No. 624,352. Patented May 2, 1899.

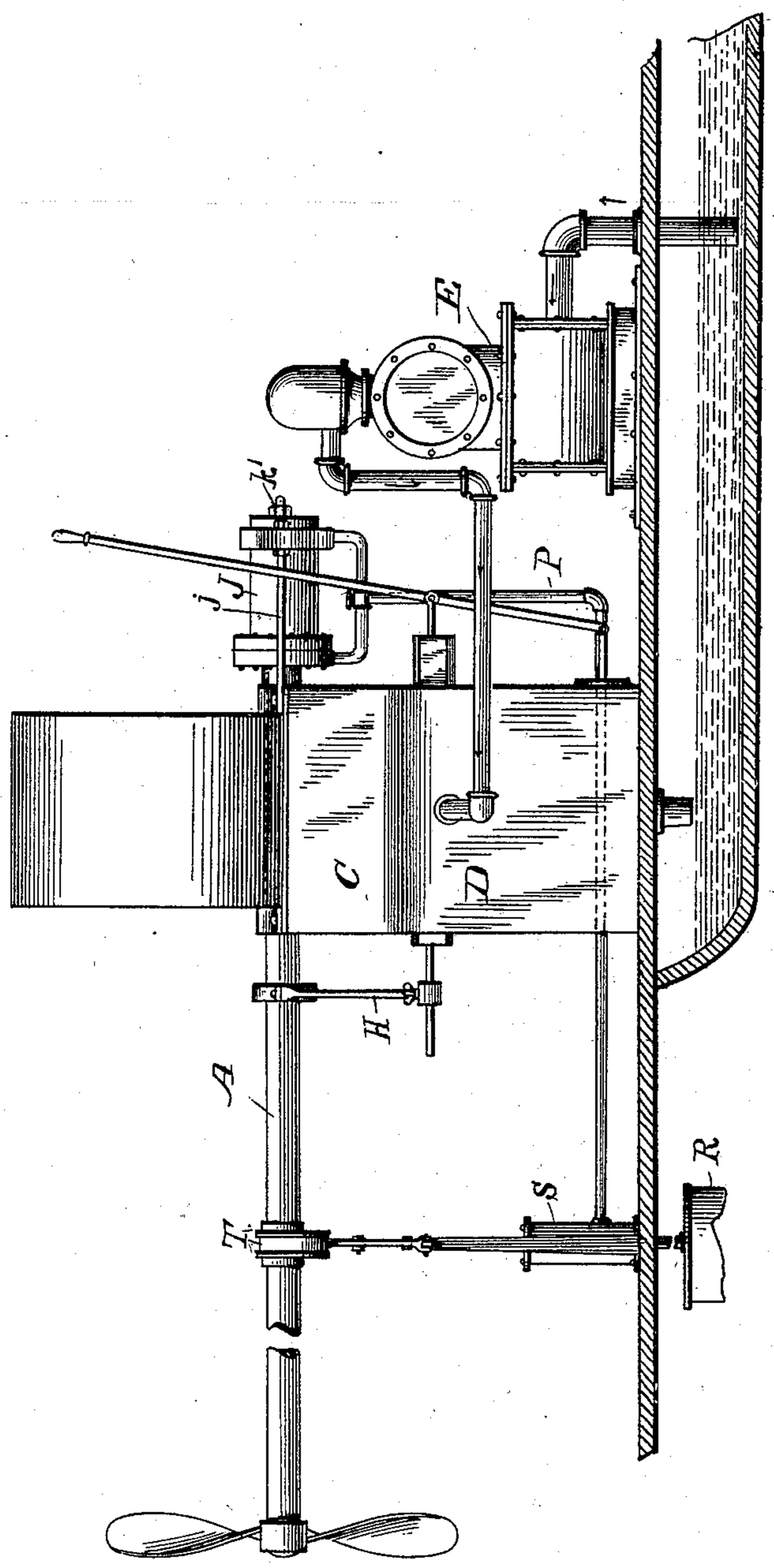
A. H. LIGHTHALL.

HYDRAULIC MOTOR.

(Application filed Dec. 19, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses
Albert Lee
John Pfeiffer Jr.

Inventor
Almerin H. Lighthall
By David H. Reed
Attorney

No. 624,352. Patented May 2, 1899.

A. H. LIGHTHALL.

HYDRAULIC MOTOR.

(Application filed Dec. 19, 1898.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

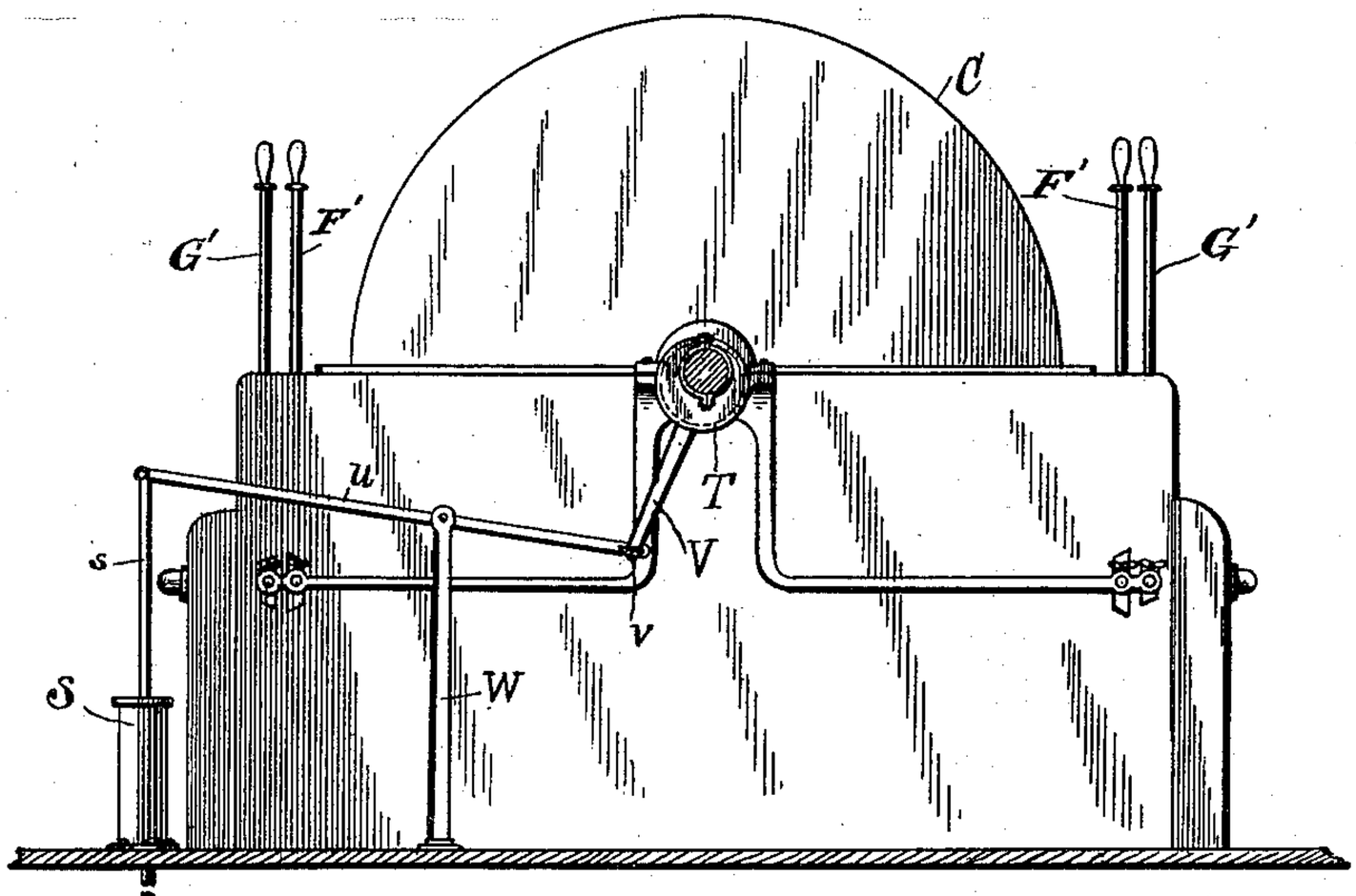
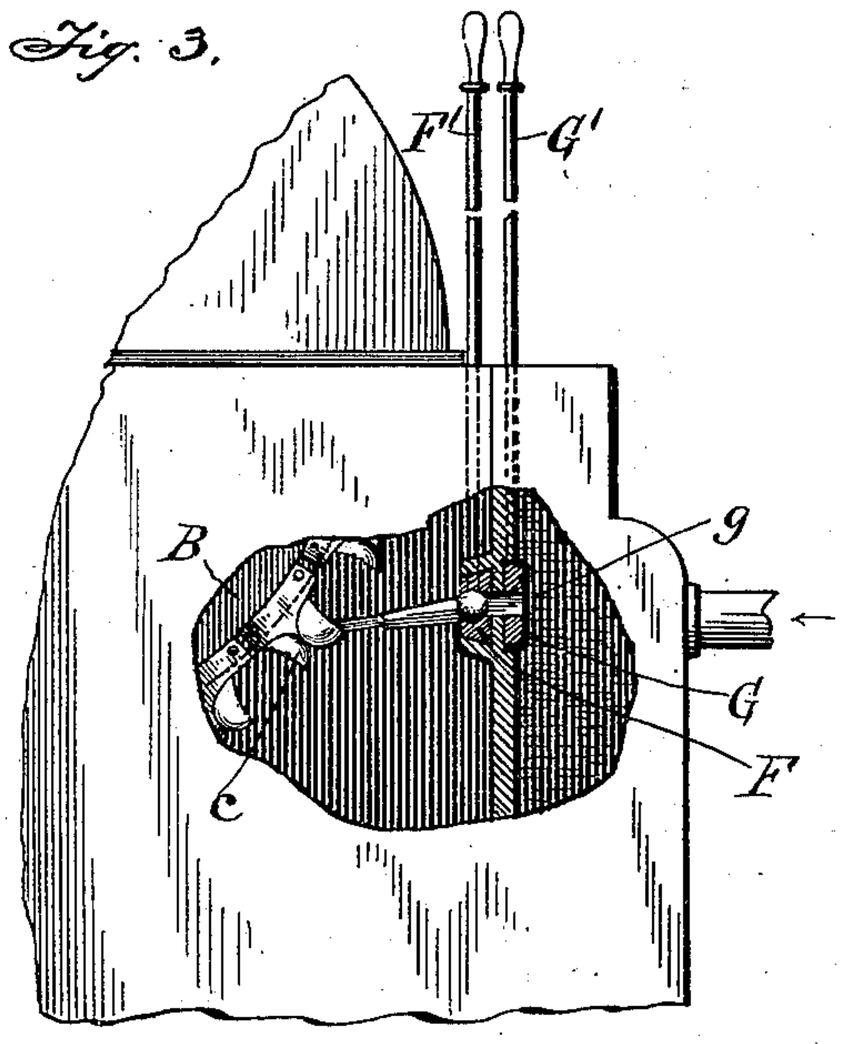


Fig. 3.



Witnesses
Albert Lee
John Pfeiffer, Jr.

Inventor
Almerin H. Lighthall
By David H. Reed.
Attorney

No. 624,352. Patented May 2, 1899.

A. H. LIGHTHALL.

HYDRAULIC MOTOR.

(Application filed Dec. 19, 1898.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 4.

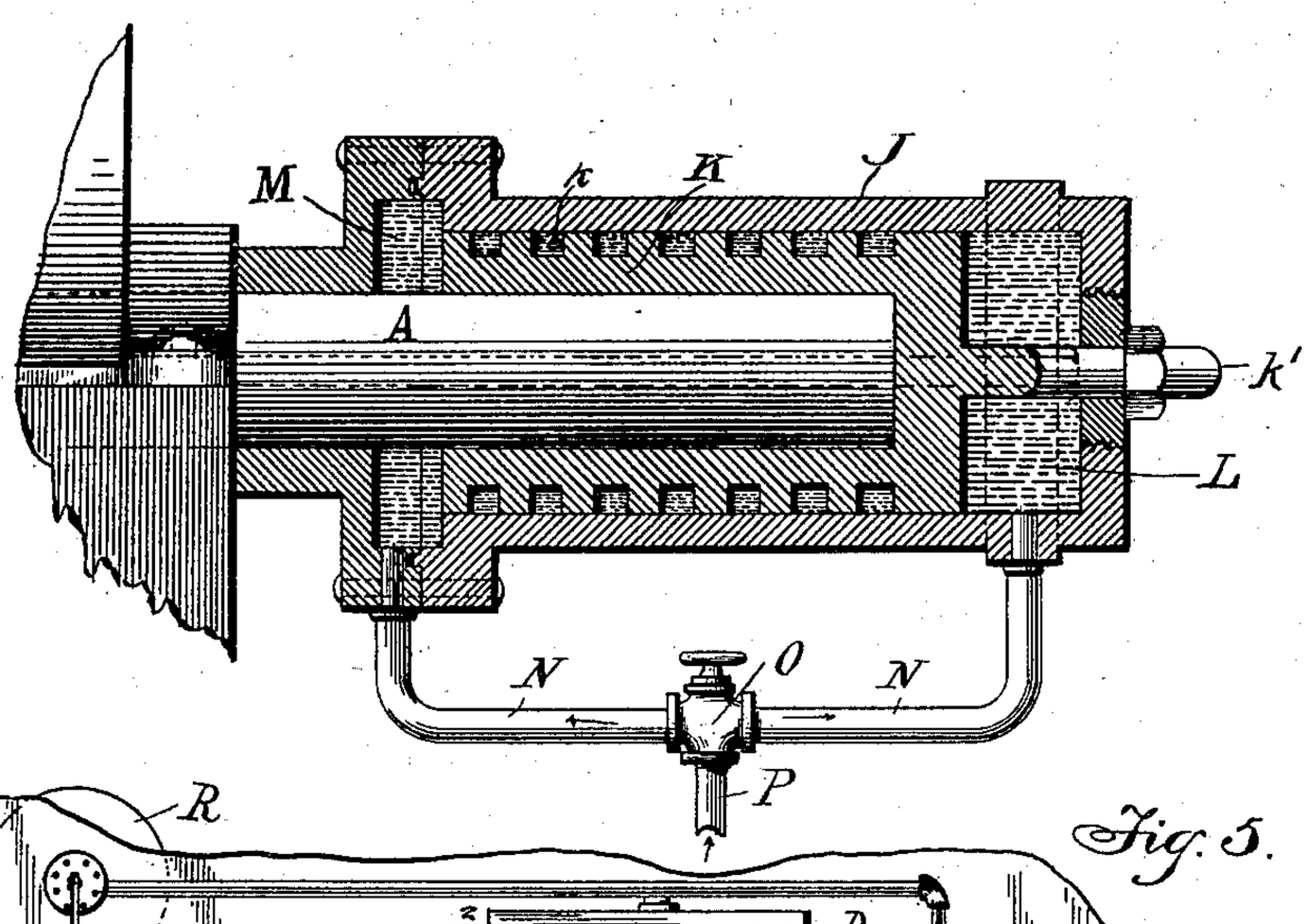
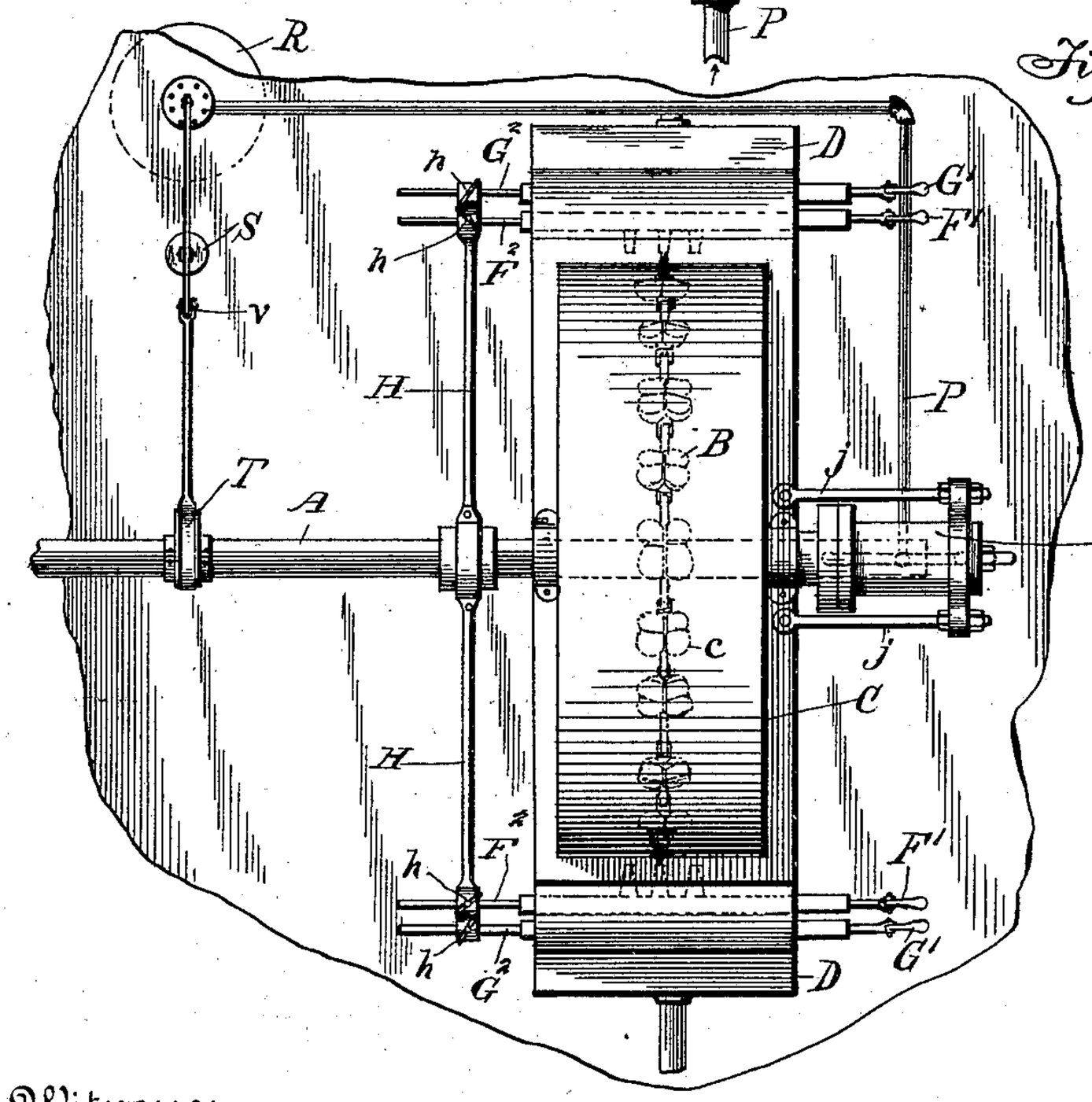


Fig. 5.



Witnesses
Albert Lee
John Pfeiffer, Jr.

Inventor
Aemerun H. Lighthall
By David H. Mead.
Attorney

UNITED STATES PATENT OFFICE.

ALMERIN H. LIGHTHALL, OF NEW YORK, N. Y., ASSIGNOR TO HENRY A. MAURER, OF SAME PLACE.

HYDRAULIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 624,352, dated May 2, 1899.

Application filed December 19, 1898. Serial No. 699,674. (No model.)

To all whom it may concern:

Be it known that I, ALMERIN H. LIGHTHALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Hydraulic Motors; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to hydraulic motors, and it relates particularly to that class of these devices adapted to the propulsion of vessels.

The primary object of the present invention is to provide, in a motor of the kind referred to, in which the shaft is driven by water under pressure directed against an impact water-wheel on the shaft, means whereby the water will at all times be caused to impinge against the most effective parts of the water-wheel.

This invention consists, primarily, of a hydraulic motor for propelling vessels, comprising a propeller-shaft capable of longitudinal movement and having an impact water-wheel thereon, movable nozzles for projecting water under pressure against the water-wheel, and a connection between the shaft and the nozzles whereby they are caused to move in unison in order to direct water at all times against the most effective parts of the wheel.

The invention consists, further, in various novel details of construction whereby the objects of the invention are attained and the effectiveness of the device insured.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a hydraulic motor for marine propulsion having my improvements applied thereto. Fig. 2 is an end view of the motor-casing, the shaft being shown in section. Fig. 3 is a fragmentary view showing a portion of the water-wheel casing broken away and showing the nozzles for directing water against the motor-wheel and the levers for regulating the flow of water through the nozzles. Fig. 4 is a sectional view of one form of a bearing which will allow a limited longitudinal movement of the propeller-shaft. Fig. 5 is a plan view of the motor, particularly showing the means for causing the nozzles to move with the shaft.

In the drawings, A represents a propeller-shaft, and B represents a motor-wheel mounted in a suitable casing C and provided on its periphery with a series of buckets or cups *c*. The buckets or cups are, as shown, each provided with oppositely-arranged indentations for the reception of water, those for receiving water for moving the shaft in a direction to propel a vessel forward being larger than those for giving it a reverse movement.

On each side of the casing C is a water-chest D, into which water under pressure from the pump E is received. Between each water-chest and the interior of the casing C are the sliding plates F, each having a series of nozzles of different diameters communicating with the openings through the sliding plates. Arranged between the plates F and the water-chests are the cut-off plates G, having a series of openings *g*, corresponding in size and arrangement to those in the sliding plates F. By the described arrangement the volume of water projected against the motor-wheel to propel the same in one direction or the other may be governed both by presenting nozzles of different sizes to direct the water from the water-chests and by varying the size of the openings in the plates F by the cut-off plate G. The position of the sliding nozzle-plates F and of the cut-off plates G are regulated by hand by the levers F′ and G′, respectively.

The best results in a construction as herein described are obtained when the propeller-shaft has a yielding thrust-bearing against which it abuts and by which shocks and jars to the vessel and possibility of injury to the propeller are prevented in increasing or diminishing the speed or the direction of movement of the shaft.

In the present embodiment of the invention I have shown a particular form of thrust-bearing in connection with the features claimed in the present application; but I do not desire herein to limit myself to the exact

form of bearing shown. The bearing is not claimed herein, but forms the subject-matter of another application for patent.

In order that the desired or necessary adjustment of the nozzles and cut-off plates in respect of the water-wheel to project the required quantity of water against the water-wheel may, when desired, be maintained irrespective of the longitudinal movement of the propeller-shaft, the shaft and the nozzle-plates and the cut-off plates are connected.

The means herein shown for connecting the shaft and the plates consists of the projections F^2 F^2 from the nozzle-plates, the projections G^2 G^2 from the cut-off plates, and the arms H, connected to the shaft in a manner to allow the latter to rotate independently and extending from the shaft at right angles. The respective arms H are connected with the projections F^2 F^2 and G^2 G^2 on the respective sides of the motor-wheel by set-screws *h*.

In the use of the device the nozzle-plate and the cut-off plate on the side of the water-wheel to give movement thereto and to the propeller-shaft in the desired direction to move the vessel in which the shaft is placed either forward or rearward are adjusted by the hand-levers F′ and G′. The quantity of water projected against the wheel is regulated both by placing nozzles of different sizes opposite the wheel and by adjusting the cut-off plates.

During the adjustment of the nozzle and cut-off plates the set-screws *h* are loose, and these are tightened when the required adjustment is made, thus connecting the shaft and the plates. The result is that any movement of the shaft in a longitudinal direction will be communicated to the nozzles and cut-off plates on the side from which water is projected against the water-wheel, and thus the arrangement of the plates is maintained in respect of the wheel and the predetermined quantity of water is kept impinging upon the centers of the buckets or vanes as the water-wheel revolves during any variations in the position of the propeller-shaft and the water-wheel.

One form of thrust-bearing suitable for use in connection with the present invention is shown as applied to the shaft A in Figs. 1 and 5, and it is shown in detail in section in Fig. 4 of the drawings. It consists, essentially, of the cylinder J, the jacket or sleeve K, and means for forcing oil into the cylinder J.

In the drawings, J represents a cylinder rigidly secured in place in a vessel by rods *j*, attached to a solid portion of the frame of the vessel, and into this cylinder projects the forward end of the shaft A. A metal jacket or sleeve K is shrunk upon or otherwise secured to the end of the shaft, and the exterior of this jacket or sleeve corresponds accurately to the interior of the cylinder J. The jacket or sleeve has in it a series of external circumferential grooves *k*, forming chambers around the same, and it has also an extension *k*′, projecting through the end of the cylinder and serving as a guide for the jacket or sleeve and for the forward end of the propeller-shaft. The relative sizes of the parts are such that a chamber L is formed between the forward end of the sleeve or jacket and the end of the cylinder, and a corresponding chamber M is formed at the rear end of the sleeve or jacket. Communicating with these chambers are the pipes N, extending from a three-way cock O. Oil under pressure is supplied to the cock O through a pipe P. The oil is allowed by means of the valve O to pass into the chamber L when the vessel is propelled in a forward direction and into the chamber M when it is propelled in the opposite direction, and thus a cushion of oil upon which the thrust of the shaft is imposed is provided, insuring the smooth running of the same and preventing shocks to or jarring of the vessel. The pressure on the cushions of oil is such that a quantity of the same will be forced between the cylinder and the sleeve or jacket and will be retained by the grooves *k*, with the result that a perfect lubrication of the parts is provided.

Oil under pressure to supply the chambers L and M is supplied from a tank R through a pump S, which pump is connected to the valve O by the pipe P. Movement is imparted to the plunger *s* of the pump from an eccentric T on the propeller-shaft A through the lever *u* and the link V. The lever is suitably fulcrumed in a standard W and is pivotally connected at one end to the plunger *s* of the pump. At the other end the lever is adjustably connected by a set-screw *v* to the link V, the adjustment permitting the regulation of the length of the stroke imparted to the plunger of the pump. By this regulation the pressure under which the oil is maintained in the chamber of the cylinder J, upon which the shaft is cushioned, may be changed to meet varying conditions arising from various speeds or conditions of propulsion.

While the cushions produced by the confining of the oil under pressure are sufficiently dense to sustain the propeller-shaft under ordinary conditions, they are yielding enough to allow slight compression in cases of extraordinary strain, and thus yielding bearing, which will prevent shocks to a vessel, is produced.

While the construction of the thrust-bearing is particularly shown and described herein, it is not claimed, as it forms the subject-matter of application, Serial No. 706,728, filed February 24, 1899.

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

1. A hydraulic motor for vessels comprising a propeller-shaft having longitudinal movement, a water-wheel mounted on the propeller-shaft, movable nozzles for projecting water against the water-wheel, and a con-

nection between the shaft and the nozzles, substantially as described.

2. A hydraulic motor for vessels comprising a propeller-shaft having longitudinal movement, a water-wheel mounted on the propeller-shaft, movable nozzles for projecting water against the motor-wheel, movable cut-off plates for regulating the flow of water through the nozzles, and a connection between the shaft and the nozzles and the cut-off plates, substantially as described.

3. A hydraulic motor for vessels comprising a propeller-shaft having longitudinal movement, a water-wheel mounted on the propeller-shaft, two series of movable nozzles of different diameters for projecting water against the water-wheel, cut-off plates for regulating the flow of water to the nozzles, hand-levers for adjusting the positions of the nozzles and the cut-off plates, and a detachable connection between the shaft and the nozzles and the cut-off plates, substantially as described.

4. A hydraulic motor for vessels comprising a propeller-shaft, a yielding thrust-bearing for the shaft, a water-wheel mounted on the shaft, nozzles for projecting water under pressure against the water-wheel, and a connection between the nozzles and the shaft, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ALMERIN H. LIGHTHALL.

Witnesses:

ALBERT LEU,

DAVID H. MEAD.