No. 811,287. PATENTED JAN. 30, 1906.

F. GRAY.

REVERSIBLE PROPELLER.

APPLICATION FILED NOV. 12. 1903.

Fig. 1.

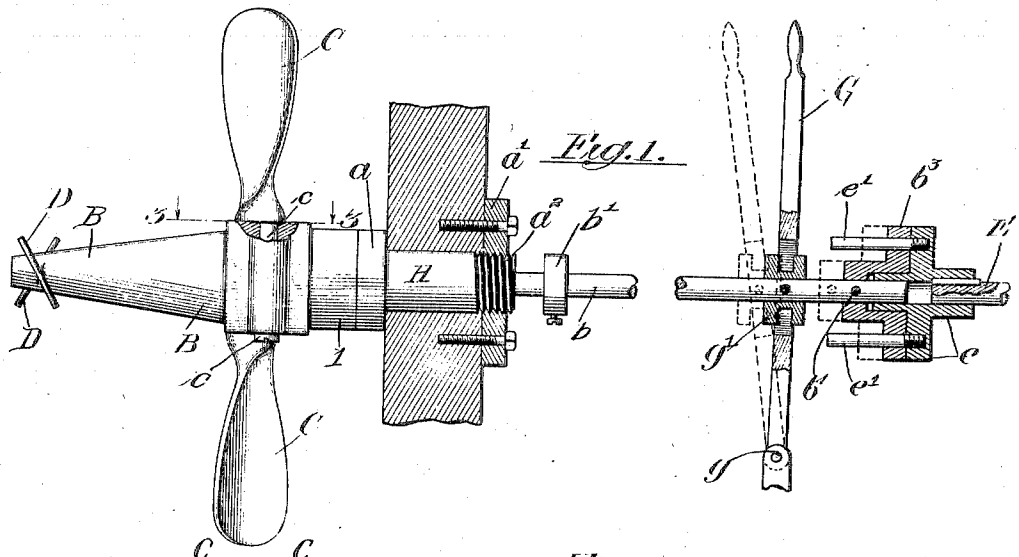


Fig. 2.

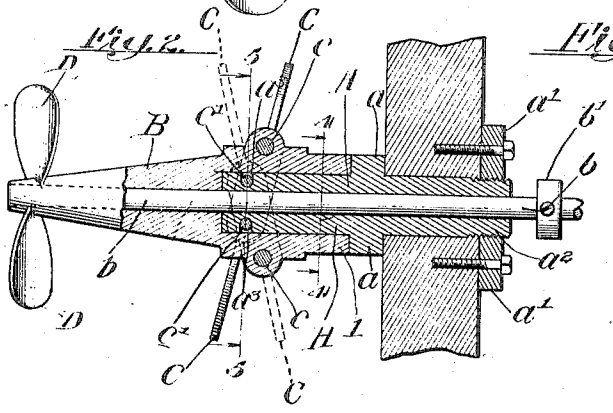


Fig. 3.

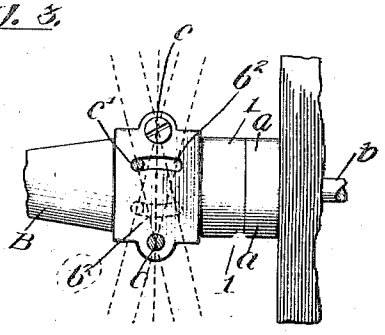


Fig. 5.

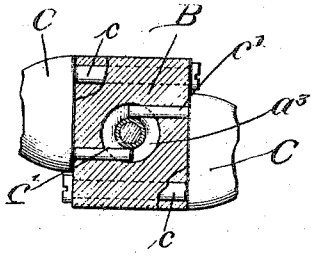


Fig. 4.

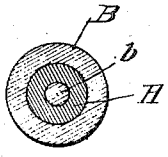
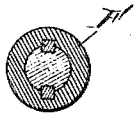


Fig. 6.



Witnesses:

R. Keith Kellen

M. J. McCabe

Inventor:

Frank Gray

By Bakewell & Durand.

Attys.

UNITED STATES PATENT OFFICE.

FRANK GRAY, OF MUSKEGON, MICHIGAN.

REVERSIBLE PROPELLER.

No. 811,287. Specification of Letters Patent. Patented Jan. 30, 1906.

Application filed November 12, 1903. Serial No. 180,801.

To all whom it may concern:

Be it known that I, FRANK GRAY, a citizen of the United States of America, and a resident of Muskegon, Muskegon county, Michigan, have invented a certain new and useful Improvement in Reversible Propellers, of which the following is a specification.

My invention contemplates an improved reversible propeller-wheel adapted more particularly for use in connection with engines which cannot be readily or satisfactorily reversed—as, for example, gas or gasolene engines—it being preferable in boats provided with engines of this type to back the boat by reversing the blades of the propeller-wheel rather than by reversing the motion of the engines.

Generally stated, it is the object of my invention to provide a simple, improved, and highly-efficient reversible construction of propeller-wheel.

A special object is to provide an improved construction whereby the blades of the propeller-wheel may be reversed by longitudinally adjusting the rotary propeller-shaft.

Another object is to provide means, consisting, preferably, of a small propeller-wheel having stationary blades, for governing or steadying the rotation of the propeller-shaft, and particularly for preventing racing of the engine while the boat is running at reduced speed or when the blades of the main propeller-wheel are being reversed for the purpose of backing the boat.

A further object is to so combine a small propeller-wheel with a large propeller-wheel on the same shaft that the tendency toward cavitation or the formation of a cavity in the water around the large propeller-wheel even when running at high speed may be greatly reduced.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a reversible propeller-wheel of this particular character.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of an adjustable or reversible propeller-wheel embodying the principles of my invention. Fig. 2 is a longitudinal sectional view of the said propeller-wheel. Fig. 3 is a detail horizontal sectional view on line 3 3 in Fig. 1. Fig. 4 is a vertical cross-section on line 4 4 in Fig. 2. Fig. 5 is a vertical cross-section on line 5 5 in Fig. 2. Fig. 6 is a cross-section showing a different form of coupling for connecting the propeller-shaft with the engine-shaft.

As thus illustrated, my invention comprises a propeller-shaft bearing A, provided, preferably, with a shoulder a, adapted to cooperate with the clamping-plate a', which screws upon the threaded end a^2 of said bearing in securing the bearing to the boat. Screws or bolts, as shown, can be employed for attaching the plate to the boat. The outer end of said bearing is provided with a circumferentially-extending groove a^3. A head-piece B is secured in any suitable manner to the outer end of the propeller-shaft b, and a collar b' is secured upon the inner portion of the propeller-shaft, the relative arrangement being such that the shaft is capable of a slight endwise play or longitudinal adjustment in said bearing. Reversible or adjustable propeller-blades C are pivotally mounted upon the said head-piece B, the pivotal connection preferably consisting of pins c, secured to said blades and mounted to turn in the sockets in the said head-piece. In addition to these pivotal pins c the reversible blades are provided with smaller pins c', each adapted to engage the groove a^3 in the bearing-sleeve A and each adapted to play in an arc-shaped slot b^2 in the head B. Preferably and as a matter of further and special improvement the outer end of the head B is provided with a pair of small propeller-blades D.

Any suitable arrangement can be employed for connecting the longitudinal or endwise-adjustable propeller-shaft with the engine-shaft E. For example, a flanged coupling or union can be employed, one flange e being secured to the engine-shaft and the other flange b^3 being secured to the propeller-shaft. The flange e can be provided with a plurality of rods or pins e', adapted to extend through and slide in openings in the flange b^3. In this way a rotation of the shaft E causes a rotation of the propeller-shaft, and at the same time the propeller-shaft can be adjusted endwise in its bearing. Fig. 6 illustrates another form of coupling. In this figure the coupling consists of a sleeve F, mounted on one of the shafts and having a splined or sliding-key connection with the other shaft. Either this form or the form shown in Fig. 1 can be employed. In Fig. 1 the flange b^3 is preferably secured to the propeller-shaft by means of a pin b^4, and by making the joints a little loose a coupling of this character is adapted to serve as a universal joint. In

other words, it permits of smooth running and of satisfactory transmission of power from the engine-shaft to the propeller-shaft, even though the two shafts be slightly out of alinement.

Any suitable arrangement can be employed for adjusting the propeller-shaft longitudinally. For example, a hand-lever G, pivoted at g, can be mounted and arranged as shown in Fig. 1. Said hand-lever is provided with an encircling portion having pins adapted to engage the grooved collar g', which latter is keyed to the propeller-shaft. With this arrangement the said shaft can be adjusted longitudinally at will.

The mode of operation is obvious. With the blades C of the main propeller-wheel set as shown in Figs. 1 and 2 the boat is propelled ahead at full speed. The thrust of the shaft is received by the flange or shoulder a, the thrust or pressure being sufficient to provide a practically water-tight joint between this flange or shoulder and the engaging end portion l of the head B. Suppose, however, that it is desired to reverse the motion of the boat. In such case all that is necessary is to simply shift the hand-lever to the position shown in dotted lines in Fig. 1, thereby reversing the angle of the blades C. When the shaft is thus adjusted longitudinally in a rearward direction to an extent to cause the collar b' to bear against the end a^2 of the bearing-sleeve, the groove a^3 acts as a fulcrum-point for the pins c', the rearward thrust of the head B being communicated to the blades through the pins c. These pins c at such time turn in their bearings as the head shifts rearward, the blades practically turning or twisting about the pivotal points coincident with the pins c'. The blades having been thus reversed, the rotation of the shaft and propeller-wheels causes a backward movement of the boat, notwithstanding the fact that at such time the small blades D are acting in opposition to the larger blades C. This, it will be seen, is for the reason that the blades C have a preponderance of surface over the blades D, so that these blades C are capable of backing the boat notwithstanding the opposing pressure or action of the blades D.

The blades D, constituting the small stationary or non-adjustable propeller-wheel, constitute a feature of special improvement. These small blades, which preferably have a greater pitch or angularity than the larger blades, prevent racing of the engine while the boat is going ahead at reduced speed or while the propeller-blades C are being reversed for the purpose of backing the boat. In other words, the blades D insure a constant resistance to the rotation of the propeller-shaft, and with their provision there is no time at which the engine has not some work to do—that is to say, at least enough to prevent the engine from racing. If it is desired to propel the boat ahead at reduced speed, the blades can be adjusted until they stand square and cut through the water without resistance, and at such time the propulsion of the boat will be due entirely to the propelling action of the blades D. These blades D being considerably smaller than the blades of the main propeller-wheel, the boat will of course move ahead at reduced speed. It is also possible with the improved arrangement which I employ to simply reduce the pitch of the blades C by adjusting the propeller-shaft, and in such case a reduced speed is obtained without danger of greatly increased speed on the part of the engine. Again, in reversing the propeller-blades there is of course a period in the adjustment or in the reversing when the blades have no pitch or angularity whatever; but even at such time the engine cannot, owing to the provision of the blades D, race or speed up in an undesirable manner. In other words, the provision of the relatively small propeller-wheel insures at all times a comparatively even and steady action of the engine. Still another beneficial result is obtained by employing the said relatively small and non-adjustable propeller-wheel. I find in practice that this small propeller-wheel rotating in unison with the larger wheel tends to reduce the tendency toward cavitation on the part of the large propeller-wheel and that consequently a higher speed can be given the main propeller-wheel and with less tendency toward cavitation. The small blades D serve to draw the water down around the blades of the large propeller-wheel, even when running at high speed, and it is in this way that the main propeller-wheel can, I find, rotate at high speed with less tendency toward cavitation than would be possible without the smaller wheel. In this way the smaller wheel, rotating in unison with the larger wheel, serves to insure a somewhat greater efficiency on the part of the larger wheel. The blades D of the smaller wheel are, it will be seen, as previously stated, preferably of such character that the pitch is greater than the angle or pitch of the blades C—that is to say, when the reversible blades are set to drive the boat ahead their bevel or angularity is preferably not as great as that of the smaller blades, inasmuch as this arrangement is found to give good results.

Obviously the smaller propelling-blades D have four functions—that is to say, they assist in driving the boat ahead, prevent the engine from racing when the larger propeller-blades C are reversed, serve as the sole means for driving the boat ahead when the larger blades are positioned at right angles to the shaft or without any pitch whatever, and to reduce the tendency toward cavitation around the larger blades. As far as the first

three functions are concerned the small propeller, or the non-reversible propeller, may be located either in front or rear of the larger or reversible propeller, and in regard to the fourth function I find that good results are obtained by placing the small propeller directly in rear of the larger propeller, and, as previously explained, the smaller blades are preferably of greater pitch than the larger blades—that is to say, the faces of the larger blades are preferably always more nearly at right angles to the axis or shaft than the faces of the smaller blades—that is to say, looking at Fig. 2 the blades C are more nearly at right angles to the shaft than the blades D when looking at Fig. 1—and though this arrangement gives good results and may be found preferable it is obvious that other arrangements can be employed without departing from the spirit of my invention.

What I claim as my invention is—

1. A reversible propeller-wheel comprising adjustably-mounted blades, the blades being mounted on an axially-adjustable and rotary head, and a longitudinally-adjustable propeller-shaft supported for rotation and connected for reversing said blades together with a stationary member having an annular groove engaged by portions rigid with the said blades.

2. A reversible propeller-wheel comprising a stationary bearing, a propeller-shaft supported for rotation and endwise adjustment in said bearing, a head secured to said shaft, and propeller-blades adjustably mounted on said head and provided with portions engaging said bearing, together with a stationary member having an annular circumferential groove engaged by portions rigid with the said blades whereby the endwise adjustment of said shaft is accompanied by an adjustment of said blades.

3. A reversible propeller-wheel comprising a stationary bearing, a propeller-shaft supported for rotation and endwise adjustment in said bearing, a head mounted on said shaft, propeller-blades pivotally mounted on said head and provided with projections, said projections being adapted to play in arc-shaped openings in the head and to engage an annular groove in said bearing, and means for manually adjusting said shaft in an endwise direction and thereby adjusting said blades.

4. A reversible propeller-wheel comprising adjustably-mounted propeller-blades, a stationary bearing, and a rotary and longitudinally-adjustable propeller-wheel shaft supported in said bearings and connected for adjusting said blades, there being a pair of shoulders on said shaft, one shoulder being adapted to bear against the bearing when the propeller-wheel is running normally, and the other shoulder being adapted to engage the inner end of the said bearing when the propeller is reversed said bearing having a circumferential groove engaged by portions rigid with the said blades.

5. The combination of a relatively large reversible propeller-wheel, and a relatively small and non-reversible propeller-wheel, the two wheels being mounted one in front of the other.

6. The combination of a relatively large reversible propeller-wheel, and a relatively small non-reversible propeller-wheel, and power-transmitting connections for connecting both wheels with the same source of power.

7. The combination of a plurality of axially-alined propeller-wheels whereof one is provided with propeller-blades reversible independently of and without reversing the blades of another wheel.

8. The combination of a plurality of axially-alined propeller-wheels, whereof one is provided with adjustable propeller-blades, and another is provided with non-adjustable blades having a greater pitch than the adjustable blades.

9. The combination of a plurailty of axially-alined propeller-wheels whereof one is provided with reversible propeller-blades and another is provided with non-adjustable propeller-blades.

10. The improved reversible propeller with reversible and non-reversible blades, substantially as shown and described.

11. The combination of a relatively large propeller-wheel and a relatively small propeller-wheel, the two being axially alined and mounted to rotate in unison in the same direction, the blades of the smaller wheel having a greater pitch than those of the larger wheel, and the blades of the larger wheel being reversible.

12. Means for driving a boat, comprising relatively large reversible propeller-blades, and relatively small non-reversible propeller-blades, substantially as and for the purposes set forth.

Signed by me at Muskegon, Muskegon county, Michigan, this 9th day of November, 1903.

FRANK GRAY.

Witnesses.

KATE MCSHANNOCK.

CHAS. I. GILES.