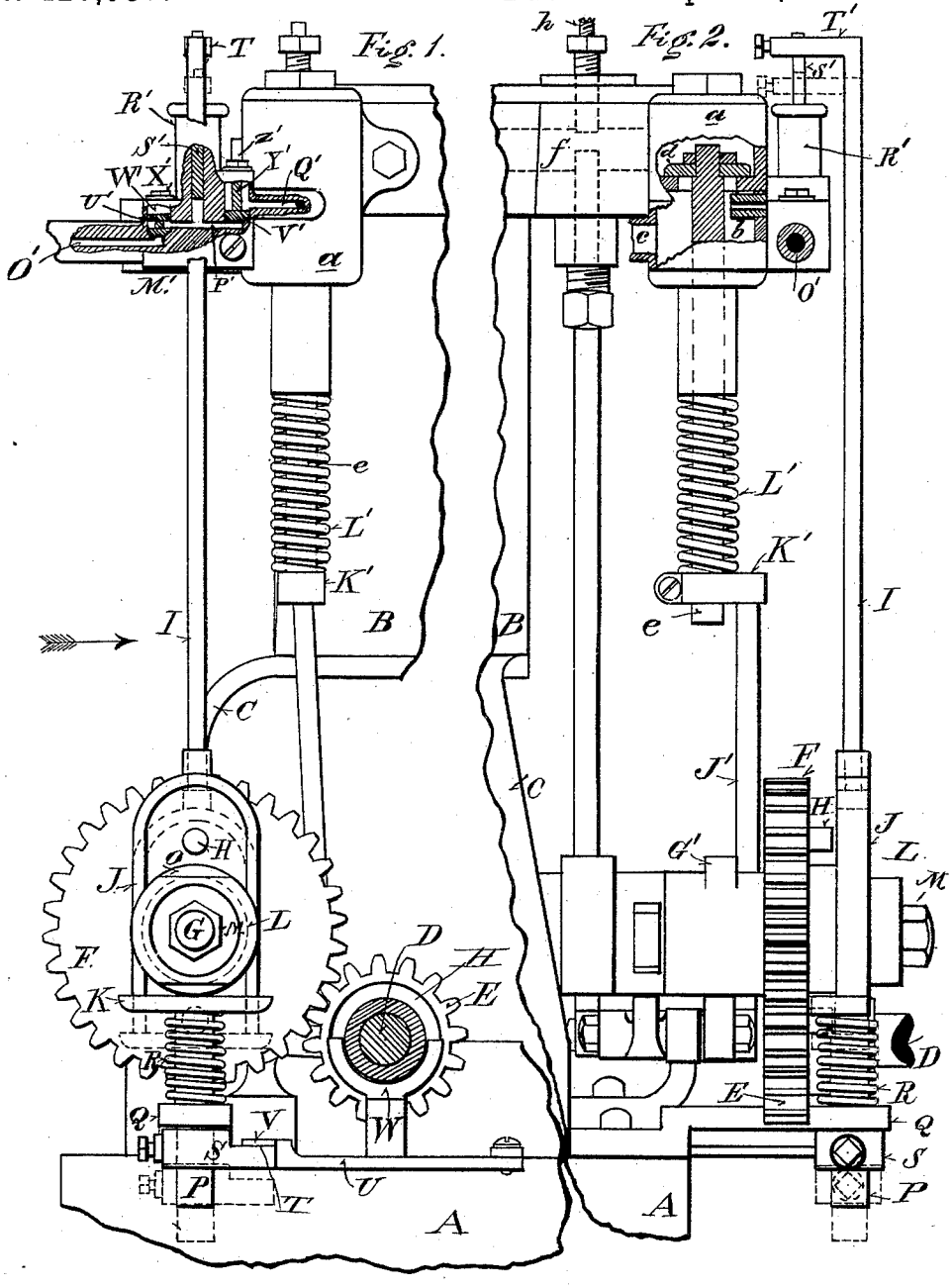
(No Model.) 3 Sheets—Sheet 1.

C. SINTZ.

GAS ENGINE.

No. 426,337. Patented Apr. 22, 1890.



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(No Model.)

3 Sheets—Sheet 2.

C. SINTZ.

GAS ENGINE.

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Fig. 3.

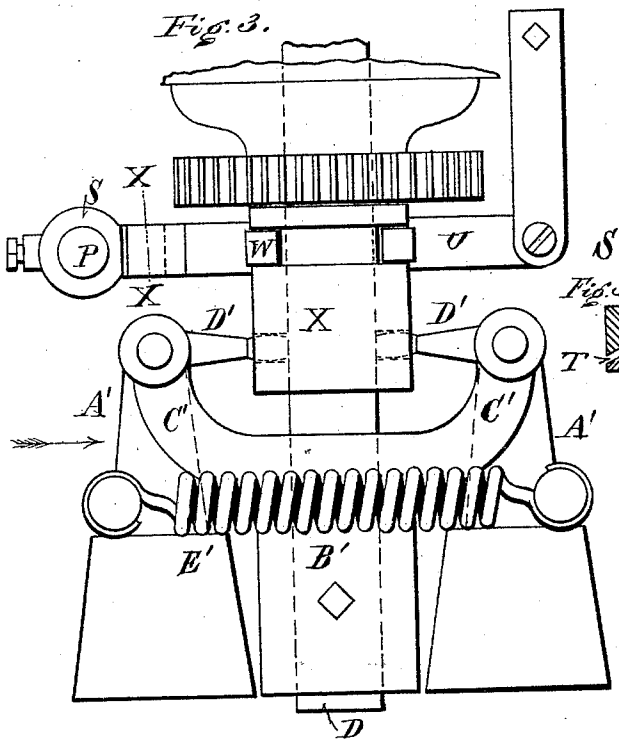


Fig. 4.

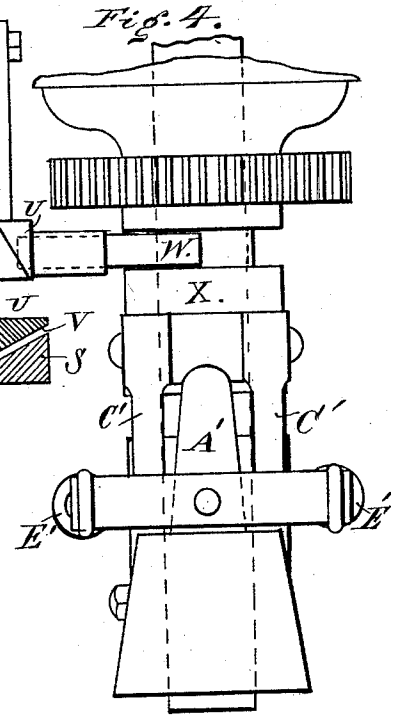


Fig. 5.

Fig. 6.

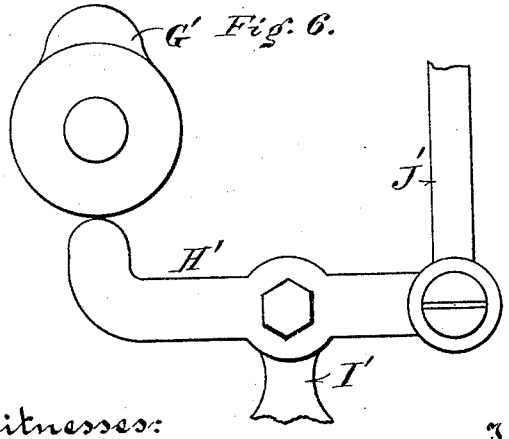
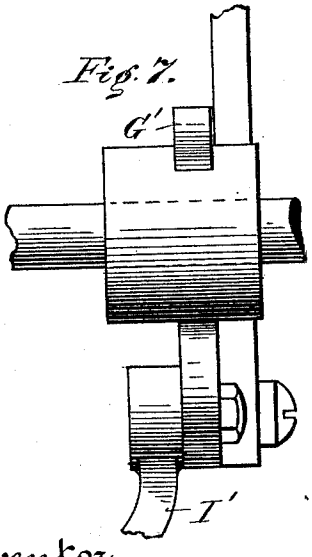


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

C. SINTZ.

GAS ENGINE.

No. 426,337. Patented Apr. 22, 1890.

Fig. 8.

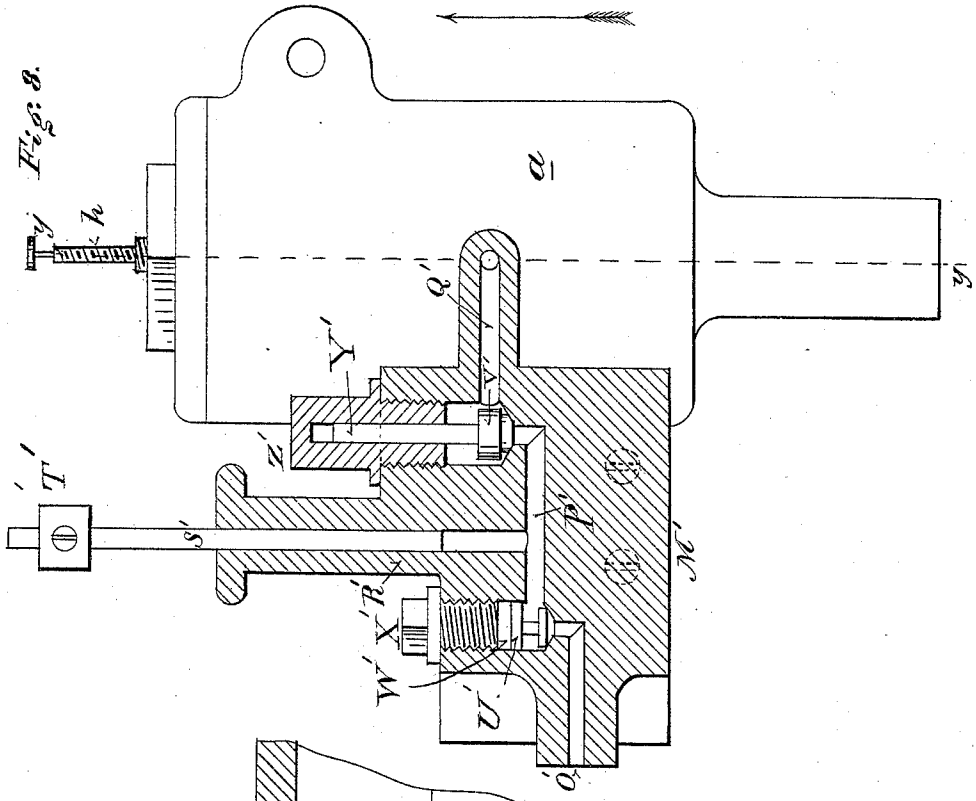
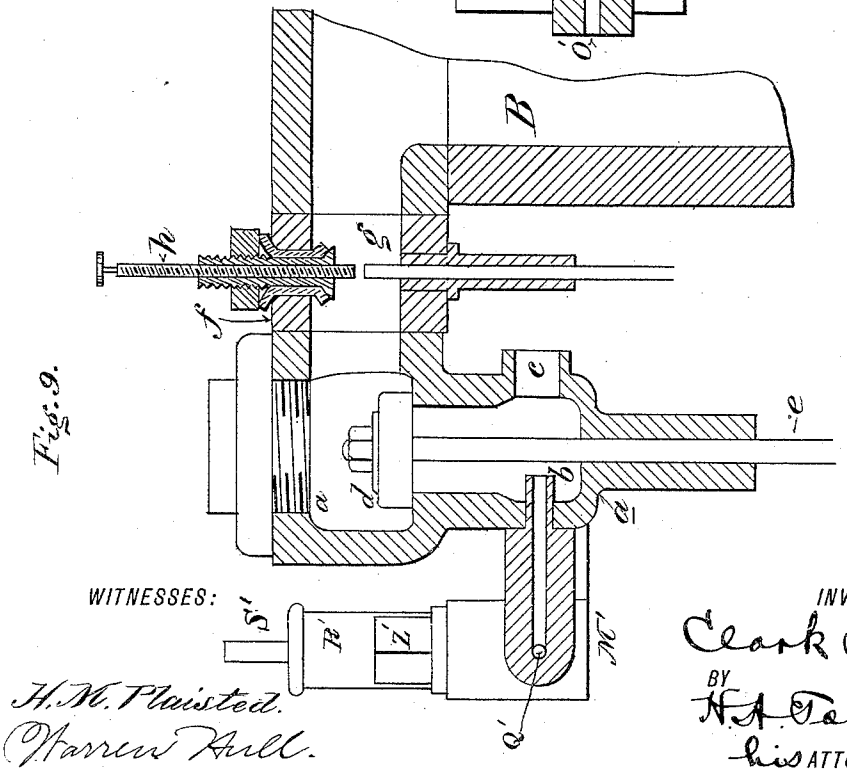


Fig. 9.



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UNITED STATES PATENT OFFICE.

CLARK SINTZ, OF SPRINGFIELD, OHIO.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 426,337, dated April 22, 1890.

Application filed September 16, 1889. Serial No. 324,168. (No model.)

To all whom it may concern:

Be it known that I, CLARK SINTZ, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to gas-engines, and the object in view is to deliver quantities of gasoline governed by the speed of the engine into a chamber or compartment for admixture with or absorption by admitted quantities of pure atmospheric air. In this way I economically provide for generating the explosive agent or motive-power compound and at the same time generate at quick intervals only so much as the then speed of the engine shall require to enable it to perform the burden to which it may be subjected.

Another object of my invention is to provide for opening the air-port which supplies air to the compartment or chamber in which it is commingled with the gasoline prior to the introduction into the chamber of the gasoline, and to maintain the air-valve in an open position until the injection of the gasoline is completed, so that the injection of the gasoline shall commence and terminate within a period of time during which the air-valve is open, whereby all liability of unabsorbed or pure gasoline to reach the cylinder shall be prevented.

I will describe the instrumentalities by which I carry my invention, which embraces these objects, into practice, the same being in accordance with an engine already complete and now in practical operation.

In the accompanying drawings, forming a part of this specification, and on which like reference-letters indicate corresponding parts, Figure 1 represents a side elevation of these instrumentalities, with portions in vertical section; Fig. 2, an elevation of the same parts, looking in the direction of the arrow in Fig. 1, also showing some of the parts in vertical section; Fig. 3, an enlarged plan view of a portion of the engine-shaft, the governor applied thereto, and the several adjunctive features; Fig. 4, a side view of the same parts, looking in the direction of the arrow shown in Fig. 3; Fig. 5, a detail sectional view of two of the parts on the line $x\ x$ in Fig. 3; Fig. 6, a side elevation of the mechanism for actuating the air-valve; Fig. 7, an end view of the same parts; Fig. 8, an enlarged detail sectional view of the gasoline-pump and a side elevation of the air-valve chamber, said parts being connected together; Fig. 9, a vertical sectional view of the air-valve chamber, the igniting-chamber, and a part of the cylinder on the line $y\ y$ in Fig. 8, also showing the igniting-terminals and the gasoline-pump in elevation.

The letter A designates a fragment of the engine-bed, upon which is mounted the cylinder B, supported by an intermediate standard C. These parts are fragmentarily shown because they do not enter into the present improvements.

The letter D designates the main shaft, suitably mounted upon the bed A, and provided with a pinion E, which meshes with a gear-wheel F of such relative proportions as may be desired, according to the cycle of operations desired between each explosion. The gear F is rigidly mounted on a shaft G, also conveniently supported by the bed A, and this gear receives motion from the pinion E. The gear F has a stud or projection H, which operates the gasoline-piston downward through the connecting-rod I and a yoke and cross-plate J and K. The yoke is guided in a vertical position by fitting over and behind a collar L, secured by a nut M upon the shaft G. This nut is cut away at O to enable it to be passed through the yoke J. From the cross-plate K extends a stout stem P through a lug Q, projecting from the base A. A spiral spring R, about the stem P and between the lug Q and the cross-plate K, serves to lift the yoke and the rod I to operate the gasoline-piston upward. It will thus be understood that this piston is given its downward stroke by the engagement of the stud H with the plate K, and its upward stroke by the extension of the spring R.

I would here observe that in order to vary the quantity of gasoline drawn into the cylinder it is necessary to vary the stroke of its piston; and that in order to terminate the downstroke of the gasoline-piston at the same time with respect to the closing of the air-valve (to be hereinafter described) irrespective of the speed of the engine, it is necessary to com-

plete the downstroke at the same extreme lower limit every time. To secure these two conditions—that of varying the quantity of the gasoline to be injected to agree with the speed of the engine, and that of always terminating the downstroke of the gasoline-piston before the air-valve is closed—I have arranged for terminating the upstroke of the gasoline-piston at various places, according to the speed of the engine, so as to govern the inflow of the gasoline accordingly. I will now describe convenient instrumentalities for this purpose. These consist of a foot S, secured to the stem P, and having an incline T, and of a pivoted arm U, having a similar incline V, which is moved against the incline T, so as to depress the foot S more or less, according to the lap of the two inclines. This engagement of the foot S with the arm U limits the upward movement of the stem P, and also determines the upstroke of the gasoline-piston. This action of the two inclines is controlled by the speed of the engine, as the arm U is connected by a yoke W with a slotted collar X, actuated longitudinally on the main shaft D by a suitable governor. As the flight of the governor balls or weights moves them radially under the centrifugal action, the movement of the collar X is increased and the arm U drawn more and more over the foot S, depressing the latter to a greater extent. Thus a variable stop is constituted to determine the upstroke of the gasoline-piston. The form of governor may vary, but a convenient type is illustrated in Figs. 3 and 4, the same consisting of weighted arms A′, pivoted to a sleeve B′, having supports C′. The arms A′ have right-angled projections D′, which engage with the collar X. Spiral springs E′ connect the weighted arms together.

I will now describe the devices for manipulating the air-valve. These consist of a cam G′, mounted on the shaft G, and arranged to press down once in each revolution upon a lever H′, pivoted upon a suitable support I′ and attached to a suitable connecting-rod J′. This rod is fastened by a clamp K′ to the stem of the air-valve. A spiral spring L′ between the clamp K′ and the lower part of the valve-chamber serves to normally seat the air-valve and to reseat it after each time it is elevated by the cam G′, rod J′, and intermediate devices just described. In lieu of the cam G′ and rod J, the sucking action of the piston may be relied on to lift the air-valve.

I will now refer to the construction and arrangement of the gasoline-pump and the air-chamber. These are preferably connected together. The former consists of a block M′, having an inlet-passage O′, P′, and Q′, provided with valve-seats at either side of an intermediate cylinder R′, in which is fitted to work a suitable piston S′, the same being connected by a clamp T′ with the rod I, already described. These valve-seats are provided with suitable check-valves U′ and V′, the upper end of the former being connected by a hole W′, closed by a suitable plug X′, (through which hole the valve is inserted and may be removed,) and the latter is guided by the elongated stem Y′, fitted to a removable plug Z′. The elongated stem serves to give the valve V′ the proper heft. The passage Q′ communicates with the interior of the air-valve chamber *a*, as more clearly seen in Figs. 8 and 9, a short projecting nozzle *b* being provided. An air-inlet port is provided at *c*. A valve *d* is seated within the chamber *a* and provided with a long stem *e*, already referred to.

I will now describe the operation of generating the explosive agent. Assume that the power-piston is at its out or down stroke. By moving it inward or upward the gasoline-piston will lift. Then by moving the power-piston outward or downward the air-valve will lift. This is almost immediately followed by the descent of the gasoline-piston, whereby the gasoline drawn into the pump during the said lifting of the gasoline-piston will now be ejected into the valve-chamber *a*, and will commence such ejection after the air-valve has been lifted. Just before the power-piston terminates its said outward or downward stroke the gasoline-piston terminates its downward stroke, and the air-valve closes just after the termination of the said downstroke of the gasoline-piston and at about the time of the termination of the said outward or downward stroke of the power-piston. The return of the power-piston will of course compress the charge which was drawn into it during its out or down stroke. Again, as the power-piston returns the gasoline-piston lifts, as before, the air-valve remaining closed until the next down or out stroke of the power-piston, when it opens, as before, and is shortly succeeded by the downstroke of the gasoline-piston, ejecting the gasoline, as before. As the power-piston is moving downward or outward, and as the air-valve is lifted before the gasoline enters the chamber *a*, it will be understood that the air is rushing into and upward through the chamber *a* when the gasoline makes its entrance into the said chamber *a*. By this means the gasoline is immediately absorbed, taken up, or intermingled with the air. The termination of the upstroke of the gasoline-piston will of course terminate sooner or later, according to the speed of the engine, as already described; yet its upward commencement and downward termination are always the same as compared to the movements of the power-piston and the air-valve.

In Fig. 9 the exploding-chamber *f* and the terminals *g* and *h* are shown interposed between the valve-chamber *a* and the cylinder B. As these features do not form any part of the present invention I will not describe them.

The passage O′ of the pump is connected with a suitable supply of gasoline. It will be observed that while the air-valve and gasoline-pump are primarily actuated from the main shaft yet the pump-piston may vary in length

of its stroke, while the air-valve will remain open a longer or shorter time; but it is constant in the distance it moves from its seat.

In lieu of the cam G′ and the rod J for actuating the air-valve, I may depend upon the sucking action of the piston in the cylinder to lift the air-valve. As the outstroke is proceeding, it will be understood that the tendency to create a vacuum in the rear of the piston-head makes it practicable to dispense with those instrumentalities as the means of actuating the said valve. When the piston reverses, the valve of course closes.

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

1. In a gas-engine, the combination, with a gasoline-pump, its piston, suitable check-valves, operating mechanism for the piston, including a spring to move it upward, gearing to move it downward, and a variable stop to limit its upstroke, of an air-valve casing communicating with said pump, a valve therefor, operating mechanism for the valve, embracing a spring to seat the valve, and a cam and lever to raise it.

2. In a gas-engine, the combination, with a gasoline-pump, its piston, and a main shaft, of a pinion on said shaft, a gear-wheel operated by the pinion, a connecting-rod and yoke operated downward by the gear-wheel, a spring which operates said rod and yoke upward, and a variable stop which limits their upward movement.

3. In a gas-engine, the combination of a gasoline-engine, its piston, a connecting-rod and yoke, a spring to lift them upward, the main shaft, a governor carried thereby, a bar operated by the governor, and a foot connected with the yoke and engaged by said bar, and a pinion and gear to operate the yoke and rod downward.

4. In a gas-engine, the combination, with the actuating-rod of a gasoline-piston, a spring to move it upward, and a foot connected to said rod, of the engine-shaft, a governor carried thereby, a pivoted bar actuated by the governor back and forth over said foot and arranged to limit the upward movement thereof.

In testimony whereof I affix my signature in presence of two witnesses.

CLARK SINTZ.

Witnesses:
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W. H. YOUNG.