No. 632.662. Patented Sept. 5, 1899.

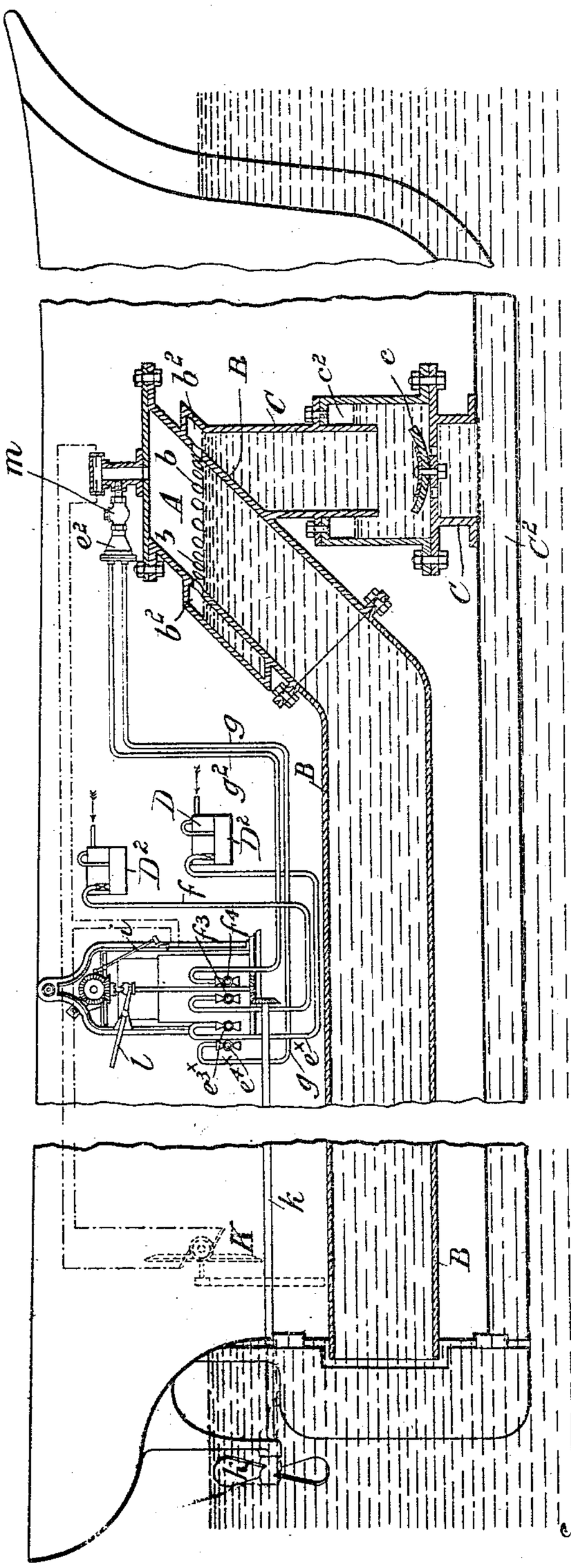
# E. TATHAM.

## MEANS FOR PROPELLING LIQUIDS APPLICABLE FOR USE IN PROPULSION OF VESSELS, &c.

(Application filed Mar. 14, 1999.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

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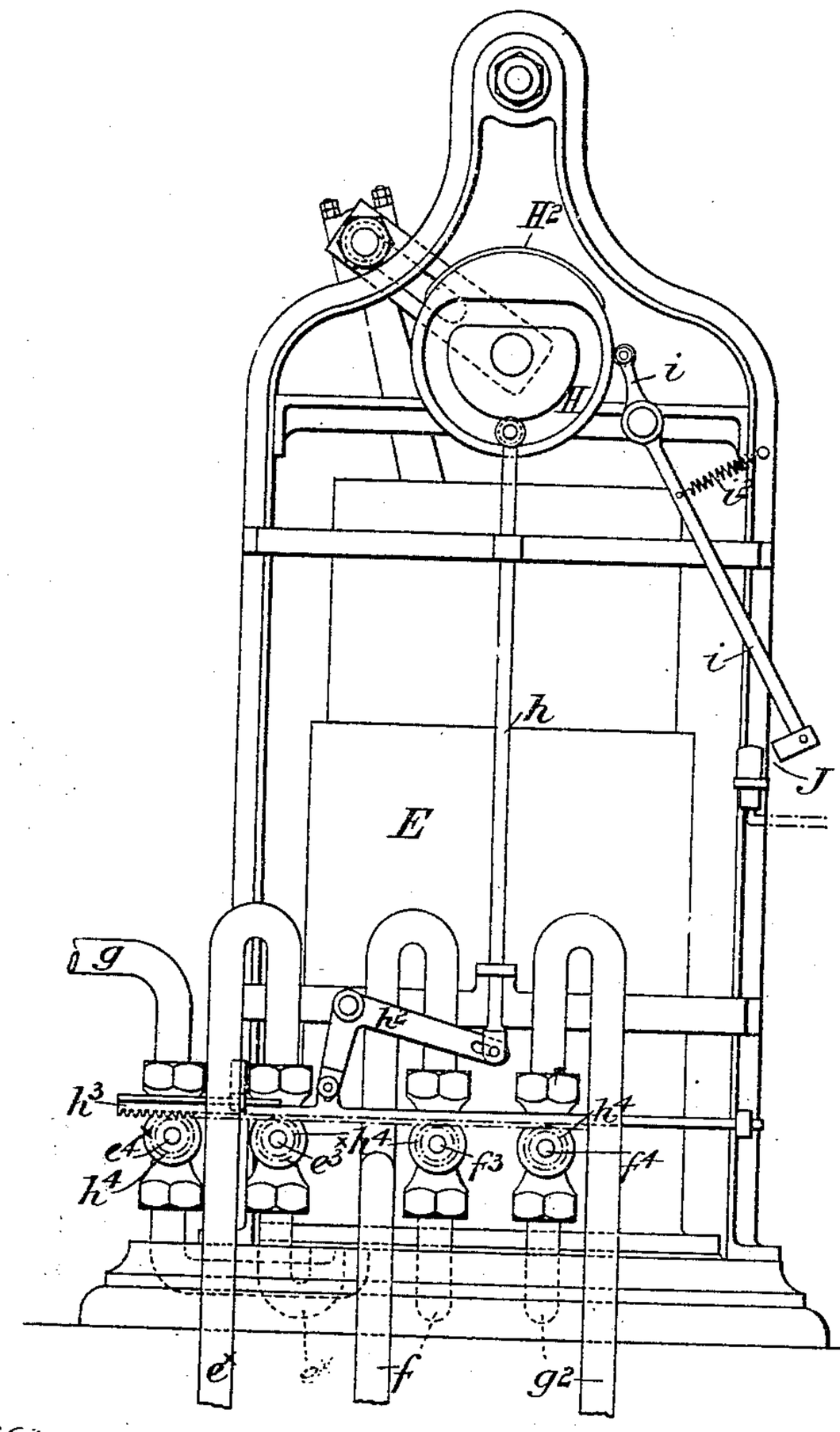
4 Sheets—Sheet 2.

*Fig. 2.*

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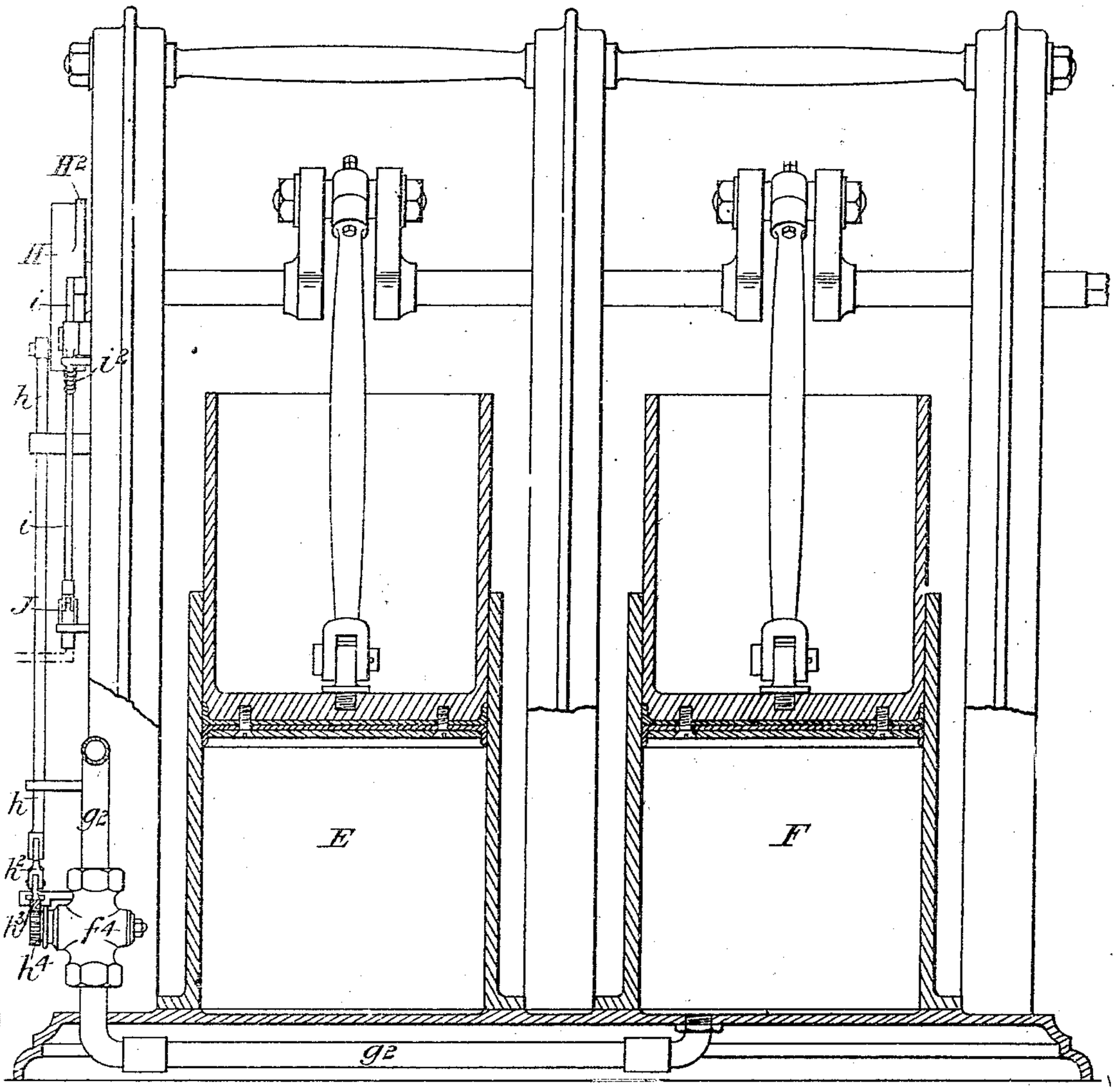
(No Model.) 4 Sheets—Sheet 3.

*Fig. 3.*

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(No Model.) 4 Sheets—Sheet 4.

Fig. 5

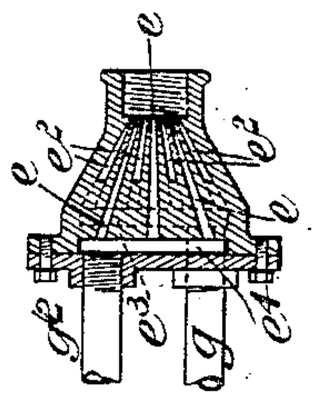
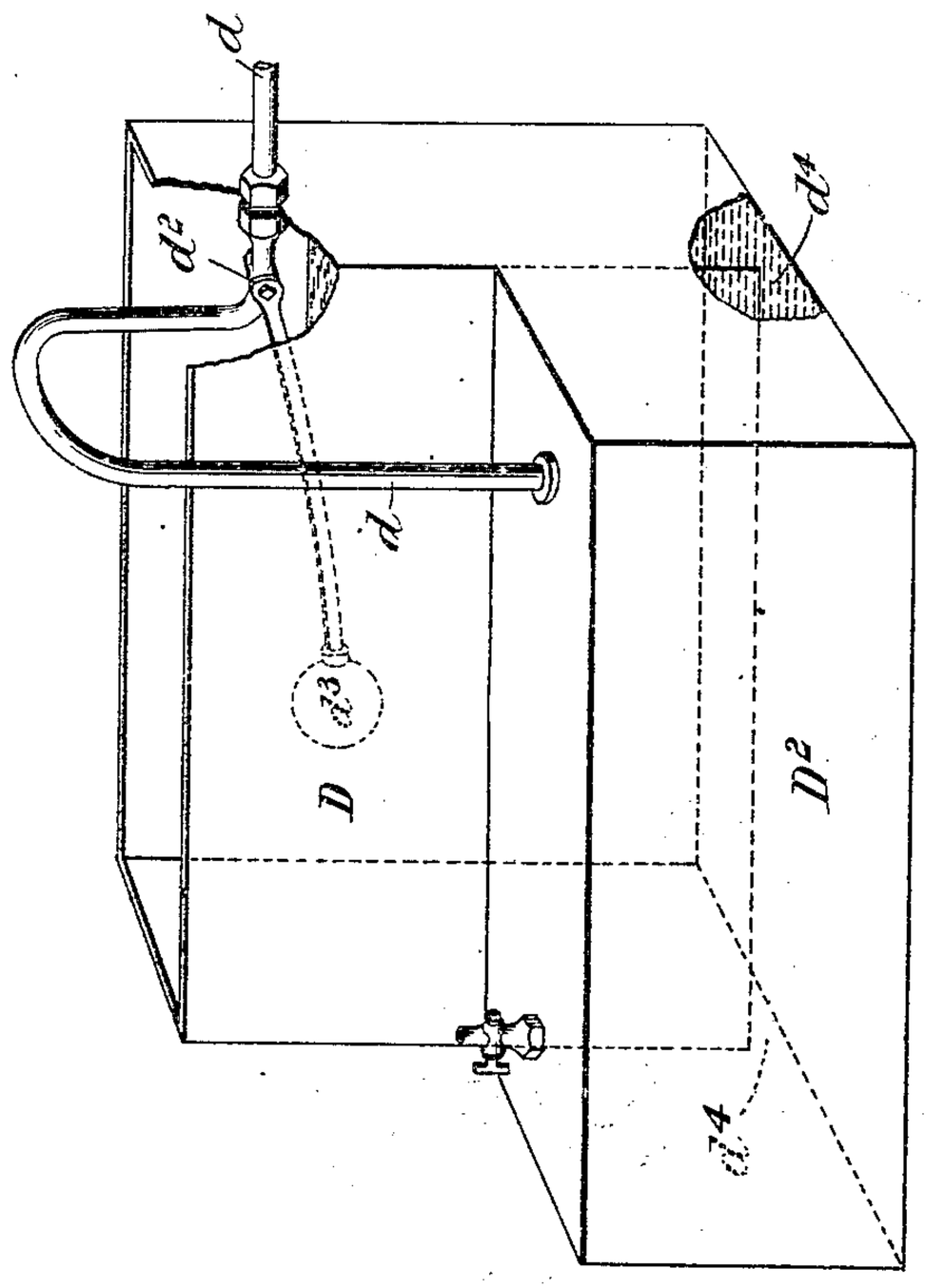



Fig. 4.

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# UNITED STATES PATENT OFFICE.

EDWIN TATHAM, OF LONDON, ENGLAND.

## MEANS FOR PROPELLING LIQUIDS APPLICABLE FOR USE IN PROPULSION OF VESSELS, &c.

SPECIFICATION forming part of Letters Patent No. 632,662, dated September 5, 1899.

Application filed March 14, 1899. Serial No. 709,049. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN TATHAM, gas engineer, a subject of the Queen of Great Britain and Ireland, and a resident of Colfe Lodge, Lewisham Hill, London, in the county of Kent, England, have invented certain Improvements in Means for Propelling Liquids Applicable for Use in the Propulsion of Vessels, the Pumping of Liquids, and the Like, (for which I have applied for a patent in Great Britain, No. 14,976, dated July 7, 1898,) of which the following is a specification.

This invention has for its object to effect the propulsion of liquids by force due to the expansion generated by the ignition of combustible gases acting directly upon the liquid to be propelled, fresh charges or supplies of the liquid entering the space from which liquid has been expelled, these fresh charges or supplies being in turn expelled by the expansion due to the ignition of succeeding charges of combustible gases.

The invention is applicable for use in the propulsion of vessels on water and in other cases where the force imparted to the propelled liquid can be utilized.

Figure 1 of the accompanying drawings represents an arrangement whereby I apply my invention to the propulsion of a vessel. Figs. 2 and 3 represent the pumping device for the gases the combustion of which is to provide the propelling force. Fig. 4 is an arrangement whereby the gases, or either of them, can be supplied at a regulated pressure; and Fig. 5 is a section of a mixing-nozzle for the gases.

Referring first to Fig. 1, the charges of combustible gases are forced into a combustion-chamber A, which is the upper end of the tube B, whose other end terminates at or is directed toward the stern of the vessel, the external water entering the said tube. When each charge of combustible gases is ignited, the expansion forces the water from the tube and propels the vessel. A fresh charge of water then enters the tube B, which may be effected by means of an inlet-tube C, which is provided with a non-return valve *c* and air-cushioning arrangement $c^2$ and communicates with the outside water, preferably near the keel $C^2$. The said tube C communicates with the tube B, preferably by surrounding it, as at $b^2$, at a part where it is provided with perforations *b* at or about the water-level. The fresh charge of water which enters the tube C and valve *c* forces out the burned gases and fills the tubes B C to the water-level, as shown in the drawings, and then a fresh charge of combustible gases is admitted and ignited, and this expels the water from the tube B, and so on during the action of the apparatus. The pumping apparatus by which the gases for the explosive mixture are forced into the combustion-chamber may be of any suitable description.

Although any suitable explosive mixture can be employed, such as a mixture of hydrocarbon gas and air, yet I generally prefer to use a mixture of oil-gases and oxygen, and in the drawings I have illustrated an arrangement for supplying the requisite charges of these gases. The oxygen and oil gas may be supplied from any suitable source. For instance, they may each be supplied from a container and be led therefrom through a pipe *d*, which passes into an open tank D and is provided with a tap $d^2$, Fig. 4, which is controlled by the float $d^3$, the said pipe passing up from the tank D and opening into the upper part of a second tank $D^2$, which is closed, except that it communicates at bottom by a slot $d^4$ with the tank D. Water or other liquid in the tanks covers this slot and rises above it to a sufficient extent to prevent the said slot being at any time uncovered by the liquid. When the gas entering the tank $D^2$ by the pipe *d* exceeds a certain pressure, it presses liquid from the tank $D^2$ through the slot $d^4$ into the tank D and so raises the level of the liquid therein that the float $d^3$ operates the tap $d^2$ so as to contract the passage for gas through the pipe *d*. The apparatus, Fig. 4, therefore constitutes an automatic arrangement for regulating the pressure of the gases which pass to the pumping apparatus and thence to the combustion-chamber A, preferably through a mixing-nozzle (illustrated in section in Fig. 5) consisting of series of slits *e* $e^2$, opening, respectively, into the spaces $e^4$ $e^3$, into which respectively open the pipes $g^2$ *g* for the respective gases, so that the oil-gas passes by alternate slits and the oxygen by the other slits and issuing from these slits become thoroughly mixed in the passages

ding to the combustion-chamber A, which ssages are provided with a non-return ve *m* to prevent back-firing. The pump- apparatus shown consists of two cylinders nd F—one for the oil-gas admitted by the e $e^{\times}$ and one for oxygen admitted by the e *f*—and controlled by taps $e^{3\times}$ $f^3$, which s and also the outlet-taps $e^{4\times}$ $f^4$ on the pipes nd $g^2$, leading the oil-gas and oxygen-gas the combustion-chamber A, are operated the cam-groove H in a cam-disk working unison with the pumps, the said cam act- on a rod *h*, which through a bell-crank er $h^2$ operates a rack-bar $h^3$, with which gage toothed pinions $h^4$, connected to the gs of the taps $e^{3\times}$ $e^{4\times}$ $f^3$ $f^4$, the said cam- ove H being so timed as to admit a charge he combustion-chamber at the requisite ervals.

The igniter can be of any suitable descrip- n—such, for example, as an electric igniter, ich can be operated by a cam $H^2$ on the ne cam-disk which acts on a lever *i* (re- ned by a spring $i^2$) to make a contact at J, that at the proper time for igniting the rge an electric circuit is completed to se an igniting-sparking to take place in combustion-chamber A. The electric rent for this purpose may be derived n a battery, or it may be generated by electric machine, such as is indicated in ted lines at K in Fig. 1, driven by a don- -engine or other motor or, in a small ves- the propeller and shaft *k*, the said don- -engine or propeller also driving the pumps ough the gearing shown in Fig. 1, the nks of the pumps or the crank of one of pumps being preferably connected to piston-rod by a slotted connection, which allow the strokes of the pumps to be ad- ted to pass the requisite proportion of the es. *l* is a clutch-lever, by which the clutch wn in Fig. 1 can be operated to put the nps out of gear with the propeller K for ting the engine, which can be done by d or by a donkey-engine or otherwise.

y providing means for diverting the di- ion of the projected water—such as by veling the outer end of the tube B, by ch the water is expelled—the direction of vessel's motion can be altered as desired. he liquid propelled by the force due to combustion of gases, as aforesaid, can be used for propelling turbines or for any purpose where such liquid can be utilized.

I claim as my invention—

1. An apparatus for propelling liquids comprising a combustion-chamber, an outlet-pipe for liquid in direct communication with the chamber, an igniter for the explosive charge, an inlet-pipe for liquid, the upper end of which surrounds the combustion-chamber and the lower end of which dips into liquid in a box containing an inlet-valve and which box is only partly filled with the liquid, perforations in the wall of the combustion-chamber communicating with the inlet-pipe all so arranged that, at each explosion, or combustion, of a charge of gases, in the combustion-chamber, liquid is expelled by the outlet, and, after each such explosion, or combustion, a fresh charge of liquid is drawn in to be expelled by the next explosion or combustion, substantially as described.

2. An apparatus for propelling vessels, comprising a combustion-chamber, an outlet-pipe for liquid in direct communication with the combustion-chamber, an inlet-pipe, an upper portion of which surrounds the combustion-chamber, a box containing a non-return valve and partially filled with liquid into which the lower end of the inlet-pipe dips, and perforations in the combustion-chamber communicating with the inlet-pipe, substantially as described.

3. An apparatus for propelling vessels, consisting of a combustion-chamber with an inlet and an outlet for liquid and a non-return valve on the inlet, an igniter for the combustion-chamber, an open tank and a second tank communicating therewith at the bottom through a slot or opening, liquid in the tank and an inlet-pipe for gas into the second tank, a tap or valve in the inlet-pipe and a float in the open tank for opening and closing the said tap or valve for regulating and supplying gases to the combustion-chamber, all substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

E. TATHAM.

Witnesses:

WILLIAM FREDERICK UPTON,

SAMUEL CRANSAZ.