

No. 630,973.

Patented Aug. 15, 1899.

J. CHRISTENSEN.  
LIQUID BALANCE RUDDER BRAKE.

(Application filed Oct. 3, 1898.)

(No Model.)

2 Sheets—Sheet 1.

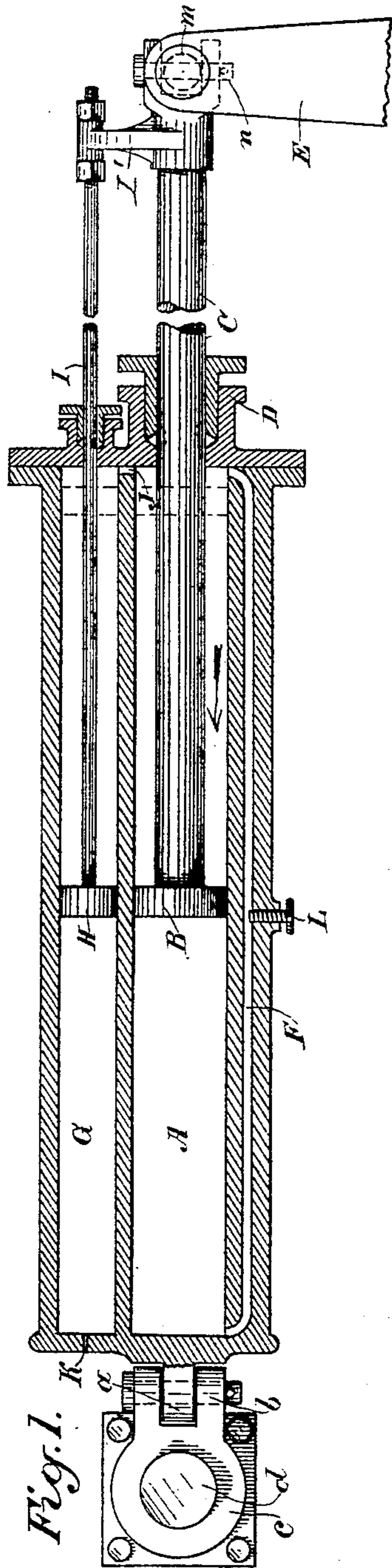


Fig. 1.

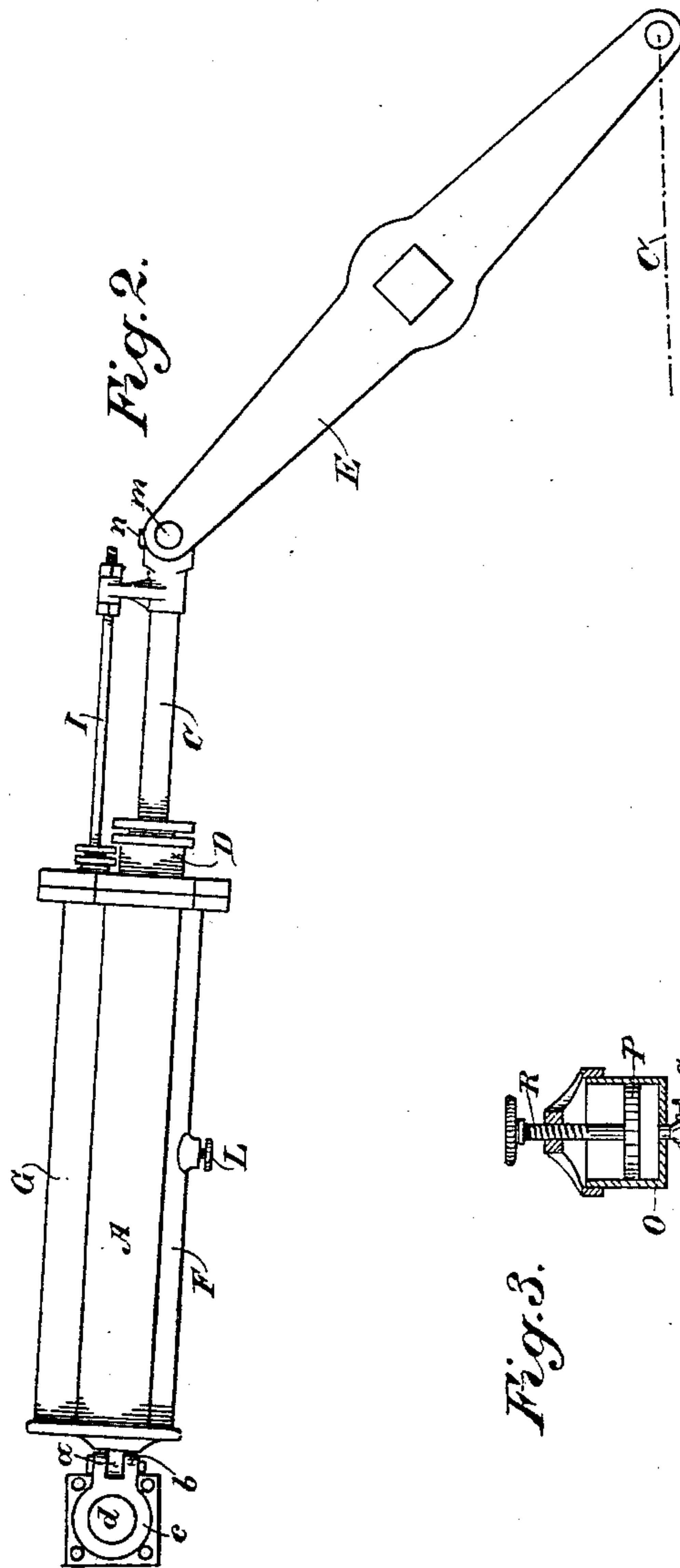


Fig. 2.

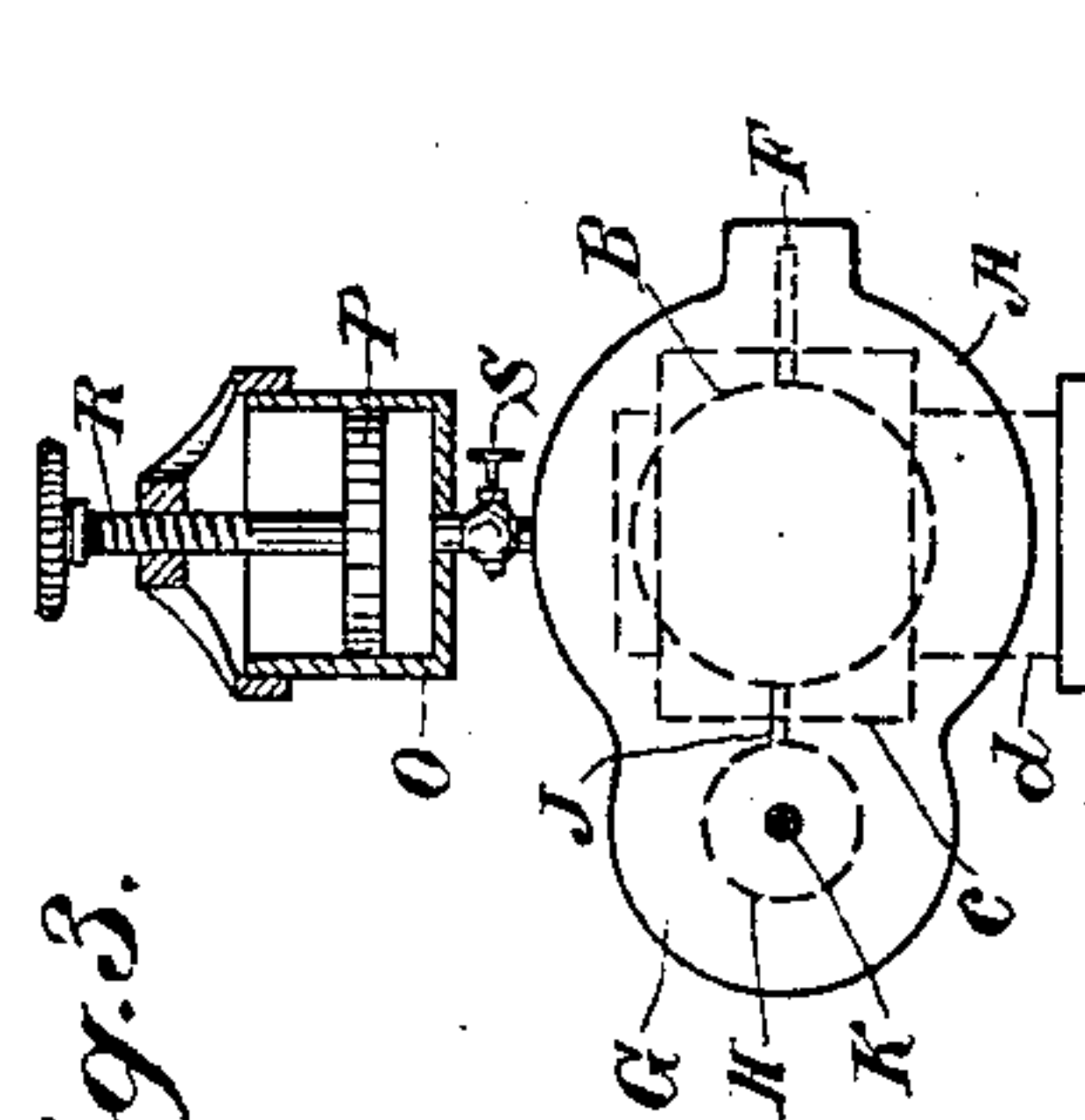


Fig. 3.

Witnesses,  
J. H. Stone  
J. F. Albrecht

Inventor,  
J. Christensen  
By Duway Strong & Co  
attys.

No. 630,973.

Patented Aug. 15, 1899.

J. CHRISTENSEN.  
LIQUID BALANCE RUDDER BRAKE.

(Application filed Oct. 3, 1898.)

(No Model.)

2 Sheets—Sheet 2.

Fig. 4.

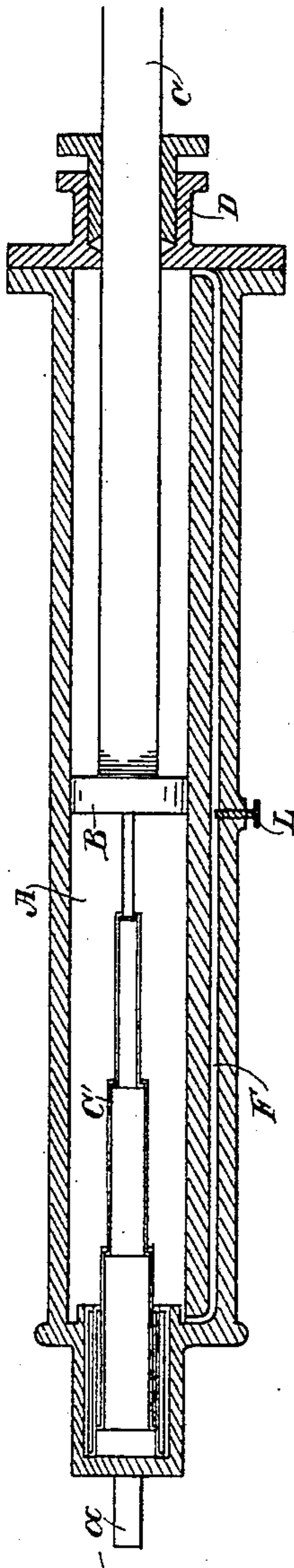


Fig. 5.

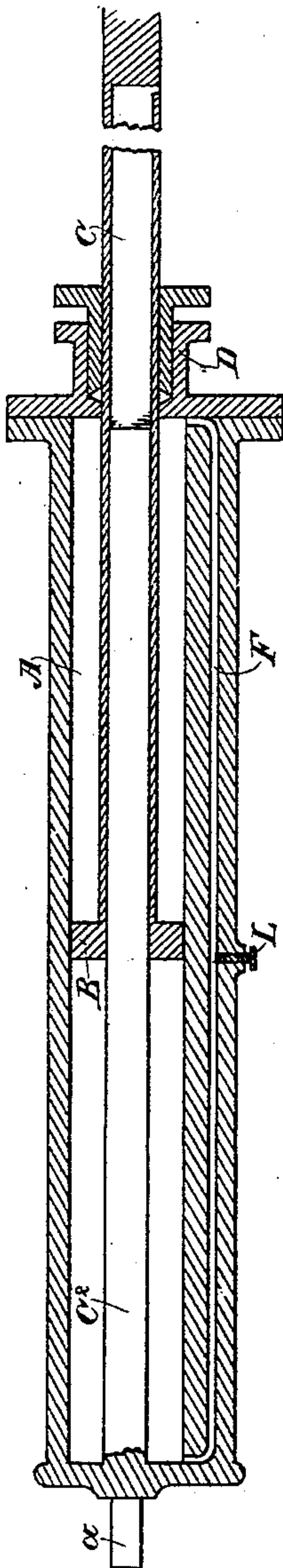
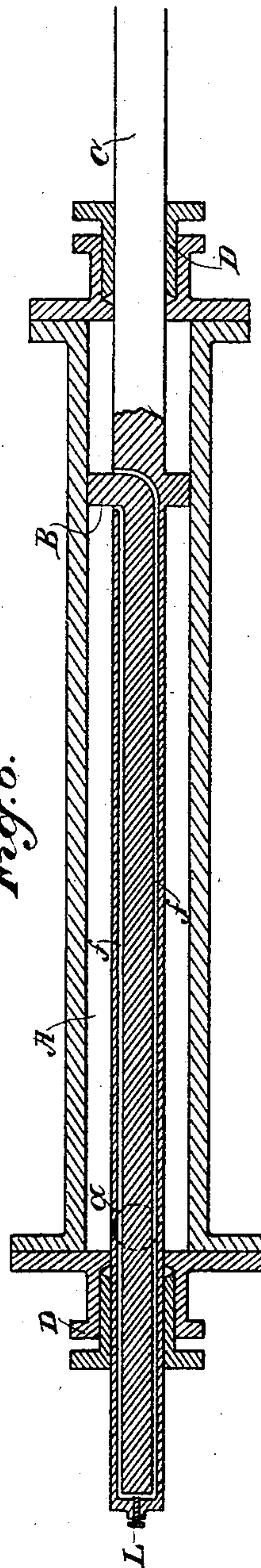


Fig. 6.



Witnesses,  
J. H. Torrey  
H. F. Aschbeck

Inventor,  
Jorgen Christensen  
By Dewey Strong & Co.  
attys.



# UNITED STATES PATENT OFFICE.

JORGEN CHRISTENSEN, OF SAN FRANCISCO, CALIFORNIA.

## LIQUID-BALANCE RUDDER-BRAKE.

SPECIFICATION forming part of Letters Patent No. 630,973, dated August 15, 1899.

Application filed October 3, 1898. Serial No. 692,496. (No model.)

*To all whom it may concern:*

Be it known that I, JORGEN CHRISTENSEN, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Liquid-Balance Rudder-Governors; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to a governor for ships' rudders.

It consists, essentially, in a novel arrangement of a cylinder or cylinders with piston movable with relation thereto, a piston-rod connecting the main cylinder with a lever fixed to and movable with the rudder-stock, and a means for transferring liquid from one side to the other of the piston within the main cylinder and for compensating for the difference between the two ends of the cylinder by reason of the space occupied by the piston-rod upon one side of the piston, and means for replenishing loss of liquid within the cylinders.

It also comprises details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a sectional view of my apparatus. Fig. 2 shows the compensating device for irregular vertical or horizontal movements of the rudder-head. Fig. 3 is an end view showing the liquid-supply. Figs. 4, 5, and 6 are modifications of the device.

The objects of this invention are to guard the rudder and steering-gear against injury through the action of the sea in heavy weather and to lighten the labor and danger to the helmsman by preventing the violent shocks to the steering apparatus caused by the blows of the waves against the rudder.

A is a cylinder having a piston B fitted and reciprocating therein and a piston-rod C extending outwardly through one end, with a stuffing-box at D. The outer end of this rod connects with a crank-lever or other arm E, which is fixed to the rudder-stock and projects at right angles with the line of movement of the piston-rod C, which is connected with the outer end of this arm.

F is a passage which is either cored and formed with the cylinder A, or, if preferred,

it may be in the form of an exterior pipe, and each end opens into the ends of the cylinder A, as shown. The cylinder A is then filled with a liquid of any suitable description, and as the rudder is moved from side to side the movement of the arm E, acting through the piston-rod C, moves the piston B, and thus causes a transfer of the liquid from one side to the other of the piston B, the liquid passing through the passage F in response to the movement of the piston. The rate of flow through the passage is regulated by a cock or valve L.

It will be seen that as one side of the piston is partially occupied by the piston-rod C, while the other side of the piston has nothing to fill the space, the amount of liquid transferred from the rear of the piston to the front or the side occupied by the piston-rod will be greater than that part of the cylinder can receive. It is therefore necessary to make some provision for the surplus liquid.

In Fig. 1 I have shown a supplemental cylinder G, lying parallel with the main cylinder A, having within it a piston H, the rod I of which extends through the head of the cylinder parallel with the rod C and at a sufficient distance from the head of the cylinder to allow the necessary reciprocations. This rod is connected directly with the rod C, so that the two move in unison, and by means of nuts upon the screw-threaded outer end of the rod I, or an equivalent device, the rod may be adjusted with relation to the arm E, and through it the position of the piston H with relation to the piston B is regulated so that the cylinder G will receive the surplus liquid. That portion of the cylinder G through which the piston-rod I passes and which corresponds with the portion of the cylinder A in which the piston-rod C moves has a capacity equal to the area of the piston-rod C plus that of the rod I. A passage J connects the two cylinders A and G, as shown, and when the piston B is moved in the direction shown by the arrow or toward the rear of the cylinder it displaces the liquid at that end of the cylinder A and transfers it through the passage F into the front end of the cylinder A. As before stated, there is a surplus of liquid on account of the space occupied by the piston-



rod C. Therefore as the piston H, moving in unison with the piston B, is also moving toward the rear of its cylinder the surplus liquid will pass through the aperture J into the small cylinder. When the piston B moves in the opposite direction, the liquid will be expelled from the cylinder G by its piston H, returning through the passage J into the cylinder A, and it will also be transferred from the front side of the piston B of the main cylinder through the passage F to the rear thereof. The rear end of the small cylinder G has an open passage K, through which air may enter or escape in unison with the movements of the piston, this end of the small cylinder having no connection with the main cylinder. The same compensation may be effected, as shown in Fig. 4, by extending the piston-rod C through the piston B and allowing it to telescope into hollow sections, as shown at C', these sections being connected with the rear end of the piston-rod, so that when the piston B moves toward the front of the cylinder these hollow telescopic sections will be extended and will fill approximately the same amount of space within the rear portion of the cylinder as is filled by the piston-rod C at the front. The transfer of liquid takes place through the passage F in this case, as previously shown, and the rear ends of the cylinder-sections C' are opened to drain any leakage which may take place through or into them.

In Fig. 5 I have shown the piston-rod C made hollow from the rear end of the piston, and a rod C<sup>2</sup>, fixed to the rear cylinder-head, extends into this hollow piston-rod, which is slidable thereon, thus filling approximately the same amount of space at the rear of the piston as is filled by the piston-rod at the front, so that the liquid may be transferred from front to rear of the piston, or vice versa, as the piston is moved.

In Fig. 6 the piston has an extension-rod in line with the rod C, and this rod passes out through the rear of the cylinder A, having a stuffing-box the same as the one through which the rod C passes at the front. This rear rod has parallel channels formed within it, as shown at f, one of these channels opening into the cylinder A just behind the piston B, while the other extends up through the rod and opens into the cylinder in front of the piston B. The rear end of this channel being connected, the liquid will pass through this channel from one side to the other of the piston, and in this construction the passage F is dispensed with, being practically formed in the piston-rod itself. In all cases the passage is regulated and controlled by a valve or cock, as shown at L, so that the rate at which the liquid passes from one side to the other of the piston may be controlled and regulated.

O is a chamber connected with the main cylinder and having a plunger P movable within it by a screw-rod R and hand-wheel or by an equivalent means. Any loss or leak-

age may be replaced by filling the cylinder O with liquid, opening the cock S, and forcing the liquid into the cylinder A by advancing the plunger P.

As the rudder-stock has more or less vertical motion, it is desirable to so connect the cylinder A with it as to allow the cylinder to move with the rudder-post without straining the connections. This is effected by forming a horizontal slot or fork in the outer end of the lever-arm E, which connects with the rudder-stock, and through the two sides of this slot a vertical pin *m* passes. The end of the piston-rod C is also slotted or forked, as shown, and the vertical slot fits over the pin *m* within the slot or fork of the arm E. A pin *n* passes through the two sides of this end of the piston-rod C and through the pin *m*, thus forming a universal joint for the movements between the piston-rod C and the lever E, the pin *n* allowing the pivoting of the piston-rod C upon the pin *m* if the rudder-stock rises or falls. At the piston end of the cylinder A is a projecting lug *a*, which is pivoted between the lugs *b*, which project from the ring *c*. This ring is turnable about the post *d*, fixed with relation to the vessel and forming the swivel about which the cylinder A oscillates from side to side as the arm E from the rudder-stock moves in an arc of a circle, which causes the cylinder to swing to and from the center of the rudder-stock, while the pivot-pin *d* holds its opposite end to its position with relation to the vessel.

The apparatus is here described and shown with a single arm E extending from the rudder-stock and a balance-cylinder and mechanism connected with it; but it may be duplicated by employing another arm E upon the opposite side of the rudder-stock and connecting a second cylinder with it, thus dividing and equalizing the strain upon the parts.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A liquid balance and governor for ships' rudders consisting of one or more cylinders having pistons movable therein and passages connecting the ends of the cylinders, a cross-head or arms fixed transversely upon the rudder-stock, and connections between the piston-rods and said arms, and a variable chamber connected with the cylinder for compensating the difference in capacity between the space in front and rear of the piston.

2. In a rudder governor and balance, a cylinder or cylinders having pistons movable therein, piston-rods extending from the piston through the front end of the cylinder and connecting with an arm or cross-head upon the rudder-stock whereby the turning of the rudder moves the piston within the cylinder, an exterior passage through which the liquid is transferred from one side of the piston to the other during its reciprocation, and a chamber connecting with the front end of the cylinder into which a quantity of liquid equal to



the space occupied by the piston-rod within the cylinder may pass when the piston is moving toward the rear.

3. In a rudder governor and balance, a liquid-containing cylinder having a piston adapted to reciprocate therein, a piston-rod extending through the front cylinder-head, a transverse arm or cross-head fixed to the rudder-stock with which the piston-rod is connected, a passage connecting the opposite ends of the cylinder whereby the liquid may be transferred from one side of the piston to the other by the reciprocations of the piston, a supplemental cylinder having a piston movable in unison with the main piston, a passage connecting the front ends of said cylinders, whereby a surplus of liquid equal to the space occupied by the main piston-rod will pass into the supplemental cylinder when liquid is transferred from the rear to the front of the main piston.

4. In a rudder governor and balance, a main swiveled, liquid-containing cylinder having a piston movable therein, a piston-rod extending through the front head, and a cross-head or yoke upon the rudder-stock with which the piston-rod is connected, a passage connecting the front and rear ends of the main cylinder, a supplemental cylinder, a passage connecting the front ends of said cylinders, a piston in the supplemental cylinder movable in unison with the main piston whereby the cubic capacity of the supplemental cylinder is increased or diminished in proportion to the part of the main piston-rod within its cylinder.

5. In a rudder governor or balance mechanism, main and supplemental cylinders having pistons movable therein in unison, connections between the opposite ends of the main cylinder and between the front ends of the main and supplemental cylinder, and a means for adjusting the position of the supplemental piston to increase or decrease the cubic capacity of that portion of the cylinder connecting with the main cylinder.

6. In a rudder governor and balance mechanism, main and supplemental liquid-containing cylinders with passages connecting the front and rear end of the main cylinder and the front ends of the two cylinders, piston-rods extending through the front heads of the cylinders, a connection between the main piston-rod and a yoke or cross-head fixed upon the rudder-stock and a connection

between the supplemental and main piston-rods whereby the supplemental rod may be lengthened or shortened and its piston correspondingly moved forward or back within its cylinder.

7. In a rudder governor and balance mechanism, a horizontally-swiveled liquid-containing cylinder having passages connecting its front and rear ends, a piston movable therein, a rod extending from the piston through the front head of the cylinder, a yoke or cross-head fixed to the rudder-stock and a universal-joint connection between the piston-rod and the cross-head, and a compensating chamber connecting with said cylinder in front of the piston.

8. In a rudder governor and balance, a liquid-containing cylinder with a piston reciprocable therein, a compensating chamber connecting with the cylinder in front of the piston, a piston-rod extending through the front end of the cylinder and connecting with a yoke or cross-head upon the rudder-stock, a universal-joint connection between the piston-rod and cross-head, a fixed post behind the cylinder having a sleeve loosely turnable about it and a swivel connection between the rear of the cylinder and said sleeve whereby horizontal and vertical movements of the cylinder may be effected.

9. In a rudder governor and balance, a swiveled liquid-containing cylinder having a reciprocating piston and a piston-rod extending through the front head of the cylinder and connecting with a yoke or cross-head upon the rudder-stock, a regulated passage connecting the front and rear ends of the cylinder and a compensating chamber connecting with the main cylinder and front of the piston and a means for recharging and supplying waste within the cylinder.

10. In an apparatus of the character described, a charging-cylinder with a valve or cock controlled passage connecting it with the main cylinder, and a pressure-actuated plunger movable in said cylinder whereby liquid may be forced therefrom into the main cylinder to supply waste or loss.

In witness whereof I have hereunto set my hand.

JORGEN CHRISTENSEN.

Witnesses:

S. H. NOURSE,  
JESSIE C. BRODIE.