(No Model.)

H. K. SHANCK.

GAS ENGINE.

No. 390,710. Patented Oct. 9, 1888.

Fig. 6.

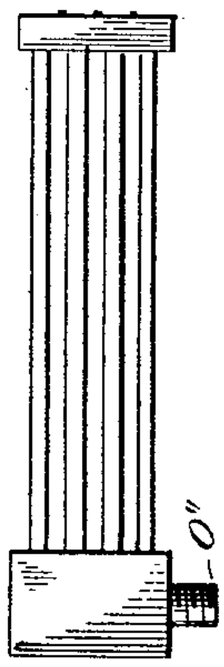


Fig. 7.

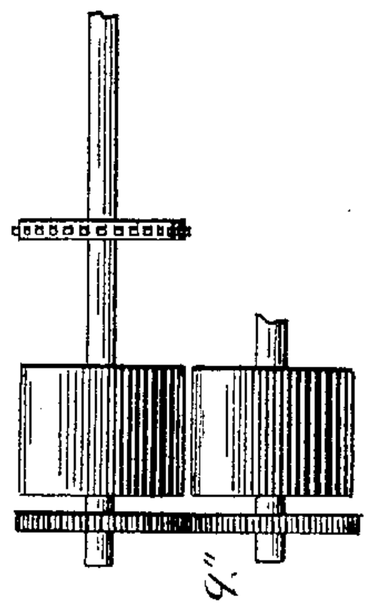


Fig. 9.

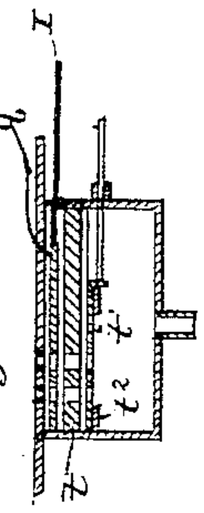


Fig. 2.

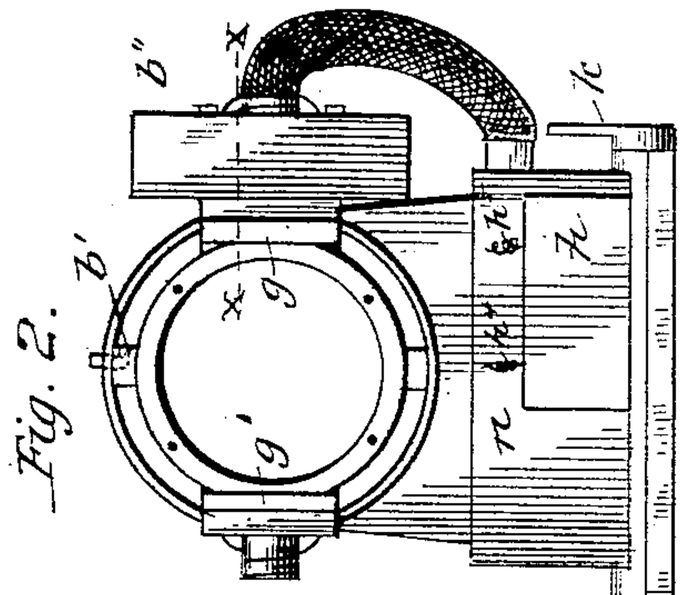


Fig. 10.

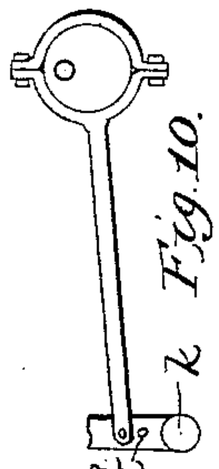


Fig. 1.

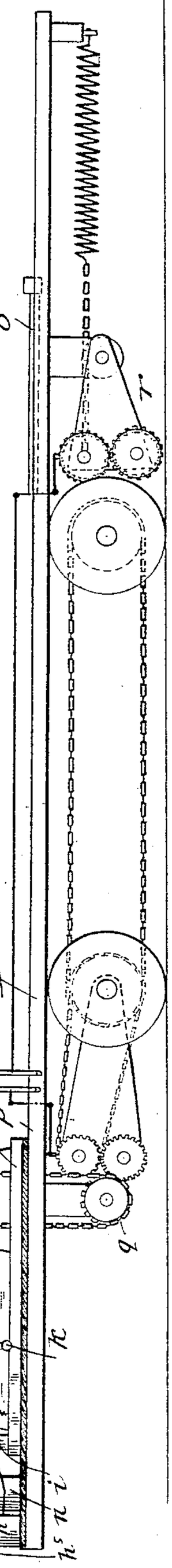


Fig. 3.

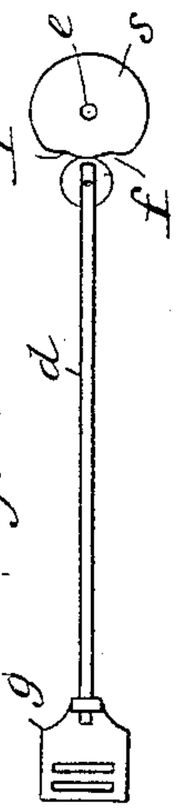


Fig. 4.

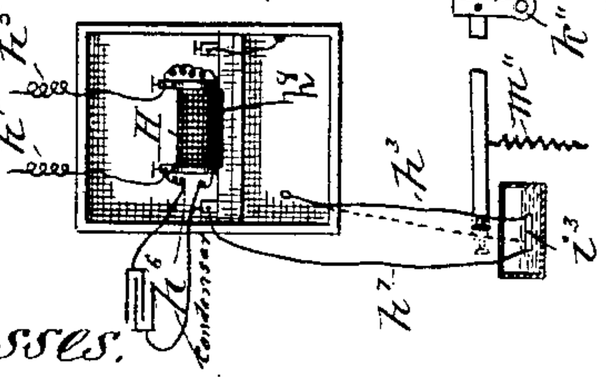


Fig. 5.

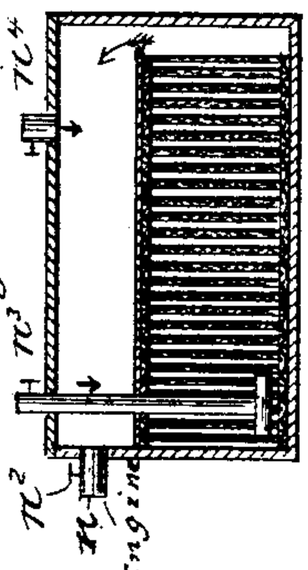
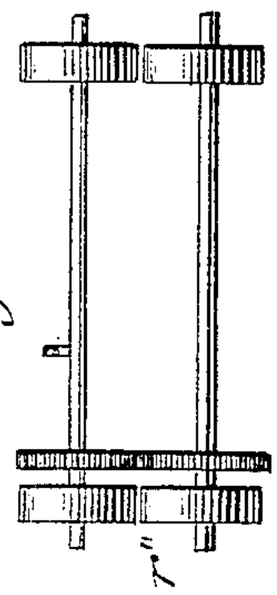


Fig. 8.



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by R. D. & A. P. Lacey.

UNITED STATES PATENT OFFICE.

HENRY K. SHANCK, OF COLUMBUS, OHIO.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 390,710, dated October 9, 1888.

Application filed March 5, 1887. Serial No. 229,831. (No model.)

To all whom it may concern:

Be it known that I, HENRY K. SHANCK, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Gas-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to portable gas-engines which manufacture their gas as the same is required, and explode the same by an electric spark.

The object of the invention is the production of an engine of the above-described type which will be simple, compact in arrangement, and easily managed, and one in which the gas will be thoroughly exploded without residuum by a statical spark.

The improvement consists in the novel features presently to be described, claimed, and shown in the annexed drawings, in which—

Figure 1 is a side view of a car-truck and engine embodying my invention; Fig. 2, an end view of an engine, showing the head of the cylinder removed; Fig. 3, a detail view of the valve and its operating-cam; Fig. 4, a detail view, on an enlarged scale, of the battery, the circuit-breaker, and the mechanism for opening and closing the circuit for producing the spark which explodes the gas; Fig. 5, a detail view of the carburetor; Fig. 6, a detail view of the heater placed in the bottom of the car; Figs. 7 and 8, detail views of the driving mechanism; Fig. 9, a sectional view on the line *x x* of Fig. 2; and Fig. 10 is a detail view of the rock-shaft and its operating mechanism.

My invention relates particularly to the gas-engine and its appurtenances—such as the carburetor, the engine of the cylinder, the main and cut-off valves, the valve-operating mechanism, the devices for generating and intensifying the electrical current for producing a spark of sufficient intensity to explode the aerated gas, and the devices for making and breaking the circuit, so as to produce the spark.

The engine is designed for general use; but it is particularly constructed and designed for propelling and heating street-railway cars, and in the drawings is shown thus applied.

The engine is shown placed upon one end of the platform A of the truck of a street-railway car. Between the bed A′ of the engine and the platform is interposed a layer, *p*, of soft material known as "mineral wool," and made from the scoria and slag of blast-furnaces, which deadens the noise of the engine and prevents the transmission of the heat to said platform, and lessens the chances of fire.

The cylinder *a* of the engine is surrounded by the jacket *b*, between which and the cylinder an annular space is left for the reception of a cooling medium for maintaining the cylinder at the proper temperature. The water-jacket is made in longitudinal sections, being divided by solid portions *b′*, as shown. Water-jackets have been put all around the cylinder, which keep the temperature at 212°. It is an advantage to have the cylinder hotter, though not so hot as it will be with no water-jacket at all. Therefore I make the said jacket in sections, permitting the water to circulate by small apertures through the solid portions, and I extend this jacket, say, only two-thirds the length of the cylinder.

The gas-chest b^2 is located to one side of the cylinder in the ordinary manner, and is provided with the usual ports for the admission of the gas into the cylinder. The valve *g*, which is the main valve, works over the valve-seat and is provided with a plurality of openings, through any one of which the gas is admitted to the cylinder. It is important to open and shut this valve quickly and to have the stroke very short to obviate the noise; hence the advantage of having a series or multiplicity of openings or ports in the valve.

Above the valve *g* is arranged a diaphragm or partition, *t*, having openings corresponding with and directly opposite to the openings in the valve-seat, and above this diaphragm is arranged a cut-off valve, *t′*, correspondingly ported and connected with the engine-governor in any well-known manner for regulating the amount of gas to be fed into the engine. The cut-off valve is held down by a keeper-plate, t^2.

Motion is imparted to the car-wheels from the main shaft *e* through suitable gearing, and

[redacted]

the main shaft is operated from the engine by the pitman C, connected with the piston-head, which is driven close up against the cylinder-head to expel all burned gases, which are conducted by suitable conveyer to a heater or radiator to the bottom of the car. When the pitman is at the limit of its outward movement, the exhaust-port is closed and the inlet-port is opened by the valve *g*, which is moved by the cam *s*, bearing against the end of the valve-rod *d*. The valve *g* closes the inlet-port and keeps it closed while the end of the rod *d* is traveling upon the outer portion of the cam and opens the inlet-port when the end of the rod *d* drops into the depression *f*. The spiral or other spring *d'* holds the end of the valve-rod *d* against the cam.

The gas-machine or carburetor, made of thin cast-iron or other material, is attached to the gas-chest by the tube or conveyer *n*, which has a valve or cock, n^2, for shutting off the gas when the engine is at rest. The pump or air-blast heretofore used for carbureting is dispensed with and the engine made to suck the air through the generator. The air enters the carburetor through the pipe n^3, which is provided with a suitable valve for regulating the amount of air to be admitted therein. This pipe n^3 extends nearly to the bottom of the carburetor, and is provided with a T-coupling or cross-pipe for spreading the air. Large-meshed wire screening is placed in the bottom of the carburetor, and above this, about two-thirds of the way of the distance between the bottom and the top of the carburetor, is arranged another screen similar to the screen at the bottom. Between these screens wicks are arranged, which are stretched from one to the other, which, being porous, attract the hydrocarbon and hold it, as it were, in suspension, to be taken up by the incoming air, which, becoming saturated or laden with the volatile gases, is delivered to the engine, where it is exploded by the mechanism and means more fully set forth hereinafter.

In case the gas is too rich and is not sufficiently aerated to explode readily, it is properly impoverished by the admission of air into the space above the wicks through the inlet n^4, which is provided with a suitable valve to regulate the needed quantity of air to bring the gas to the proper explosive quality. By regulating the several cocks connected with the carburetor a gas of desired density and specific gravity can be produced at will.

The gas is exploded in the cylinder by an electrical spark of great density, which will be designated as the "statical spark." The induction-coil H is of ordinary construction, and has a condenser, h^8, located in its base and included in the primary wire.

The induction-coil and battery are both located in the box *h*, the induction-coil in the upper part of the box and the battery in the lower part of the box. The wires of my coil on primary and secondary are heavier than usual. The wire h^2 from one pole of battery connects with the primary wire of the induction-coil H, and the wire h^3 from the other pole of the battery extends into a tank, *i*, containing fluid, such as water or water and glycerine, &c. The wire h^3 forms one terminal of the circuit from the battery through the primary wire of the induction coil, and the wire h^7 forms the other terminal of this circuit. The wire h^7 connects with the plate i^3, placed in the tank *i*. The wire h^5 is carried by the lever *j*, which is mounted upon a movable fulcrum, *k*, which is an arm keyed to the end of the rock-shaft K, journaled transversely relative to the engine. The opposite end of the shaft is provided with an arm, k^3, which is connected with some suitable means for rocking the shaft K and moving the lever *j* to and fro. The rear end of the lever *j* is connected with the lever *l'* by the link *l*. The free end of the lever *l'* bears upon the cam *m*, carried by the main shaft *e*, by means of the cam *m*, the lever *m'*, and the lever *j*. The wire h^5 is raised and lowered by means of the vibrating arms *k*. The wire is carried back and forth over the plate i^3. This movement of the wire h^5 makes and breaks the circuit and produces the spark which explodes the gas. The making and breaking of the circuit is accomplished under the fluid contained in the tank *i*, which prevents the burning or oxidation of the metal when the contact is made and broken. The cam *m* lifts *j* when the backward limit is reached and the contact broken at l^3 in the tank i^2. Then j^2 moves in its forward limit, drops there, and thus makes contact i^3, when again j^2 moves backward and breaks contact by dropping off from i^3. This is set to do so just when the inlet-port *g* is closed, and in the fraction of an instant the secondary spark is thrown into the cylinder by the wires h^4 and h^5. The secondary poles have a Leyden condenser, h^6, connected with them to make the spark unfailing in its work. This Leyden condenser may be flat and suitably small as well as with the old Leyden jar. Again, I can also make the requisite spark by using a suitable dynamo instead of the battery, breaking the contact in the liquid and using the Leyden condenser with the secondary, as already described. When my dynamo has electro-magnets, I must use the shunt-circuit.

It will be further seen that I have furnished a portable engine in which all the steps are taken with the best of results: first, an automatic suction, whereby the air is supplied to the carburetor; second, the carbureting of the fluid; third, the proper portioning of the air and fluid, whereby the exact quantity is produced before it reaches the gas-chest and cylinder; fourth, the instantaneous shutting in of the gas, whereby the explosive force of the fluid is more effectively utilized; fifth, the application of the intensified Leyden-jar spark; and, sixth, the explosion of the gas.

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

1. The combination, with the street-car platform and the gas-engine, of a layer of mineral wool interposed between the platform and the bed of the engine, substantially as and for the purpose described.

2. In a gas-engine, the combination of the cylinder provided with a valve-seat, and having a series of narrow openings in the valve-seat, the gas-chest having a diaphragm, which diaphragm is provided with a corresponding series of coincident openings, the main valve q, located between the valve-seat and the diaphragm, the valve t', placed against the diaphragm, and the keepers t^2, for supporting the valve t' and holding it against the said diaphragm, the valves q and t' having coincident openings with the valve-seat and the said diaphragm, substantially as and for the purpose specified.

3. In a gas-engine, the combination, with the cylinder and the induction-coil having its secondary wires connected therewith and separated for the passage of the spark, of the tank for holding water, or water and glycerine, the terminals of the primary wire extended into said tank and below the surface of the liquid, and the mechanism, substantially as described, for closing and moving one of said terminals over the other, producing a rubbing contact and separating said terminals and carrying the movable terminal without touching it, substantially as described, and for the purpose described.

4. The combination, with the cylinder of the gas-engine and the induction-coil having its secondary wires connected therewith and separated for the passage of the spark, of the tank containing liquid, the terminals of the primary wire extended into said tank, the lever supporting one of said terminals, and mechanism, substantially as described, for moving said lever in the direction of its length and vibrating it about its fulcrum, substantially as set forth.

5. The combination, with the cylinder of the gas-engine and the induction-coil having its secondary wires connected with the cylinder and separated for the passage of the spark, of the two Leyden condensers, one located in the circuit of the primary wire of the coil and the other located in the circuit of the secondary wire for intensifying the spark, substantially as and for the purpose described.

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

HENRY K. SHANCK.

Witnesses:
VAN BUREN HILLYARD,
G. P. KRAMER.