Nov. 3, 1925. 1,559,816

C. E. WARD

RUDDER CONTROL FOR TOW BOATS

Filed April 29, 1925 3 Sheets-Sheet 1

FIG. 1.

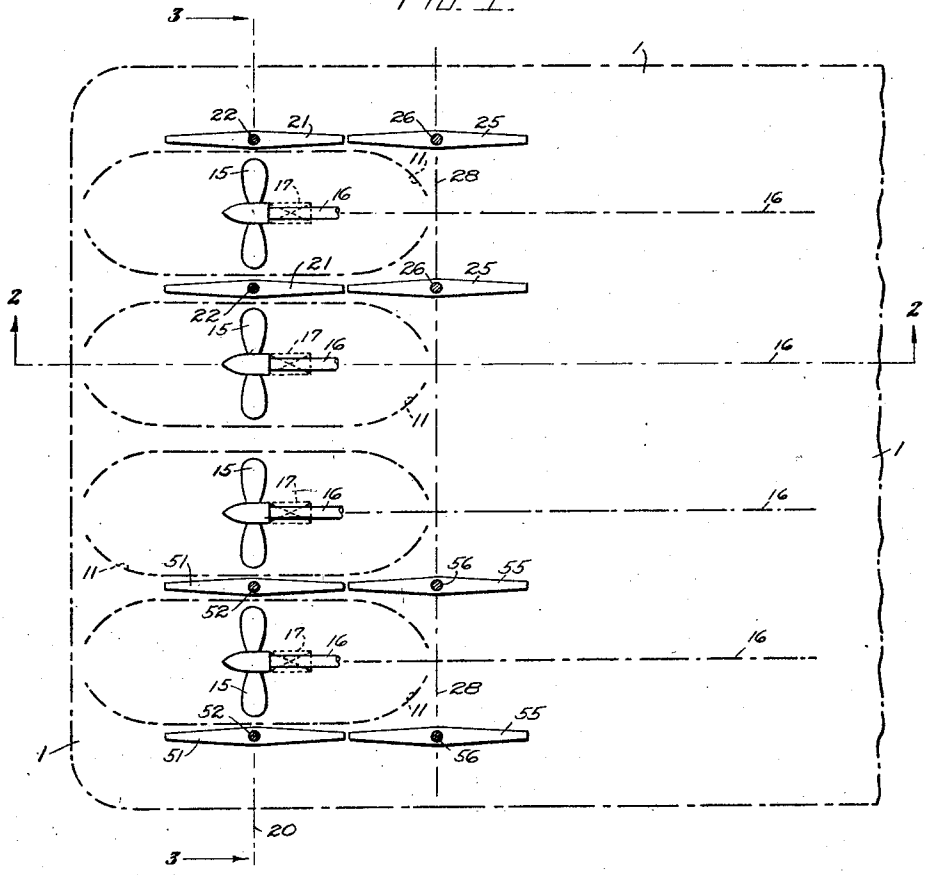
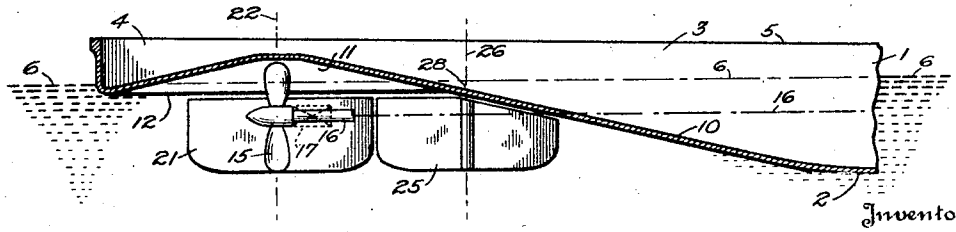


FIG. 2.



Inventor:

CHARLES E. WARD

By F. A. Witherspoon

Attorney.

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C. E. WARD

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FIG. 3.

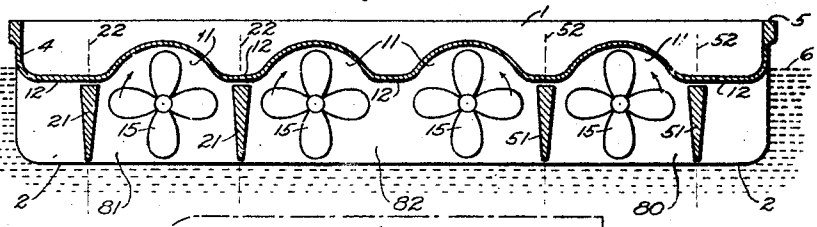


FIG. 4.

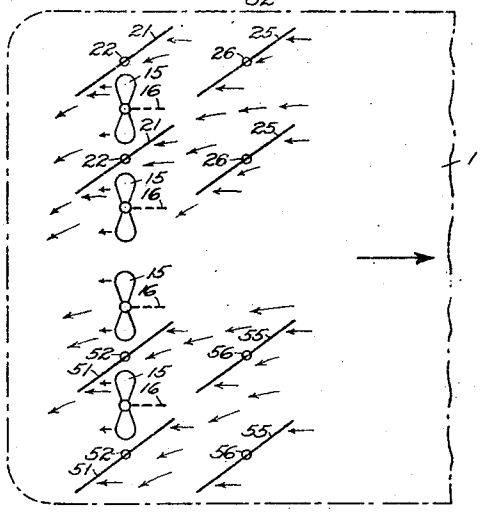
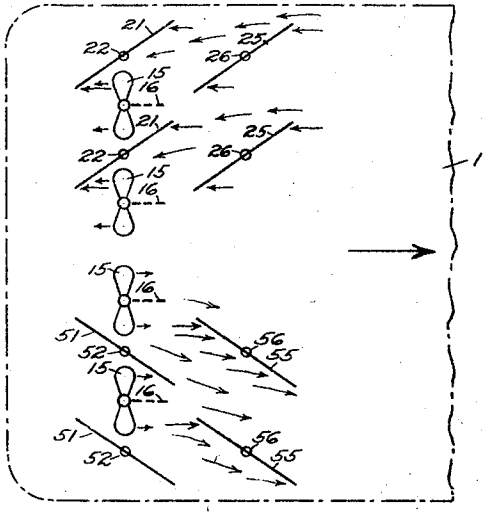


FIG. 5.



Inventor:

CHARLES E. WARD

By F. A. Witherspoon

Attorney.

Nov. 3, 1925. 1,559,816

C. E. WARD

RUDDER CONTROL FOR TOW BOATS

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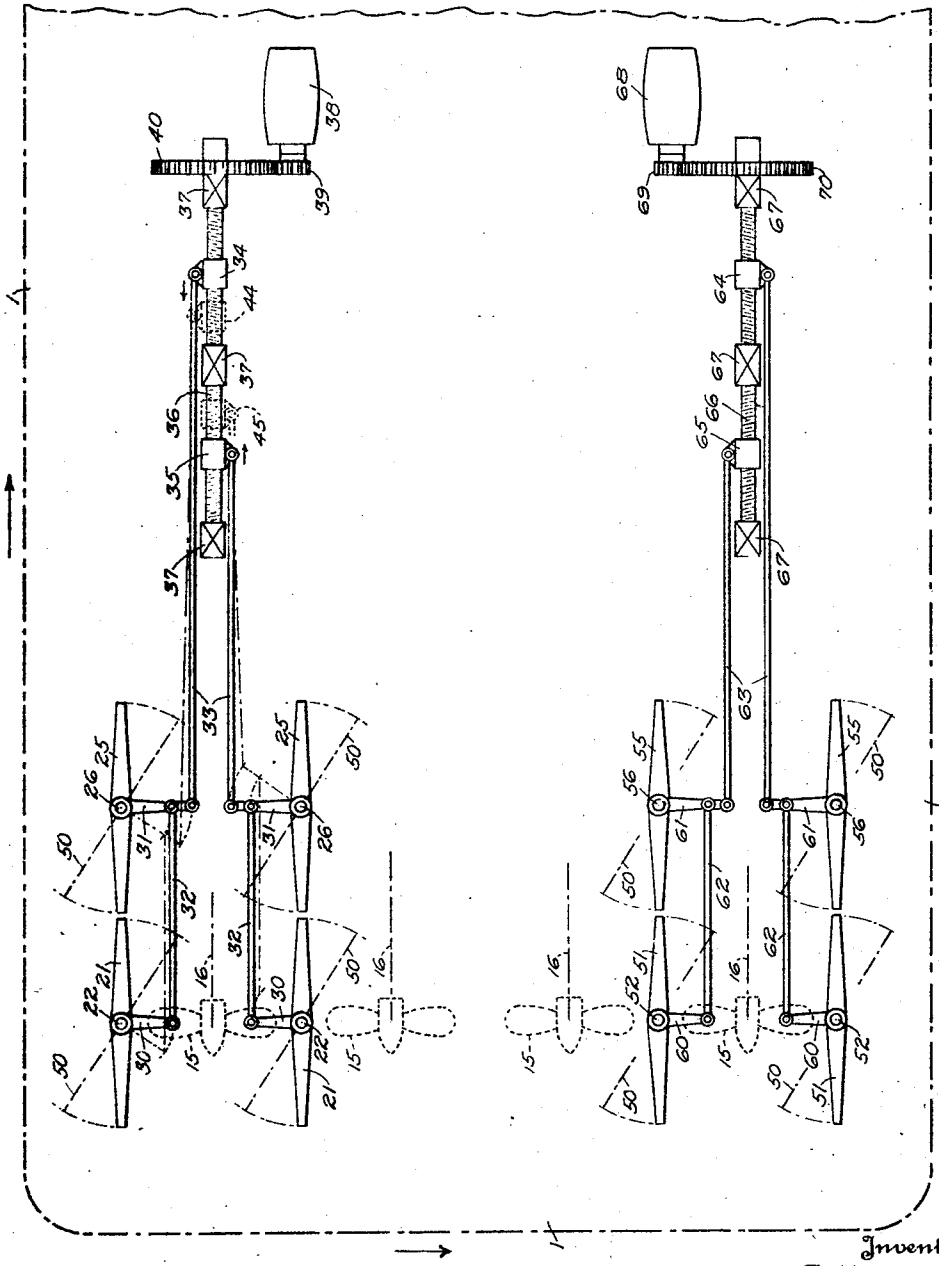


FIG. 6.

Inventor:
CHARLES E. WARD

By F. M. Witherspoon
Attorney

Patented Nov. 3, 1925. 1,559,816

UNITED STATES PATENT OFFICE.

CHARLES E. WARD, OF CHARLESTON, WEST VIRGINIA, ASSIGNOR TO THE CHARLES WARD ENGINEERING WORKS, OF CHARLESTON, WEST VIRGINIA, A CORPORATION OF WEST VIRGINIA.

RUDDER CONTROL FOR TOWBOATS.

Application filed April 29, 1925. Serial No. 26,709.

To all whom it may concern:

Be it known that I, CHARLES E. WARD, a citizen of the United States, residing at Charleston, in the county of Kanawha and State of West Virginia, have invented certain new and useful Improvements in Rudder Controls for Towboats; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to rudder constructions for tow boats and has for its object to provide a construction more efficient in use than those heretofore proposed.

With these and other objects in view, the invention consists in the novel details of construction and combinations of parts more fully hereinafter disclosed and particularly pointed out in the claims.

This invention constitutes an improvement over the construction disclosed and claimed in my copending application filed April 8, 1925, Serial No. 21,680 entitled Rudder construction for tow-boats.

Referring to the drawings, forming a part of this specification, in which like numerals designate like parts in all the views;

Figure 1 is a diagrammatic top plan view of the stern of a boat made in accordance with this invention;

Figure 2 is a longitudinal sectional view taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows;

Figure 3 is a transverse sectional view taken on the line 3—3 of Fig. 1 and looking in the direction of the arrows;

Figure 4 is a diagrammatic view showing the arrangement of parts when desired to move a tow boat in one direction;

Figure 5 is a diagrammatic view illustrating a different arrangement of parts when desired to move the boat in the same direction as indicated in Fig. 4; and

Figure 6 is a diagrammatic top plan view of the stern of a boat illustrating the control of the rudders.

A tow boat is generally indicated at 1 and comprises the main bottom 2, the sides 3, and the stern 4. The main bottom 2 is substantially parallel with the gunwales 5 and the waterline indicated by the line 6, see Fig. 2. Near the stern, the bottom 2 is inclined upwardly as indicated at 10 and is provided with a plurality of tunnels or chambers 11, as well understood in ships of this character and as clearly shown in the drawings. The bottom 10 in forming these tunnels 11 also forms a secondary bottom 12, as clearly shown in Figs. 2 and 3, which is substantially parallel to the aforesaid waterline 6 and slightly therebelow.

The cross section of the tunnels 11 at the central or deepest portions thereof is circular and within this circular formation are located the screw propellers 15 mounted on the shafts 16 and journaled as diagrammatically illustrated at 17 in the drawings. The propellers and their shafts, together with the tunnels 11 associated therewith, are all so disposed relative to each other that each propeller 15 will be located in a tunnel 11, and above the main bottom 2 of the boat, see Fig. 3. Further, the propellers 15 are disposed in a common transverse plane as represented by the line 20 in Fig. 1.

With special reference to Figs. 1, 2 and 3, it will be observed that there is provided on the port side, or the left hand side when looking toward the front end of the vessel, a plurality of rudders 21 whose stems or axes 22 are located in the same transverse plane 20 with the propellers 15, and that the top surfaces of the rudders 21 are substantially flush with the secondary bottom 12. The rudders 21 are further disposed adjacent the propellers 15 so that there is a propeller 15 located between a pair of rudders 21, whereby each rudder 21 is free to swing in either direction about its stem 22 without interfering with the propellers 15.

Associated with each port rudder 21 is a forward rudder 25 whose stem 26 is located in the same longitudinal plane of the towboat with the stem 22 of its associated aft rudder 21, and further, the stems 26 are so spaced from the stems 22 that the adjacent ends of each pair of rudders 21 and 25 will just pass each other when operated, see Figs. 1 and 2. Also the stems 26 of the rudders 25 are located substantially in a transverse plane represented by the line 28, said plane parallel to the plane 20, and passing through the points where the portions of the secondary bottom 12 meet the inclined bottom 10. In other words, the stems 26 of the forward rudders 25 are substantially disposed opposite the forward

end of each adjacent tunnel 11 for a purpose as will presently appear.

All of the port side aft rudders 21 and their associated forward rudders 25 are worked in unison. That is to say, no one of these aft rudders can be turned without turning to the same degree and in the same direction each of the forward rudders associated therewith. This may be accomplished in any well known and suitable way, such as illustrated in Figure 6 wherein the stems 22 and 26 of each associated pair of port side rudders are provided respectively with the tillers 30 and 31 connected as by the link 32. Each tiller 31 is extended to pivotally connect with one end of a bar 33 adapted to operate each pair of associated rudders 21 and 25. The other end of each bar 33 is pivotally connected to a threaded collar indicated at 34 and 35, and said collars are adapted to be moved in opposite directions at the same time by reason of the right and left threaded worm 36, journaled as at 37 to the vessel 1 and actuated by the motor 38 through the reducing gears 39 and 40. In other words, when the worm 36 is actuated by the motor 38, the collar 34 will be moved in the direction indicated by the arrow or to such a position as indicated in dotted lines at 44, and at the same time the other collar 35 will be moved as indicated by its arrow in the opposite direction or to such a position as indicated in dotted lines at 45, all as clearly shown in Fig. 6. The result of these movements will be to move the port rudders 21 and 25 in the same direction, in unison, and through the same number of degrees, or to such new parallel positions as indicated by the dashed lines 50.

With reference to Figures 1, 3 and 6 it will be seen that there is provided on the starboard side, or the right hand side when looking toward the front of the vessel, a duplication of the rudder construction and control as above described. That is to say, there is provided a plurality of aft rudders 51 whose stems or axes 52 are located in the same transverse plane 20 with the stems 22 of the port aft rudders 21 and the propellers 15. Further, the rudders 51 are in all respects similar to the rudders 21, and have associated therewith, in planes longitudinally disposed of the vessel, the forward starboard rudders 55 whose stems 56 are located in the same transverse plane 28 with the stems 26 of the forward port rudders 25. The rudders 51 are also disposed transversely adjacent the propellers 15 and located to either side of a tunnel 11, so that each rudder 51 is free to swing in either direction about its stem 52 without interfering with the said propellers.

Likewise, all of the starboard aft rudders 51 and their associated forward rudders 55 are operated in unison in a manner similar to that above described. In other words, the stems 52 and 56 are provided with the respective tillers 60 and 61 pivotally connected as by the link 62. Further, the starboard rudders are moved by similar actuating means comprising the bars 63, threaded collars 64 and 65 on the right and left threaded worm 66 journalled at 67, motor 68, and reducing gears 69 and 70. Thus it will be seen that when the worm 66 is actuated, the collars 64 and 65 will be oppositely moved with respect to each other, thereby turning the starboard rudders through the same number of degrees at the same time and in the same direction. With special reference to Fig. 6, it will therefore be seen that when the tow boat 1 is moving in a direction straight ahead, the port rudders 21 and 25 and the starboard rudders 51 and 55 will be in the positions shown in full lines, whereas when the course of the tow boat is changed, all of the rudders may be thrown to such positions for example as indicated by the thin dash lines 50, whereupon the stern of the boat will be put hard over in the direction of the arrow.

The purpose of arranging the port rudders 21 and 25 and the starboard rudders 51 and 55 as above described is to form channels for the water passing said rudders. With particular reference to Figs. 1, 3, 4 and 5, it will be seen that when the rudders are set for straight ahead, said rudders will form parallel channels disposed longitudinally of the boat and through which the water may pass. Stated in still other language the forward starboard rudders 55, together with their cooperating aft rudders 51 constitute walls or partitions forming the water channel such as indicated at 80 in Fig. 3. In a similar manner the opposite or port rudders 21 and 25 form walls of the channel 81 and the adjacent port and starboard rudders form the water channel 82. Thus when the propellers are turning to propel the boat straight ahead it will be readily understood that the water in the channels 80, 81 and 82 and in the tunnels 11, is circulated and forced rearwardly, and due to the fact that the aft and forward rudders on both sides of the vessel are set as shown in Figure 6, there is provided a substantial wall tending to prevent the lateral movement of the stern part of the said vessel. In this respect as is understood in multiple screw propelled boats the port set of propellers when the vessel is going ahead turn in one direction while the starboard set of propellers turn in an opposite direction. In other words, the port and starboard propellers are right and left hand screws respectively, or vice versa, whereby the port propellers will turn in the clockwise direction indicated by the arrows in Fig. 3 whereas the starboard propellers will turn in a

counter-clockwise direction as seen in said figure when said vessel is being propelled forward.

By the construction above disclosed it has been found possible in a boat being propelled forward at full speed, to reverse the propellers and turn the same at full speed aft in order to swing the boat in any direction desired without damage thereto. That is to say, due to the tunnels 11 and the particular disposition of the rudders relative to said tunnels and the propellers, such a change in the rotation of the propellers can be made in a surprisingly short time, and the position of the rudders changed during said time in order to change the course of the vessel, without the usual and heretofore objectionable damage to the rudders and propellers.

When all the rudders are put hard over or in such a position as illustrated in Fig. 6 by the dotted lines 50, there is still provided a plurality of channels for the water set in motion by the propellers 15. In this instance, however, the right hand forward port rudder 25 cooperates with the left hand or outer aft port rudder 21 to form therewith a wall or partition forming with the outer forward port rudder 25 one channel, and forming with the right hand aft port rudder 21 a second channel for the water set in motion by the port propeller 15. In similar manner the starboard rudders cooperate with each other to form similar channels for the water set in motion by the starboard propellers. In other words, due to the fact that all of the port rudders are linked together and moved equally and simultaneously, they will at all times be parallelly disposed toward each other thereby forming parallelly disposed water channels with a propeller therein for the water set in motion by a port propeller associated therewith, and said channels will be disposed below the bottom of the boat. In exactly the same manner the starboard rudders being linked together will at all times form parallelly disposed water channels for the water set in motion by one of the starboard propellers, and when the port and starboard rudders are operated in the same direction, then both the port water channels and the starboard water channels will likewise be disposed parallel to each other.

It is the purpose of this invention, however, to have separate and independent means for operating the group of port rudders and the group of starboard rudders, although it must be understood that these independent means may be actuated simultaneously and in the same direction. With special reference to Fig. 4 there is illustrated the arrangement of parts when it is desired to move the stern of the vessel in the direction of the arrows. In this case the port propellers as well as the starboard propellers are moving to force the water therefrom in the direction of the short arrows, and both the port rudders and the starboard rudders are moved by their independent means through the same number of degrees and in the same direction, so that all the rudders of the vessel are in parallel relation with each other. Thus it will be seen that the water set in motion by the propellers will assume a course indicated by the longer arrows, between the rudders. Thus it will be seen that the water will strike the obliquely disposed blades of the rudders with the tendency toward deflection therefrom, but as is well known, in this action the resistances of the rudders and the water will compel the stern of the boat to swing or move in the direction of the heavy arrow.

In Fig. 5 the swinging of the stern of the vessel in the same direction as indicated in Fig. 4 is accomplished in a better and more efficient manner. In fact, by actual tests, it has been found that vessels with the arrangement of parts disclosed above, wherein the rudders may be independently operated, have better control, are quicker to respond and therefore more to be desired, than vessels employing the constructions heretofore proposed. In Fig. 5 the large arrow indicates the direction in which the vessel is moving, and it will be assumed that it is desired to move the stern of the vessel in the direction of the transverse arrow. The port propellers are continued in their direction of rotation whereby the water set in motion thereby is in the direction of the short arrows. The port group of rudders is operated by its independent means whereby said rudders assume the oblique positions as indicated. The course of the water in the channels formed by the port rudders will then be in the direction indicated by the arrows thus creating a tendency to deflect from the rudders, but as stated in reference to Fig. 4, the stern of the boat will yield transversely as a result in the direction of the arrow. At the same time the direction of rotation of the starboard propellers is reversed and the independent means actuated to set the starboard group of rudders over to the position shown, or substantially opposite to the position of the port rudders. Thereupon the water set in motion by the starboard propellers will be forced therefrom in the direction of the short arrows, will impinge upon the blades of the starboard rudders and thereby set up a water course in the channels formed between the parallelly disposed starboard rudders flowing in the direction indicated by the longer arrows. The result of course is that the resistances created by the starboard rudders and the water contacting therewith will compel the stern of the boat to yield or

move transversely or move in the direction of the arrow. Thus it will be seen that the port propellers and associated group of rudders acting independently, compels a certain amount of transverse swing in the direction indicated. Also the starboard group of propellers and associated group or rudders also acting independently compels a certain amount of transverse swing in the same direction as clearly indicated. The sum of these two certain amounts of swing, compelled independently of each other has been found to be greater than the amount of swing compelled by all propellers rotating in the same direction and forcing water therefrom against the blades of the parallelly disposed rudders in both the port and starboard groups as shown in Fig. 4.

The net result therefore of the particular arrangement and disposition of the parts illustrated and described above is that a vessel answers the helm, or the change in the position of the rudders much more quickly and with greater certainty than is the case in any other arrangement with which I am acquainted. As a matter of fact, tests have shown that not only does this arrangement of parts secure an accurate and quick response to the helm, but it does so without retarding the mechanical speed of the boat in the water. These advantages are of great importance in boats of this type.

It is obvious that those skilled in the art may vary the details of construction as well as the arrangement or parts without departing from the spirit of the invention, and therefore it is not desired to be limited to the above disclosure except as may be required by the claims.

What is claimed is:—

1. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders coacting with said aft rudders; and means to independently operate the port and starboard rudders.

2. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders one coacting with one of each of said aft rudders; and means to independently operate the port and starboard rudders.

3. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders mounted in a transverse plane parallel to said first named plane and coacting with said aft rudders; and means to independently operate the port and starboard rudders.

4. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders mounted in a transverse plane passing substantially through the forward ends of said chambers and coacting with said aft rudders; and means to independently operate the port and starboard rudders.

5. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders coacting with said aft rudders to form a channel for the water set in motion by said propellers; and means to independently operate the port and starboard rudders.

6. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said

chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders mounted in a transverse plane parallel to said first named plane and coacting with said aft rudders to form a channel for the water set in motion by said propellers; and means to independently operate the port and starboard rudders.

7. In a tow boat of the chambered type the combination of a plurality of transversely disposed and longitudinally extending chambers; a plurality of aft rudders disposed on the port side of said boat and mounted in the transverse plane passing substantially through the centers of said chambers; a second plurality of aft rudders disposed on the starboard side of said boat and mounted in said transverse plane; a propeller located in each chamber and in said transverse plane; a plurality of forward rudders mounted in a transverse plane passing substantially through the forward ends of said chambers and coacting with said aft rudders to form a channel for the water set in motion by said propellers; and means to independently operate the port and starboard rudders.

8. In a tow boat of the chambered type the combination with a plurality of chambers of a plurality of rudders mounted in transverse and longitudinal planes below and adjacent said chambers, said rudders constituting a port group and a starboard group; a plurality of propellers, one in each chamber, disposed in one of said transverse planes; and means to operate each group of rudders.

9. In a tow boat of the chambered type the combination with a plurality of chambers of a plurality of rudders mounted in a plurality of transverse and longitudinal planes below and adjacent said chambers, one of said transverse planes passing substantially through the centers of said chambers, said rudders constituting a port group and a starboard group; a plurality of propellers, one in each chamber, disposed in one of said transverse planes; and means to operate each group of rudders.

10. In a tow boat of the chambered type the combination with a plurality of chambers of a plurality of rudders mounted in a plurality of transverse and longitudinal planes below and adjacent said chambers, one of said transverse planes passing substantially through the centers of said chambers and the other transverse plane passing substantially through the forward ends of said chambers, said rudders constituting a port group and a starboard group; a plurality of propellers, one in each chamber, disposed in one of said transverse planes; and means to operate each group of rudders.

11. In a tow boat of the chambered type the combination with a plurality of chambers of a plurality of rudders mounted in transverse and longitudinal planes below and adjacent said chambers, said rudders constituting a port group and a starboard group; a plurality of propellers located within the outer longitudinal planes of said rudders, one in each chamber, disposed in one of said transverse planes; and independent means to operate each group of rudders.

12. In a tow boat of the chambered type, the combination with a plurality of chambers of a plurality of propellers, one in each chamber, disposed in a transverse plane passing substantially through the centers of each chamber; a plurality of rudders constituting a part group and a starboard group, said rudders mounted in transverse and longitudinal planes below and adjacent said chambers, each rudder of one transverse plane coacting with one of the rudders in the other transverse plane to form a channel for the water set in motion by one of said propellers; and independent means to operate each group of rudders.

13. In a tow boat of the chambered type the combination of a plurality of aft rudders located in a transverse plane; a plurality of forward rudders located in a plane parallel to said transverse plane as well as in the same longitudinal planes of said aft rudders, said aft and forward rudders constituting a port group and a starboard group; a plurality of chambers located above and between said aft rudders; a propeller in each chamber to set in motion the water therein as well as the water in the channel formed by the adjacent aft rudders and their associated forward rudders; and independent means to operate each group of rudders.

14. In a control system for tow boats the combination with a screw propelled tow boat, of rudders disposed in a plurality of groups and in a plurality of transverse planes, one of said planes passing through the plane of the propellers, and means for operating each group of rudders.

15. In a control system for tow boats the combination with a screw propelled tow boat of the chambered type, of rudders adjacent said chambers and disposed in a plurality of groups and in a plurality of transverse planes, one of said planes passing through the plane of the propellers, and means for operating each group of rudders.

16. In a control system for tow boats the combination with a screw propelled tow boat, of rudders disposed in a plurality of groups and in a plurality of transverse and longitudinal planes, one of said planes

coinciding with the plane of the propellers, and means for independently operating each group of rudders.

17. In a tow boat of the chambered type the combination of a propeller in each chamber; and rudders disposed in a plurality of transverse planes, one of said planes passing through said propellers.

18. In a tow boat of the chambered type the combination of a propeller in each chamber; and rudders disposed in a plurality of transverse and longitudinal planes, one of said transverse planes passing through said propellers.

In testimony whereof I affix my signature.

CHARLES E. WARD.