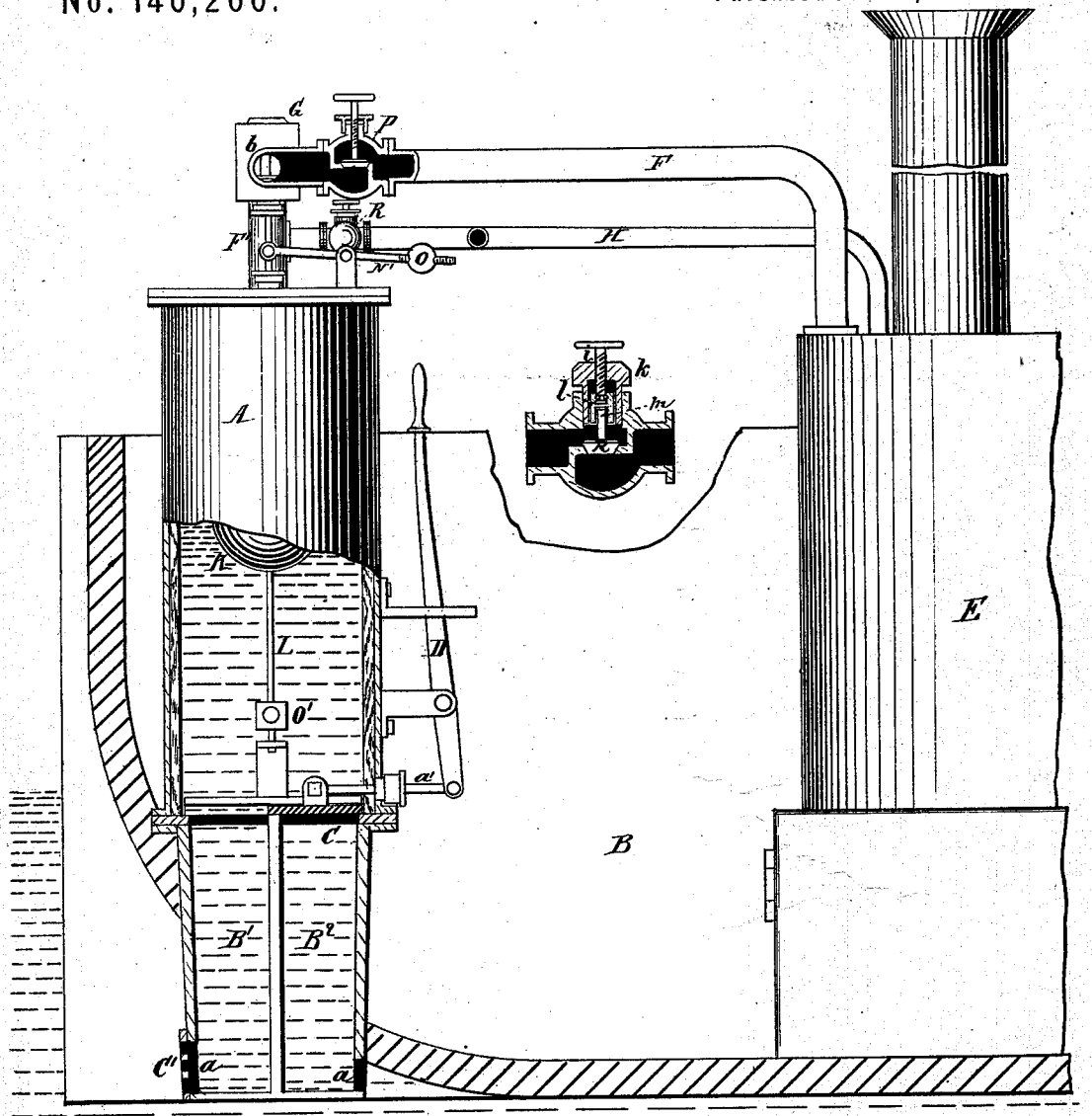
3 Sheets--Sheet 1.

J. S. MORTON.

Marine Propulsion.

No. 146,266. Patented Jan. 6, 1874.



Witnesses:
G. Martin
A. W. Hart

Inventor:
John S. Morton
Per Munn & Co

Attorneys.

3 Sheets--Sheet 2.

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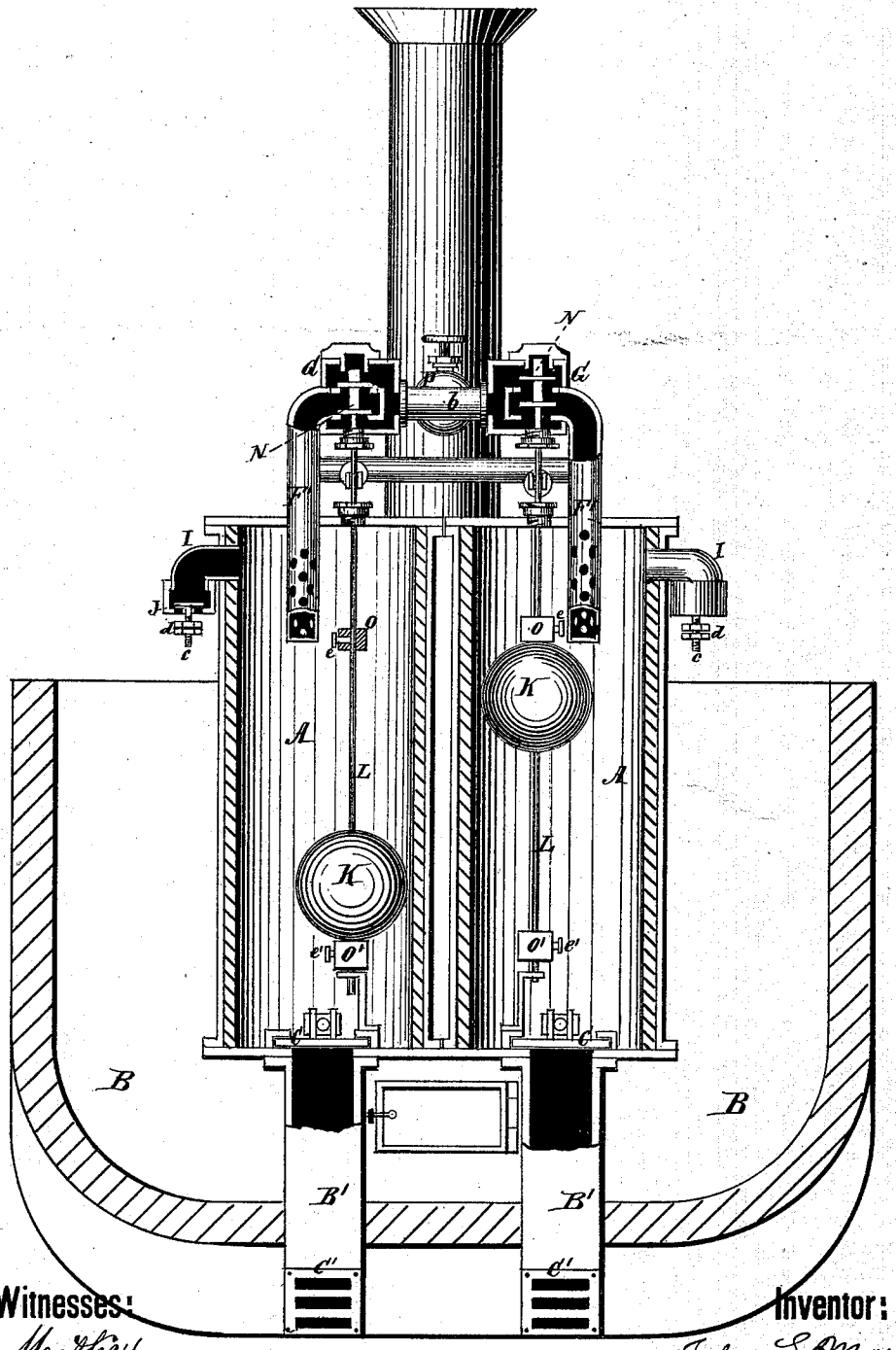

Witnesses:

G. Mathys.

A. W. Hart

Inventor:

John S. Morton

Per Munn & Co

Attorneys.

3 Sheets--Sheet 3.

J. S. MORTON.

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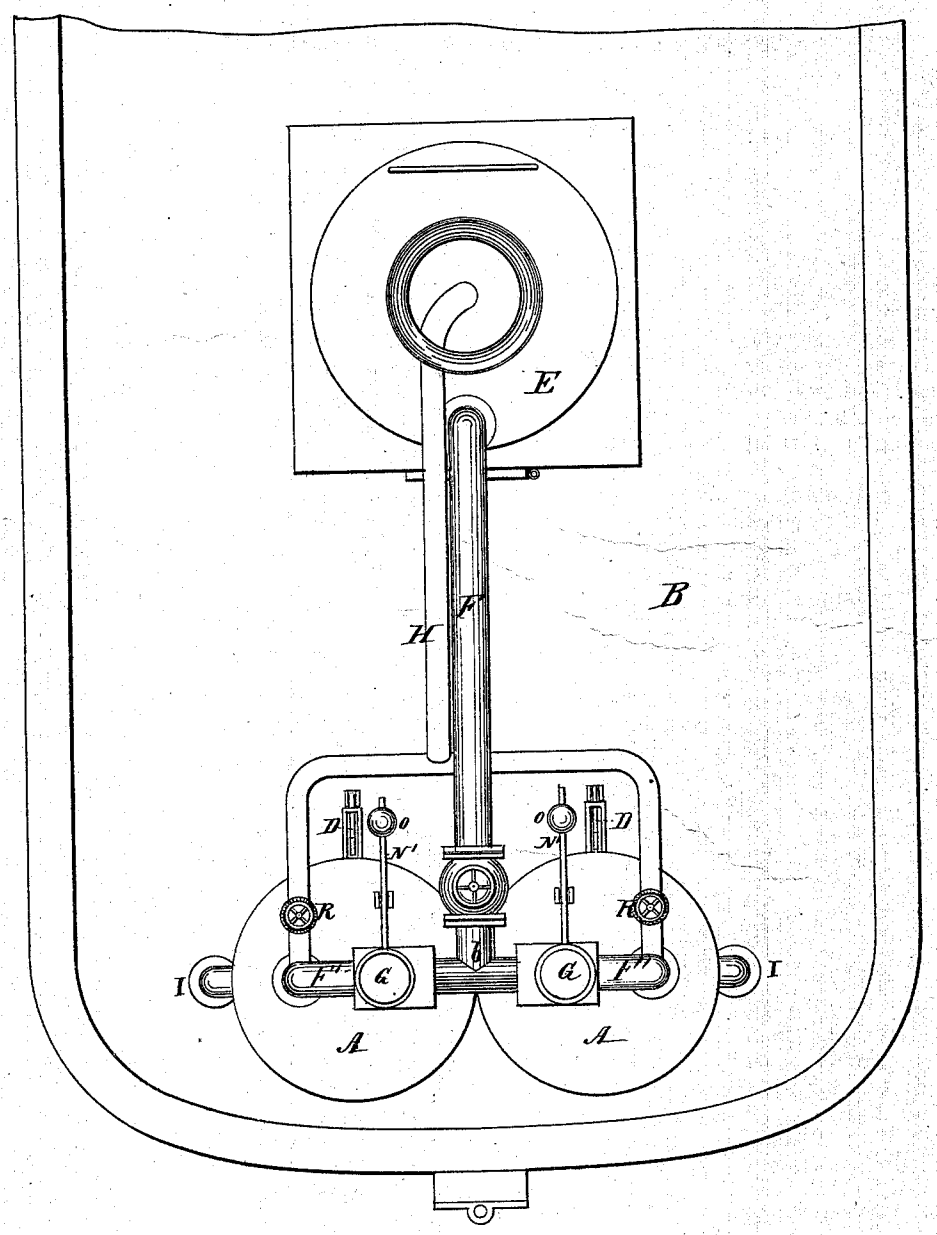

Witnesses:

G. Mathys

A. W. Cartt

Inventor:

John S. Morton

Per Munn & Co

Attorneys.

UNITED STATES PATENT OFFICE.

JOHN S. MORTON, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN MARINE PROPULSION.

Specification forming part of Letters Patent No. **146,266**, dated January 6, 1874; application filed December 12, 1873.

To all whom it may concern:

Be it known that I, JOHN S. MORTON, of the city and county of Philadelphia, and State of Pennsylvania, have invented a new and Improved Direct-Acting Steam and Water Propeller; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Sheet I represents a partly sectional side elevation of the propelling apparatus applied to a boat or vessel; also, a section of the hot-air check-valve. Sheet II represents a cross-section of the same. Sheet III represents a plan view.

My invention relates to improvements in propellers for navigable vessels, in which paddle-wheels or screws—also pistons, piston-rods, cranks, and walking-beams—are dispensed with, and steam and water are brought in direct contact in suitably-arranged cylinders or chambers, having openings at their lower ends through which the water is alternately admitted and expelled by the corresponding alternate steam-pressure and vacuum therein, the rapidity of propulsion being directly dependent, other things equal, on the rapidity of the in-and-out flow of water, or the force with which it is ejected through the orifice in the cylinder or chamber into the body of water in which the vessel floats.

The invention consists in stops for the floats, which may be adjusted higher or lower for the purpose of increasing or lessening the vertical movement of the floats, to the end of controlling the admission of steam to the cylinders or chambers, and thereby also determining, subject to the atmospheric pressure, the height to which the water shall rise therein at each pulsation. The invention further consists in providing the valve-rods with "starting" or setting levers having adjustable weights, the function of the same being twofold. First, to enable the valves to be set in proper position for admitting steam to the cylinders or chambers to put the vessel in motion; and, secondly, to relieve the floats of the weight of the valves and valve-rods so that they may act more freely and quickly than they otherwise would. The invention further consists in providing for admission of highly-heated air or gases of combustion from a furnace into the steam and water cylinders or chambers, for the purpose of expanding the cold air therein, preventing undue condensation of the steam by increasing the temperature of the cylinders preliminary to and simultaneously with the expulsion of the water therefrom. The invention also includes other features of construction and arrangement of parts, as hereinafter described.

Referring to the drawing, the steam and water cylinders A are shown located side by side at the stern of the boat or vessel B, and provided with a non-conducting lining of wood or other non-conducting material. Each has a pair of water-legs, B′ B″, extending below the water-line and nearly or quite to the keelson. Each leg has an opening, *a*, one on the front and the other on the rear side, so that the vessel may be propelled in either direction according to the position of the slide-valves C, which are arranged to close the entrance to one leg when the other is open, and vice versa. The valves are operated by rods *a′* sliding horizontally in suitable stuffing-boxes, and by hand-levers D pivoted to said rods, and having suitable fulcrums exteriorly of the cylinders, by the side of which they extend upward so as to be convenient of access to the engineer or other person in charge of the propelling apparatus. The aforesaid openings in the legs of the cylinders may be left free or covered with a removable grating, C′, formed of a frame provided with cross-bars, as shown. One of the objects of the same is to prevent admission of comparatively large pieces of wood, timber, ice, or other floating objects, whose rapid entrance and ejection might effect an injury to the cylinders. I also conceive advantage may be derived from the use of the grating, over and above the slight obstruction the bars necessarily offer to the in-and-out flow of water, from the fact that a number of streams of water or other fluid, when injected into a body of water or other fluid, penetrate said body to a shorter distance than they would if combined in a single stream. Hence, the effect of a divided stream of water from the cylinders A would be less injurious to the banks of a canal than a single stream penetrating farther. It

is also probable that other advantages are incidental to the use of the gratings; but it is unnecessary to detail them here.

I intend to provide a series of removable plates with orifices of various sizes and forms, and also a series of gratings with different-sized bars or openings, so that I may attach such a one as conditions indicate or require at different times. The means of attachment may be screw-bolts or other suitable devices.

The steam-generator E is connected with the cylinders A by means of a pipe, F, which divides at *b*, each branch leading to a steam-chest, G. From the steam-chest G a pipe, F′, leads downward into each cylinder, a short distance below the top thereof. Such extension within the cylinders is perforated on the sides, and closed at the end, so that the steam on entering the cylinders will be caused to diverge laterally in numerous jets or currents, mingling with and expanding the air above the lower or closed end of said pipe F′, and be diffused over the stratum of air over the water below, thus causing it to act uniformly on the water, in place of plunging vertically downward as one stream or current into the water, as would happen if the pipes F′ were open at the end and imperforate on the sides. An open-ended pipe, H, leads from the combustion-chamber of the generator-furnace, and is bifurcated, like the steam-pipe F, each branch entering one of the cylinders or chambers A, and terminating in the upper third thereof. The function of this pipe is to convey from the furnace a portion of the highly-heated air or the gases produced by combustion, and deliver the same in the cylinders as the vacuum is created and the cold or atmospheric air and water are entering. To provide for such admission of the cold or outer air, short tubes I are attached to and communicate with the upper end of the cylinders, the same curving downward, as shown, to facilitate the closing of the poppet-valves J on their seats by aid of gravity. Each valve J has a guide and screw-stem, *c*, on which is placed a nut, *d*. By adjusting the nut the play of the valve will be regulated or limited at pleasure, and thereby, also, the amount of atmospheric air admitted to the cylinder in a given time. The floats K (preferably round or oval in form) are bored longitudinally to adapt them to slide on the vertical rods or bars L, which extend up through the upper heads of the cylinders, and into the valve-chests G, where they connect with and operate steam-valves N. The valve-rods L have slight vertical play, to lift the valves off their seats and allow the admission of steam to the cylinders. This vertical movement is caused by the movement of the floats. In rising, the latter come in contact with stop-blocks O, which are made adjustable on the rods by means of clamp-screws *e*, and, in falling, as the water is forced out by steam-pressure, their movement is arrested by corresponding stops O′, near the lower end of the rods. By placing and securing these blocks higher or lower—*i. e.*, further apart or nearer one another on the valve-rods—it is apparent the time during which the valves N will be held open will be correspondingly increased or diminished; and hence, also, the time during which the steam-pressure and succeeding vacuum will exist; and hence, again, the height and quantity of water in the cylinders at any time. It is not, however, designed that the water shall, in any case, be allowed to rise quite to the lower end of the perforated steam-induction pipes F′.

It is necessary, to production of the best effect, that the floats should slide on the rods with the least possible friction, but especially that they should have no other weight to raise than that due to the friction of the rods L in their stuffing-boxes; also, that a means should be provided for raising the valves N when it is desired to put the propelling apparatus in action. To this end I employ levers N′, which are pivoted centrally to fulcrum-posts on the top of the cylinders, and also at one end to the valve-rods. Their free ends are screw-threaded, and have balls or weights *o* applied thereto, which may be adjusted to exactly weigh or counterbalance the weight of the rods and valves.

The admission of steam to the chests G is controlled by a throttle-valve, P. But the valves R, located in the bifurcations of the hot-air tubes H, are arranged both for automatic action as check-valves, and for positive control. The stem *i*, which screws through the nut *k*, has a tube or sleeve, *l*, attached to its inner end, and in this the stem *m* of the valve plays; hence, when the vacuum is created in the cylinders, the valves R will rise and allow hot air to pass over from the furnace; but when the vacuum ceases, and steam is admitted, the valves will again close on their seats. When it is desired to entirely prevent the admission of hot air to the cylinders, the stem *i* is screwed down, thus causing the sleeve or tube *i* to hold the valve R on its seat. The valves N, in the steam-chest G, are of disk form, and secured on the rods at the same distance apart as the diameter of the pipe F, a valve-seat being formed in or on each side of the pipe.

The operation of the propelling apparatus is as follows: Steam being generated to a suitable pressure in boiler E, and the valves of one steam-chest raised from their seats by aid of the starting-lever N′ belonging thereto, and the throttle-valve P raised, steam will enter through pipe F′, fill the cylinder, and expel whatever quantity of water may be therein. As the water falls in the cylinder its float K follows, by effect of gravity, until it strikes against the stop-block O′, and hence closes the valves on their seat. The steam partly escapes with the air and water, and partly condenses, thus creating a vacuum in the cylinder, which the water instantly seeks to fill. Simultane-

ously with the creation of the vacuum the valves J and R open automatically, admitting cold and hot air, which commingle in the cylinder. When the water has risen sufficiently high, to cause the float to strike against the stop-block O, and to raise the valves anew, the steam again enters, and being somewhat expanded by the more highly-heated air, their combined expansive force causes the ejectment of the water.

The operation of one cylinder, and its connected apparatus, is identical with the other, and being alternate in time a stream of water is constantly forced into the floatative body of water, thus causing a constant propulsive effect on the vessel.

I have above described the essential principles of the apparatus, and its construction in general and detail, as shown in the drawings; but I do not design to limit myself to details. For example, in place of forming separate water-legs for each cylinder, the diaphragm or partition may be dispensed with, and a gate provided which shall close one of the openings *a* and open the other, according as it is desired to propel the vessel forward or backward.

Also, other arrangements of levers may be made for working the water-valves C, which would operate with equal facility with those shown in the drawings.

When preferred, or for any reason necessary, the cylinders may also be located near (or nearer) the middle of the boat or vessel, and have water-passages leading outward and downward toward the bow and stern. Nor would it be a departure from the spirit of my invention to employ other means of adjusting the weights on the valve-levers N′; and there may be two sets of levers, separate and distinct from each other, one set for counterbalancing the weight of the valves and valve-rods, the other for adjusting the valves. Other forms of valves might be likewise adopted than those here shown, and with equally good effects.

Having thus described the invention, what I claim is—

1. In the direct-acting steam and water propeller herein described, the stop-blocks O O′, secured by, and made adjustable by, means of set-screws *a′*, in combination with the floats, rods, and valves, as set forth.

2. In a direct-acting steam and water propeller, the combination of a starting and counterbalance lever with the steam valve or valves, valve-rod, and float, or their equivalents, as shown and described, for the purpose specified.

3. In a direct-acting steam and water propeller, the combination of the hot-air pipe with the steam and water cylinders, or their equivalents, as shown and described.

4. In the direct-acting steam and water propeller herein described, the steam-pipe F′, perforated on its sides, and imperforate at the end, as shown and described, for the purpose specified.

Witnesses: JOHN S. MORTON.
R. B. NEWBOLD,
CHAS. T. SHIVELY.