(No Model.)

J. W. EISENHUTH.

DOUBLE ACTING EXPLOSIVE ENGINE.

No. 430,310. Patented June 17, 1890.

Fig. 1

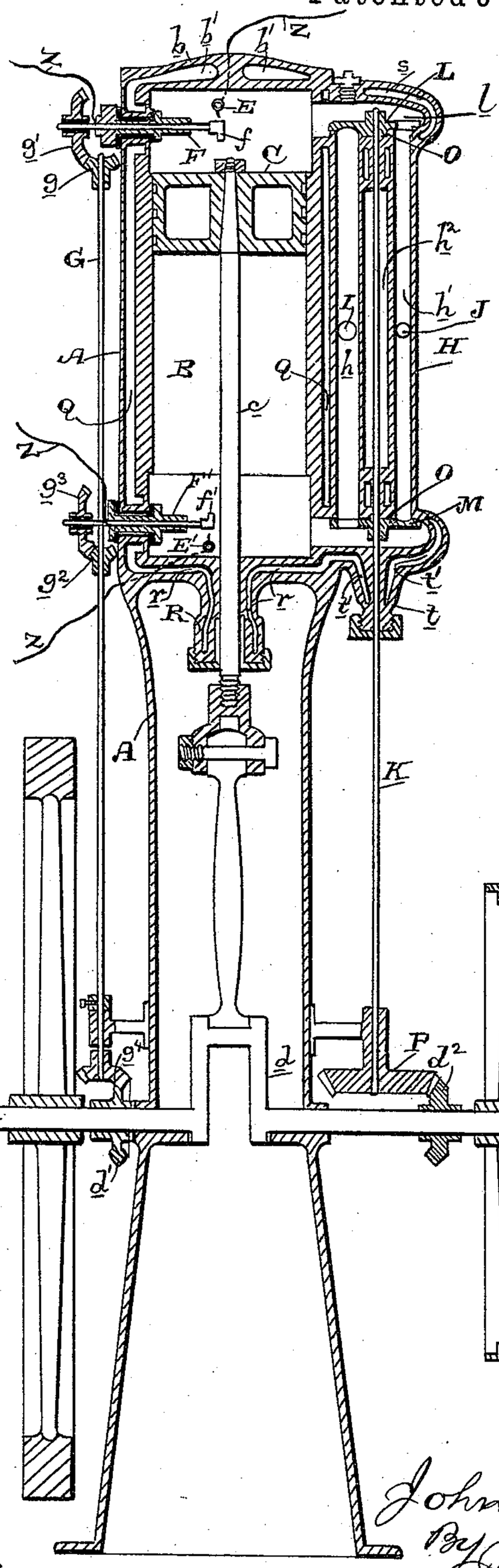
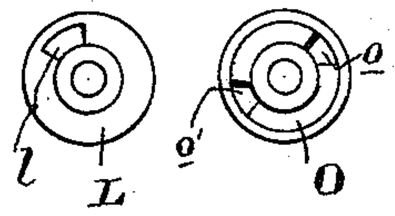


Fig. 3. Fig. 2



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UNITED STATES PATENT OFFICE.

JOHN W. EISENHUTH, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE ELECTRIC VAPOR ENGINE COMPANY, OF SAME PLACE.

DOUBLE-ACTING EXPLOSIVE ENGINE.

SPECIFICATION forming part of Letters Patent No. 430,310, dated June 17, 1890.

Application filed December 6, 1889. Serial No. 332,816. (No model.)

To all whom it may concern:

Be it known that I, JOHN WASHINGTON EISENHUTH, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Double-Acting Explosive Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of explosive engines in which the gas admitted to the cylinder is exploded by means of an electric spark.

My invention consists in the constructions and combinations of devices, all of which will be hereinafter fully described, and specifically pointed out in the claims.

The object of my invention is to provide a simple and effective double-acting engine which can be used as both an explosive engine and a steam-engine, as may be desired, it being so constructed that it can be readily changed from an explosive engine to a steam-engine by taking out the electrodes and plugging up the holes with suitable plugs, then taking off the cylinder-head and bolting on a false piece or a boss to same, which enters the recess of the cylinder, and which fills up the space above the piston, so that there will be no loss of steam, as when working steam it requires very little space between cylinder-head and piston. Not so when working engine explosively, as there must be sufficient space to hold and compress the charge of gas and air before exploding same; hence I must have at least twenty-five times more space between the piston and cylinder-head when working gases and air than when working steam, thus making it necessary to have a deep recessed chamber at each end of the cylinder.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a vertical section of my engine, taken in the longitudinal plane of the crank-shaft. Fig. 2 is a plan of the valve-seat. Fig. 3 is a plan of the valve.

A represents, generally, the shell or frame of the engine, in the upper portion of which is formed the cylinder B, having a cap or head *b*, and having within it the piston C, the rod *c* of which extends down to and is connected with the crank *d* of the crank-shaft D. Projecting through the side of the cylinder at its upper portion is a stationary electrode E, and a similar stationary electrode E′ projects through the side of the cylinder at its lower portion and below the piston. Projecting through the upper portion of the side of the cylinder, at right angles to the stationary electrode E, is a rotary electrode F, consisting of a shaft having on its inner end a contact-point *f*, adapted to be brought into electrical connection with the stationary electrode E. A similar rotary electrode F′ is mounted in the lower portion of the cylinder, and has on its inner end a contact-point *f*′, adapted to be brought into electrical connection with the stationary electrode E′ below. All of these electrodes are suitably insulated from the engine by means of proper non-conducting sleeves or washers separating them from the metal through which they pass.

Z represents the electric wires leading to the several electrodes, whereby they are included in the electric circuit, adapting them when brought into contact to create an electric spark. The means for operating the rotary electrodes consists of a vertical rotary shaft G, mounted in suitable guides on the frame of the engine. This shaft has at its upper end a beveled pinion *g*, which meshes with a beveled pinion *g*′ on the outer end of the rotary electrode above, and suitably insulated therefrom by pressed paper or vulcanized rubber or asbestus sleeves, which pass through the pinion. The shaft also carries the beveled pinion g^2, which meshes with a beveled pinion g^3 on the outer end of the lower rotary electrode and suitably insulated therefrom, as above stated. The lower end of the the shaft carries a beveled pinion g^4, which meshes with a beveled pinion *d*′ on the crank-shaft of the engine. It will be seen from this construction that a rotary motion will be transmitted from the crank-shaft to the rotary electrodes in each end of the cyl-

inder, and their points are relatively so arranged with respect to each other that the spark in the upper end will be created to explode the gas at the proper time and the spark in the lower end will be created to explode the gases in the lower end of the cylinder at the proper time. On one side of the cylinder is formed what may be termed, generally, the "engine-chest" H. This consists of three passages, the innermost passage (designated by *h*) communicating with the cylinder at each end and the outermost passage (designated by *h'*) communicating with the cylinder at each end, the former passage being the exhaust-passage and the latter being the inlet-passage. From the exhaust-passage issues the pipe I and into the inlet-passage enters the pipe J, the former being the exhaust-pipe and the latter being the inlet-pipe for the combined air and gas. Between these two passages in the chest is a third passage h^2, through which passes the valve-stem K, whereby said stem is completely housed and is not interfered with or exposed to the inlet and exhaust passages. The upper end of this stem carries the valve L for the upper end of the cylinder, and it carries below the valve M for the lower end of the cylinder. These valves are similar, but are oppositely arranged, so as to control properly each its own end of the cylinder.

The valve-seat O is shown in Fig. 2. Through its center the valve-stem passes, and on one side is the inlet-port *o* and on the other side the exhaust-port *o'*. The valve itself is shown in Fig. 3, and consists of a disk of metal centrally secured upon the valve-stem, and having throughout one-half of its circumference (more or less) the port *l*. As the valve is rotated this port comes successively into communication with the exhaust-port of the valve-seat and with the inlet-port of said seat. As is shown in Fig. 1, a rotary motion is imparted to the valve-stem to operate the valves by means of a bevel-gear P on the lower end of the stem, which meshes with the bevel-gear d^2 on the crank-shaft.

It will be seen that the cylinder is provided with a water space or jacket Q, which can be used for steam when working engine by steam. As this is a double-acting engine, the piston-rod must extend downwardly through a stuffing-box, which is shown at R, and this stuffing-box is also provided with a water-jacket *r* for the purpose of keeping it cool and preventing the packing from being burned out. The cap or head *b* of the cylinder is also water-jacketed, as shown at *b'*, and the valve casings or housings are also water-jacketed, as shown at *s*. The stuffing-box *t*, through which the valve-stem passes, has a water-jacket *t'*. All of these water-jackets communicate with each other, so there is a complete circulation of water throughout all the parts which are liable to become heated. The water-jacketing of the valve-casings avoids the danger of back-firing into the inlet of the gas. As before stated, the jacket of the cylinder may be used for steam when the engine is being operated by steam, thus keeping the cylinder hot and saving considerable condensation.

Though this engine may be operated by gases forced in from a separate compressor, I prefer it to operate compressively—that is to say, to compress its own gases within the cylinder and to explode them on alternate strokes. To effect this, the power-transmitting gears will be suitably combined and arranged to provide for the proper motion of the electrodes, and the controlling-valves and their operating-gears will be properly constructed. For example, the gear d^2 on the crank-shaft would be but one-half the diameter of the gear P on the valve-stem, and the port *l* in the valve would be about equal to or a little larger than either of the ports *o* or *o'* in the valve-seat.

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

1. In an explosive engine, and in combination with its cylinder and piston, the valve-chest on its side, having separate exhaust and inlet passages communicating with the cylinder, and the rotary valve controlling said passages, said valve having the curved port in one side, substantially as herein described.

2. In an explosive engine, and in combination with its cylinder and piston, the valve-chest on one side of the cylinder, having the separate exhaust and inlet passages communicating with the ends of the cylinder and the intervening passage, the rotary valve-stem passing upwardly through said intervening passage, and the ported valves on said stem, controlling the exhaust and inlet passages to the ends of the cylinder, substantially as herein described.

3. In an explosive engine, the cylinder, the piston thereof, and the crank-shaft operated by the piston, in combination with the valve-chest on one side of the cylinder having the separate exhaust and inlet passages communicating with each end of the cylinder, and the intervening passage, the rotary valve-stem passing up through said intervening passage, the ported valves upon said stem for controlling the exhaust and inlet passages, and the means for rotating said stem, consisting of the pinion on its lower end and the pinion on the crank-shaft, substantially as herein described.

In witness whereof I have hereunto set my hand.

JOHN W. EISENHUTH.

Witnesses:
S. H. NOURSE,
H. C. LEE.