

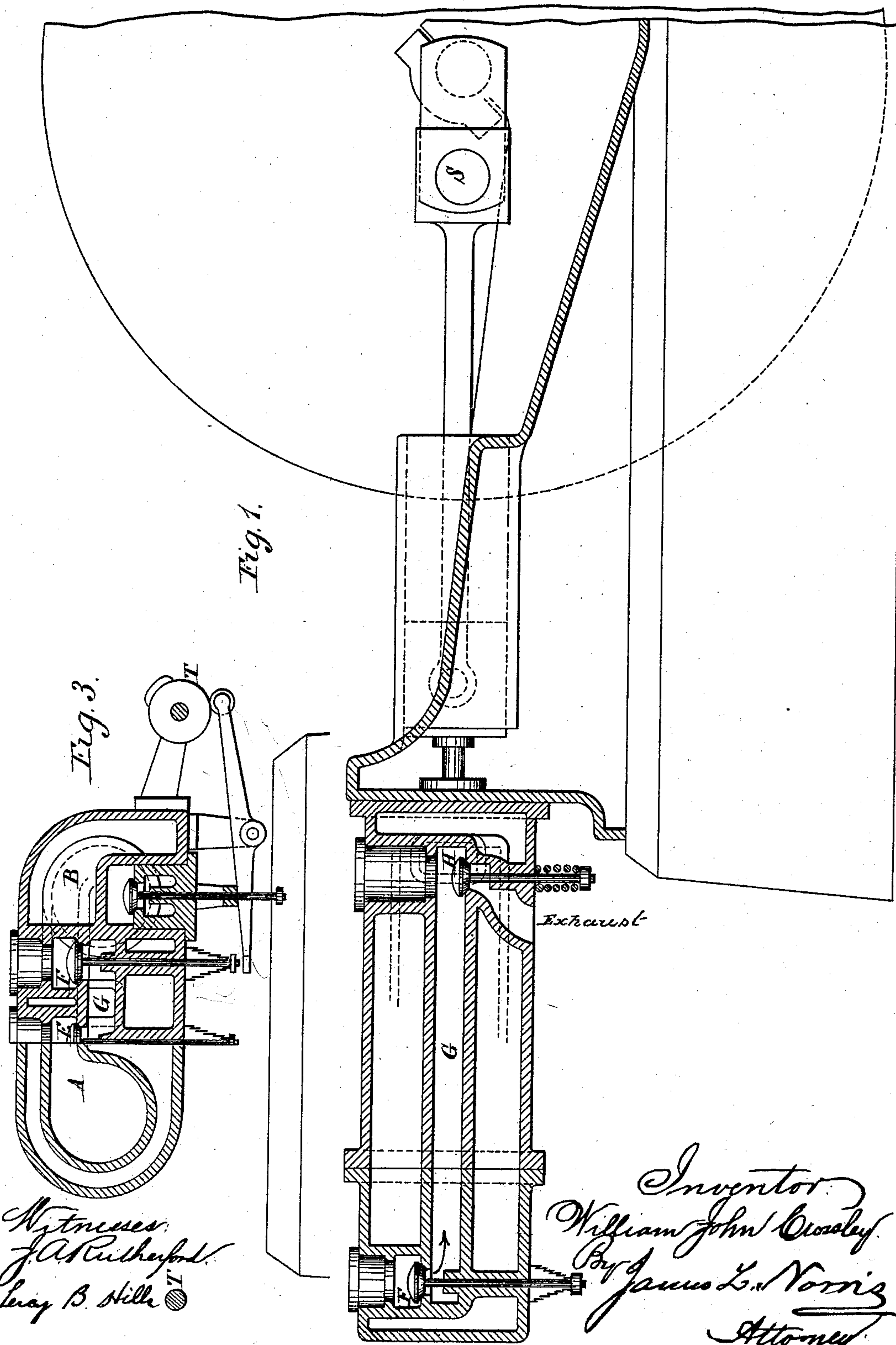
(No Model.)

2 Sheets—Sheet 1.

W. J. CROSSLEY.  
COMPOUND GAS OR OIL MOTOR ENGINE.

No. 406,706.

Patented July 9, 1889.



Witnesses:  
J. A. Rutledge  
Levy B. Still

Inventor  
William John Crossley  
By James L. Norris  
Attorney

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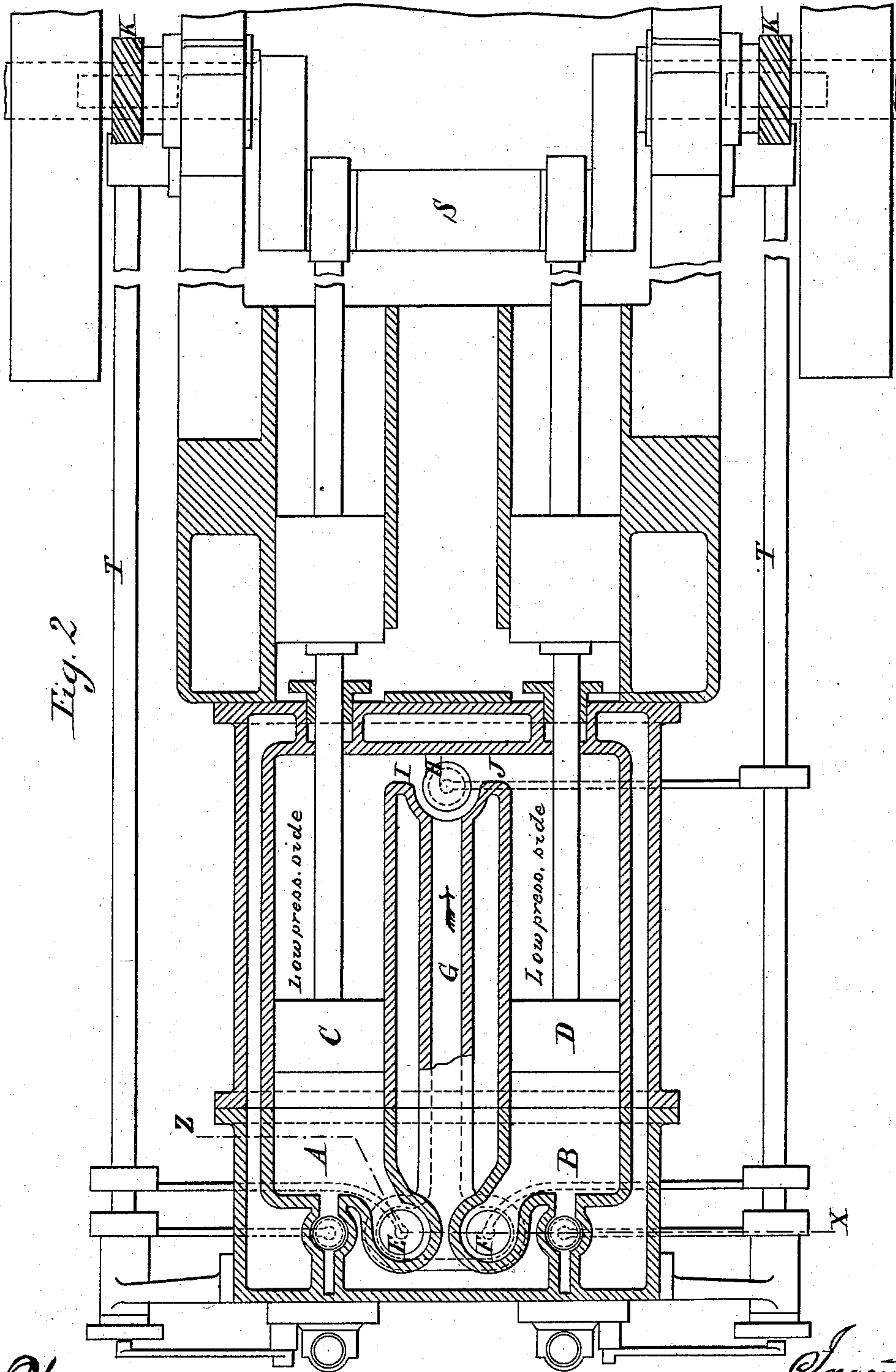


Fig. 2

Witness:  
J. A. Rutherford  
Per B. Hille

Inventor:  
William John Crossley  
By James L. Harris  
Att'y.



# UNITED STATES PATENT OFFICE.

WILLIAM J. CROSSLEY, OF OPENSHAW, MANCHESTER, COUNTY OF LANCASTER, ENGLAND, ASSIGNOR TO THE GAS-MOTOREN-FABRIK-DEUTZ, OF DEUTZ-ON-THE-RHINE, GERMANY.

## COMPOUND GAS OR OIL MOTOR-ENGINE.

SPECIFICATION forming part of Letters Patent No. 406,706, dated July 9, 1889.

Application filed January 31, 1889. Serial No. 298,270. (No model.) Patented in England February 4, 1888, No. 1,705; in France January 12, 1889, No. 195,331, and in Belgium January 15, 1889, No. 84,635.

*To all whom it may concern:*

Be it known that I, WILLIAM JOHN CROSSLEY, a citizen of England, residing at Openshaw, Manchester, in the county of Lancaster, England, have invented a new and useful Compound Gas or Oil Motor-Engine, (for which I have obtained patents in Great Britain dated February 4, 1888, No. 1,705; in France, dated January 12, 1889, No. 195,331, and in Belgium, dated January 15, 1889, No. 84,635,) of which the following is a specification.

My invention relates to the construction and arrangement of a gas or oil motor-engine in such a manner that it operates as a compound engine—that is to say, the gaseous products of combustion, after propelling a piston, are utilized for performing further work by acting expansively on a larger area of piston before being finally discharged as exhaust. For this purpose I arrange side by side two cylinders having their pistons both connected to one crank, so that they move to and fro together. Each of these cylinders is provided with governing, charging, and discharging valves worked as in gas or oil motor-engines of the Otto kind; but the action of the valves for the one cylinder is so timed in regard to the action of the valves for the other cylinder that when the one piston is drawing in charge the other piston is being propelled, and when the one piston is compressing charge the other is expelling products of combustion, all these operations being performed in the usual way at the rear ends of the cylinders. The cylinders are closed at their front ends, where their piston-rods pass through stuffing-boxes, and there is a communication from the discharge-valves of both cylinders to the front ends of both, and thence to an exhaust-valve common to both. As both pistons make their back-stroke together, one of them expelling products of combustion, these products, instead of escaping as exhaust, pass to the front ends of both cylinders and press on both pistons, expanding to nearly double their volume, and thereafter during the forward stroke of the pistons they are expelled as exhaust.

Figure 1 of the accompanying drawings is a longitudinal section of an engine according to my invention, this section being taken nearly on the middle line between the two cylinders. Fig. 2 is a sectional plan. Fig. 3 is a transverse section on the line X Z.

The two cylinders A and B, placed parallel to one another, have their pistons C and D made with rods which project through stuffing-boxes at the front ends of the cylinders and are connected to a single crank S on the fly-wheel shaft. Each cylinder is provided with the usual charging and igniting valve-gear worked from counter-shafts T, revolving at half the speed of the fly-wheel shaft. These counter-shafts also work, as usual, the exhaust-valves E and F; but these, instead of opening into a discharge-pipe leading to the outer air, open into a central passage-way or pipe G, which leads to ports I and J at the front ends of the two cylinders, and to a discharge-valve H, which may be worked from either of the counter-shafts T, so as to be opened twice in every revolution of T.

The bevel or skew gear K, by which the shafts T T are worked, is set so to move the valves that while the one piston is making its outstroke, receiving behind it a combustible charge, the other piston is being propelled by the firing of a charge, and while the one piston is making its return-stroke, compressing the charge behind it, the other piston is expelling exhaust. The exhaust-valves E and F being alternately opened, the exhaust-gases expelled either from A or from B pass along the passage-way or pipe G to both the ports I and J and enter both cylinders, expanding therein and propelling both pistons backward. At every forward stroke of the pistons the valve H is opened, allowing escape of the products of combustion which had expanded in both cylinders. In this manner the expansion of the products of combustion from each single cylinder into the two cylinders, which present nearly double the capacity of the single cylinder, is utilized as in a compound engine to aid the pistons in their back-stroke.

When the governor of the engine cuts off



the supply of combustible to the rear end of either cylinder, so that there are no products of combustion to expand in the front ends, the discharge-valve opens, admitting air to the front ends.

Having thus described the nature of my invention and the best means I know of carrying the same out in practice, I claim—

1. A compound gas or oil motor-engine consisting of two cylinders having discharge-valves at the rear ends, the two reciprocating pistons, an exhaust-valve common to the front ends of both cylinder, and a passage-way leading from the said discharge-valves and communicating with the front ends of both cylinders to conduct the gaseous products from behind each piston into the spaces in front of both pistons, where such products expand and are discharged through the exhaust-valve common to both cylinders, substantially as described.

2. A compound gas or oil motor-engine consisting of two cylinders located side by side, having at their rear ends alternately-opened discharge-valves and provided with front

communicating ends, the two pistons connected with a single crank-shaft to move to and fro together, an exhaust-valve opened at intervals and common to the front open ends of both cylinders, and a passage-way interposed between the cylinders and leading from the said discharge-valves to and communicating with the front ends of both cylinders and the exhaust-valve to conduct the gaseous products from behind each piston into the spaces in front of both pistons, where such products expand, move the pistons rearward, and then discharge through the exhaust-valve common to both cylinders, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 14th day of January, A. D. 1889.

W. J. CROSSLEY.

Witnesses:

G. C. SMITH,  
*Solicitor, Manchester.*

ROBT. TOMLINSON,  
*Notary's Clerk, 44 Mosley St., Manchester.*