

No. 620,411.

Patented Feb. 28, 1899.

N. H. BORGFELDT.
SCREW PROPELLER.

(Application filed Jan. 25, 1898.)

(Model.)

Fig. 1.

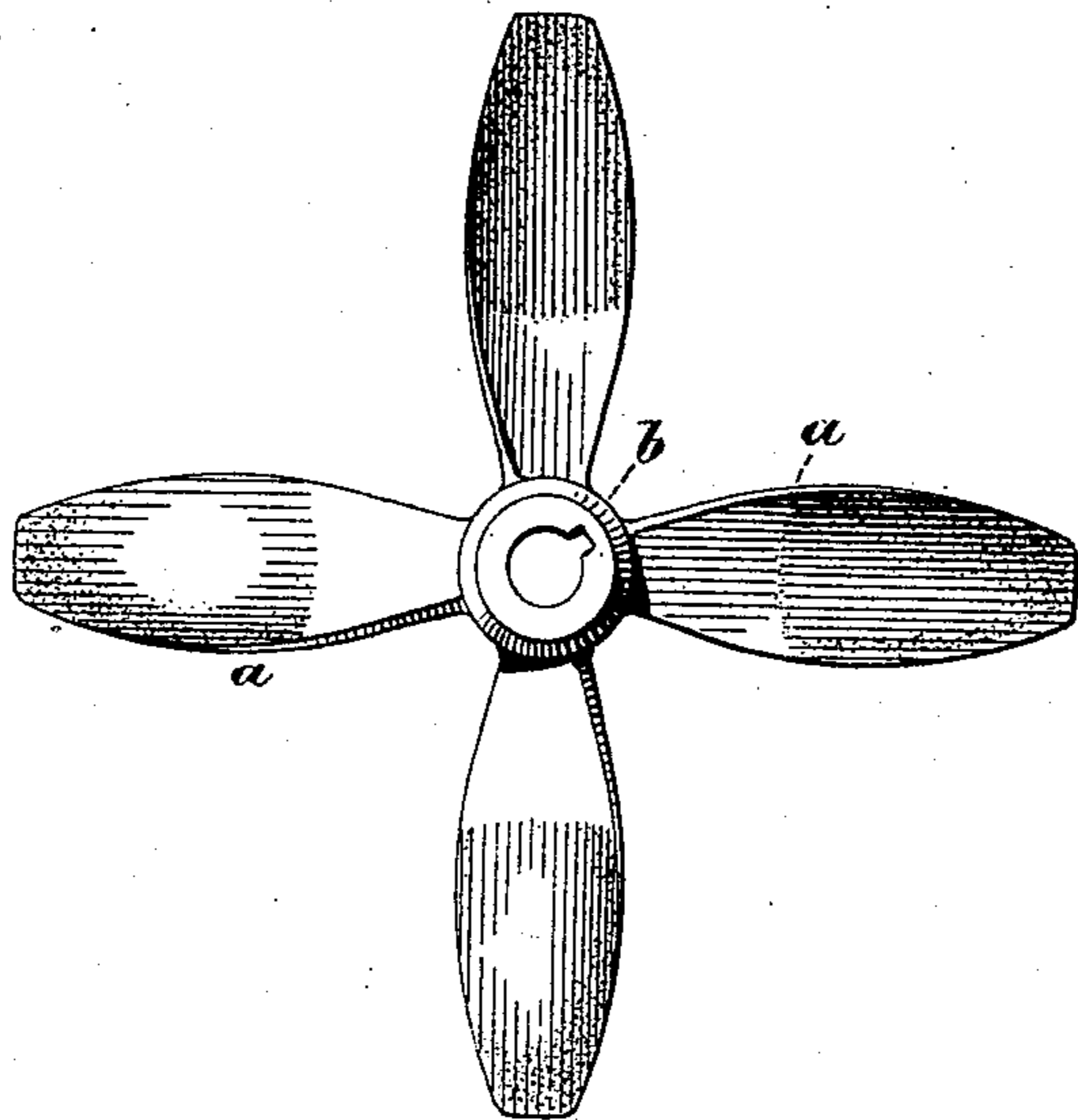


Fig. 8.

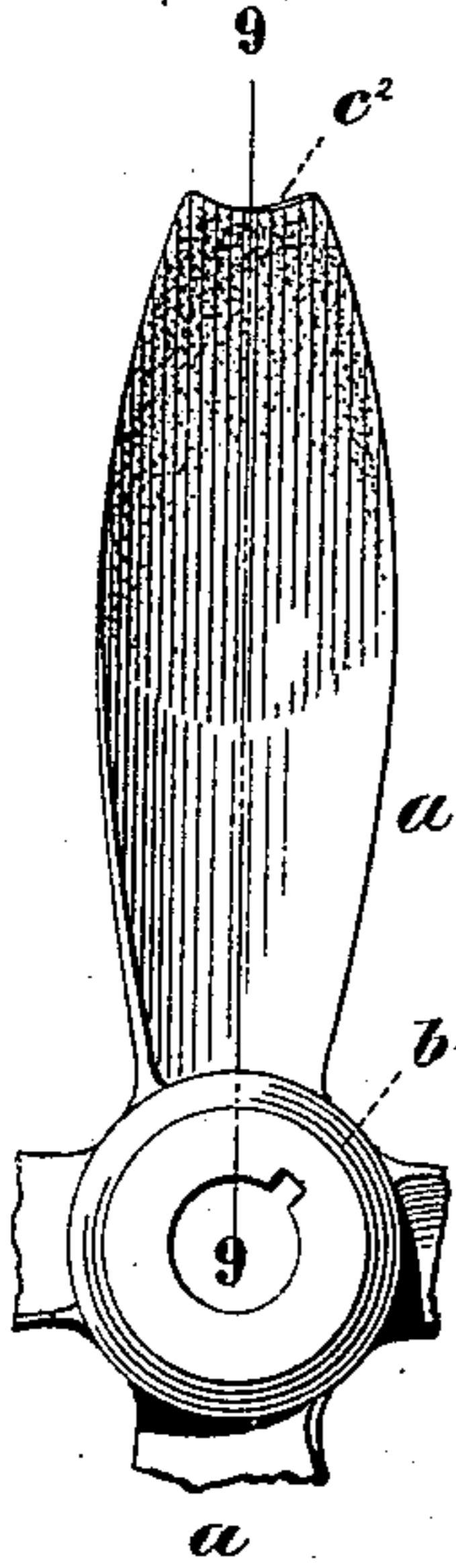


Fig. 4.

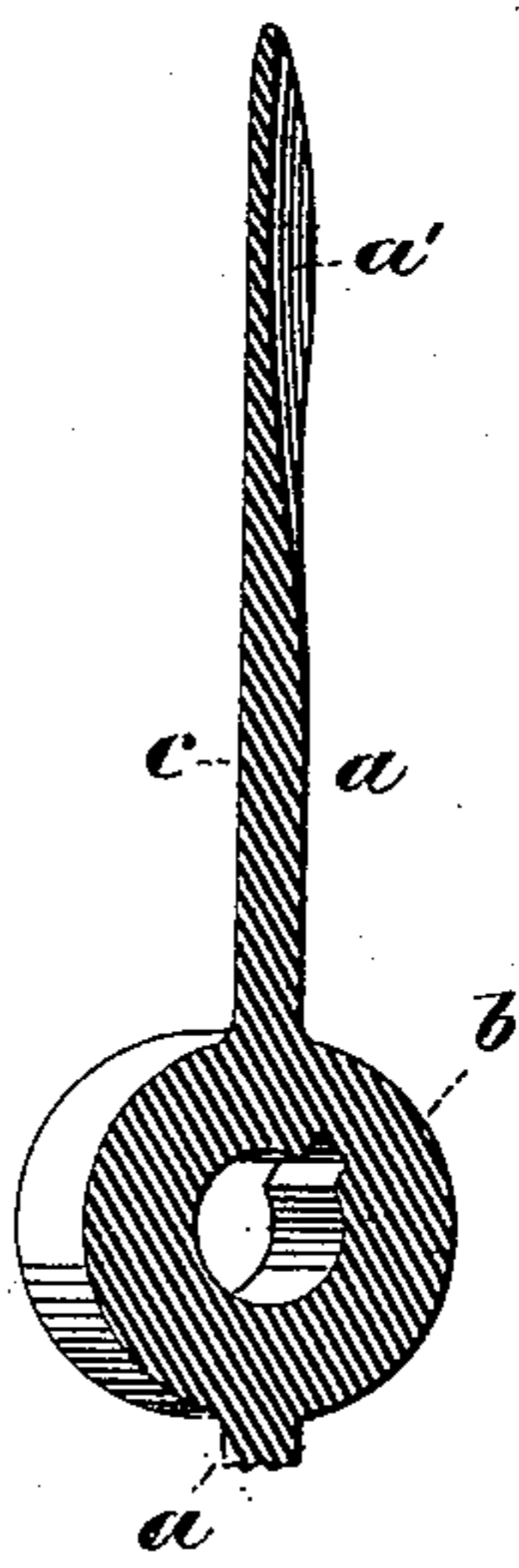


Fig. 2.

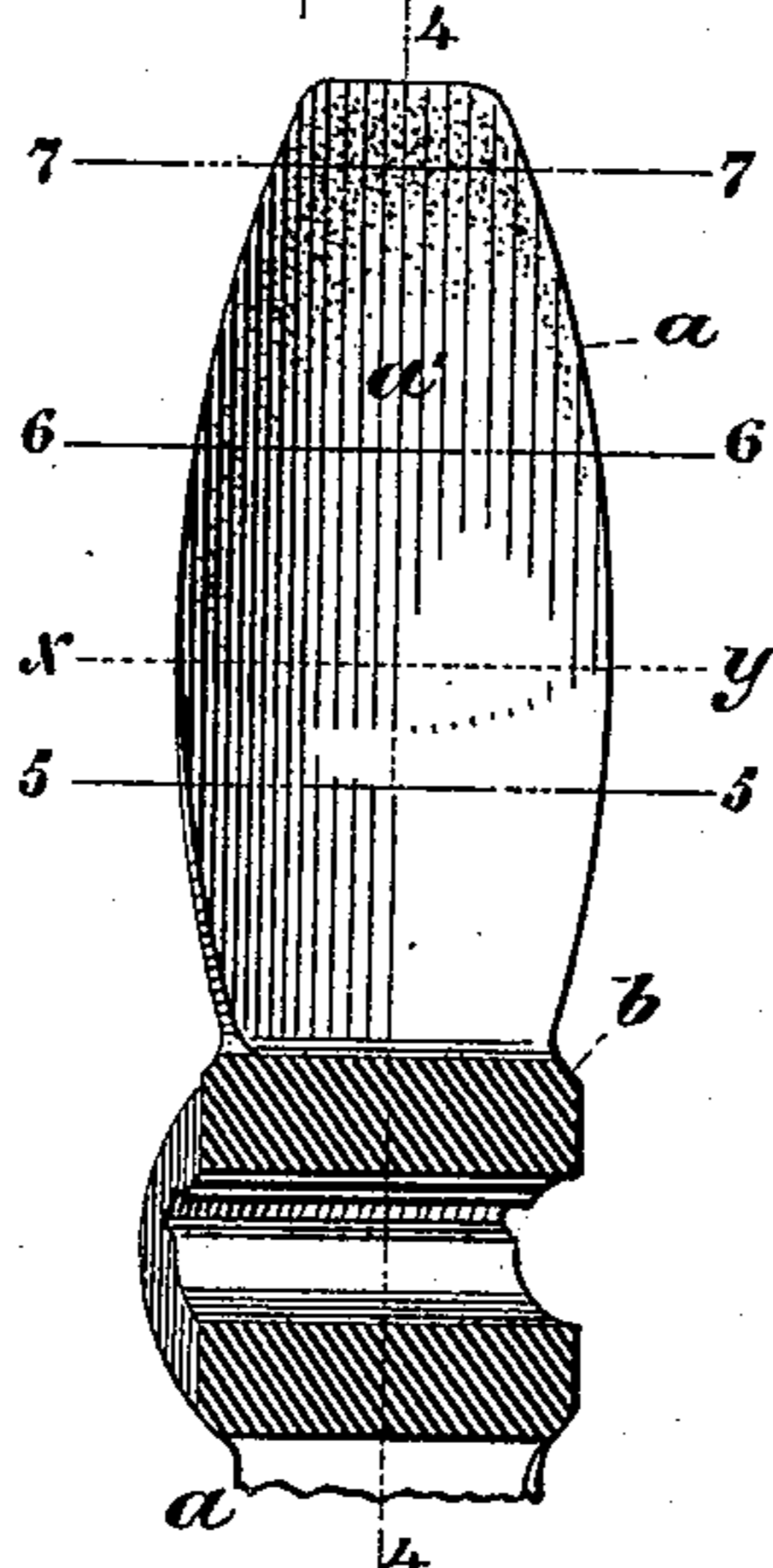


Fig. 3.

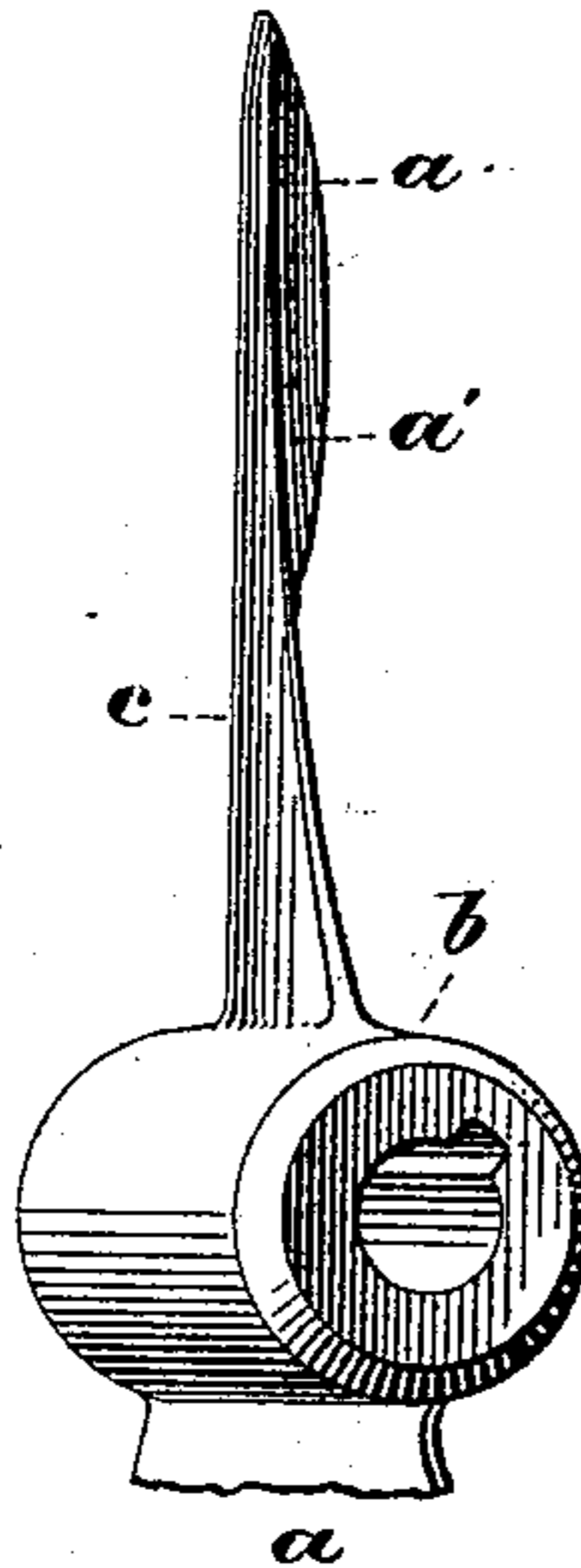


Fig. 9.

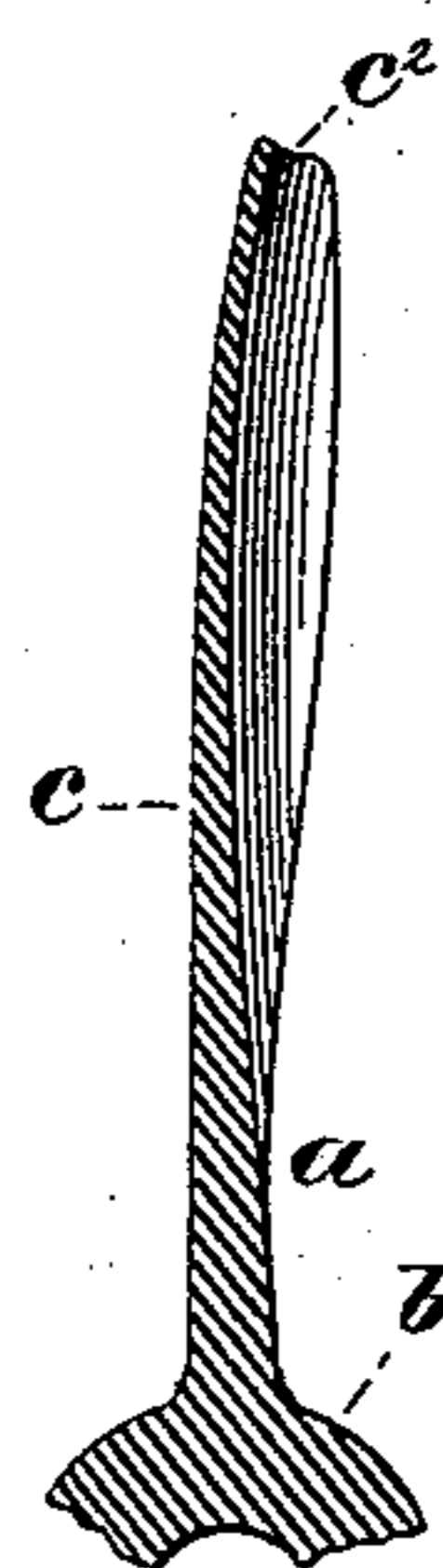


Fig. 5.



Fig. 6.



Fig. 7.



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SCREW-PROPELLER.

SPECIFICATION forming part of Letters Patent No. 620,411, dated February 28, 1899.

Application filed January 25, 1898. Serial No. 667,844. (Model.)

To all whom it may concern:

Be it known that I, NICHOLAS H. BORGFELDT, a citizen of the United States, residing in the city of New York, State of New York, have invented certain new and useful Improvements in Screw-Propellers, of which the following is a specification.

My invention relates to screw-propellers, and has for its object to produce a highly-efficient screw-propeller.

My invention will be understood by referring to the accompanying drawings, in which—

Figure 1 is a side view of a propeller embodying my invention. Fig. 2 is a detail face view of a blade thereof, the hub of the propeller being shown in section and the remaining blades being broken away. Fig. 3 is a detail perspective view of the blade shown in Fig. 2. Fig. 4 is a section on line 4 4 of Fig. 2. Figs. 5, 6, and 7 are sections on lines 5 5, 6 6, and 7 7, respectively, of Fig. 2 and show the preferred shape of the concavity in the blade, as will be fully set forth hereinafter. Fig. 8 is a face view of a modified form of propeller-blade embodying my invention. Fig. 9 is a section on line 9 9 thereof.

Propeller-blades heretofore in use have usually been provided with substantially straight working faces on the go-ahead side and also with substantially straight outer edges. These propellers have a certain efficiency and, as is well known, operate against the water which comes within their sphere of action and propel the ship. By my invention, however, instead of employing flat substantially straight blades I employ blades *a*, which are provided with concavities therein on their working faces deeper at the outer edge or extremity of the blade in proportion to its width than at points near the inner end of the blade or its axis of rotation. Any desired efficient number of these propeller-blades may be mounted upon a hub *b* or other carrier, four being shown in Fig. 1 for the purposes of convenience.

By referring to Figs. 1, 2, 3, and 4 it will be observed that the propeller-blade *a* instead of presenting a substantially uniformly flat surface to the water, as heretofore, has been provided upon its go-ahead side or working face with a concavity *a'*.

By referring to Fig. 7 it will be observed

that the concavity *a'* is of greater depth in proportion to the width of the blade along the line 7 7 than it is along the line 6 6, a section of which is represented in Fig. 6, and the hollow ceases before the line 5 5 is reached, (see Fig. 5,) the terminus of the concavity occurring practically along the line *x y*, where the curved portion merges into the straight face 1 2 of the propeller-blade. (See Fig. 5.)

I prefer to make the backing side *c* of the propeller-blades slightly curved along their radial lines, as shown in Fig. 9; but they may be straight, if desired. The form, pitch, and construction of the blades may be varied—as, for instance, by being made curved, as shown at *c'* in Figs. 8 and 9.

I have found in practice that propellers constructed according to my invention are from five to ten per cent. more efficient than flat-bladed propellers of the same size, configuration, and pitch, having determined the same to my satisfaction by a long series of experiments. I have not as yet evolved a theory to account for this increased efficiency which is satisfactory to myself. At present I am of the opinion, and the same is fortified by the observation of many experiments, that the hollowed character of the go-ahead or working face of the propeller-blades enables the water to be thrown off from the said working face or go-ahead side of the propeller-blade with greater velocity and at a sharper angle to the axis of rotation of the blades than heretofore, which produces a greater component of forward motion than throwing the water off at less velocity and a wider angle to the axis of rotation of the propeller-blades. I will not, however, vouch for the correctness of this theory. Another possible explanation is this: An ordinary propeller passing through the water has, it is said, the effect of spinning the water which comes within its sphere of action into a horizontal spiral vortex, the said vortical current being projected aft in the shape of a rope and the component currents of the said "rope" being made by individual blades and follow the paths of the strands of the rope. Now it is quite possible that by the operation of my new propeller each of these strands of the current rope is given a harder twist than heretofore, or some such effect is produced. These, however, are mere

theoretical considerations and do not in the least detract from the fact that I have taken propellers and by hollowing their working or go-ahead faces, as described, have obtained
5 increased efficiencies varying from five to ten per cent. These increased efficiencies have manifested themselves in an increase in energy; but it is quite possible to so arrange and proportion the hollows and the blades as
10 to obtain an increase in speed.

I do not intend to be understood as claiming herein, broadly, propellers having a recessed working face.

What I claim, and desire to secure by Letters Patent, is—
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1. A screw-propeller having one or more blades concave at their outer ends on their working faces, the said concavities extending inward for a portion only of the length of the

blade and being deeper in proportion to the width of the blade at or near the extremity of the said blades than at points nearer the axis of rotation of the blade. 20

2. A screw-propeller provided with blades having concave outer ends on their working faces, the said concavities extending inward for a portion only of the length of the blade and being deeper in proportion to the width of the blade at or near the extremity of said blades than at points nearer the axis of rotation of the blade, the said concavity broadening and shallowing toward the axis of rotation of the blade substantially as described. 25 30

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Witnesses:

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