No. 700,278. Patented May 20, 1902.

L. WILSON.

REVERSIBLE SCREW PROPELLER.

(Application filed Sept. 23, 1901.)

(No Model.) 4 Sheets—Sheet 1.

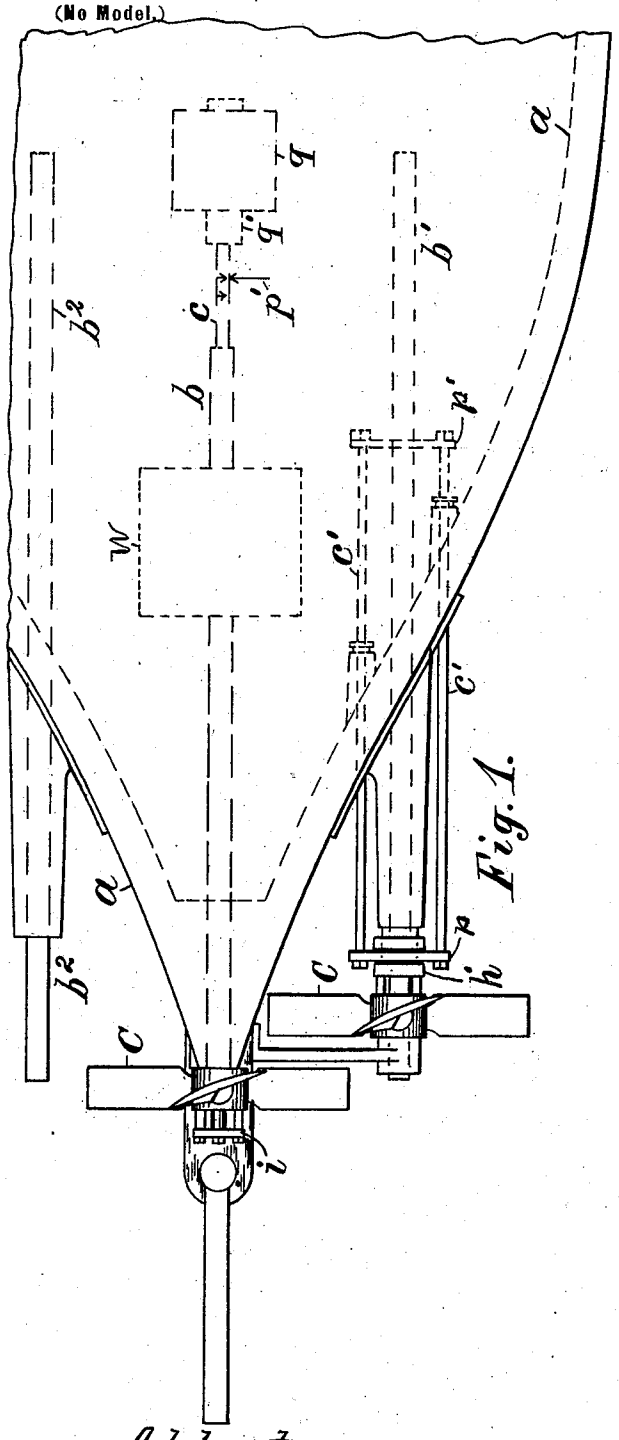


Fig. 1.

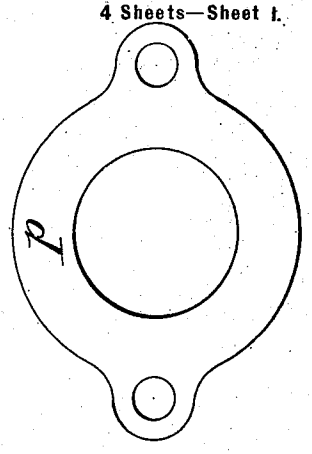


Fig. 6.

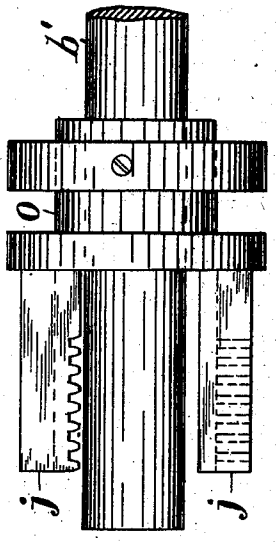


Fig. 5.

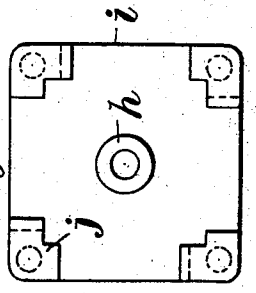


Fig. 4.

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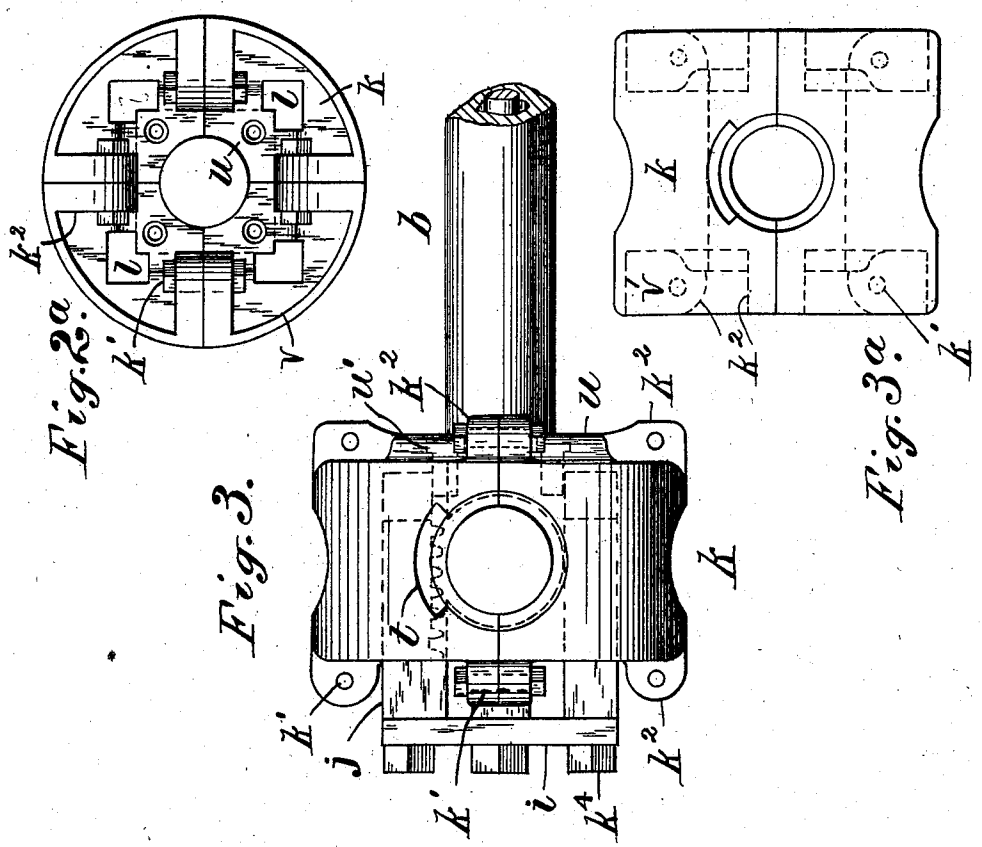
No. 700,278. Patented May 20, 1902.

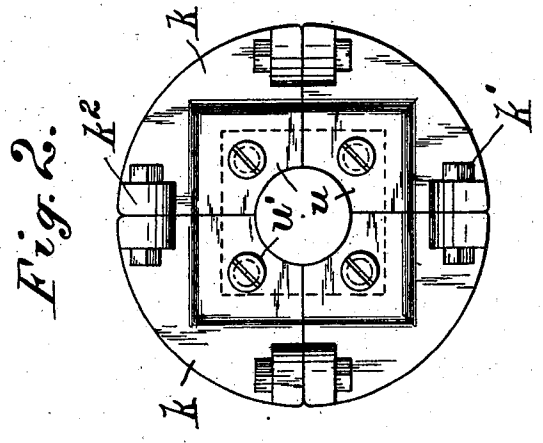
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REVERSIBLE SCREW PROPELLER.

(Application filed Sept. 23, 1901.)

(No Model.) 4 Sheets—Sheet 2.





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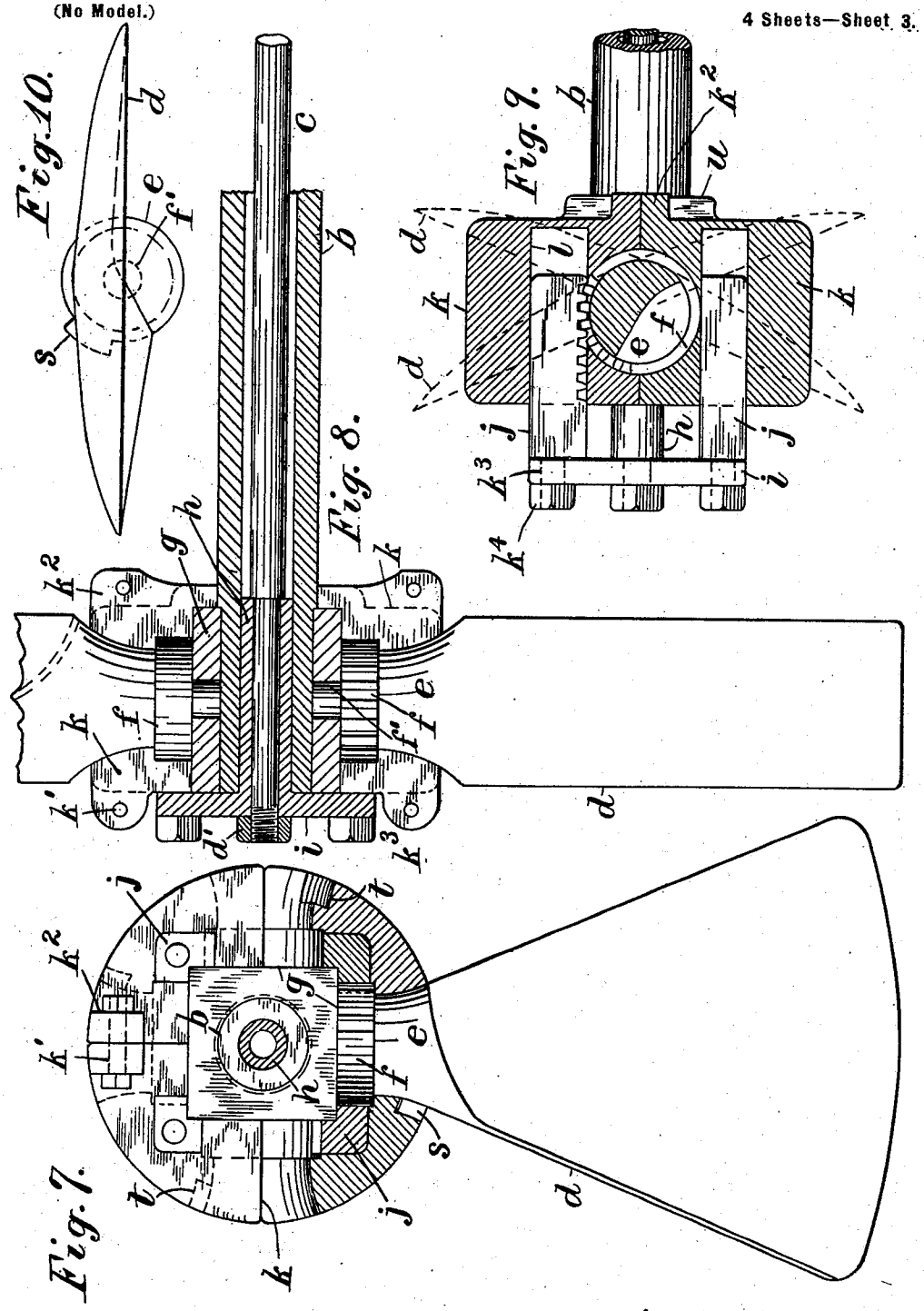
No. 700,278. Patented May 20, 1902.

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REVERSIBLE SCREW PROPELLER.

(Application filed Sept. 23, 1901.)

(No Model.) 4 Sheets—Sheet 3.



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REVERSIBLE SCREW PROPELLER.

(Application filed Sept. 23, 1901.)

(No Model.) 4 Sheets—Sheet 4.

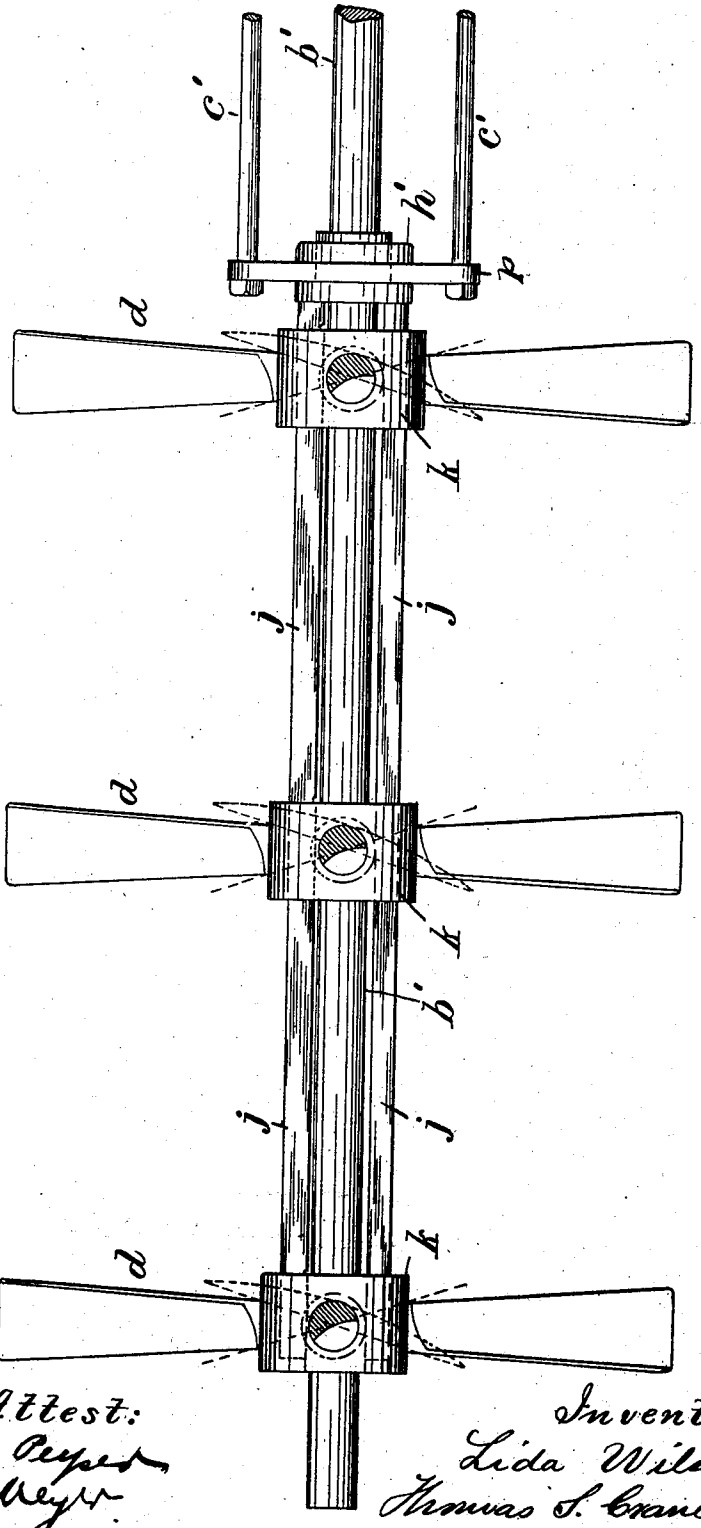


Fig. 11.

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UNITED STATES PATENT OFFICE.

LIDA WILSON, OF BROOKLYN, NEW YORK.

REVERSIBLE SCREW-PROPELLER.

SPECIFICATION forming part of Letters Patent No. 700,278, dated May 20, 1902.

Application filed September 23, 1901. Serial No. 76,271. (No model.)

To all whom it may concern:

Be it known that I, LIDA WILSON, a citizen of the United States, residing at Pierrepont House, Montague street, Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Reversible Screw-Propellers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to provide an improved construction in that class of screw-propellers provided with shifting blades by which the angles of the blades relative to the shaft may be changed when the propeller-shaft is either at rest or in motion, so as to alter, retard, reverse, or stop the motion of the vessel propelled, and the invention includes means for shifting simultaneously the blades of several propellers upon the same shaft. Such shifting blades are especially useful where the propeller-shaft is rotated by a turbine, rotary, or other engine having considerable momentum or otherwise so constructed that it cannot be readily or quickly reversed, as the shifting of the angle of the blades on their seats relatively to the propeller-shaft permits the movement of the propeller-shaft to be continuously in the same direction, whether driving the vessel at full speed ahead or astern, and also operates to reduce the speed of the vessel when the blades are placed in an intermediate position or to resist its movement in either direction when the blades are so placed as to revolve in a circular plane.

In this construction the foot of each propeller-blade is formed with a circular flange and held movably upon a flat seat formed on the hub of the propeller by a suitable collar, and the construction of the parts which embody the present invention will be understood by the following description.

The drawings illustrate a propeller having four blades and a hub having four sides to form the flat seats for the circular flanges, and the collars are shown divided upon the center of each seat, but all connected together, so as to form a continuous ring around the hub. The center of the foot is provided with a strong steady-pin fitted into a hole in the hub to steady the foot in its turning movement upon the seat. A part of each of the flanges is provided with teeth, and the ring which forms the collar is provided with passages through which racks may be projected parallel with the shaft to engage the said teeth, and the racks are all connected with a sleeve fitted to the exterior or interior, or both, of the propeller-shaft and which serves to move all the racks and cause all the propeller-blades to turn simultaneously through the desired arc of movement. One or more projections are formed upon the foot of the blade and the collar or hub to confine the turning of the blade upon the hub within the extreme desired limits and to hold the blade in position when at such extremes. The sleeve attached to the racks is moved fore and aft upon the propeller-shaft by a shifting bar inside it (if the propeller-shaft is hollow) or by any convenient system of levers and connections attached to the hull of the vessel outside the propeller-shaft and clear of the screw-propeller. Such system of levers or the shifting bar inside the hollow propeller-shaft may (according to their size) be worked by hand or by means of mechanical power, and if by power I prefer to employ a hydraulic ram having the proper length of cylinder and piston travel necessary to move the racks the precise distance required to rotate the propeller-blades to the required degree. The projections which limit the movement of the blade upon the collar or hub operate to firmly sustain the blades when they are turned to their extreme positions, and the hydraulic or other agency used to rotate the blades serves to hold them securely in any intermediate position.

In case the propeller-shaft be hollow and the screw-propeller is fitted near the outer end of the shaft, the sleeve which carries the racks may be fitted both within and outside the shaft and extended beyond the end of the same into an outer bearing to assist in supporting the shaft and from such extension to receive and support the racks; but in case the propeller-shaft has one or more screw-propellers disposed at one or more intermediate point or points of its length between the hull and outer end of the propeller-shaft the sleeve is placed around the outside of the shaft close to the first inboard

or nearest to the hull screw-propeller and moved fore and aft on the propeller-shaft by suitable means. In such latter case the sleeve is preferably formed with an annular groove and provided with a yoke surrounding and working in said groove, by which to move and hold the sleeve in any desired position. In such a case I prefer to actuate the yoke by two shifting bars extended along and near to the propeller-shaft, at opposite sides thereof, and carried through the hull in stuffing-boxes into the vessel, where the power may be applied to such shifting bars to move the sleeve in the desired manner.

In cases where there are several intermediate screw-propellers the movement of the racks on those astern of the first inboard propeller may be communicated to them by extending the racks from said first inboard propeller to engage with the teeth on the flanges of the blades of the propellers farther astern. This means of operating the sleeve is convenient for use with solid propeller-shafts and with hollow shafts driven by reciprocating engines.

It is obvious that a variety of mechanism may be used, as shafts provided with cams, eccentrics, levers, and gears, to move the sleeve in the manner described and that such mechanism may be arranged to operate through and along the hull of the vessel or from the rudder-post by levers or gearing supported thereon; but I have shown in the accompanying drawings only the means for moving the sleeve by shifting rods parallel with the interior and with the exterior of the propeller-shaft, as these are the simplest constructions and least exposed to derangement; but my invention embraces any equivalent mechanism.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 shows the stern of a vessel with three propeller-shafts and propellers upon two of the same, provided with means for turning the propeller-blades upon their hubs. Fig. 2 is an end view of the propeller-hub collars, showing the side next to the propeller-shaft. Fig. 3 is a plan of the hub, the collars and a part of the propeller-shaft, with the propeller-blades entirely removed. Fig. 2^a is an end view of the ring forming the divided collars as the same is represented in Fig. 11, and Fig. 3^a is a plan of the same separated wholly from the propeller shaft and hub. Fig. 4 shows the inner end of the rack-bars with the head of a sleeve adapted to fit within a hollow propeller-shaft. Fig. 5 is a side elevation of the end of a propeller-shaft, with a sleeve fitted upon the exterior of the same and provided with the rack-bars. Fig. 6 is a front view of the yoke for shifting such sleeve. Fig. 7 is an end view of the propeller hub and shaft with the collars which hold the blades upon the hub, and one of the propeller-blades secured thereby, with the adjacent collars in section upon the center line. The sleeve is shown in section at the outer end of the hub and the head of the sleeve removed. Fig. 8 is a longitudinal section of the propeller shaft and hub with the collars and two of the blades secured thereby and one of the blades broken for want of room upon the drawing. Fig. 9 is a plan of the propeller shaft and hub with the collar and the shank of the blade in section at the outer side of the rack-bars, and Fig. 10 shows one of the propeller-blades viewed from the outer end. Fig. 11 is a diagram showing three propellers with their blades controlled by the same racks.

a designates the hull of the vessel, *b* a central propeller-shaft, and *b'* and b^2 side propeller-shafts.

The propeller C upon the shaft *b* in this figure is shown provided with a sleeve projected from the end of the shaft to turn the propeller-blades, and the propeller C' upon the shaft *b'* is shown provided with a sleeve *h'*, fitted to the exterior of the shaft behind the propeller to turn the propeller-blades. A shifting bar *c* is extended through the shaft *b* to operate the head *i* of the sleeve *h*, which carries the rack-bars for turning the blades upon the propeller C. Two shifting bars *c'* are shown adjacent to the shaft *b'* and connected with a yoke *m* for shifting the sleeve *h'* upon said shaft. No propeller is shown upon the shaft b^2, as it may be provided with the same appliances as the shaft *b* or as shaft *b'*.

Referring to Figs. 7, 8, and 9, the propeller-blades are designated *d*, their necks or shanks *e*, and their base or foot is shown provided with annular flange *f*. The shank *e* is flared outwardly to the blade from the flange *f*, so as to strengthen it and the hold of the collar thereon. The hub *g* of the propeller is shown with four flat sides forming seats to receive the bases of the propeller-blades, and the center of each seat is formed with a hole to receive a steady-pin *f'*, projected from the center of the base or foot of the blade. A collar *k* is fitted to each of the seats upon the hub and recessed internally to embrace the flange *f* and the flaring shank *e* of the propeller-blade and operates in conjunction with the steady-pin *f'* to firmly secure the propeller-blade upon the hub, while permitting the blade to be turned thereon. A portion of each of the flanges *f* is provided with teeth, as shown in Fig. 9, and a rack-bar *j* is extended along the side of the flange parallel with the shaft *b* and fitted to said teeth to turn the flange and its attached blade. The collars are greatly strengthened in their connection with the hub by their union to one another over the corners of the hub, and the series of collars constitute a ring with a circular exterior and square or other polygonal opening in the center which fits upon the hub snugly. Such ring will be termed the "collar-ring" herein. One rack-bar *j* is required to turn each propeller-blade, and four rack-bars are shown in Fig. 7 movable upon the corners of the hub *g* and fitted through slots *l*, which are

formed in the collar-ring, to guide and hold such bars. The propeller-shaft *b* is shown hollow, and a sleeve *h* is shown fitted to the bore of the shaft *b* near its end within the hub *g*, and such sleeve is formed with a head *i*, to which the rack-bars *j* are attached. The rack-bars *j* and the sleeve *h* may be formed integral with the head in a single casting; but I have shown the rack-bars *j* provided with round shanks k^3 and bolted to the head by nuts k^4, as shown in Fig. 9. A stud *s* is shown fixed upon the shank of each of the blades, and a segmental recess *t* is provided in each of the collars of sufficient length to permit the turning of the shank through the desired arc, but to arrest and hold the propeller-blades *d* at the two extremes of such arc movement, which are indicated by dotted lines *d* in Fig. 9. The stud *s* and recess *t* form contacting surfaces, which not only limit the arc movement of the propeller-blade, but serve to sustain it there when in operation, and thus relieve the rack-bar from strain at such times. The rack-bar *j* is shown of angle shape in cross-section, (see Fig. 7,) and one wing of each angle is smooth as it passes by one side of the flange *f*, which is unprovided with teeth, while the other wing of the rack-bar is made a little wider and is formed with teeth to engage the toothed flange *f*, Fig. 9.

In Fig. 8 the sleeve *h* is shown drawn forward by its shifting bar *c*, so that the head *i* touches the end of the hub and turns the blades into one of their extreme positions, while the sleeve is shown in Fig. 9 pushed outwardly and the flange *f* turned so as to shift the blade to its opposite extreme position. It is obvious that the movement of the shifting bar *c* may serve to move and hold the blade in any position intermediate to its two extremes, and it is also obvious that when the blade is set in the central position between the said extremes it would neither propel the vessel forward nor backward, but operate, even when revolving, as a brake to the motion of the vessel.

The shifting bar may be actuated and controlled by any suitable means, a hydraulic cylinder *q* being indicated in diagrammatic form in Fig. 1, with a piston-rod *q'* connected and coupled to the shifting bar *c*. The proportions of the cylinder may be such that the movement of the piston is restricted to the same distance that the bar *c* is required to travel, and the full actuation of the piston thus turns the propeller-blade on the hub from one extreme of angle relatively to the shaft to the other.

An index is indicated by an arrow *p'*, adjacent to the hydraulic cylinder, and marks upon the bar *c*, which coincide with the arrow-head when the blades are in their respective extreme positions, and the angle or position of the blades on the hub can thus be ascertained by such index.

The actuation of the sleeve *h* and the connected rack-bars by a single shifting-bar *c* can be effected where the propeller-shaft is hollow; but where the shaft is solid the sleeve may be fitted to the exterior of the shaft, as shown at *h'* in Figs. 1, 5, and 11, where the sleeve is formed with an annular groove *o*, adapted to receive a yoke *p*, which can be moved by any suitable means, as by the two shifting-bars *c'*, which are extended parallel with the propeller-shaft to the inside of the vessel, where they are shown connected by an auxiliary yoke *p'*; but both bars may be extended to the source of power, and thus actuated simultaneously. Such yoke or bars are readily actuated by any suitable means and serve to operate and control the propeller-blades the same as the single rod *c*. The yoke *p* and rods *c'* do not revolve with the propeller-shaft; but the sleeve *h'* revolves with the propeller C', and as the sleeve is fitted to the exterior of the propeller-shaft it may obviously be applied to the shaft at any point in its length where the propeller-hub is secured. The sleeve *h'* forms what may be termed an "inboard" connection to the bases of the propeller-blades, while the sleeve *h* and its head *i* form what may be termed an "outboard" connection, as *h'* operates upon the forward side of the propeller, and the other, *h*, upon the stern side.

Fig. 11 shows a means of actuating the blades upon several propellers by the same set of rack-bars, the bars being extended from one propeller-hub to another through the slots *l* of the collars *k*, and thus turning all the blades upon the series of propellers simultaneously. In this figure three propellers are shown with the rack-bars connected to an inboard sleeve *h'*, fitted to the exterior of the propeller-shaft and actuated by rods *c'*, as described above; but it is obvious that the racks can be extended in an opposite direction from an outboard sleeve carrying the head *i* and that the blades of all the propellers would be actuated thereby in the desired manner.

The right-hand end of the propeller-shaft *b'* in Fig. 11 is the end nearest to the hull of the vessel, which would be supported in the stern-bearing, and the opposite end is shown extended through the hub of the outboard propeller to be supported in an outboard bearing.

The construction of the collar-ring is shown a little different in Figs. 7 to 9, inclusive, (where the construction does not require the rack-bars to pass entirely through the collar-ring,) and in Figs. 2^a and 3^a and 11, in which the collar-ring is constructed to permit the movement of the rack-bars entirely through the slots or passages *l*. The division of each collar is shown longitudinal or parallel with the axis of the propeller-shaft; but it is obviously immaterial how the collar is divided for application to the shank and flange of the propeller-blade. With the construction shown the different sections are secured to-

gether by bolts k', inserted through lugs k^2 upon the contiguous edges of the section. To strengthen the construction, the sections of the collars upon the adjacent sides or seats of the hub may be formed in one piece with one another, as shown in Figs. 2 and 2^a, and fitted each to one corner of the hub, or they may be formed in halves extending across the hub.

The collar-ring shown in Figs. 2, 3, 8, and 9 is provided at one end with a flange u, which laps over one end of the hub and is secured thereto by a countersunk bolt u', and each of such parts is formed with the longitudinal slot or passage v to receive and guide the rack-bar j.

In Figs. 2^a and 3^a the collar-ring is shown provided at both ends with the flanges u, adapted to lap over both ends of the hub, which construction, in connection with the fitting of the collars upon the seats, engages the collar-ring with the hub upon every side and forms an exceedingly strong and durable support for the propeller-blades.

In Figs. 2^a and 3^a a flange v is projected over the lugs k^2, so as to produce a smoother surface in contact with the water. I have claimed this particular construction of the divided collars; but any other suitable construction may be employed which is suited to hold the base of the propeller-blade securely upon its seat on the hub, so that it is capable of rotation on the said seat through the desired arc.

While I have made a special claim to the shifting-bars c or c' for moving the rack-bars, it is obvious that the rack-bars may be moved fore and aft by any convenient system of levers or other connections, so as to turn the propeller-blades through the desired arc. The reversal of the propelling force is thus effected without material resistance from the momentum of the revolving parts and without stopping or changing the direction of motion of the engine (of whatsoever nature) that may be employed to drive the propeller-shaft.

In Fig. 1 I have diagrammatically indicated by dotted lines the casing of a rotary turbine to turn the propeller-shaft to drive the vessel, and the reversal of the direction of the motion of the vessel is effected while the turbine continues revolving in the same direction, and thus any interruption of its movement or resistance from its momentum is wholly avoided. The same would be true if the propeller-shaft were operated by a reciprocating engine, an electric motor, or any other agent.

It will be understood that the invention may be embodied in various forms which are not shown herein, and in particular it should be understood that the shape given to the base of the propeller and to the collar by which it is secured movably upon the seat of the hub can be made of any desired contour which affords the requisite strength and support.

Having thus set forth the nature of the invention, what is claimed herein is—

1. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having each a base provided with a flange having teeth and fitted to its respective seat, a collar secured upon the seat over each of such flanges, racks extended through the collars parallel with the shaft and engaged with the teeth on their respective several flanges, the propeller-shaft being hollow, and a sleeve fitted within the end of the shaft and having a head attached to the racks, and a shifting-rod attached to and extended from the sleeve through the interior of the shaft to shift the sleeve as required.

2. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having each a base provided with a flange having teeth and fitted to its respective seat, a collar secured upon the seat over each of such flanges, appliances to limit the arc through which the blades can turn on the seat, and racks extended through the collars parallel with the shaft and engaged with the teeth upon their respective several flanges, and means for moving the racks to turn the respective blades upon their seats simultaneously.

3. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having bases with flanges provided with teeth and fitted to their respective seats, and their shanks flared from the flanges toward the blades, a collar secured upon each seat and fitted to embrace the flange and flaring portion of the shank, and racks extended through the collars parallel with the shaft and engaged with the teeth on their respective several flanges, with means for moving the racks to turn the respective blades on their seats simultaneously.

4. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having each a base provided with a flange having teeth and fitted to its respective seat, a collar secured upon the seat over each of such flanges and slotted to admit a rack to engage with the teeth upon its respective flange, racks extended through the collars parallel with the shaft and each rack engaged with the teeth upon its respective flange, a sleeve attached to the racks to shift them simultaneously parallel with the shaft, and stops applied respectively to the blade and to the collar to contact at the extremes of the desired arc turning movement to limit it and to support the blade at such extreme positions independently of the rack.

5. A screw-propeller having a hub with seats thereon, the hub attached to the propel-

ler-shaft, propeller-blades having bases with flanges provided with teeth and fitted to such seats, and their shanks flared from the flanges toward the blades, a collar secured upon each seat and fitted to embrace the flange and flaring portion of the shank, and racks extended through the collars parallel with the shaft and engaged with the teeth on their respective several flanges, with means for moving the racks to turn the respective blades on their seats, a segmental recess in the collar adjacent to the shank and a stud upon the shank to contact with the ends of such recess and limit the arc turning movement of the blade, substantially as herein set forth.

6. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having each a base provided with a flange having teeth and fitted to its respective seat, a collar secured upon the seat over each of such flanges, appliances to limit the arc through which the blades can turn on their seat, and racks extended through the collars parallel with the shaft and engaged with the teeth upon their respective several flanges, and means for moving the racks to turn the respective blades upon their seats simultaneously, each collar being divided and each segment thereof fitted to the flange and shank of its respective blades, the contiguous parts of the divided collar being provided with flanges and bolts for clamping them together and to the hub.

7. A screw-propeller having a hub with seats thereon, the hub attached to the propeller-shaft, propeller-blades having bases with flanges provided with teeth and fitted to such seats, and their shanks flared from the flanges toward the blades, a collar secured upon each seat and fitted to embrace the flange and flaring portion of the shank, and racks extended through the collars parallel with the shaft and engaged with the teeth on their respective several flanges, and means for moving the racks to turn the respective blades on their seats simultaneously each collar being divided and each segment thereof fitted to the flange and shank of its respective blades, the parts of the collars between and bearing on adjacent blades being formed in one piece and fitted to the hub, the respective flanges and shanks, and the contiguous parts of the divided collars being provided with flanges and bolts for clamping them together and to the hub, whereby all the segments are united to one another and to the hub, substantially as and for the purposes set forth.

8. The combination, with a propeller-shaft, of a series of propeller-blades mounted on hubs thereon, each blade having a base provided with teeth, and adapted to be held but capable of turning upon the hub, a collar for securing each base upon the hub and slotted to admit racks to engage the teeth upon the bases of the blades, the racks being extended from one screw-propeller to another parallel with the shaft through the slots of the collars, and means for moving the racks fore and aft to turn the blades upon all the propellers simultaneously through the desired arc.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LIDA WILSON.

Witnesses:
L. LEE,
THOMAS S. CRANE.