

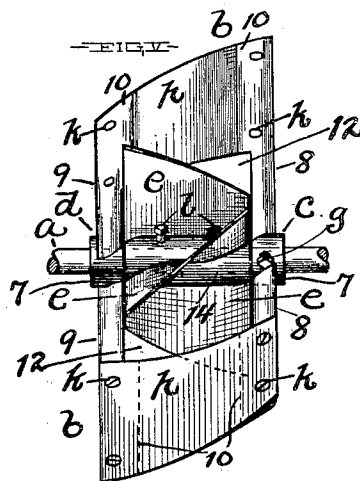
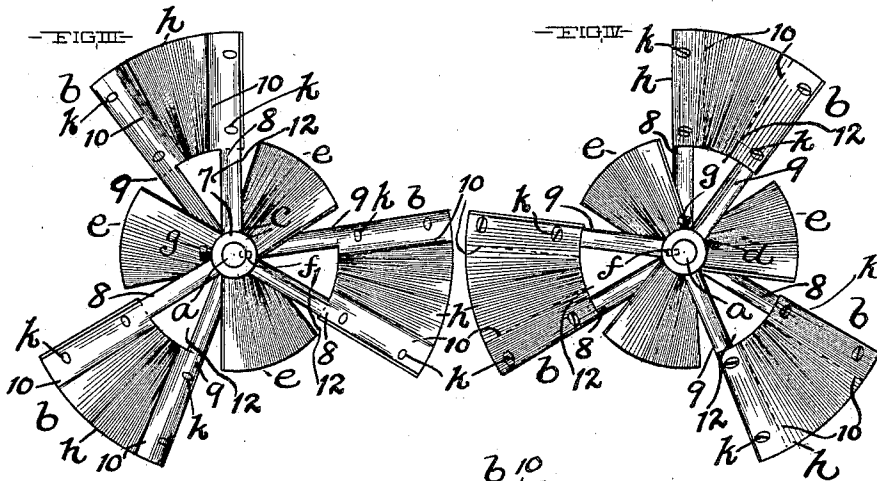
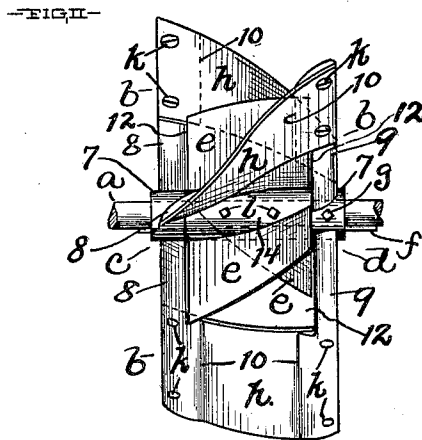
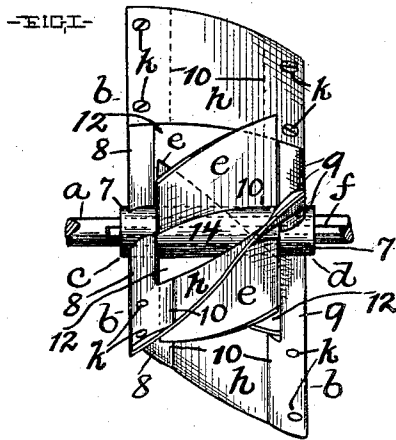
No. 676,900.

Patented June 25, 1901.

**I. LEHMAN.
PROPELLER.**

(Application filed Feb. 18, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

ISADOR LEHMAN, OF CLEVELAND, OHIO.

PROPELLER.

SPECIFICATION forming part of Letters Patent No. 676,900, dated June 25, 1901.

Application filed February 18, 1901. Serial No. 47,842. (No model.)

To all whom it may concern:

Be it known that I, ISADOR LEHMAN, a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in 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 pertains to make and use the same.

My invention relates to improvements in propellers.

The object of this invention is to construct a propeller that has greater efficiency than the propellers heretofore devised; and with this object in view and to attain certain other advantages hereinafter appearing the invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a side elevation of a propeller embodying my invention. Fig. II is a top plan relative to Fig. I. Figs. III and IV are opposite end elevations, respectively, of the propeller. Fig. V is a plan of the propeller looking downwardly upon the outer end of one of the small blades *e* of the propeller and is approximately a left-hand side elevation relative to Fig. III.

Referring to the drawings, *a* designates the propeller-shaft.

My improved propeller comprises a set of propelling-blades *b*, preferably three in number. The three blades *b* are arranged, preferably, at equal intervals circumferentially of the shaft *a*. Each blade *b* projects laterally of the shaft and extends longitudinally of the shaft a suitable distance. Each blade *b* is arranged at an angle to the shaft. The blades *b* correspond, preferably, in their arrangement relative to the shaft and are constructed and applied, preferably, as follows: Two spiders *c* and *d* are mounted upon the shaft *a* and operatively connected with the shaft, preferably by the well-known means of groove and feather, as at *f*, and are preferably rigidly secured to the shaft by means of set-screws *g*. Each of the said spiders has a central hub *7*, embracing the shaft *a* and provided with as many radially or approximately radially arranged arms as there are blades *b*,

and 8 and 9 designate the arms of the spiders *c* and *d*, respectively. The two spiders *c* and *d* are set in such different positions circumferentially of the shaft *a* that the arms 8 of the spider *c* and the arms 9 of the spider *d* shall alternate in end elevation of the propeller, and the arms of the two spiders of the propeller illustrated form three pairs of arms, with each arm of each spider forming one of the arms of a pair of arms. The arms of each pair of arms belong, therefore, to the different spiders *c* and *d*, respectively, and diverge in end elevation of the propeller and participate in the formation of a blade *b*, as will hereinafter more fully appear. Each arm of each spider is arranged at an angle in end elevation of the said arm to the hub of the said spider, and consequently at a corresponding angle to the shaft *a*. The spider-arms preferably correspond in their angular arrangement relative to the shaft. The arms of each of the aforesaid pairs of spider-arms are enlarged in width toward each other, as at 10, between their outer extremities and a point about midway between their opposite ends, and a suitably-curved plate *h* of preferably uniform or approximately uniform thickness throughout is secured to the outer and wider portions of the said arms, preferably removably, by means of screws *k*, which plate *h* extends, preferably, from end to end of the said wider and outer portions of the said arms, but does not extend inwardly beyond the said wider portions of the said arms, so as to form a water-passage-way-forming opening 12, extending laterally through and centrally of the inner portion of the blade *b*, which is formed by the said plate *h* and the spider-arms supporting or carrying the said plate *h*. The opening 12 in the inner portion of each blade *b* not only materially lightens the blade, but facilitates the operation of the blade.

The old construction of propeller-blade involving a solid blade required additional thickness in the blade next to the hub of the propeller-wheel to render the blade strong enough, and the work of propelling was done by the outer and wider portion of the blade, and the inner and thicker and solid portion of the blade impeded the operation of the blade. These objectionable features are

avoided in my improved construction, which not only forms a blade which is exceedingly strong and durable and comparatively cheap, but which renders practical the use, in forming the outer portion of the blade, of a plate *h* of uniform thickness and comparatively light.

The spider-arms have their outer and wider portions gradually reduced in thickness toward their inner side edges, so as to avoid square or abrupt shoulders at the said edges, and I would here remark that the plate *h* of each blade *b* preferably overlaps the pair of spider-arms participating in the formation of the said blade at one and the same side of the said pair of arms.

I would remark that my improved construction, hereinbefore described, without any additional features constitutes a superior and advantageous and efficient form of propeller; but to still further enhance the efficiency of the propeller another set of propelling-blades *e*, alternating with the blades *b*, is preferably provided. The set of blades *e* comprises, therefore, three blades, arranged each preferably centrally between two adjacent blades *b*. The blades *e* are formed upon a hub 14, which embraces the shaft *a*, and is operatively connected with the said shaft *a* by the groove and feather *f*, and rigidly secured to the shaft to prevent endwise displacement thereof by suitably-applied set-screws *l*. Each blade *e* projects laterally of the shaft between the two adjacent blades *b* and is arranged at an angle to the hub 14 and extends from the inner end of the arm 8 of one of the said blades *b* to the inner end of the arm 9 of the other of the said blades *b*, and the said blade *e* is arranged, therefore, as required to operate upon the water passing through the opening 12 of the one or the other of the two adjacent blades *b*, according as the propeller rotated in the one or the other direction. The blades *e* project, preferably, about one-half as far from the shaft as the blades *b* and are preferably just large enough to effectually operate upon the water passing through and between the inner portions of the blades *b*.

Of no inconsiderable importance is the participation of the arms of the spiders *c* and *d* in the formation of the blades *b*. As already indicated, the two spider-arms 8 and 9, participating in the formation of each blade *b*, are correspondingly arranged at an angle to or diagonally of the propeller-shaft and are flat in end elevation, so that the sides of the said arms at each side of the opening 12 in the said blade form working surfaces. In other words, each blade *b* has not only an opening 12 extending laterally through and centrally of the inner portion of the blade, but has the outer and imperforate portion thereof extended inwardly at each side of the said opening, so as to provide working surfaces at the sides of the said opening. Also, the enlargement in width of the outer por-

tions of the arms or members 8 and 9 of each blade *b*, and especially the widthwise enlargement of the said arms toward each other, is important, in that the said enlargement reinforces the plate *h* of the said blade.

What I claim is—

1. A propeller comprising a shaft, a set of propelling-blades arranged at suitable intervals circumferentially of the shaft and formed by the following: two spiders operatively mounted upon and a suitable distance apart longitudinally of the shaft and having pairs of radially or approximately radially arranged flat arms arranged at an angle in end elevation, to the shaft, with the two arms of each pair of arms being members of the different spiders, respectively, and diverging toward their outer ends in end elevation of the propeller, and a plate rigid with the outer portions of and extending between the arms of each pair of arms and arranged at an angle to or diagonally of the axial line of the propeller, and the aforesaid arms having flat sides correspondingly angularly arranged to the said axial line and forming efficient working surfaces.

2. A propeller comprising a shaft, a set of propelling-blades arranged at suitable intervals circumferentially of the shaft and formed by the following: two spiders operatively mounted upon and a suitable distance apart longitudinally of the shaft and having pairs of radially or approximately radially arranged flat arms arranged at an angle, in end elevation, to the shaft, with the two arms of each pair of arms being members of the different spiders, respectively, and diverging toward their outer ends in end elevation of the propeller, and with one of the said arms having its outer portion enlarged in width, and a plate secured to the outer portion of the arms of each pair of arms and extending inwardly from the outer ends of the said pair of arms a suitable distance.

3. A propeller comprising a shaft, a set of propelling-blades arranged at suitable intervals circumferentially of the shaft and formed of the following: two spiders operatively mounted upon and longitudinally of the shaft and having pairs of radial or approximately radial arms arranged, in end elevation, at an angle to or diagonally of the shaft, with the two arms of each pair of arms being members of the different spiders, respectively, and diverging toward their outer ends in end elevation of the propeller, and having their outer portions enlarged in width toward each other, and a plate secured to the outer and wider portion of the arms of each pair of arms and extending inwardly from the outer ends of the said arms a suitable distance.

4. A propeller comprising a shaft, a set of propelling-blades arranged at suitable intervals circumferentially of the shaft and formed by the following: two spiders operatively mounted upon and a suitable distance apart longitudinally of the shaft and having pairs

of radially or approximately radially arranged arms arranged at an angle in end elevation to the shaft with the two arms of each pair of arms being members of the different
5 spiders, respectively, and diverging toward their outer ends in end elevation of the propeller and having their outer portions enlarged in width and gradually reduced in
10 thickness toward their inner side edges, and a plate secured to the outer and wider portions of the arms of each pair of arms and extending inwardly from the outer ends of the said arms a suitable distance, substantially
as and for the purpose set forth.

15 5. A propeller comprising a set of suitably-arranged propelling-blades having water-passage-way-forming openings extending laterally through the inner portions of the blades, and another set of propelling-blades alternating
20 with the first-mentioned blades and arranged to operate upon the water passing through the openings of and between the first-mentioned blades, substantially as and for the purpose set forth.

25 6. A propeller comprising a set of suitably-arranged propelling-blades provided with

openings extending laterally through the inner portions of the blades, and another set of smaller propelling-blades alternating with the
first-mentioned blades and arranged centrally
30 between the inner and open portions of the said first-mentioned blades, substantially as and for the purpose set forth.

7. A propeller comprising a shaft, two hubs
7 and 7 operatively mounted upon the shaft
35 a suitable distance apart longitudinally of the shaft and provided with suitably-arranged propelling-blades provided with openings extending laterally through the inner portions
of the blades between the aforesaid hubs, and
40 another hub operatively mounted upon the shaft between the two first-mentioned hubs and having propelling-blades alternating with the first-mentioned blades and arranged to
operate upon the water passing through the
45 openings of the said first-mentioned blades.

Signed by me at Cleveland, Ohio, this 14th day of February, 1901.

ISADOR LEHMAN.

Witnesses:

C. H. DORER,
A. H. PARRATT.