No. 611,125. Patented Sept. 20, 1898.

H. A. HUMPHREY.

GAS OR OIL MOTOR ENGINE.

(Application filed Nov. 30, 1897.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

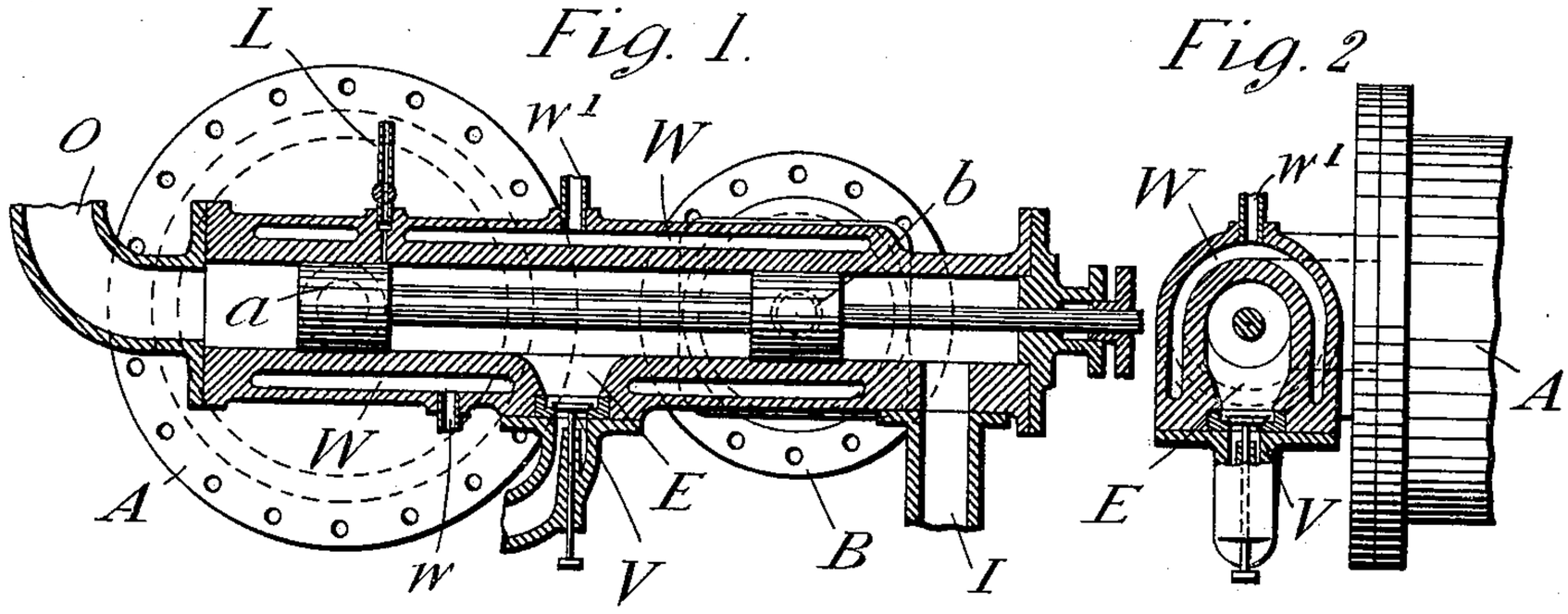


Fig. 2

Fig. 3.

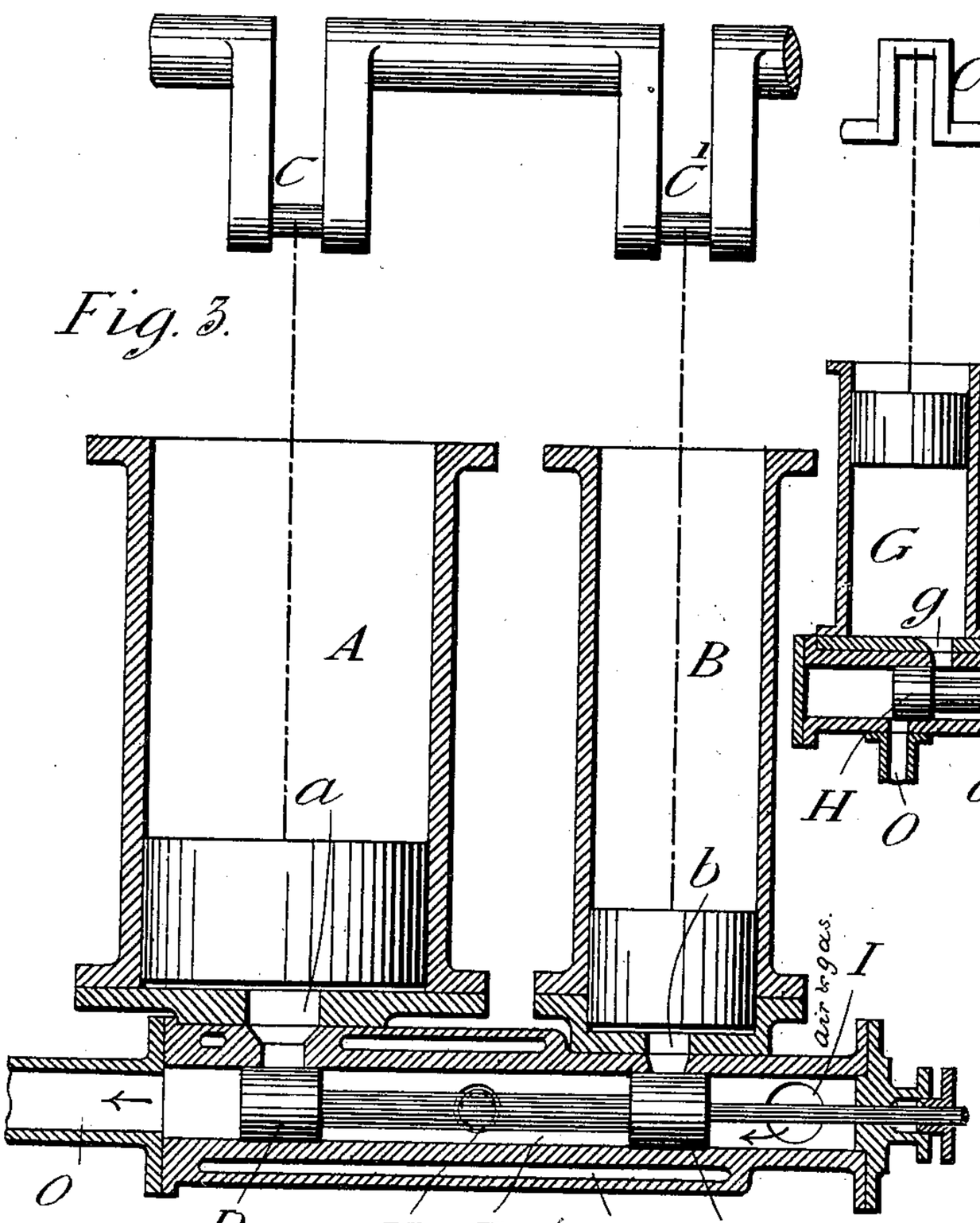
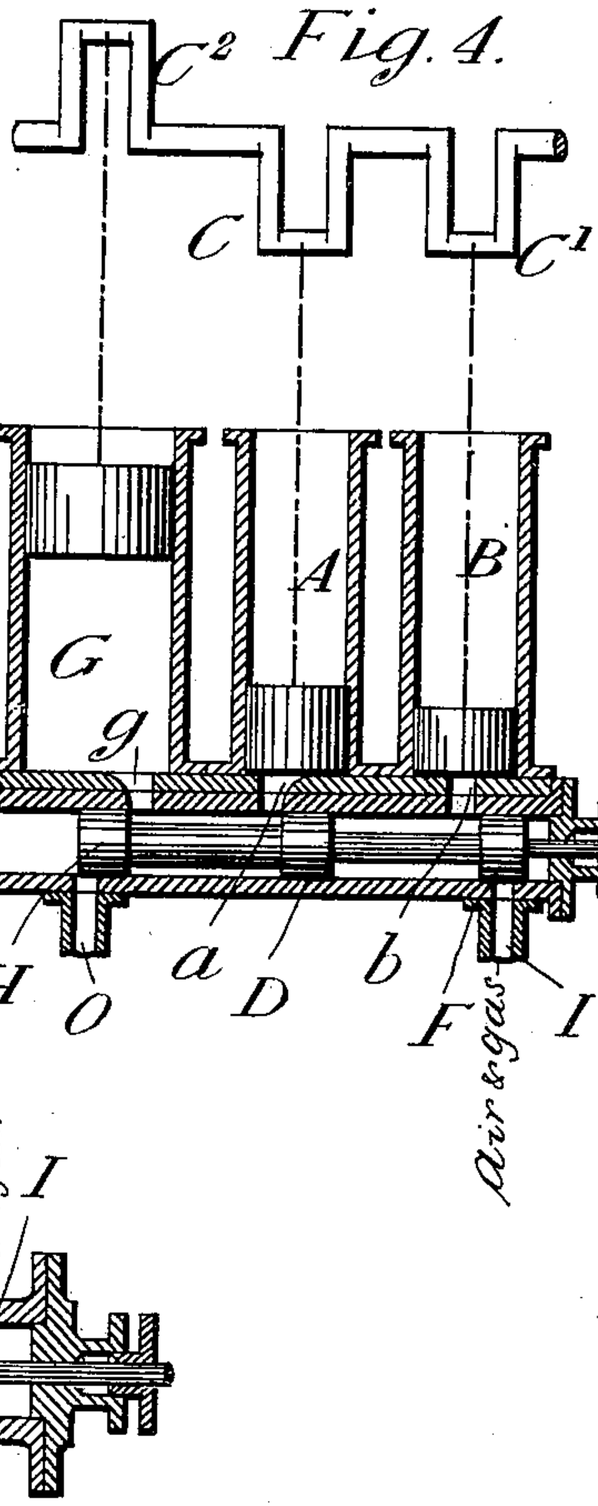


Fig. 4.



Witnesses:
James F. Mansfield
Wm. C. Sullivan

Inventor:
Herbert Alfred Humphrey.
By Alexander & Dowell

No. 611,125. Patented Sept. 20, 1898.

H. A. HUMPHREY.

GAS OR OIL MOTOR ENGINE.

(Application filed Nov. 30, 1897.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 5.

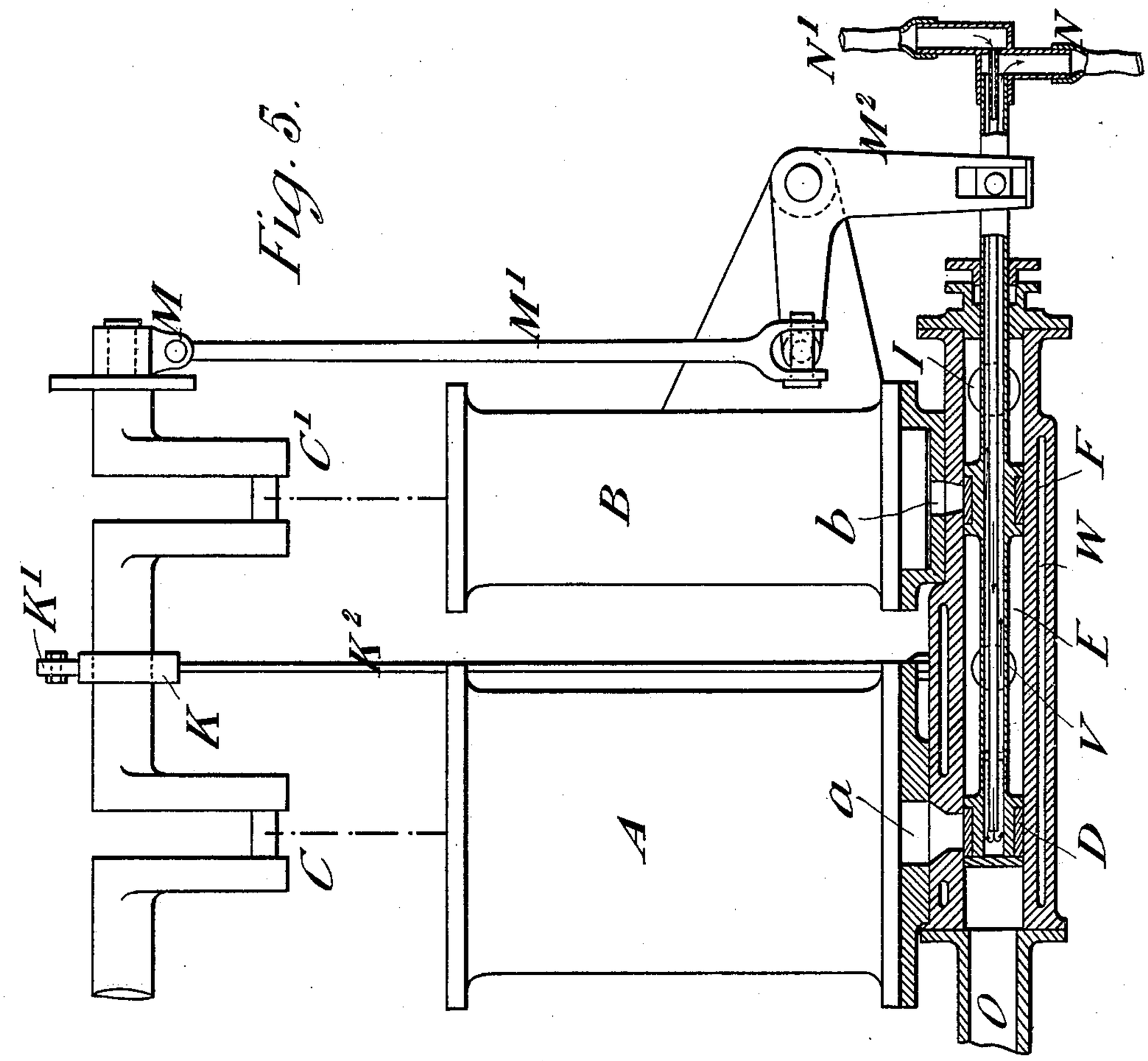
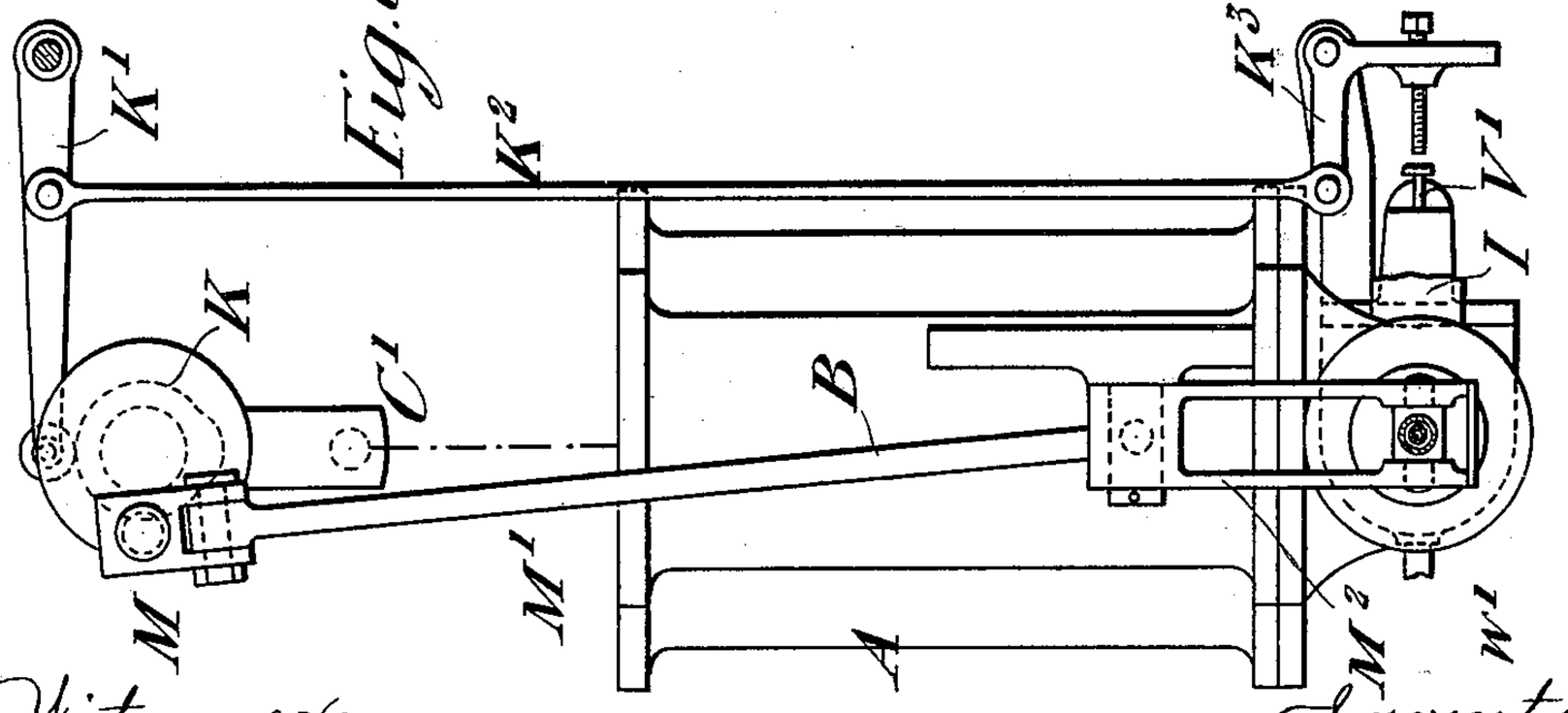


Fig. 6.



Witnesses:
James R. Mansfield.
William C. Sullivan.

Inventor:
Herbert A. Humphrey.
By: Alexander & Dowell
Attorneys.

UNITED STATES PATENT OFFICE.

HERBERT ALFRED HUMPHREY, OF NORTHWICH, ENGLAND.

GAS OR OIL MOTOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 611,125, dated September 20, 1898.

Application filed November 30, 1897. Serial No. 660,261. (No model.) Patented in England January 5, 1895, No. 347.

To all whom it may concern:

Be it known that I, HERBERT ALFRED HUMPHREY, engineer, a citizen of England, residing at West View, Winnington, Northwich, in the county of Chester, England, have invented certain new and useful Improvements in Gas or Oil Motor Engines, (for which I have obtained a patent in Great Britain, No. 347, bearing date January 5, 1895,) of which the following is a specification.

My invention relates to a simple construction of a gas or oil motor engine whereby I obtain economy and efficiency of action, as I shall describe, referring to the accompanying drawings.

Figure 1 is a longitudinal and Fig. 2 a transverse section of the valve and combustion-chamber of an engine according to my invention, of which Fig. 3 is a sectional plan. Fig. 4 is a sectional plan of a modification by which the engine is adapted to work as a compound engine. Fig. 5 is a plan view, partly in section; and Fig. 6 is a side elevation showing the mechanism for actuating and cooling the valves.

Referring first to Figs. 1, 2, and 3, A is the working cylinder of a gas or oil motor engine having its piston connected to a crank C, and B is a pump-cylinder having its piston worked from a crank C′, which is on the same shaft with C and coincides or nearly coincides with it in position. Both cylinders communicate by ports *a* and *b* with a valve and combustion chamber E, in cylindrical portions of which the piston-valves D and F, rigidly connected together, are caused to reciprocate by a crank M on the engine-shaft, working by a rod M′, a bell-crank lever M^2, jointed to the valve-rod, or its equivalent. Near one end of the chamber E is an inlet I for a mixture of air with gas or oil vapor, and at the other end there is an outlet O for discharge of exhaust. In another part of the chamber there is a check-valve V, covering an outlet. This valve is worked by a cam K on the engine-shaft, causing reciprocation of lever K′, rod K^2, and bell-crank lever K^3, which act on the valve B′. The chamber E is preferably kept cool by water circulating in a jacket W from inlet *w* to outlet *w*′. Water may also circulate through the valves D F and their rod, the valves being in that case made hollow, and a tubular rod having an internal tube, both connected to flexible tubes N N′ for discharge and supply, as shown in Fig. 5.

The engine operates in the following manner: When the valves F D are in the position shown, the space in E between them contains high-pressure combustion-gases. The valves F and D being then moved to the left, so as to put port *b* in communication with I and to put *a* in communication with the space in E between the valves, the high-pressure gases expanding from E into the cylinder A propel its piston. At the same time the piston of B making its outstroke draws in by ports I and *b* a mixture of air and gas and finally air. The valves F D being moved to the right, so as to put port *b* in communication with the space in E between the valves and to put *a* in communication with O, and the valve V being opened during the first part of the instroke of the piston, the pistons are caused by the momentum of the fly-wheel to make their instrokes, the piston of B first forcing air through the chamber E to sweep out the residuary products of combustion, and then on the valve V being closed forcing mixed air and gas into E to mix with the air already there and compressing the whole, while the piston of A discharges exhaust through *a* and O. The valves F D being again moved to the position shown, the gaseous mixture in E is fired by electricity or by an ignition-tube L or otherwise, so that the space between the valves contains high-pressure combustion-gases, whereupon the action is repeated.

As shown in Fig. 4 the cylinder A is made smaller and another larger cylinder G is provided having its piston connected to a crank C^2, opposite the crank C C′. The valve-rod is also extended to the left, connecting to a third piston-valve H, which governs a port *g* to cylinder G and the outlet-port O. The operation is the same as that above described so far as regards the pump B and cylinder A, which in this case constitutes a high-pressure cylinder; but the gases, after performing work in A, instead of directly escaping as exhaust pass first by *a* and *g* into the larger cylinder G and expand therein, performing further work, and finally escape at O. The addi-

tional piston-valve H and the ports *g* and O are arranged relatively to the other pistons and ports suitably for this cycle of operations.

Having thus described the nature of this invention and the best means I know for carrying the same into practical effect, I claim—

1. The combination of a working cylinder, a pumping-cylinder, pistons therein, a crank-shaft to which both pistons are connected, a combined valve and combustion chamber communicating with each of said cylinders by separate ports and inlet and outlet ports leading into said chamber, with a pair of valves in said chamber adapted, when shifted in one position to simultaneously establish communication between the inlet-port and pump-cylinder, and between the working cylinder and space between the valves; and when shifted to another position to establish communication between the working cylinder and the outlet-port, and between the pumping-cylinder and the space between the valves between the pistons, for the purpose and substantially as described.

2. The combination of a pumping and a working cylinder, and a combined exploding and valve chamber communicating with each of said cylinders by separate ports, and having inlet and exhaust ports at its opposite ends, with a check-valve in said chamber intermediate the valves, and a pair of valves in said valve-chamber adapted to first establish communication between the inlet and the pumping-cylinder, and between the space between the valves and the working cylinder, and then to establish communication between the working cylinder and the outlet, and between the pump-cylinder and the space between the valves; and means for opening the check-valves during part of the return stroke of the pistons, for the purpose and substantially as described.

3. The combination in a gas or oil motor engine, of a pumping-cylinder, a primary and secondary working cylinder, the pistons in said cylinders, and the crank-shaft to which all said pistons are connected substantially as described; with a combined exploding and valve chamber having single-port communication with one end of each cylinder, triple valves in said valve-chamber rigidly connected to a common rod, an inlet-port at one end of said chamber, and an outlet-port at the other end, and a valve arranged intermediate the first and second valves, and means for operating said valves, all for the purpose and substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 15th day of November, A. D. 1897.

HERBERT ALFRED HUMPHREY.

Witnesses:
ALBERT WILLIAM IMRAY, Jr.,
H. BERTRAM BRUNNER.