the boss axis and the other side edge farther toward the forward or cutting edge of the blade, substantially as described.

3. In a propeller, the combination of a boss, a blade having a base conforming to a surface on the boss, on which surface the base is capable of adjustment, said blade
5 extending at its inner margin laterally beyond the base thereof, means to secure said base on said surface, and means to clamp said margin on the boss, substantially as described.

0 4. In a propeller, the combination of a boss, a blade having a base conforming to a surface on the boss, the base being capable of adjustment on said surface, and said

blade extending at its inner margin laterally beyond the base thereof and into a recess in the boss, means to secure said base on said surface, and means to clamp said margin of the blade within said recess, substantially as described. 15

In testimony whereof I affix my signature, in presence of two witnesses. 20

OTTO HÄBIG.

Witnesses:

ERNST H. L. MUMMENHOFF,
EDWARD P. R. HOPF.