R. W. BIRKETT.

REGENERATIVE COUNTER PROPELLER FOR MARINE VESSELS.

APPLICATION FILED JAN. 24, 1920.

1,386,835. Patented Aug. 9, 1921.

2 SHEETS—SHEET 1.

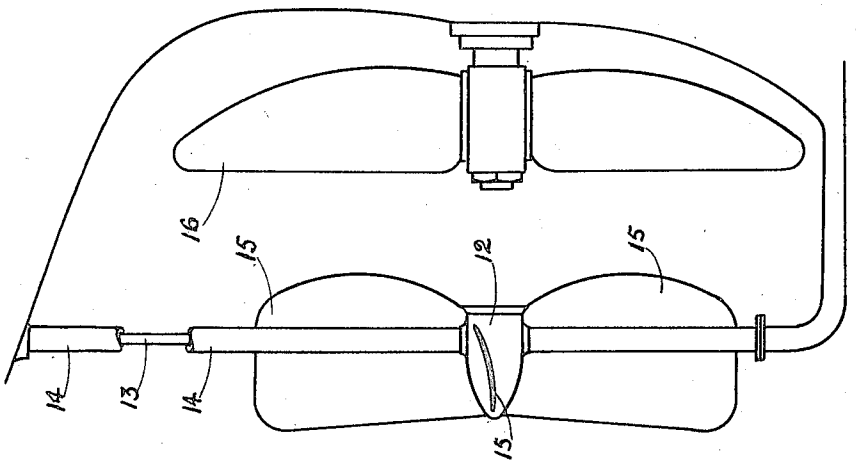

FIG. 3.

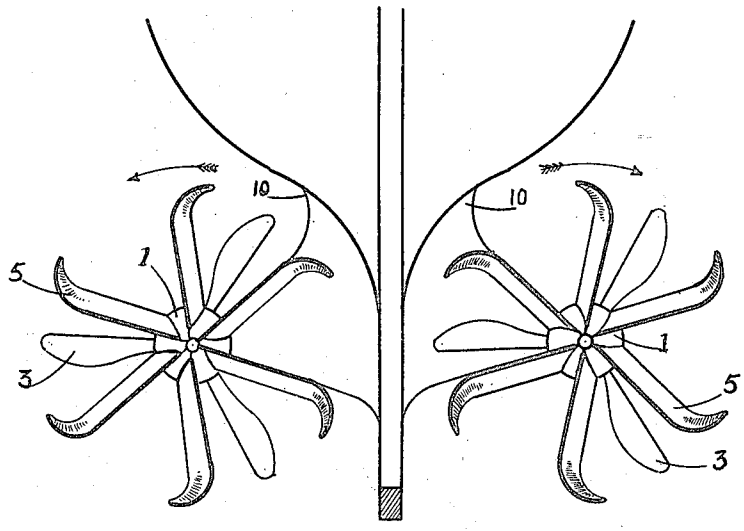

FIG. 2.

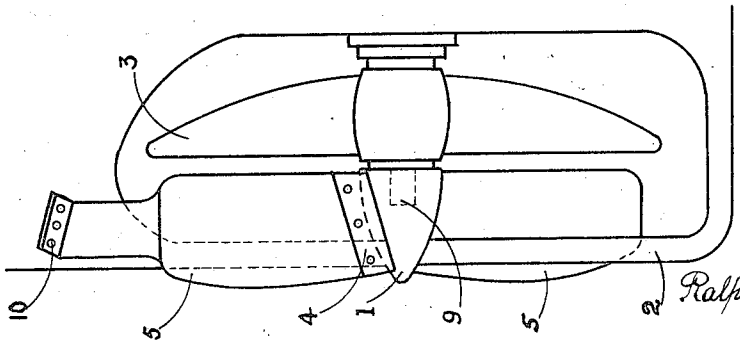

FIG. 1.

INVENTOR.

Ralph Whitehead Birkett.

R. W. BIRKETT.

REGENERATIVE COUNTER PROPELLER FOR MARINE VESSELS.

APPLICATION FILED JAN. 24, 1920.

1,386,835.

Patented Aug. 9, 1921.

2 SHEETS—SHEET 2.

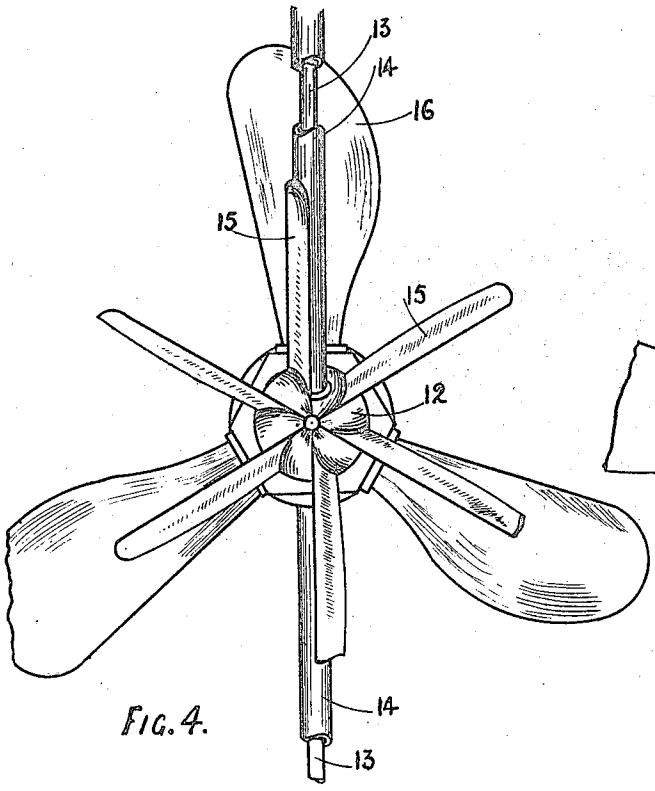

FIG. 4.

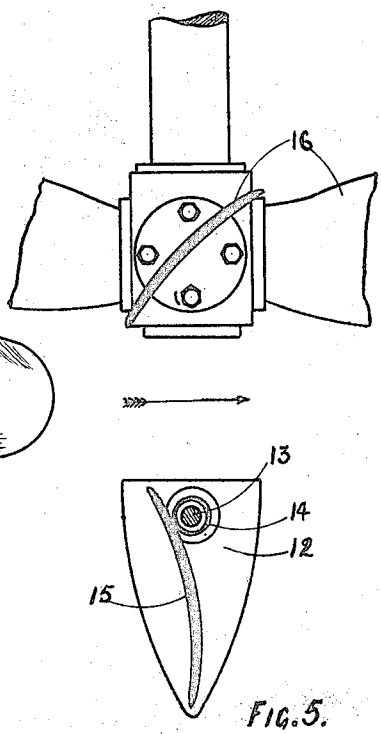

FIG. 5.

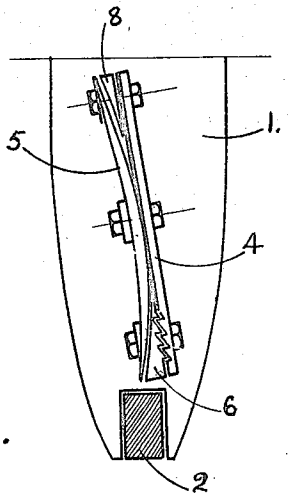

FIG. 6.

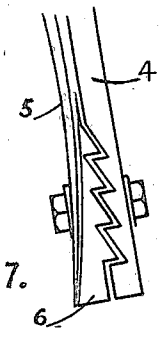

FIG. 7.

INVENTOR

Ralph Whitehead Birkett.

UNITED STATES PATENT OFFICE.

RALPH WHITEHEAD BIRKETT, OF SUTTON, ENGLAND.

REGENERATIVE COUNTER-PROPELLER FOR MARINE VESSELS.

1,386,835. Specification of Letters Patent. Patented Aug. 9, 1921.

Application filed January 24, 1920. Serial No. 353,851.

To all whom it may concern:

Be it known that I, RALPH WHITEHEAD BIRKETT, a subject of the King of Great Britain and Ireland, and resident of Sutton, Surrey, England, have invented new and useful Improvements in Regenerative Counter-Propellers for Marine Vessels, of which the following is a specification.

This invention relates to devices of the order of auxiliary attachments employed in conjunction with screw-propellers for marine craft, which devices have been generically known as "regenerative propellers", or "counter propellers" or "stator propellers".

Such devices are based upon the principle of intercepting or deflecting the currents of water outflowing from a revolving screw-propeller, with a view to increasing the efficiency of thrust or propulsive effect. They consist primarily of blades or deflectors, placed around or in the wake of the propeller, and said blades are usually fitted in a surrounding and supporting casing of tubular form, or are built in a sort of tunnel construction formed in the superstructure of the vessel.

My invention however, differs from such known types, inasmuch as its blades, being stationary, are disposed radially and are mainly supported by a fixed central hub, which hub may in turn be partly supported by an extension of the end of the propeller shaft, or may be attached to the stern frame, while the outer ends of some of the blades may be attached to, or stayed from the superstructure of the vessel. The construction is thus quite open, and there are no encircling casings or tunnel-tubes, thereby eliminating such frictional surfaces, which have been found detrimental in practice.

It is well understood that the angle, in relation to the axis of the propeller and direction of travel of the vessel at which such guiding blades are set, must be carefully selected. Heretofore reliance has been placed upon calculations to determine this angle, or it has been assumed that it must be such that the plane of the reacting surfaces of the counter-propeller blades must coincide approximately to the angle of outflow of fluid from the revolving propeller blades. The angle of the blades being thus determined, the counter-propeller has been so constructed, that the setting of its blades has been unalterable.

As is well known however, the characteristics of the best and most efficient screw propeller for any vessel, can only be approximately arrived at by calculation, and its final determination is a matter for experimental trial; so that it is often found necessary to run trials with several differing designs of propellers, before the most successful for an individual vessel can be finally selected.

Any such necessary modifications will usually involve a modification of the angle of the propeller blades, and when the propeller is to run in conjunction with a counter-propeller, such modification renders necessary a corresponding modification of the angle of the blades of the counter-propeller. Thus in existing practice, it is necessary when fitting a new propeller, also to provide an entirely new counter-propeller to conform to its characteristics, if the best effects are to be obtained from the combination.

Further, the best degree of deflection from the angle of axial outflow from the propeller by the angular setting of the counter-propeller surfaces, may differ from the angle which was assumed, (as this may be influenced to some extent by the pitch and speed of revolution of the propeller) in which case also it becomes desirable to change the angle of the counter-propeller blades, and this can only be done by entirely reconstructing or providing a new counter-propeller fitting.

In order to deal more easily with such varying conditions therefore, my present invention provides, for the first part, for the construction of a hub, or center, and the blades of a counter-propeller, in such manner, that the angle of the reacting surfaces of said blades, in relation to the axial line of the propeller shaft and the direction of travel of the vessel, is variable, in order to obtain the highest propulsive efficiency of the combination, of a screw propeller and a counter-propeller, as described herein.

Secondly, my invention further provides, that the said hub, instead of being rigidly fixed as described, may alternatively be pivoted, or hinged, somewhat in the manner of a steering rudder, in order that the counter-propeller may perform an additional function, in steering, or assisting the steering, of a vessel, by diverting and directing the propulsive jet issuing from the screw-pro-

peller, the jet being then influenced by the counter-propeller blades to flow aft in a port or starboard angle.

My invention is applicable to any vessel obtaining its propulsion from screw-propellers.

In the accompanying drawings:—

Figure 1. is a side-elevation of the stern portion of a vessel, showing its screw-propeller and the first form of a fixed counter-propeller, as provided by this invention.

Fig. 2. is an end view of similar counter-propellers as adapted to twin-screw vessels.

Fig. 3. is a side-elevation of a counter-propeller in the second form, adapted to a single-screw vessel, and pivoted to operate for steering purposes.

Fig. 4. is an end-view of the combination shown in Fig. 3.

Fig. 5. is a plan-view of the same.

Fig. 6. is a plan-view of the boss or hub of the counter propellers, showing (sectionally) one of its blades, and the bracket lug on the boss and manner of attaching the blades to same.

Fig. 7. is an enlarged view of a portion of Fig. 6. showing the adjustable serrated liner or distance-piece interposed to determine the angle of the blade setting.

The construction in Fig. 1. is adapted for single-screw vessels, when it is convenient to secure the hub 1. to the sternpost 2. just aft of the propeller 3. The hub 1. may have a recess formed in its after end (as shown in Fig. 6.) to fit it around the sternframe 2. Upon the periphery of hub 1. are cast, or otherwise formed, the lugs or brackets 4. The plane surfaces or faces of these lugs are straight, but the lugs are set at a slight angle to the axial center-line of the propeller shaft. The blades 5. of the counter-propeller radiate from 1. and are secured at their inner ends to lugs 4., by means of removable bolts or screws, but are not permanently riveted thereto. The outer ends of some of the blades may be extended and secured to the superstructure as shown at 10., to serve as supporting stays for the counter-propeller fitting.

Referring to Figs. 6. and 7., the inner surfaces of brackets 4. may be serrated as shown, to correspond with serrations in the liners 6., the bolt-holes in which may conveniently be slotted to facilitate adjustment. The wedge-shaped distance-pieces 6. are interposed between lugs 4. and blades 5. and their outer faces are curved suitably to fit the curved surfaces of the said blades.

Thus, by varying the distance of insertion of 6., or alternatively by fitting liners of differing thickness or taper, the angle of the setting of blades 5. with relation to the axial center-line of propeller 3., may be varied as desired.

The counter-propeller fitting is held against rotation, and in the types shown in Figs. 1. and 2., is not intended to have any working movement.

Should the curvature of blades 5. be considerable, taper liners of suitable shape would also be fitted as at 8. in Fig. 6.

My design is equally adaptable to multiple-screw vessels, and in Fig. 2., I have indicated one method of fitting, for example, to a twin-screw vessel. The hubs 1. in such cases will be bored out to receive the end of an extension of the propeller shaft as indicated at 9. in Fig. 1. The details of attachment of blades 5. to hubs 1. will be similar to Fig. 6., and some of the blades being attached to the hull as at 10., will give additional support and prevent the counter-propeller rotating.

In the case of large counter-propellers, further staying of the blades to each other might be desired, and the construction shown can easily be so fitted. As I do not consider this essential in all cases, and further, as it is very advisable to keep the space between the blades, and their periphery completely open, and free from all obstructions producing frictional surfaces, I have not shown any such stays on my drawing.

The direction of rotation of the propellers 3. is shown by the arrow in Fig. 2., and it will be observed that each radiating blade 5. is slightly bent, or curved toward the tip in a direction opposite to the rotation of the propeller. This method of construction is sometimes used, but is not essential, and is not claimed as a part of this invention. I have shown an alternative construction with straight blades in Fig. 4., which can be equally used in counter-propellers of the types of Fig. 1. or Fig. 2.

Another modification of my invention is shown in Figs. 3., 4. and 5, which could be adopted in suitable cases, whereby an additional function can be performed by counter-propellers made hereunder.

In this form, while the counter-propeller blades might be made either fixed or adjustable upon the hub, as in Fig. 1. and Fig. 2., the details of support for the hub would be differently arranged. Referring to Fig. 3., it will be seen that the counter-propeller is then not supported by the end of the screw-propeller shaft, as in Fig. 1., but that a space is allowed between the propeller 16. and the counter-propeller fitting. Abaft the propeller 16. a fixed sternpost 13. is shown, which might be specially provided, or, (if the ordinary form of rudder is dispensed with) the usual position for the rudder-post can be utilized. Around this stern-post 13., a hollow shaft or tube 14. is fitted. The post 13. and the tubular shaft 14., pass vertically through hub 12., but 14. is connected to 12. and forms its axle, which is revoluble around 13. Thus, if 14. be extended upward through

the deck of the vessel and be connected to a tiller or other steering-gear, then a partial revolution of 14. in either direction, will have the effect of turning the blades 15. of the counter-propeller to any desired port or starboard angle.

This application of the counter-propeller will enable the vessel being steered by deflection of the outflowing currents from the propeller blades 16, and will give a powerful steering effect, that can be utilized either alone, or in conjunction with an ordinary rudder. It will in fact, constitute in itself a multiple-bladed rudder, steering directly by the power of the propulsive stream, instead of the secondary reaction of the ordinary rudder, while securing also the beneficial action of the counter-propeller in regenerating the otherwise lost energy of the rotatory motion of the propeller currents.

From the foregoing and by reference to the attached drawing it will be obvious that, when the main propellers (3. in Figs. 1. and 2., or 16. in Fig. 3.) are revolved, the outflowing currents of water from their blades, which would normally have a movement in part of circular or spiral character, will as regards such rotatory motion, be broken up, and diverted to flow in an axial direction, by the reactive effect of the angularly disposed blades of the counter-propeller, as shown in sectional plan in Fig. 5. For the reasons previously stated, the angle of incidence of the blades (5. or 15.) has an important influence upon the efficiency of the counter-propeller, and the best angle cannot be absolutely predetermined. As described therefore, one object of my present invention is to provide means, whereby the angular position of the said blades, may be provided to be alterable and adjustable, instead of (as in previous devices of the kind) being fixed and unalterable, in relation to the angle of the propeller blades (3. or 16.). By this provision, the best possible relationship of the angular settings of the revolving propeller blades and the stationary regenerating blades, may be ascertained by actual trials of the vessel, before a permanent, or semi-permanent, fixing of the position of the said counter-propeller blades is decided upon. This object is equally attained by any of the figures shown, and also a secondary object, namely, steering or assisting the steering of a vessel, is additionally attained, when the modified arrangement shown in Fig. 3. is adopted.

It is to be understood further, that the methods above described, and shown in the drawings, are given by way of example only, and that numerous other means may be devised for effecting the objects or combinations stated, all of which means will fall within the scope of this invention.

What I claim is:—

1. In a device of the class described, in combination with a screw propeller, a central hub supported from the structure of a vessel and arranged centrally behind the said screw propeller, a plurality of stationary detachable blades radiating from said central hub, and disposed with their forward edges facing approximately in the direction of travel and secured to said hub and to the structure, with means for readjusting the angular disposition of their plane surfaces to any desired angle in relation to the axial line of the shaft of the said screw propeller.

2. In a regenerative propeller of the class described, in combination with a screw propeller, a central hub having brackets with straight plane faces on its outer surface, intermediary liners, said liners having one surface straight and fitted against said bracket faces and their outer surface curved adaptably to the curved surfaces of detachable radiating blades attached to said hub by bolting through said liners and brackets, with means for adjustably securing said blades with their plane surfaces set in any desired angular position in relation to the axial line of the shaft of the said screw propeller.

3. In a device of the class described, in combination with a screw propeller, a central hub, a plurality of radiating blades attached to said hub and disposed with their plane surfaces approximately parallel to the direction of travel, said hub and blades arranged centrally behind said screw propeller and supported by a vertical tubular axle shaft, said tubular shaft fitted around a vertical solid shaft fixed in the stern structure of a vessel, said axle shaft passing through the forward end of hub and keyed to same and supported at its lower end in a footstep bearing and adapted to be partially revolved for steering purposes so as to turn the said hub and attached blades to port and starboard angles of the vessel's course.

Dated this sixth day of January, 1920.

RALPH WHITEHEAD BIRKETT.

Witnesses:

DOROTHY M. LESSETT,

ARTHUR W. LUNDRIDGE.