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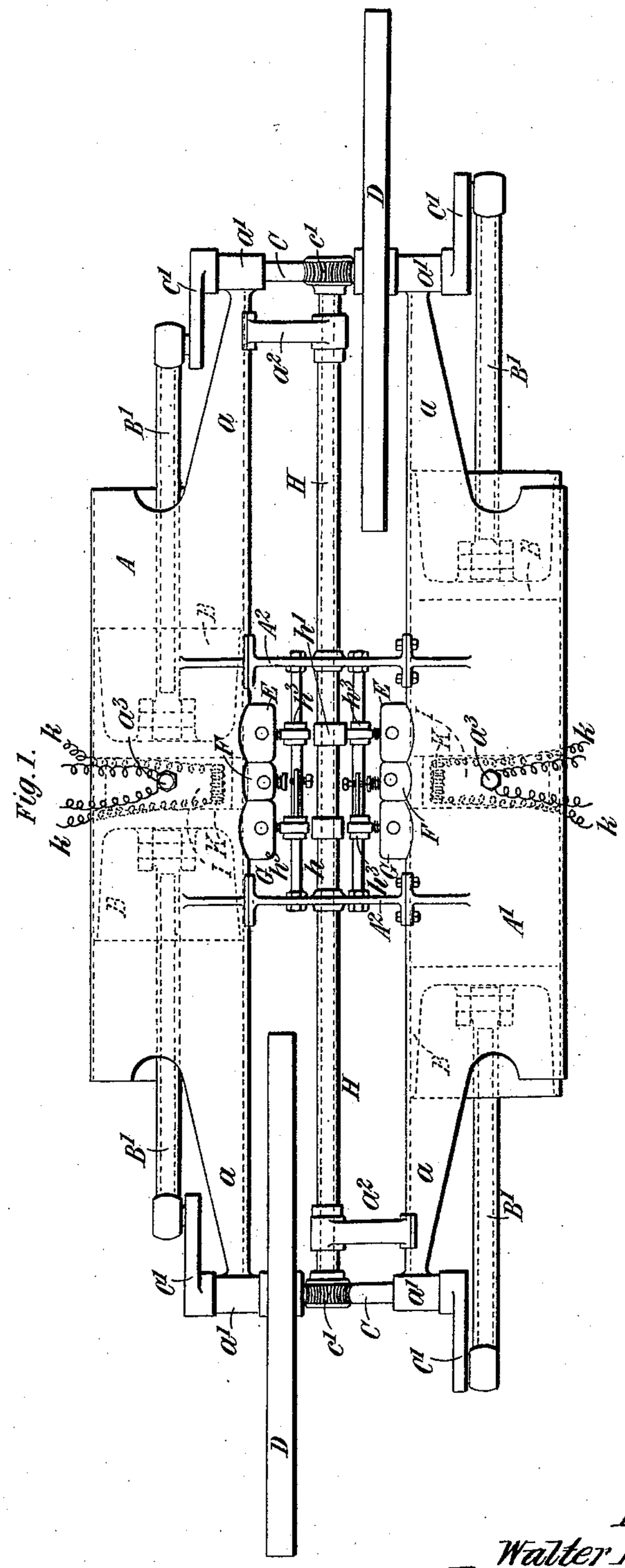
W. ROWBOTHAM.

OIL, GAS, OR LIKE ENGINE.

No. 574,762. Patented Jan. 5, 1897.

Fig. 1.



Witnesses.
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Fig. 2.

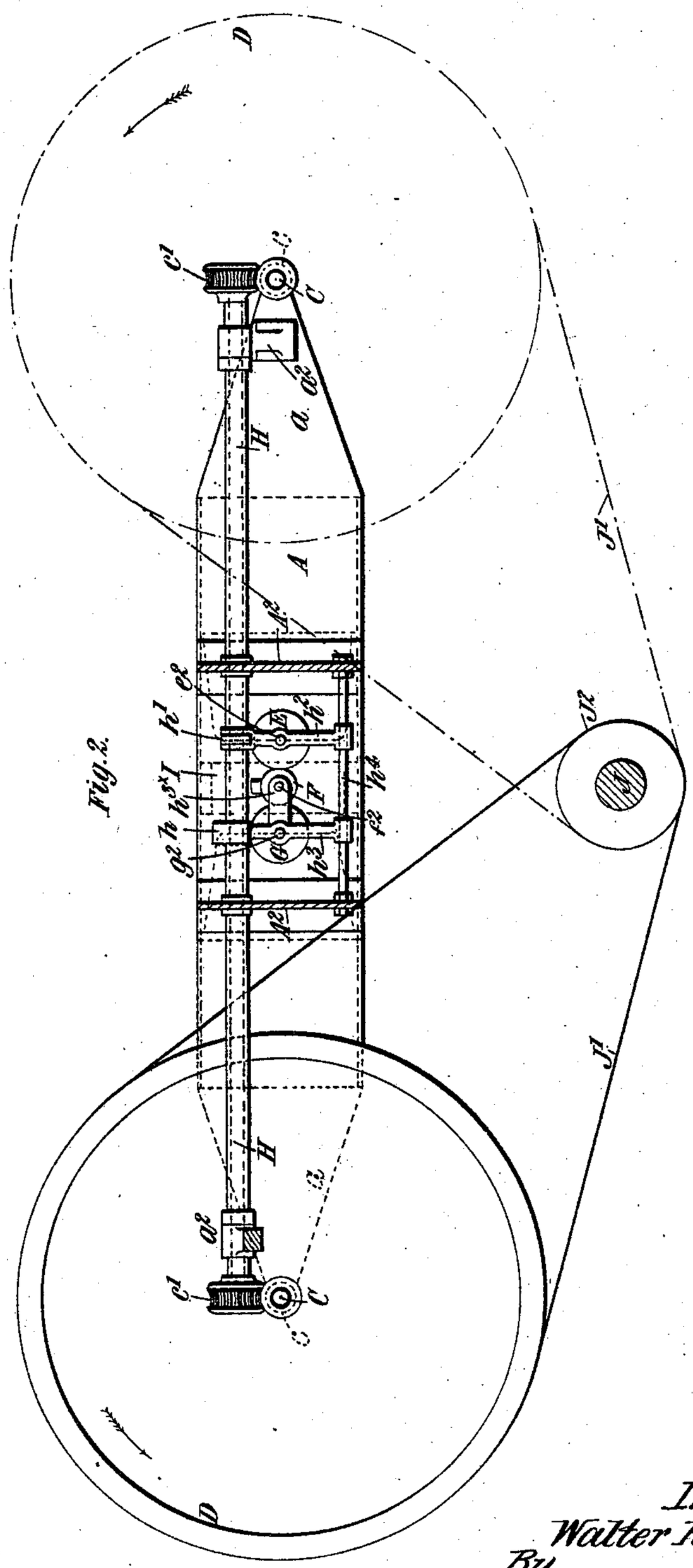

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Fig. 3.

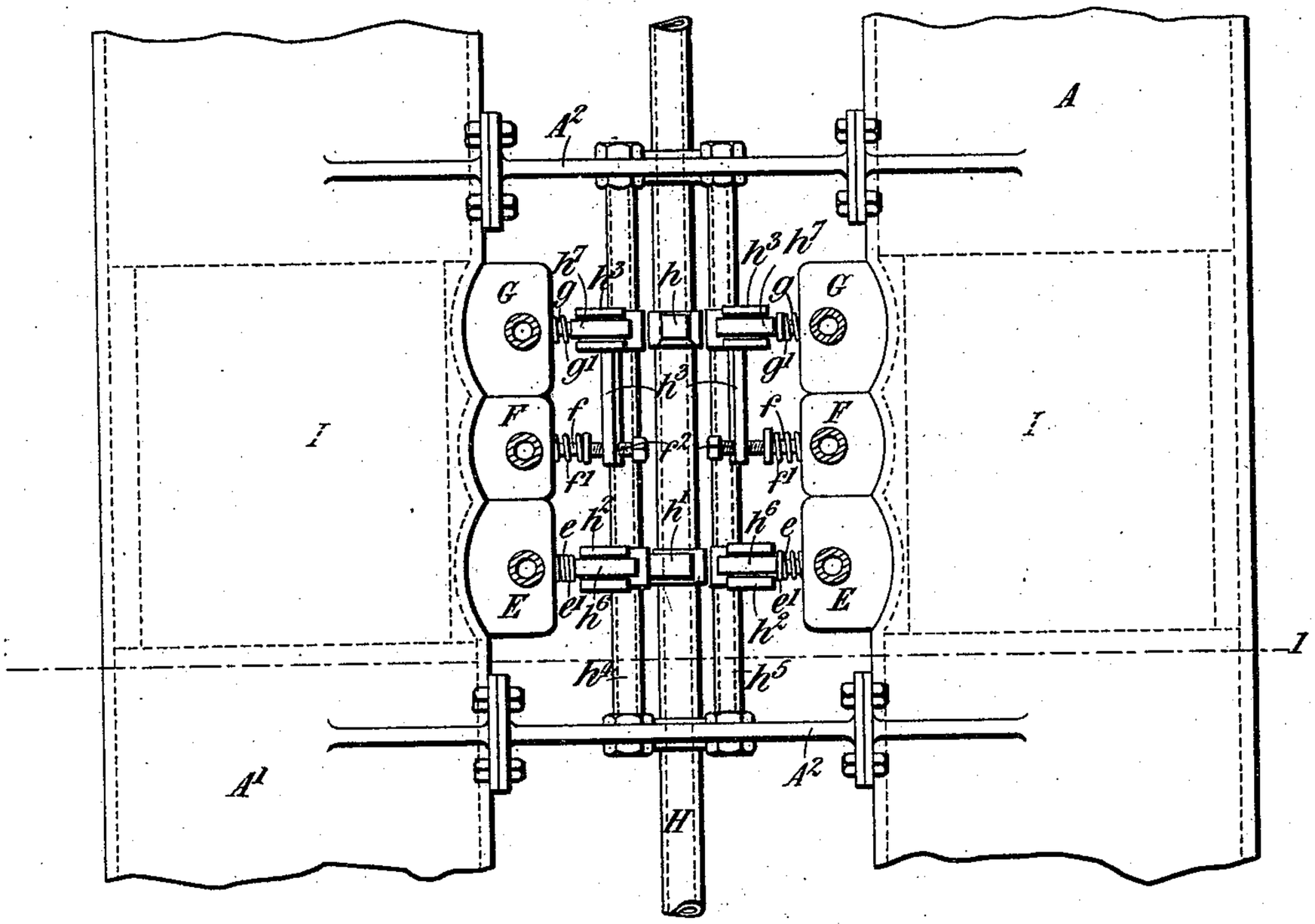
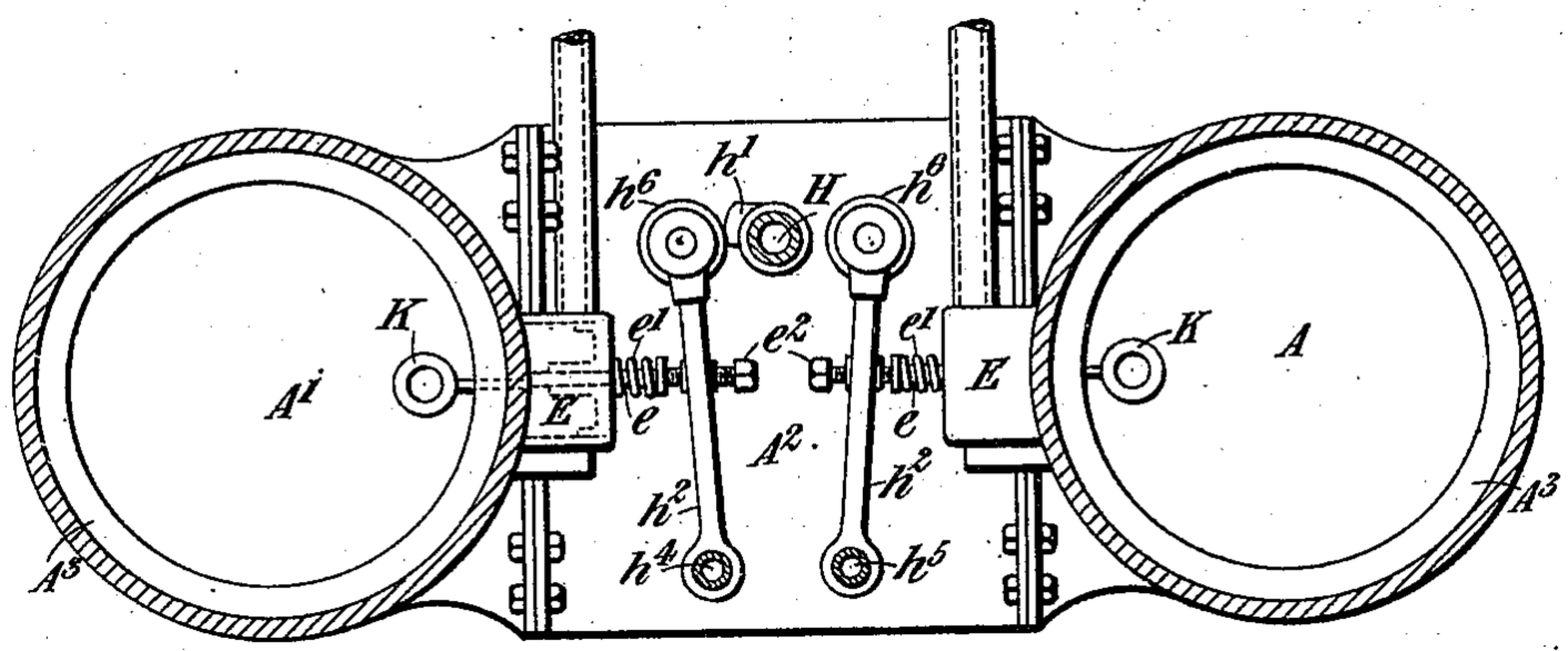


Fig. 4.



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UNITED STATES PATENT OFFICE.

WALTER ROWBOTHAM, OF BIRMINGHAM, ENGLAND.

OIL, GAS, OR LIKE ENGINE.

SPECIFICATION forming part of Letters Patent No. 574,762, dated January 5, 1897.

Application filed April 30, 1896. Serial No. 589,774. (No model.)

To all whom it may concern:

Be it known that I, WALTER ROWBOTHAM, electrical engineer, a subject of the Queen of Great Britain, residing at 27 Vittoria Street, Birmingham, England, have invented certain new and useful Improvements in Oil, Gas, or Like Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates more particularly to that class of motor-engines worked by explosive or combustible mixtures of air and gas or air and hydrocarbon or other oil, and has for its chief object to so construct engines of this kind that they will be specially suitable for the propulsion of road-vehicles and boats and for other propulsive purposes where extreme lightness and absence of vibration are of importance.

According to my invention the working cylinder is open at both ends and is provided with two pistons that move in opposite directions, the explosion or combustion chamber being situated between the two pistons and substantially at the middle of the cylinder, so that the shocks due to the explosions of the working charges will be absorbed by the oppositely-moving pistons and be prevented from being transmitted to the framing of the engine. The rectilinear reciprocating movement of the two pistons is converted into continuous rotary movement by any suitable means, and appropriate valves are provided for admitting the air and gas or air and oil to the cylinder or combustion-chamber and for allowing the products of combustion to escape. The ignition of the explosive mixture is effected by an electric sparking device or devices.

To vaporize the charges of oil, I employ an electrically-heated body, which is situated within or forms part of the cylinder or combustion-chamber and is preferably so arranged with respect to the inlet opening or nozzle through which the charges of oil are admitted to the cylinder or combustion-chamber that the said charges will be injected directly onto the electrically-heated body. Such vaporizing device is not, however, claimed herein, as it forms the subject of another application for patent filed simultaneously herewith.

The explosion or combustion chamber, where the vaporization and ignition take place, may be lined with asbestos, fire-clay, indestructible porcelain, or other refractory material to confine the heat and keep the cylinder externally cool without the use of a water-jacket and water circulation. All the parts of the engine are, where practicable, made tubular or hollow for reducing the total weight of the engine as much as possible.

In the accompanying drawings I have illustrated an oil-engine constructed in accordance with my invention and provided with two cylinders. It will be readily understood that the engine may be provided with only one cylinder, if desired.

Figure 1 is a plan; Fig. 2, a central longitudinal section; Fig. 3, a detail plan view drawn to a larger scale and showing the valves and valve-gear, and Fig. 4 a transverse section on the line 1 1 of Fig. 3.

A A′ are the two working cylinders; B B, the pistons; C C, the crank-shafts; C′ C′, the cranks; B′ B′, hollow piston-rods connecting the pistons to the cranks; D D, the fly-wheels; E E, the air-admission valves; F F, the oil-admission valves; G G, the exhaust-valves, and H a longitudinal tubular shaft carrying the valve-gear for operating the aforesaid valves. I is the lining, of asbestos, fire-clay, indestructible porcelain, or other refractory material, with which the combustion-chambers are provided.

The cylinders A A′ are in the form of comparatively long tubes rigidly connected together by transverse plates A^2 and having extensions *a*, which terminate in bearings *a′* for the hollow crank-shafts C. Each crank-shaft is provided with a worm *c*, gearing with a worm-wheel *c′*, keyed to the hollow longitudinal shaft H, and this shaft is carried by brackets a^2, bolted to the extensions *a* of the cylinders.

The engine is intended to be affixed to the under frame of a carriage, the revolution of the crank-shaft being transmitted to the axle J of the road-wheels of the vehicle by belts J′ J′, passing around the fly-wheels or pulleys D and the pulley J^2 on the said axle J, as shown in Fig. 2. If preferred, other means may, however, be employed for transmitting the motion from the engine to the axle J, as,

for instance, by bevel or spur wheels gearing with a bevel or spur wheel keyed to the longitudinal shaft H.

The aforesaid shaft H is provided with two tappets $h\,h'$, the former of which operates the exhaust-valves G, and the latter the air and oil inlet valves E and F. The said valves may be of any suitable construction, those shown in the drawings consisting of conical valves whose stems $e\,f\,g$, Figs. 3 and 4, are provided with collars that are acted on by spiral springs $e'\,f'\,g'$, surrounding the said stems and normally tending to keep the valves closed. $h^2\,h^3$ are rocking arms pivotally connected to rods or spindles $h^4\,h^5$, that are carried by the transverse plates A^2. These arms have at their upper ends antifriction-rollers $h^6\,h^7$, which are directly acted on by the aforesaid tappets $h\,h'$. The said arms are also provided with set-screws $e^2\,f^2\,g^2$, which, by striking against the ends of the valve-stems $e\,f\,g$, open the valves at the proper times as the tappets $h\,h'$ during their revolution collide with the said rollers $h^6\,h^7$. It will be observed that only two tappets are required for operating all the valves, as in the arrangement shown the air and oil valves on each cylinder are adapted to be operated simultaneously, and for this purpose each of the arms h^3 is furnished with a lateral projection $h^{3\times}$, carrying the set-screw f^2.

$a^3\,a^3$ are electric igniters, which are shown as consisting of insulated screw-plugs fitting into the walls of the cylinders and carrying at their inner ends a pair of bent wires, between the inner ends of which the sparks leap when the electric circuit is completed. I do not, however, confine myself to the use of these igniters, as others of suitable construction may be employed for the purpose.

K K are the electrically-heated bodies for vaporizing the oil as it enters the combustion-chambers of the cylinders. These bodies may consist of solid plates or cylindrical hollow blocks of refractory material heated by the passage of an electric current through a wire surrounding or embedded in the aforesaid refractory material. These blocks are located within the combustion-chambers at points in proximity to the oil-inlet valves F.

$k\,k$ are the electric conductors for conveying to the said bodies the current from any suitable source of electric supply.

The cycle of operations taking place during the working of the engine is as follows: Assume the parts to be in the position shown in Fig. 1, that is to say, with the pistons in cylinder A at the termination of their inward stroke and the pistons in cylinder A′ at the termination of their outward stroke. All the valves are now closed, the cylinder A having previously received an explosive charge and compressed it, while the charge in cylinder A′ has exploded and driven the pistons of this cylinder to the extremity of their outward stroke. The vaporization of the compressed charge in cylinder A has been effected by the electrically-heated body K. The igniters in cylinder A now operate and explode the charge in this cylinder, thereby driving the pistons therein outwardly. During the outward stroke of the said pistons in cylinder A the exhaust-valve of cylinder A′ opens and allows the products of combustion in cylinder A′ to escape during the inward stroke of the pistons of this cylinder. The pistons in the cylinder A now perform their inward stroke by the momentum of the fly-wheels, and the products of combustion are expelled from this cylinder through the exhaust-valve thereof, while a fresh charge of air and oil is admitted to cylinder A′ during the outward stroke of the pistons in this last-mentioned cylinder. The momentum of the fly-wheels, still acting, causes the charge already admitted to cylinder A′ to be compressed and a fresh charge to be received in cylinder A. The charge in cylinder A′ is vaporized and then ignited, and the pistons of this cylinder are driven outwardly, while the charge in cylinder A is compressed by the pistons of this cylinder moving inwardly. The compressed charge in cylinder A is then vaporized and ignited. A fresh cycle of operations then commences, the shaft H performing a quarter of a revolution at each stroke of the pistons.

What I claim is—

In an explosive-engine, the combination with a pair of open-ended cylinders each provided with two pistons, and driving crank-shafts and fly-wheels mounted at opposite ends of the cylinders and driven by said pistons, of a shaft extending longitudinally between the two cylinders and driven by gearing from the said crank-shafts, valve mechanism arranged on the opposite sides of the two cylinders for controlling the inlet, exhaust and air valves, and means actuated by said shaft for operating the valve mechanism, substantially as described.

In testimony whereof I have hereunto set my hand this 10th day of April, 1896.

WALTER ROWBOTHAM.

Witnesses:

ARTHUR A. BERGIN,

WM. MILLARD JACKSON.