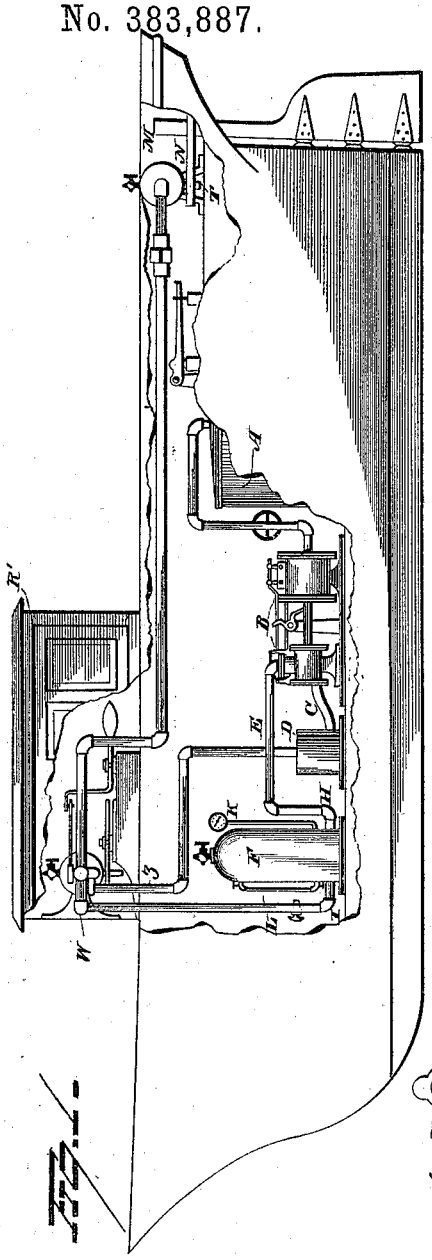
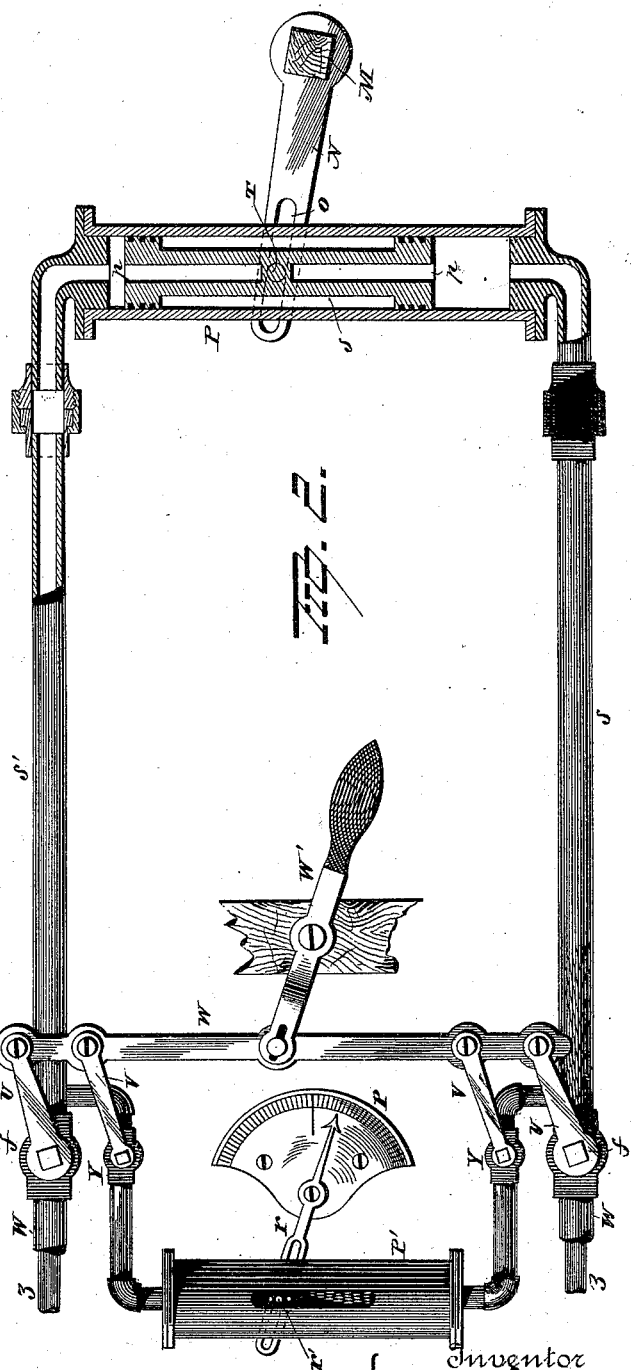
(No Model.) 2 Sheets—Sheet 1.

W. M. JACKSON.

MECHANISM FOR UTILIZING AND CONTROLLING HYDRODYNAMIC FORCES.

No. 383,887. Patented June 5, 1888.





Witnesses
A. Montgham.
Wm P. Patton

Inventor
Walter M. Jackson
By his Attorney
H. C. Seymour

(No Model.) 2 Sheets—Sheet 2.

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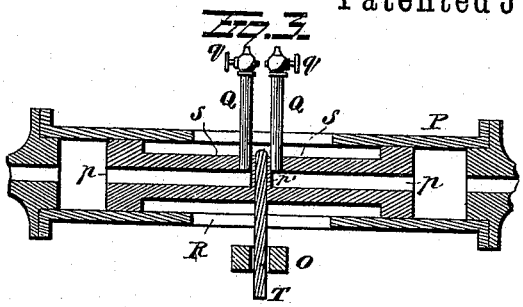
Fig. 3.



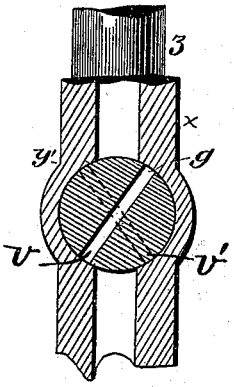
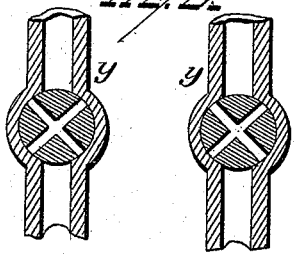


Fig. 4.

Fig. 5.



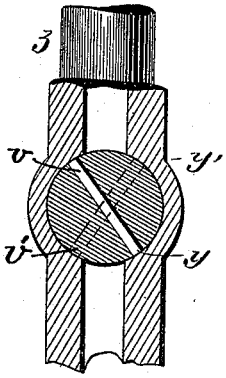


Fig. 7.

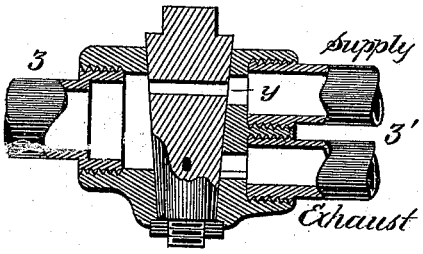


Fig. 6.

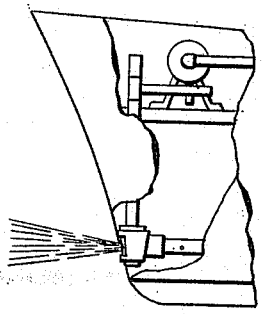
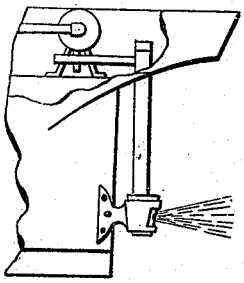


Fig. 8.



Witnesses.
E. M. Cunningham.
Wm. I. Patton

Inventor.
Walter M. Jackson
By his Attorney
H. A. Seymour

UNITED STATES PATENT OFFICE.

WALTER MARSH JACKSON, OF NEW YORK, N. Y.

MECHANISM FOR UTILIZING AND CONTROLLING HYDRODYNAMIC FORCES.

SPECIFICATION forming part of Letters Patent No. 383,887, dated June 5, 1888.

Application filed August 4, 1887. Serial No. 246,141. (No model.)

To all whom it may concern:

Be it known that I, WALTER MARSH JACKSON, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Mechanism for Utilizing and Controlling Hydrodynamic Forces; and I do hereby 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.

My invention relates to an improved mechanism for utilizing and controlling hydrodynamic forces.

The object is to provide novel mechanism by which said mechanism may be moved or locked in any desired position to counteract opposing forces or resistances, thus becoming dynamic or static at will, producing a double function, and for a proper designation of which I employ the term "hydrodynamic."

With these ends in view, my invention consists in combining hydraulic and hydrostatic forces for the purpose of creating and maintaining mechanical motions and effects. It is evident that a combination of this character may be employed for many purposes; hence I do not limit myself to any single or specific selection; but to make my invention clearly understood I will describe and illustrate by drawings the same for steering a vessel.

For most effective action, and where it is necessary that the static condition be absolute and positively static, I rely upon the employment of fluids which are practically incompressible; but in using the word "fluids" I intend the same in its broadest sense, since my invention is operative for certain purposes when elastic fluids—such as steam, atmospheric air, and others—are employed; but inelastic fluids are far preferable—such as water, oil, or mixtures of glycerine and water. When the fluid employed is incompressible, it becomes practically its own governor of the desired static condition, and where the fluid employed is elastic a mechanical device in some form of rigid lock must be used to secure such static state.

Water is the best fluid which can be used for all seasons of the year, except, possibly, during cold weather, when the same might congeal. Oil or a mixture of glycerine and water could be substituted and thus obviate this difficulty.

Having selected water as the fluid to be employed in this instance, I will proceed to describe my invention.

In the accompanying drawings, Figure 1 represents my improved mechanism applied to a vessel. Fig. 2 is a plan view of my device, showing the stern-cylinder and its double-headed plunger in longitudinal horizontal section. Fig. 3 shows a cylinder and its double-headed plunger in longitudinal vertical section. Fig. 4 shows my port compound valve closed in horizontal section, taken through its inlet or supply port, and showing by dotted lines its outer or exhaust port beneath. Fig. 5 shows my starboard compound valve closed in horizontal section, taken through its inlet or supply port, and showing by dotted lines its outlet or exhaust port beneath. Fig. 6 shows my starboard and port duplex valves closed in horizontal section, taken through the ports. Fig. 7 shows a longitudinal vertical central section of a compound valve, drawn with the supply or inlet port open and the outlet or exhaust port closed, also showing the independent supply and exhaust conduits and the combined supply and discharge conduit. Fig. 8 shows my cylinder and plunger attached to a lever or tiller for changing the direction of a jet of water, the vessel being steered or propelled by means of such jet. Fig. 9 shows my cylinder and plunger attached to a lever for changing the direction of a jet of water, the vessel being stopped, backed, or guided by means of such jet.

I attach to an ordinary boiler or other source of power, in this case a steam-boiler, (represented by letter A in Fig. 1,) any suitable water-forcing device, simple, compound, or triple expansion, in this case a simple piston steam-pump, B. The suction-pipe of the pump may open directly into the water which floats the vessel, or it may open into a tank which communicates with said water, or into a tank, D, which does not communicate with the outside water. The water after leaving the pump through pipe E enters the receiver F at or near its base, at point H, and escapes by means of an exit, I, also located at or near its base. The

receiver is made of any suitable material, and may be provided with pressure-gage K and glass indicator L. This receiver may be dispensed with altogether and the pumped water passed direct to my hydrodynamic device. In the particular case being described, however, I employ the receiver, because the hydrodynamic apparatus is more perfectly operated by this means.

To the ordinary rudder-post of the vessel M is attached a lever, N, (shown in Figs. 1, 2, and 3,) standing, preferably, at a right angle with the post, and vertically through this lever is constructed a slot, O, said slot running lengthwise with the lever. This lever N serves the ordinary purpose of a tiller, by means of which the rudder is swung back and forth or held firmly in any desired position. Directly over or under the lever and in a line with its slot—in this case over—is located a cylinder, P, made of any suitable material to resist high pressure—such as steel, brass, copper, white metal, &c.—said cylinder having a slot, R, on its upper and lower sides. Inside of this cylinder is located a double-headed plunger or piston, S, its articulating surface suitably packed to prevent the water from passing and communicating. In each head of the plunger a hole or pocket, *p*, is bored toward the center, leaving a solid wall, *p'*, between the two extremities and in the center of the plunger. At or near the bottom of each pocket another hole is bored, at right angles to the pocket, the two holes passing through the plunger's upper half and communicating with the slot in the cylinder. Into each of these latter holes a pipe, Q, is inserted, said pipes being each provided with a suitable petcock extending through the upper slot in the cylinder. Through the solid center of the plunger I pass a rigid post, T, preferably steel, (shown in Figs. 1, 2, and 3,) said post projecting downward through the lower slot in the cylinder and passing through the slot O (shown in Fig. 2) in the tiller or rudder post lever. It is obvious that if I desire to place the cylinder below the tiller it is only necessary to reverse it, bringing the petcocks on the under side and the post T on the upper, and passing said post up through the slot in the tiller.

In the pilot-house R', or at any other convenient point, I locate a duplicate cylinder, plunger, petcocks, and driving-post; but instead of having a lever connected to the rudder-post I employ an arrow or indicator, *r*, pivoted in its center, with a slot at its tail to engage the driving-post *r'*, its free point left to swing upon and over a special dial-plate marked on opposite sides D and S for port and starboard. The two cylinders P' P, the one in the pilot-house and the one connected with the rudder, have open ends with threads cut upon them, or flanges, as in this case, for the purpose of connecting with the port and starboard circulating-conduits *s s'*.

Having placed my apparatus in position, I connect the conduits. Thus one pipe, *s*, leads from the port end of the stern-cylinder to the port end of the bow-cylinder, and the other pipe, *s'*, leads from the starboard end of the stern-cylinder to the starboard end of the bow-cylinder, the two double-headed pistons S S' dividing the pipe-circuit into two distinct chambers, each chamber guarded near its connection with the bow-cylinder by a duplex valve, Y, which is so constructed (illustrated in Fig. 6) that when it is on the center it is closed and when off to port or starboard it is open. At the bow end of the two circulating conduits I provide a compound valve, one for each conduit. One I term the "port," and the other the "starboard." The outer end of the casing of the valves is provided with two distinct openings, (shown in Fig. 7,) the upper opening, Z, being the supply and the lower opening, Z', the exhaust. The other end of the valve-casing is provided with but one opening, *z*, (see Fig. 7,) and connects with the circulating-conduit.

By reference to Figs. 4 and 5 it will be seen that the port compound valve has its supply-port *v* running from left to right, while the dotted lines or exhaust-port *v'* runs from right to left. Exactly the reverse is true of the starboard compound valve shown in Fig. 5. The upper pipe leads to the receiver, and the exhaust-pipe leads to the tank. Both the supply-pipes may join and lead to the receiver in common, and the same may be the case with the two exhaust-pipes.

It will readily be seen by reference to the drawings that the holes in the compound valves are drilled in such relation that when the valves stand square across both the supply and exhaust are closed. If moved to the left, the supply of the port is opened, while the exhaust remains closed, the supply of the starboard being closed and its exhaust opened.

To the stem of each of the compound valves is connected a lever, U, each extending back parallel with the circulating-conduit, and to each of the duplex valves is attached a similar lever, V, thus having four levers of equal lengths grouped parallel to each other. I connect the four levers by pivoting them to a cross-bar, W, and to the center of the cross-bar I pivot another lever, W', which in turn is pivoted to a fixed point below, terminating in a free handle to be grasped by the pilot or helmsman. As the exhaust-pipe returns to the tank from which the water was drawn by the pump, it will readily be seen that the water, or oil, or glycerine and water, may be repeatedly used.

To make my invention more clearly understood, I will explain its operation, which is as follows: The steam-pump is started, and, drawing water from the tank D, said water is forced into the receiver and accumulates under the air-cushion, compressing the air more and more until the reflex pressure from the receiver upon the pump-piston in pounds total is equal to the pounds total exerted by the steam against the steam-piston, when the pump

will stop, and will remain inactive until the pressure in the receiver is relieved, when it will again exert itself to maintain the receiver-pressure to the standard, thus becoming automatically operative. In starting my apparatus for the first time the pipes will be filled with air, and, as an elastic medium in my circulating-conduits would be objectionable for the purpose, the air must first be discharged. For this purpose the petcocks located at the extremities of the pockets in the plungers are opened, and as soon as the air is all driven off (this determined by water flowing from the cocks) the petcocks are closed and probably may not be required to be opened again. The pipes and conduits are now full of water, and as the water escapes from the receiver F under a high pressure it will contain no interstitial air, since the high pressure will effectually squeeze it all out before leaving the receiver. Now, by swinging the handled lever W′ in the pilot-house to the port side, the supply-port of the port compound valve is opened and its exhaust remains closed, and the supply-port of the starboard compound valve remains closed while its exhaust is opened; at the same time the two duplex valves Y are opened. Thus the pressure and the water taken in at the port compound valve and reflected against the port ends of the bow and stern plungers move the plungers toward the starboard side, the pressure and the water giving way by means of the starboard supply-port remaining closed and its exhaust opened. This motion drives the rudder to port and the arrow over the dial to port. Thus the handled lever, the arrow, and the rudder assume the same common direction. Now, if the handled lever be swung to starboard, the duplex valves are opened, the supply-port of the starboard compound valve is opened while its exhaust is closed, and the supply of the port compound valve is closed and its exhaust opened. Thus the rudder and arrow will swing to starboard. Now, if it be desirable, which it certainly is, to fix the rudder in any one position, we swing the handled lever to the center, and all the ports in all the valves are closed and the plungers are caught between the two lines of incompressible fluid, remaining as fixed as if of integral steel.

Figs. 8 and 9 show my invention applied to tillers which connect with water-jets at the bow or stern of the vessel, or both, for the purpose of changing the direction of the jet and thus guiding or maneuvering the vessel, this feature being fully described in another application, Serial No. 244,519, filed July 16, 1887. It will readily be seen that a comparatively small double-headed plunger may be employed, for if a plunger has only thirty square inches area and the receiver-pressure be five hundred pounds to the square inch the force against the tiller would be fifteen thousand pounds, while when locked by the closing of the valves no power could move it without bursting the conduits save the release of the water by the exhaust. As the quantity of water used to manipulate the plungers would be diminutive, a very small set of pipes would be employed, since the high pressure would force all the water required through a very small opening in a fraction of a second's time. Thus the action would be prompt, easy, and effective. The same invention may be employed for many purposes besides guiding vessels. It would prove useful for opening and closing valves at a distance. When it is desirable to lock the valve, incompressible fluids may be used. In cases where locking is unnecessary elastic fluids may be employed. It is evident that the bow-cylinder described, with its indicators, may be omitted in cases where it is not necessary to know the exact degree of direction or motion of the mechanism acted upon by the plunger described as attached to the rudder or jet-tiller. The duplex valves would also be omitted in this latter case.

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

1. In mechanism for utilizing and controlling hydrodynamic forces, the combination, with a suitable pump, conduits connected therewith, and a plunger located in a casing or cylinder connected at both ends with the conduits, of a series of valves located in said conduits and adapted to be simultaneously actuated to equalize or vary the pressure on opposite ends of the plunger, and thereby retain it either in a stationary position at any point of its travel or actuate it in either direction, substantially as set forth.

2. In mechanism for utilizing and controlling hydrodynamic forces, the combination, with a suitable pump, discharge-conduits connected therewith, and a plunger located in a cylinder or casing connected at both ends with said conduits, of valves located in the several conduits for governing supply and exhaust passages connecting with each end of the plunger, and means for simultaneously actuating said valves, substantially as set forth.

3. In mechanism for utilizing and controlling hydrodynamic forces, the combination, with a suitable pump, a receiver, suitable conduits connected with the pump and receiver, and a plunger located in a cylinder connected at its opposite ends with said conduits, of valves located in the conduits for equalizing or varying the pressure on opposite ends of the plunger, substantially as set forth.

4. In mechanism for utilizing and controlling hydrodynamic forces, the combination, with the tiller of a vessel, of a plunger connected with the tiller, and a suitable pump, conduits, and a series of valves located in the conduits and adapted to be operated simultaneously for equalizing or varying the pressure on opposite ends of the plunger, and thereby move the tiller in either direction or hold it stationary at any point of its travel, substantially as set forth.

5. The combination, with a fluid-cylinder

and means for constantly supplying this cylinder, of a double-headed plunger having pockets in each head and adapted to reciprocate in the cylinder, said cylinder having elongated slots formed therein between the heads of the plunger, and outlets leading from the pockets through the slots of the cylinder, substantially as set forth.

6. In a vessel, the combination, with a fluid-cylinder, a pump, and a receiver containing air or other elastic medium, wherein the water is forced from the pump, of a double-headed plunger adapted to reciprocate in the cylinder, and a system of valves located in the conduits and connected, so as to be operated simultaneously, and adapted to vary and equalize the fluid-pressure on both heads of the plunger, substantially as set forth.

7. The combination, with a cylinder having elongated slots therein, of a double headed plunger adapted to reciprocate therein, said plunger having pockets formed therein and conduits connected to the opposite ends of said cylinder, substantially as set forth.

8. The combination, with a cylinder having elongated slots therein, of a double-headed plunger adapted to reciprocate therein, said plunger having pockets formed therein and pipes leading from the pockets through the slots in the cylinder, substantially as set forth.

9. The combination, with a cylinder having slots therein extending lengthwise of the cylinder, of a double-headed plunger adapted to reciprocate therein, said plunger having pockets formed therein, pipes leading from the pockets through the slots in the cylinder, and a stem located in the plunger and adapted to communicate motion to any connected mechanism, substantially as set forth.

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

WALTER MARSH JACKSON.

Witnesses:
GEO. T. GADEN,
GEO. M. WARDEY.