Feb. 20, 1962 J. M. A. C. BERGE 3,021,810

RUDDER AND DROP-KEEL CONSTRUCTION

Filed April 18, 1960 2 Sheets-Sheet 1

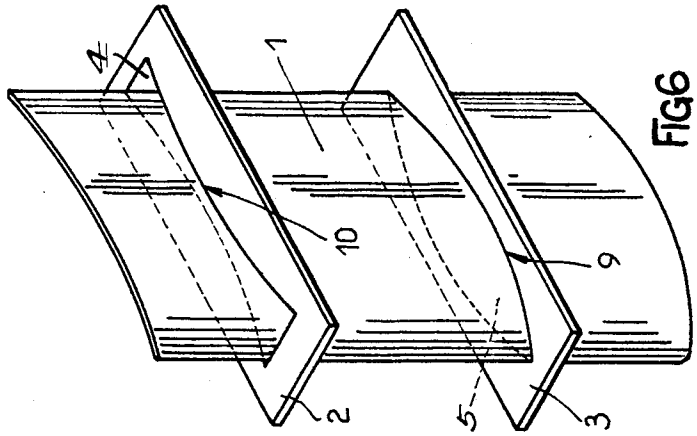


FIG6

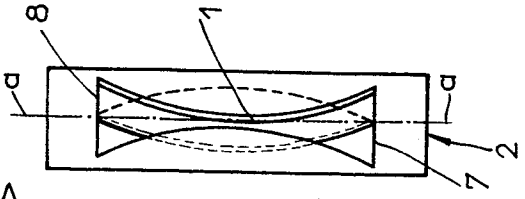


FIG5

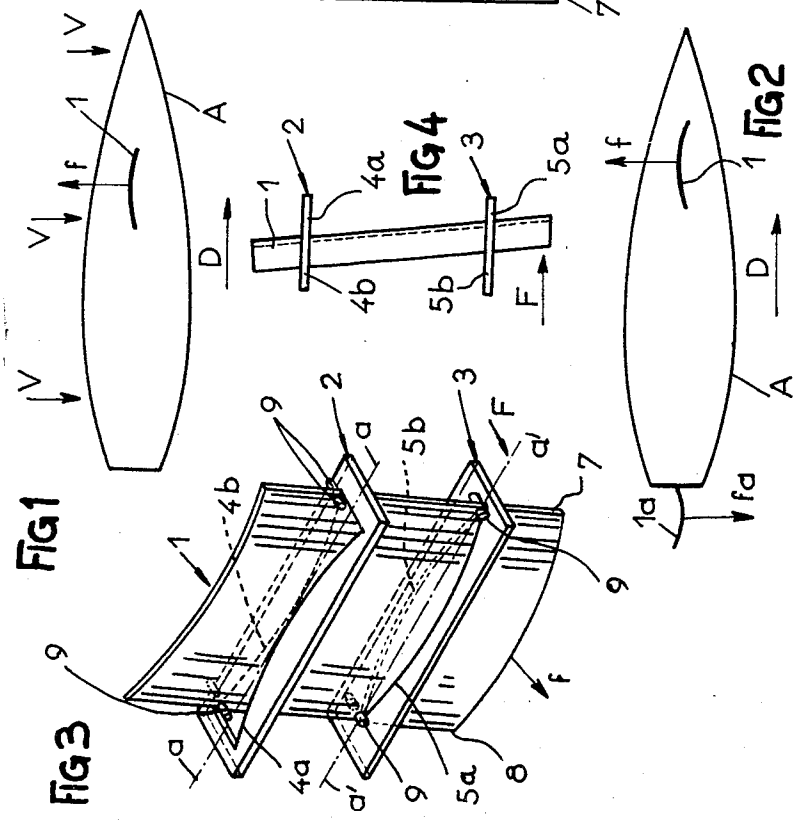


FIG4

FIG2

FIG1

FIG3

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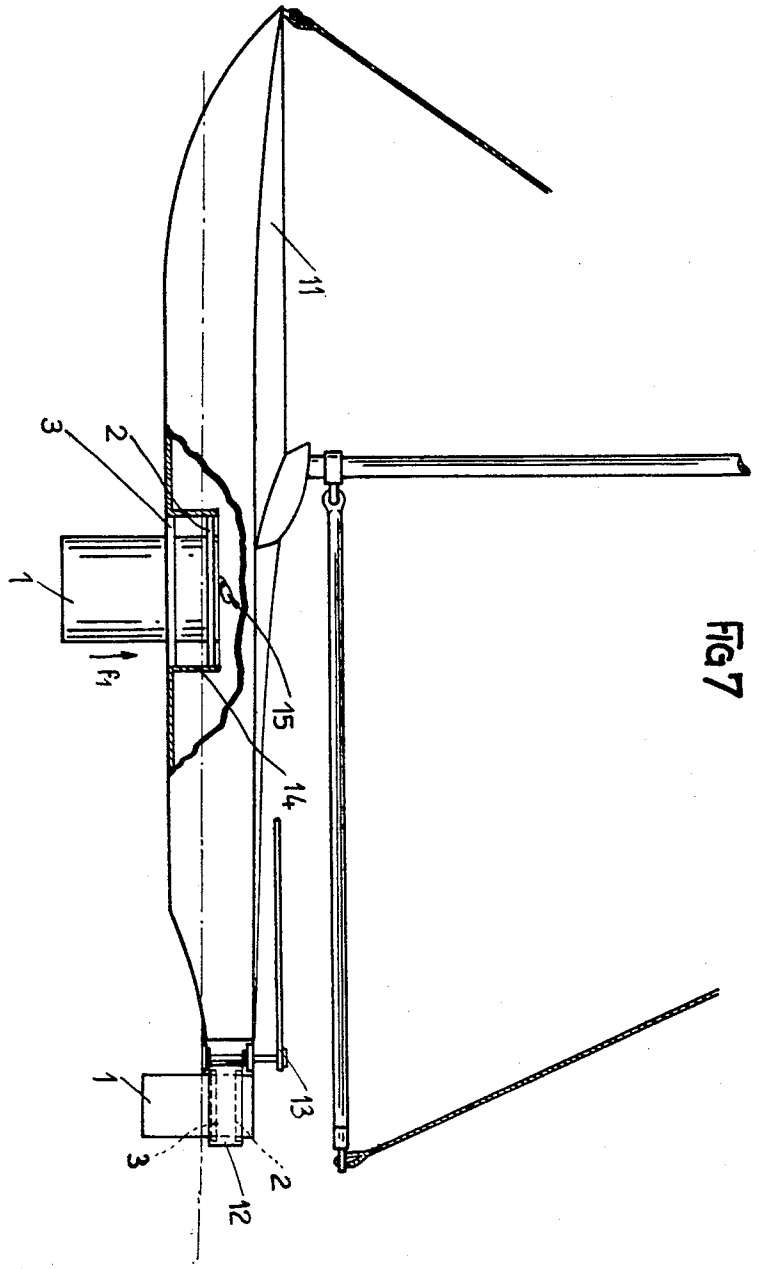


FIG 7

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RUDDER AND DROP-KEEL CONSTRUCTION

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This invention relates essentially to a method of constructing rudders, drop-keels, centre-boards or the like devices for boats, ships and other sea-craft of all types.

It is known that when a curved surface moves within a liquid along a straight line tangent to the centre of said curve, a hydrodynamic force develops which tends to displace the moving surface in a direction at right angles to the aforesaid line toward the convexity of the curve.

This reaction is advantageously applicable to the construction of drop-keels or centre-boards of sailing ships in order to reduce or eliminate sailing drift, and also to the construction of rudders for all types of ships and boats.

A number of drop-keels, rudders and like devices aiming at providing this curvature effect have already been proposed.

It is the essential advantage of the present invention over these existing devices to make it possible to obtain this curvature alternately in one and the other direction and in an entirely automatic manner for both drop-keel and rudder constructions.

It is also known that the reaction pressure applied by the water medium against the immersed surface of a movable drop-keel or the rudder back-piece develops a cantilever force in the upper portion of the drop-keel or rudder back-piece.

Indeed, if we consider the device usually provided for holding in position the drop-keel or the back-piece of a rudder we see that as a consequence of the reaction pressure exerted by the water against the immersed portion of the drop-keel or back-piece a pressure of same direction is applied to the base of the holding device and a pressure of opposite direction is applied to the upper portion of the same holding device.

According to the present invention, advantage is taken of this opposition of forces resulting from the fact that the drop-keel and the back-piece of the rudder are constantly kept in a cantilever condition for producing the desired curvature of the drop-keel and back-piece, this opposition constituting the essential factor utilized by the present invention.

Therefore, it is the object of this invention to provide a method of constructing drop-keels, centre-boards, rudders and like devices for boats, ships and all other seacrafts, which consists in making the drop-keel, centreboard, rudder or like device from flexible or yielding sheet material, fitting this sheet in guide slots having curved edges so directed that said drop-keel or rudder, when they receive the reaction pressure from the water medium, assume a predetermined curved configuration by simple bearing against the edges of said slots.

These slots are formed for example in two bearing strips having the same holding function as a drop-keel shaft or the members holding the back piece of a rudder.

The lower guide slot consists for example of two convex curves and the upper guide slot of two concave curves.

Assuming that under the water-pressure the drop-keel or the back-piece of a rudder bears against the lower slot on the port side, due to the cantilever effort, the upper portion of the drop-keel or back piece will engage the upper concave slot on the starboard side.

Provided that the drop keel and the back-piece of the

rudder are made from a material having a sufficient flexibility, the portion bearing against the convex curve will tend to assume this convex curvature. If the upper bearing strip has an exactly similar concave curvature, it will yield a curved surface having exactly the same curvature along the vertical portion lying between these strips.

As a consequence of the fact that a plane surface becomes rigid in a direction at right angles to a curvature imparted thereto, the curvature thus obtained along a certain portion of its height will tend to develop identically throughout the height of the drop-keel or of the rudder back-piece.

This invention is also concerned with all rudders, drop-keels or like devices for boats, ships and sea-crafts of any description which are arranged in accordance with the method set forth hereinabove, said devices being characterized in that they have a flexible structure and are adapted to co-act with bearing or guide slots formed with curved edges so directed as to cause the device fitted therein to take automatically a curved configuration when it is caused to engage said edges as a consequence of the water reaction pressure.

This invention is also concerned, by way of novel industrial products, with ships, boats and sea-crafts of all types equipped with rudders and/or drop-keels, centre-boards or like devices of the type set forth hereinabove.

Other features and advantages of this invention will appear as the following description proceeds with reference to the accompanying drawing forming part of this specification and illustrating diagrammatically by way of example a few typical forms of embodiment of the invention. In the drawing:

FIGURE 1 is a diagrammatic plane view showing the reaction created in a water medium by a drop-keel arranged in accordance with the teachings of this invention;

FIGURE 2 is a similar diagram showing the combined action exerted on the operation of a ship by a rudder and a drop-keel constructed in accordance with the teachingus of this invention;

FIGURE 3 is a diagrammatical perspective view showing the fitting of the drop-keel of this invention in its guide members;

FIGURE 4 is a lateral view of the drop-keel shown in FIGURE 3;

FIGURE 5 is a plane view from the above also showing the drop-keel of FIGURE 3; and

FIGURE 6 is another perspective view showing an alternate embodiment of the mounting of FIGURE 3.

FIGURE 7 is an elevational side view of a boat having the invention applied thereto.

From the diagram of FIGURE 1 it will be seen that a curved drop-keel 1 emerging from the hull of a boat A receiving a lateral wind-pressure exerted in the direction of the arrows V and sailing in the direction of the arrow D, produces a reaction in the direction of the arrow f which constitutes a drift-counteracting force, that is, a force tending to reduce the drift angle of the boat.

By utilizing the combined reactions f and f_a of a drop-keel 1 and a rudder 1*a* having opposite curvatures (see FIGURE 2) a torque tending to veer the boat may be created.

In the example illustrated in FIGURE 3 a drop-keel, centre-board or rudder constructed according to the teachings of this invention consists of a board or sheet 1 of flexible material such as wood, metal, plastics or other material, mounted by means of supports 2 and 3 and extending therethrough, adequate guide slots 4, 5 being formed in these supports respectively. These supports 2, 3 may consist simply of plates designed for securing the drop-keel and superposed at a suitable relative spacing.

These plates 2 and 3 may be secured one to the other by means of rigid posts or tubes for instance (not shown). The assembly may be mounted within a drop-keel shaft so as to constitute for example the lower and upper walls of said drop-keel shaft. The drop-keel, the width of which corresponds to the length of the slots 4, 5, may slide in said slots and is preferably provided with means such as chains or ropes which allows it to be raised and lowered, just as it occurs with center boards or drop-keels of known type. In the case of a rudder, the supports 2 and 3 may be secured either to the propeller post, or to any other structure solid with said propeller post.

The length of the guide slots 4, 5 corresponds substantially to the width of the drop-keel and these slots are disposed in two horizontal planes, that is, in planes perpendicular to the plane of the drop-keel. Preferably, each slot is of symmetric configuration, its axis of symmetry (a—a or a'—a') being, for example, parallel to/or merging in the longitudinal plane of symmetry X—X of the boat or like craft. The opposite edges of a same slot constitute two curved lines of same curvature but opposite directions.

The edges of the two slots 4 and 5 which lie on the same side with respect to the plane of the drop-keel have also the same curvature but in opposite directions. Thus, the slot 4, as shown, has the contour of a bi-concave meniscus and the other slot 5 has substantially the contour of a biconvex meniscus (see FIGURE 3).

As illustrated in FIGURE 2, with this arrangement the drop-keel, under the influence of the water-pressure F, will be capable, by bearing with its upper portion against the edges 4b and 5a of slots 4 and 5 positioned on either side of the plane of the drop-keel, to take automatically a curved shape corresponding to the curvature (of same direction) of the edges 4b and 5a of these slots.

Due to its curvature, the drop-keel creates a reaction f of the type set forth hereinabove which is of same direction as F and tends to counteract the drift resulting from the lateral wind-pressure. This reaction f may be equal to or greater than F, so that the boat driftage will be neutralized.

If the water-pressure is opposite to this direction F, the drop-keel 1 will take a position symmetrically opposite to the position just described with respect to the common plane of symmetry of slots 4, 5 which intersects their centre lines a—a and a'—a', in order to bear in this case against the other edges 4a and 5b of slots 4 and 5 respectively, thereby imparting a curved configuration but of opposite direction to the drop-keel 1.

The plate or sheet constituting the drop-keel 1 may be simply threaded through the slots 4 and 5 and held at its upper end on the supporting plates 2 and 3 by simple means such as lugs, studs, projections or the like provided on these leading and trailing edges 7, 8, respectively, as shown diagrammatically at 9. Thus, the drop-keel may slide vertically in the slots 4, 5 and abut in its lowermost position with its projections 9 against the plate 2 while retaining its freedom to curve or incline itself under the water-pressure F to assume the position and shape illustrated for example in FIGURES 3 and 4.

According to the modified form of embodiment shown in FIGURE 6, different curvatures may be imparted to the edges of the two guide slots, for example a more pronounced curvature may be given to the lower convex guide slot 9 than to the upper concave slot 10. In this case, the curvature effect will increase down to the lower edge of the drop-keel or back-piece of rudder 1. If on the contrary, the curvatures of the lower slot are less pronounced than those of the upper slot, the curvature effect produced upon the drop-keel or back-piece will decrease down to the lower edge of the drop-keel or back-piece. Therefore, a relatively great number of combinations may be contemplated according to the type of boat and also to the desired results.

Of course, this invention should not be construed as being limited to the specific forms of embodiment shown and described and suggested herein, for many modifications may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

A conventional boat or similar vessel including a hull 11, is indicated in FIGURE 7. This figure shows the device connected to and mounted in the boat hull when it is to be used as a steering means and when it is a drop-keel. When used as a steering means the device is mounted in a hollow supporting box or case 12 secured to the rudder guide bar 13. When used as a drop-keel the device is slidably mounted in a drop-keel shaft 14, and is provided at its upper portion with a handle 15 which allows it to be raised and lowered as shown by the arrow f_1.

What I claim is:

1. In a steering means for a seacraft an upper rigid support member and a lower rigid support member substantially parallel to said upper support member, each of said support members having provided therein a slot of symmetrical configuration with curved edges, a plate means fitted in said slots and having on its edges protruding means abutting against said support member, said plate means being made of flexible sheet material whereby said curved edges cause said plate means to assume automatically a curved configuration when it is pressed against said edges by the water reaction.

2. A steering means as claimed in claim 1 wherein the length of said slots corresponds substantially to the width of said plate means.

3. A steering means as claimed in claim 2 wherein the edges of said slots which lie on the same side with respect to said plate means are curved in opposite directions.

4. A steering means as claimed in claim 3 wherein the axis of symmetry of said slots lies in the longitudinal plane of symmetry of the seacraft.

5. A steering means as claimed in claim 4 wherein one of said slots is of concave configuration and the other of biconvex configuration.

6. A steering means as claimed in claim 5 wherein the slot provided in said lower support member is of biconvex configuration and the slot provided in said upper support means is of biconcave configuration.

7. A steering means as claimed in claim 6 wherein the edges of the slot provided in said lower support member have a more pronounced curvature than those of the slot provided in said upper support member.

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