(No Model.) 3 Sheets—Sheet 1.

C. H. ATKINS.

DIRECT ACTING PUMPING ENGINE.

No. 456,131. Patented July 21, 1891.

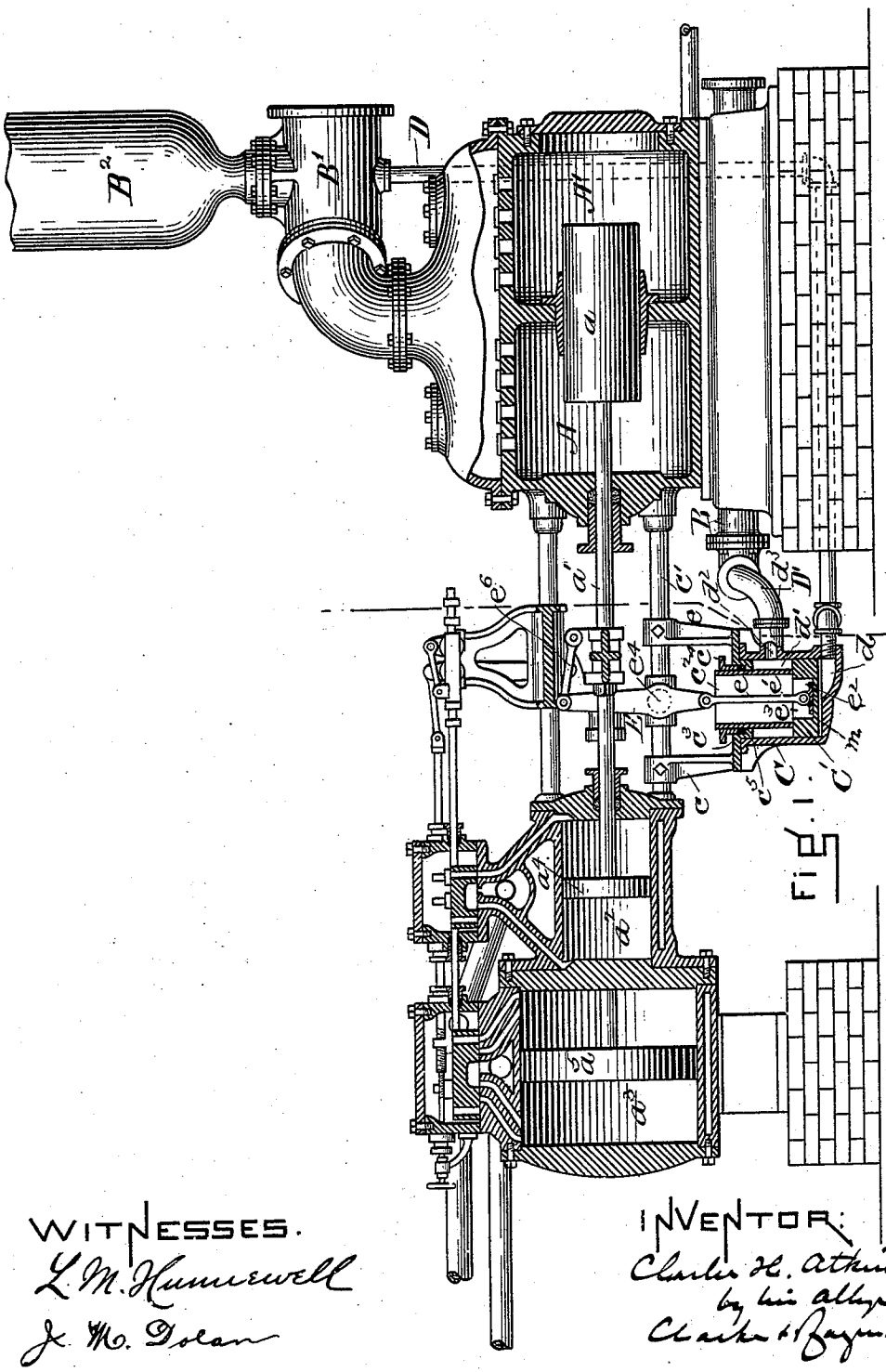


Fig. 1.

WITNESSES.
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INVENTOR:
Charles H. Atkins
by his attys
Clarke & Raymond

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

C. H. ATKINS.

DIRECT ACTING PUMPING ENGINE.

No. 456,131. Patented July 21, 1891.

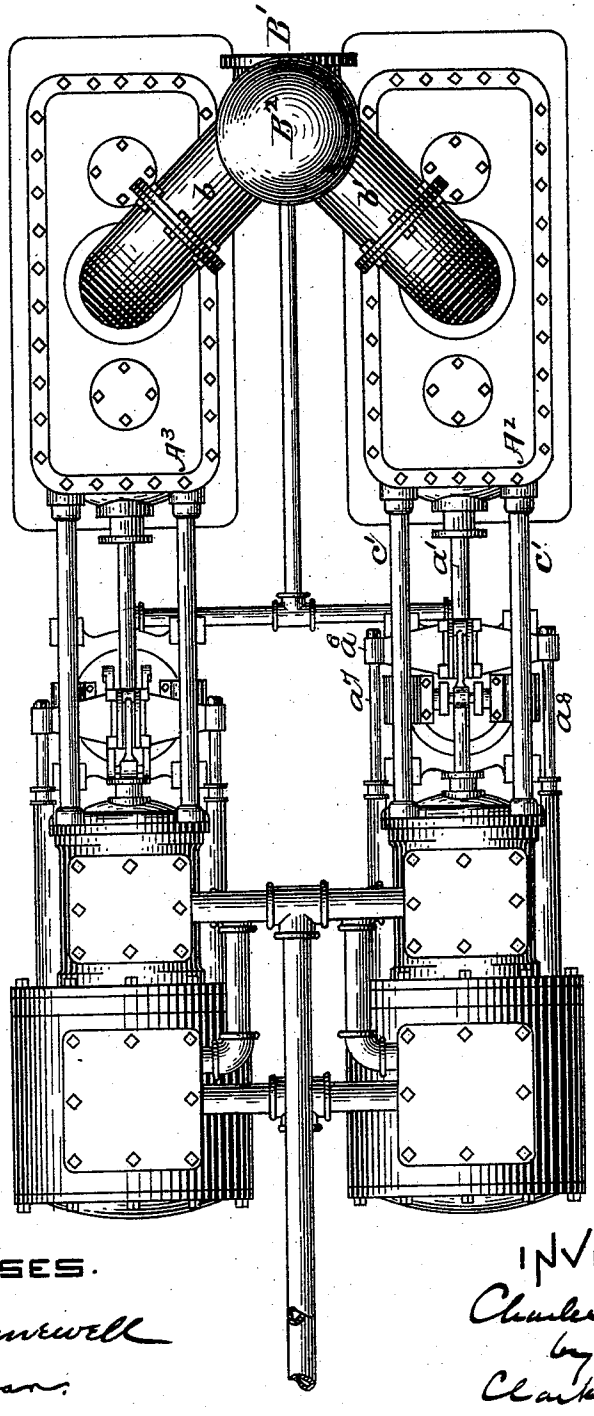


FIG. 2.

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(No Model.) 3 Sheets—Sheet 3.

C. H. ATKINS.

DIRECT ACTING PUMPING ENGINE.

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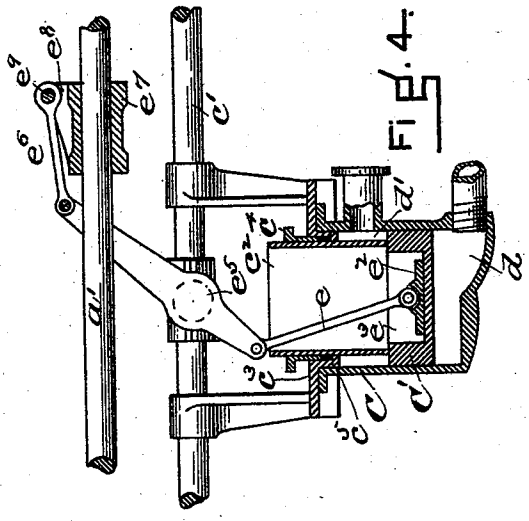


Fig. 4.

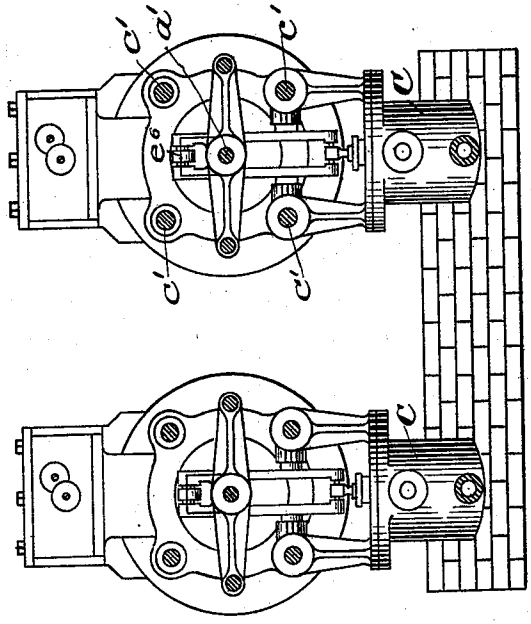


Fig. 5.

WITNESSES.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES H. ATKINS, OF PALMER, MASSACHUSETTS.

DIRECT-ACTING PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 456,131, dated July 21, 1891.

Application filed October 6, 1890. Serial No. 367,153. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. ATKINS, of Palmer, in the county of Hampden and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Direct-Acting Pumping-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

In direct-acting pumping-engines it is desirable to equalize as much as possible the pressure acting upon the pistons of the engine to force them through their stroke. Various means have before been used for accomplishing this purpose. The most common is the balance-wheel.

My invention comprises a cylinder located preferably below the main piston-rod of the pumping-engine in a vertical plane with it, but with its center at a right angle thereto, a piston contained in said cylinder connected with the piston-rod by means of a link attached to the piston and to an arm of a lever, said lever pivoted to a stationary support, and another link connecting the other arm of the lever with the main piston of the pumping-engine. The cylinder is suspended from cross supports or bars on the frame of the pumping-engine, and is connected by suitable connecting-pipes with the water-main, through which the water is forced from the pumping-cylinder of the engine, or with the air-chamber of the pump and with the suction-pipe, through which water is drawn by the pumping-cylinder of the engine. The equalizing or auxiliary cylinder piston and lever are so located in relation to the main piston of the pumping-engine that at the beginning of the stroke of the main piston of the engine the equalizing-piston is at the upper end of its throw from the bottom of the cylinder, the cylinder-space between the piston and the head being filled with water from the water-main. The equalizing-piston is then moved downward in its cylinder, expelling the water from the cylinder into the water-main until the main piston has reached the center of its stroke, when the equalizing-piston reaches the end of its downward stroke, the water having been expelled from the portion of the cylinder-chamber below the piston into the water-main. When the piston is in this position, the piston, link, and intermediate lever are vertical, and during this downward movement of the equalizing-piston the main pistons of the pumping-engine have been transmitting power to said equalizing-piston through the medium of the intermediate lever and connections. Upon the main pistons passing the center of their stroke the equalizing-piston is forced or moved upward by the water-pressure from the water-main and applies power to the main piston-rod. This upward movement continues until the end of the stroke of the main piston-rod and assists during the last half of the stroke of the main piston-rod the action of the prime motor force thereon. The connection of the cylinder-space above the equalizing-piston with the suction side of the pumping-cylinder enables additional power to be exerted upon the equalizing-piston.

In the drawings the invention is applied to a duplex direct-acting pumping-engine.

Figure 1 is a view, principally in vertical central section, of one side of the duplex engine. Fig. 2 is a view in plan thereof. Fig. 3 is a view in section upon the dotted line of Fig. 1 and upon parts to the left of said line. Fig. 4 is a view, principally in vertical section enlarged, of the equalizing-cylinder, its piston, and connections.

Referring to the drawings, A is one plunger-chamber, and A′ the other plunger-chamber. a is the plunger; a', the piston-rod; a^2, the high-pressure cylinder; a^3, the low-pressure cylinder, and a^4 the piston in the high-pressure cylinder, which is at the end of the piston-rod a'.

a^5 is the piston of the low-pressure cylinder a^3, which is connected with the piston-rod a' by the yoke a^6 and piston-rods a^7 a^8. (See Fig. 2.)

The plunger-chambers A A′ have suitable inlet and outlet ports, and are connected in the usual way with the suction or supply pipe B and the main B′. The main B′ is common to the two pumps A^2 A^3, (see Fig. 2,) and the main is connected with the plunger-chambers of each pump by the branches b b'. (See Fig. 2.)

B^2 is the air-chamber, common to both pumping-engines. The steam-cylinders a^2 a^3

have suitable induction and eduction ports and controlling-valves, the ports and valves being in construction and operation like those common to duplex pumping-engines. Between the steam-cylinder and the plunger-chambers of each pump there is a vertical equalizing or auxiliary cylinder C, closed at its bottom, except as hereinafter stated, and open at its top. This cylinder C is suspended by means of hangers *c* from the cross-bracing or tie-rods *c'*, (see Figs. 1 and 2,) the rods being supported and connected at each end with the shell of the plunger-chamber on the one side and the shell of the steam-cylinder on the other. There is of course a separate equalizing-cylinder for each pump. In this cylinder is a piston C'. This piston has the solid bottom *m* of the full bore of the cylinder C, and also the annular section *c'*, which is of less bore than the solid bottom, and extends upward therefrom and is open at its top c^2. This section *c'* is centered in the cylinder C by a ring c^3, which is fastened to the upper end of the cylinder, and this ring also supports the stuffing-box c^4. The ring has an extension c^5 into the cylinder-chamber. The equalizing-cylinder is connected with the water-main B' or with the air-chamber B^2 by the pipe D, the passage in said pipe opening into the bottom of the cylinder through a port *d* in the bottom of the cylinder and of course below the solid bottom of the piston. The cylinder is also connected with the suction-pipe B by the pipe D', (see Fig. 1,) which is connected with a chamber *d'* above the solid bottom by means of the passage d^2 in the coupling or extension d^3.

The piston C' is connected with the lever E by means of the link *e*, which is pivoted at its lower end *e'* to a block e^2, set or fastened in a recess e^3 of the solid bottom *c* of the piston. The lever E is pivoted at e^4 to a cross-shaft or pivot e^5, (see Fig. 4,) carried or supported by boxes upon the horizontal rods *c'*, and the lever is connected at its upper end, by means of the link e^6, with a block e^7, made fast to the piston-rod *a'* and having lugs e^8, which support a pin e^9, passing through the end of the link e^6. The fulcrum e^4 of the lever E may be varied to change the length of the arms of the lever in relation to each other as may be desired. As shown in the drawings, the short arm of the lever is below the fulcrum-point and the long arm above it. The fulcrum may be changed, however, to make both arms equal or to bring the long arm below and the short arm above the fulcrum-point. At the beginning of the stroke of the pistons a^4 a^5 and piston-rod *a'* the equalizing-piston C' is in its highest position in the cylinder C, and the space in the cylinder C below the bottom of the piston is filled with water under pressure from the main B' or with air under pressure from the air-chamber B^2. The chamber *d'* above the solid bottom of the piston is of its smallest size and is filled with water from the suction-pipe B. During the first half of the stroke of the pistons and main piston-rod the equalizing-piston C' is moved downward in the cylinder C to the position represented in Fig. 1 by means of the power exerted thereon through the medium of the lever E, the lever being moved from an inclined position to a vertical position, as represented in Fig. 1. This causes the water or air in the section of the cylinder C below the piston C' to be expelled through the pipe D into the water-main or air-chamber and causes water to be drawn from the suction-pipe B through the pipe D' into the chamber *d'* of the cylinder C, and this of course absorbs a portion of the first impulse of the steam upon the pistons a^4 a^5. By the continued movement of the steam-pistons and the main piston-rod *a'* the lever E moves from its vertical position and the equalizing-piston C' now begins to act through the lever E upon the piston-rod *a'* to assist it and the steam-pistons through the remainder of their stroke, the water or air under pressure from the main B' entering the cylinder-chamber below the bottom of the piston C' and forcing it upward. At the same time the water is drawn from the chamber *d'* through the suction-pipe D' by means of the suction of the pump. This causes auxiliary power to be received by the lever E and applied to the piston-rod *a'* during the last half of its stroke. The position of the piston C' and lever is then as represented in Fig. 4—that is, the piston is again in its highest position and the chamber beneath it filled with water or air. Upon the reverse movement of the steam-pistons and piston-rod *a'* the equalizing-piston and lever operate and are operated as above specified—that is, during the first half of the reverse movement of the piston-rod the water is expelled from the lower part of the piston-chamber C by the movement of the piston C' downward therein, and during the last half of the stroke power is connected with the piston-rod *a'* by the water-pressure from the main acting upon the piston C' and lever.

While I have shown the equalizing-cylinder as connected with the suction side of the pump as well as with the main, I would not be understood as limiting the invention to a construction in which this connection is used, as this connection may be dispensed with.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. The combination, in a direct-acting pumping-engine, of the steam-pistons, main piston-rod and plunger of the engine with a cylinder suspended from the engine-frame, the said cylinder being at right angles to the main piston-rod *a'*, a piston in said cylinder connected with the main piston-rod by a lever and links, said lever and links, a chamber in the cylinder below the piston connected with the water-main or air-chamber of the pump, and a chamber above the said piston con-

nected with the suction side of the pump, all as and for the purposes described.

2. The combination, in a direct-acting pumping-engine, of the main piston-rod a', the cross-rods c', the cylinder C, its hangers c, the pipe D, connecting the bottom of the cylinder-chamber with the water-main, the pipe D′, connecting the cylinder-chamber above its piston with the suction, the piston C′, having a solid bottom m, connected by means of a link with the lever E, and the open tubular extension c', of smaller bore than the main portion C′ of the piston, the annular ring c^3 and its stuffing-box c^4, and the lever E, connected at its upper end with the main piston-rod a', substantially as described.

CHARLES H. ATKINS.

Witnesses:
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J. M. DOLAN.