(No Model.)

C. A. KUNZEL, Jr.

GAS ENGINE.

No. 571,447. Patented Nov. 17, 1896.

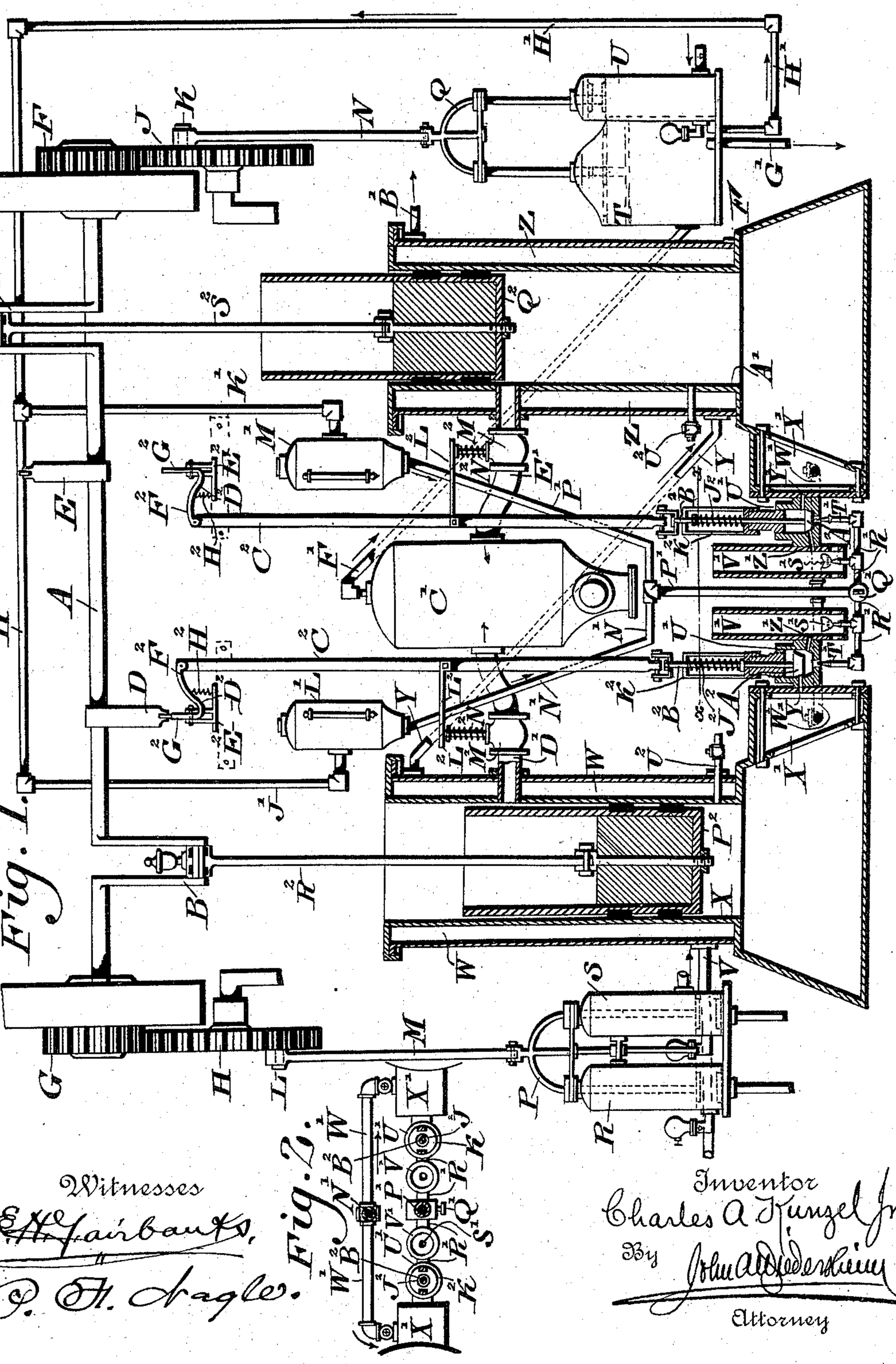

Fig. 1.

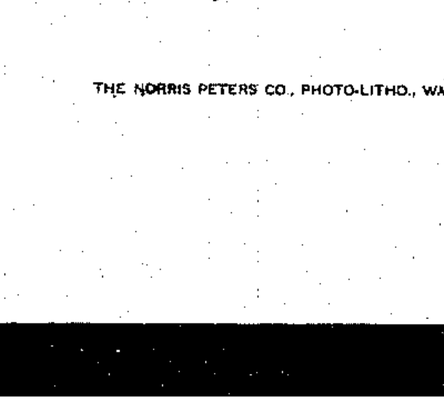

Fig. 2.

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CHARLES A. KUNZEL, JR., OF HOBOKEN, NEW JERSEY.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 571,447, dated November 17, 1896.

Application filed December 10, 1895. Serial No. 571,686. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. KUNZEL, Jr., a citizen of the United States, residing at Hoboken, county of Hudson, State of New Jersey, have invented a new and useful Improvement in Gas-Engines, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of a novel construction of gas-engine, in which the motive power is obtained by means of the explosion of a suitable chemical, provision being made for causing the explosions to occur at proper intervals, whereby a reciprocating motion is imparted to pistons in cylinders adjacent to the points of explosion.

It further consists of novel details of construction, all as will be hereinafter set forth.

Figure 1 represents a partial vertical section and side elevation of a gas-engine embodying my invention. Fig. 2 represents a section of a portion of the apparatus on line *x x*, Fig. 1.

Similar letters of reference indicate corresponding parts in the two figures.

Referring to the drawings, A designates the main shaft, which is provided with the cranks B and C, disposed at an angle of substantially one hundred and eighty degrees relative to each other.

D and E designate cams or wipers, also attached to said shaft in reversed directions.

F and G designate pinions mounted on said shaft, which mesh with the gears H and J, to which latter are attached crank-pins K and L, which are also set at an angle of substantially one hundred and eighty degrees to each other and which engage the connecting-rods M and N, which are pivoted to the frames P and Q, to which are attached pistons and piston-rods, which work, respectively, in the cylinders R, S, T, and U, thus forming pumps, the function of the pump R being to force a freezing liquid through the pipe V into the jacket W, which surrounds the cylinder X, and thence by the pipe Y to the jacket Z, which surrounds the cylinder A′, from which jacket the freezing liquid is conducted by the pipe B′ to any desired point.

The pump S is for water, which can be utilized for any desired purpose, as for running hydraulic elevators or for use in connection with ice-machines. The function of the pump T, which in practice is constructed somewhat larger than shown in Fig. 1, is to remove the gases caused by the explosion in the cylinders X and A′ from the reservoir C′, said gases being conducted to the latter from said cylinders by means of the pipes D′ and E′.

F′ designates the suction-pipe, leading from said reservoir C′ to the aforesaid pump T, and and G′ designates the discharge-pipe therefrom.

The pump U is employed to force air through the pipes H′, J′, and K′ to the reservoirs L′ and M′, which latter are provided with manholes or similar devices for introducing into said reservoir L′ an explosive chemical or liquid, such as gasolene, and into the reservoir M′ a chemical or fluid, such as coal-oil, which produces an inflammable gas when air is forced into said reservoir M′. N′ and P′ designate pipes leading from said reservoirs L′ and M′, the pipe P′ leading down into the valve Q′, from which latter extend the branch pipes R′ in either direction, the same having the gas-burners S′ and T′ arising therefrom, said burners T′ entering an opening in the base of the valve-chambers U′ and being alternately ignited and extinguished, as will be explained, while the burners S′ enter the tubes V′, which are open at the top and provided with openings at their base for the admission of oxygen to support combustion, said burners S′ being ignited all the time.

The pipe N′ extends down behind the pipe P′ into a suitable fitting, at which point it divides, having a branch W′ extending into each of the explosion-chambers X′ at the base of each of the cylinders X and A′, each branch pipe W′ having therein a suitable check-valve, the arrangement of the several connections, &c., being best seen in Fig. 2. Each valve-chamber U′ is located intermediate the chamber X′ of each of the engine-cylinders and one of the tubes V′.

Y′ designates a port connecting the interior of each valve-chamber U′ with its adjacent chamber X′, and Z′ designates another port between each of the tubes V′ and each of the aforesaid valve-chambers U′, in each of which latter reciprocate the valves A^2, the latter being provided with the stems B^2, which are pivoted to the rods C^2, each of which latter

have pivotally attached to their upper ends an arm F^2 of a bell-crank D^2, the same being pivotally mounted in a suitable stand or bracket E^2, which it will be understood may be supported in any suitable manner. Each of the other arms G^2 of each bell-crank is struck at intervals by the appropriate cam or wiper D or E, located over the same.

H^2 designates a spring interposed between each arm F^2 and its bracket.

J^2 designates a spring contacting with a suitable portion of each valve-stem B^2 and also with a cage K^2, inclosing the same.

L^2 designates an arm attached to each of the rods C^2 and adapted to actuate the stem of the valve M^2, one of the latter being located in each of the passages D′ and E′.

N^2 designates a spring for holding the stems of each of said valves in proper position when they are not actuated by the arms L^2. The cylinders X and A′ are provided with pistons P^2 and Q^2, and R^2 and S^2 designate connecting-rods extending from each piston to its appropriate crank B and C above, respectively.

U^2 designates air-valves which are attached to the cylinders X and A′ and serve to admit a sufficient supply of air at proper intervals to the explosive mixture under the respective pistons.

The operation is as follows, assuming the parts to be in the position shown: The reservoir L′ having been charged with the proper explosive, such as gasolene, and the reservoir M′ with an inflammable gas-producing fluid or liquid, such as coal-oil, it will be seen that each stroke of the air-pump U will force a predetermined quantity of air into said reservoirs L′ and M′, thus forcing a charge of the explosive into the explosion-chambers X′, and also into the burners T′ the requisite quantity of the inflammable gas evolved by the admixture of air under pressure with the coal-oil contained in the reservoir M′. Referring now especially to the left-hand cylinder X and its explosion-chamber X′ and the left-hand valve-chamber U′ and burner T′, it will be seen that the said chamber X′ is now filled with the explosive mixture, while the lower portion of the adjacent valve-chamber U′ and the burner T′ thereunder are at this instant charged with gas from the reservoir M′, the burners S′ being ignited all the time. The left-hand valve A^2 at this instant is moved sufficiently to uncover the port Y′, whereupon the explosion takes place under the piston P^2, and the latter is forced upward into the position in which the piston Q^2 is now seen. It will be understood that the burners S′ are enabled to remain continuously ignited so long as the flow of gas thereto is uninterrupted by reason of their location within the tubes V′, which are so constructed as to afford a sufficient supply of oxygen to support combustion at all times. The extinction of the burners T′ is caused at the proper intervals by the descent of one or other of the valves A^2, the proper valve, when in its inferior position, which it assumes at intervals, as seen at the right-hand side of Fig. 1, causing the extinction of the burner T′ thereunder, by reason of the downward current of air created by the descent of said valve, the latter also assisting to cut off the supply of oxygen to its burner when in its inferior position, as seen at the right of Fig. 1. The relighting of the burners T′ is caused when the proper valve A^2 rises, as indicated at the left of Fig. 1, by a portion of the inflammable gas from the pipe P′ being forced past the burners S′ into the burner T′, which is under the elevated valve, and thence into the chamber below said valve and out through the adjacent port Z′ into the lower portion of the adjacent tube V′, in which the continuously-burning jet S′ is located, through the agency of which latter the gas contained in the lower portion of the valve-chamber is ignited, and the explosion caused in the adjacent chamber X′, and the piston P′ forced upwardly, the operation hereinabove described occurring alternately in each cylinder and valve-chamber. The exhaust-valves M^2 are opened and closed at the proper intervals by means of the contact of the arms L with their stems and the spring N^2 assisting in restoring said valves to their normal positions, the exhaust from each engine-cylinder being conducted by the pipes D′ and E′ to the reservoir C′ and exhausted therefrom by the pump T. Each of the valves A^2 is caused to reciprocate at the proper intervals by the contact of the wipers D and E with the bell-cranks D^2, which have the rods C^2 leading therefrom to the stems B^2 of said valves.

The function of the air-valves U^2 and of the check-valves in the branch pipes W′ will be evident without further explanation.

The engine, as hereinbefore explained, is more particularly designed for ice and refrigerating machines, cooling apparatus, and the like.

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

1. In a gas-engine, a pair of engine-cylinders, explosion-chambers therefor, a tank for holding a suitable explosive, conduits leading from said tank to said explosion-chambers, a pair of open-ended tubes suitably supported, a valve-chamber intermediate each of said tubes and an explosion-chamber, ports forming a communication between said chambers and tubes, gas-burners located in said valve-chambers and tubes, the burners in the latter being ignited continuously, means for forcing gas into said burners, valves in said valve-chambers, each valve being adapted to alternately open and close the communication between the ports leading from its chamber to the adjacent explosion-chamber and tube, and to cut off communication between said ports, when in inferior position, and means for actuating said valves.

2. In a gas-engine, reservoirs adapted to contain gasolene and coal-oil respectively, means for conducting air under pressure to said reservoirs, engine-cylinders provided with explosion-chambers, conduits leading from said gasolene-reservoir to said explosion-chambers, open-ended tubes, a valve-chamber intermediate each tube and an explosion-chamber, communicating ports between each explosion-chamber, its valve-chamber and tube, a port in the lower portion of each valve-chamber, a gas-burner adjacent each of the last-mentioned ports, and adapted to be alternately lighted and extinguished, other gas-burners located within said tubes and adapted to burn continuously, valves in said valve-chambers, each valve being adapted to alternately open and close the communication between the ports leading from its chamber, said ports being closed to each other when their controlling-valve is in inferior position, and means for actuating said valves.

3. In a gas-engine, a pair of engine-cylinders, valve-chambers, and explosion-chambers therefor, an exhaust-reservoir, exhaust-conduits leading to the latter from each cylinder, valves in said conduits adapted to be operated in unison with the valves in said valve-chambers, a source of supply for an explosive and an inflammable gas, means for conducting the same to the explosion and valve chambers respectively, burners connected with the gas supply, valves in said valve-chambers, each valve being adapted to alternately open and close the communication between the ports leading from its chamber, said ports being closed to each other when their controlling-valve is in inferior position, and means for actuating said valves.

4. In a gas-engine, the cylinders X and A′, each having an explosion-chamber X′, the inlet-valve chambers U′, each having a valve A^2 therein, and the ports Y′ and Z′, the latter leading to the tubes V′, the gas-conduit P′ having the branches R′, each provided with the burners S′, T′, said burners S′, burning continuously, while the burners T′ are alternately ignited and extinguished, means for conducting an explosive mixture and an inflammable gas to the explosion-chambers and burners respectively, the reservoir C′, valved exhaust-conduits leading from each engine-cylinder thereto, and means for actuating the inlet and exhaust valves.

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