(No Model.) 2 Sheets—Sheet 1.

S. LAWSON.

GAS ENGINE.

No. 306,933. Patented Oct. 21, 1884.

Fig. 2.

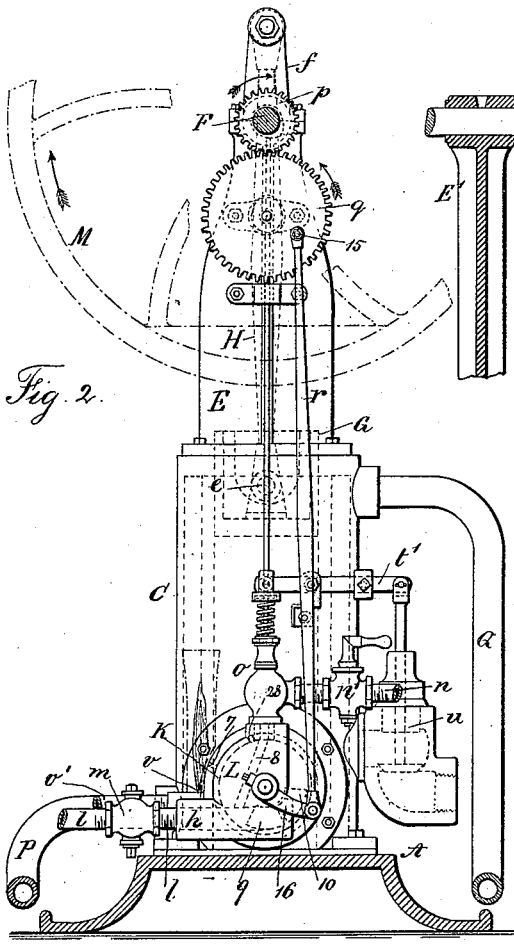


Fig. 1.

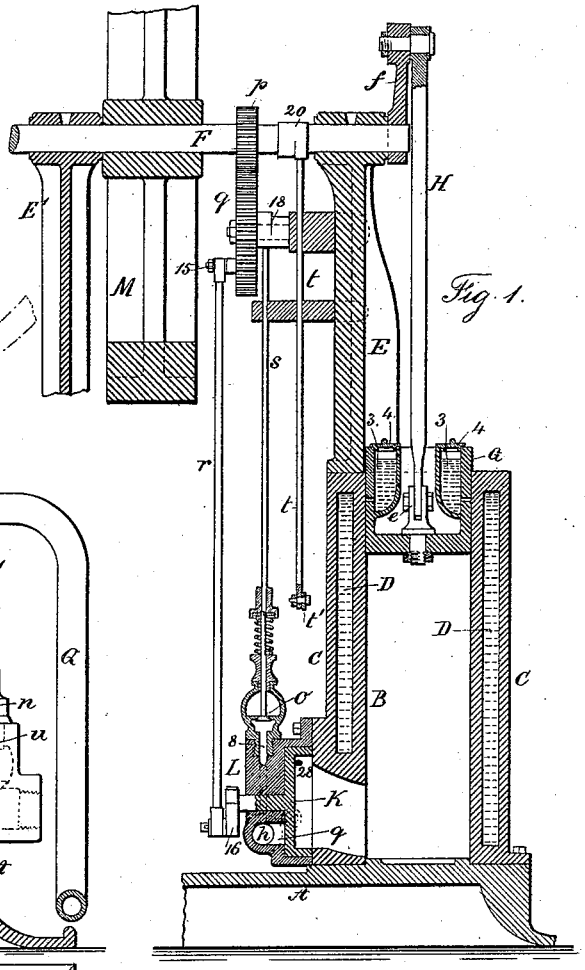
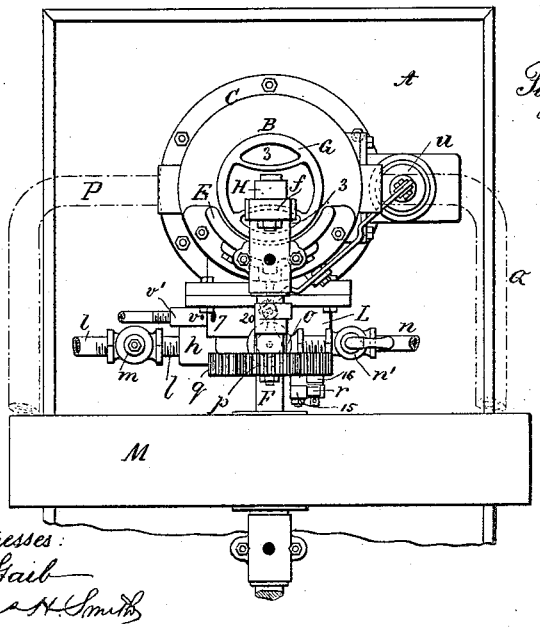


Fig. 3.



Witnesses:
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Chas. H. Smith

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per Samuel W. Serrell
Atty

(No Model.) 2 Sheets—Sheet 2.

S. LAWSON.

GAS ENGINE.

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Fig. 4.

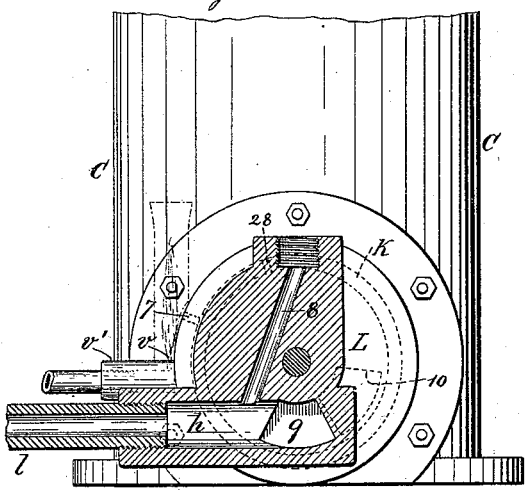


Fig. 6.

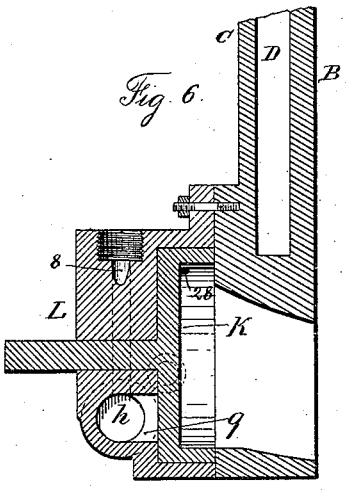


Fig. 5.

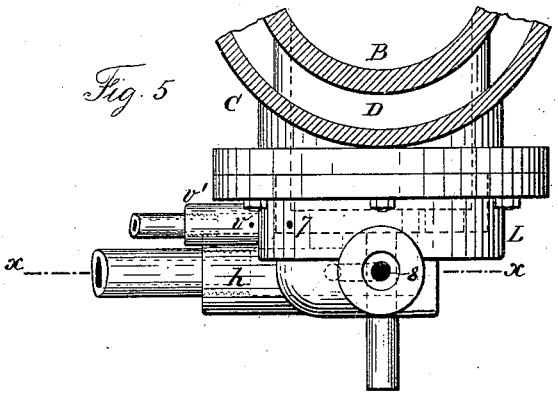


Fig. 7.

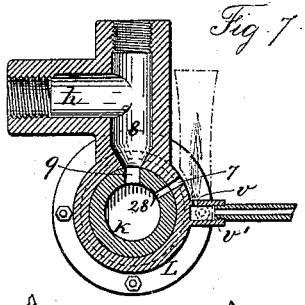


Fig. 9.

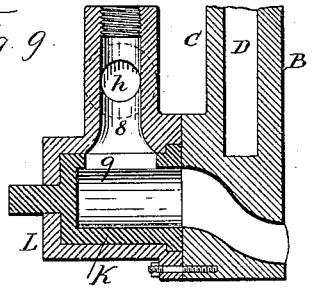
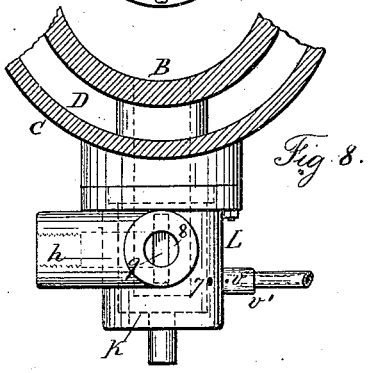


Fig. 8.



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Inventor

Samuel Lawson

per Samuel W. Serrell atty

UNITED STATES PATENT OFFICE.

SAMUEL LAWSON, OF FITCHBURG, MASSACHUSETTS, ASSIGNOR TO HIMSELF, AND ALONZO T. WELCH, OF NEW YORK, N. Y.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 306,933, dated October 21, 1884.

Application filed March 23, 1883. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL LAWSON, of Fitchburg, in the State of Massachusetts, have invented an Improvement in Gas-Engines, of which the following is a specification.

Gas-engines have been made with a water-jacket around the cylinder, and the air and gas have been mixed together before being admitted into the cylinder.

My invention relates to the combination of devices hereinafter described, whereby the gas-engine is greatly simplified and its operation rendered very reliable, and risk of explosion or fire is prevented. In my gas-engine the air-inlet and the gas-outlet join at a valve which is opened at the time the piston commences to rise, so as to draw in both the air and gas, which latter at that moment is admitted to pass into the air-passage, so that the air and gas commingle in the proper proportions as they pass into the cylinder. The gas-valve closes, instantly the oscillating valve also closes, the piston completes its stroke, and when the air and gases have been compressed nearly to atmospheric pressure the crank turns its center, and instantly a small opening in the oscillating valve coincides with an opening in the case, and a flame is drawn in from a gas-jet burning outside the cylinder, and it ignites the gas in the cylinder, exploding the same, and giving to the piston and fly-wheel the velocity and power resulting from the explosion and expansion of the gases. At the next stroke the expended gases are expelled from the cylinder, a valve being opened for that purpose. The crank that actuates the oscillating valve and cam that operates the gas-inlet valve are rotated once for each two revolutions of the engine-shaft, and the oscillating valve receives an accelerated and retarded movement from a crank, pitman, and rock-shaft.

In the drawings, Figure 1 is a vertical section of the engine. Fig. 2 is an elevation of the same. Fig. 3 is a plan view. Fig. 4 is a section in larger size at the line *x x*. Fig. 5 is a detached plan of the valve-case. Fig. 6 is a section of the engine-valve in larger size than that shown in Fig. 2. Fig. 7 is a cross-section. Fig. 8 is a plan, and Fig. 9 is a longitudinal section, of a modification of the oscillating valve.

Upon the bed-plate A the cylinder B is bolted, and there is around this cylinder a jacket, C, leaving a water-space, D.

Above the cylinder B there is the frame E, and the main engine-shaft F is supported in journal-boxes in this frame E. There is a second frame, E′, with journal-box to support the shaft F, near its other end. This frame E′ is to be bolted at its lower end to the bed-plate A.

Within the cylinder B there is a piston or plunger, G, with a joint, *e*, to the connecting-rod H, that gives motion to the crank *f* and shaft F. The piston or plunger G will not require packing-rings if it has a smooth and true surface fitting closely the interior of the cylinder; but a packing or rings may be used.

In order to keep the plunger lubricated, I use one or two oil-cells, 3 3, cast with the plunger, and occupying the sides of the hollow interior of such plunger, there being holes through the cylindrical portion to allow the oil or lubricant to reach the surfaces that are in contact. I also provide movable covers 4 to exclude dust.

At one side of the engine there is a valve-case and a port or passage leading to the oscillating valve K within the case L. An air-inlet, *h*, is provided at one side of this case, to which a tube, *l*, is preferably connected, and it is advantageous to employ a cock, *m*, that regulates the opening through which air is drawn, in order to prevent too much air passing in. The gas, preferably ordinary gaseous hydrocarbon, is supplied by a pipe, *n*. There may be a gas-bag intervening between the main and the pipe *n*, if desired, or a chamber, so as to prevent inequality in the gas-supply when drawn suddenly into the cylinder. The cock *n′* serves to regulate the quantity of gas passing from the pipe *n*, and the valve *o* is opened automatically at the proper time to allow the gas to pass by the passage 8 to the air-pipe *h*.

At the junction of the passage 8 and air-pipe there is a port, 9, opening into the cylinder. This port is closed by the oscillating valve K, except momentarily, when the port

10 in the valve K coincides with or opens the port 9 for the air and gas to be drawn into the cylinder.

I remark that the oscillating valve K is opened simultaneously with or slightly before the gas-valve *o* is opened, so that the piston, rising, may draw in both air and gas, and the two will commingle thoroughly, and the proportion can be regulated by the cocks, and the gas-valve should close slightly before the engine-valve, so that there will be no risk of gas passing into the external atmosphere. The air-pipe *l*, extending some distance from the valves, prevents the odor of the gas escaping, because any traces of gas are constantly drawn into the cylinder. It is sometimes advantageous to have this pipe extend to the outside of the building in which the engine is situated, so that if the gas-valve should become obstructed, so as not to close, the escaping gas will not enter the building.

In order to give to the respective valves the proper movement, I make use of the gear-wheels *p* and *q*, the latter being twice the size of the former, so as to make one revolution to two of the engine-shaft.

Upon the wheel *q* there is a crank-pin, 15, and a link or rod, *r*, to the arm 16 on the shaft or axis of the oscillating valve K. The parts are constructed and proportioned so that the crank-pin 15 gives to the oscillating valve an oscillating movement of the required extent and rapidity to act in the manner hereinafter set forth. The crank-pin 15 is carried around regularly by the wheel *q;* but it gives to the valve an accelerated and retarded rocking or oscillating motion, because the arm 16 on the axis of the valve is longer than the radius of the crank, and at the extremes of the movement of the valve the crank-pin is moving at right angles to the connecting-rod. This allows the valve to be kept open the proper length of time for the air and gas to be drawn in, and for the flame-opening to be closed rapidly as soon as the flame is drawn in.

Upon the tubular arbor or hub of the wheel *q* there is a cam, 18, that acts upon the upper end of the rod or stem *s* to open the gas-valve *o*, and upon the shaft F there is a cam or toe, 20, to act upon the rod *t*, and by the lever *t'* open the exhaust-valve *u*. (See dotted lines in Fig. 2.) At *v* there is a flame that burns from a small orifice in the gas-pipe *v'*, and there should be a cock to regulate the size of the flame. I remark that a lamp might be used in place of a gas-jet. In the oscillating-valve case, and close to the middle part of the flame, there is a hole at 7, and in the oscillating valve K there is a hole, 28, that coincides with the hole 7 at the time the crank is moving upwardly, so that the flame is drawn in, and the gases are ignited to produce the explosion.

In order to start the engine, it is only necessary to light the flame at *v* and turn the gas on, then rotate the fly-wheel M in the direction indicated by the arrow, and after one or two revolutions the gas and air act in the cylinder and propel the engine by the explosive force, the parts acting in the following order: As the plunger descends, the exhaust-valve *u* is opened by the cam 20, rod *t*, and lever *t'*, and the gases or air are expelled from the cylinder B. As the crank passes its lowest point, the oscillating valve commences to open, and then the gas-valve opens and the atmosphere and commingled gases are drawn into the cylinder as the plunger rises by the momentum of the fly-wheel. The gas-valve is closed, and then the oscillating valve is closed, cutting off the further inlet of air and gas at whatever point is required for the most efficient action. This may be regulated by adjusting the length of the arm 16 and the position of the same to the port of the oscillating valve. As the piston descends, the air and gases are compressed and become about the same pressure as that of the atmosphere, and as the crank passes its lowest point the hole 28 in the oscillating valve comes to a position to coincide with the hole 7 in the case, and the flame is drawn in by the suction action as the plunger rises and ignites the charge, and the explosion serves to propel the piston and give to the fly-wheel the additional momentum to cause it to drive the pump or other mechanism. As the plunger comes down the second time, the gases remaining in the cylinder are expelled, when the exhaust-valve is opened and the before-described operations are repeated.

In Figs. 7, 8, 9 the oscillating valve is shown as a hollow cylinder, with the inlet-port in the cylindrical portion instead of being in the disk.

The operations of the parts are the same as before described, and the mechanism for actuating the valve is unaltered.

The pump that is driven by this gas-engine is of any desired character. It is connected by a crank with the shaft F, and at P there is a pipe that admits water into the jacket C around the cylinder B, and at Q there is a pipe leading to the pump, so that the water in its passage to the pump passes through this jacket; hence said cylinder is always kept cool, and the explosion of the gases does not heat either cylinder or piston; hence the lubricating material is not consumed, and there is no smell from the heat acting on the oil. The water may pass through the pump, and then through the jacket, or else pass through the jacket before going to the pump.

In consequence of using a cylindrical or disk valve that is oscillated, I am able to obtain the necessary rapidity of motion at the periphery for opening and closing the passage for the flame, and at the same time there is very little friction or wear, because the valve turns upon its seat with but little pressure, except when the explosion occurs.

In cases where the air and gas are compressed so as to be at a greater pressure than the atmosphere the escape-valve should be opened only every other stroke, when the cyl-

inder is to be freed from the products of combustion.

I do not claim a gas-engine in which there is a rotary valve within the engine-cylinder revolving once to two strokes of the piston, as this is rotated at a nearly uniform speed and is exposed to unnecessary wear. By my improvement the valve is made to oscillate with an accelerated and retarded movement, which opens and closes the ports rapidly, and the valve is moving slowly when exposed to pressure. In instances where an oscillating valve has been used the same has been kept to its seat by spring-pressure, and hence there was loss of power and wear by unnecessary friction.

I am aware that in gas-engines the cylinder has been surrounded by a jacket, and water has been caused to circulate through the same from a reservoir.

In air-engines one of the cylinders has been surrounded by a water-jacket for the purpose of keeping one cylinder cooler than the other, the water being made to circulate by a pump.

In my improvement the water is compelled to travel around the cylinder by the action of the pump, and keeps the whole cylinder cool, to prevent injury to the cylinder or piston from the gas-flame within the cylinder, and the vertical cylinder is made with the lateral inlet, where the valve-case and valve are applied, the parts being cast so that circulating water partially surrounds the walls of this lateral inlet, so that the heat of the cylinder is conducted but little to the valve or valve-case.

I claim as my invention—

1. A vertical cylinder having an opening at the base, and the plunger within such cylinder, in combination with a valve-case attached to the cylinder at such opening, a circular valve within such case, a valve-stem and mechanism for giving to such valve an oscillating motion, air and gas supply pipes, a valve for the gas-pipe, and a passage-way in which the air and gas commingle as they pass to the oscillating valve and into the cylinder, substantially as set forth.

2. In a gas-engine, the combination, with the gas-supply valve, of an air-inlet pipe, into which the gas is admitted, and an oscillating valve within a case at one side of the cylinder, and upon a horizontal stem at the junction of the air and gas pipes, and mechanism, substantially as specified, for opening the oscillating valve slightly before the gas-valve is opened, substantially as set forth.

3. In a gas-engine, the combination, with the air-inlet pipe and the gas-inlet valve, of a valve-case, and an oscillating valve within the case at one side of the cylinder, a port for the passage of the commingling air and gas, and an opening for the admission of flame, and mechanism for oscillating said valve with an accelerated and retarded motion, the passages in the valve being arranged to allow the flame to be drawn into the cylinder after the supply of air and gas has been shut off, substantially as set forth.

4. The combination, in a gas-engine, of the vertical cylinder, plunger, connecting-rod, crank and shaft with the gear-wheels *p* and *q*, gas supply and valve *o*, valve K, valve-case at one side of the cylinder, air-supply pipe, igniting-burner and exhaust-valve, and mechanism for communicating to the valve K an accelerated and retarded oscillating motion, substantially as set forth.

5. The plunger in the vertical cylinder of a gas-engine, having an oil-receptacle cast within the plunger, and a hole opening through the side of the plunger, for the purpose and as set forth.

6. The cylinder for a gas-engine, having a water-jacket around it and a lateral opening at one side, in combination with a valve-case fastened to the cylinder, a hollow cylindrical valve within the case, and provided with ports for the mixture of air and gas to pass to the cylinder, and for the flame to be drawn in, and a shaft to the valve passing through the case, whereby the valve is pressed upon its seat by the pressure of the gases when they explode, but is free to turn with but little friction at other times, as set forth.

Signed by me this 21st day of March, A. D. 1883.

SAMUEL LAWSON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.