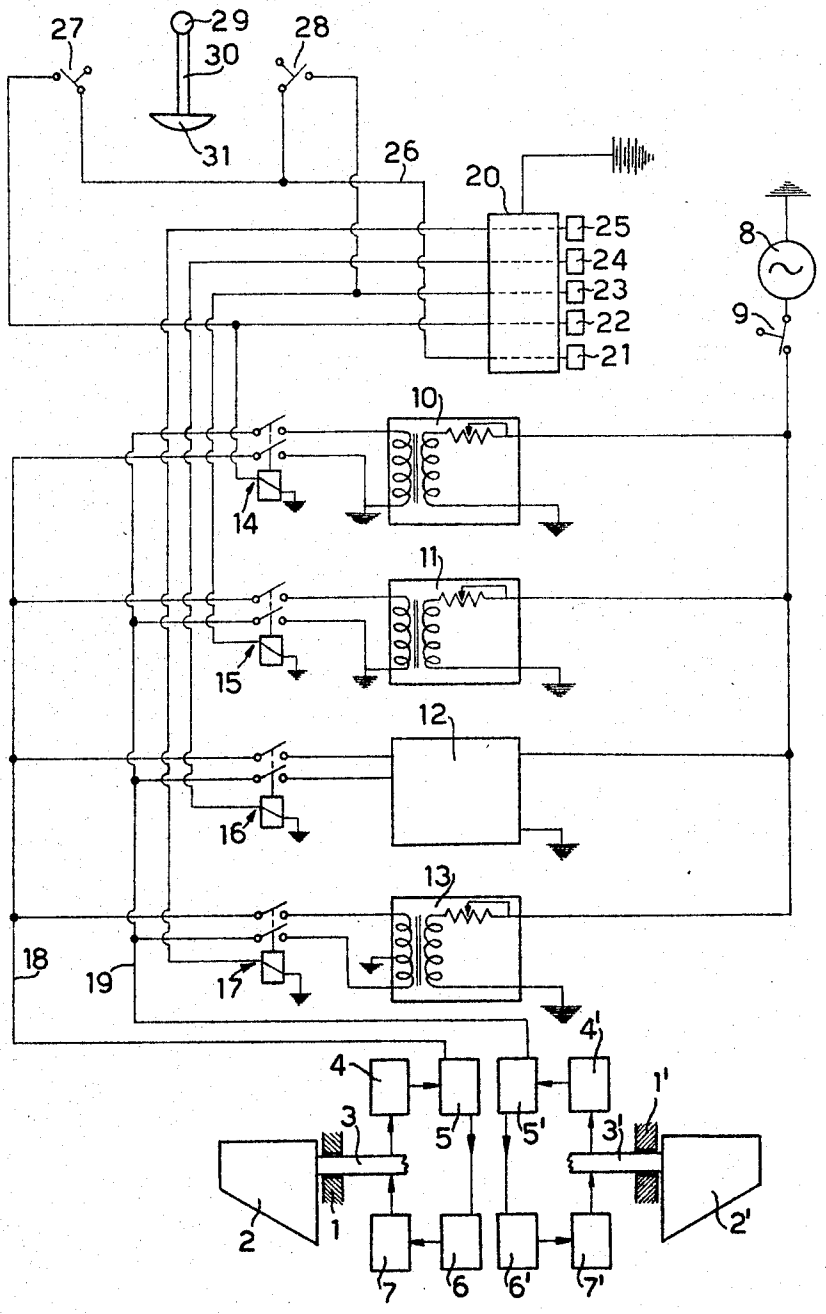
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ACTIVATED-FIN INSTALLATION ON BOARD SHIPS

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ACTIVATED-FIN INSTALLATION ON BOARD SHIPS

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This invention has as its object an activated-fin system on board ships comprising at least one pair of fins, one fin on each broadside of the ship.

Anti-roll stabilization systems for ships are known, which resort to activated fins, i.e. fins jutting from the ship's broadsides and which are automatically controlled to be inclined with respect to the direction of the water threads which impinge on the ship during its displacement along its course, by impressing to the ship the torque which is necessary to counteract the tilting moment induced by the sea waves.

In these systems the overall behaviour of the fins is coordinated by a single centralized control unit, of the kind described, for example, in the copending application No. 440,378 filed March 17, 1965, and which comprises sensing elements of the gyroscopic and accelerometric kind which detect the instantaneous parameters of the rolling movement, as a function whereof they send a signal to a computer unit: this latter, via an electric bridge control station and a servoamplifier, transmits a signal which activates an actuating mechanism acting in turn upon the fins and thus balancing, in every instant, the motional behaviour of the ship. The behaviour of the fins is thus predominantly dictated by the rolling motion conditions of the ship and is such that the movements of the fins positioned on the right-hand broadside of the ship is correlated with that of the fins positioned on the left-hand broadside, so as to provide in every instant and with respect to the axis of rolling of the ship, conspiring torques.

Therefore if, for example, the R.H. fins are rotated so as to impart to the ship a downward thrust, the L.H. fins are rotated so as to impart to the ship an upward thrust.

An object of the present invention is to provide a system adapted to permit the employment of the fins not only as anti-rolling stabilizing means, but also as an ancillary turning means concurrently with the rudder's action and as an ancillary braking means concurrently with the braking action of the propellers.

In order that the first of these objects may be fulfilled, it is essential that the pairs of fins may be enabled to take and to keep, continually, and without being influenced by the conditions of the sea, a trim such as to provide the ship with a constant torque tending to tilt the ship towards the center of the turning path so as to counteract the action of the centrifugal force which would tend, conversely, to tilt the ship towards the outside of said path. In order to make a greater turning speed possible and to decrease the turning radius, the cruising speed being the same, it is convenient to exploit only those fins which are placed internally of the turning path, while leaving in their at rest position those fins which are placed outside: under such circumstances, in fact, the torque about the vertical axis of the ship, induced by the horizontal component of the thrust upon the fin which is internal to the path's curvature, contributes toward the curvature of said path.

In order that a braking action may become operative it is necessary that the two fins of a pair may take simultaneously the same upwardly directed or downwardly directed inclination so as to supply the ship with a vigorous thrust against the motion, by exploiting the horizontal components of the hydrodynamic thrusts.

The activated-fin system of the present invention is of the kind in which each fin of at least one pair of fins provided aboard can be individually actuated by an actuating mechanism controlled, via a servoamplifier, by a signal coming out of an electric bridge control station, and is characterized in that said electric bridge control station receives a signal generated by an apparatus responsive to the hydrodynamic thrust acting on each fin, and a signal emitted by a device selected from a group, common to all of the fins, comprising a device responsive to the ship's rolling motion and whose activation induces a simultaneous and opposite movement of the fins to stabilize the ship, a device whose actuation induces the upward rotation of the fin located on the left-hand broadside of the ship and the simultaneous inactivation of the fin located on the right-hand broadside of the ship, a device whose actuation causes the upward rotation of the fin located on the right-hand broadside of the ship and the simultaneous inactivation of the fin located on the ship's left-hand broadside and a device, whose activation induces the simultaneous and concordant rotation of both fins of the pair, control means being provided for selectively activating each of the aforesaid devices.

An exemplary embodiment of a system according to the invention is described herein, without implying any limitation, reference being had to the accompanying drawing, the single figure of which is illustrative of a circuit diagram for the actuation of the fins of a pair of activated fins installed on shipboard.

In the figure, **1** and **1'** connote the left-hand and the right-hand broadsides of a ship, respectively, **2** and **2'** the L.H and R.H. fin, respectively, **3** and **3'** the shafts which, passing through the ship's broadsides, carry, in a cantilever fashion said fins, controlling the rotation thereof.

Within the ship there is provided, for each fin, a local control unit formed by a thrust- or angle-transducer, **4** or **4'**, according to the stabilization system which is adopted, responsive to the hydrodynamic thrust acting upon the corresponding fin and generating a signal, called actuated control signal, or feedback signal, and by an electric bridge control system **5** or **5'** to which said feedback signal is fed and by which a signal is fed out which, through a servoamplifier **6** (or **6'**, respectively) controls an actuator **7** or **7'** which positions the relevant fin. The actuated-control-, or feedback-signal is compared, within the bridge control station, with a control signal, or ordered lift signal, coming form one of the devices to be subsequently described; the signal emitted by the electric bridge control station consists of the differential between the ordered lift signal and the feedback signal.

The reference numeral **8** connotes an electric generator forming a part of a power supply source which, via a general switch **9** feeds four devices, indicated by the numerals **10**, **11**, **12**, and **13**, respectively. The devices **10** and **11** comprise, each, a transformer to be matched with a calibration potentiometer, a leg of the transformer's secondary winding being grounded. The device **13** is akin to those indicated by **10** and **11** and differs therefrom only in that the secondary winding of the transformer is grounded at the midpoint of said winding. The device indicated by **12** is of a well known construction and comprises the assembly of gyroscopic and accelerometric sensing elements which detect the parameters of the ship's rolling motion converting them into the ordered lift signal causing the ship's stabilization to take place. By the numerals **14**, **15**, **16** and **17** there have been indicated normally open relays whose actuation establishes a communication between the devices **10**, **11**, **12** and **13** and the leads **18** and **19** connected, in turn, to the bridge

control stations 5 and 5', respectively. Every one of said relays is connected via a lead to the distinct push-button of a five-button switch 20, diagrammatically shown in the drawing and fed by a storage battery.

The push-buttons are indicated by the numbers 21, 22, 23, 24, 25, the push-button 22 being connected to the relay 14, the push-button 23 to the relay 15, the push-button 24 to the relay 16, and the push-button 25 to the relay 17. The push-button 21 is connected via a lead 26 to two normally open microswitches 27 and 28 and such that the closure of either microswitch puts in communication the lead 26 with the relay 14, or with the relay 15, respectively. By 29 there has been diagrammatically indicated the rudder's axis to which is keyed a stud 30 with a sliding block 31 which, during the tiller's rotation, is permitted to come into contact with either microswitch 27 or 28 to close it. The five-button switch 20 is of the well known construction in which a push-button, as it is depressed, remains in its lowered position connecting the relevant relay (or the lead 26 in the case of the push-button 21) with the feeding storage battery; by depressing another push-button, the push-button which had been previously depressed is lifted up again to its at rest position thus cutting off the power supply to its respective relay.

Assuming now that the electric generator 8 is active and that the switch 9 is closed, by depressing the push-button 22, the flow of electricity coming from the storage battery connected to the switch 20 is caused to occur towards the relay 14 which closes the circuit between the secondary winding of the matching transformer which is a part of the device 10, and the leads 18 and 19. On the lead 19 there is an electric signal, adjusted by the transformer's calibration potentiometer, such as to cause, via the respective local control unit, the upward rotation of the fin 2', whereas on the lead 18 connected to the grounded end of the transformer's secondary winding, there is no electric signal which implies an inactive condition of the fin 2.

With the fins so positioned, the ship goes through a sharp and quick rightward turn.

By depressing the push-button 23 the push-button 22 is caused to revert to the at rest position and the relay 15 is energized: in a fashion which is very much the same as outlined above, in this case the upward rotation of the fin 2 is caused to occur along with the inactivity condition of the fin 2' so that the ship will turn leftwards.

The push-buttons 22 or 23 are usually depressed only during installation-testing or in quite exceptional emergencies. Usually, when it is desired that the rudder action be aided by the fins for effecting a quick turn, the push-button 21 is depressed: thus the electric current which is on the lead 26 cannot flow on until either microswitch 27 or 28 is actuated and closed by the sliding block 31 rotating concurrently with the tiller about the axis 29.

The mutual positioning of the microswitches, the axis 29 and the sliding block 31 is selected in such a way that either microswitch is closed only after that the tiller has been rotated beyond a preselected angular stroke.

The push-button 21 being depressed, whenever the sliding block 31, with the tiller rotated as to cause a rightward turn to occur, closes the microswitch 27, electric current flows from the lead 26 to the relay 14 energizing the latter and closing it, a sharp rightward turning movement of the ship being the result. Whenever the sliding block 31 closes the microswitch 28 current flows from the lead 26 to the relay 15 and the ship abruptly turns leftwards.

By depressing the push-button 24 the relay 16 is energized and the leads 18 and 19 become connected to the device 12 which sends to the bridge control stations 5 and 5' signals inducing, in a well known way, the simultaneous movement of the right-hand and left-hand fins of the pair of fins in reciprocal directions to give rise to the ship's stabilization, thus attenuating or suppressing the ship's rolling. The device 12 can be of any constructional type as conventionally employed on board ships for suppressing the rolling.

Finally, by depressing the push-button 25 the energization and closure of the relay 17 are caused to occur: through the matching transformer's secondary winding, which is a part of the device 13, a secondary winding which is grounded in its midpoint, a signal of equal magnitude is fed into the leads 18 and 19, which signal, via the respective local control units, induces a simultaneous upward tilting of the fins 2 and 2', the consequence being a braking action against the ship's forward motion. It is obvious that a braking action could also be experienced even though the two fins of a pair should be rotated downwardly, but the upward rotation has been found of particular advantage since the resultant of the hydrodynamic thrust on each fin is split, in this case, into two components, one, horizontal, which induces a direct braking action, and the other, directed downwardly, which induces an appreciable sinking of the hull: the increased draught of the ship forms an exalted dynamic hindrance which contributes toward the braking action.

What is claimed is:

1. An activated-fin system for ships comprising at least one pair of fins, one fin on either broadside of the ship, each actuated individually by an actuating mechanism controlled, through a servoamplifier by a signal coming from an electric bridge control station, characterized in that said electric bridge control station is fed by a signal generated by an apparatus responsive to the hydrodynamic thrust acting upon each fin and by a signal transmitted by a device selected from a group, common to all of the fins, comprising a device responsive to the ship's rolling motion and whose actuation causes the simultaneous opposite movement of the fins for stabilizing the ship, a device whose actuation causes the upward rotation of the fin placed on the left-hand broadside of the ship and the simultaneous inactivation of the fin placed on the right-hand broadside of the ship, a device whose actuation causes the upward rotation of the fin placed on the right-hand broadside of the ship and the simultaneous inactivation of the fin placed on the left-hand broadside, and a device, whose actuation causes the simultaneous rotation in the same direction of both fins of the pair, control means being provided for the selective actuation of each of the devices aforesaid.

2. A system according to claim 1, characterized in that said control means are manually actuatable.

3. A system according to claim 2, characterized in that said manually-actuatable control means comprise means presetting the devices, whose actuation causes the upward rotation of the fin placed on the left-hand broadside and on the right-hand broadside of the ship, respectively and the simultaneous inactivation of the fin placed on the right-hand, and on the left-hand broadside respectively, to be individually and automatically actuated when the tiller is rotated beyond a preselected angular stroke with respect to the straight course direction.

4. A system according to claim 1, characterized in that said simultaneous rotation in the same direction of both fins of the pair takes place in an upward direction.

No references cited.

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