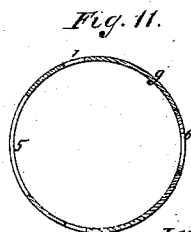
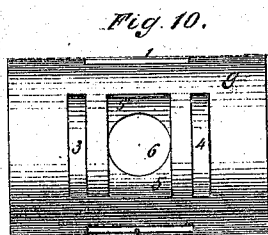
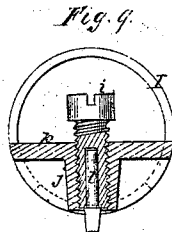
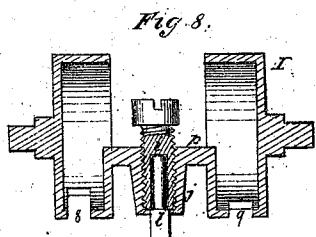
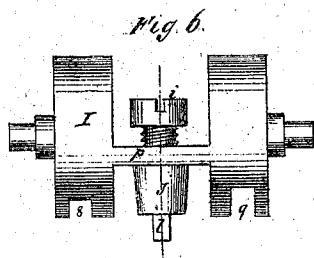
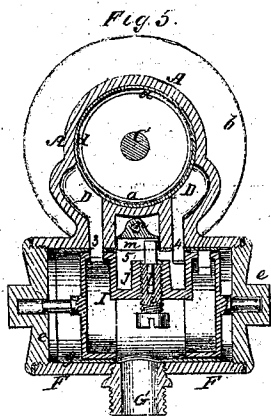


A. D. Laws,
Hydraulic Engine.

2, Sheets, Sheet 2.

No. 102,948.

Patented May 10, 1870.



Witnesses:
C. A. Mully
C. C. Pochill

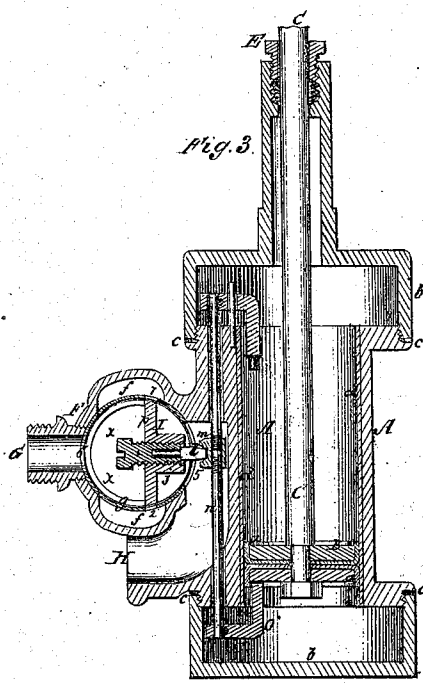
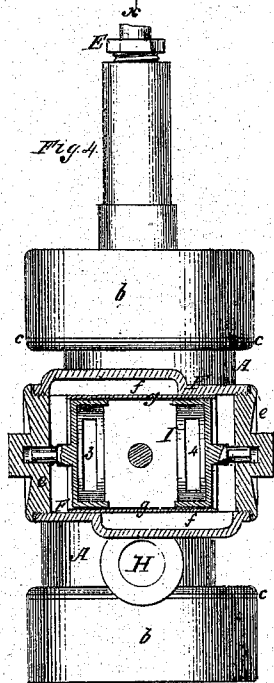
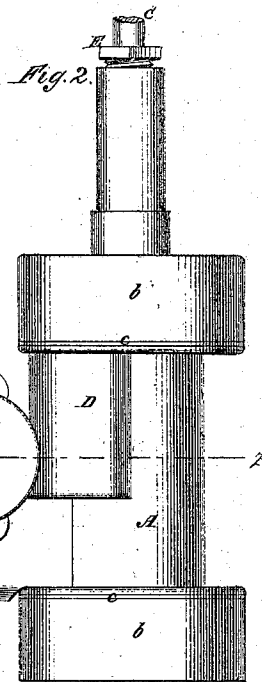
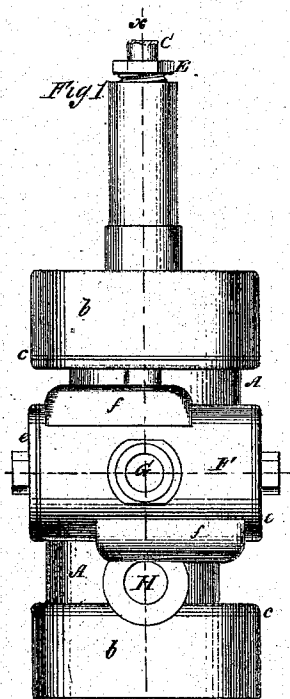
Inventor:
A. D. Laws
per atty.
J. M. Cutler

A. J. Laws,
Hydraulic Engine.

2, Sheets, Sheet, 1.

No. 102,948.

Patented, May, 10, 1870.



Witnesses:
C. C. Moulton
C. C. Beechell

Inventor:
A. J. Laws
per atty.
J. M. Curtis

UNITED STATES PATENT OFFICE.

ALBERT D. LAWS, OF BRIDGEPORT, CONNECTICUT.

IMPROVEMENT IN HYDRAULIC ENGINES.

Specification forming part of Letters Patent No. 102,948, dated May 10, 1870.

To all whom it may concern :

Be it known that I, ALBERT D. LAWS, of Bridgeport, of Fairfield county, in the State of Connecticut, have invented a new and useful Improvement in Hydraulic Engines; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

My invention relates to certain new and useful improvements in hydraulic engines.

Previous to my invention this kind of engine has been made, but their construction and mode of operation have been such as to involve too great expense to justify their adoption into general use for many purposes for which the common water-supply in cities would be sufficient as a motive-power; and they have been also found to be too complex, and liable to leakage, and to get out of order.

My invention has for its object to provide for use a simple, cheap, durable, and effective engine, which can be readily applied in all cases where the usual water-supply will furnish sufficient motive power, and one which shall not be liable to get out of working order, and will have little or no liability of any leakage; and to these ends my invention consists in the employment, in connection with the usual cylinder (with its ports) and piston, of an auxiliary cylinder and piston-valve, the latter having a reciprocatory motion induced by the water-power, and which opens and closes the ports of the main cylinder, and a rotatory motion effected by the piston of the main cylinder, and which opens and closes its own ports, as will be presently more fully described; and my invention further consists in effecting the rotatory motion of the valve-piston by means of a suitable device acting upon the periphery of the said piston, and actuated directly from the main piston, as will be hereinafter more fully explained; and my invention further consists in forming the ports and water-passages by combining, with a cylinder having simple recesses cast in its internal surface, a cylindrical jacket, as hereinafter more fully described; and my invention further consists in so constructing and combining the main and auxiliary cylinders and their valve mechanism that all the working parts shall be confined within the water-tight cylinders,

whereby I am enabled to avoid the protrusion of working parts and the use of stuffing-boxes, as will be presently more fully described; and my invention further consists in the construction and arrangement of the main and auxiliary cylinders and their water-passages and working parts, so that the exhaust from both cylinders is through the same port or passage, all as hereinafter more fully described.

To enable those skilled to make and use my invention, I will proceed to describe the construction and operation of one of my improved hydraulic engines, referring by letters to the accompanying drawings, in which—

Figure 1 is a front elevation; Fig. 2, a side elevation; Fig. 3, a vertical section at *x x*, Fig. 1; Fig. 4, a vertical section at *y y*, Fig. 2; Fig. 5, a horizontal section at *z z*, Fig. 2; Figs. 6, 7, 8, and 9, detached views of valve-piston, and Figs. 10 and 11, detail views of the lining or jacket of the auxiliary cylinders.

In the several figures the same part will be found designated by the same letter of reference.

A is the main cylinder, B its piston, and C the piston-rod.

The piston B I propose to make, as shown, with a double cup-packing at *a a*. The cylinder is made with two heads or caps, *b b*, which screw on, as represented, with suitable packings at *c*, and are so shaped as to form the proper water-spaces at each end, which communicate with the water-passages D D at each end. (See Fig. 5.)

E is a common stuffing-box, and *d* is the internal jacket or lining of the main cylinder. F is the auxiliary or valve-cylinder, which, like the main cylinder, is provided with suitable brads *e e*, water-passages *f f*, and a lining or jacket, *g*. (See Figs. 4 and 10, 11.) G is the supply-port or water-entrance passage, and H is the exhaust-pipe or exit-passage. I is the piston-valve, (which is illustrated in detail at Figs. 6, 7, 8, 9,) which is arranged within the auxiliary cylinder F, as shown, in such a manner that it can move back and forth (from end to end) in said cylinder, and can also, to a certain extent, turn on its axis, as will be presently described. *i* is a set-screw, passing through the teat portion *j* of the valve, and carrying in it a pin or stud, *l*, the head of which projects through the exhaust-port of

cylinder F, and is operated upon by a shoe, *m*, which is attached to a sliding rod, *n*, that works longitudinally in a hole or bearing made in the cylinder A, as clearly shown. This rod *n* has fastened to each of its ends a dog, *o*, which is struck by the piston-head B at each stroke, and moved along a short distance for purposes to be presently explained.

At Fig. 10 may be clearly seen the openings 1 2 in the jacket *g*, which communicate with the passages *f f*, and constitute the water-ports of the cylinder F.

The jacket *d* of the main cylinder extends the whole length of the latter, and the passages D D communicate at 3 4 (see Fig. 5) with the cylinder F and its valve. 5 is the exhaust-port of both cylinders, and communicates with the exhaust-passage or water-exit H.

In the jacket *g* there is a hole at 6 (see Figs. 3, 10, and 11) corresponding in size, and arranged at the passage G for the free passage of the water to the piston-valve I, to supply both cylinders.

The peculiar form of valve I can be best comprehended from the drawings, and, before describing the operation of the machine, it is only necessary to say that it must be remembered that the piston-valve I is divided, by a sort of partition part at *p*, and that the space on one side of this partition is always in communication with the supply-port G, and that, by the shifting of this partition portion *p*, (by the turning of the valve on its axis,) one and the other of the ports 1 2 is alternately brought into communication with said space that is always full of the supply-water; and it must also be remembered that this space, which is always a source of supply, also communicates with the ports 8 9, (see Figs. 6, 7, 8,) so that, by the motion of the valve endwise, and the bringing of these ports 8 9 alternately in line with the openings 3 4, the water is admitted through first one end, then the other of these ports, to different ends of the main cylinder.

To explain the operation, let me suppose the main cylinder to have received a supply of water at its upper end, and the piston to be just about completing its downward stroke, as illustrated at Fig. 3. Now, as there shown, the piston-head, as it completes its stroke, comes against the lower one of the dogs *o*, causing the rod *n* to slide downward, whereby the shoe *m* is made to move the lug or head of pin *l* in the same direction, and thus rotate the valve I on its axis. This rotation of the valve I opens the port 1 into communication with the supply-space, (*x*, see Fig. 3,) and permits the water to rush into passage *f*, and to that end of valve I which is nearest to one end of cylinder F, whereby the said valve is forced endwise toward the opposite end of cylinder F. (In the meanwhile the water at said opposite end of cylinder F exhausts, through port 2, the rotation of said valve that opens port 1 into communication with

the supply opening port 2 into communication with the exhaust-chamber.) This endwise motion of the valve, however, closes the port 4 leading to the upper end of main cylinder, and opens the exhaust of that end, and opens communication between port 3 (leading to the lower end of main cylinder) and the supply, so that the water now rushes in below the piston and reverses or drives it upward.

As the piston reaches the upper end of main cylinder it strikes the other dog, *o*, and a reverse rotatory motion is imparted (through the medium of rod *n*, shoe *m*, and pin *l*) to the valve I, causing it to open port 2 to the supply and port 1 to the exhaust, and be moved back endwise to its first-named position, whereby the ports leading to the main cylinder are opened to the supply and exhaust in such manner as to induce to the descent of the piston, and so on the engine keeps in motion.

The arrangement of the ports and valve, and the amount of motion, are, of course, regulated so as to permit sufficient room for the free play of the piston-valve in the cylinder F, and the reversal of its motions, it will be seen, will be so rapid that there will not be much slamming of the valve.

It will be understood that, by the employment of valve I, arranged to operate as described, the whole operation of the engine is made automatic, while at same time its motions are all positive, and its mechanism perfectly simple.

I have arranged the pin *l* with its cylindrical shank in a socket or hole in the screw *i*, so that, by simply partially withdrawing the screw *i*, (by inserting a screw-driver in the nozzle G,) said pin *l* will be extricated from shoe *m* and drawn within the jacket *g*, so that the valve I may be pulled out through either end of cylinder F, the cap of the latter being off.

It will be seen that the rotatory motions of the valve being effected by the application of a positive motion applied to the periphery, they are reliable, while at the same time the operating mechanism is simple, and is all confined within the machine, which is a great desideratum, since there are, in consequence, no working parts to be packed, and consequently liable to leakage.

By the employment of the jackets or cylinder-linings I am enabled to make the cylinders simpler and cheaper, since, in lieu of coring out all the passages and ports, I simply cast the cylinders with depressions on their inner faces, which I cover over with the sheet-metal jackets, having cut in them the proper ports or openings.

It will be seen that the passages and ports are so arranged that both cylinders exhaust at 5 through the same opening.

Having fully described the construction and operation of my improved engine, so that one skilled in the art can make and use it, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination, with the main engine, of an auxiliary engine, (for opening and closing the ports of the main engine,) constructed and operating substantially in the manner set forth.

2. A piston-valve, in combination with the main engine, when moved axially by an internally-arranged mechanism operating directly on the valve, substantially as described.

3. A cylinder having its ports formed by making recesses in the interior thereof, and combining therewith a cylindrical jacket or lining, substantially as hereinbefore set forth.

4. The combination of a main and auxiliary engine, when all the valve and other working mechanism is confined within the cylinders, substantially as and for the purposes set forth.

5. The arrangement, substantially as shown, of the ports, so that both cylinders exhaust through the same port, as described.

In testimony whereof I have hereunto set my hand and seal this 1st day of March, 1870.

A. D. LAWS. [L. s.]

Witnesses:

JAMES C. COOKE,
ISRAEL M. BULLOCK.