Aug. 15, 1967 W. E. LEIGH 3,335,688

CONTROL VALVE CAM AND FOLLOWER

Filed Oct. 22, 1965

2 Sheets-Sheet 1

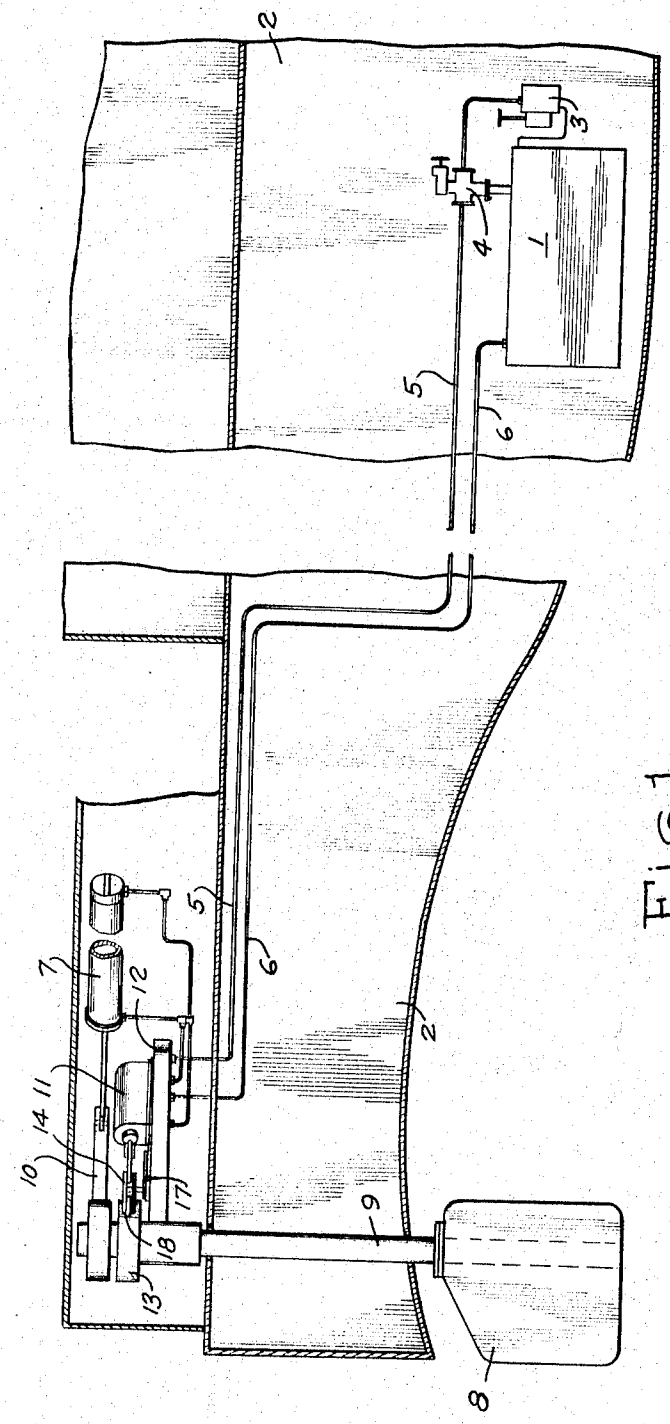


Fig 1

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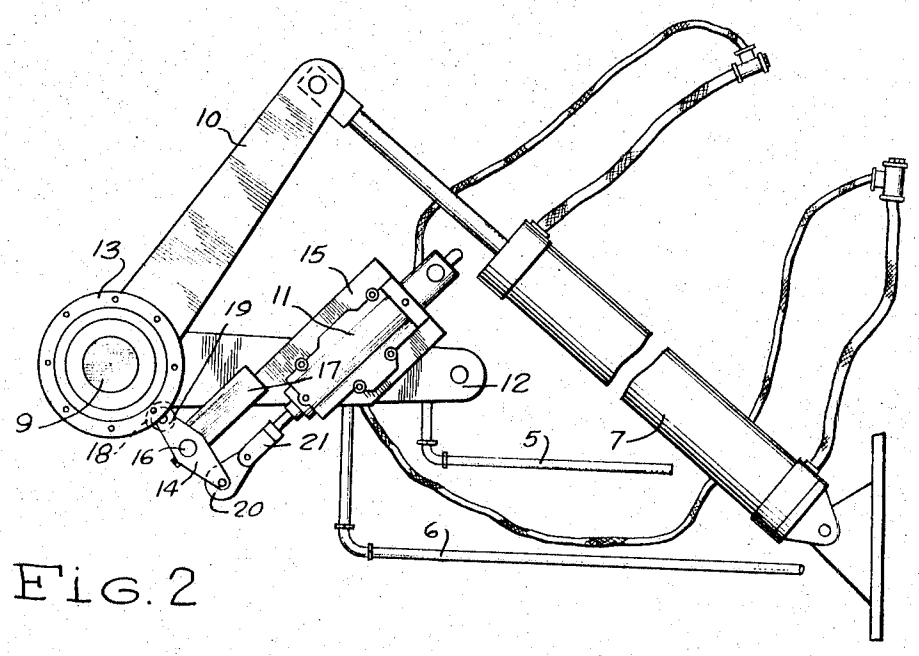


FIG. 2

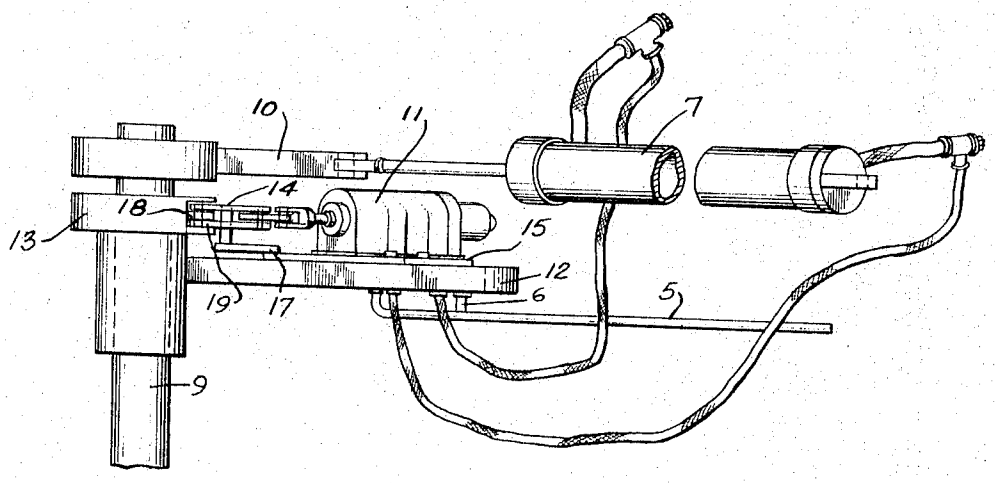


FIG. 3

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CONTROL VALVE CAM AND FOLLOWER

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This invention may be used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a hydraulic control mechanism, more specifically, to a cam and follower for actuating the hydraulic valve and cylinder of a rudder control mechanism. The invention provides direct hydraulic actuation for rudder control in place of manual actuation with hydraulic boost.

Previously, rudder control has been manual, with hydraulic boost. The prior art system consists essentially of a control valve attached to the rudder post. Movement of the steering lever in the pilothouse causes the valve to open to move a hydraulic cylinder which rotates the rudder post. A disadvantage of this system is that continuous overshooting and maneuvering of the steering lever is required to bring the rudder to the desired position. This maneuvering is required because the steering lever cannot be moved in advance of the rudder post rotation. Another disadvantage is that manual pressure and attention to the steering lever is required until the rudder has been set in its new position.

An object of this invention is to provide a rudder control mechanism whereby the steering lever may be set at a desired new position in advance of the rudder.

Another object is to provide a rudder control mechanism in which movement of a steering lever cam in advance of the rudder actuates a hydraulic cylinder which controls and causes rotation of the rudder post to set the rudder in line with the steering lever setting.

Another object is to eliminate overshoot by providing a rudder control mechanism in which the rotation of the rudder post is automatically stopped when the rudder is aligned with a preset steering lever position.

The structural features of the invention are illustrated in the accompanying drawings in which the control mechanism is depicted in a rudder control system. It is to be understood that the control mechanism could be used in many systems other than for rudder control, and that the control system could be other than hydraulic, for example, electrical.

FIG. 1 is an elevation view of a ship's rudder, the rudder control mechanism, and the hydraulic system for the control,

FIG. 2 is a plan view of the rudder post and rudder control mechanism.

FIG. 3 is an elevation view if the rudder post and rudder control mechanism.

Referring to the drawings, FIG. 1 illustrates the control mechanism and its hydraulic system. The hydraulic system can be conventional but will be briefly described. Storage tank **1**, located within boat hull **2**, is the reservoir for the hydraulic fluid. A conventional pump **3** is used to lift fluid from tank **1**. The tank may also be equipped with a relief valve and gauge, shown schematically at **4**. Fluid lines **5** and **6** complete a circuit from tank **1** through the control valve **11** and main hydraulic cylinder **7**. The rudder and rudder post are shown at **8** and **9**, respectively.

Referring to FIG. 2, the control mechanism is shown to comprise the hydraulic cylinder **7**, rudder post **9**, rudder post extension **10**, control valve **11** mounted on bracket **12**, cam disk **13** and cam follower **14**. Rudder post extension **10** is pivotally connected at its distal end to cylinder **7** and rigidly connected to post **9** at its proximate

end. Expansion or contraction of cylinder **7** causes a rotation of extension **10**, post **9**, and consequently rudder **8**. A conventional four-way valve **11** is the control valve for cylinder **7**. The valve is spring loaded for return to neutral position and is rigidly attached to plate **15** which is fixed to bracket **12**. Bracket **12** is attached to post **9** to rotate with the post. Cam follower **14** can consist of a rocker arm pivotally attached at **16** to bar **17**. Bar **17** is fixed to plate **15**. Cam disk **13** is notched at **18** to receive end **19** of rocker arm **14**. End **20** of arm **14** is pivotally attached to plunger **21** which operates valve **11**. Cam disk **13** is connected with a steering lever in the pilothouse to rotate with the steering lever, and is concentrically and rotatably mounted on post **9**.

In operation, when a rudder movement is desired the steering lever in the pilothouse, not shown, is moved to the desired setting. This rotates cam disk **13** and unseats rocker **14** which actuates plunger **21** and valve **11** to expand or contract cylinder **7**. Without further handling or attention from the pilothouse, post extension **10** moves the rudder post and bracket **12** until end **19** of arm **14** is again aligned with notch **18** of cam **13**. When notch **18** and arm **19** are aligned the arm reseats itself and shuts off fluid flow through valve **11**. At this point, the rudder has assumed a position corresponding to that set by the pilothouse steering lever. A movement of cam **13** in the opposite direction will cause a rotation of post **9** in the opposite direction by changing the direction of force on plunger **21**.

The control mechanism of this invention permits the rudder movement to be controlled by an easily and accurately moved steering lever. Once the steering lever has been set, no further manual pressure or attention is required from the pilothouse. The steering lever has a definite feel for the neutral position and can be brought immediately to the desired setting without waiting for the rudder to actually make the move. Overrunning or overshooting of the desired rudder setting is prevented, as is the need for maneuvering the rudder into the desired setting.

I claim:

1. A device for controlling rotation of a shaft having rotation means, said device comprising actuating means mounted on and rotatable with respect to said shaft, control means mounted on said shaft to rotate with said shaft for actuating and controlling said rotation means, said actuation means being rotatable from a neutral position with respect to said control means to a position which actuates said control means, said control means remaining actuated until said rotation means has rotated said shaft and control means to said neutral position with respect to said actuating means.

2. The device described in claim **1** wherein said rotation means comprises a hydraulic cylinder pivotally connected to an extension fixed to said shaft to rotate said shaft, wherein said actuating means comprises a cam, and wherein said control means comprises a hydraulic valve and a cam follower, said cam follower coacting with said cam to actuate said valve when said cam is rotated from the neutral position and to return to the neutral position when said valve is returned to alignment with the neutral position of said cam.

3. A device for controlling rotation of a shaft, said device comprising a hydraulic cylinder pivotally connected to a frame member and to an extension fixed to said shaft to rotate said shaft, a notched cam concentrically mounted on said shaft and rotatable with respect to said shaft, a hydraulic control valve for admitting fluid to said hydraulic cylinder, said valve being mounted on a bracket attached to said shaft to rotate therewith, said valve further comprising a plunger and a rocker arm pivotally connected to said bracket, said rocker arm being pivoted

out of a neutral position wherein it is aligned within the notch of said cam when said cam is rotated, the movement of said rocker arm actuating said control valve to cause said hydraulic cylinder to rotate said shaft and valve to a position where said rocker arm is again in a neutral position aligned within the notch of said cam.

4. In a control system for controlling the rudder movement of a boat, said system including a rudder, a rudder post, and a hydraulic system and cylinder for rotating said rudder post, a rudder control mechanism comprising a hydraulic control valve within said hydraulic system for admitting fluid to said hydraulic cylinder, said valve being mounted on a bracket fixed to said rudder shaft to rotate with the shaft, a plunger for actuating said control valve, a rocker arm cam follower pivotally connected to said plunger and to said bracket, and a cam having a notch to define the cam's neutral position, said cam being concentrically mounted on said rudder shaft

and rotatable with respect to said shaft, said rocker arm being seated within said cam notch in the neutral position and being actuated upon rotation of said cam to admit fluid to said hydraulic cylinder to cause rotation of said rudder post and valve until said rocker arm reaches the neutral position of said cam whereupon the rocker arm again seats itself within said notch thereby cutting off fluid flow to said hydraulic cylinder and stopping rotation of the rudder.

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