No. 793,842. PATENTED JULY 4, 1905.

R. O. LE BARON.

EXPLOSION ENGINE.

APPLICATION FILED JUNE 4, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

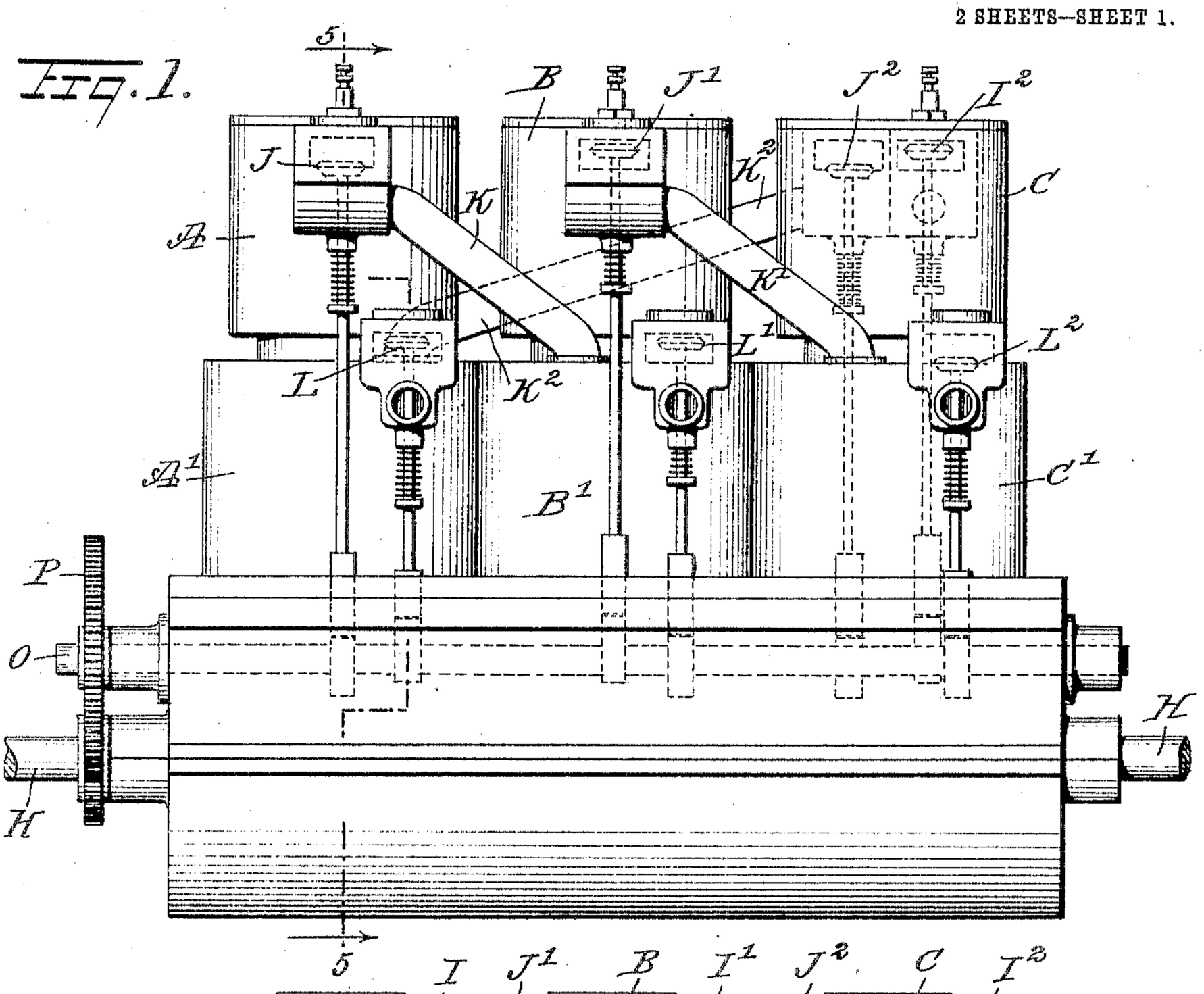

Fig. 2.

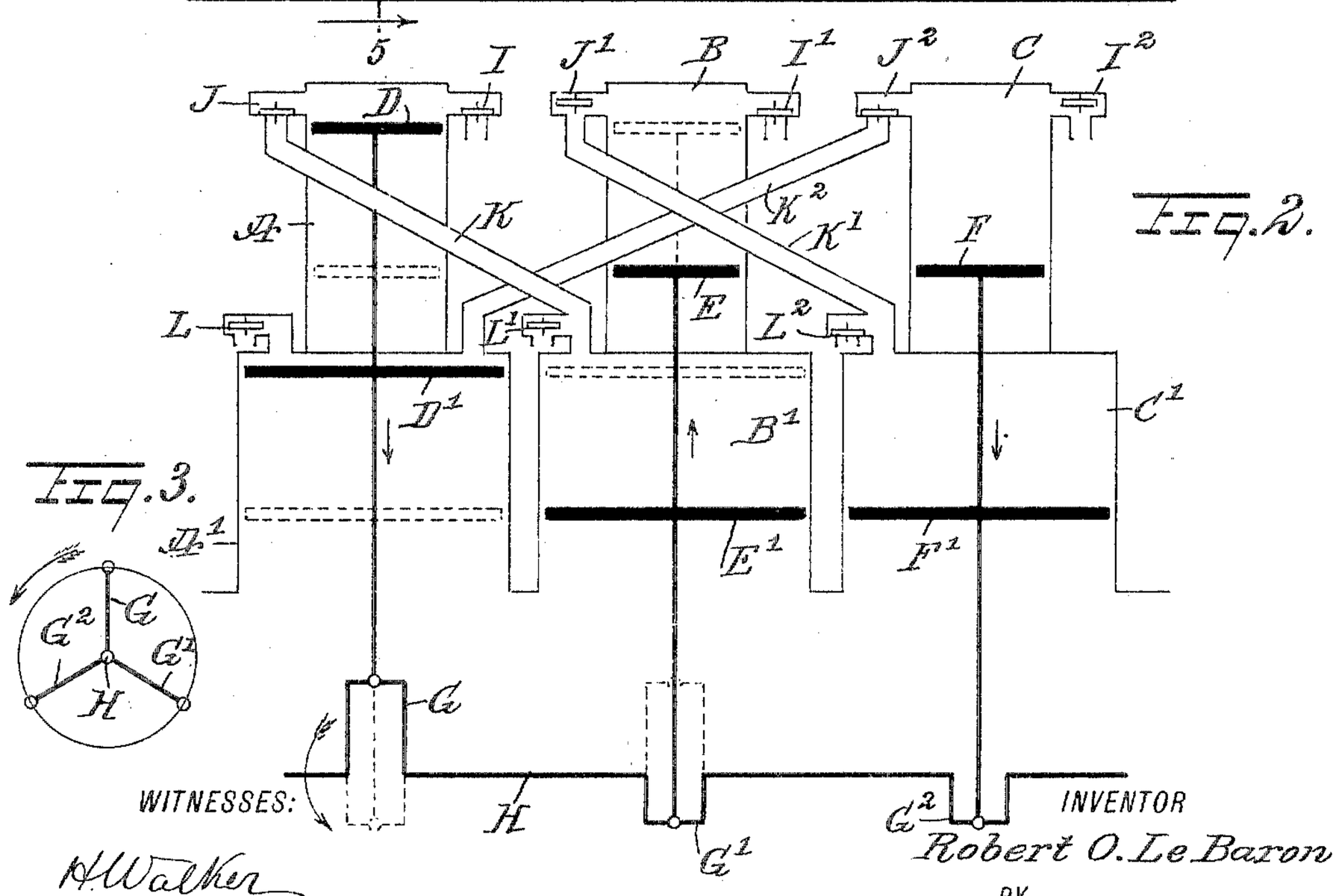

Fig. 3.

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Fig. 4.

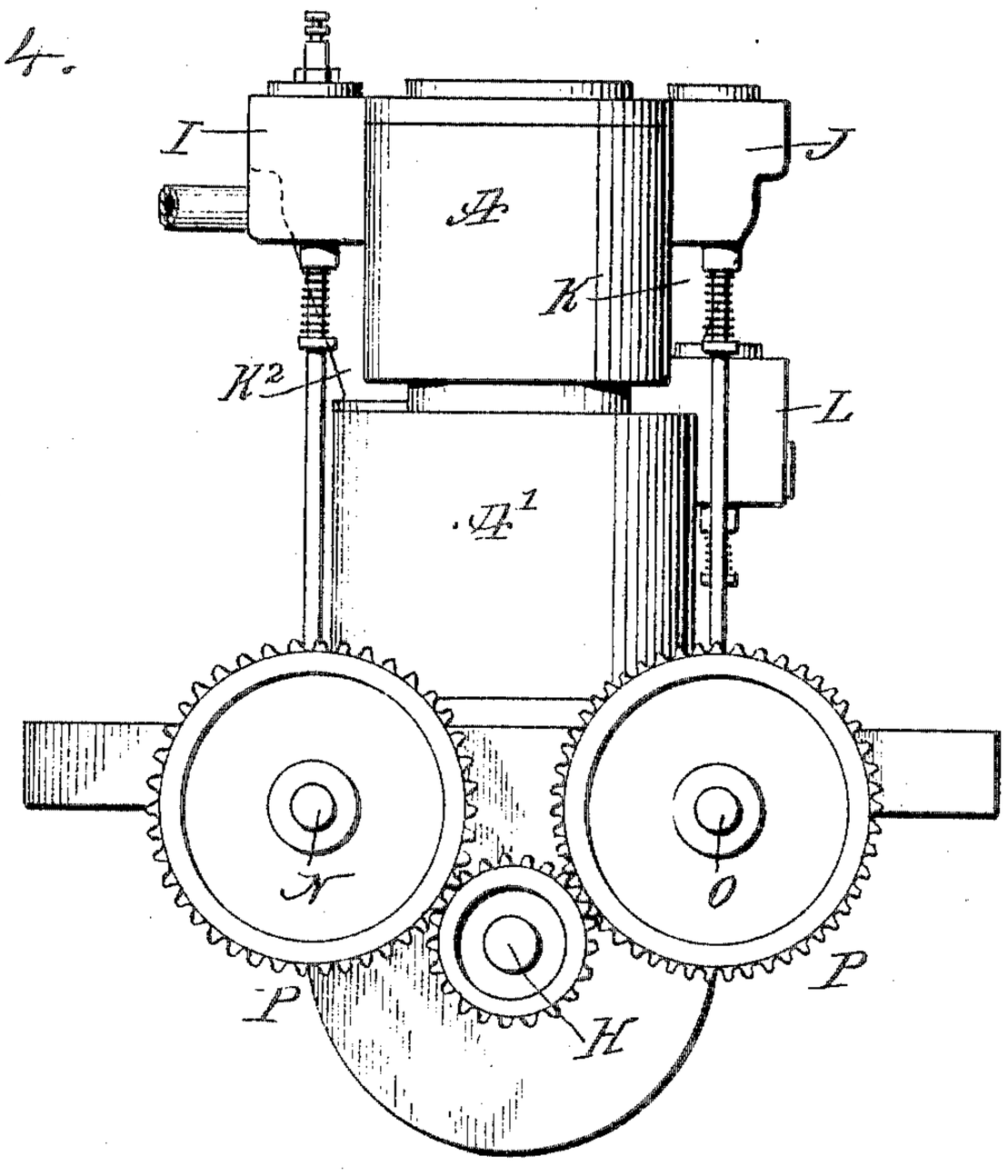
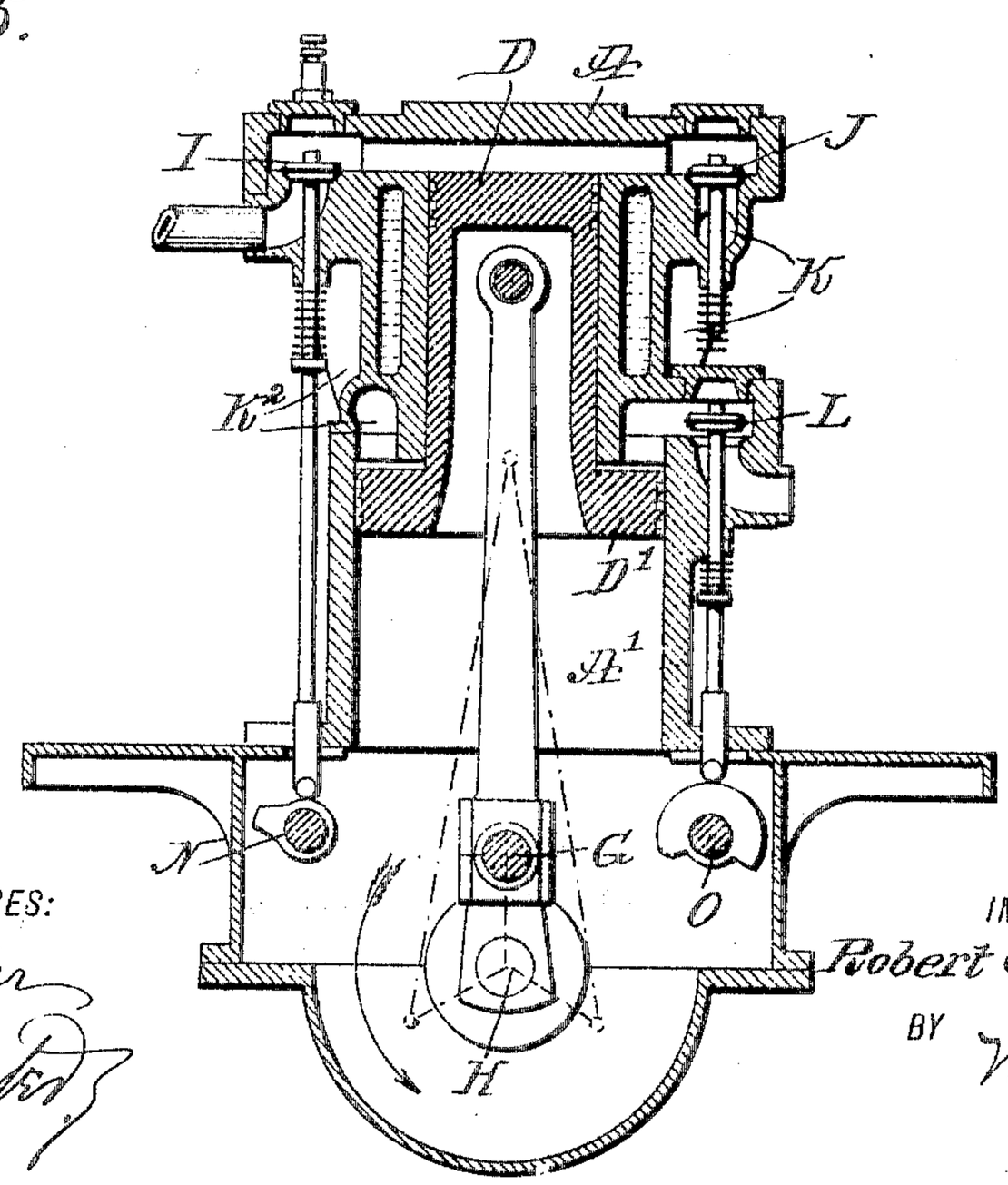


Fig. 5.



WITNESSES:

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No. 793,842. Patented July 4, 1905.

UNITED STATES PATENT OFFICE.

ROBERT OWEN LE BARON, OF PONTIAC, MICHIGAN, ASSIGNOR OF ONE-HALF TO GEORGE H. DRAKE, OF PONTIAC, MICHIGAN.

EXPLOSION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 793,842, dated July 4, 1905.

Application filed June 4, 1904. Serial No. 211,137.

To all whom it may concern:

Be it known that I, ROBERT OWEN LE BARON, a citizen of the United States, and a resident of Pontiac, in the county of Oakland and State of Michigan, have invented a new and Improved Explosion-Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved gas, gasolene, or the like explosion-engine arranged to utilize the expansive power of the gas to the fullest advantage and to allow running the engine with the greatest economy.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

A practical embodiment of my invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of my improvement. Figs. 2 and 3 are diagrammatic views of the improvement. Fig. 4 is an end view of the improvement, and Fig. 5 is a transverse section of the same on the line 5 5 of Fig. 1.

The explosion-engine illustrated in the drawings is of the four-cycle type and is provided with three pairs of cylinders A A′, B B′, and C C′, of which the cylinders A, B, and C are the high-pressure cylinders and the cylinders A′, B′, and C′ are the low-pressure cylinders. In the pair of cylinders A A′ reciprocate the connected pistons D D′, and similar pistons E E′ reciprocate in the pair of cylinders B B′, and like pistons F F′ operate in the pair of cylinders C C′. The several pairs of connected pistons D D′, E E′, and F F′ are connected with crank-arms G, G′, and G^2, set at angles one to the other, as plainly indicated in Fig. 3, and forming part of the crank-shaft H, journaled in suitable bearings on the main frame of the engine.

The high-pressure cylinders A, B, and C are provided at their upper or working ends with inlet-valves I I′ I^2, respectively, and also with exhaust-valves J J′ J^2, respectively, of which the valve J is connected by a pipe K with the upper or working end of the low-pressure cylinder B′, the exhaust-valve J′ of the high-pressure cylinder B is connected by a pipe K′ with the working end of the low-pressure cylinder C′, and the exhaust-valve J^2 of the high-pressure cylinder C is connected by a pipe K^2 with the working end of the low-pressure cylinder A′.

From the foregoing it will be seen that the exhaust-valve of the high-pressure cylinder of one pair of cylinders is connected with the working end of the low-pressure cylinder of another pair of cylinders, so that the exhaust-gas from the high-pressure cylinder of one pair of cylinders can pass into the low-pressure cylinder of another pair of cylinders to work expansively therein and press on the corresponding low-pressure-cylinder pistons D′ E′ F′, respectively, and at the same time the corresponding high-pressure piston is at the downward suction-stroke.

The working or upper ends of the low-pressure cylinders A′, B′, and C′ are provided with exhaust-valves L, L′, and L^2, respectively, and the inlet-valves I I′ I^2 for the several high-pressure cylinders are controlled by suitable mechanism from a cam-shaft N, and the exhaust-valves J J′ J^2 L L′ L^2 are controlled by suitable mechanism from a cam-shaft O, both cam-shafts N and O being driven by a suitable gearing P from the main crank-shaft H.

The working ends of the high-pressure cylinders A, B, and C are provided with the usual igniting devices. (Not shown.)

The operation is as follows: When the several parts are in the position as indicated in the drawings, then the explosion has taken place in the upper end of the high-pressure cylinder A, so that the piston D therein is forced downward by the force of the explosion. The piston E in the high-pressure cylinder B is now on its return or exhaust stroke, while the piston F in the cylinder C is on its downward or suction stroke, and the gases from the previous explosion in the high-pressure cylinder B now pass from this cylinder, by way of the valve J′ and pipe K′, into the cylinder C′ to press on the piston F′ to aid the

latter in its downward stroke, so that the exhaust-gases from the high-pressure cylinder B are utilized in the low-pressure cylinder C′ at the time the pistons F F′ are on the downward stroke, the piston F in addition being on its suction-stroke. Now when the piston D is on its return or upward stroke the valve J opens and the gases from the previous explosion pass through the pipe K into the cylinder B′ to press on the piston E′, so as to aid the latter in its downward stroke, as the piston E is now on its downward or suction stroke. At the time this takes place an explosion occurs in the upper end of the cylinder C, so that the piston F is forced downward by the force of the explosion, and when this piston is on the return stroke then the valve J^2 opens to allow the gases to pass from the high-pressure cylinder C, by way of the pipe K^2, into the low-pressure cylinder A′ to act on the piston E′ therein when the latter is on the downstroke and its companion piston D is on the suction-stroke. From the foregoing it will be seen that while the piston in a high-pressure cylinder is on the suction-stroke to draw in a fresh supply of gas its companion piston in the low-pressure cylinder is actuated on by the expansive force of the gases delivered into this low-pressure cylinder from the high-pressure cylinder of another pair of cylinders, and consequently the expansive force of the gases is utilized without requiring explosions in the low-pressure cylinders.

It is understood that I do not limit myself to the number of pairs of cylinders shown and described, as the same may be varied and two or more than three pairs of cylinders may be used and connected with each other in the manner above described for producing the desired result.

It is understood that when the pistons D′, E′, and F′ are on the return stroke during the compression period the corresponding exhaust-valves L L' L^2 open to allow free exhaust of the gases from the working ends of the low-pressure cylinders A′ B′ C′.

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

1. An explosion-engine having pairs of cylinders, each pair consisting of a high-pressure cylinder and a low-pressure cylinder, the exhaust of the high-pressure cylinder in one pair of cylinders being connected with the low-pressure cylinder of another pair of cylinders at the time the high-pressure cylinder of this last-mentioned pair of cylinders is on the suction-stroke.

2. An explosion-engine having pairs of cylinders, each pair consisting of a high-pressure cylinder and a low-pressure cylinder, the exhaust of the high-pressure cylinder of one pair of cylinders being connected with the pressure side of the low-pressure cylinder of another pair of cylinders, the connections being such that the high-pressure cylinder of one pair of cylinders is connected with the low-pressure cylinder of another pair at the time the high-pressure cylinder for the last-mentioned pair of cylinders is on the suction-stroke.

3. An explosion-engine having pairs of cylinders, each pair consisting of a high-pressure cylinder and a low-pressure cylinder, the exhaust of the high-pressure cylinder in one pair of cylinders being connected with the pressure side of the low-pressure cylinder of another pair of cylinders, connected pistons for each pair of cylinders, a crank-shaft having its cranks set at angles one to the other and connected with the said connected pistons, and valves controlled from the said crank-shaft and controlling the flow of the gas from the high-pressure cylinders to the low-pressure cylinders.

4. An explosion-engine having pairs of cylinders, each pair consisting of a high-pressure cylinder and a low-pressure cylinder, the exhaust of the high-pressure cylinder in one pair of cylinders being connected with the pressure side of the low-pressure cylinder of another pair of cylinders, connected pistons for each pair of cylinders, a crank-shaft having its cranks set at angles one to the other and connected with the said connected pistons, valves controlled from the said crank-shaft and controlling the flow of the gas from the high-pressure cylinders to the low-pressure cylinders, and exhaust-valves for the low-pressure cylinders and controlled from the said crank-shaft.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBT. OWEN LE BARON.

Witnesses:
A. Le Baron,
R. L. Owens.