May 6, 1947. R. STEPHENS, JR 2,420,154

RUDDER CONTROL LINKAGE

Filed Jan. 4, 1945 2 Sheets-Sheet 1

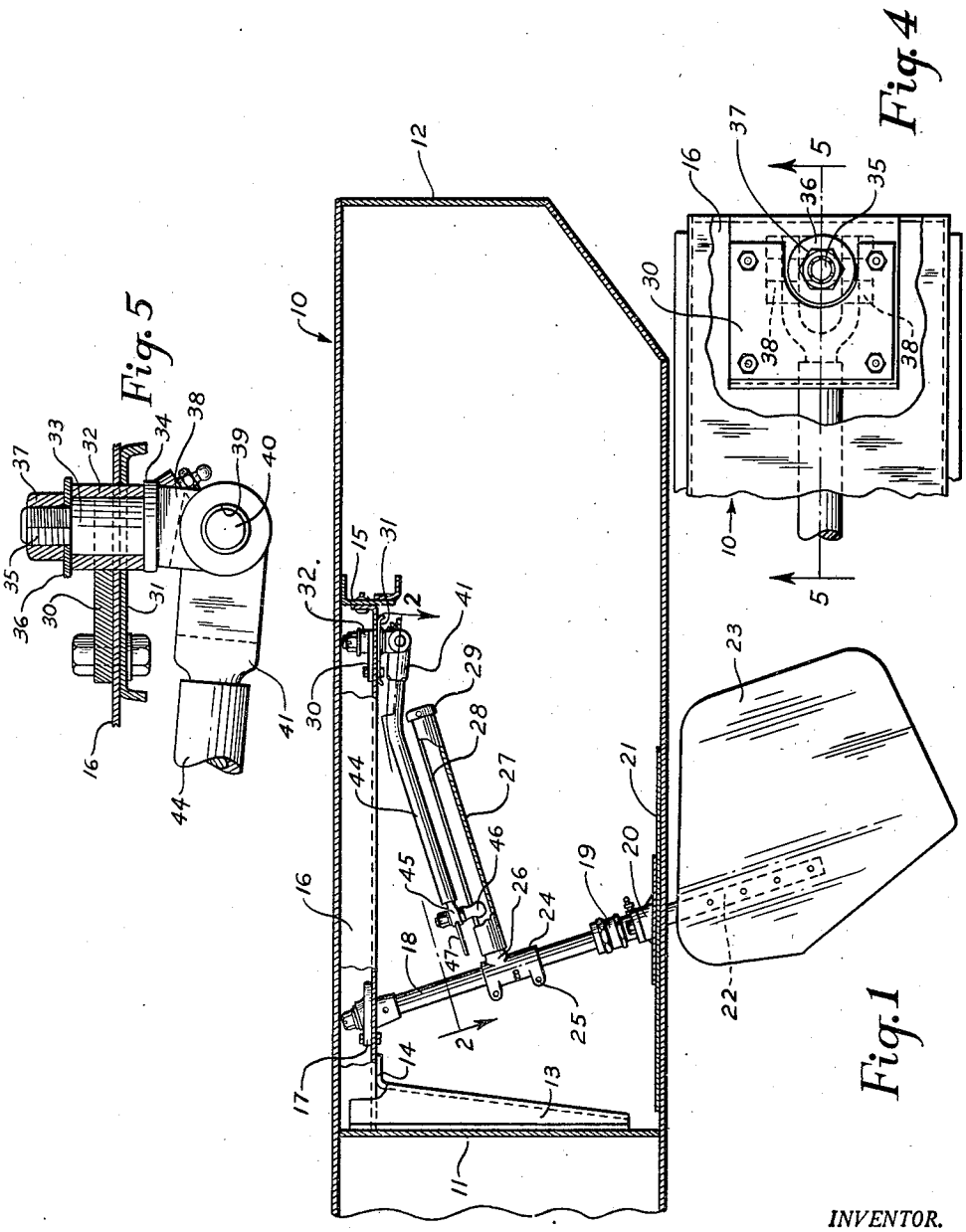

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Fig. 2

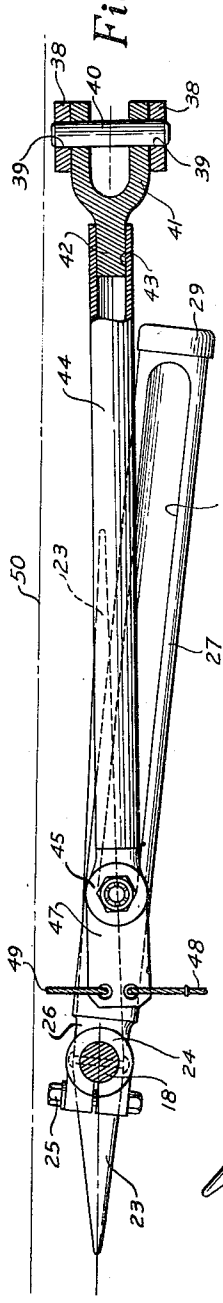
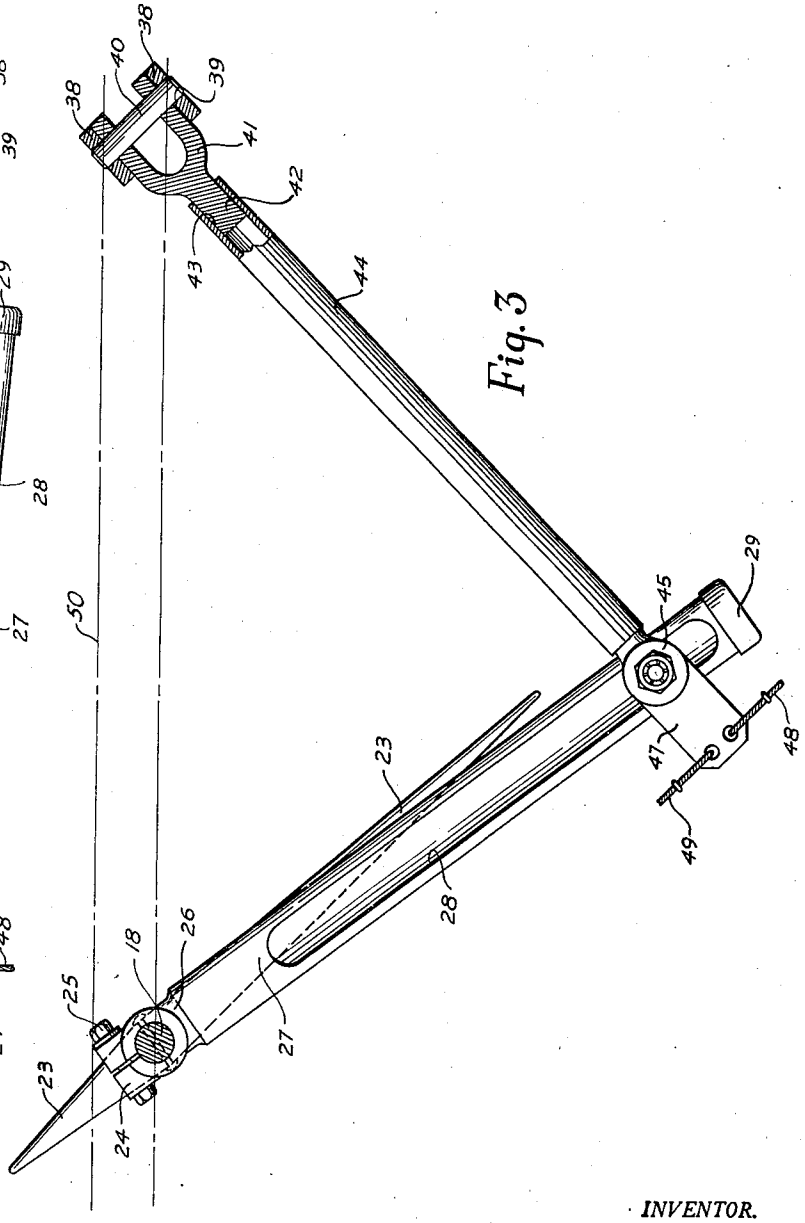


Fig. 3



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RUDDER CONTROL LINKAGE

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This invention relates generally to rudder controls and more particularly to a rudder control mechanism for boats.

An object of the present invention is to provide a rudder control mechanism in which the rudder is turned in response to movement of the steering means at rates varying with different angular positions of the rudder.

Another object of the invention is to provide a rudder control mechanism in which the initial response to the steering means is at a higher rate than the response in the final range.

Still another object of the invention is to provide a rudder control mechanism in which the rudder is turned in response to movement of the steering means at a rate continuously varying from a maximum when the rudder is parallel to the longitudinal centerline of the boat to a minimum when the rudder is turned to its maximum angular position in either direction.

Still another object of the invention is to provide a rudder control mechanism particularly adapted for use with amphibious vehicles of the type in which both the steering wheels of the vehicle and the rudder are operated by the same steering means, and in which a substantial turn of the rudder is possible with only a partial turn of the steering means. This permits a complete turn of the rudder with only a partial turn of the front wheels and provides the quick control of rudder essential in amphibious operations of military character.

Other objects and advantages of the present invention will be made more apparent as this description proceeds, particularly when considered in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal vertical cross-sectional view, partially broken away, of the after portion of a boat embodying my improved rudder control mechanism.

Figure 2 is a horizontal cross-sectional view taken on the plane indicated by the line 2—2 of Figure 1, showing the parts of the mechanism in their proper relation for straight-ahead steering.

Figure 3 is a horizontal cross-sectional view similar to Figure 2, but illustrating the parts of the mechanism in their relative positions for maximum turning in one direction.

Figure 4 is a fragmentary plan view, partially broken away, of a detail of the construction shown in Figure 1.

Figure 5 is a vertical cross-sectional view taken on the plane indicated by the line 5—5 of Figure 4.

Referring now more particularly to the drawing, the reference character 10 indicates the after portion of the hull of a boat. A vertical bulkhead 11, spaced from the transom 12 of the boat, carries a bracket 13 having a rearwardly extending horizontal flange 14. Supported at its forward end by the flange 14 and bolted at its rearward end to the transversely extending angle iron 15 is an inverted channel-shaped member 16. A support 17 is bolted to the member 16 near its forward end, and a rudder post 18 has its upper end journalled in a bearing in the support and its lower end extending through the stuffing-box 19 and journalled in a bearing in the support 20, the latter being suitably attached to the bottom wall 21 of the hull 10. The portion 22 of the rudder post 18 extending through the bottom wall 21 of the hull has suitably secured thereto a rudder 23, which is adapted to be turned to steer the boat.

A split bushing 24 is clamped to the rudder post 18 intermediate the support 17 and the stuffing box 19 by means of the bolts 25, and is provided with a rearwardly extending boss 26 to which is suitably secured, as for example by welding, a tubular lever 27. The tubular lever 27 is provided in its upper surface with a slot 28 extending axially thereof, and its rearward end is closed by means of a cap 29.

As best seen in Figure 5, the after end of the channel shaped member 16 is reinforced by means of plates 30 and 31 positioned on opposite sides of the member 16. A bearing 32 extends through the member 16 and the plate 31 and is suitably secured thereto, as for example by welding. The bearing 32 extends vertically and has journalled therein a stud 33. The stud 33 is provided with a shoulder 34 engageable with the lower end of the bearing 32 and with a reduced threaded portion 35 at its upper end adapted to receive a washer 36 and a nut 37 to retain the stud in the bearing. The lower portion of the stud 33 is bifurcated, forming ears 38 provided with the aligned apertures 39.

A pin 40 extends through the apertures 39. Journalled upon the pin 40 is a yoke 41 having a forwardly extending portion 42 which is reduced in diameter and which is secured in a bore 43 formed in the rearward end of a tiller in the form of a tubular lever 44. It will be noted that the lever 44 is thus mounted for pivotal movement around a vertical axis formed by the stud 33 and a horizontal axis formed by the pin 40. In this manner, universal movement of the lever 44 is obtained.

The forward portion of the tubular control

lever 44 is bent downwardly to enable the latter to be positioned adjacent and parallel to the tubular lever 27. An apertured lug 45 is secured to the forward end of the control lever 44 and carries a ball connection 46 extending downwardly therefrom. The neck portion of the ball connection 46 closely engages the slot 28 formed in the upper surface of the tubular lever 27, and the enlarged end portion of the ball connection is received within the tubular lever 27. Assembly of the ball connection within the tubular lever 27 is accomplished by removing the cap 29 from the end of the lever 27 and inserting the ball connection therein. It will be apparent that the ball connection 46 is slidable axially within the tubular lever 27 and forms a universal connection therewith.

Secured to the lug 45 and extending forwardly therefrom is a plate 47 to which are attached a pair of control cables 48 and 49. The control cables are suitably connected to conventional steering means (not shown) such as a steering wheel. In the case of an amphibious vehicle, one steering control may be utilized for both the rudder and the wheels of the vehicle, and the cables 48 and 49 may be connected to this control.

It will be noted in Figures 2 and 3 that the rudder post 18 and the pivotal point of the yoke 41 are positioned a short distance to one side of the longitudinal center line 50 of the hull of the boat. In addition, when the rudder 23 is parallel to the center line of the boat, as in Figure 2, the control lever 44 and the tubular lever 27 are disposed at a slight angle thereto. In certain hull constructions the vortex formed by the propeller results in unequal turning circles to the left and right. This is counteracted by the offset construction mentioned above, and approximately equal minimum turning circles in each direction are obtained.

Operation

At the outset it should be mentioned that the type of rudder control mechanism herein described is particularly advantageous when used with an amphibious vehicle of the type in which one steering wheel controls both the rudder and the front wheels of the vehicle, and is used on a well-known type of amphibious cargo vehicle currently used in military operations. Vehicles of this type have conventional steering controls for steering the front wheels of the vehicle during land operation. For simplicity of construction and operation, the same steering wheel is used to steer the vehicle during water operation. This is accomplished by coupling the rudder of the vehicle to the steering wheel so that turning the latter turns both the rudder and the front wheels of the vehicle. For amphibious operation, it is essential to provide a quick control of the rudder, and it is therefore desirable to enable the rudder to be turned a substantial amount with only a partial turn of the steering control and a resulting partial turn of the front wheels of the amphibious vehicle. As hereinafter described, the initial response of the rudder to the steering control is at a higher rate than the response in the final range of travel. Although particularly advantageous for amphibious vehicles, it will be understood that this type of rudder control mechanism is also desirable in other types of boats as well.

The steering wheel (not shown) is linked to the plate 47 by means of the cables 48 and 49. Since the plate 47 is attached to the control lever 44 by means of a lug 45, operation of the steering wheel results in moving the lever 44 toward one side of the hull of the boat about the pivot formed by the stud 33 journalled in the bearing 32. The resulting movement of the ball connection 46 carried by the control lever 44, swings the control lever 27 about the axis of the rudder post 18. The lever 27, being rigidly connected to the rudder post by means of the split bushing 24, turns the latter and also the rudder 23 carried thereby.

During the initial angular movement of the control lever 44 from the position shown in Figure 2, in either direction, the ball connection 46 engages the tubular lever 27 at a point spaced a minimum distance from the rudder post 18. As the control lever 44 is turned from the position shown in Figure 2 to the position shown in Figure 3, the ball connection 46 slides radially outwardly from the rudder post 18 in the tubular lever 27 and engages the latter at points spaced progressively a greater distance from the rudder post 18.

From the foregoing it will be noted that the length of the lever arm of the control lever 44 is fixed, and that the effective length of the lever arm of the tubular lever 27 varies depending upon the point of engagement of the ball connection 46 and the lever 27. During the initial turning of the rudder from a straight-ahead position, a given increment of angular movement of the lever 44 results in a maximum angular movement of the lever 27. Further movement of the steering controls in the same direction results in affecting a smaller angular movement of the lever 27 for the same angular movement of the lever 44. In the extreme angular position of the rudder, the movement of the ball connection 46 is in a direction substantially parallel to the lever 27, resulting in an extremely small movement of the latter. In this manner the rate of movement of the rudder is continuously variable from a maximum in the initial stages of the steering to a minimum in the final range travel.

It will be noted that the rudder post 18 is rearwardly inclined with respect to the hull of the boat, and that the tubular lever 27 extends substantially radially thereof. The angular movement of the lever 27 about this inclined axis is compensated for by means of the universal connection between the control lever 44 and the hull 10, and the universal connection 46 between the levers 44 and 27.

Although I have shown and described certain embodiments of my invention, it will be understood that I do not wish to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of my invention as defined in the appended claims.

What I claim is:

1. In rudder control mechanism for boats having a hull, the combination of a rudder post pivotally mounted upon said hull, a rudder carried by said rudder post, a tubular lever secured to said post and extending generally radially therefrom, said lever having a slot in one side thereof extending axially of the lever, a tiller pivotally mounted at one end upon said hull and carrying on its other end means for controlling its motion, and a ball connection also mounted at said other end of said tiller and extending through said slot into said tubular lever, said ball connection being slidable in said slot and occupying positions in said tubular lever at points variously spaced from said rudder post in different angular positions of said rudder.

2. In rudder control mechanism for boats hav-

ing a hull, the combination of a rudder post pivotally mounted upon said hull slightly to one side of the longitudinal centerline of said hull, a rudder carried by said rudder post, a lever secured to said post and extending generally radially therefrom, said lever being disposed at a slight angle to the said rudder when the said rudder is parallel to the center line of the boat, a tiller pivotally mounted at one end upon said hull slightly to one side of the longitudinal centerline of said hull and carrying on its other end means for controlling its motion, and pivot means carried by said tiller engageable with said first-mentioned lever at points variously spaced from said rudder post in different angular positions of said rudder.

3. In a rudder control mechanism for boats having a hull, the combination of a rudder post pivotally mounted on said hull, said rudder post being inclined rearwardly with respect to said hull, a rudder carried by said rudder post, a lever secured to said post and extending substantially radially thereof, a tiller universally mounted at one end on said hull and carrying, on its other end, means for controlling its motion, universal ball connection means also mounted at the said other end of the said tiller for moving the said rudder lever, and sliding contact means between said ball connection and said lever whereby the point of contact between the said tiller and the said lever is moved axially of said rudder lever as the said tiller is activated.

4. In a rudder control mechanism for boats having a hull, the combination of a rudder post pivotally mounted upon said hull slightly to one side of the longitudinal center line of said hull, a rudder carried by said rudder post, a lever secured to said post and extending generally radially therefrom, said lever being disposed at a slight angle to the said rudder when the said rudder is parallel to the center line of the boat, a tiller pivotally mounted at one end on said hull

slightly to one side of the center line of said hull and carrying on its other end means for controlling its motion, pivot means also mounted on said other end of said tiller for moving the said lever, and sliding contact means between the said pivot and said rudder lever whereby the point of contact between said tiller and said rudder lever is moved axially of said rudder lever as said tiller is activated.

5. In rudder control mechanism for boats having a hull, the combination of a rudder post pivotally mounted upon said hull, a rudder carried by said rudder post, a lever secured to said rudder post and extending generally radially therefrom, said lever having thereon connection engaging means extending axially of said lever, a tiller pivotally mounted at one end upon said hull and carrying on its other end means for controlling its motion, and a pivoted connection also mounted at said other end of said tiller and engaging said connection engaging means on said lever, said connection being slidable on said connection engaging means and occupying positions on said lever at points variously spaced from said rudder post in different angular positions of said rudder.

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