(No Model.) 2 Sheets—Sheet 1.

C. E. EMERY.

APPARATUS FOR REGULATING THE ROLLING AND PITCHING OF VESSELS.

No. 471,212. Patented Mar. 22, 1892.

Fig. 3

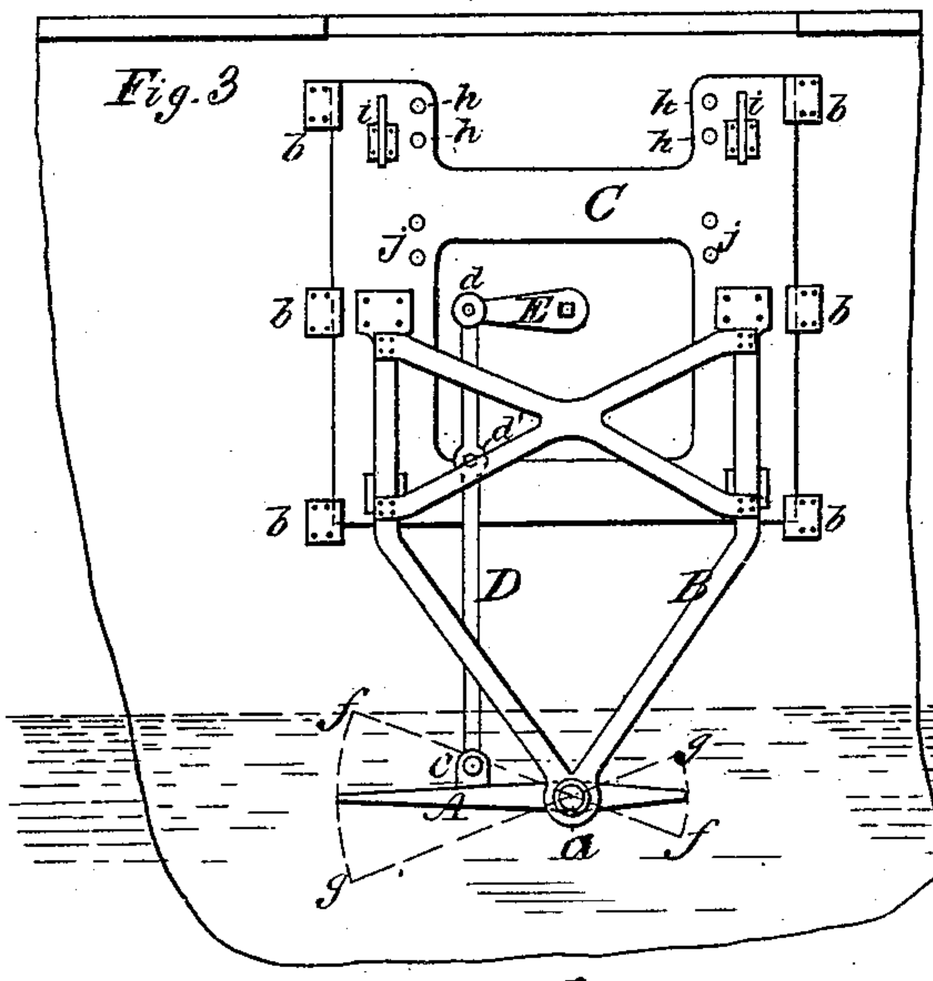


Fig. 4.

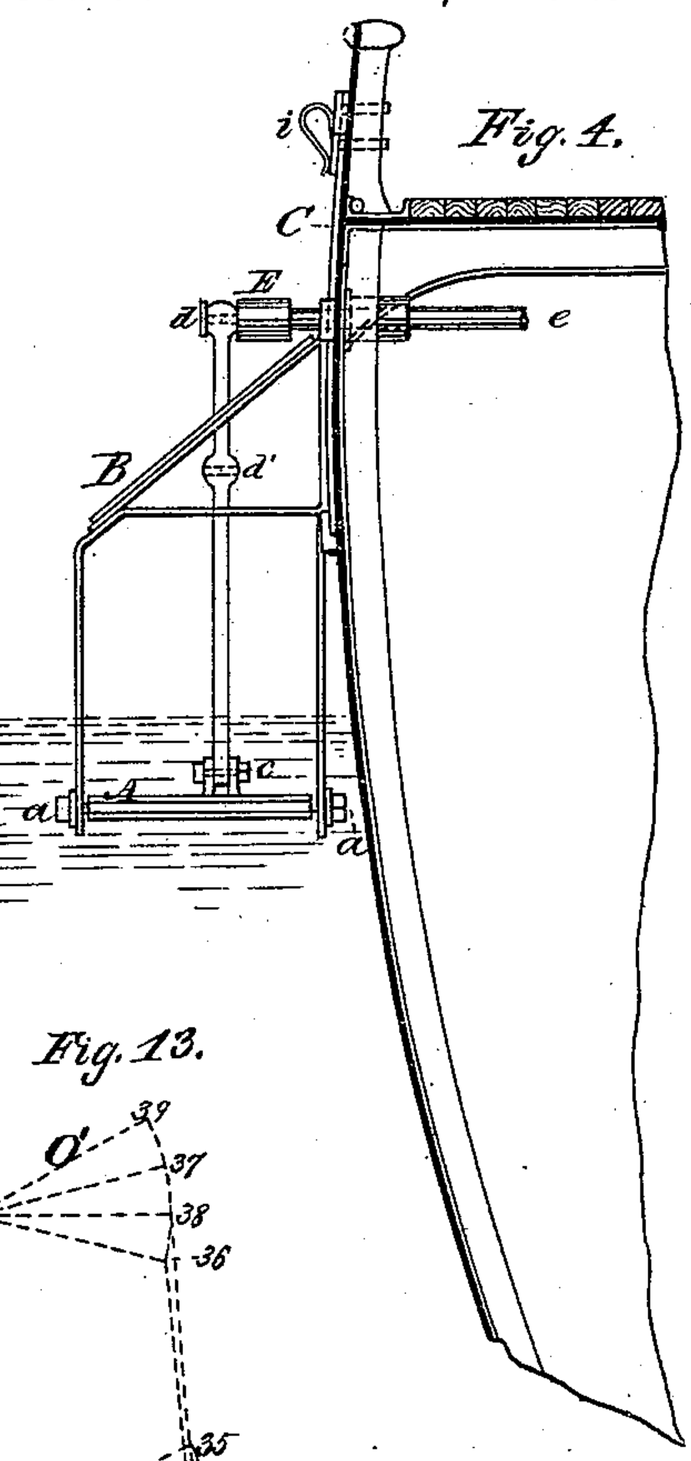


Fig 5.

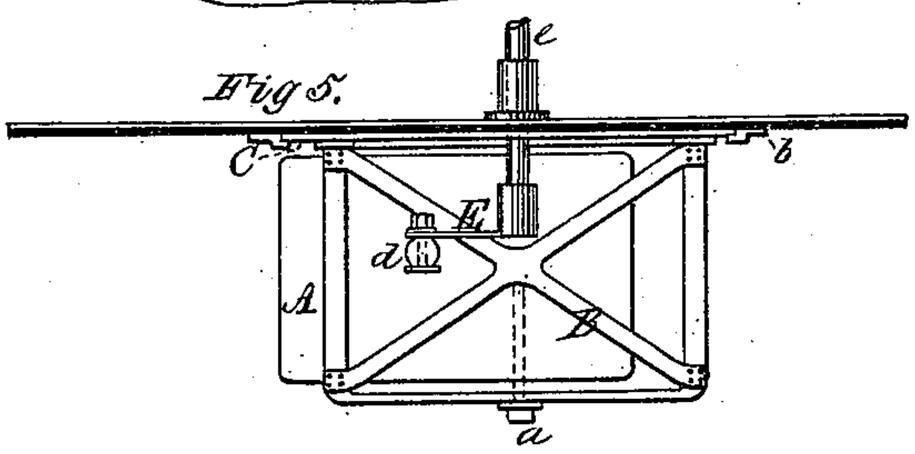


Fig. 13.

Fig. 1.

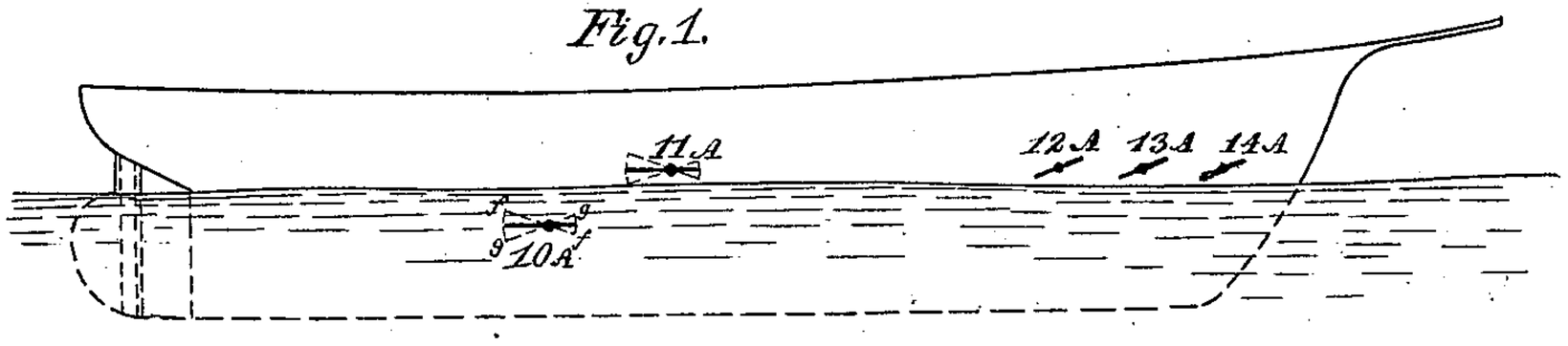
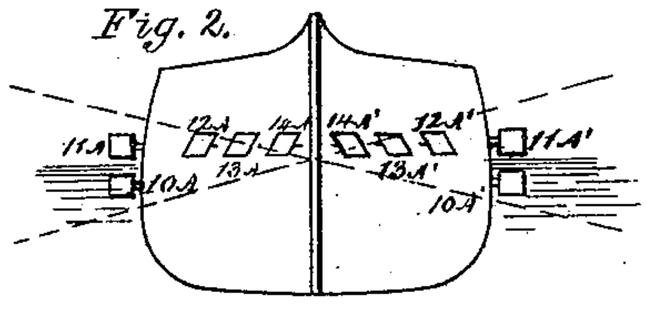


Fig. 2.



Witnesses;

Eugene J. Reilly

George C. Bennell.

Inventor;

Chas. E. Emery.

(No Model.) 2 Sheets—Sheet 2.

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APPARATUS FOR REGULATING THE ROLLING AND PITCHING OF VESSELS.

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Fig. 7.

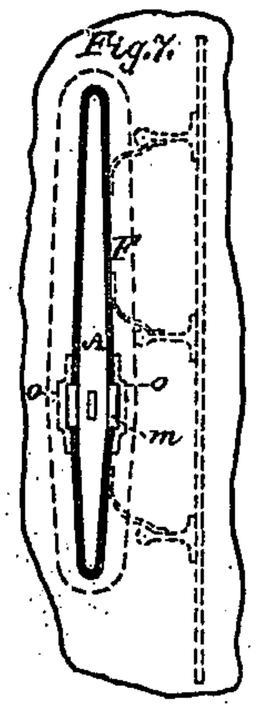


Fig. 6.

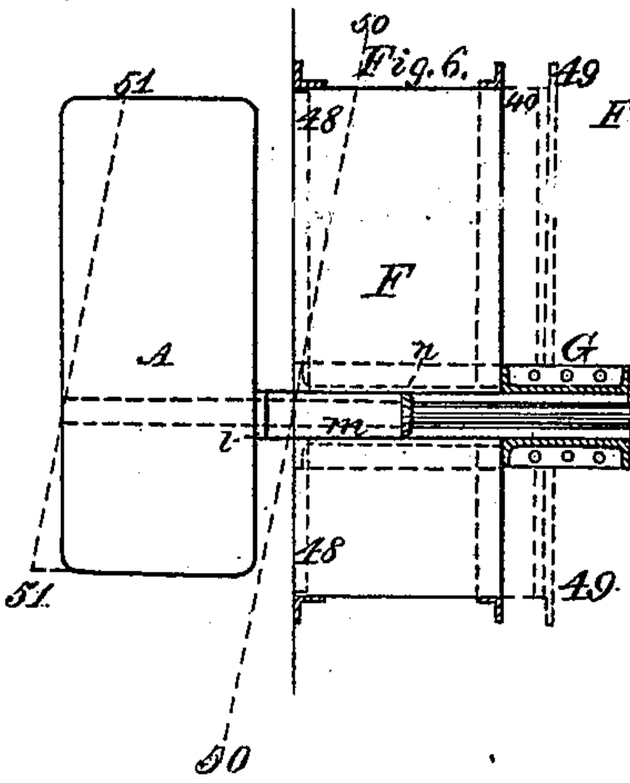


Fig. 14

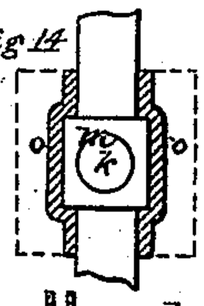
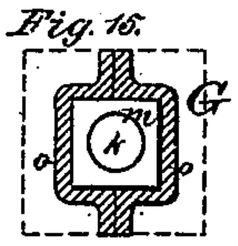


Fig. 15.



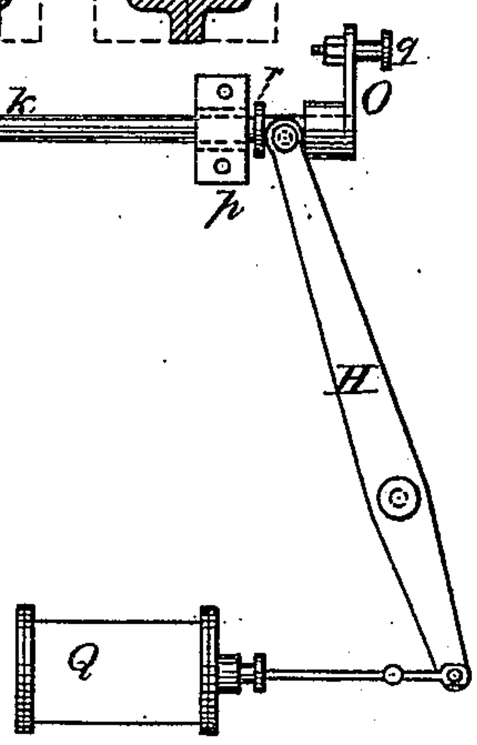


Fig. 12.

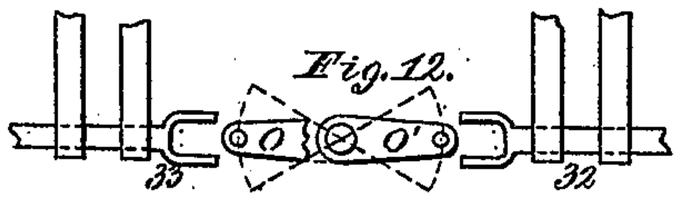


Fig. 11.

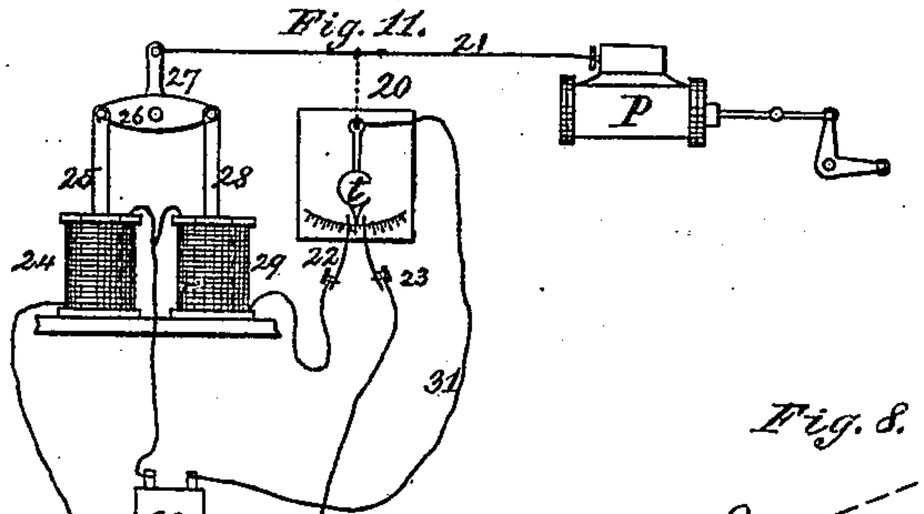


Fig. 8.

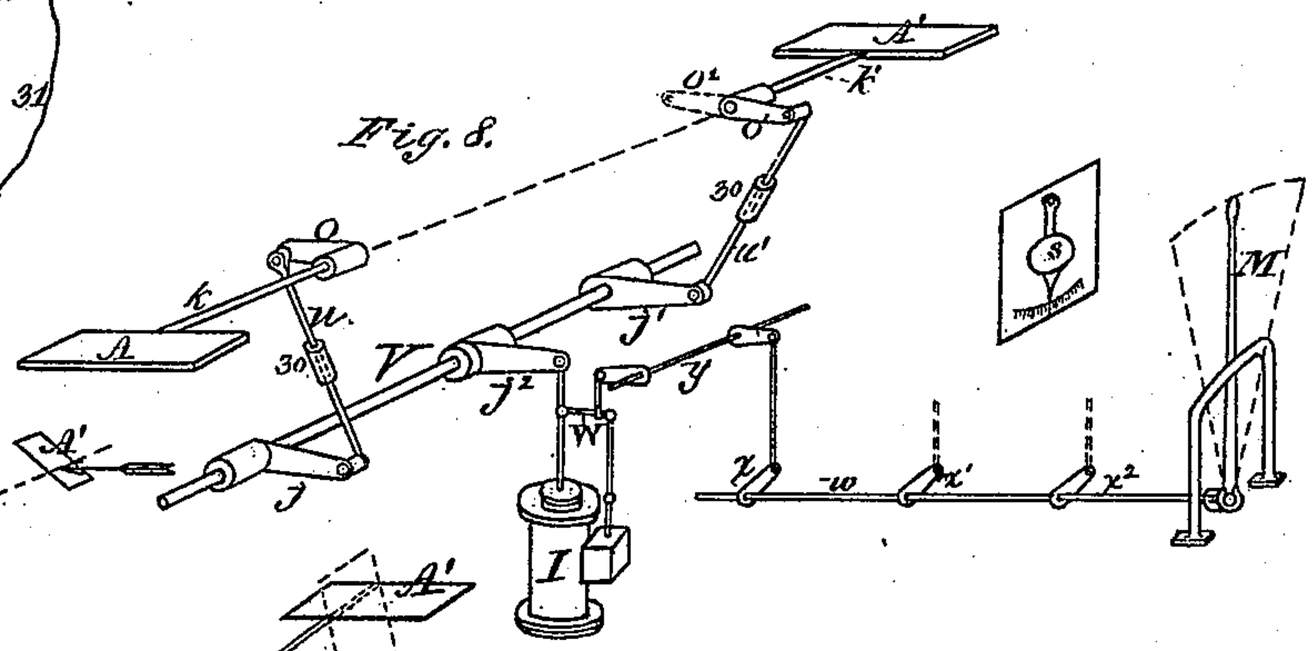


Fig. 10.

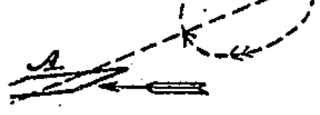


Fig. 9.

Inventor;

Chas. E. Emery

Witnesses;

Eugene J. Reilly.

George C. Pennell.

UNITED STATES PATENT OFFICE.

CHARLES E. EMERY, OF BROOKLYN, NEW YORK.

APPARATUS FOR REGULATING THE ROLLING AND PITCHING OF VESSELS.

SPECIFICATION forming part of Letters Patent No. 471,212, dated March 22, 1892.

Application filed January 13, 1890. Renewed February 11, 1892. Serial No. 421,085. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. EMERY, of Brooklyn, Kings county, New York, (office in New York city,) have invented a new and Improved Apparatus for Regulating the Rolling and Pitching and Checking the Speed of Vessels; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making part of this specification.

In the application of this invention it is proposed to apply at one or more points on the sides of a vessel horizontal rudders or fins, of which part of the number under certain circumstances will be set slightly above the ordinary water-level with the front edges higher than the rear, so that as the vessel rolls when moving ahead the fins on the low side will act on the water and tend to raise the vessel to an upright position. It is proposed, also, to set a number of such fins near the bow of the vessel, so that those on both sides will be buried as the bow settles in pitching and tend to lift the same and reduce the pitching action. In other cases it is proposed to set a number of the horizontal rudders or fins just above or at any desired distance below the surface of the water, and by steam, hydraulic, or other power put in action by a movement of the hand or an automatic apparatus through suitable mechanism set the fins with their front edges higher than their rears on the side of the vessel which is rolling down into the water and with the front edges lower than the rears on the side where the hull is rolling out of the water, thereby checking the rolling movement by the action of the inclined surfaces on the water. Means are also provided whereby in case a collision or other accident is imminent some of the fins may be set vertically, or nearly so, when the resistance to their movement through the water will check the speed of the vessel.

In the drawings, Figure 1 represents a side view of the hull of a vessel, showing fins in position. Fig. 2 is a view of the bow of same vessel. Fig. 3 is a vertical elevation of apparatus for supporting a fin on the side of a completed vessel with means for operating the same, all capable of ready removal in port. Fig. 4 is an end view of the same with part of the hull in section, and Fig. 5 is a plan view of the same. Fig. 6 represents, in connection with a horizontal section of hull, a plan view of a fin which can at will be protruded outside the vessel and be operative for the purposes before referred to at sea or be drawn into a water-tight pocket in the side of the hull flush with the surface, so as not to make a surface projection in port. Fig. 7 is an external view of a section of the hull, showing the exterior opening of the pocket above referred to, with the fin in position therein. Fig. 8 is a perspective sketch showing the general arrangement of the fins, operating-engines, and regulating-levers. Fig. 9 is a sketch of a similar kind, showing also mechanism for checking the speed of the vessel. Fig. 10 is a diagram illustrating the turning efforts produced by the opposite inclination of the fins on the sides of the vessel. Fig. 11 is a view of an automatic apparatus for performing the regulation. Fig. 12 shows means for locking the fins while they are being drawn into the cavities. Fig. 13 is a sketch showing method of arranging fins at such angles on the two sides of the vessel as to prevent the possibility of overturning a cranky hull. Figs. 14 and 15 are enlarged details of the outer bearing and guides for the fin shown in Figs. 6 and 7.

In Figs. 3, 4, and 5, A represents a horizontal rudder or fin pivoted at *a a* in the arms of the braced frame B, attached to a plate C, which plate is engaged at the edges by the lips of clamps *b*, attached to the side of the hull. At the point *c* there is articulated to the fin A a connecting-rod D, the upper end of which articulates at *d* with the lever-arm E on a rock-shaft *e* (corresponding to K in other figures) extending within the vessel. Evidently by rocking the shaft *e* the fin A may be inclined in either direction—for instance, so that the center line will lie in the general direction of *f f* or *g g* or any intermediate position. The fin in this case is shown below the surface of the water, and bolts may be placed in holes *h* through the bulwarks to secure the supporting-plate C in place. If, however, it be desired to keep the fin higher up—say at or near the surface of the water—the plate C may by the application of tackles to the eyes *i* be lifted so that the holes *j j* will

come into the positions of *h h*, as shown The pin connecting the rock-arm E with the connecting-rod D should at the same time be shifted to a hole *d'* as much nearer the lower end of rod D as the plate C is moved upward, when evidently the operation will be the same as before. When coming into port, the rock-shaft *e* may be disengaged from the rock-arm E and pulled flush within the side of the vessel, when the plate C, with frame B and fin A, may be lifted as a unit out of the lips of the clamps *b* and stowed away until again required. It is preferred that the fins be provided for in the original construction of the vessel. In Figs. 6 and 7 A is the fin, as before, and F a water-tight pocket inside the vessel, but with its side open through the outside of vessel to receive the fin. A heavy rock-shaft *k* is secured rigidly in the fin A and provided near the fin with a bearing *m*, confined longitudinally between the collars *l* at the fin and *n* on the rock-shaft. The outside of the bearing *m* is preferably made square in sections, enlarged, as shown in Figs. 14 and 15, and is arranged to slide in guides *o o* in the upper and lower portions of the pocket, as shown in Fig. 7 and in section in Fig. 14. At the rear of the chamber F is attached a square box G, which continues the guides *o o* backward, such box being of such size and length as to permit the bearing *m* to run back within the same when the fin is within the chamber F. The shaft *k* extends within the vessel through a stuffing-box *v* in continuation of the box G, is supported in a bearing *p*, and carries at its end a rock-arm O, with operating-pin *q*. A collar *r* is separated from the hub of rock-arm O to form a groove, in which engages a roller pivoted to the end of a working beam H, to the other end of which beam, below its fulcrum, is connected an engine Q or equivalent motive power sufficient to slide the rock-shaft *k*, with the fin A, from the position shown outside the vessel within the pocket or chamber F and back and forth, as desired. A similar rock-shaft, pin, and operating apparatus would be placed on the opposite side of the vessel. The general method of operating the fins is shown in the perspective sketch, Fig. 8, independent of bearings and details of hull. As shown, the nearest fin A has its operating-lever O at the left, and the farthest fin A' on the other side of the vessel has its operating-lever O' to the right. The lever-arms O and O' are respectively connected by rods *u* and *u'* to rock-arms *j j'* on the same side of a rock-shaft V, which is provided with an arm j^2, receiving motion from a suitable motive power, such as a steam or hydraulic engine I. As the piston of this engine is moved down, evidently the rock-arms j^2 *j j'* and O O' would move down, whereby the right or front edge of fin A would be raised and the front edge of fin A' depressed, and the action of the water upon the inclined surfaces, as shown by the arrows in Fig. 10, would on the left-hand side tend to lift the fin and the hull to which it is attached, as per the elliptical arrow, and on the other side tend to depress the fin and hull, as also shown by an arrow, so that at the time the vessel was rolling in the opposite direction to the elliptical arrows the fins would tend to correct such motion, and evidently when the vessel righted itself and tended to roll the other way, if the piston of engine I were put in the opposite direction, thus reversing the angles of the fins, the latter would act similarly to right the hull and check the rolling.

M is an operating-lever, preferably standing athwartships in the pilot-house or elsewhere and connected directly or by wire ropes and guide pulleys or levers to a rocking shaft *w*, which through an arm *x* thereon, and when necessary an intermediate rock-shaft *y*, operates the fulcrum of a floating lever W, which is at one end articulated to the piston-rod end and at the other end to the valve-stem of the engine I. The effect of the combined movements is to cause the piston of engine I to move in either direction proportionally to the movement of lever M, for after the lever M has moved one way and opened the valve of engine I the piston will move a proportional distance and shut the valve in a manner familiar to experts, so that when the lever M is in the center the piston of the engine I will be practically in the center and the fins A and A' practically horizontal, and the inclination of the vanes in opposite directions will be proportioned to the movement of the lever M. It is proposed to adjust the lever M to suit the inclination of vessel indicated by a pendulum *s*. Upon rock-shaft *w* a number of rock-arms *x' x²* can be arranged, as shown, for connection to engines operating other fins to be moved coincidently with those illustrated, or evidently other fins may be operated by connecting-arms corresponding to O O' directly with the rock-shaft V by carrying rods like *u u'* at an angle. In this way several pairs of fins may be operated from the engine I. By so making the connection from regulating-lever M to the valve that as the vessel heels to the right the lever should be moved to the left to right her, and vice versa, a man standing athwartships and holding the lever, if he kept the lever moving with the natural movement of the body in preserving an upright position, would in a certain sense automatically regulate the rolling. To accomplish this the levers on rock-shaft *y* may both be put to the left, for instance. Automatic regulation may also be secured by attaching to the top of a heavy pendulum *t*, Fig. 11, a lever 20, (shown in dotted lines,) connected by a rod 21 with the valve of a small engine P, the piston of which would by suitable connections be made to operate the rock-shaft *y* or *w*, and thereby the valve of the main engine I, which adjusts the fins, or evidently the engine P may replace the engine I when the former has sufficient power

to operate the fins, when preferably a floating lever like *w* would be interposed to operate the valve. Instead, however, of connecting the arm 20 of pendulum *t* directly to the valve, the motion of the pendulum may be employed to open and close an electric circuit arranged to operate the valve of engine P. For instance, the pendulum may be connected with one pole of a battery, and as it moves either to the right or left close electrical circuits through contact-pieces 22 23. For instance, if pendulum *t* be connected by a wire 31 with one pole of a battery 32 and the pendulum-ball move to the left, so as to come in contact with contact-piece 22, a current may be caused to pass through the left coil 24 of a double solenoid and attract the armature 25 therein, which through one arm of double lever 26, lever-arm 27, attached thereto, and connection 21 would operate the valve of engine P in one direction, and from a motion of the pendulum to the right, so as to touch contact-piece 23, a current may be caused to pass through the right coil 29 of the solenoid, thus attracting the armature 28, and through the levers 26 and 27 and rod 21 operating the valve of engine P in the opposite direction, thereby reversing the direction of the angle of the fins, as previously explained. Electrical engines may be substituted for the solenoid.

Any form of secondary engine, either steam, electrical, or both, or any combination of magnets or solenoids heretofore used for producing a powerful movement from an initial feeble one, may be employed in this case so long as the initial movement is derived from the motion of the vessel or any form of inclinometer. So, also, any combination of levers, wire ropes, chains and pulleys, or any equivalent arrangement may be used to transmit the motion from the lever M or a wheel or other device performing its office to the valve of the operating-engine I. So, also, each fin may be connected to a separate engine and the valve of this engine connected in any known manner with an operating-lever corresponding to M, or chains and pulleys from a drum on one large engine may be run to drums on the shafts of each of the fins to adjust them all coincidently. It is only possible to show one method of performing each of the operations required.

In Figs. 1 and 2 five fins are shown on each side of the vessel. Those below the surface of the water designated 10^{A} $10^{A'}$ would be drawn within the vessel in smooth weather substantially on the plans shown in Figs. 6 and 7, and pushed out and adjusted at every roll, in the manner herein described, in stormy weather. Fins 11^{A} and $11^{A'}$ above the surface of the water and near the center of the length of the vessel may be mechanically secured with the front edges of the fins higher than the rears on both sides of the hull, and thus act only when rolled into the water, and then tending to check such rolling when vessel is moving ahead. In a heavy storm, however, even these fins should be connected, so that they will be set at opposite angles, and thereby those on both sides of hull aid in preventing rolling as heavy waves pass by. Fins 12^{A}, $12^{A'}$, 13^{A}, $13^{A'}$, 14^{A}, and $14^{A'}$ near the bow of the vessel are preferably set above the water-line and maintained mechanically at a fixed angle, with their fronts higher than their rears, thereby reducing pitching action, and also in the same manner as described in relation to 11^{A} reducing the rolling action. In bad weather one or more pairs of these bow-fins may be adjusted at each roll in the same manner as the midship-fins. On coming into port the bow-fins may be drawn inboard, as in Figs. 6 and 7, or, being out of water, they may, after the vessel arrives in smooth water, be removed from their shanks by using a scaffold from the outside and the shanks moved inboard, in which case the reverse operation would be gone through with before the vessel leaves port. The fins at the extreme bow may also be permanently secured to vessel.

To prevent the possibility of overturning the vessel when, for instance, a submerged fin, like 10^{A}, Fig. 1, is set with the leading edge lower than the following edge and on account of sudden injury to the man operating the regulating-lever M, or from some defect of apparatus, the angle of the fin is not reversed as soon as the vessel comes upon an even keel, but keeps on pulling that side of the vessel down, it is proposed for cranky vessels to limit the angle at which the fins running deeper into the water are set, so that no injury can result, but not to limit the angle of those running up toward the surface of the water, for the reason that if they are not shifted in time they will simply heel the vessel sufficiently to bring themselves out of water, where they will cease to act. This can be accomplished simply by varying the lengths of the connecting-rods *u u'*, Fig. 8, so that for a given motion of the arms on rock-shaft V the fins A will be less inclined when dipping than when rising. This action is illustrated in Fig. 13, in which V represents the center of the corresponding rock-shaft, (shown in Fig. 8,) and the arm *j'* thereon, moving through a constant angle, is represented at its limits by 34 35. If *k'* be the center of the fin rock-shaft, the arm O' thereon will for a length of connecting-rod reaching from 34 to 36 move O' to 37 when *j'* reaches 35, thereby producing substantially equal angles up and down of rock-arm O' and the fin connected therewith; but if connecting-rod originally extend from 34 to 38, then as rock-arm *j'* moves to 35 rock-arm O' will move to 39 and the fin corresponding in general direction to O' will in the first case lie practically horizontally and all its movement be above the horizontal, so that if the leading edge of the fin were on the same side as the lever there would be no action when the fin was in the position 38, but

only when vessel rolled fin up and it was adjusted to the position 39. Similarly adjustments may be made so that the blade, when fin is carried down by the rolling of the vessel, will have a very slight angle tending to correct the rolling, but insufficient to do injury of the kind previously outlined. The adjustment to secure different angles for upward and downward movements may be secured by any means of altering the lengths of the rods *u u'*, such as turn-buckles 30 30, Fig. 8, or it may similarly be accomplished by any means of producing an angular change of the position of the rock-arms on the rock-shaft. When each fin is operated by a single engine, the same result can be produced by limiting the stroke of the engine in the direction producing dip.

In order to lock the rock-shafts *k k'* in mid-position, particularly when preparing to pull the fins inboard, sliding bars 32 and 33, Fig. 12, may be employed, with jaws on their ends to engage with the ends of the levers O' and O. For instance, a jaw would hold the fin fair with the opening of the pocket F, Fig. 6, so that the connecting-rods *u'* and *u*, Fig. 8, may be disconnected and the engine Q be operated to shift through lever H the shaft *k*, bringing the fin A within the pocket in the vessel and a similar operation be performed on the other side. When it is desired to make the fins move coincidently, so that they can both be tipped upward toward the bow at the same time, it may be readily secured by having an operating-engine I for each fin and a separate lever M for operating the valve of such engine, or with the arrangement shown in Fig. 8 the connections may be changed. For instance, the lever O' may be extended by the shaft *k'*, forming an opposite lever O^2, when by temporarily locking the fin in any suitable manner—for instance, as shown in Fig. 12—the connection *u'* may be shifted to the lever O^2, when the angles of the fins A A' will be changed together.

The arrangement of the fin A, pocket F, and sliding bearing *m* (shown in Fig. 6) may be at times conveniently applied to rudders, which would be represented by turning the drawing on its side. For instance, an auxiliary rudder would be made almost identical with the fin shown; but the system is also adapted for the convenient construction of a main rudder. If the shaft *k* be arranged vertically at the stern of a vessel such as shown in Fig. 1 and the pocket F be carried entirely through the overhanging stern and provided with guides *o o* for a journal *m*, the rudder may be put down from the top, carrying its lower journal *m* with it, and it will only be neccessary to set over the upper opening a bearing substantially in the position of the box G and stuffing-box *v*. When used either as a fin above water or as a rudder, by making a bolted joint to secure the plate 40, inclosing the inside of the pocket F, this plate may be unbolted, taking away with it the parts G and *v* and the fin or rudder drawn inward or upward for repairs. The box F may be built inward from the side of the vessel and supported by angles; but it is preferred to locate it near the line of a deck, where it will be less in the way and may be supported from the deck-beams, as shown in dotted lines in Fig. 7. To prevent cutting through the frames of the vessel for the length required, the fin may be hung in a slot in the end of the rock-shaft *k* and swung around so that its short end will point toward the vessel before it is pulled inside.

When a collision is imminent, the headway of the vessel may be readily checked by setting the immersed fins 10^A $10^{A'}$, Fig. 1, vertical, or nearly so, so as to offer great resistance to the movement of the vessel through the water. When the fins are operated by chains wound around drums on the shafts *k k'* and such chains pulled by any motive power, the required change of angle can be obtained readily, even when the fins are set to change angles in opposite directions, for even then if both are turned one-fourth of a revolution from the horizontal they will evidently be vertical. There is, however, great strain upon the parts in such an operation, and it is desirable to use links and levers whenever possible. Fig. 9 shows an arrangement for this purpose. In this figure the vessel is supposed to be moving toward the left. Preferably one fin is set forward of the one on the opposite side of the vessel, and, as shown, the operating-levers O O' are both turned aft and the levers on the rock-shaft V below are turned in opposite directions, so as to cause the change of angle produced by the operation of the engine I to take place in opposite directions, the same as in Fig. 8. In Fig. 9, however, the rods *u* and *u'*, connecting the levers *j* and O and *j'* and O', are jointed at the center and articulated with connecting-rods 41 and 42, leading to rock-arms 43 and 44 on a rock-shaft 45, moved by an arm 46, connected to a steam or hydraulic cylinder or other prime mover 47. When the piston of the cylinder 47 is in the position shown, as well as the rock-arms 43, 46, and 44, the connecting-rods *u* and *u'* are maintained nearly vertical, and the operation of the prime mover I takes place through such rods in adjusting the fins, the same as in Fig. 8. When, however, it is desired to check the speed of the vessel, a lever like M, operating the valve of cylinder I, as described in relation to Fig. 8, would first be thrown to the center, when the several levers on rock-shaft V, Fig. 9, would move to the center and the fins be set horizontally. Then pressure being applied to the piston of the cylinder 47 by operating another lever situated near M, the rock-shaft 45 would be revolved toward the left, carrying all the levers thereon to the left, as well as connections 41 and 42, thereby bending the connecting-rods *u* and *u'* at the central joints

and bringing them substantially to the position shown by the dotted lines, thereby throwing the levers O and O′, as well as the fins A and A′, connected therewith, into a vertical or nearly vertical position, producing great resistance, tending to check the speed of the vessel. The lever for operating the valve of cylinder 47 may be "interlocked" with a lever M, putting in operation the piston of cylinder I, so that the former lever can only be moved when the latter is in mid-position, the details of which interlocking would be similar to those used in railroad signaling apparatus. Evidently, with the piston of cylinder I in mid-position the piston of cylinder 47 may be operated through a limited distance, and will then set the fins A and A′ coincidently through any desired angle less than ninety degrees. The general arrangement of parts in Figs. 6 and 7 may be employed as a brake, acting the same as the fin A when vertical, but without angular adjustment, by making a vertical slot in the side of the hull covered inside by a pocket F, with a fin on one or more shafts *k* operable by a prime mover Q, so that such a fin or brake could be thrust out by the prime mover while in a vertical direction and be withdrawn at will. As no angular adjustment would be provided in this case, there could be two rods *k* attached to different parts of the fin A, or there could be one shaft *k* and the throw of the prime mover be limited so that the fin would not entirely leave the pocket F, and thereby be held rigidly in a vertical position. To avoid cutting the frames of the vessel, the slot shown in Fig. 7 may be made vertical, even for carrying a fin, which when thrust out is to be turned nearly horizontally and operated to prevent rolling, &c., as described in relation to Figs. 6 and 7. In such case the stops 32 and 33, Fig. 12, would be arranged to hold the levers O and O′ and fins A A′ vertical and the jaws be wide enough in the direction of the length of the shaft *k* to permit the fins to be thrust outside the vessel in a vertical position and held there by the stops. Then in an emergency the fins could be thrust out by prime mover Q and act as brakes to retard the vessel, even when not connected to act as fins to prevent rolling. Evidently, also, the slot shown in Fig. 7 may be made at an angle with the horizontal, so that the fin as it is thrust out will gradually come into action, and if prime mover Q be made controllable at will, like prime mover I, the thrusting out and retraction of the fin may be utilized to check rolling, on principles already described.

The after edge of the opening for the fin shown in Fig. 7 will cause some resistance as the vessel moves through the water, and particularly so when such opening is vertical. To prevent this, a plate 48 48, of which an edge view is shown in dotted lines in Fig. 6, may be attached rigidly to the bearing *m* in the position shown, so that its outer side, when the fin A and bearing *m* are pushed out, will come flush with the side of the ship. As plate 48 48 is attached to the piece *m*, it will be pulled back with it into the vessel as the fin is retracted, simply requiring that the pocket F be deepened sufficiently to receive it, as shown in dotted lines at 49 49. When the fin is placed in the bow of the vessel, which is inclined to the line of the keel—for instance, on the line 50 50—the fin may have a similar inclination on its outer edge, as shown by dotted lines 51 51, so that when pulled within the vessel its outer edge will be flush with the side. When this general construction is used for a rudder, such rudder, particularly if it be a spare one, may be arranged in the stern at one side of the center line of the vessel, when the bottom edge corresponding to 51 51 would be shaped to suit the shape of the stern when rudder was pulled within it, and the top so shaped that when rudder was thrust out it could turn through the required angle. When the rudder or fin is not to be balanced, evidently the short end (shown in all the figures) would be omitted. When the plate 48 48 is attached to bearing *m*, the latter may be circular on its exterior instead of square, as the plate would keep it from turning. Evidently the plate 48 48 may be made part of a frame extended around the fin to support an outer bearing for it, as in Fig. 4, which would, however, be pulled with the fin within the vessel flush with the side. So, also, plate 48 48 may have rods attached, passing through stuffing-boxes, like *v* on shaft *k*, to which rods motion would be applied to move the fin in and out through what would practically become its frame—viz., the plate 48 48 and bearing *m*.

It will be observed that the motion of the vessel through the water causes the water alongside to appear to move backward, or, in other words, there is a relative backward current alongside the vessel when moving ahead, and the energy of this current is utilized by the means referred to or their equivalents to tend to produce rolling or pitching motions in opposite directions to those imparted to the vessel by the roughness of the water. For instance, the tendency of the bow of the vessel to pitch downward is resisted by the relative current of water impinging on the bow-fins referred to, which tends to lift the bow and thereby check the pitching. So, also, when the vessel rolls to starboard said rolling is checked by the action of the relative backward current upon the fins which tend to roll the vessel to port, the contrary effect being produced when the vessel originally rolls to port. It will be observed that to produce this righting action the fins would be set spirally to the longitudinal movement of the vessel. For instance, if the vessel rolls to the left the fins would be set substantially like the threads of a right-hand screw, and by their action upon the water first resist the rolling action, and, finally, so to speak, "screw" the vessel around to an upright position, when, if the

fins were made inactive, the righting action would cease. On the contrary, if the vessel rolls in the opposite direction—viz., to starboard—the fins would be set in spiral lines to form fragments of a left-hand screw, and the action of such fins upon the water would first tend to check such rolling and then act to screw the vessel around a longitudinal axis to an upright position, by which time the vanes should be again made inactive.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with the hull of a vessel, a fin or fins and adjusting apparatus therefor operable at will to set such fin or fins spirally in relation to the longitudinal motion of the vessel through the water with a view of revolving or tending to revolve the hull around a longitudinal axis at will to check rolling, substantially as and for the purposes specified.

2. In combination with the bow of a vessel, a fin or fins arranged above the average water-line, each with its leading edge higher than the following edge, whereby the relative backward current will tend to reduce pitching, substantially as and for the purposes specified.

3. In combination with the hull of a vessel provided with fins, apparatus adapted and operable at will to adjust the angles of the fins on opposite sides of the hull in reverse directions with reference to each other, substantially as and for the purposes specified.

4. In combination with the hull of a vessel provided with fins, apparatus adapted and operable at will to adjust the angles of the fins on opposite sides of the hull in reverse directions with reference to each other, but in different degrees when the leading edges of a fin are inclined upward than when the same are inclined downward, substantially as and for the purposes specified.

5. In combination with the hull of a vessel, fins on opposite sides of the hull, a prime mover and suitable connections between such fins, such prime mover operable to adjust the angles of the fins on opposite sides of the hull in reverse directions with reference to each other, and a hand-lever or equivalent connections for putting in operation at will such prime mover, substantially as and for the purposes specified.

6. In combination with the hull of a vessel, fins on opposite sides of the hull, a prime mover, suitable connections between such fins and such prime mover, valve-gear for controlling such prime mover, and automatic apparatus receiving its initial movement from the inclination of the vessel and operating such valve-gear through suitable connections to adjust through such mechanism the angles of the fins on the opposite sides of the hull in reverse directions with reference to each other, substantially as and for the purposes specified.

7. In combination with the hull of a vessel, fins on opposite sides of the hull, a prime mover and connections from the same to the fins, arranged and operating to adjust the angles of such fins on opposite sides of the hull in reverse directions with reference to each other, another prime mover and suitable connections arranged and operating to throw the same fins vertical, or nearly so, and hand-levers or equivalents and connections for putting in operation such prime movers, substantially as and for the purposes specified.

8. In combination with the hull of a vessel, fins on opposite sides of the hull, a prime mover and connections from the same to the fins, arranged and operating to adjust the angles of such fins on opposite sides of the hull in reverse directions with reference to each other, such connections embodying connecting-rods jointed near the center, another prime mover and suitable connections from the same to the central joints of the connecting-rods and arranged and operating by bending such rods at the joints to throw the fins vertical, or nearly so, and hand-levers and connections for putting in operation such prime movers, substantially as and for the purposes specified.

9. In the construction of apparatus for supporting and operating a fin on a vessel and in combination with the hull and with a pocket formed therein to receive such fin, suitable guides formed in such pocket, a journal on the shank of such fin, collars limiting the length of such journal, and a slide-bearing *m* to support the fin in different positions through such journal on the shank, substantially as and for the purposes specified.

10. In combination with the hull of a vessel provided with a pocket to receive a retractable fin or rudder and with a sliding bearing or frame to support the same, and a plate 48 48, attached to such frame, arranged and operating to close the external opening of the pocket when the fin or rudder is protruded, substantially as and for the purposes specified.

11. In combination with the hull of a vessel and a pocket in the same to receive a fin, a fin which may at will be drawn within such pocket or be protruded outside the hull, the shaft of such fin provided with means for rotating the same, collars on such shaft, a prime mover, a lever or equivalent means for putting in operation such prime mover at will, and connections from such prime mover engaging with the collars on such shaft in such way as to permit the shaft and fin to be moved longitudinally at will without interfering with the rotary motion of the same, substantially as and for the purposes specified.

12. In combination with the hull of a vessel and a pocket in the same to receive a fin, guides in and attached to such pocket, a fin which may at will be drawn within such pocket or be protruded outside the hull, the shaft of such fin provided with means for rotating the same, a journal on such shaft and with collars limiting the length of such journal, a sliding bearing *m* on such journal to support

the shaft and fin in different positions, additional collars on such shaft to engage with mechanism for operating the shaft longitudinally, a prime mover and connections to adjust the angle of such fin when outside of the vessel, a prime mover and connections to adjust the shaft longitudinally, and suitable means for independently putting in operation such prime mover, substantially as and for the purposes specified.

CHAS. E. EMERY.

Witnesses:
N. R. ALLISON,
E. J. REILLY.