(No Model.) 3 Sheets—Sheet 1.

J. F. DALY & W. L. CORSON.

GAS ENGINE.

No. 557,493. Patented Mar. 31, 1896.

Fig. 1.

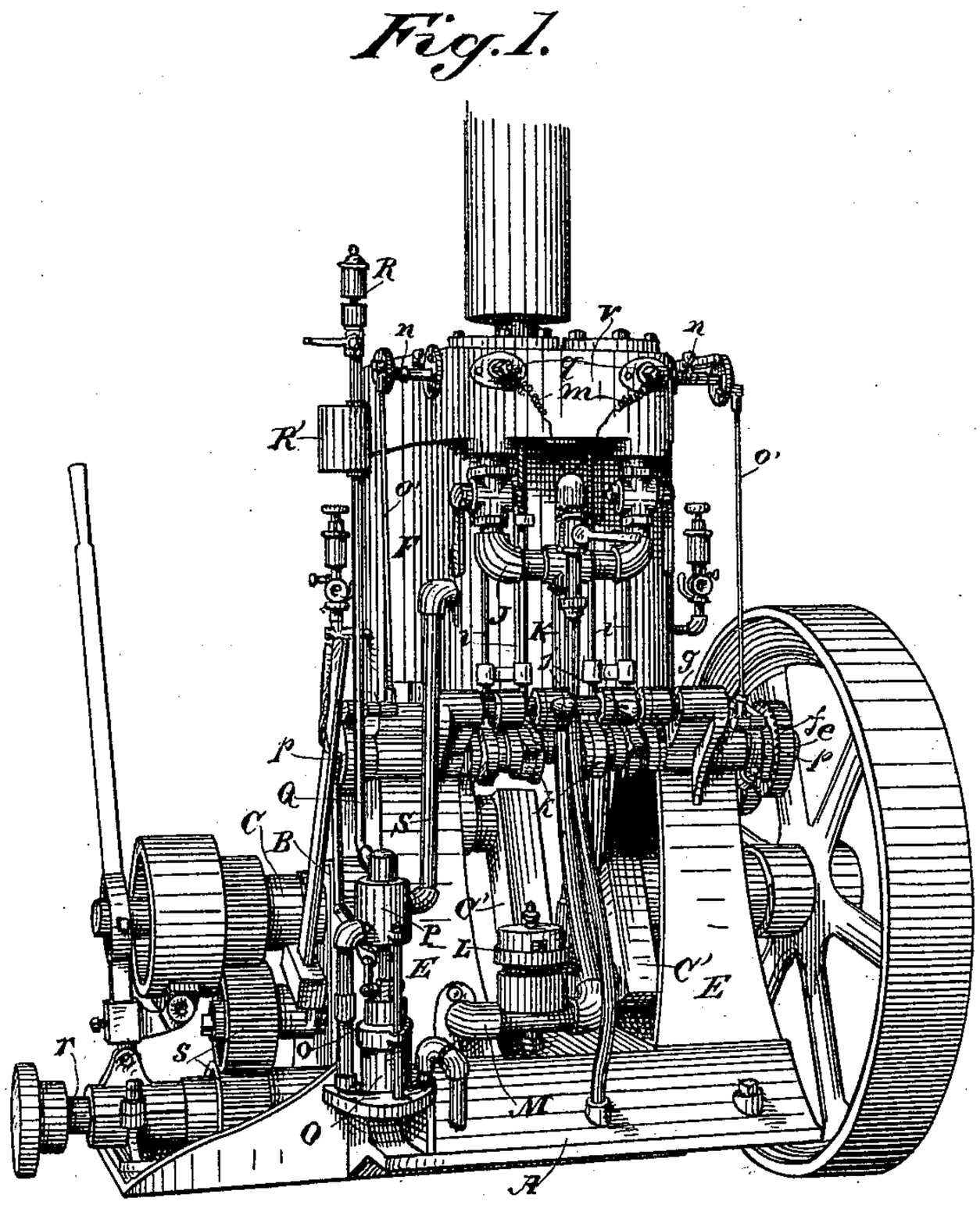

Fig. 5.

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By Lowry & Co. Attys

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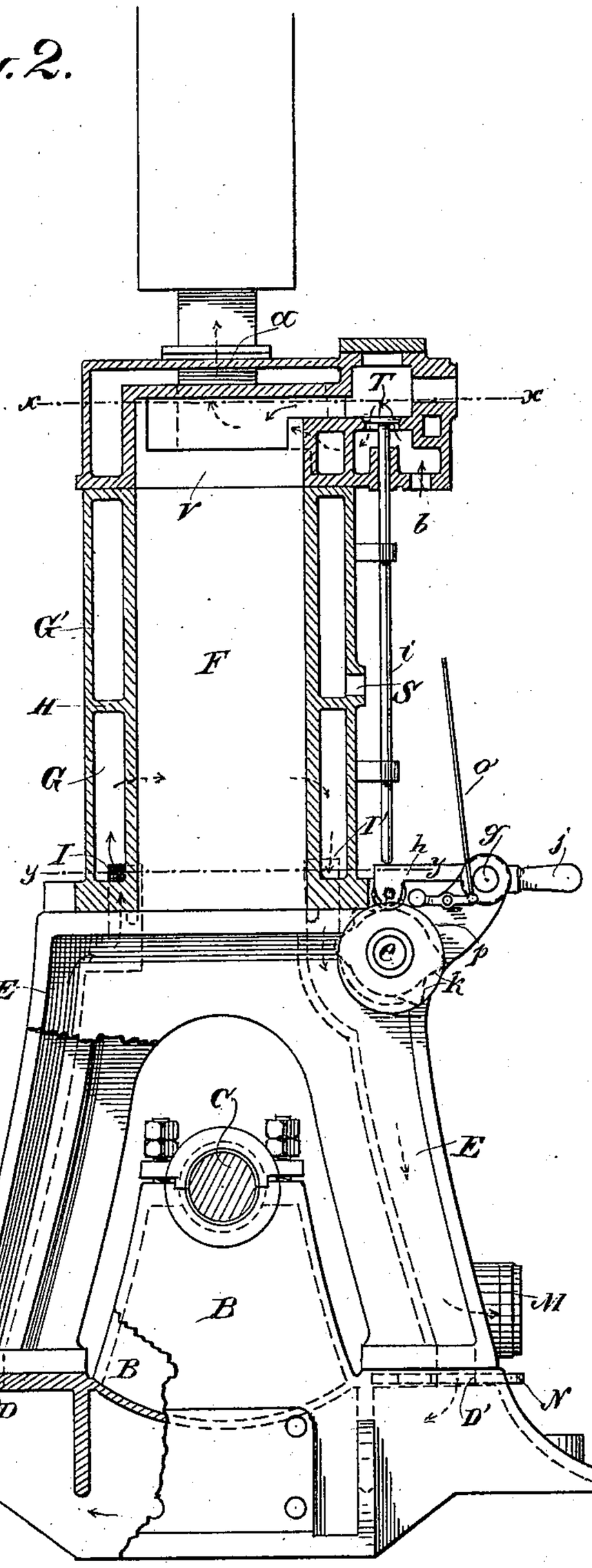
Fig. 2.



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Attys

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J. F. DALY & W. L. CORSON.

GAS ENGINE.

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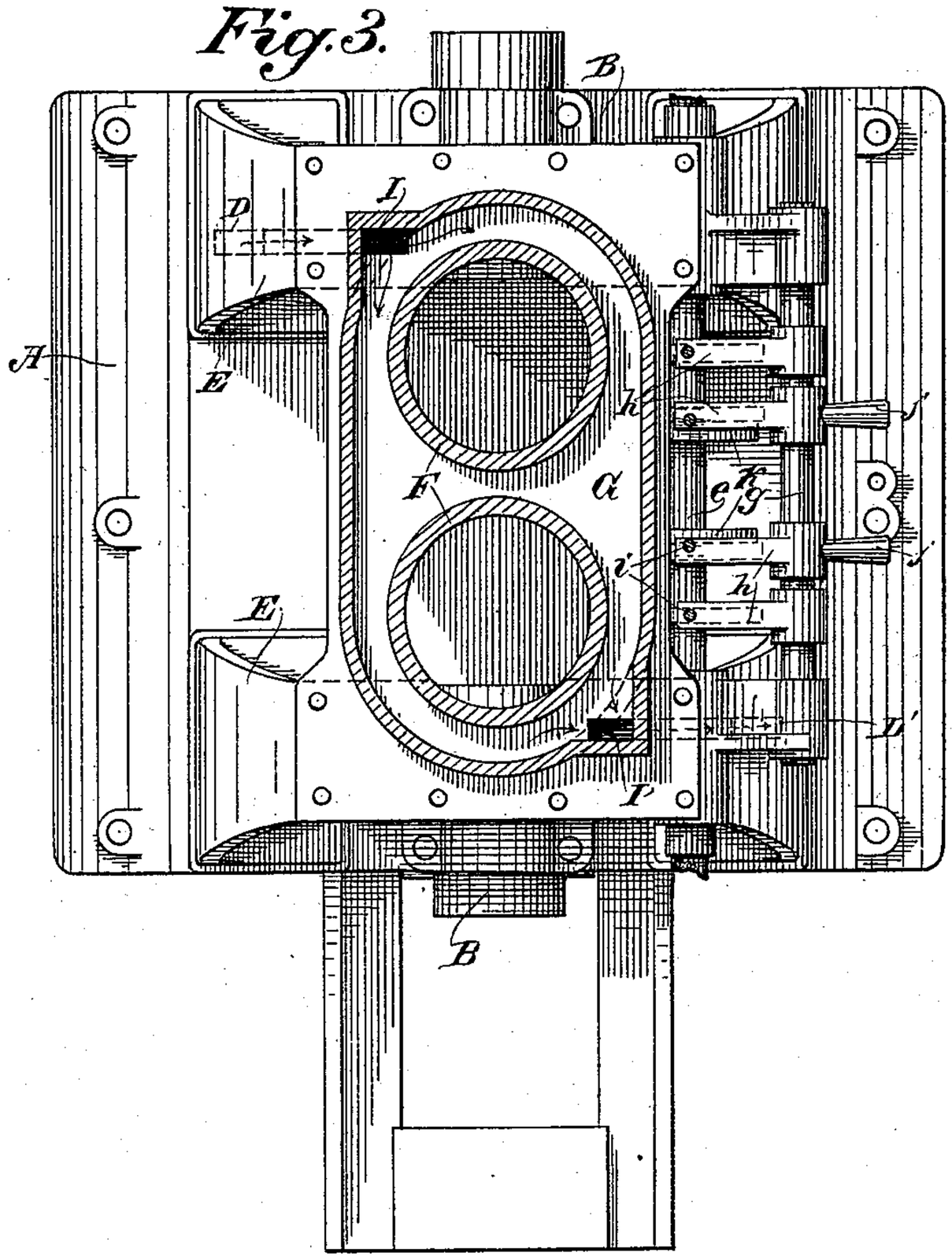
Fig. 3.



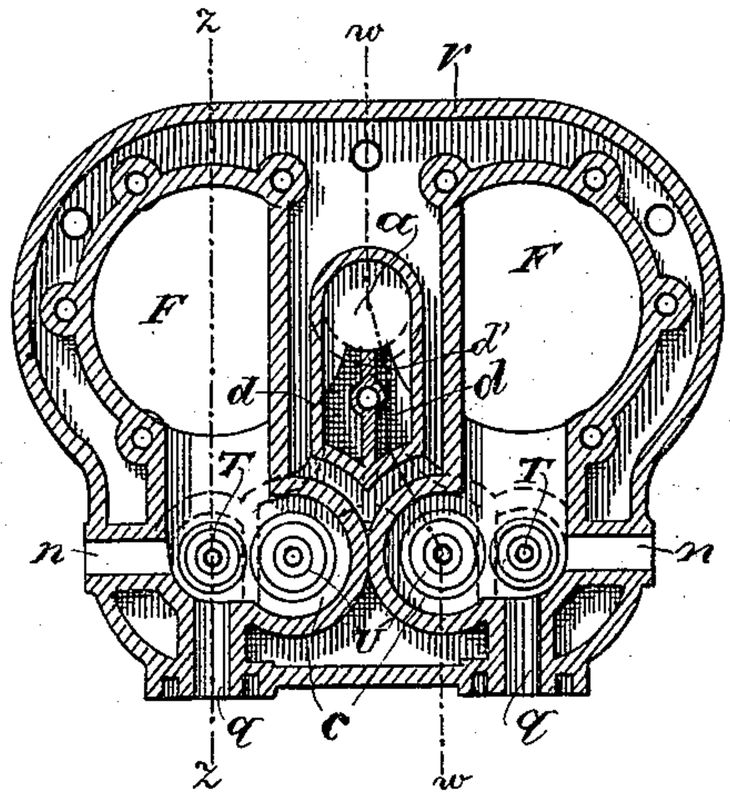


Fig. 4.

Witnesses;
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UNITED STATES PATENT OFFICE.

JOHN F. DALY AND WILLIAM L. CORSON, OF SAN FRANCISCO, CALIFORNIA, ASSIGNORS TO THE UNION GAS ENGINE COMPANY, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 557,493, dated March 31, 1896.

Application filed October 25, 1894. Serial No. 526,943. (No model.)

To all whom it may concern:

Be it known that we, JOHN F. DALY and WILLIAM L. CORSON, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Gas-Engines; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to certain improvements in gas-engines.

It consists in details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a general perspective view of the engine. Fig. 2 is a vertical section taken through line *z z* of Fig. 4. Fig. 3 is a horizontal section taken through line *y y* of Fig. 2. Fig. 4 is a horizontal section taken through line *x x* of Fig. 2. Fig. 5 is a vertical section taken through line *w w* of Fig. 4.

The object of our invention is to provide certain improvements in gas-engines, which while applicable to engines of any size are especially adapted for engines of large size in which two or more cylinders are used with a common crank-shaft and for propelling vessels or for other similar work.

A is the base-plate of our engine, which is made hollow and has the central portion depressed below the sides, so as to fit it to the interior of a vessel and its keelson, and the rear portion of this bed is also made converging or narrowing, so that the bed-plate can be set into the run of the vessel at the lowest possible point. Upon this bed-plate are cast or fixed pillow-blocks B, which carry the journal-boxes of the main engine-shaft C. The upper surface of the bed-plate has openings made in it at D, and upon this part of the bed-plate, which is made flat, are set the A-shaped frames E, which arch above the pillow-blocks and are bolted to the bed-plate so as to make tight joints, and upon these frames, which are situated at each end of the bed-plate, is journaled the cam-shaft, while the engine-cylinders F are bolted to the top of these frames in line above the cranks C′ of the crank-shaft C. By this construction the bed-plate, pillow-blocks, crank-shaft, frames, and cylinders are very compactly united, while at the same time the shaft and working parts are easy of access.

Two of the legs of the frame E are made hollow and have passages made in them coinciding with the passages D in the base-plate, for a purpose to be hereinafter described.

The cylinders F are surrounded by a jacket or casing G G′. This jacket or casing is divided horizontally by a partition H into two independent chambers. The lower chamber is so constructed at diagonally opposite sides as to have passages I I′ made through the bottom, and these passages connect with those in the corresponding legs of the frame E, as plainly shown in Figs. 2 and 3.

Air is circulated through the frames and the lower chambers of the cylinders by the action of the pistons reciprocating in the cylinders F, which draw the air through their respective inlet-valves, and these are supplied through branch pipes J from the main pipe K, connecting with the carbureter L and thence by a pipe M with the lower part of one of the legs of the hollow frame E.

The lower portion of the bed-plate A being open to correspond with the inlet-opening I, which leads into one of the legs of the frame E, it will be seen that the vacuum produced by the movement of the pistons in the cylinder will cause the air to rush in through the opening D, thence passing up through the hollow leg of the frame E and the passage I will enter the chamber G around the lower part of the cylinders, and will circulate around the cylinders and become heated by contact with them; thence the air passes down through the passages I′ into the other hollow leg of the frame E and thence to the pipe M and carbureter, where it is mixed with the vapor of the hydrocarbon liquid, so as to produce an explosive gas which then enters the cylinders through the passages and inlet-valves.

If it be desired to draw the air directly through the vaporizer without passing it around the cylinders, it is effected by means of a valve or gate N. This gate is so located with relation to the base-plate and the passage M that when it is in one position it opens a passage directly through D′ into the base-

plate, so that air may be drawn directly through the pipe M to the carbureter without being heated, but when the gate is moved so as to close the passage D′ the air will then be drawn in around the cylinders, as previously described. This construction enables the engineer to regulate the quality of explosive gas by increasing or diminishing the temperature of the air which passes through the carbureter.

O is a water-pump, and in line with it is an air-pump P, the pistons of the two pumps being fixed to the same piston-rod, so as to be reciprocated simultaneously by connection with an eccentric or crank pin *p* on the cam-shaft of the engine. Air from the pump P is forced through a pipe Q and serves to operate the whistle R which is used for signals, as in the case of steam-vessels. The compressed air may be stored in a suitable receiver, as at R′, and will serve for signaling purposes when the engine is not running. In order to keep the temperature of the air thus compressed in the pump P from rising too high, a pipe *o* from the water-pump O leads to a jacket around the pump P, and the water first circulates around this pump-cylinder, thence passes through the pipe S to the upper chamber G′ surrounding the cylinders, and this water-jacket serves to keep the cylinders cool in the usual manner of gas-engines.

The explosive gas is admitted to the cylinders F through inlet-valves T and the waste products remaining after the explosion are exhausted therefrom through exhaust-valves U. These valves are arranged in pairs in a head V which is common to both the cylinders and which has an exhaust-passage *a* intermediate between the two.

Figs. 2, 4, and 5 show the arrangement of the valves and passages. The explosive gas is admitted by the opening of the valve T, through which it passes into the inlet-valve chamber through a passage *b*, Fig. 2, and it passes from there into the explosion-chamber formed in the head V in line above the cylinder F. When the piston returns after the explosion has propelled it to the lower end of the cylinder, it forces the waste products of the explosion out through the chamber *c*, and the exhaust-valve U being opened at the proper time the products of combustion escape through the passage *d* to the exhaust-pipe *a*, as previously described. The same operation takes place with the other cylinder, the exhaust-passages of each opening into the common exhaust-pipe, and being separated by a partition *d′* in the head, as shown in Fig. 4. The head, with the two sets of valve-chambers for each cylinder, inlet and exhaust passages, is thus formed in a single casting which is fixed to the upper ends of the cylinders, and many joints are thus saved. This head, with its various chambers and exhaust-passage, is jacketed similarly to the cylinders and is connected therewith so that water from the upper part of the cylinder-jackets will circulate in the jacket of the head and keep the exhaust-passage and other parts cool which are liable to be heated by the constant escape of the hot products of combustion.

e is a counter-shaft carrying the cams by which the valves are opened at the proper time and those by which the igniting devices are alternately brought into contact and separated from each other. This shaft is driven by a train of gearing *f* from the main shaft C.

In front of the shaft E is a second shaft *g* upon which are fulcrumed the arms *h*, the opposite ends of which extend beneath the valve-stems *i* and just above the cams upon the shaft E by which the valve-stems are actuated and the valves alternately opened and closed.

The ends of the lever-arms *h* are preferably provided with rollers or antifrictional devices, as shown, which travel upon the surface of the cams and reduce the friction of the movement.

The sleeves of the arms *h* which actuate the exhaust-valves are slidable upon the shaft G by means of handles *j*, which project from the front, as shown.

The cams *k*, which actuate the exhaust-valves, are made of considerable width and have two different forms of cams formed upon their periphery. One of these cams serves to open and close the exhaust-valves regularly when the engine is in full operation. The other cams are so constructed that the exhaust-valves will be held open, so that a great portion of the charge which has been drawn into the cylinder will escape before the valve is closed. The object of this is to assist in starting the engine, it being well known that in starting a gas-engine it is necessary to make a revolution or two of the machinery, so as to draw in a charge of gas and compress it before an explosion can take place to start the engine. With large engines it would be impossible to start them in this manner if it were necessary to compress a full charge of gas in the cylinders. Therefore by moving the handles *j* the cam-levers *h* are shifted over that portion of the cam *k* which will act to hold the exhaust-valve open until a large part of the charge of gas has been exhausted from the cylinder, leaving but a small proportion to be compressed and exploded, this small portion being sufficient to give the necessary impulse to the moving parts, and after the engine is started the cam-levers are again shifted along the shaft G until they stand above that portion of the cams *k* which operates the valves in the manner desired when the engine is in full operation, retaining a full charge of gas within the cylinders.

The wires *m* for the electrical igniting devices of the two cylinders pass in through insulated connections, as shown in Fig. 1, entering the explosion-chambers in the heads of the two cylinders. The other electrodes are carried by oscillating shafts *n*, the oscillation

of the shafts bringing these electrodes into contact with the stationary ones and separating them to form a spark at the instant when the explosion is desired. This construction, being shown in Patent No. 430,505, issued to John F. Daly and Mora M. Barrett June 17, 1890, is not here illustrated.

The shafts *n* are connected by rods *o'* with with cams *p* upon the cam-shaft *e*, by which they are oscillated. The cams are adjustably secured to the cam-shaft E and may be moved so that the spark is produced for the explosion earlier or later, as may be desired. The adjustment is well shown at the right side of Fig. 1, where the cam is secured by a set-screw to a curved slot in the gear *f*, which drives the shaft *e*. The stationary electrodes are adjusted with relation to those fixed upon the rock-shafts *n* by means of screws and nuts *q*, Fig. 1.

Power is transmitted from the main crank-shaft C to drive the propeller of the vessel or other mechanism through the shaft *r*, to which the propeller-shaft is coupled, and intermediate gearing, (shown at *s*,) the usual or any suitable reversing mechanism being employed to reverse the motion of the propeller without changing the movement of the engine.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A gas-engine having a hollow base-plate with openings through its top, frames secured to said base having passages through them coincident with those of the base-plate and jacketed cylinders on the frame with the jacket-space in communication with the passages through said frames whereby air is caused to circulate through the passages of the frame and around the cylinders, and means for conveying said air to a carbureter.

2. A gas-engine having a base-plate converging from the upper surface downward, and from the front toward the rear end said base-plate adapted to fit the timbers and run of a vessel, and having an air-passage through it, pillow-blocks cast with the base-plate for supporting a crank-shaft, independent frames or standards bolted to the ends of the base-plate, inclosing the pillow-blocks one of said frames or standards having an air-passage through it, coincident with the passage through the base-plate, cylinders upon the frame with a surrounding air-space coincident with the passage through the said frames or standards, and means for connecting said air-passage with a carbureter.

3. In a gas-engine, a hollow base-plate with openings through the top, hollow A-shaped frames bolted to the base-plate having openings in the legs coincident with those of the base-plate, cylinders supported upon the frames having chambers or jackets surrounding them, passages leading from the hollow frame-legs into the jacket-space and a pipe connecting one of the hollow legs with a carbureter and through that with the engine-cylinders whereby a circulation of air takes place through the frame and around the cylinders before it enters the carbureter.

4. In a gas-engine, a base-plate, cylinder-supporting frames bolted thereto having one leg of each frame made hollow, passages connecting the hollow legs with a jacket or chamber surrounding the cylinders, a passage connecting one of the legs with the carbureter, and thence with the inlet-valve chambers of the engine-cylinders, a passage connecting the other leg with the hollow base-plate whereby a circulation of air through the hollow legs and around the cylinder takes place before the air enters the carbureter, a second opening or passage communicating directly from the base-plate to the pipe leading to the carbureter, and a gate or valve controlling this opening so that when closed, air will pass around the cylinders before entering the carbureter, and when opened it admits air directly to the carbureter.

5. In a gas-engine, the hollow base-plate, a frame with hollow legs connecting with the base-plate, cylinders fixed to said frame in line above the crank-shaft with which their pistons are connected, chambers surrounding the lower part of the cylinder, with means for circulating air through the supporting-frames and around the cylinders, other chambers surrounding the upper part of the cylinders and separated from the air-chambers, and a pump actuated by mechanism connecting it with the driven parts of the engine whereby water is supplied to the upper surrounding chamber of the cylinders.

6. In a gas-engine, cylinders arranged in pairs above the crank-shaft to which their pistons are connected, chambers surrounding said cylinders and separated into two parts, one of which is adapted to receive and circulate air before it passes to the carbureter, and inlet-valve chambers, and the other adapted to receive water to surround the upper portion of the cylinders, air and water pump cylinders, the pistons of which have a common piston-rod, and are driven simultaneously, a jacket surrounding the air-pump chamber, a pipe connecting the water-pump with said jacket whereby the circulation of water is maintained from the water-pump around the jacket to the air-pump, and a pipe connecting the jacket with the water-chamber around the main cylinders.

7. In a gas-engine, a pair of cylinders mounted upon a frame above the crank-shaft with which their pistons are connected, air and water jackets surrounding said cylinders, a water-pump and a pipe extending therefrom to supply the water-chamber of the cylinders, an air-pump operating in conjunction with the water-pump having a pipe leading therefrom to a whistle or signal device, a jacket surrounding the air-pump and interposed be-

tween the parts of the pipe leading from the water-pump to the engine-cylinders whereby the water is first circulated around the air-pump before entering the cylinder-jacket.

8. In a gas-engine, a pair of cylinders, a crank-shaft with which the pistons of the cylinders are connected, a single head fitting the upper end of the two cylinders containing compression and ignition chambers for each cylinder with inlet and exhaust valves and valve-chambers for the same, and passages leading from the exhaust-valves, and uniting in a single exhaust pipe or passage intermediate between the chambers of the two cylinders.

9. In a gas-engine, a pair of inverted cylinders, a base-plate and frame upon which they are supported in line above a common crank-shaft which is journaled in pillow-blocks upon the base-plate and between the legs of the frame, a cam-shaft journaled across the front of the frame, gearing connected with the main engine-shaft by which the cam-shaft is rotated, and cams fixed thereon engaging the valve-stems to open them at proper intervals, and interposed fulcrumed levers with anti-frictional contact-rollers journaled in the ends to travel in contact with the cams.

10. In a gas-engine, the double inverted cylinders situated above a common crank-shaft with which their pistons are connected, a cam-shaft journaled across the front of the frame and driven by gearing from the main engine-shaft having cams by which the valves are actuated, a second shaft fixed parallel with the cam-shaft forming a fulcrum for cam-levers which are interposed between the cams and the valve-stems, antifriction-rollers on one end of the levers between the cams and valve-stems and handles on the opposite ends of the levers by which said levers are moved to coincide with different cams whereby the opening and closing of the valves are varied.

In witness whereof we have hereunto set our hands.

JOHN F. DALY.
WILLIAM L. CORSON.

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M. J. LAWRENCE.