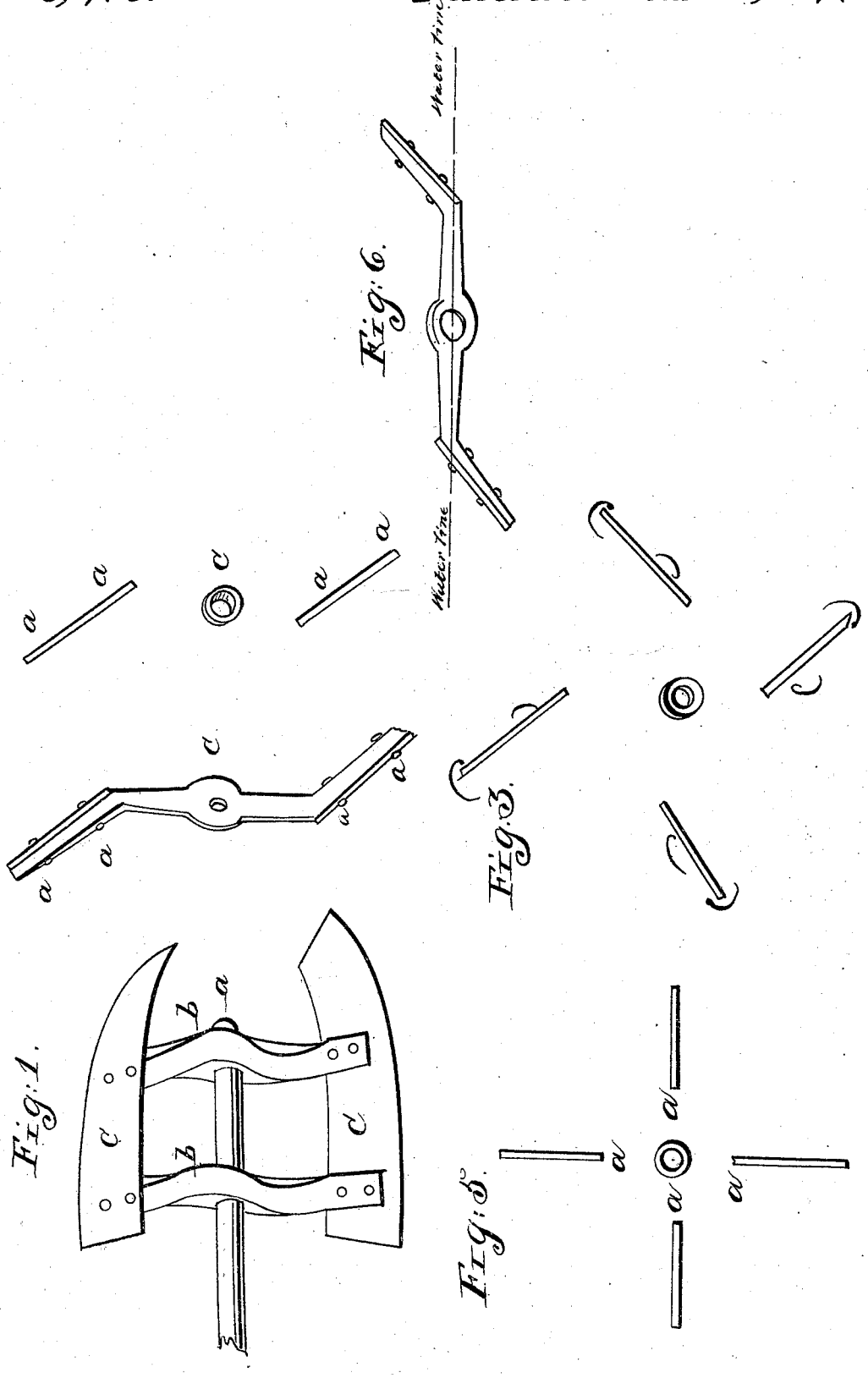
R. Bulkley,

Screw Propeller.

No. 3,476. Patented Mar. 13, 1844.



UNITED STATES PATENT OFFICE.

RALPH BULKLEY, OF NEW YORK, N. Y.

OBLIQUE PADDLE-PROPELLER FOR PROPELLING BOATS AND OTHER VESSELS.

Specification of Letters Patent No. 3,476, dated March 13, 1844.

To all whom it may concern:

Be it known that I, RALPH BULKLEY, of the city, county, and State of New York, have invented a new and useful Improvement on a submarine propeller, denominated "oblique water-wheel," as per Letters Patent to me, the said RALPH BULKLEY, bearing date the 7th day of August, in the year 1821, to be used for the purpose of propelling steam-batteries or vessels of war of any description or other vessels or watercraft of any description, the specification of which contains the following words, to wit: "Four or more paddles are placed upon the opposite sides of an axle or shaft in a diagonal or oblique position to the direction of the shaft, and all inclining in the same direction, making an angle with the shaft or axle of forty-five degrees, or a greater or less angle, as may be found convenient, the paddles being placed upon the shaft in a position similar to the position of the sails of a windmill;" and in order to convey a more comprehensive idea of the construction of diagonal or oblique propellers to shafts the following explanation as to the position of the buckets was added in that specification, namely: "Let the superficies of a circle be divided into four equal parts by lines drawn through the center, and let each quarter of the circle be bent from its position in an equal degree, keeping the center points together and making an angle at the circumference of each quarter with the former circumference of forty-five degrees, or such other angle as may be found convenient, and in such a manner that the circumference of the former circle shall run through the center or middle part of the circumference of each quarter of the circle so bent from its former position," so that each bucket, at a line drawn from the middle of its outer edge inward to the shaft, is perpendicular or at a right angle, or nearly so, to the shaft. In contradistinction therefor from the said radially-formed buckets of submarine oblique water wheels or propellers this improvement is denominated the "double-angle submerged propeller;" and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, to wit:

Two or more propeller buckets are to be attached to a shaft to operate spirally in performing revolutions. The relative slopewise or oblique position of each bucket to the shaft is both latitudinal and longitudinal, of which the drawing at Figure 1, represents a perspective view, *a*, *a*, the shaft, *b*, *b*, the arms, *c*, *c*, the buckets. Fig. 2, represents a transverse section drawn through the center of the buckets, and the arms which support them, from the circumference across the shaft.

Letters, *a*, *a*, *a*, *a*, represent the arms, with sections of the buckets attached to the arms.

C, represents the aperture through which the shaft is inserted.

Fig. 3, represents a transverse section of the buckets between and at a distance from the arms, showing the direction to the shaft of each one, or of four buckets, as at *d*, *d*, the position of the shaft is represented at Fig. 2.

The arms between the buckets and the shaft may be formed at an angle to the shaft equal to the angle of the buckets attached to them, or at a less oblique angle as it approaches the shaft, so that the stem of the arm may act in propelling. The buckets may be applied of equal width from end to end, or broader at one end than the other, and with plain, or with convex, or concave or elliptical surface edges or corners. They may be made oblong or of such other shape and dimensions as may be suited to convenience and the place of application. They may also be made to extend to the extreme outer end of the shaft, or to project beyond it, and the shaft may or not be secured with braces, fastenings or guards, at its outer end, depending on its relative strength and circumstances. It would however be preferable to apply shafts of sufficient relative strength to require no bracing at the outer end. The shaft may be of uniform diameter or tapering toward the outer end. Each bucket may be secured on two or more arms, or they may be braced one to the arm of the other in situations where such precautions are required and the angles may be formed, suited to the velocity intended to be attained and the relative power to be applied.

Its application as a submerged propeller is intended for use in any and all descriptions of floating batteries, vessels of war, vessels and boats of any description, to which such a propeller can be applied to advantage, whether the propelling agent be of steam or other power.

The method for determining the angles of the buckets forming "the double angle submerged propeller," may be as follows, and the angles described as follows may be considered suitable for producing velocity, to wit, the bucket is to be extended from the shaft sufficiently to produce the required diameter of the wheel for use on a parellel line with the shaft; the bucket is then to be turned, its two ends transversely, to an angle with the shaft of about thirty degrees; then the outer edge of the said bucket is to be again turned longitudinally about thirty degrees from a line through its center perpendicular to the shaft, and being thus placed and secured upon suitable arms, braces, or supporters, it presents a double angle position, both latitudinally and longitudinally, and in like manner each additional bucket is to be applied, reference being had to the annexed drawing.

It is believed that this improvement differs from all others in use, as well in its construction as in its action upon the water and the effects produced, to wit: it may be remarked that a line drawn through the center of a bucket, of the ordinary screw, angle, or oblique propelling wheel, is intended to be perpendicular to the shaft, as shown at Fig. 5, in the drawing herewith, which being compared with the position of the double angle bucket, represented at Fig. 3, in the drawing, shows the comparative difference, and its action upon the water is different, and producing entirely different effects, as, for instance, if a radially formed bucket were placed, say three feet from the center of the shaft, the bucket being three feet in width, it is evident that in performing revolutions the inner edge of the bucket, in its circular motion, will move but half as fast, or but half the distance of the outer edge. The inner edge of a bucket thus formed might be liable to be producing back water, while its outer edge might be propelling, and might thus prevent attaining the great velocity which might be attained if each and every part of the bucket operated uniformly in a propelling action, whereas on the principle of the double angle propeller herein described the buckets may be so graduated that the inner edge will have the same effect in propelling as the outer edge, thereby avoiding any liability of back water, and at the same time discharging the water in a way calculated to produce the greatest possible effect in propelling, it being intended in its contact with, and clearance from the water, when passing through it, nearly to resemble the propelling action of a fish, which with comparatively large bulk, and small propellers, will dart itself up powerful rapids, and observation will make it clearly manifest that the propelling action of a fish is in its nature double angular. And in further illustration of the difference of the action, of radial, and of double angle propellers, it may be remarked that both descriptions are in effect comparable to that of moving a boat by sculling instead of rowing, and it is presumed that a skillful man at sculling can for short distances move a boat as fast or faster than two men, each of equal strength, could do at rowing.

Although the apparent principle of sculling consists in placing an oar over the stern of the boat and moving it to and fro in the water, yet if the blade of the oar be placed vertically in the water and be moved to and fro in that position the boat would be moved so comparatively slow that such a method of using the oar propeller would be, as it now is, considered not useful, whereas if an oar be placed over the stern of a boat, and after its blade is thrown off, on one angle to the right or to the left, its blade be then turned to a second angle longitudinally the position of the oar would be such that its lower edge, in sculling, would move in advance of its upper edge. It is while the oar is moved in this peculiar position that boats receive the impulse which causes them to dart so rapidly ahead, and as above described, the position of the oar in action would be at a double angle. And it is this peculiar position of the oar, and its effective action while in that position, that is comparable to "the double angle submerged propeller," as shown at Fig. 3 in the drawing herewith, which represents the lower or inner edge of the propeller as moving, like that of the oar, in advance of the upper or outer edge, and in contradistinction of the action of the radially applied bucket, as shown at Fig. 5, letter *a*, in the drawing herewith. And further, if the oar as above described were so placed vertically in the water, at the stern of a boat, and plied with a motion similar to what it would have if performing an arc of a circle, its lower edge constantly pointing to the center, it would cause the upper edge to move a little in advance of its lower edge, and would cause the water to pass under the lower edge of the oar, whereas if the blade of the oar be turned off to a second angle it is evident that in forcing it toward the center of the boat the lower edge would move in advance of the upper edge, and the water which came in contact with it would pass over the upper edge of the oar, as shown at Fig. 2, Fig. 3, and Fig. 6 in the drawing herewith, thus showing as great a difference in action between the radial and the double angle buckets as there is in the names which distinguish them. And among the many other specific points in which "the double angle submerged propeller" differs from the screw propeller, and the oblique water wheels or

propellers, as also all others in use, the following may be enumerated, to wit, "the double angle submerged propeller," when in propelling action, becomes effective by receiving the water longitudinally from end to end on the inside edge of the buckets, thereby commencing the propelling action at the inside edge of the bucket, from end to end, whether it be moved fast or slow, and discharging the water over the outer edge of the bucket, whereas the radially formed bucket, in its propelling action, receives the water at the advance end of the bucket, thereby causing an entire different action of the water on the inside edge of the bucket, producing disadvantageous results partly by reason of the buckets being so placed on a revolving propeller, where different diametrical distances perform different circular distances at each revolution, as, for instance, if the outer edge of the bucket were at a diameter of six feet, the circular motion would be say eighteen feet, and if its inner edge were at a diameter of three feet, its circular motion would be, say nine feet, or only one half the circular distance performed by the outer edge, and in like proportions from the circumference to the center.

And among the advantages of this improvement, the following may be enumerated, to wit, its construction as described is such that by applying proportionally strong arms and shaft it may be constructed and applied to use of any required dimensions; and from the peculiar action of its buckets upon the water, as described, it is believed that a greater velocity may be attained by it than by any other propelling wheels in use, and in consequence of the effective contact with and action of the said buckets upon the water, as described, wheels may be made of comparatively small dimensions, for use in shoal water, each bucket having a propelling action at its inner edge, as well as at its outer edge, and are well calculated for vessels carrying guns, regarding speed, safety from exposure to shot, and the relieving of the upper part of the vessel from the incumbrance of side wheels.

What I claim as my invention and desire to secure by Letters Patent, is—

Giving to the inclined or spiral paddles an inclination from the radius, for the purpose and in the manner described.

RALPH BULKLEY.

Witnesses:

JOSEPH BULKLEY,

JOHN T. DOYLE.