(No Model.)

2 Sheets—Sheet 1.

P. MURRAY, Jr.

HYDRAULIC MOTOR.

No. 348,136. Patented Aug. 24, 1886.

Fig. 1.

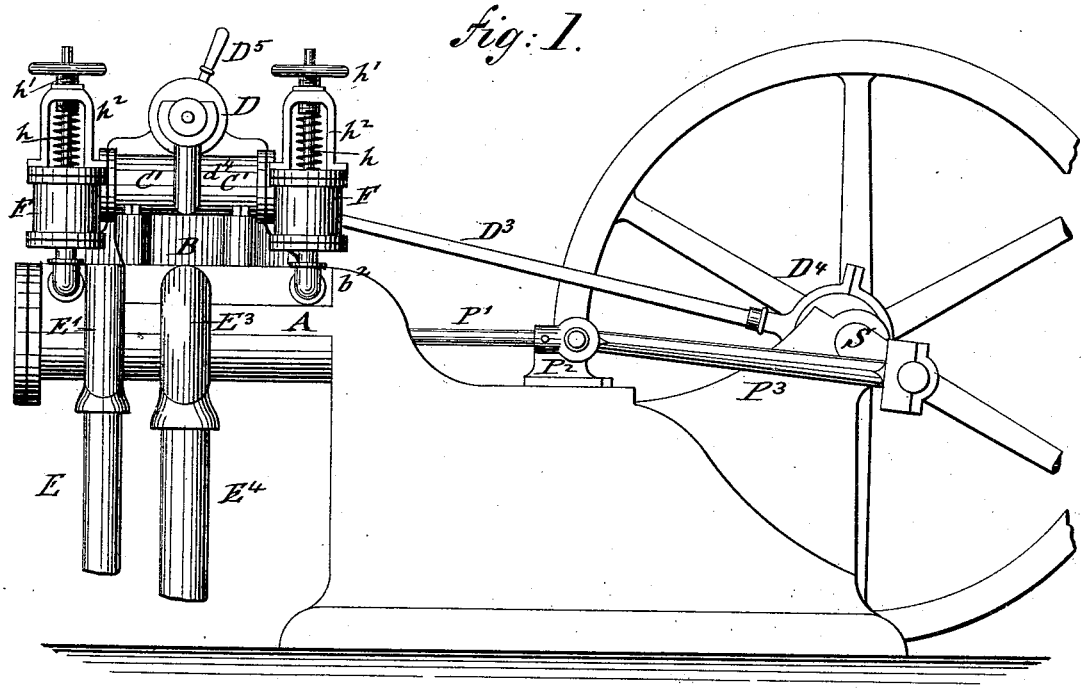
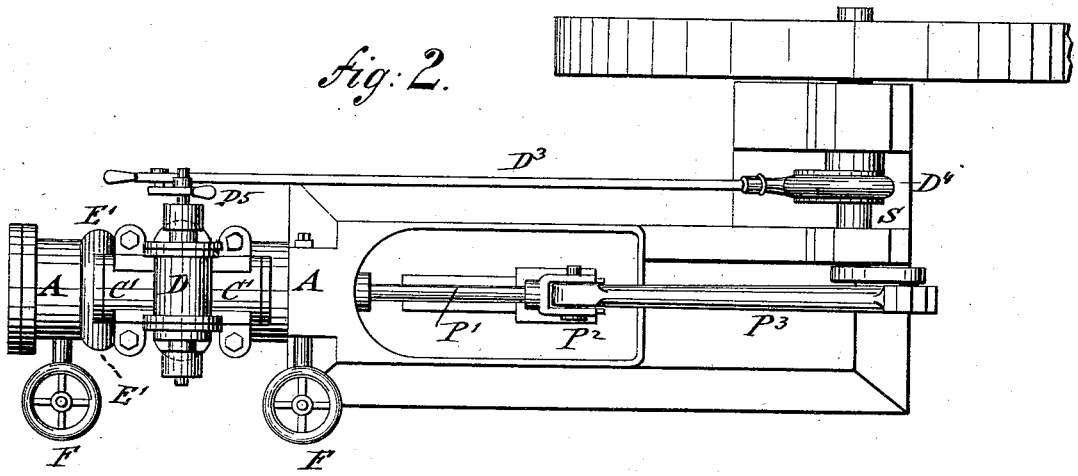


Fig. 2.



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(No Model.)

2 Sheets—Sheet 2.

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No. 348,136. Patented Aug. 24, 1886.

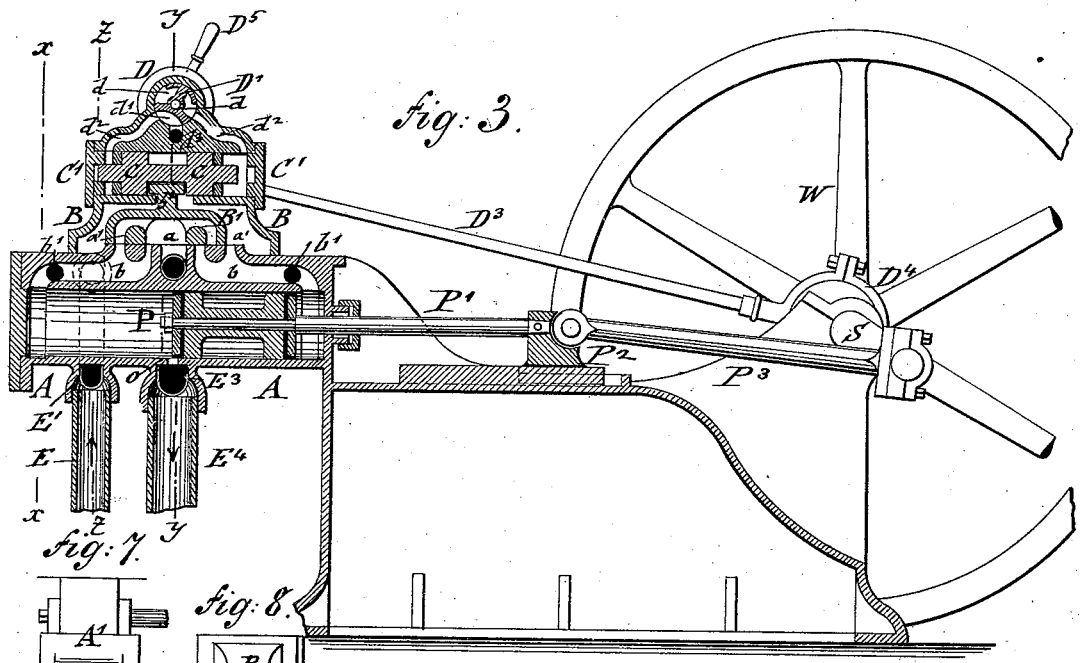

Fig. 3.

Fig. 7.

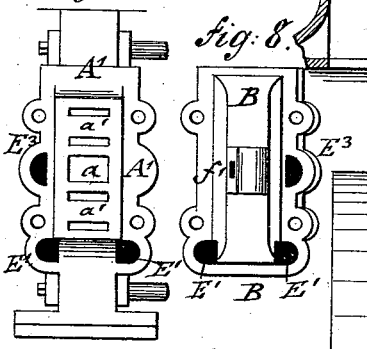

Fig. 8.

Fig. 4.

Fig. 6.

Fig. 5.

Fig. 10.

Fig. 9.

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UNITED STATES PATENT OFFICE.

PETER MURRAY, JR., OF NEWARK, NEW JERSEY, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE BACKUS MANUFACTURING COMPANY.

HYDRAULIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 348,136, dated August 24, 1886.

Application filed November 30, 1885. Serial No. 184,233. (No model.)

To all whom it may concern:

Be it known that I, PETER MURRAY, Jr., of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Hydraulic Motors, of which the following is a specification.

This invention relates to an improved hydraulic motor of that class in which a reciprocating piston is acted upon by the water at each end of the stroke; and the invention consists of the combination of a main cylinder having water inlet and outlet ports, a reciprocating main piston, a reciprocating slide-valve that is guided in a valve-chest on the main cylinder, a reciprocating piston located in a casing above the slide-valve and actuated by the same, and an oscillating valve that is operated by an eccentric on the driving-shaft, and connected by channels with the guide-casing of the piston, so as to operate the valve-actuating piston. The water is supplied by supply-channels to the chest of the slide-valve and the casing of the oscillating valve, from which it is supplied by channels to either end of the valve-piston and to an outlet-channel communicating with the exhaust-channel of the chest of the slide-valve. The inlet-channels of the main cylinder are connected with storage-cylinders, having spring-actuated pistons, by which, at the beginning of each stroke of the main piston, power is stored up, the same being exerted near the end of the stroke when the main piston passes over a relief-port at the central part of the main cylinder, said port communicating with the main outlet-channel, as will more fully appear hereinafter.

In the accompanying drawings, Figure 1 represents a side elevation of my improved hydraulic motor. Fig. 2 is a plan. Fig. 3 is vertical longitudinal section of the same. Figs. 4, 5, and 6 are vertical transverse sections, respectively, on lines *x x*, *y y*, and *z z*, Fig. 3. Fig. 7 is a top view of the face of the main cylinder. Figs. 8 and 9 are bottom views, respectively, of the chest of the slide-valve and of the slide-valve itself; and Fig. 10 is an inside view of the head of the casing of the oscillating valve, showing the supply-ports of the same.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the main cylinder, which is supported on a suitable bed-plate and provided at its upper part with a face, A′, having a central outlet-port, *a*, and two inlet-ports, *a′*, at each side of said outlet-port *a*, as shown in Fig. 7. The inlet-ports *a′* communicate by channels *b b* with opposite ends of the main cylinder, as shown in Fig. 3.

To the top of the main cylinder A is screwed a valve-chest, B, within which is arranged a slide-valve, B′, that is provided with three ports and with a T-shaped shank, $b^{\times}$. The shank $b^{\times}$ passes through a slot at the top of the chest B and engages a double valve-piston, C, which is guided in a cylindrical chest, C′, supported on the top of the valve-chest B. The faces of the double valve-piston C are provided with suitable packing, so as to prevent the water from passing from the ends of the casing C′ to the valve-chest B.

On the top of and transversely to the cylindrical chest C′ is arranged a chest, D, of cylindrical shape, within which is arranged an oscillating valve, D′, the shaft of which is connected by a crank-rod, D^2, and rod D^3 to an eccentric, D^4, on the driving crank-shaft S.

To the shaft of the oscillating valve D′ is applied a handle, D^5, by which the starting of the motor is facilitated. The oscillating valve D′ is provided with two inlet-ports, *d*, and an intermediate outlet-port, *d′*, which communicate alternately with channels d^2 d^2, leading to the casing of the valve-piston C, and with an outlet-channel d^3, as shown in Fig. 3. Water is supplied to the oscillating valve D′ and valve-piston C by supply-channels *f f* in the head D^6 of the valve-chest D.

The water for driving the motor is supplied by an inlet-pipe, E, and an annular channel, E′, which extends around the cylinder A and communicates at both sides of the same with the valve-chest B′, as shown in Fig. 3. From the valve-chest B′ extends in the casing C′ a supply-channel, *f′*, which communicates with the channels *f* in the head D^6 of the valve-chest D, as shown in Figs. 4 and 10. The channels *f f* supply alternately water to the inlet-ports *d d* of the oscillating valve D′, the channels d^2 d^2, and the opposite ends of the valve-piston C, so as to impart reciprocating motion to the same. The water is exhausted

alternately from the casing C′ through the channels d^2, port d', and outlet-port d^3 to an outlet-channel, d^4, that extends sidewise along the casing C′ and valve-chest B to an exhaust-channel, E^3, that extends around the main cylinder A and communicates with the exhaust-pipe E^4, as shown in Fig. 5. The exhaust-channel E^3 communicates also with the outlet-port *a* of the cylinder A, so as to conduct off the water from the latter by the action of the slide-valve B′. The slide-valve B′ is so arranged that when the water is supplied to the cylinder at one end the cylinder will be exhausted at the opposite end, as shown clearly in Fig. 3, the outlet-port being twice as large as one of the inlet-ports, and being placed by the slide-valve B′ in communication with two inlet-ports, *a′ a′*, so that the water to be exhausted passes off very quickly and without obstructing the motion of the main piston P. The piston-rod P′ is connected to a cross-head, P^2, and the latter by a crank-rod, P^3, to the driving-shaft S, as customary in reciprocating motors. The inlet-channels *b b* of the main cylinder A are connected, by openings *b′* and lateral tubes b^2, with vertical storage-cylinders F. Inside of the storage-cylinders F are arranged pistons, the piston-rods of which are cushioned by spiral springs *h*, interposed between the heads of the cylinders F and screw-nuts *h′*, supported on yokes h^2 of the cylinders F, as shown in Fig. 1. In place of the springs the pistons may be cushioned simply by the air in the upper part of the storage cylinders. The storage-cylinders F are alternately acted upon by the water supplied through the inlet-channels *b b* of the valve-chest B, to either end of the cylinder A, so that the same pressure which is exerted on the main piston is exerted on the pistons in the storage-cylinders and so as to raise the pistons of the same and store up a certain amount of power, which will be given out and exerted on the main piston, so as to move the same over a central relief-port, *o*, at the bottom of the main cylinder, which port communicates with the exhaust-channel E^3, as shown in Figs. 3 and 5. The pressure of the water is exerted simultaneously on the main piston and one of the storage-pistons. As the main piston is moved forward the oscillating valve will be shifted so as to change the course of the water-supply to the valve-piston, and shift the same and the slide-valve, reducing thereby the pressure of the water on the main piston. When the pressure on the main cylinder has been reduced below the pressure in the storage-cylinders, the latter will then begin to give out their accumulated power, so as to complete the stroke of the main piston and move the same over the relief-port, so that some of the water in the cylinder is permitted to pass into the exhaust-channel. The main piston is thereby free to commence its return-stroke without being blocked by the water in the main cylinder. Without this relief-port there would be a back-pressure of the water on the piston. A fly-wheel, W, on the driving-shaft S, carries the crank of the same over its dead-points and starts the main piston on its return-stroke. The oscillating valve is shifted by the action of the eccentric and connecting rod, so that water is supplied to the opposite end of the valve-piston and the same shifted together with the slide-valve. The water is thereby supplied to the opposite end of the cylinder, and the motion of the main piston is reversed.

In reciprocating water-motors heretofore in use the flow of water is arrested when the slide-valve is shifted for changing the motion of the main piston. This causes the pounding of the water and causes the motor to work with considerable noise. In my motor this is obviated, as the water is supplied in a continuous flow, both to the slide-valve and to the oscillating valve that controls the motion of the valve-piston and slide-valve. Before the main piston has completed its stroke the oscillating valve is shifted, and thereby the motion of the valve-piston and slide-valve reversed. The slide-valve changes the flow of water from one end of the cylinder to the other before the main piston has completed its stroke.

By the arrangement of the storage-cylinders and outlet-ports having twice the area of the inlet-port, the full power of the water is exerted on the main piston throughout its stroke without any back-pressure on the same, while the reversing of the motion of the main piston is facilitated by the relief-port, so that the motor performs its work in a regular, even, and noiseless manner.

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

1. The combination of a main cylinder having inlet and outlet ports, a valve-chest, a reciprocating slide-valve, a reciprocating valve-piston connected to the slide-valve, an oscillating valve operated by an eccentric on the driving-shaft, a chest inclosing said oscillating valve and having a head with two channels, a supply-channel connecting the chest of the slide-valve with the head of the oscillating valve, supply and exhaust channels connecting the oscillating valve with the valve-piston, and an exhaust-channel connecting the exhaust-port of the valve-piston with the outlet-pipe, substantially as set forth.

2. The combination of a main cylinder having inlet-channels and a central relief-port, a reciprocating main piston, a valve-chest, an inlet-pipe connected to the valve-chest, a reciprocating slide-valve, an outlet-pipe communicating with the exhaust-port and relief-port of the cylinder, and power-storage cylinders and pistons connected to the inlet-channels of the cylinder, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

Witnesses: PETER MURRAY, JR.
SIDNEY MANN.
MARTIN PETRY.