(No Model.)

5 Sheets—Sheet 1.

# N. YAGN.

## SCREW PROPELLER.

No. 333,805. Patented Jan. 5, 1886.

FIG. 1.

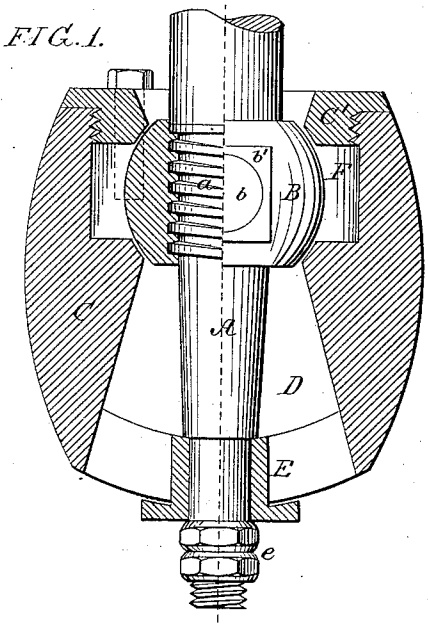



FIG. 2.

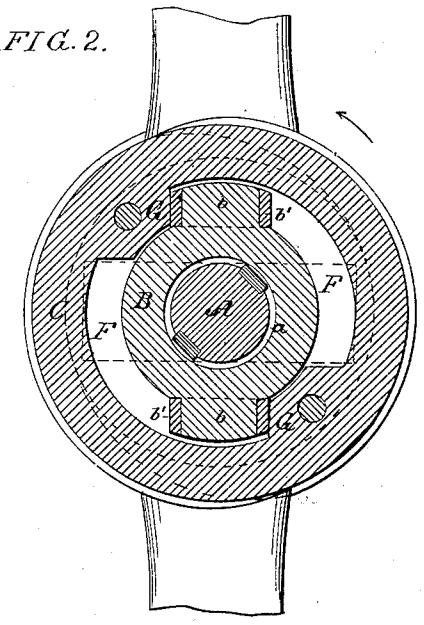



FIG. 3.

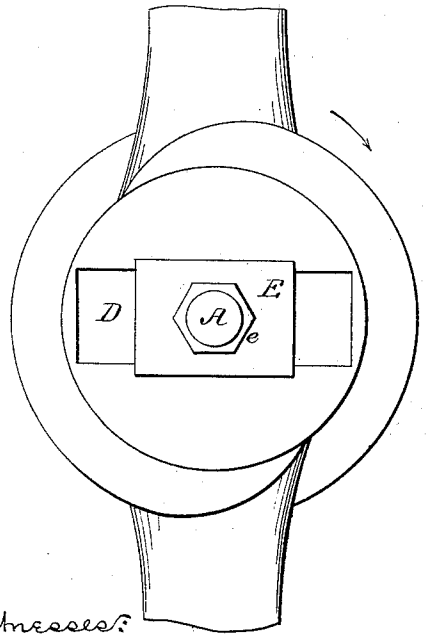
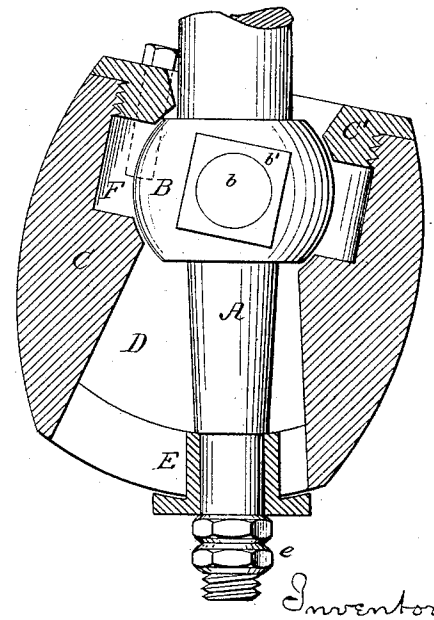



FIG. 4




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Inventor:

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by his Attorneys

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## SCREW PROPELLER.

No. 333,805. Patented Jan. 5, 1886.

FIG. 5.

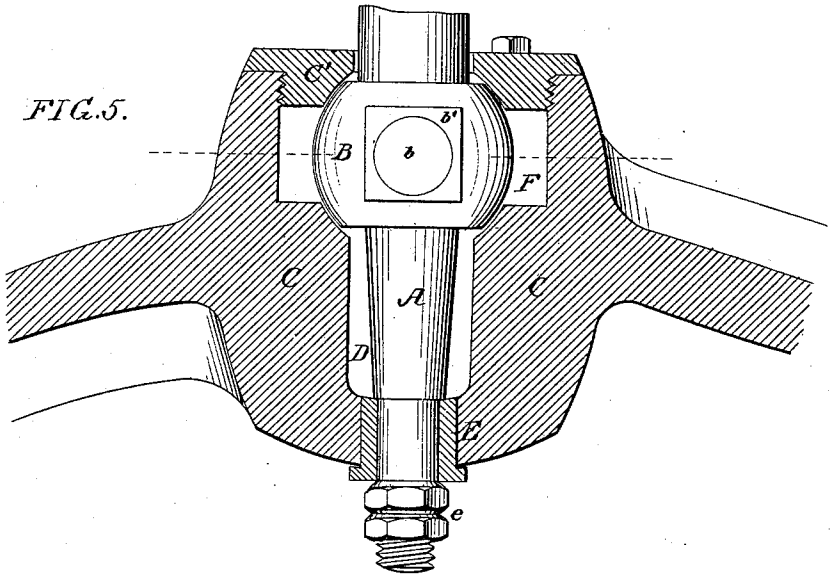



FIG. 6.

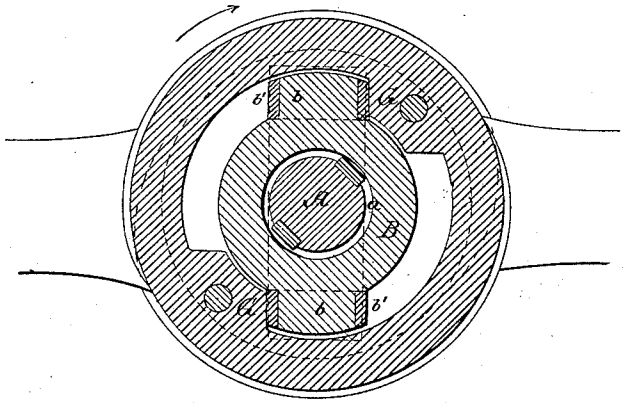
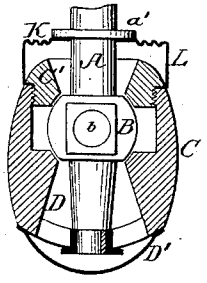



FIG. 16.




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(No Model.) 5 Sheets—Sheet 3.

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## SCREW PROPELLER.

No. 333,805. Patented Jan. 5, 1886.

FIG. 7.

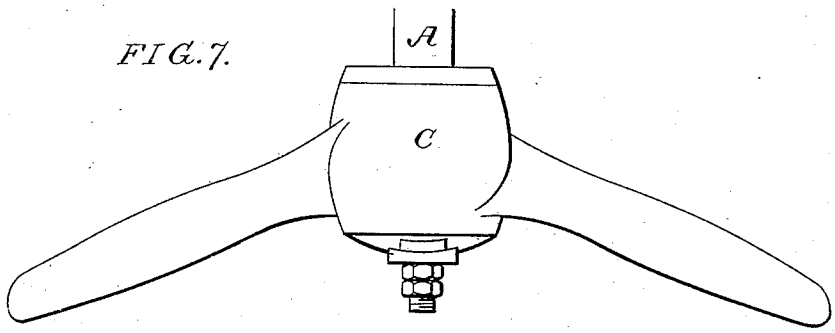



FIG. 8.

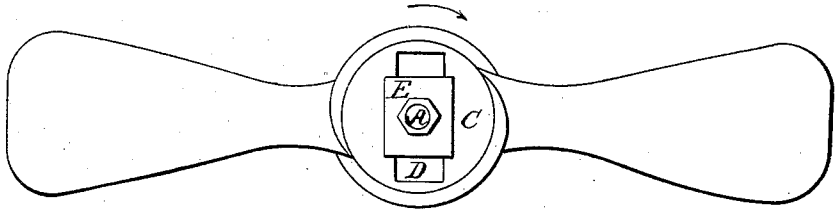



FIG. 9

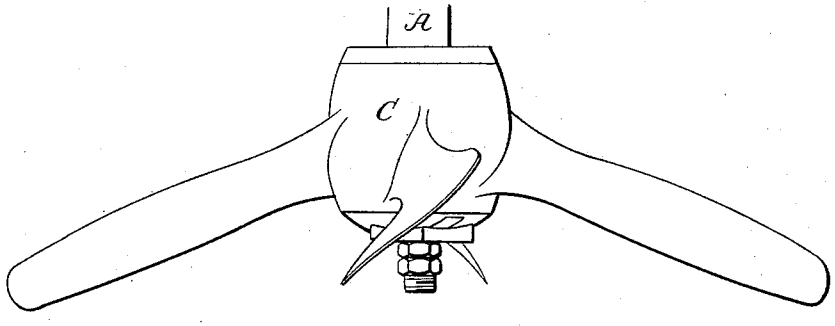
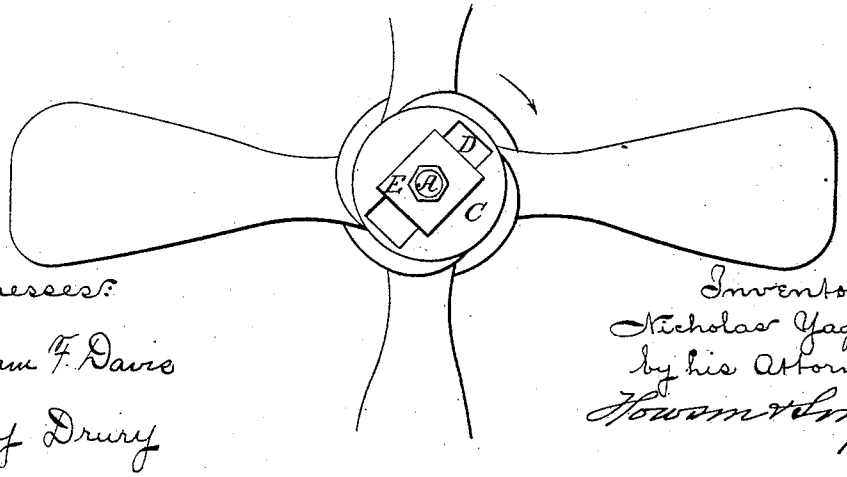



FIG. 10.




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(No Model.) 5 Sheets—Sheet 4.

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## SCREW PROPELLER.

No. 333,805. Patented Jan. 5, 1886.

FIG. 11.

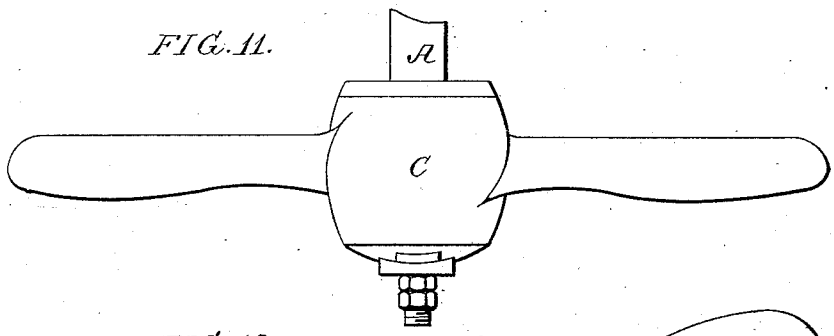



FIG. 12.

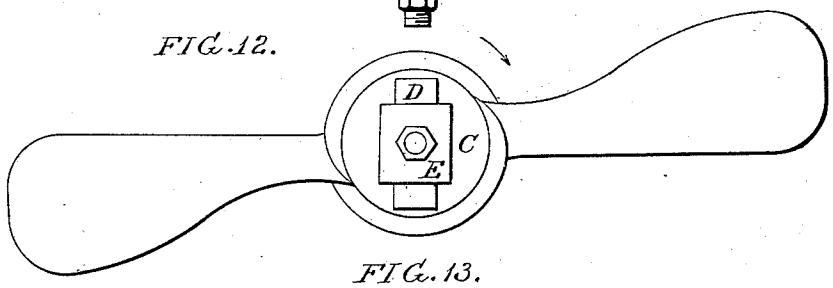



FIG. 13.

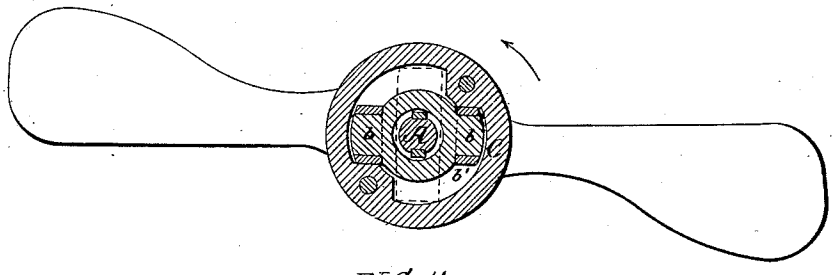



FIG. 14.

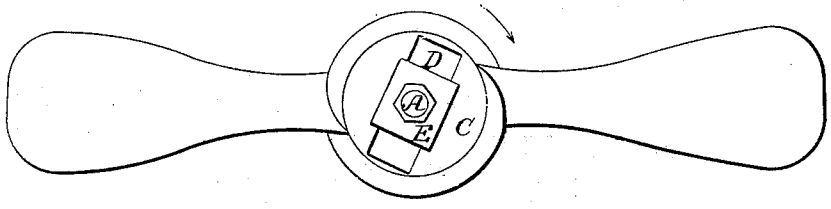
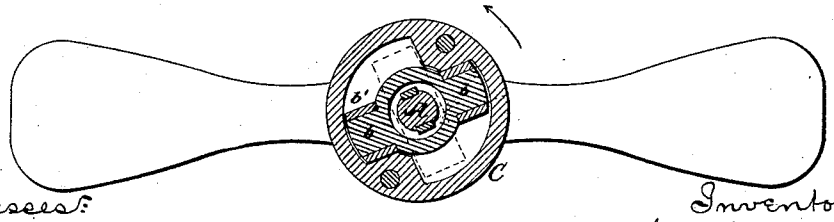



FIG. 15.




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(No Model.)

5 Sheets—Sheet 5.

# N. YAGN.

## SCREW PROPELLER.

No. 333,805. Patented Jan. 5, 1886.

FIG. 9'

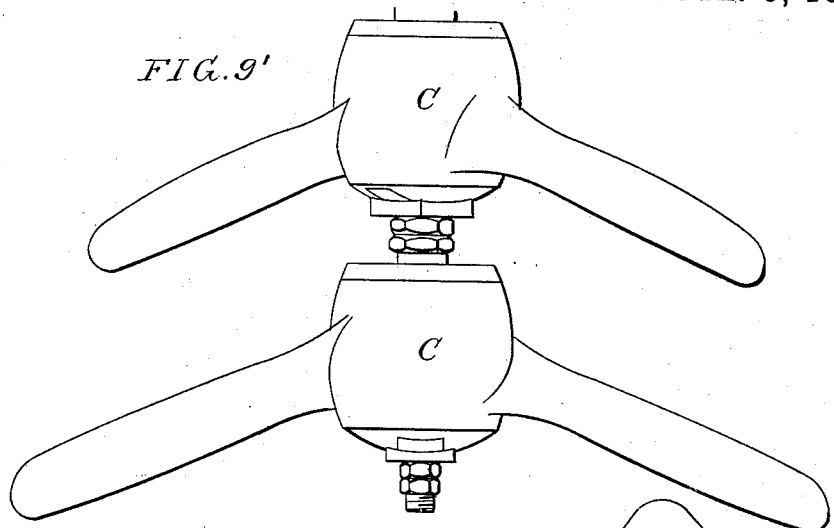
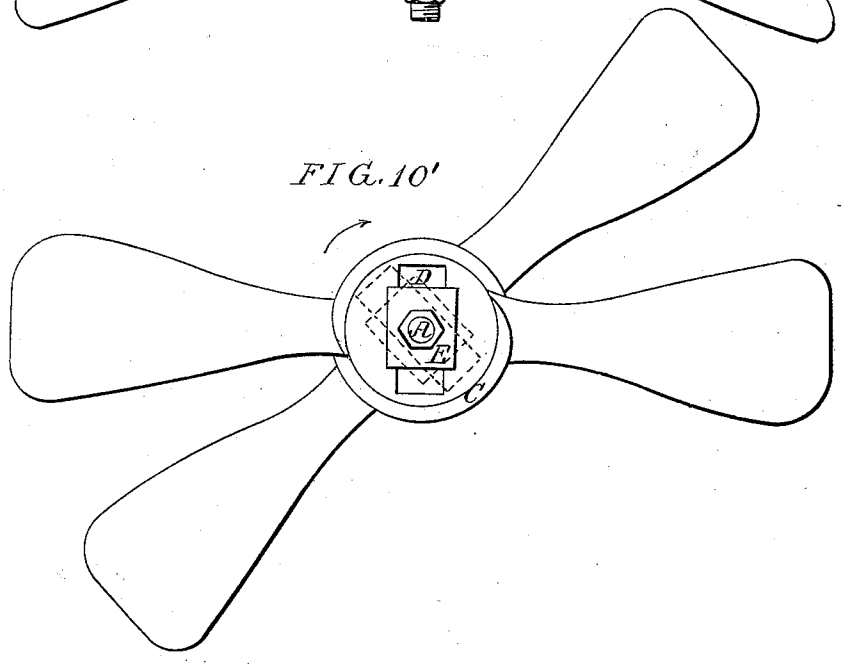



FIG. 10'




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Henry Bossert.

Inventor:
Nicholas Yagn
by his Attys:
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N. PETERS. Photo-Lithographer, Washington, D. C.

# UNITED STATES PATENT OFFICE.

NICHOLAS YAGN, OF ST. PETERSBURG, RUSSIA.

## SCREW-PROPELLER.

SPECIFICATION forming part of Letters Patent No. 333,805, dated January 5, 1886.

Application filed May 15, 1885. Serial No. 165,587. (No model.) Patented in Belgium April 30, 1885, No. 68,542; in Italy August 27, 1885, No. 18,601; in France September 16, 1885, No. 168,286, and in Germany October 10, 1885, No. 33,297.

*To all whom it may concern:*

Be it known that I, NICHOLAS YAGN, a subject of the Czar of Russia, and residing in St. Petersburg, Russia, have invented certain Improvements in Screw-Propellers, of which the following is a specification.

The object of my invention is to so construct a screw-propeller that the angle of inclination of the blades thereof can change automatically in accordance with the alterations in the relative velocity and direction of the motion of the water in which the propeller is working, so that the propeller may operate to the best advantage. This object I attain as hereinafter fully described.

In the accompanying drawings, Figure 1 is a longitudinal section, and Fig. 2 a transverse section, of the propeller hub and shaft. Fig. 3 is a corresponding end view. Fig. 4 is a longitudinal section of the hub in a position of greatest inclination to the axis. Fig. 5 is a longitudinal section, and Fig. 6 a transverse section, showing the hub in a locked position. Fig. 7 is a plan view of a propeller to which my improvements are applied. Fig. 8 is an end view of the same. Fig. 9 is a plan, and Fig. 10 an end view, of a modified form of propeller. Fig. $9^{bis}$ and Fig. $10^{bis}$ are corresponding views of another modification. Figs. 11 and 12 are similar views of a further modification, and Fig. 13 is a sectional view of the same. Fig. 14 is a view of a modification. Fig. 15 is a sectional view of the same, and Fig. 16 is a view of a further improvement.

A is the propeller-shaft, and C the hub, carrying the usual blades, which for small-size propellers may be formed in one with the hub, while for large sizes it is preferable to have the blades separate and affix them in any suitable manner to the hub. On the propeller-shaft is rigidly secured a spherical enlargement or boss, B, which is adapted to a corresponding seat in the hub C, and is held in place by a screw-cap, C′, bolted to the hub. The spherical enlargement B may be formed in one piece with the shaft A, or may be fixed to the latter by being screwed thereon at *a*, as illustrated in Fig. 1. The opening in the retaining-cap C′, for the passage of the shaft A, is somewhat larger than the diameter of the shaft, in order to permit a movement of the hub to a limited extent upon the spherical enlargement of the shaft, as illustrated in Fig. 4, for a purpose described hereinafter.

To the outer end of the shaft A is secured a bearing block, E, held in place by the nuts *e* on the end of the shaft, and this bearing-block is adapted to an open rectangular slot, D, Fig. 3, which may have its side walls tapering, as illustrated in Fig. 1. The bearing-block E is free to slide with some friction on its seat in the slot D when the hub C oscillates on the shaft, as hereinafter described, the bearing-block forming a guide for the shaft.

On the spherical enlargement B on the shaft are two radial pins, *b*, on which are mounted rectangular bearing-blocks *b′*, the latter being free to turn on the pivot-pins *b*, but with some friction. The blocks *b′* are adapted to recesses or grooves F F in the hub, these recesses terminating in diametrically-opposite abutments G, as illustrated in Fig. 2. These abutments bear such relation to the slot D that when the propeller-shaft is turned to drive the propeller forward the blocks *b′* of the pins *b* will bear against those faces of the abutments G which will leave the pivot-pin *b* in a line at right angles to the slot D, as illustrated in Fig. 2, so that in that position the propeller hub and blades are free to turn to a limited extent on these pivot-pins, Fig. 4.

With the construction of propeller described above, the blades on meeting in their motion an increased resistance from the water will turn or deviate in the direction in which the angle of their meeting with the water decreases, so that the thrust-power of the two opposite blades will in this way be automatically equalized. When the propeller is driven backward, however, this freedom of movement of the blade on the shaft would be detrimental. It is therefore important that the propeller should then be practically fixed to the shaft, and this is why the slots or grooves F are provided with the abutments G. When the shaft is driven to turn the propeller backward, the bearing-blocks *b′* of the pivot-pins *b* will be carried round to bear against the opposite sides of the abutments from those described above, as shown in Fig. 6, so that a

line drawn through the centers of the pivot-pins will be parallel with the length of the slot D, and the propeller can no longer oscillate on the shaft.

In order to obtain the self-adjustment of the blades of the propeller when driven forward, these blades should extend backward of a plane drawn through the pivots *b*, as shown in Figs. 7 to 10, or else the blades must be arranged at one side of the axis of oscillating movement, as illustrated in Figs. 11 to 15, instead of parallel to such axis, as illustrated in Figs. 2, 3, and 8.

In Figs. 9 and 10 is shown the construction of a four-bladed propeller embodying my invention. In this construction it is advisable to arrange the slot D at an angle of forty-five degrees to the direction of one of the opposite pairs of blades.

In Figs. $9^{bis}$ and $10^{bis}$ is shown a combination of two propellers mounted on one propelling-shaft. Each of these propellers, when the vessel is moving ahead, may have the oscillating movement described above.

In order to protect the interior parts of the propeller from dirt, sea-plants, or sea-animals penetrating through the slot D or the aperture in the cover C′, the outer end of the slot D may be closed by a metallic lid, D′, secured to the hub, as shown in Fig. 16, and the aperture in the cover C′ may be protected by means of a flexible corrugated metallic disk, K, secured to a collar, *a*′, on the shaft A, and having an annular flange, L, bearing lightly on the exterior surface of the hub C.

I claim as my invention—

1. The combination of the propeller-shaft having pivot-pins *b* with the propeller-hub mounted on said shaft to receive said pivot-pins, the hub having a slot for the reception of the outer end of the shaft, substantially as set forth.

2. The combination of the propeller-shaft having a spherical enlargement, B, and pivot-pins *b*, with a hub and an inclosing-cap, C′, to fit said spherical enlargement and to receive the pivot-pins, all substantially as set forth.

3. The combination of the propeller-shaft having pivot-pins *b* and a bearing-block, E, at its outer end, with a hub to receive the pivot-pins and having a slot, D, in which said block finds its seat, as specified.

4. The combination of the propeller-shaft with a hub free to oscillate on said shaft, and also to turn thereon to a limited extent, substantially as described.

5. The combination of the propeller-shaft having pivot-pins with a hub free to oscillate on the shaft and having grooves to receive the said pins, substantially as specified.

6. The combination of the propeller-shaft having a boss carrying pivot-pins, and bearing-blocks on the pins, with a hub mounted on the shaft and having interior grooves, to which said blocks are adapted, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

NICHOLAS YAGN.

Witnesses:

FREDERICK KAUPE,

NICHOLAS TSCHEKALOFF.