

No. 633,862.

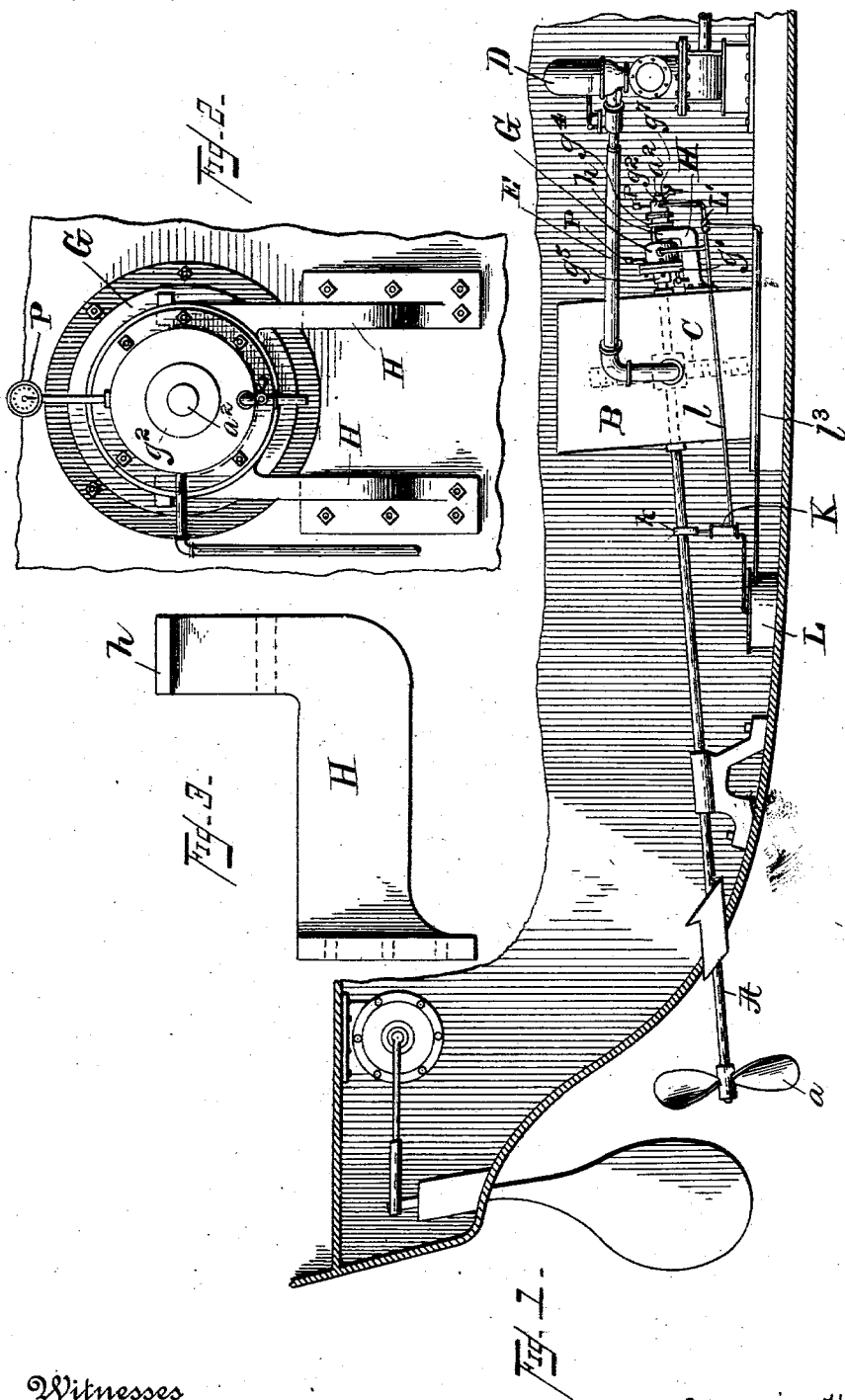
Patented Sept. 26, 1899.

A. H. LIGHTHALL.  
THRUST BEARING.

(Application filed Feb. 24, 1899.)

(No Model.)

2 Sheets—Sheet 1.



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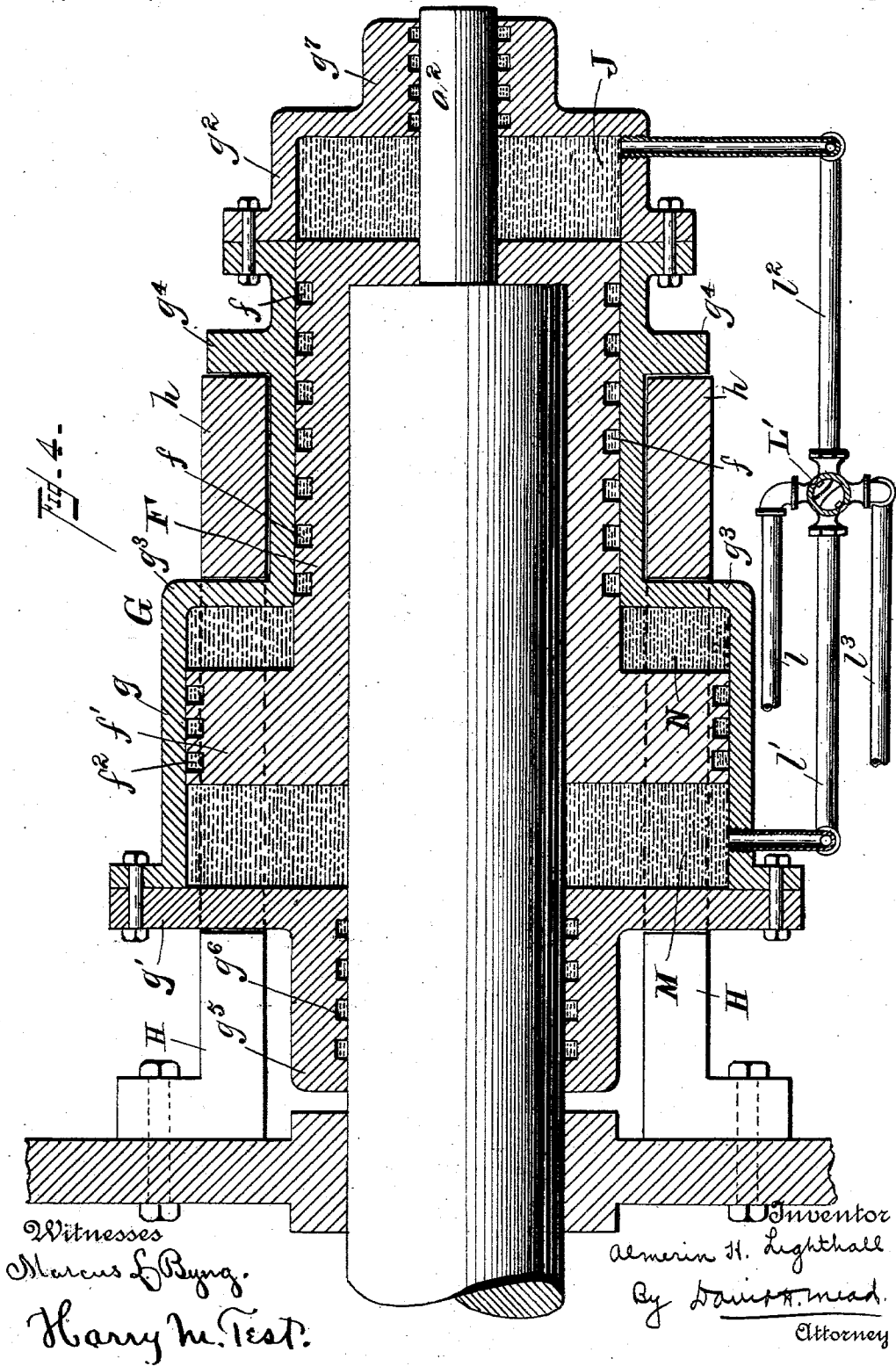
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2 Sheets—Sheet 2.



# UNITED STATES PATENT OFFICE.

ALMERIN H. LIGHTHALL, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HENRY A. MAURER AND HENRY MAURER, OF SAME PLACE.

## THRUST-BEARING.

SPECIFICATION forming part of Letters Patent No. 633,862, dated September 26, 1899.

Application filed February 24, 1899. Serial No: 706,723. (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 Thrust-Bearings; 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 thrust-bearings.

The primary object of the present invention is to provide an effective thrust-bearing for the propeller-shaft of a vessel capable of adaptation to varying pressures incident to the propulsion of a vessel in either direction at varying speeds and under varying conditions.

Further, the object of the invention is to provide a thrust-bearing of such construction that the pressure exercised on the shaft to propel a vessel in either direction shall be imposed on a liquid maintained under pressure.

Further, the object of the invention is to provide a thrust-bearing of such construction that the pressure exercised on the shaft to propel a vessel in either direction shall be imposed upon a liquid maintained under pressure, which liquid shall be utilized for the lubrication of the shaft and of the parts connected thereto.

Further, the object of the invention is to provide a thrust-bearing of such construction and having such attachments that a fluid under pressure shall by the rotation of the shaft to which the bearing is applied be forced into the bearing and receive the pressure of the shaft as the vessel in which the shaft is placed is driven in either direction.

With these objects in view the invention consists, essentially, of a thrust-bearing comprising an elongated sleeve or jacket of small diameter rigidly attached to a shaft, a casing receiving the sleeve or jacket and having its inner face corresponding in diameter to that of the outer face of the sleeve or jacket, chambers formed between the ends of the sleeve or

jacket and those of the casing, and a liquid maintained in the chambers and upon which the entire thrust of the shaft is imposed.

Further, the invention consists of various novel details of construction, by which the effectiveness of the device is insured.

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

Figure 1 is a side view of a hydraulic marine engine having my invention applied thereto, the same being shown as located in a vessel. Fig. 2 is an end view of the bearing and of the means for holding it in place. Fig. 3 is a side view of one of the brackets by which the bearing is attached to the casing of the motor, and Fig. 4 is a horizontal sectional view of the bearing.

In the drawings, A represents a propeller-shaft having on its outer end a propeller *a* and having its inner end extending through a casing B. Fixed on the shaft and arranged in the casing B is an impact water-wheel C. (Shown by dotted lines in Fig. 1 of the drawings.) The water-wheel C receives motion from water under pressure conveyed from a pump D through pipes E and projected against the wheel. The parts above described, excepting the shaft, are not claimed herein and are only shown to make clear the construction, arrangement, and use of the thrust-bearing. The forward end of the shaft A is sustained and it and the parts connected with it are lubricated by the means now to be described.

F represents a jacket or sleeve which is shrunk upon or otherwise secured to the forward end of the shaft. This jacket or sleeve has in its outer face a series of circumferential grooves *f*, forming annular chambers around it.

Receiving the forward end of the shaft and the sleeve or jacket is a shell or casing G, which in the present embodiment of the invention is made up of the main portion *g* and the ends *g'* and *g''*. The portion *g* of the shell is enlarged at its rear end, forming on the exterior thereof the shoulder *g''*, and the forward portion has on its face a rib *g'*. The shell or casing is held in place by brackets H, attached to the casing B. The shell G rests

upon the horizontal portions of the brackets, and the upturned ends  $h$  of the brackets extend between the shoulder  $g^3$  and the rib  $g^4$  on the respective sides of the shell G, and by this means the shell and the parts contained or carried by it are rigidly held in place. The rear end  $g^5$  of the shell or casing has a cylindrical extension  $g^5$  of a size to receive the shaft A, and the inner face of the extension has a series of grooves  $g^6$  extending around the same. The forward end  $g^2$  of the shell or casing has an extension  $g^7$ , also grooved on its inner face. The forward end of the shaft has a reduced portion  $a^2$ , which is received by the opening in the extension  $g^7$  and serves to guide the shaft and maintain it in position during any longitudinal movement to which it may be subjected. The part  $a^2$  of the shaft is of much less diameter than the sleeve or jacket in order that the exposed end area of the sleeve or jacket within the casing which comes in contact with the liquid under pressure may be reduced only slightly.

The shell or casing G is, as shown in Fig. 4 of the drawings, formed with an interior chamber larger at the rear end, and the jacket or sleeve F has an enlarged annular rear portion  $f'$  corresponding in diameter to the inner diameter of the rear portion of the shell or casing, and its face which comes in contact with the inner face of the shell or casing has in it the annular grooves  $f^2$ . The length of the main portion of the sleeve or jacket F corresponds to the distance between the shoulder  $g^3$  and the rear face of the forward end  $g^7$  of the shell or casing, so that when the sleeve or jacket is removed from the forward end  $g^7$  to form a chamber J between the forward end of the sleeve or jacket and the end  $g^7$  an annular chamber N is formed between the shoulder  $g^3$  and the enlarged portion  $f'$  of the sleeve or jacket.

The sleeve or jacket being, as shown, of less length than the length of the interior of the shell or casing G, there will, when the parts are aggrouped, always be a space or chamber M between the rear end of the sleeve or jacket and the end  $g^5$  of the shell or casing, a chamber N between the shoulder  $g^3$  and the enlarged portion of the jacket or sleeve, and another chamber J between the latter and the forward end  $g^2$  of the shell. In order that spaces or chambers referred to shall at all times be filled with a liquid under pressure against which the sleeve or jacket shall bear when the vessel is propelled either forward or backward and upon which the entire strain of such propulsion shall be imposed, I provide a pump K, connected with a reservoir L, for forcing through suitable pipes a liquid, preferably oil, into the interior of the shell or casing G. As a convenient means of operating the pump K the piston thereof is connected to an eccentric  $k$  on the propeller-shaft A, the length of the stroke imparted by the eccentric being regulated by the necessary pressure at which the liquid is required

to be maintained in the shell or casing. The liquid from the pump is conducted to a cock L' through a pipe  $l$ , and from this pipe extend the branch pipes  $l'$  and  $l^2$ , leading, respectively, to the chambers M and J. The cock L' is a two-way cock, as shown in Fig. 4, and it has connected with it a drip or return pipe  $l^3$ , extending to and connected with the reservoir L.

By the described construction and arrangement of parts it will be seen that when motion is imparted to the propeller-shaft A the liquid, such as oil, will be forced by the pump to the cock L' and from there by one of the branch pipes to either the chamber M or the chamber J. When the vessel is propelled in a forward direction, the cock L' is so turned as to allow the flow of oil from the pump to the chamber J. The position of the cock necessary to allow this connects the chamber M with the return or drip pipe  $l^3$ . In the backward movement of a vessel the chamber M is connected with the reservoir.

In the operation of the thrust-bearing, when constructed and arranged as herein shown and described, the oil under pressure from the pump receives the entire pressure of the shaft in propelling the vessel in either direction, insuring a practically frictionless bearing. The lubrication of the sleeve or jacket and the shaft where it comes in contact with the ends of the shell or casing is provided for by oil forced from the chamber M or J, according to the direction of movement of the vessel, between the sleeve or jacket and the shell, or between the shaft and the openings in the respective ends of the shell or casing. The oil forced between the parts is retained in the grooves with which the parts are provided in suitable quantities to afford perfect lubrication. The oil contained in the chamber N is forced from one of the end chambers by the pressure of the shaft. A portion of the oil in this chamber must escape therefrom, when, after the vessel is driven rearward for a time, the reverse movement is given, and as the escape must be effected by forcing the oil between the shell and the sleeve the escape is slow, and therefore a cushion which will prevent shocks or jars by the too-rapid longitudinal movement of the shaft under the described conditions is avoided.

Each chamber M and J has connected with it a pressure-gage P, by means of which the pressure on the liquid in a chamber in propelling the wheel in one direction or the other, and therefore the actual power exerted by the propeller-shaft, is indicated.

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

1. A thrust-bearing comprising an elongated sleeve or jacket of small diameter rigidly attached to a shaft, a casing receiving the sleeve or jacket and having its inner face corresponding in diameter to that of the outer

face of the sleeve or jacket, chambers formed between the ends of the sleeve or jacket and those of the casing and means for maintaining a liquid under pressure in the chambers, substantially as described.

2. A thrust-bearing comprising an elongated sleeve or jacket of small diameter rigidly attached to a shaft, and provided with a series of open circumferential grooves, a casing receiving the sleeve or jacket and having its inner face corresponding in diameter to that of the outer face of the sleeve or jacket, chambers formed between the ends of the sleeve or jacket and those of the casing, and means for maintaining a liquid under pressure in the chambers, substantially as described.

3. A thrust-bearing comprising an elongated sleeve or jacket of small diameter rigidly attached to a shaft, and a casing receiving the sleeve or jacket and having its inner face corresponding in diameter to that of the outer face of the sleeve or jacket, chambers formed between the ends of the sleeve or jacket and those of the casing, and means for forcing liquid under pressure into the chambers, substantially as described.

4. A thrust-bearing comprising a sleeve or jacket rigidly attached to a shaft and having an enlarged portion, a casing having its interior corresponding in size and shape to that of the jacket or sleeve, chambers formed between the ends of the sleeve or jacket and

those of the casing, a chamber formed between the enlarged portion of the sleeve or jacket and that of the casing, and means for maintaining a liquid under pressure in the several chambers, substantially as described.

5. A thrust-bearing comprising a shaft having a reduced forward end, a sleeve or jacket rigidly attached to the shaft, a casing receiving the sleeve or jacket and having its inner face corresponding in diameter to the outer face of the sleeve or jacket, chambers formed between the ends of the sleeve or jacket and those of the casing, and means for maintaining a liquid under pressure in the chambers, substantially as described.

6. A thrust-bearing comprising a shaft, a sleeve or jacket rigidly attached to the shaft, a casing the interior of which corresponds in size to the exterior of the sleeve or jacket, elongated openings in each end of the casing for receiving the shaft and having grooves in their inner faces, chambers formed between the ends of sleeve or jacket and those of the casing, and means for maintaining a fluid under pressure in the chambers, substantially as described.

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

ALMERIN H. LIDTHALL.

Witnesses:

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