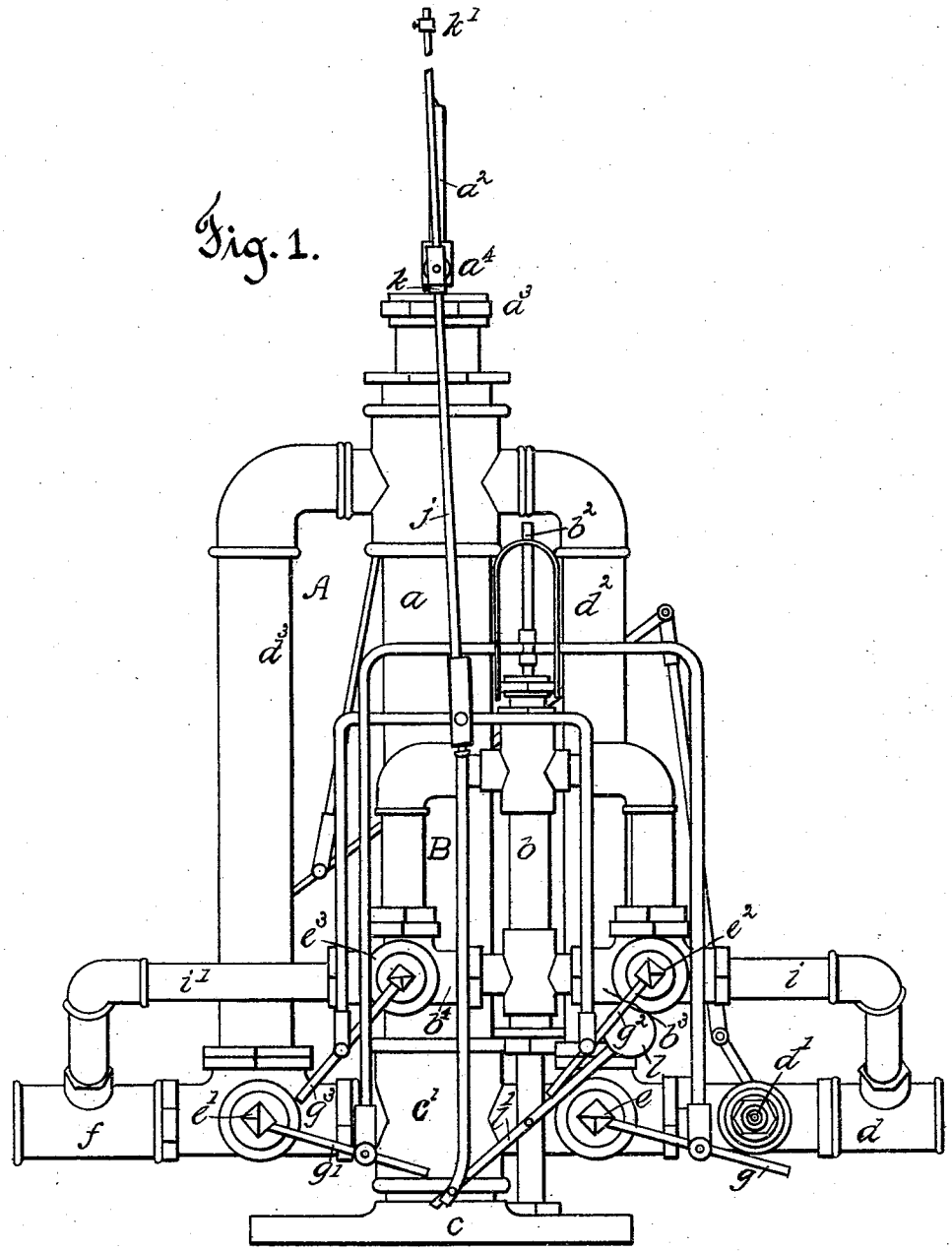
(No Model.) 3 Sheets—Sheet 1.

I. H. SPENCER.

WATER MOTOR.

No. 479,097. Patented July 19, 1892.

Fig. 1.



Witnesses
H. A. Giddings
A. B. Jenkins.

Inventor
Ira H. Spencer.
by Chas. L. Burdett
Atty.

(No Model.) 3 Sheets—Sheet 2.

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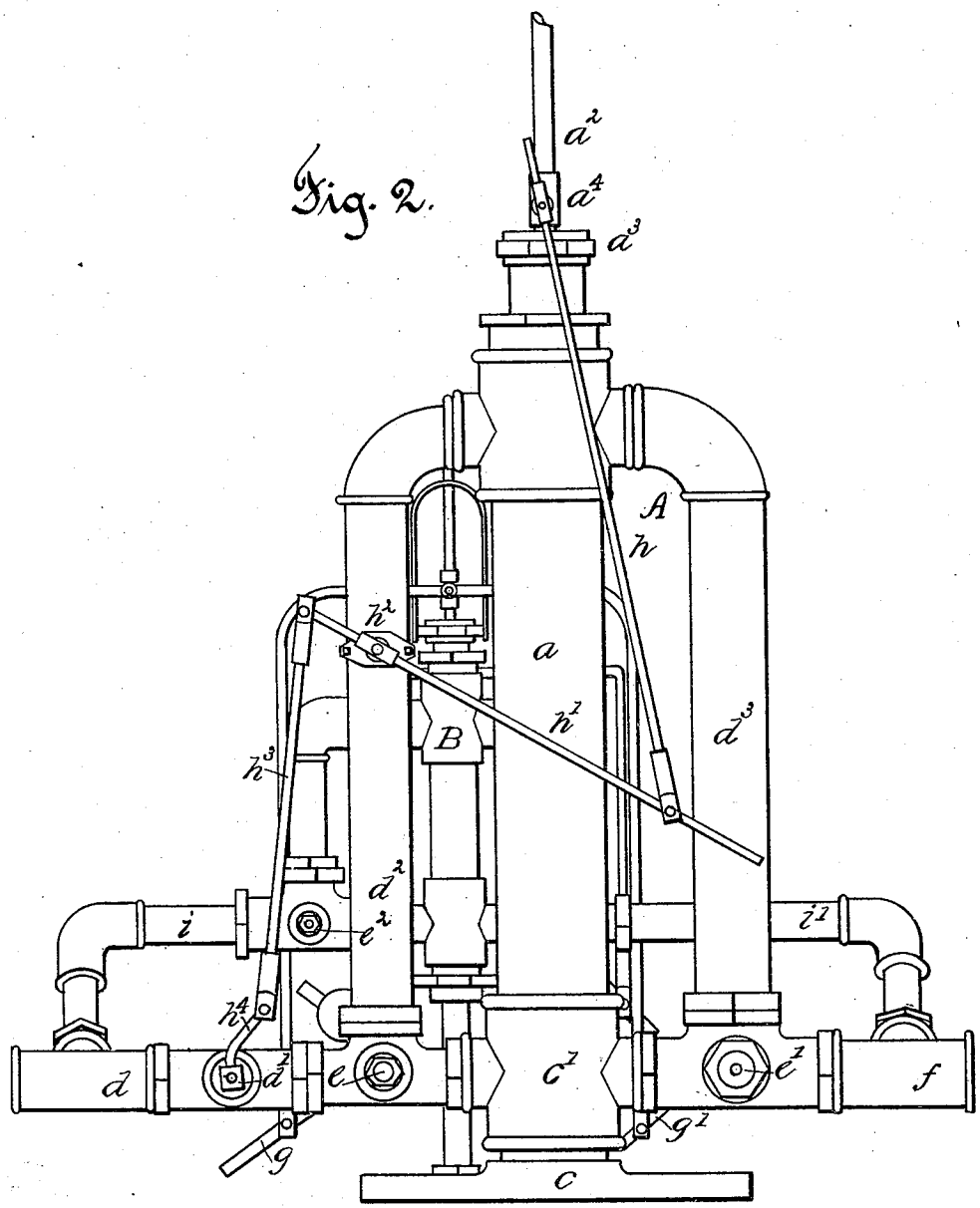
Fig. 2.



Witnesses
H. A. Giddings
A. B. Jenkins

Inventor
Ira H. Spencer.
by Chas. L. Burdett
Atty.

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I. H. SPENCER.

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Fig. 3

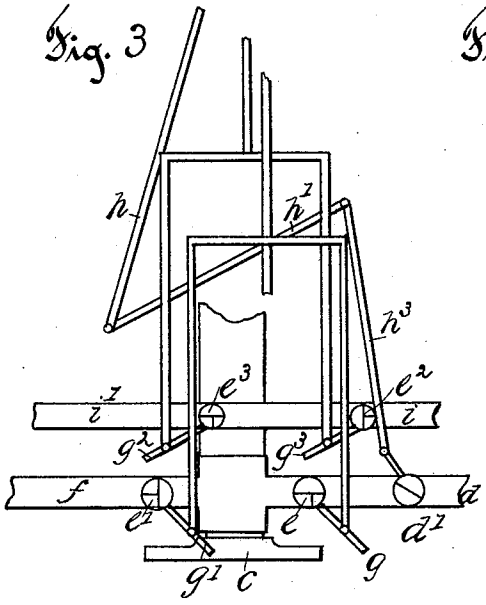


Fig. 4

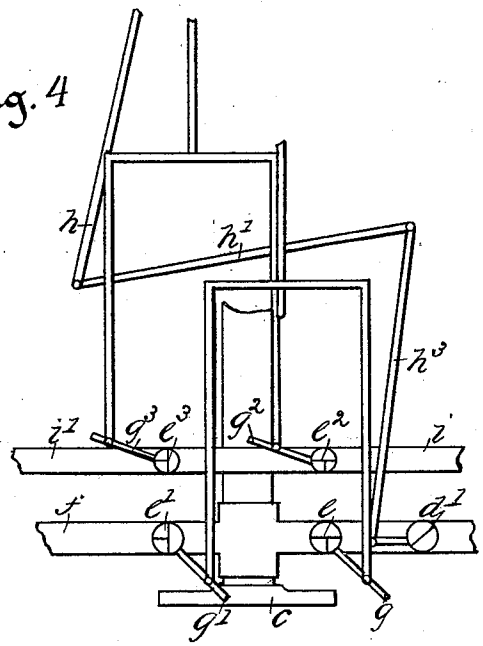


Fig. 5

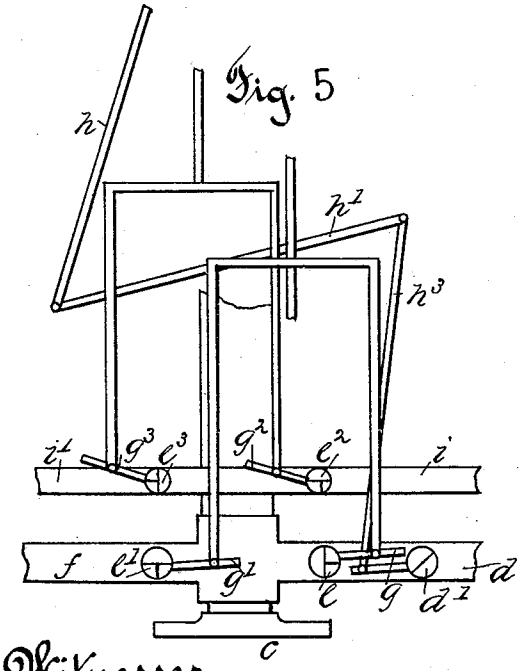
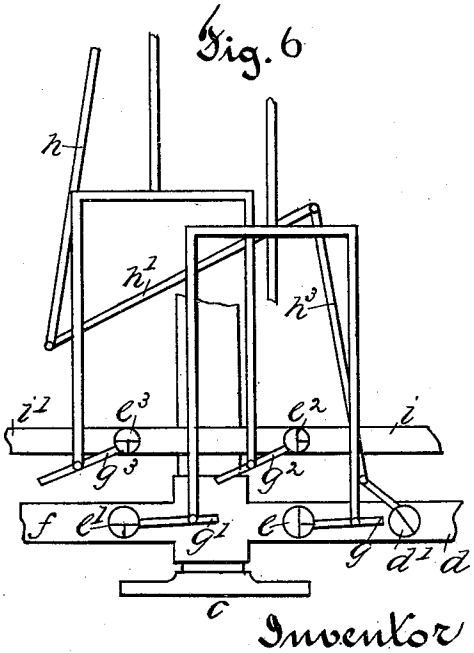


Fig. 6



Witnesses
H. C. Giddings
A. B. Jenkins.

Inventor
Ira H. Spencer,
by Chas. L. Burdett
Atty.

UNITED STATES PATENT OFFICE.

IRA H. SPENCER, OF HARTFORD, CONNECTICUT.

WATER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 479,097, dated July 19, 1892.

Application filed October 5, 1891. Serial No. 407,706. (No model.)

To all whom it may concern:

Be it known that I, IRA H. SPENCER, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Water-Motors, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

The object of my invention is to provide an engine or apparatus having moving parts that will be operated by the flow of water under pressure, the device being adapted to be connected up to a water-pipe in which there is a pressure available for moving the operating parts.

To this end my invention consists in the several parts making up the motor as a whole, and in the combination of such parts, as more particularly hereinafter described, and pointed out in the claims.

Referring to the drawings, Figure 1 is a view in front elevation of my improved water-motor. Fig. 2 is a view in rear elevation of the device. Fig. 3 is a diagram view showing the position of the parts at the beginning of the upward stroke of the main engine. Fig. 4 is a diagram view showing a succeeding step in the operation of the device and with secondary engine in operation. Fig. 5 is a diagram view showing another succeeding step in the operation of the device. Fig. 6 is a diagram view showing the fourth step in the operation of the device or just as the main piston has completed its return stroke.

The motor as a whole is composed of a main engine A and a secondary engine B, that is similar in construction to the main engine, but is, however, much smaller in the size of the operating parts. In the main engine the cylinder a is supported on any suitable base c, usually in an upright position, the inlet-pipe d communicating with the chamber c' at the lower end of the cylinder, within which the piston, that may be of common construction, is located, the piston-rod a^2 extending through a cap a^3, that is of any suitable construction and provided with suitable packing to prevent the outflow of the water about the piston-rod. On the inlet side of the engine there is a governor-valve d', that is connected up with the moving parts in such way as to remain partly open at all times, being open to its fullest extent when the piston is about half-way in its stroke, the object of this construction and operation of the governor-valve being to diminish the flow of water, and therefore the pressure as the piston approaches the end of its stroke, so as to prevent shock by sudden stoppage. An inlet-valve e is arranged at the junction of the main inlet-pipe d and a branch pipe d^2, that communicates with the upper end of the cylinder at a point beyond the end of the stroke of the piston, and a similar pipe d^3, forming an outlet, extends from the chamber in the same end of the cylinder and communicates with the outlet-pipe f, that is preferably, for convenience, in line with the inlet-pipe and extends from the cylinder and on its opposite side. An outlet-valve e' is arranged at the point of junction of the pipes d^3 and f. These valves e and e' are three-way cocks of ordinary construction, and each of them is provided with a lever-handle g g', that is connected to the operating parts as a means of opening and closing the valves.

The piston-rod a^2 of the main engine bears a cross-head a^4, that on one side is connected by a rod h to a lever h', that is pivoted to a suitable support, as a bracket h^2, on the pipe d^2, the other end of the lever being connected by a rod h^3 with the lever-handle h^4 of the governor-valve d'.

A secondary engine B, that is a counterpart of the main engine, but of a much smaller size, is connected to a branch i of the main water-pipe d, the inlet to the secondary engine coming from a point beyond the governor-valve, while the outlet from the secondary engine connects up to the pipe f at a point beyond the valve e', although it is not necessary that the secondary engine should be connected with the same source of water-supply or the same pipes that serve to connect and operate the main engine. The secondary engine has a cylinder b, within which is located a piston of common construction, and piston-rod b^2, the latter extending through suitable packing in the cylinder-head. An inlet-pipe b^3 extends from the supply-pipe i, communicating with the chamber at each end of the cylinder b, and an outlet-pipe b^4 extends from these chambers to the

outlet-pipe i'. At the points of connection of these several pipes the three-way valves e^2 e^3 are arranged, each having lever-handles g^2 g^3 connected to the plug, and these lever-handles are in turn connected by means of rods to the cross-head a^4 of the main piston. The connecting-rod j extends through the opening in the cross-head, and stop devices k k' are adjustably secured to the connecting-rod j, so that the connecting-rod will be moved in either direction by contact of the cross-head with the stop devices, the latter being arranged in proper position to give to the connecting-rod the proper extent of throw to open and close the valves e^2 e^3 at the proper times. The lever-handles of the valves e and e' are connected by suitable rods to the piston-rod b^2 of the secondary engine, the function of which is to operate the inlet and outlet valves of the main engine.

In order to prevent the closing of the valves e^2 e^3 before the proper time, a counterpoise-weight l is secured to one end of the lever l', the other end of the lever being connected to the lower end of the connecting-rod that controls the movement of the valves e^2 e^3. This counterpoise operates to hold the valves with the connecting-rod at the upper limit of its play until the downward movement of the cross-head encounters the stop k and insures the timely operation of the valves.

When the several parts are in the position shown in Fig. 3 of the drawings, the valve e is turned so as to allow the full pressure of the water on the inlet-side of the engine to be exerted in the chamber below the piston in the cylinder a, and this pressure operates to cause the piston to make an upward stroke. When this upward stroke is completed and when the valve e is still open, the valve e^2 in the secondary engine is turned so as to allow the water to flow freely into the inlet-pipe b^3 to the under part of the cylinder b, the valve e^3 being in such position as to prevent any further flow of the fluid through the pipes. The upward movement of the piston-rod a^2 carries the cross-head into contact with the stop k' on the connecting-rod j, and by moving the connecting-rod opens the valves e^2 and e^3, the valve e^2 being opened so as to allow the water to flow into the chamber below the piston in cylinder b, and the valve e^3 being opened on the outlet side to form an exhaust-valve for the water above the piston of the secondary engine. The pressure of the water in the cylinder below the piston causes the piston to lift, and this lifting of the piston operates the valves e and e' by means of the connecting-rod, turning the valve e' so as to allow the water to flow through the inlet-pipe d^2 to the upper end of the cylinder above the piston, and closing the outlet-valve e' against any flow of water from the pipe d^3, but opening an exhaust-way for the outflow of water from the cylinder below the piston when the piston is forced downward by the inflow of water through the valve e and the inlet-pipe d^2. The piston is forced downward by the pressure of the water and the cross-head in its movement strikes the stop k, moves the connecting-rod j, and returns the valves e^2 e^3 to their original position. In this position of the valve e^2 the water flows through the pipe b^3 into the cylinder above the piston and forces it downward, and by this downward movement returns the valves e and e' to the position that they had at first, the valve e^3 having been turned so as to allow the water in the cylinder and below the piston to pass freely out of the cylinder on the downward stroke of the piston. All of the several operative parts are now in the position first described, and the several successive movements of the pistons and valves will be repeated as long as a pressure is maintained in the supply-pipe.

The operation of the governor-valve d^2 is to prevent shock by the sudden stopping of the piston-rod of the main engine; but it is not abolutely necessary to the successful working of the engine that this governor-valve shall be attached, as this same function is performed by the secondary engine b, which in its operation of the valve of the main engine diminishes the flow of water at each end of the stroke of the main piston. As I have said, this governor-valve d' is not absolutely necessary, but it aids the secondary engine in preventing a hammering at each end of the stroke of the piston of the main engine.

In the diagram views, Figs. 3, 4, and 5, are shown the position of the valves and connecting-rods in successive steps in the operation of the device. In these diagram views the fluid-ways through the several valves are indicated by the lines as shown on each valve. For instance, on the valve e is shown the mark T, which shows that the opening through the valve is straightway into the bottom of the cylinder; but when this valve is turned by the upward movement of the handle-lever g this straightway through the valve is closed and the fluidway extends in and then up. The marks on the several valves indicate the fluidways through the valves at the successive steps in the operation of the device in each of these diagram views.

I claim as my invention—

1. In combination, in a water-motor, a main engine having the inlet and exhaust pipes connected with the opposite ends of the cylinder, the inlet and exhaust valves appurtenant to the inlet and exhaust pipes, a secondary engine having corresponding parts and valves, a yoke connected to the lever-handles of the valves of the secondary engine and to the cross-head secured to the piston of the main engine, the adjustable stops attached to the connecting-rod on opposite sides and in the path of movement of the yoke, and the yoke secured to the piston-rod of the secondary engine and connected

with the lever-handles of the inlet and exhaust valves of the main engine, all substantially as described.

2. In a fluid-motor, in combination with a main engine having a reciprocating piston with chambers at opposite ends of the cylinder and inlet and outlet pipes connected with said chambers, the inlet and exhaust valves located in the respective pipes, the secondary engine connected to the main supply-pipe at points beyond the said valves and having a reciprocating piston, and the inlet and exhaust valves, the valve-operating rods operatively connecting the inlet and exhaust valves of the secondary engine with the piston of the main engine, and the secondary engine having its piston-rod operatively connected with the lever-handles of the inlet and exhaust valves of the main engine, all substantially as described.

IRA H. SPENCER.

Witnesses:
A. B. JENKINS,
H. D. SPENCER.