

R. B. HAIN.
COMBUSTIBLE VAPOR ENGINE.

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Ralph B. Hain
BY

Leather V. Moulton
ATTORNEY.

UNITED STATES PATENT OFFICE.

RALPH B. HAIN, OF GRAND RAPIDS, MICHIGAN.

COMBUSTIBLE-VAPOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 531,182, dated December 18, 1894.

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To all whom it may concern:

Be it known that I, RALPH B. HAIN, a citizen of the United States, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Combustible-Vapor Engines; and I do hereby 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.

My invention relates to improvements in combustible vapor engines, and its object is to provide the same with certain new and useful features, hereinafter more fully described and particularly pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of a device embodying my invention, on the line 1—1 of Fig. 2; and Fig. 2 an elevation of the same.

Like letters refer to like parts in both of the figures.

A represents the cylinder of the engine, which is closed at the top by a suitable head A' and open at the bottom, being downwardly connected with a compression chamber B, within which chamber is the usual cranked shaft and connecting rod, the upper end of said rod being pivoted to a piston C traversing the cylinder A.

D is a check valve for admitting the charges of combustible vapor to the compression chamber, and E a pipe extending from the compression chamber to the valve chamber E' at the top of which latter is a check valve F to periodically permit the charges to pass into the fire chamber G leading from said check valve to the upper end of the cylinder A.

Above the check valve F and opening into the chamber G is a recess containing an igniter of any suitable construction not herein described in detail, but only in its relation to the other parts. Surrounding the cylinder A is a water jacket M and outside of said water jacket is another casing or jacket N, having openings near the bottom and forming an air jacket which latter is prolonged upward and incloses an exhaust pipe J, arranged in line with the axis of the cylinder A and above the same. At the top of said pipe and jacket is a connecting cap or ring having inwardly in-

clined openings L, and the lower end of said exhaust pipe is inserted in the axis of the head A', in which head is an exhaust port I', extending radially within said head and thence vertically down the side of the cylinder A, as at I', opening into said cylinder near the bottom thereof at I, whereby as the piston descends the port I is uncovered and permits the contents of said cylinder to pass out through the ports I, I', I'', and pipe J. Said exhaust by lateral action causes a rapid upward circulation of air through the air jacket, said air entering at the openings O and escaping at the openings L. This current of air thus serves to aid in cooling the cylinder and exhaust pipe and prevents the same from radiating heat into the surrounding space which is especially desirable in certain locations, such as in boats, or close rooms.

The operation of my device is as follows: Upon the upward stroke of the piston a charge of combustible vapor is taken in at the check D. Upon descent of the piston this charge is sufficiently compressed to lift the check F and pass over into the cylinder expelling the contents of the same through the exhaust passages, now opened by uncovering of the port I. As the piston rises, this charge is now compressed within the upper end of the cylinder, and the fire chamber G. This compressed charge is now fired by the igniter H, and drives the piston C downward, with sufficient force to operate the engine, the check F being seated at the instant any back pressure comes thereon. The igniter H and check valve F being at the outer end of the chamber G, the incoming charge however small sweeps all the products of combustion away from the same and insures certain firing of the new charge, and cleanliness of the valve. So also the new charge coming in to the cylinder at the upper end as the old charge is passing out at the lower end thereof, said new charge does not get mixed with the products of the old, but carries the same ahead of it toward the exhaust port; also if a partial charge only is admitted the new charge is kept wholly separate from the residue of the old and at the top of the cylinder in proper place for effective firing by the igniter and undiluted; while the residue of the old charge is next the piston and first to escape at the

next exhaust. The engine thus operates as effectively and economically with partial as with full charges.

What I claim is—

- 5 1. In a combustible vapor engine, the combination with the cylinder having an exhaust port intermediate its ends, the stack surmounting said cylinder, and a water jacket surrounding said cylinder, of the exhaust
10 passage extending through said water jacket and opening into said stack, and the air jacket surrounding said water jacket and stack and open to the atmosphere at its ends, substantially as described.
- 15 2. In a combustible vapor engine, the combination with the cylinder having an exhaust port intermediate its ends, the stack sur-

mounting said cylinder, and the water jacket surrounding said cylinder, of the exhaust passage extending through said water jacket and opening into said stack, an air jacket surrounding said water jacket and stack and formed with openings at one end, and a ring secured to the tops of said stack and air jacket and formed with a flange having openings communicating with the space in the air jacket, substantially as described. 20 25

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

RALPH B. HAIN.

Witnesses:

LUTHER V. MOULTON,
WILLIAM S. MCCOY.