April 10, 1956 E. F. PEPPARD 2,741,210

BOAT AND PADDLE WHEEL STEERING SYSTEM

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FIG. 1

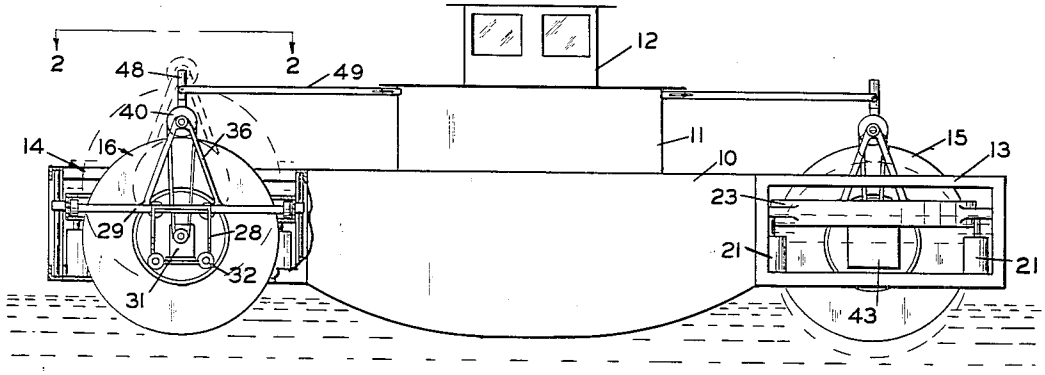
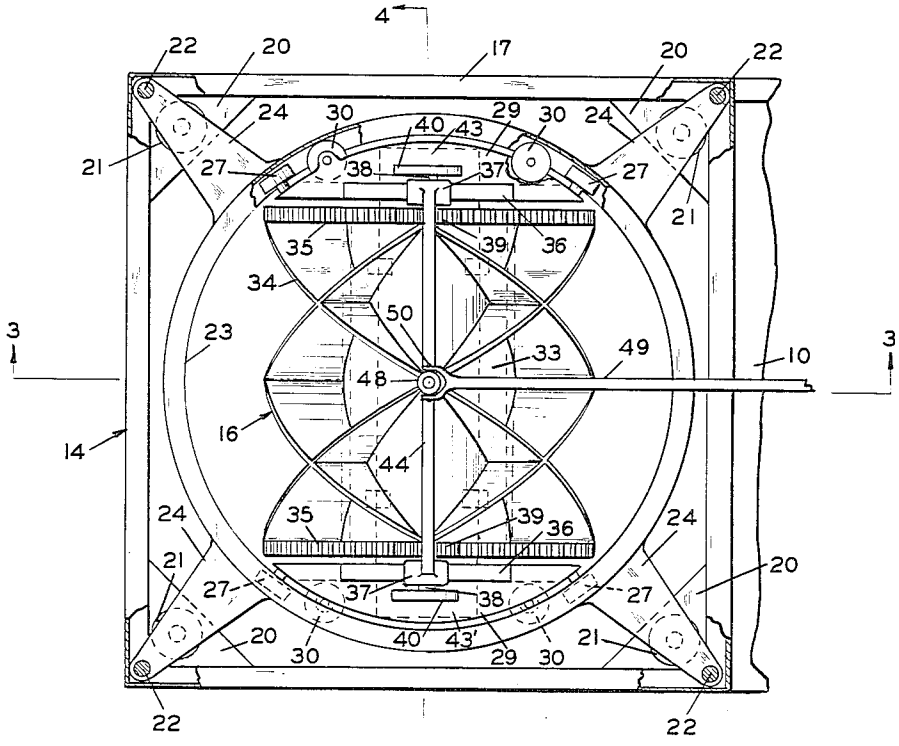


FIG. 2



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FIG. 3

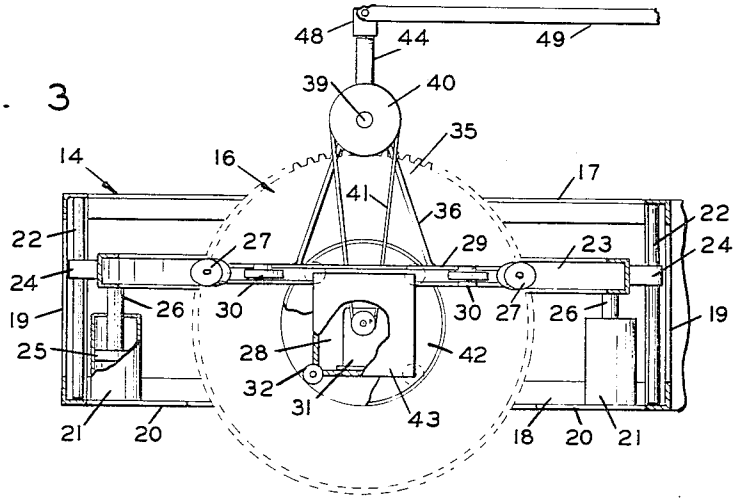


FIG. 4

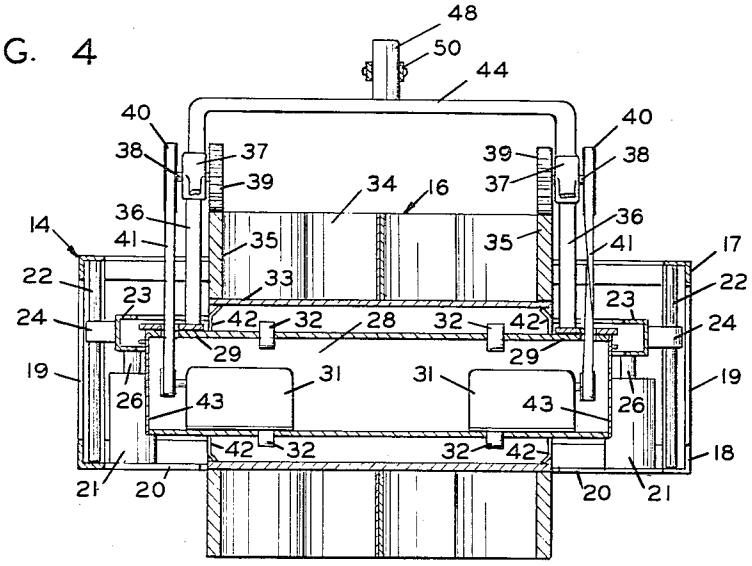


FIG. 5

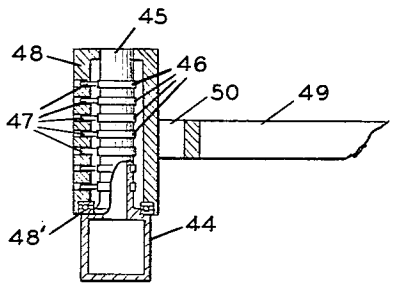
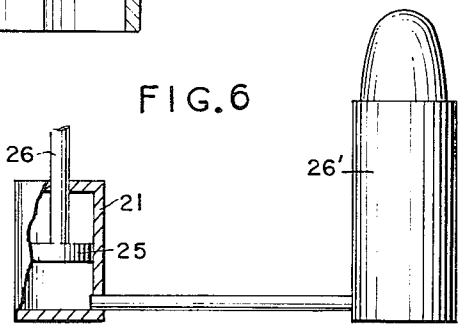


FIG. 6



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BOAT AND PADDLE WHEEL STEERING SYSTEM

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14 Claims. (Cl. 115—50)

This invention relates to watercraft and more particularly to a shallow draft paddle wheel boat which is especially adapted to be used as a towboat or tugboat.

In a boat or ship for use extensively in rivers, lakes and inland waterways, particular attention must be paid to the design of a craft which has few parts protruding from the underwater hull, since the depth of the water in inland bodies varies a great deal and there is likelihood that any large propeller or rudder protruding beneath the hull would be damaged by striking the bottom. In the past, steam boats having paddle wheels have been used on these inland bodies of water because there is very little danger of damaging the propelling paddle wheel. Because of the low speed characteristics of a propelling paddle wheel, bulky low speed reciprocating machinery has been used to provide the necessary power to drive these paddle wheels.

Due to the lack of maneuverability of prior art paddle wheel ships, and with the advent of high speed internal combustion engines, the trend in the art has been toward multi-screw propeller driven ships which may utilize these compact power units and also have the added advantage of being more easily maneuverable. With the advantages mentioned above, a propeller driven ship has the disadvantage of usually having the propulsion propellers extending beneath the hull of the ship where they can be damaged. Further, these propellers provide a reasonably small displacement area and, hence, they must drive a small column of water at a reasonably high speed with resulting lowered efficiency.

Briefly, my invention comprises a paddle wheel boat having propelling means such as propelling wheels which may be supported at the forward and after ends of the hull, each propelling wheel is independently rotated about its transverse axis, which axis may be independently pivoted about its vertical axis, and also may be raised or lowered with respect to the hull. The mechanism for raising and lowering the transverse axis functions to determine the depth of stroke of the paddle blades and also acts as a counterbalance member by means of which the paddle wheel will automatically be raised if one of its blades strikes an object on the bottom of the body of water, then automatically lowered after the paddle wheel has passed over the object.

Accordingly, it is an object of my invention to provide a paddle wheel type boat or ship which utilizes small internal combustion engines for power and which also has high maneuverability characteristics.

Another object of my invention is to provide propulsion means which is especially adapted to provide maximum power, maximum efficiency, and maximum maneuverability for a boat which is adapted to operate in shallow waters.

Another object of my invention is to provide a towboat having paddle wheels which may separately be rotated in a 360° horizontal arc to provide propulsion in any desirable direction.

Another object of my invention is to provide a towboat having the above characteristics and which is provided with propulsion machinery so arranged that the center of gravity is at the center of the ship.

Another object of my invention is to provide a towboat having paddle wheels forward and aft which may be raised or lowered into the water so as to utilize the optimum ratio of displacement area to effective horsepower.

Another object of my invention is to provide a paddle wheel type boat or ship wherein the paddle wheels are hydraulically balanced to ride up and away from obstructions.

Other and further objects and advantages of my invention will become apparent from the following description when taken in conjunction with the accompanying drawings in which like characters of reference designate corresponding parts throughout the several views, and wherein:

Fig. 1 is a side elevation of a ship constructed in accordance with my invention.

Fig. 2 is an enlarged top view taken along line 2—2 of Fig. 1.

Fig. 3 is a cross-sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is a cross-sectional view taken along line 4—4 of Fig. 2.

Fig. 5 is a partially broken side elevation of a detail.

Fig. 6 is a schematic view of a detail showing the hydraulic accumulator connected to the hydraulic cylinder.

Referring now to the embodiment chosen for purpose of illustration, numeral 10 denotes the hull of a ship constructed in accordance with my invention and having superstructure 11 and wheel house 12. It should be noted that wheel house 12 is centrally located with respect to hull 10 so that the pilot may have full vision in all directions as well as full observation of the operation of the paddles.

Projecting both from the forward and after ends of hull 10 are frame structures 13 and 14 which in turn respectively support propelling wheels 15 and 16. The construction of each frame structure and each propelling wheel is identical, the structure of the after propelling wheel being shown in more detail in Figs. 2, 3 and 4.

In Figs. 2, 3 and 4, frame structure 14 is illustrated as comprising an upper rectangular frame 17 and a lower rectangular frame 18 which are rigidly connected together by struts 19 extending vertically between the corners of the respective frames. Now it can be seen that both frame structure 13 and frame structure 14 comprise a box-shaped member projecting in front of and behind hull 10.

At each corner of lower frame 18, triangular-shaped reinforcing gussets 20 support hydraulic cylinders 21, the function of which will be described in more detail hereinafter. Adjacent each of the vertical struts 19 and within the frame structure, are vertical stabilizing bars 22 which are rigidly connected to the corners of upper and lower frames 17 and 18 and serve to transmit the thrust from the propelling wheel 16 to frame structure 14. The assembly for horizontal rotation and lifting or lowering of propelling wheel 16 comprises an annular channel member 23 which is positioned within the frame structure and connected to bars 22 by arms 24 which are slidably positioned thereon so that member 23 may be moved up and down within the frame structure 14. In order to support member 23 and to provide for vertical movement and positioning thereof, a piston 25 is located within each of cylinders 21 and connected to arms 24 through piston shafts 26. A conventional hydraulic accumulator system 26' provides hydraulic fluid for cylinders 21 at substantially constant pressure, so that propelling wheel 16 may be positioned horizontally or either

raised or lowered by increasing or decreasing the pressure. The additional functions of the hydraulic piston **25** and hydraulic cylinder **21** will be covered in more detail later in the specification.

Suspended from member **23** by rollers **27** which ride on the lower lip of member **23**, is an engine room **28**, rollers **27** being fixed to engine room **28** by roller retaining plates **29**, which extend from the ends of the upper horizontal wall of engine room **28**. To transmit the forward or rearward thrust of the propelling wheel to member **23**, and also to assist rollers **27** in positioning the engine room with respect to member **23**, I have provided a plurality of horizontal rollers **30** along the outer arcuate edge of roller supporting plate **29** which rollers extend into member **23** and ride against the vertical annular wall thereof.

As seen most clearly in Figs. 3 and 4, engine room **28** is substantially square in cross-section and its length is substantially equal to the diameter of annular channel **23** thus providing sufficient space within engine room **28** for prime movers such as engines **31** mounted within either end thereof. Bearings **32**, see Fig. 1, are rotatably fixed along the longitudinal edges of the engine room **28** to provide a bearing surface for the propelling wheel which comprises a paddle supporting sleeve **33** encompassing substantially the entire engine room **28** in concentric manner. Paddle blades **34** extend outwardly from sleeve **33** and may be of any conventional shape; however, in combination with my mechanism for raising and lowering the propelling wheel in the water, it is preferable to provide paddles of substantially large cross-sectional area and depth, which are capable of smooth entry into the water and exit from the water as the paddle is rotated. Hence, I have provided interlaced helical paddle blades **34** which extend radially from sleeve **33** and which are seen most clearly in Fig. 2. In this figure, it may be seen that each paddle blade **34** begins at one end of sleeve **33**, extends around the outer periphery of the sleeve **33** and terminates at the other end thereof, 180° axially from its start. A second paddle blade **34** begins at the same point as the first paddle blade and extends around sleeve **33** in an opposite direction to terminate at the other end of the sleeve, in a position adjacent the first blade. Other blades start 90° radially from the first and second blades and parallel the path of these blades so that each individual blade terminates axially 180° from its beginning. Therefore, it may be seen the paddle blades **34** are arranged in interlaced multi-thread screw formation having both left and right hand threads.

Concentrically fixed at both ends of sleeve **33** for rotation therewith are pinions **35**, each being respectively driven from one of engines **31** through a transmission means as illustrated in Figs. 1, 3 and 4. Each transmission means comprises an A frame **36** mounted outwardly adjacent its respective pinion in an upright position on one of plates **29**. At the apex of each A frame **36** there is a horizontal journal **37** which rotatably retains a power transmission shaft **38** having a pinion driving gear **39** at one end and a pulley **40** at the other end. Each gear **39** meshes with its respective pinion **35**, and each pulley **40** is connected to one of engines **31** through a continuous belt **41**.

In order to protect the rollers **32** from floating objects in the water, annular flanges **42** are located around the outside of housing **28** and about the inside periphery of the ends of sleeve **33**. To protect the engine room **28** from entrance of water, end covers **43** are provided at each end of engine room **28**, and ingress and egress to and from the engine room is provided by hatches **43'** indicated by broken lines on plates **29** in Fig. 2. These hatches **43'** have appropriate openings through which belts **41** extend and by means of which air is supplied to the engines **31**.

Fixed to bearings **37**, above the paddle wheel is a yoke **44** which passes across the top of the paddle wheel and supports at its center portion an upstanding slip ring carrying shaft indicated by numeral **45** in Fig. 5. Slip ring carrying shaft **45** is concentric with member **23** so that upon horizontal rotation of the paddle wheel within member **23**, shaft **45** will merely rotate about its axis. On the outer periphery of slip ring carrying shaft **45** are a plurality of slip rings **46** which correspond to a plurality of vertically spaced brushes **47**. Brushes **47** are carried by brush retaining sleeve **48** which journals shaft **45** and is rotatably mounted by roller bearing **48'** on yoke **44**.

A cable carrying arm **49** is pivotally supported on the superstructure **11**, and its free end is provided with a pair of spaced arms **50**, between which in turn, is pivotally mounted sleeve **48**. Such cables (not shown) as are necessary to provide electrical current for starting and stopping the engines, controlling the speed thereof, for motorizing rollers **27** or **30** to pivot the propelling wheel within annular channel **23** and lighting for the engine room **28**, may enter the propelling wheel through the slip ring arrangement described above. Other means such as the device illustrated in U. S. Patent No. 149,091 may be utilized for rotating the propelling wheel about a vertical axis.

Summing up the operation of my paddle wheel boat, the propelling wheels **15** and **16**, independently mounted fore and aft on the hull, are supported by hydraulic pressure so that they may ride up and over any obstacles which they may strike and also so that the depth of the paddle wheel stroke may be maintained at an optimum depending on the speed of the engines. By pumping hydraulic fluid into or out of cylinders **21**, each propelling wheel may be raised or lowered as desired; in addition, since the hydraulic fluid is at substantially constant pressure, any force acting on the bottom of the propelling wheel such as when it strikes an obstruction will cause the paddle wheel to be raised since fluid will rush into the bottom of cylinder **21**.

Because the prime movers are within the center of the propelling wheels, the axis of rotation of each propelling wheel may be varied in a horizontal plane defined by annular channel **23**; hence, each propelling wheel may be independently positioned to drive a column of water in any direction through a 360° horizontal arc.

It is obvious therefore, that maneuvering feats, hitherto unknown for a ship of this class may be accomplished. For example, by positioning the axis of rotation of each paddle along the center line of the ship, while driving a column of water in opposite directions, the ship may be made to execute at twist with "no way on." Further, by driving a column of water in the same direction with each propelling wheel, the ship may be made to move sideways or at obliques as desired.

It will be obvious to those skilled in the art that many variations may be made in the single embodiment chosen for purpose of illustration without departing from the scope of my invention as defined by the appended claims.

I claim:

1. In a shallow draft paddle wheel boat, a paddle wheel for propelling said boat, said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means within said paddle wheel for rotating said paddle wheel about a transverse axis to propel said boat, means for rotating said paddle wheel about an upright axis to steer said boat, and lifting means connected to said boat selectively operable to raise and lower said paddle wheel with respect to the waterline on said boat.

2. In a shallow draft paddle wheel boat, a paddle wheel for propelling said boat, said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means within said paddle wheel for rotating said paddle wheel about a transverse axis to propel said boat, means for rotating said paddle wheel about an upright axis for steering of said boat, hydraulic accumulator means

supporting said paddle wheel on said boat and counterbalancing the weight of said paddle wheel, and lifting means connected to said boat selectively operable to raise and lower said paddle wheel with respect to the waterline on said boat.

3. In a shallow draft paddle wheel boat, a paddle wheel for propelling said boat, said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means within said paddle wheel for rotating said paddle wheel about a transverse axis to propel said boat, means for rotating said paddle wheel about an upright axis to steer said boat, and hydraulic accumulator means connected to said boat and supporting said paddle wheel on said boat and counterbalancing the weight of said paddle wheel, said paddle wheel being mounted for free upward movement so as to ride up and over obstructions in its path.

4. In a shallow draft paddle wheel boat, a paddle wheel for propelling said boat, said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means within said paddle wheel for rotating said paddle wheel about a transverse axis to propel said boat, means for rotating said paddle wheel about an upright axis to steer said boat, counterbalancing means supporting said paddle wheel on said boat and counterbalancing the weight of said paddle wheel, and lifting means connected to said boat selectively operable to raise and lower said paddle wheel with respect to the waterline on said boat.

5. In a shallow draft paddle wheel boat, a paddle wheel at each end of said boat, at least one said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means for rotating each said paddle wheel about a transverse axis to propel said boat, means for rotating at least one said paddle wheel about an upright axis to steer said boat, and counterbalancing means on said boat supporting at least one said paddle wheel on said boat and counterbalancing the weight thereof.

6. In a shallow draft paddle wheel boat, a paddle wheel at each end of said boat, at least one said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means for rotating each said paddle wheel about a transverse axis to propel said boat, means for rotating at least one said paddle wheel about an upright axis to steer said boat, counterbalancing means on said boat supporting at least one said paddle wheel on said boat and counterbalancing the weight thereof, and lifting means selectively operable to raise and lower at least one said paddle wheel with respect to the waterline on said boat.

7. In a shallow draft paddle wheel boat, a paddle wheel at each end of said boat, at least one said paddle wheel being mounted for rotation about both a transverse axis and an upright axis, means for rotating each said paddle wheel about a transverse axis to propel said boat, means for rotating at least one said paddle wheel about an upright axis to steer said boat, counterbalancing means on said boat supporting each said paddle wheel on said boat and counterbalancing the weight of each said paddle wheel, and lifting means selectively operable to raise and lower each said paddle wheel with respect to the waterline on said boat.

8. In a shallow draft paddle wheel boat, a paddle wheel at each end of said boat, each said paddle wheel being mounted for independent rotation about both a transverse axis and an upright axis, means for rotating each said paddle wheel about a transverse axis to propel said boat, means for rotating each said paddle wheel

about an upright axis to steer said boat, counterbalancing means on said boat supporting each said paddle wheel on said boat and counterbalancing the weight of each said paddle wheel, and lifting means selectively operable to raise and lower each said paddle wheel with respect to the waterline on said boat.

9. In a shallow draft paddle wheel boat, a rectangular frame connected to said boat, hydraulic counterbalance means mounted at the corners of said frame, an annular member mounted on said hydraulic counterbalance means to be raised and lowered by the same, a paddle wheel mounted in said member for rotation about its axis and for rotation within said member about an upright axis, means connected to said member for rotating said paddle wheel about said upright axis to steer said boat, and means within said paddle wheel for rotating the same about its axis.

10. In a shallow draft paddle wheel boat, a frame connected to said boat, hydraulic conuterbalance means mounted to said frame, an annular member mounted on said hydraulic counterbalance means to be raised and lowered by the same, a paddle wheel mounted in said member for rotation about its axis and for rotation within said member about an upright axis, means connected to said member for rotating said paddle wheel about said upright axis to steer said boat, and means within said paddle wheel for rotating the same about its axis.

11. The structure as claimed in claim 10 wherein said means for rotating said paddle wheel includes an engine axially within said paddle wheel, a rack on said paddle wheel and pinion means engaging said rack and driven from said motor for rotating said paddle wheel.

12. The structure as claimed in claim 10 wherein said hydraulic counterbalance means includes a hydraulic accumulator supplying substantially constant pressure, hydraulic cylinders positioned on said frame, and hydraulic pistons within said cylinders and connected to said annular member.

13. The structure as claimed in claim 10 wherein said annular member includes an annular channel member and said means for rotating said paddle wheel about an upright axis includes horizontal rollers riding in said annular channel member and other rollers supporting said paddle wheel within said annular channel member.

14. In a shallow draft paddle wheel boat, a paddle wheel having a hollow axis, an engine room disposed in said hollow axis, means within said engine room for rotating said paddle wheel about its axis, an annular member surrounding said paddle wheel and connected to said boat, said engine room being suspended from said annular member, means connected to said engine room for rotating said engine room and said paddle about an upright axis within said annular member to steer said boat, and support means projecting from said annular member for connecting said annular member to said boat.

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