L. A. FRAYER & C. O. HOWARD.

EXPLOSIVE ENGINE.

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908,657. Patented Jan. 5, 1909.

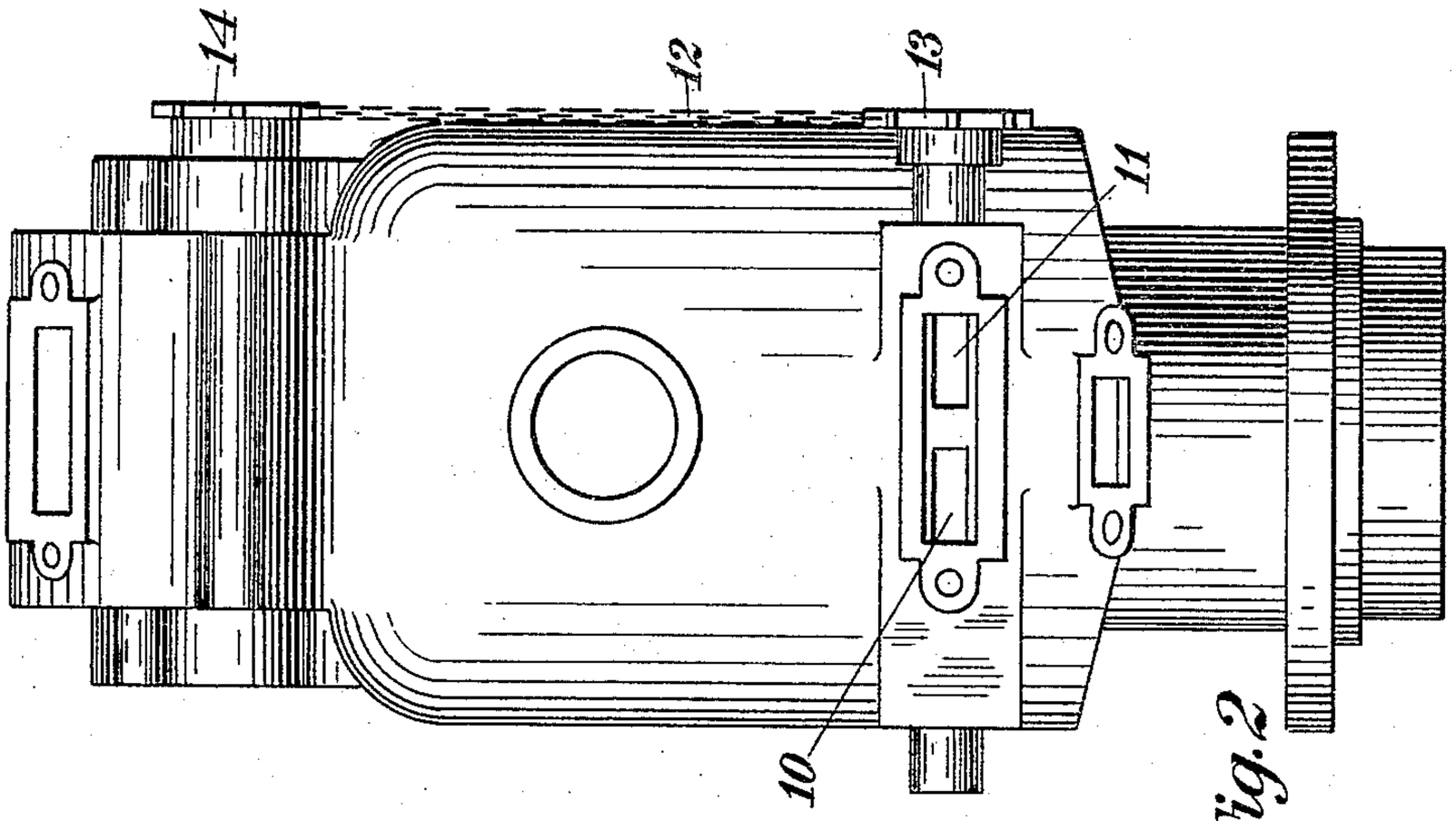

Fig. 2

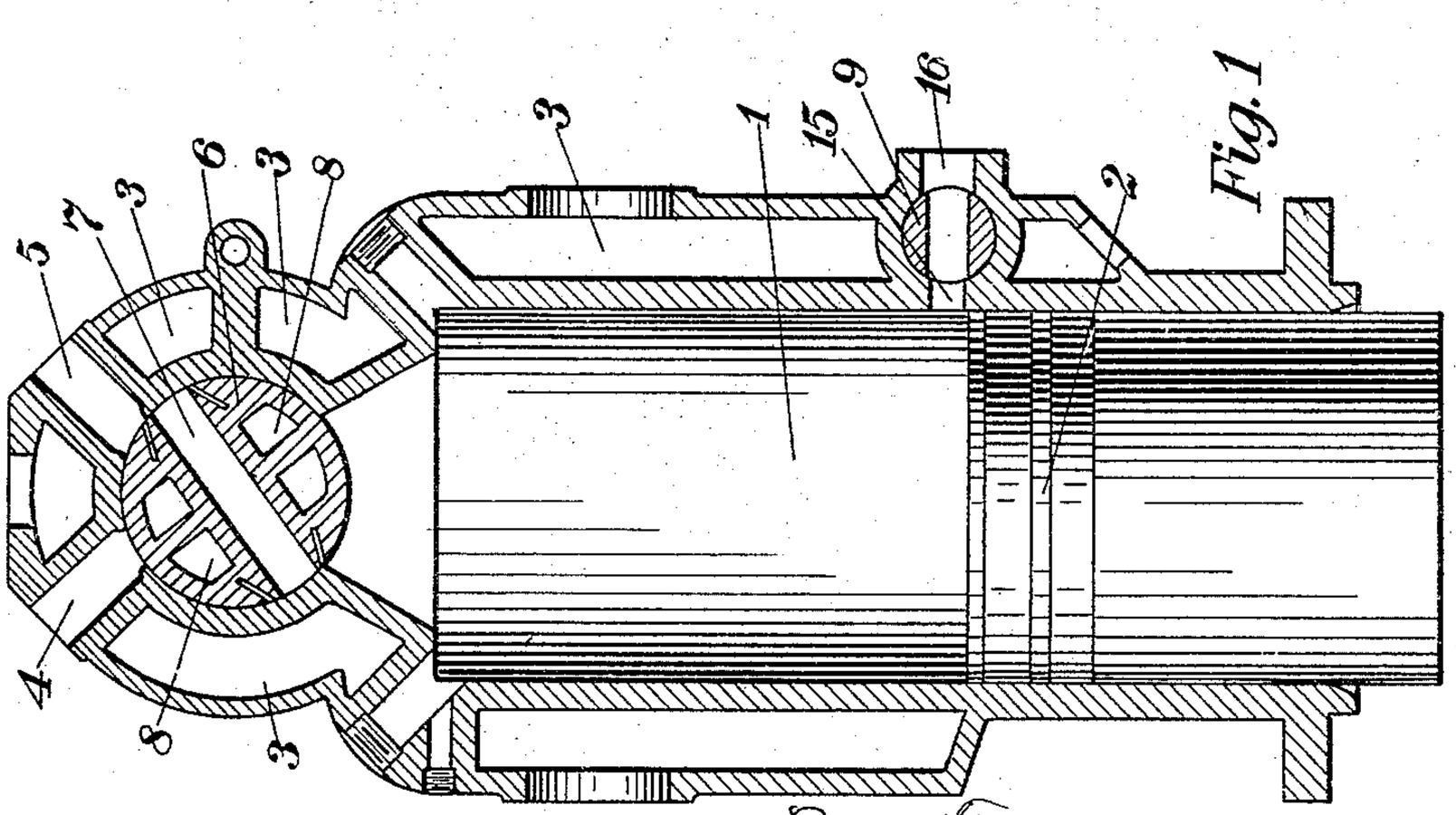

Fig. 1

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UNITED STATES PATENT OFFICE.

LEE A. FRAYER AND CHARLES O. HOWARD, OF COLUMBUS, OHIO, ASSIGNORS OF ONE-THIRD TO MOSES W. KOUNS, OF COLUMBUS, OHIO.

EXPLOSIVE-ENGINE.

No. 908,657. Specification of Letters Patent. Patented Jan. 5, 1909.

Application filed August 31, 1908. Serial No. 451,015.

To all whom it may concern:

Be it known that we, LEE A. FRAYER and CHARLES O. HOWARD, citizens of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

Our invention relates to improvements in explosive engines, especially in an auxiliary exhaust valve construction for use in an engine containing a main valve of the rotary form or main valves of other desired constructions.

In our construction it is contemplated that the exhaust through the main valve will take place directly after the exhaust has taken place through the auxiliary valve, whereby the greater portion of the exhaust gases will pass out through the auxiliary exhaust valve. Our auxiliary exhaust valve is adapted for rotation, having the opening extending therethrough preferably in a right line, and the exhaust will take place therethrough twice during each revolution thereof; the passage of the exhaust gases tends to produce a carbon deposit in the passageway, and as the exhaust passes alternately therethrough from one side and from the other, the effect will be to sweep off and carry away the deposit produced at the edges of the opening through the valve by the passage of the exhaust gases therethrough from the opening on the opposite side. In this manner the passageway through the valve will be kept free and open at all times. Further, in our construction, the exhaust gases sweep on a right line through the valve and ports, which construction disposes of the exhaust in the most expeditious manner, only a slight amount of the heat being communicated to the valve and ports as compared with the heat communicated in a construction utilizing a puppet valve in which the exhaust gas is required to change its direction in being carried away. By the use of our rotary exhaust valve, the exhaust gas is effectually excluded and prevented from being returned to the cylinder during the suction stroke of the piston.

In the accompanying drawings which are hereto attached and hereby made a part of this specification, Figure 1 is a vertical transverse section through a cylinder having our rotary exhaust valve applied thereto, and Fig. 2 is an elevation of the construction shown in section in Fig. 1, disclosing especially the manner of operating the valve.

In the drawings in which the same numeral indicates the same part throughout, 1 is a cylinder having the piston 2 mounted therein for reciprocation in the usual manner.

3 indicates the compartments for the cooling fluid, surrounding especially the upper portion of the cylinder and the main valve chamber.

4 indicates the inlet port and 5 the exhaust port, 6 is a rotary valve provided with a diametrical passageway 7 therethrough to be brought into register with the inlet and the exhaust ports at predetermined intervals, and in Fig. 1, the passageway 7 is just on the point of being opened to communication between the cylinder and the exhaust port 5. Chambers or passageways 8 within the body of the valve 6 are provided for the distribution therethrough of the cooling medium. Preferably in the construction of the rotary valve shown in Fig. 1 at 6, the intake, compression and explosion, and exhaust occur once during each half revolution thereof.

We have found that in connection with a main valve or valves, an auxiliary exhaust is of very great advantage and benefit, and we have provided a rotary valve 9 for that purpose, which we mount in the walls of the cylinder, as shown, the walls being properly chambered and having a passageway or port 15 connecting with the interior of the cylinder and the passageway 16 connecting with the exterior. The rotary valve 9 is provided with the passageways 10 and 11 therethrough, and is connected by means of the chain 12 working over the sprockets 13 and 14 with the rotary valve 6; the movement of the two valves is so timed that the auxiliary exhaust valve 9 is opened for the discharge of the exhaust when the piston 2 is clearing the port 15 on its downward travel, thereby permitting the exhaust to escape first through the auxiliary exhaust valve. When the piston 2 has reached its lowermost point, just below the auxiliary exhaust port 15, the passageway 7 of the main valve is just coming into communication with the exhaust port 5, whereby the burned gases remaining in the cylinder 1 are exhausted, the exhaust being aided and expedited by means of the subsequent upward or scavenging stroke of the piston. As this scavenging stroke is com-

pleted, the valve 6 has moved onwardly carrying the passageway out of register with the exhaust port, but bringing it in position for subsequently registering with the inlet port whereby a fresh charge of the combustible material is furnished to the cylinder. Meanwhile the piston has again receded, and upon making its return stroke compresses the charge and the latter is then fired, whereupon the piston retreats and upon uncovering the port 15, the burned gases are exhausted thereinto through the valve 9 and out through the opening 16; just as the piston 2 has cleared the port 15 thereby completely opening the same, the passageway through the main valve is being brought into increasing register with the exhaust port 5, as above described.

The rotary valve 9 moves in unison with valve 6 and both valves are preferably so connected with the driving shaft that they perform one revolution while the driving shaft performs four. Assume that the charge has just been fired, and the piston is on its downward stroke; the valve 9 is rotating into register with the ports 15 and 16, and when the piston 2 has cleared the port 15, said registration is complete and the exhaust rushes out through the passageway thus created; the piston thus begins its upward or scavenging stroke, and meanwhile the main valve is being positioned for the exhaust out through the port 5, and as the piston travels upwardly the exhaust gases remaining in the upper portion of the cylinder are expelled through the main valve. Meanwhile the valve 9 has rotated out of register with the ports 15 and 16, and the exhaust gas that passed outwardly is prevented from returning to the cylinder. The succeeding return stroke of the piston is the suction stroke, during which the exhaust valve is closed. The following stroke of the piston is the compression stroke, and upon firing the compressed charge, the same cycle of movement takes place, and upon the uncovering of the port 15 by the piston on its downward stroke, the valve 9 is positioned in registration with the ports 15 and 16 for the escape of the exhaust gases, the escape being through the valve from the opposite side thereof to that through which the preceding exhaust took place. The exhaust thus taking place through the valve 9 from the opposite sides thereof alternately, any deposits of carbon upon the edges of the valve opening will be swept away by the succeeding exhaust, therefore the valve will be kept free and clear. By the use of the rotary auxiliary exhaust, we provide a passageway for the exhaust on a right line, whereby the tendency of the same to heat the adjacent parts is diminished; excessive heating and accumulating of carbon from the burned gases is inevitable in the use of the puppet valve construction for the auxiliary exhaust, and our improvements herein constitute a marked advance over the constructions hitherto in use.

We do not desire to confine ourselves to the specific construction shown and described, and in fact contemplate the use of our rotary auxiliary exhaust valve in engines of which the main valves are of the puppet style, or of any other style.

What we claim is:

1. In an explosive engine, having a main valve construction, a rotary auxiliary exhaust valve positioned in the wall of said engine and arranged to permit the passage of the exhaust gases from the cylinder twice during each rotation thereof, and means for actuating said rotary valve.

2. In an explosive engine having a main valve construction, a port opening through the side wall thereof, a rotary auxiliary exhaust valve positioned to register with said port twice during each revolution thereof, whereby the deposit of carbon in the passageway of said valve by the exhaust therethrough is swept away by the following exhaust therethrough.

3. In an explosive engine having a main valve construction and a straight port through the side wall thereof, a rotary valve having a passageway therethrough for registration with said port, whereby the exhaust takes place on a right line and the carbon deposit of one exhaust is swept away by a subsequent exhaust.

In testimony whereof we affix our signatures in the presence of two witnesses.

LEE A. FRAYER.
CHARLES O. HOWARD.

Witnesses:
GEO. W. RIGHTMIRE,
A. RAGER.