(No Model.) 3 Sheets—Sheet 1.

C. W. FOSTER.

REVERSIBLE BLADE PROPELLER.

No. 602,902. Patented Apr. 26, 1898.

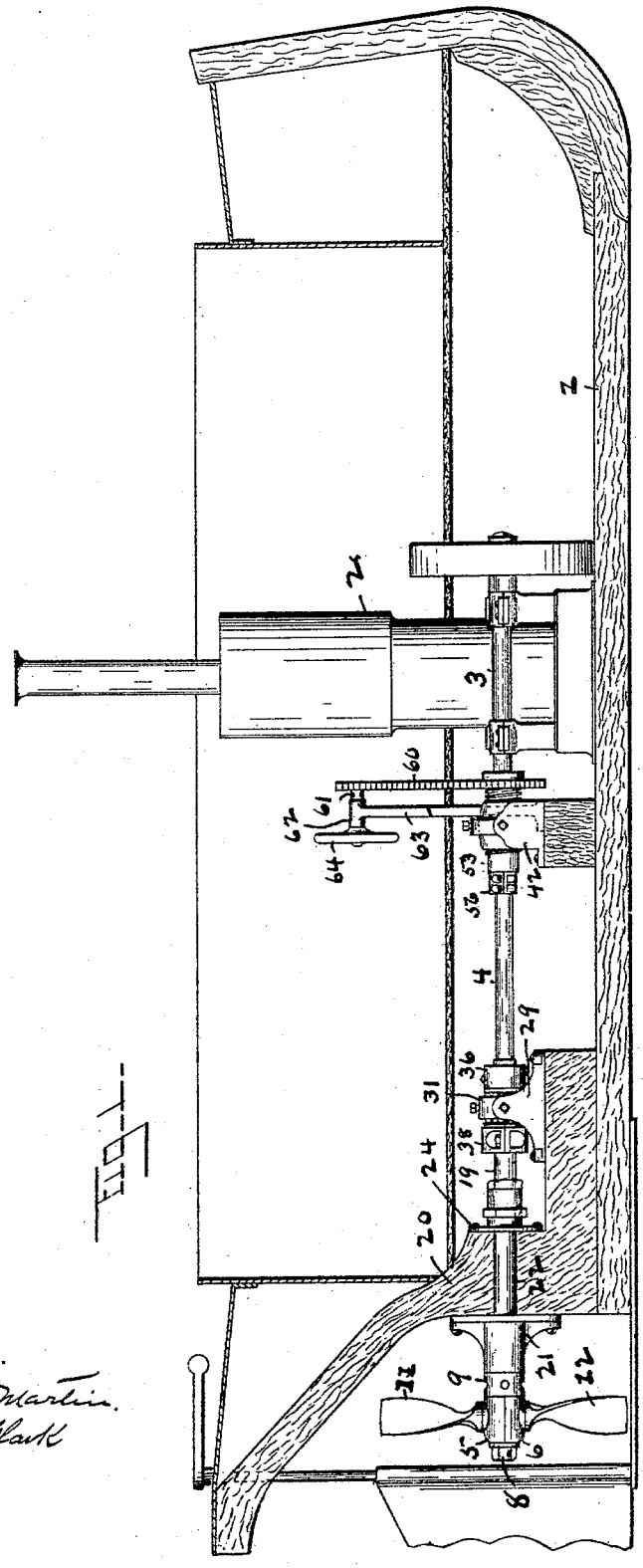

Fig. 1.

Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

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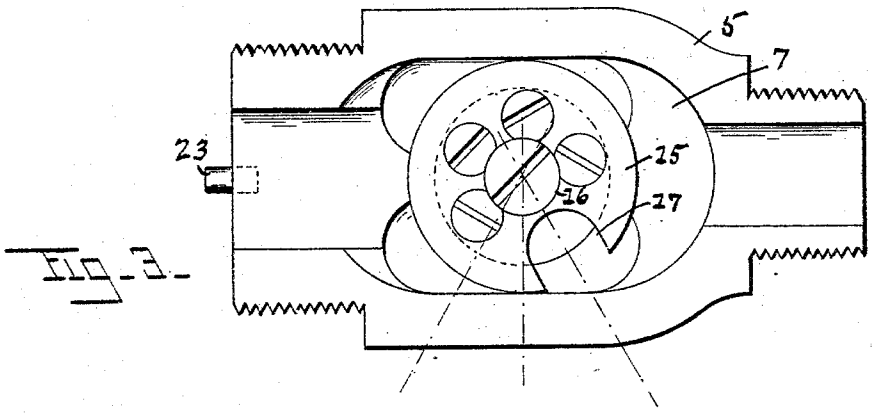

Fig. 3.

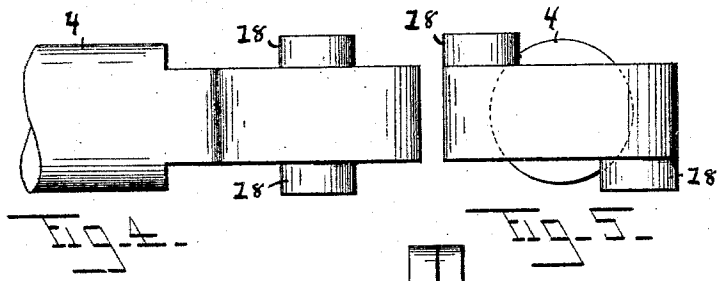

Fig. 4.

Fig. 5.

Fig. 2.

Witnesses.

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(No Model.) 3 Sheets—Sheet 3.

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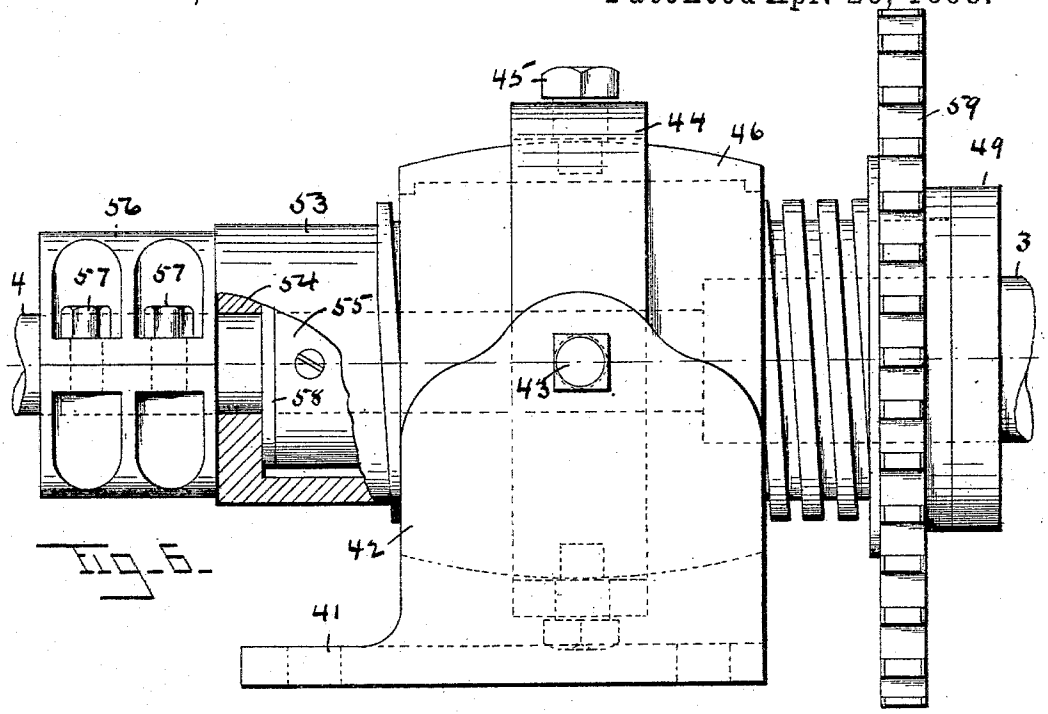

Fig. 6.

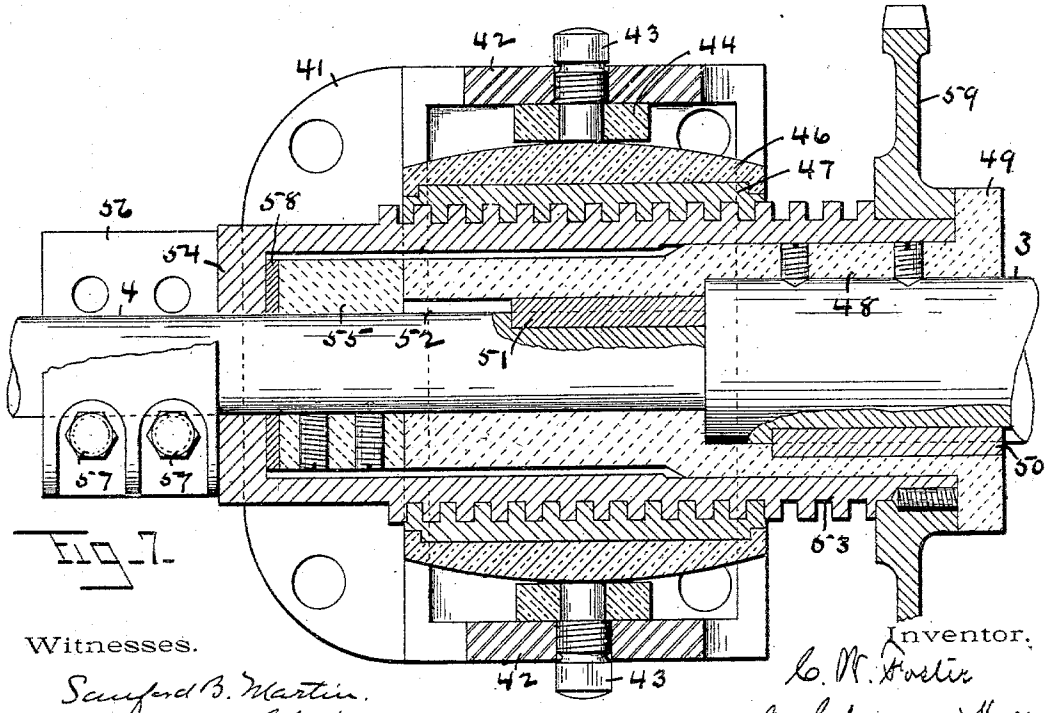

Fig. 7.

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UNITED STATES PATENT OFFICE.

CHARLES W. FOSTER, OF NEW HAVEN, CONNECTICUT.

REVERSIBLE-BLADE PROPELLER.

SPECIFICATION forming part of Letters Patent No. 602,902, dated April 26, 1898.

Application filed December 15, 1896. Serial No. 615,759. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. FOSTER, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Reversible-Blade 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 screw-propellers, and particularly to that class of such propellers in which the blades are reversible independently of the hub, to the end that the boat to which the wheel is applied can be caused to move in either direction or brought to a stop without interrupting the movement of the wheel in one direction.

Among the objects of the invention are to provide a propeller-wheel having an improved construction whereby its blades are rendered reversible without impairing the strength of the wheel as a whole and to provide novel means for securing the reversing movement of the propeller-blades.

To these ends my invention consists in the reversible-blade propeller and its operating means, constructed and operating as hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a longitudinal sectional view of a boat equipped with a propeller embodying the invention. Fig. 2 is a plan view, partly broken away, of the propeller and of the inner and outer bearing-plates for its shaft. Fig. 3 is an inner face view of one of the two members composing the wheel-hub. Fig. 4 is a plan view of the outer end of the propeller-shaft. Fig. 5 is an end view of said shaft. Fig. 6 is a side elevation, partly broken away, of the blade-reversing mechanism. Fig. 7 is a horizontal section of said mechanism.

Referring to Fig. 1, the numeral 1 designates the hull of a boat, 2 the propelling-engine thereof, and 3 the crank-shaft of said engine, all of which may be of the usual form. The propeller-shaft 4 is operatively connected to said crank-shaft 3 at one end in such manner as to be capable of a limited longitudinal movement independently of the latter, as will be presently described, and at its opposite end is so connected to the propeller that its longitudinal movement causes a reversing movement of the blades of the latter, and to the latter construction attention is first directed.

The hub of the propeller devised by me is divided longitudinally into as many equal parts as there are blades. In the example herein shown two blades are employed, and the hub is therefore divided into two equal parts 5 and 6, each of which is provided with an internal chamber 7, as shown in Fig. 3, and is exteriorly threaded at its outer and inner ends, as shown. An internally-threaded cap 8, applied to the outer end, and a spanner-nut 9, applied to the inner end of said hub, serve to securely lock said members together when the parts are assembled. Each of said members is provided with a circular opening to receive the shank of the propeller-blade and with an exterior boss 10, surrounding said opening, to form a strong and secure seat for the blade. The two blades 11 12 are provided at their inner end with a shank 13, which enters the opening in the hub, and with a flange 14, which has a true bearing against the boss 10, and a disk 15, secured to said shank at its inner end, serves to securely hold the blade in position. I prefer to locate said disks within countersunk recesses in the inner faces of the hub members, as shown in Fig. 2, and to secure them to the blade-shanks by means of a series of screws whose heads are overlapped by a larger screw 16, as shown in Fig. 3, as I thus secure a very strong and reliable connection between the disk and shank and which at the same time permits a blade to be removed and replaced for any purpose with entire convenience. This result is also greatly facilitated by making the hub to consist of separable members, as described. The blades thus mounted upon the hub are capable of a revolving movement about the axes of their shanks as a center, and each of the disks 15 is provided with a notch or recess 17 to receive one of two oppositely-projecting lugs 18 on the flattened end of the propeller-shaft 4, whereby the limited longitudinal movement of said shaft in opposite directions will im-

part a partial rotation to said disks and the blades in like directions.

In Fig. 3 the three broken lines indicate the amount of movement imparted to the blades, the two outer lines indicating the positions of the disks to cause the blades to drive the boat forwardly and rearwardly, respectively, and the center line indicating the position of the disks when the blades stand perpendicularly to the water and exert no power thereon in either direction.

By reference to Fig. 5 it will be observed that the lugs 18 are located upon opposite sides of the center of the shaft, thereby balancing the action upon the blades and preventing any undue strain upon the shaft.

The outer end of the propeller-shaft is closely fitted within a sleeve 19, which extends from the thrust-bearing through the bearing in the stern-post 20 and through the stern-bearing 21, secured to the outer side of the stern-post, as shown in Figs. 1 and 2. The extreme outer end of said sleeve 19 is surrounded by a sleeve 22, of composition bronze or other hard metal brazed thereto, which takes the wear of the stern-bearing 21 and terminates at its outer end with an exterior flange, as shown. The spanner nut or collar 9 at the inner end of the wheel-hub is provided with an internal flange which overlaps the flange on said sleeve 22 and serves to hold the wheel-hub securely against the ends of said sleeves 19 and 22, as shown in Fig. 2. Each of the hub members 5 6 is provided with a dowel-pin 23 at its inner end, which pins entering corresponding holes in the ends of the sleeves 19 22 prevent the hub from turning independently of the said sleeves. It will be obvious from an inspection of Fig. 2 of the drawings that by removing the screw-cap 8 and turning spanner-nut 9 in one direction the hub of the wheel will be moved rearwardly in such manner as to permit its members to be separated, and that easy access to the inner side of the hub is thus afforded for the removal of an injured blade or other purpose.

At the inner side of the stern-post the sleeve 19 is provided with a stuffing-box composed of the bearing-plate 24, having the threaded hub 25, the gland 26, and the lock-nut 27 applied to said hub, with the usual packing within said gland, thus preventing any leakage of water around said sleeve into the hull.

At the inner end of the propeller-shaft is located the mechanism devised by me for producing the longitudinal movement of said shaft necessary to secure the reversing movement of the propeller-blades, which is constructed as follows: A bed-plate 41, secured to a part of the keel, is provided with two upwardly-projecting arms 42, (see Figs. 1, 8, and 9,) through which pass the screw-bolts 43, which enter recesses in a ring 44 at diametrically opposite points of the latter. Through said ring 44 pass screw-bolts 45 at an angle of ninety degrees to the bolts 43, which enter recesses in a ring 46, having a threaded core 47, thus forming a nut supported by a universal joint. To the end of the crank-shaft 3 of the engine 2 is secured a sleeve 48, which has the flanged end 49 and projects beyond the end of said shaft within the hollow nut 46, a key 50, introduced between said shaft and sleeve, compelling the latter to revolve with the former. The front end of the propeller-shaft 4 enters the rear end of said sleeve 48 and in its forwardmost position abuts against the end of the crank-shaft, as shown in Fig. 9. A spline 51 on said shaft 4 enters an internal groove 52 in the sleeve, whereby the propeller-shaft is caused to revolve with the crank-shaft and its sleeve, while being free to move longitudinally independently thereof. An exteriorly-threaded sleeve 53, loosely mounted upon the sleeve 48, engages the thread of the nut 46, and at its rear end is provided with an internal flange 54, which loosely embraces the propeller-shaft 4. At the front side of said flange 54 of said threaded sleeve and between it and the end of sleeve 48 is located a collar 55, rigidly secured to the shaft 4, and at the rear or outer side of said flange is located a split collar 56, adjustably secured to shaft 4 by screw-bolts 57, by loosening which said collar can be adjusted upon the shaft to compensate for wear. A loose antifriction-collar 58 is preferably interposed between the collar 55 and the flange 54, as shown. To the front end of the threaded sleeve 53 is secured a sprocket-wheel 59, which is connected by a chain 60 to a smaller sprocket-wheel carried at the front end of a shaft 61, mounted in a bearing 62 at the upper end of a stand 63, suitably supported at its lower end on a portion of the keel. Said shaft 61 carries at its rear end a hand-wheel 64 or other device to enable it to be conveniently operated by hand. It will be apparent from an inspection of Figs. 1 and 9 that by revolving the sleeve 53 through the hand-shaft 61 and its sprocket connections said sleeve will be caused to advance and recede through the nut 46 and that such movement of said sleeve will, through its flange 54 and the collars 55 and 56 on the propeller-shaft, cause the latter shaft to partake of its movement, and thereby actuate the propeller-blades without interrupting the revolving movement of said shaft and the wheel. By mounting the nut 46 in the manner described all danger of any binding action between it and the threaded sleeve is obviated, and the propeller-shaft is maintained in its true working position regardless of any straining of the hull.

While I have thus particularly described and prefer to use the means herein shown for securing the longitudinal motion of the propeller-shaft to actuate the propeller-blades, it will be understood that so far as the particular construction of the wheel is concerned other forms of means for longitudinally moving the shaft may be used within the spirit of my invention.

It will be observed that in the construction of a reversible-blade propeller and its actuating means, as herein shown and described, I combine great strength and durability of parts with simplicity of construction and reduce the liability of the working parts to get out of working order to a minimum.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a reversible-blade propeller mechanism, a wheel-hub divided longitudinally into a plurality of sections, a blade pivotally supported in each of said sections, a screw-cap engaging the threaded outer end of said hub, and a spanner-nut, engaging the inner end thereof, substantially as and for the purpose described.

2. In a reversible-blade propeller mechanism, a wheel-hub divided longitudinally into a plurality of sections each of which sections is provided with a blade-opening and with a boss surrounding said opening at the outer side thereof, combined with a plurality of blades each of which is provided with a shank which enters one of the openings in said hub and with a flange which bears against the boss adjacent to said opening, substantially as described.

3. In a reversible-blade propeller mechanism, the combination with a wheel-hub and a plurality of blades revolubly seated in said hub, of a propeller-shaft entering said hub and having a crank connection with each of said blades, a sleeve surrounding said shaft, means for locking said wheel-hub to said sleeve at its rear end, a thrust-bearing engaging said sleeve at its front end, and means for revolving said shaft and for imparting a longitudinal movement thereto to actuate said blades about their axes as a center, substantially as described.

4. The combination with a propeller-wheel having reversible blades and a propeller-shaft, of intermediate connection between said shaft and the blades of said wheel whereby longitudinal movement of the former will impart a rotary movement to the latter about their axes, an internally-threaded ring supported adjacent to the front end of said shaft, an exteriorly-threaded sleeve engaging the thread of said ring and having a portion thereof projecting between two stops on said shaft, and means for imparting a revolving movement to said sleeve, whereby a longitudinal movement will be imparted to said sleeve and the shaft to reverse the position of the propeller-blades, substantially as described.

5. The combination with a reversible-blade propeller and a longitudinally-movable propeller-shaft operatively connected to the blades of said wheel, of an internally-threaded ring located adjacent to the front end of said shaft, an exteriorly-threaded sleeve engaging the thread of said ring, said sleeve carrying at one end a sprocket-wheel and having at its opposite end an internally-projecting portion which enters between two collars secured to said shaft, a shaft carrying a hand-wheel and a second sprocket-wheel, and a chain connecting said sprocket-wheels, arranged and operating substantially as described.

6. The combination with a reversible-blade propeller, a propeller-shaft and intermediate connections between said shaft and the blades of said wheel whereby longitudinal movement of the former will impart a reversing movement to the latter, of a motor the crank-shaft of which carries a sleeve-coupling the end of which embraces and has a spline-and-groove connection with the front end of said propeller-shaft, an exteriorly-threaded sleeve loosely embracing said sleeve-coupling and having a portion thereof swivelly connected to said shaft, an internally-threaded ring hung to a fixed support and engaging said threaded sleeve, and means for imparting a revolving movement to said sleeve, arranged and operating substantially as described.

7. The combination with a reversible-blade propeller and a propeller-shaft operatively connected with the blades of said propeller for reversing the movement thereof, of universally-supported bearings supporting said shaft adjacent to each of its ends, and means substantially as described for imparting both a revolving and a longitudinal movement to said shaft.

8. The combination with the wheel-hub composed of the longitudinal sections 5 6 having blade-openings surrounded by the bosses 10, of the blades 11 12 having shanks 13 and flanges 14, crank-disks 15 secured to said shanks within the hub, shaft 4 having the studs or pins 18 engaging notches or recesses in said disks and means for revolving said shaft and for imparting longitudinal movement thereto, substantially as described.

9. The combination with the hub composed of the sections 5 6 having the blades 11 12 revolubly seated therein, of the longitudinally-movable shaft 4 entering said hub and engaging said blades through an intermediate crank mechanism, sleeve 19 surrounding said shaft, screw-cap 8 inclosing the outer end of said hub, and spanner-nut 9 embracing the inner end of the hub and locking it to said sleeve, substantially as described.

10. The combination with the shaft 4, of the ring 44 hung upon horizontally-disposed pivots, interiorly-threaded ring 46 supported by vertical pivots within said ring 44, exteriorly-threaded sleeve 53 engaging the thread of said ring 46 and provided with the internal flange 54, collars 55 and 56 located on said shaft upon opposite sides of said flange, and means for revolving said sleeve, substantially as described.

11. The combination with the motor-shaft 3 having the sleeve 48 secured thereto, of shaft 4 entering said sleeve and having a spline-and-groove connection therewith, exteriorly-threaded sleeve 53 embracing the sleeve 48

and having sprocket-wheel 59 secured thereto at its front end and having the internal flange 54 at its rear end, internally-threaded ring 46 hung upon a universal joint and engaging said sleeve 53, collars 55 56 on shaft 4 at opposite sides of said flange 54, and shaft 61 carrying the hand-wheel 64 and a sprocket-wheel which has chain connection with said wheel 59, arranged and operating substantially as set forth.

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

CHARLES W. FOSTER.

Witnesses:

GEORGE E. HALL,

A. F. FOSTER.