No. 739,220. PATENTED SEPT. 15, 1903.

J. H. REDFIELD.

EXPLOSIVE ENGINE.

APPLICATION FILED NOV. 21, 1902.

NO MODEL.

Fig. 2.

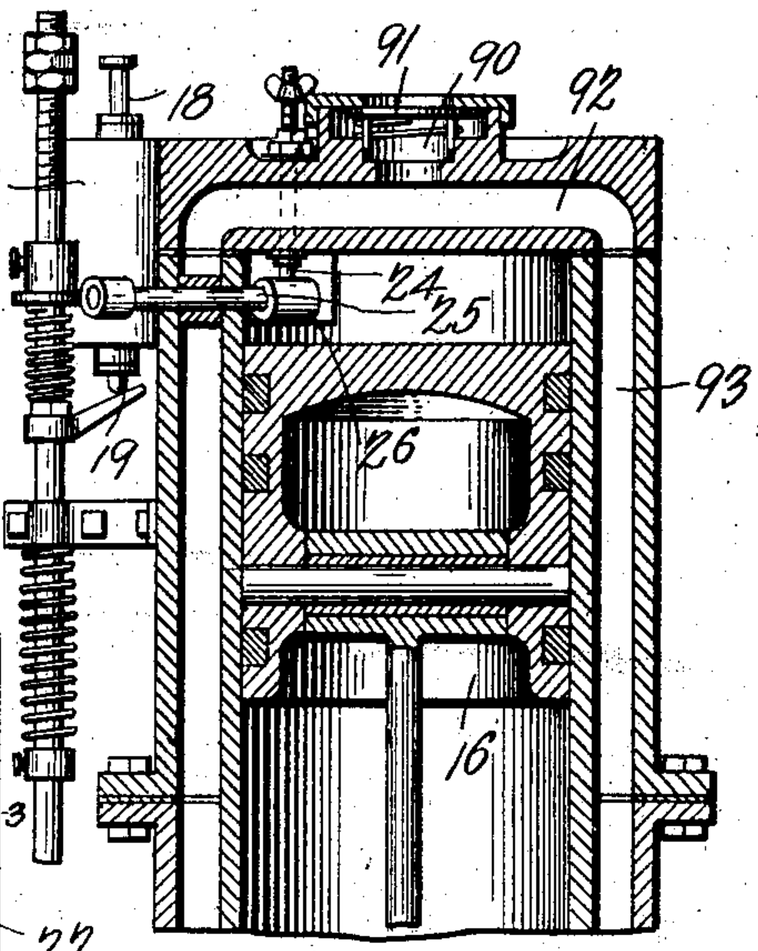

Fig. 1.

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN H. REDFIELD, OF SPOKANE, WASHINGTON.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 739,220, dated September 15, 1903.

Application filed November 21, 1902. Serial No. 132,318. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. REDFIELD, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented a new and useful Explosive-Engine, of which the following is a specification.

This invention relates to certain improvements in explosive-engines, and more especially to that class of engines for use in the operation of drills or other tools in mines, tunnels, and similar places where engines of this character cannot ordinarily be employed, owing to the poisonous exhaust and the consequent vitiation of the air.

An object of the invention is to provide for the cooling of the cylinder by entirely inclosing the crank-chamber and employing it as a suction-inlet chamber of which the lower or inner face of the trunk-piston forms the operative element, the air to cool the cylinder being drawn in through an opening in the upper cylinder-head and thence through ports or passages situated in the wall of the cylinder and into the crank-chamber, from whence it is discharged, together with the products of combustion, through a pipe leading to the outer air.

A still further object of the invention is to provide for the conveyance of the poisonous exhaust from the engine to the mouth of the mine, tunnel, or other place where the engine is located.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation of a gas-engine constructed in accordance with my invention. Fig. 2 is a sectional plan view of the same on the line 2 2 of Fig. 1. Fig. 3 is a view of a portion of the upper end of the cylinder on the line 3 3 of Fig. 1.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The engine is provided with a supporting-base 10, on which is bolted a crank-chamber 11, having suitable bearings for the support of a crank-shaft 13, having one or more fly-wheels 14, either or both of which may be used as belt-wheels. On top of the crank-casing is bolted a cylinder 15, in which is a trunk-piston 16, connected in the usual manner to the crank-shaft.

At one side of the cylinder is bolted a valve-chamber 17, formed in the usual manner and provided with inlet and exhaust valves, of which the stems are indicated at 18 and 19, respectively. This portion of the structure may be similar to that ordinarily followed in the construction of four-cycle engines and forms no part of the present invention. The explosive mixture is fed to the valve-chamber 17 through a supply-pipe 20, and the exhaust is led through a pipe 21 to a muffler 22, which may be of any ordinary construction, and from thence to the outer air in a manner more particularly described hereinafter.

In the upper portion of the explosive-chamber is an insulated sparking plug 24, of the usual construction, and which may be connected to a source of electrical energy in the ordinary manner. In the side of the explosion-chamber is a bearing for the reception of a rock-shaft 25, to the inner end of which is secured a movable contact 26, which forms the opposing terminal of the circuit, the separation of the two electrodes resulting in the formation of an arc and the spark igniting the explosive mixture in the usual manner.

The sparking and the valve-operating mechanisms form no part of the present invention and may be operated in any ordinary manner.

In order to cool the cylinder, I provide in the cylinder-head a port or passage 90, closed by an inwardly-opening check-valve 91. This opening communicates with a number of ports or passages 92, formed in the cylinder-head and communicating in turn with vertically-disposed ports 93, formed in the wall of the cylinder and terminating at the upper portion of the closed crank-chamber 11. The construction is such that on the upstroke of the piston during the compression and exhaust

of the gases a partial vacuum will be created in the crank-chamber and air will be drawn through the opening 90 and downwardly through the ports 92 and 93 to cool the cylinder. This air enters the crank-chamber, and on the downstroke of the piston is forced out through a pipe 95, having an outwardly-opening check-valve 96. The pipe 95 is led directly to the outer air, so that a portion of the air in the tunnel or mine is constantly being pumped to the surface of the ground and must be replaced by fresh air from without, thus creating a natural circulation and at all times keeping up a constant supply of fresh air.

The exploded gases are led from the lower portion of the muffler through a pipe 97 to the air-exhaust pipe 95, the connecting-pipe 97 being provided with an outwardly-opening check-valve 98, so that none of the exploded gases can enter the tunnel or mine and vitiate the air. As a further means of inducing the circulation the muffler may be provided with one or more pipes 99, having inwardly-opening check-valves 100 and a controlling-valve 101 to permit the flow of a quantity of fresh air into the muffler, there to mingle with the exploded gases and be carried off through the air-exhaust pipe 95.

It will of course be understood that the positions of the check-valve and discharge-pipe may be transposed and the air drawn into the crank-chamber direct on the upstroke of the piston and thence discharge upwardly through the passages in the walls of the cylinder and forced out through the discharge-pipe connected to the top thereof, and this change may be made without in any manner departing from my invention.

Having thus described my invention, what I claim is—

1. A ventilating system for mines, tunnels, shafts and the like comprising a gas-engine acting in part as an air-pump to induce the flow of a current of vitiated air from the mine through the cylinder-jacket and thus effecting the heating of the air by radiation and conduction from the heated cylinder, a discharge-pipe leading to the outer air and serving to conduct the vitiated and heated air thereto, and a connecting-pipe for conveying the exhaust from the engine to said pipe to further assist the heating operation and by its force or impact aiding in the movement of the air toward the outlet end of said pipe.

2. A ventilating system for mines, tunnels, shafts and the like, in which a gas-engine is employed for the operation of drills and other tools, said gas-engine acting in part as an air-pump and inducing the current of vitiated air from the mine through the cylinder-jacket to thereby cool the cylinder and at the same time heat the air by conduction and radiation from the cylinder, a discharge-pipe leading from the engine to the outer air and through which said vitiated and heated air is conducted, connections between the exhaust and a muffler, an air-entrance pipe leading to the muffler to conduct thereinto vitiated air from the mines, said pipe being provided with a check-valve, and a connecting-pipe between the muffler and the discharge-pipe to convey away the exhaust and the air entering the muffler, the discharge through the pipe being effected partly by the force or impact of the exhaust, partly by the pumping action of the gas-engine, and partly by the natural tendency of the heated air to rise to the surface end of the pipe.

3. In an apparatus of the class described, a gas-engine having a cylinder and provided with a crank-chamber, air-passages leading through the walls of the cylinder to form a cooling-jacket therefor, the inner side of the piston of the engine acting in connection with the crank-chamber to form a pump for inducing the flow of vitiated air from a mine through the cylinder-passages to thereby cool the cylinder and at the same time heat the air by radiation and conduction from the heated cylinder, an air-discharge pipe leading from the engine to the outer air and provided with an inwardly-closing check-valve, a muffler, a connecting-pipe between the muffler and the exhaust-port of the engine, and a second pipe also containing a check-valve and connecting the muffler to the air-discharge pipe, the connection between the two pipes being at a point beyond the check-valve of the main pipe, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN H. REDFIELD.

Witnesses:

ALEX. A. ANDERSON,

H. RANAHAN.