No. 640,392. Patented Jan. 2, 1900.

G. W. LEWIS.

GAS ENGINE IGNITION DEVICE.

(Application filed June 21, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

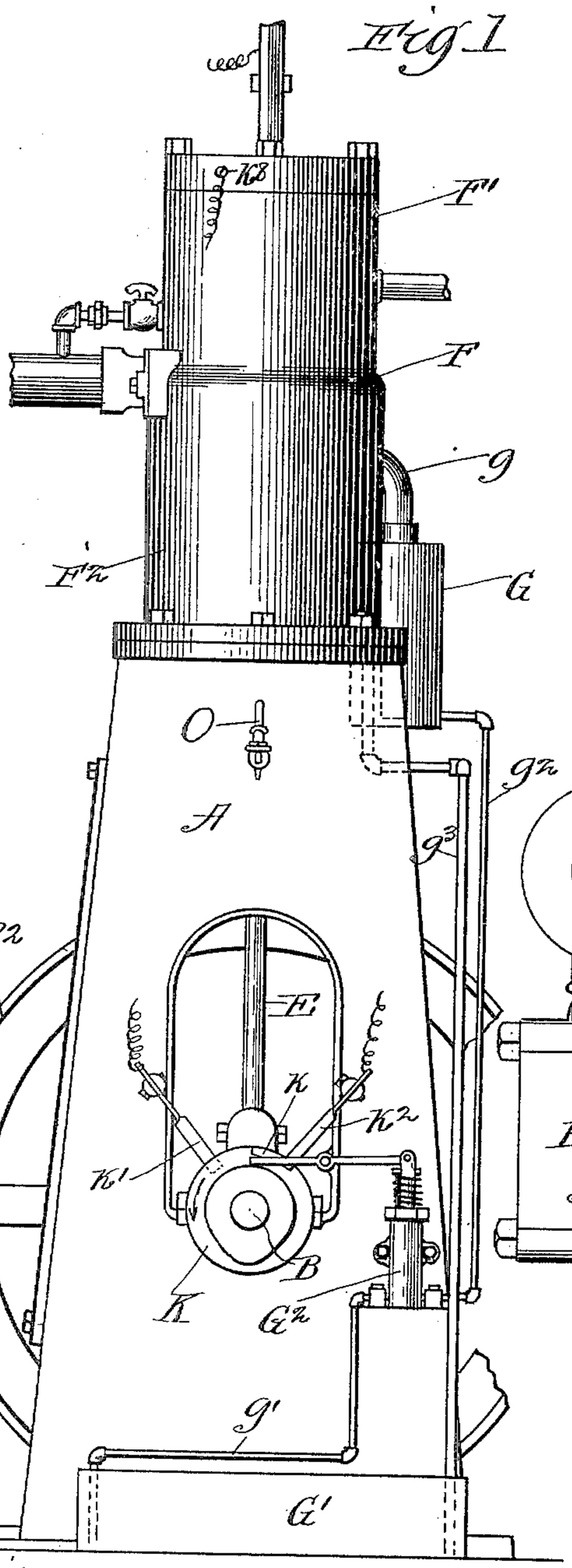


Fig. 3

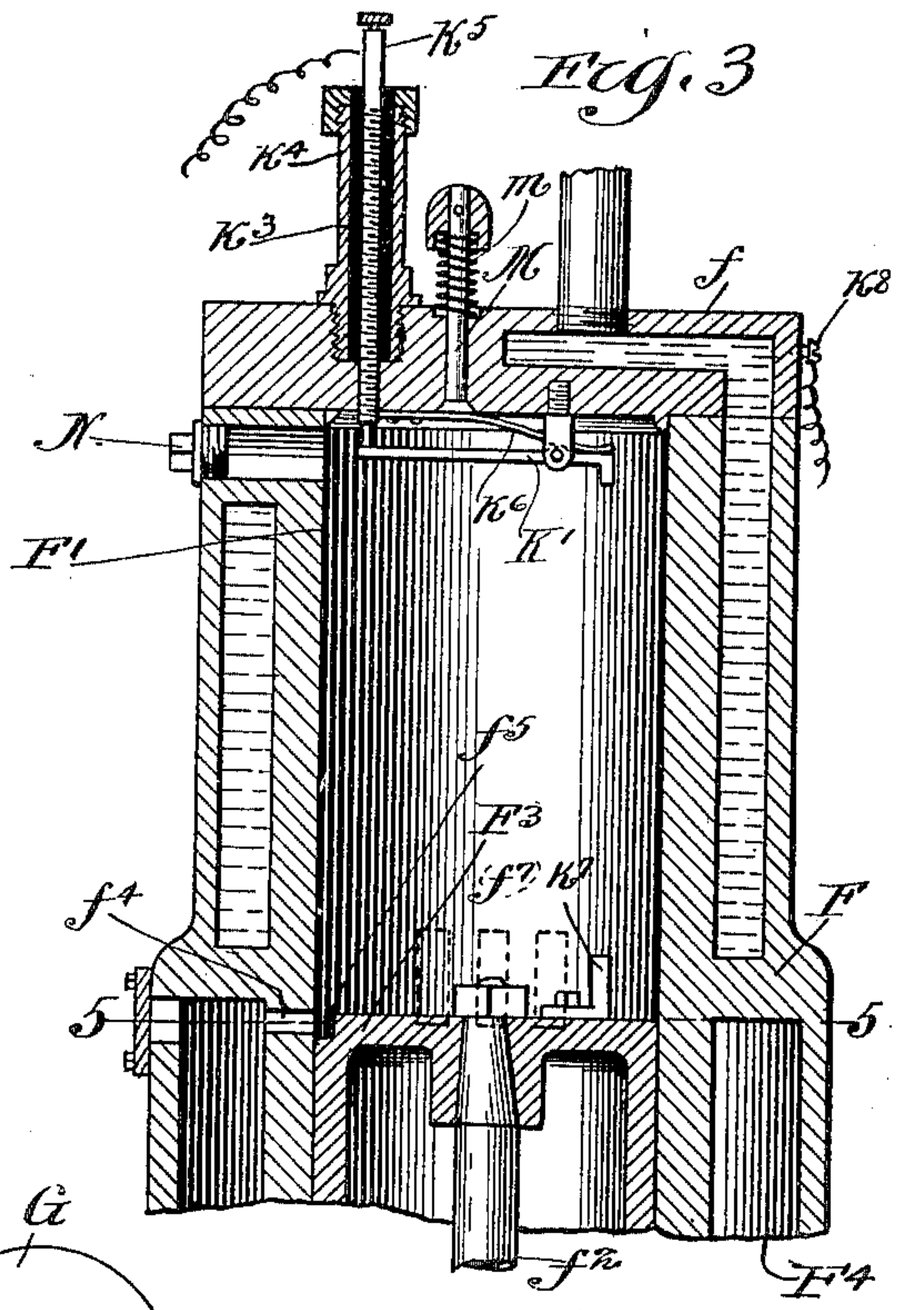
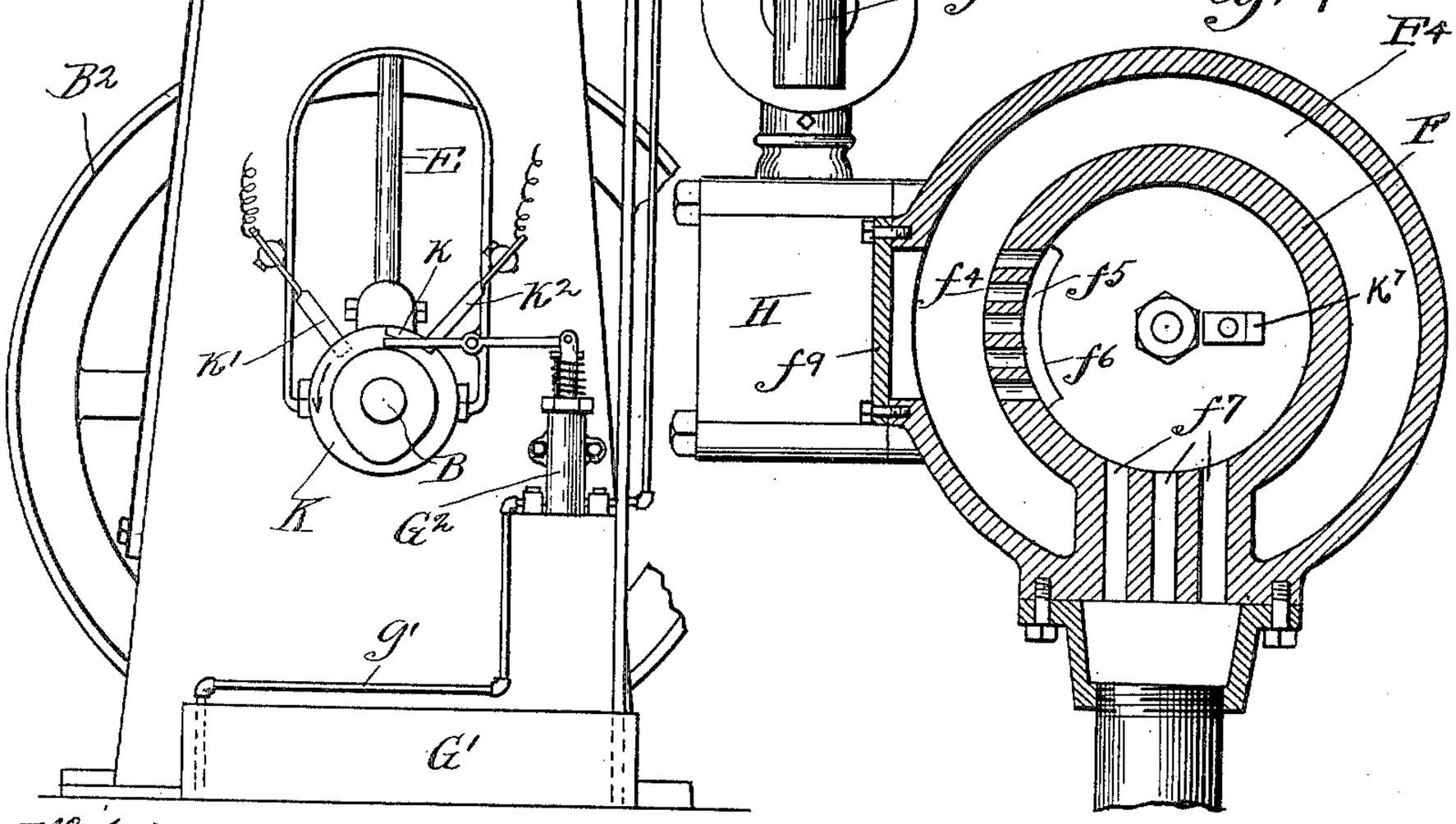


Fig. 4



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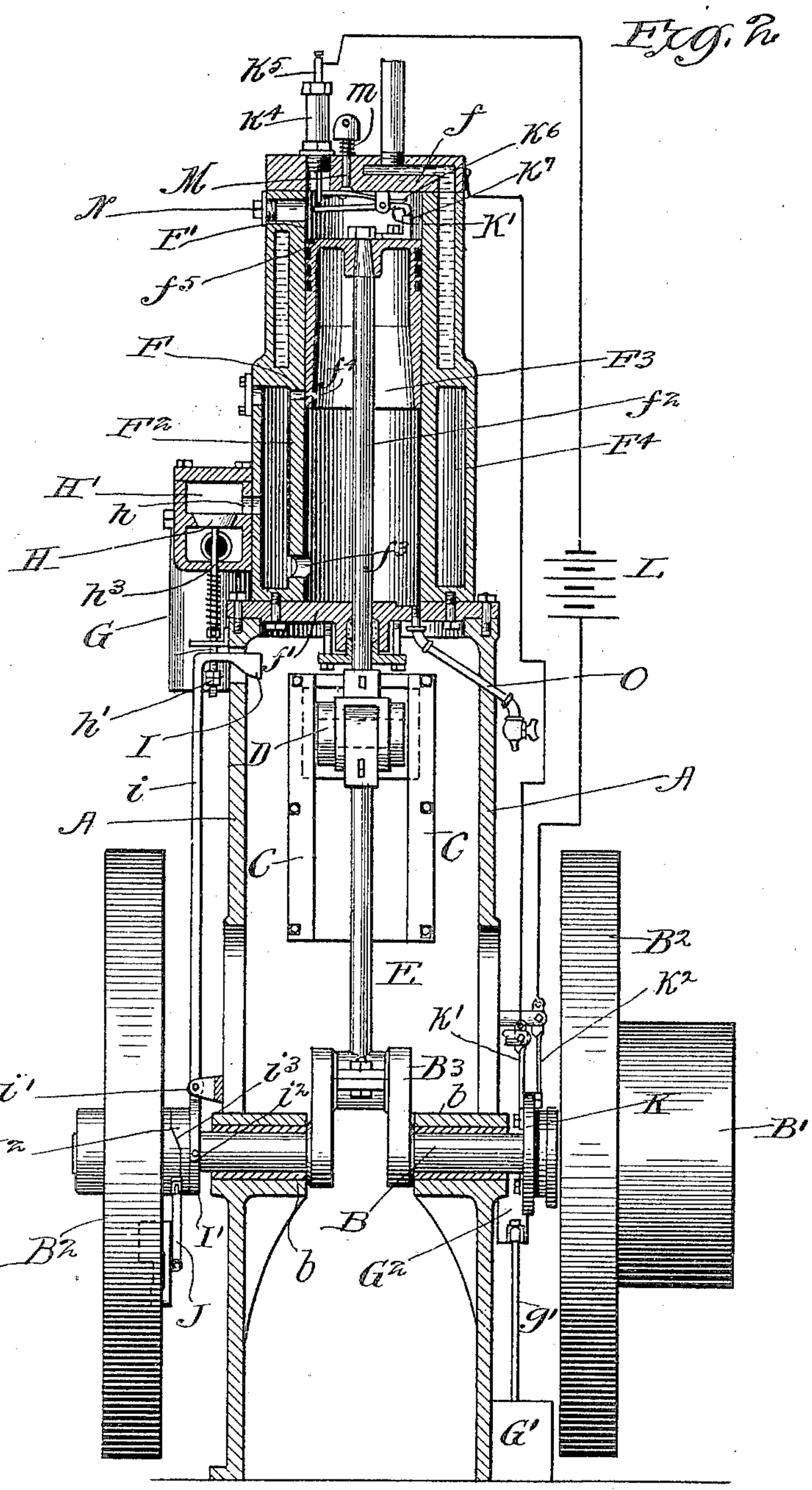
(No Model.) 3 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3

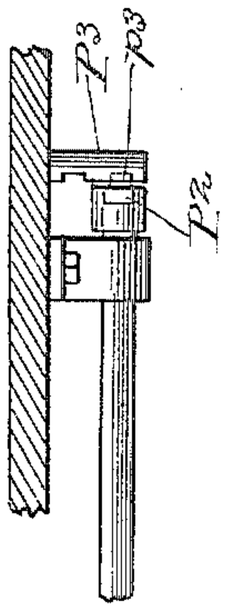


FIG. 5

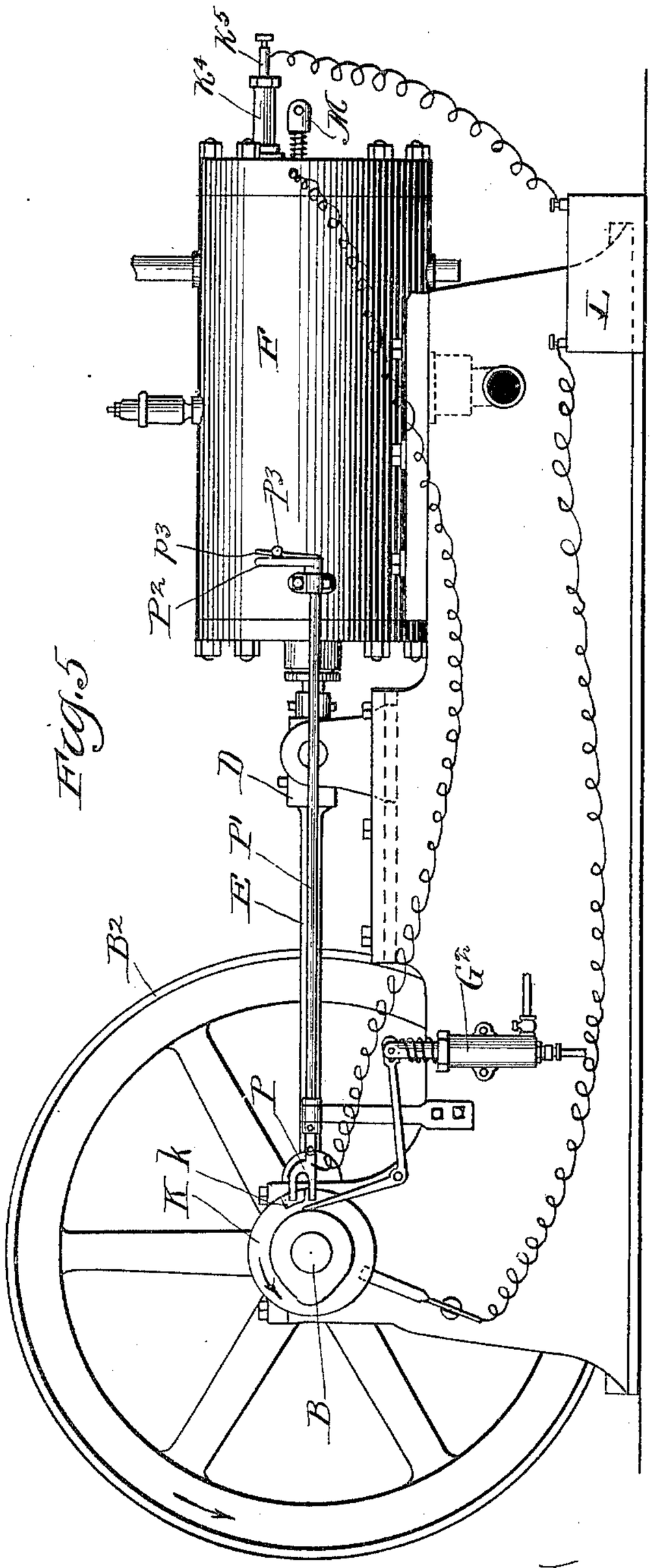
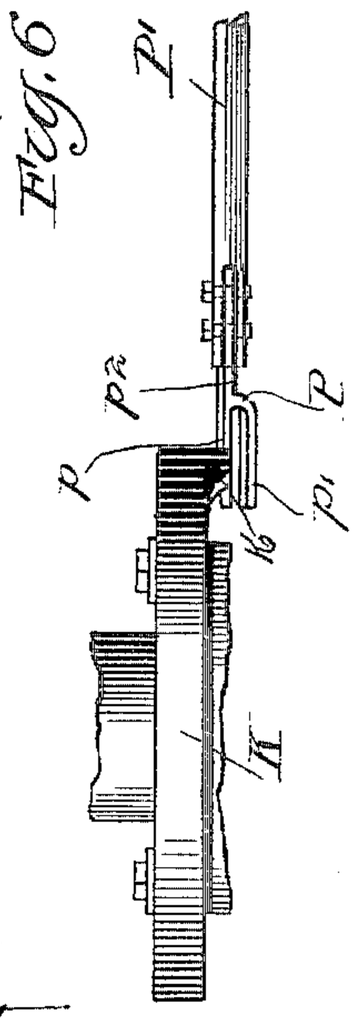


FIG. 6



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UNITED STATES PATENT OFFICE.

GEORGE W. LEWIS, OF PHILADELPHIA, PENNSYLVANIA.

GAS-ENGINE IGNITION DEVICE.

SPECIFICATION forming part of Letters Patent No. 640,392, dated January 2, 1900.

Original application filed November 8, 1894. Renewed September 22, 1898, Serial No. 691,629. Divided and this application filed June 21, 1899. Serial No. 721,375. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. LEWIS, of the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, formerly of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Engine Ignition Devices, (Case A;) and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in gas or vapor engines, and has for its primary object to provide a practical, simple, and otherwise advantageous construction in the electrical connections through which the igniting-spark is produced in the power-cylinder, and also improvements by which a large or heavy engine may be easily and readily started.

In the drawings I have shown both vertical and horizontal gas-engines to which my invention is applied, wherein—

Figure 1 is a side elevation showing a vertical engine provided with my invention. Fig. 2 is a vertical section of the engine shown in Fig. 1 in the axis of the bearings for the crank-shaft, said crank-shaft and fly-wheels and pulley thereon being shown in elevation. Fig. 3 is an enlarged axial section of the power end of the cylinder in the same plane as the parts are shown in Fig. 2. Fig. 4 is a horizontal section in the plane of line 5 5 of Fig. 3. Fig. 5 is a side elevation of a horizontal engine containing my improvements. Fig. 6 is an enlarged view of the cam, which is seen in side elevation in Fig. 5, and circuit-closer engaged by said cam.

The general construction and arrangement of the inlet and exhaust valves and the valve-mechanism for controlling the same, as well as the fuel-supplying devices, are like the construction shown and claimed in a companion application filed simultaneously with this application, said companion application and the present application being divided from my prior application, Serial No. 691,629, renewed on September 22, 1898.

First describing the construction shown in Figs. 1 to 4, inclusive, A represents the frame supporting the various parts of the engine.

B is a centrally-cranked power-shaft carrying a driving-pulley B′ and fly-wheels B^2 B^2.

C C are guides secured to the frame, in which slides a cross-head D.

E is a pitman connecting the cross-head with the crank B^3 of the crank-shaft.

F is a cylinder, of which F′ is the power end and F^2 the pump end. The power end of said cylinder is closed by a head *f* and the pump end by a head *f*′, the latter of which is provided with a stuffing-box through which extends the piston-rod f^2, which connects the piston F^3 with the cross-head D.

G is a carbureter, and *g* is an air-inlet pipe having a straight portion which passes into the carbureter G.

G′ is a supply-tank, and G^2 a pump operated by a cam on the main shaft, which is connected with said supply-tank by a pipe *g*′ and with the carbureter by a pipe g^2.

g^3 designates an overflow-pipe leading from the carbureter back to the supply-tank.

H is a valve for admitting the explosive mixture into the cylinder, said valve, as herein shown, opening directly from the carbureter into a valve chamber or chest H′, which communicates with the cylinder.

The cylinder F is connected with a chamber F^4, external to and concentric with the lower portion of the cylinder, said chamber F^4 being in communication with the lower end of the interior of the cylinder proper by one or more wide passages f^3 and in communication with the valve-chamber H′ by one or more passages *h*. The chamber F^4 is also in communication with the power end of the cylinder when the piston is at or near the extreme end of its power-stroke through a port or ports f^4. The piston F^3 is shown as being of trunk form or hollow in order that the communicating spaces, consisting of the space below the piston and the outer space F^4, may be as large as possible in proportion to the space behind the piston after the power-stroke has been completed within the least practicable limits, the relative proportions of these spaces in the engine shown being about four to one. The piston F^3 covers the passage f^4, except when

the piston is at or near the end of its power-stroke, as shown in Fig. 3. Said piston is provided with a recess f^5, as seen most clearly in Figs. 3 and 4, which is arranged to come opposite the inlet port or ports f^4 when the cylinder is at the end of its power-stroke, said recess having its rear wall f^6 abrupt, so as to deflect the incoming mixture of gas and air to the power-head of the cylinder. The exhaust-ports f^7 of the cylinder are arranged at right angles to the inlet-ports f^4, as shown in Fig. 4, this construction preventing the escape of the explosive mixture which enters through the inlet-ports, as more clearly set forth in said companion application.

The supply-valve H is operable at each rotation of the crank-shaft and is adapted to be controlled as to the length of its opening stroke, and therefore as to the amount of mixture supplied through the same, by any suitable form of governor or controlling mechanism. As herein shown, a governing device like that described and claimed in my said prior application, Serial No. 691,629, is applied to control said valve. Said governing device consists of a wedge-shaped gage I, connected with a vertical arm *i*. Said arm is pivoted at *i'* near its lower end and is connected at its lower end with a collar I' on the main shaft. Between this collar I' and the hub of the fly-wheel B^2 is inserted a second collar I^2, having one of its edges inclined, as shown at i^3, in conformity to the contiguous end of the wheel-hub, and with this interposed bevel or inclined edged collar I^2 is connected the lever J of a familiar form of centrifugal governor, as shown in Fig. 2. The stem h^2 of the valve H extends through the wall of the valve-chest and is provided below the gage I with an adjustable nut *h'*, which strikes the lower edge of the gage when the valve is raised. With this construction when the gage is thrown outwardly through the operation of the centrifugal governor it acts to limit the opening of the valve, and therefore the amount of explosive mixture supplied to the engine.

Referring now to the construction and arrangement of the electric mechanism for producing the spark in the power end of the cylinder, and which constitutes the present invention, said parts are made as follows:

K is a disk fixed to the crank-shaft, which disk has a short laterally-projecting contact or cam *k* upon one of its sides.

k' k² are contact-pieces, of which the former bears continuously against the plane side of the disk K and the latter, k^2, is in position to be struck by the projection *k* on the opposite side of the disk at each rotation of the crank-shaft.

k^5 is an electrode which projects through a mass of insulating material k^3 contained within a tube k^4, which latter is inserted into the head which closes the power end of the cylinder, as shown more clearly in Fig. 3.

K' is a lever within the power end of the cylinder, which is pivoted between its ends and adapted to vibrate toward and from the adjacent head of the cylinder, the long arm being arranged to strike the inner end of the electrode k^5 and being normally held in contact with said electrode by means of a spring k^6. The piston is provided with a stud k^7, arranged to strike the small arm of the lever K' as the piston approaches the end of its compression-stroke. The contact-piece *k'* is connected with the upper end of the cylinder—as, for example, at k^8—and the contact-piece k^2 is connected with the outer end of the electrode k^5.

In the circuit is included a battery L or other source of supply of electricity.

The arrangement of the contact *k* on the disk K with reference to the stroke of the piston is shown to be and desirably is such that the circuit is closed at the time the stud k^7 on the piston strikes the lever K', whereupon the circuit is opened between the long arm of the lever and the electrode k^5 to produce a spark at such break in the circuit just before the piston has completed its compression-stroke. The contact *k* is circumferentially short and leaves the contact-piece k^2 before the lever K' again strikes the electrode k^5, so that for a brief time the circuit is broken at two points, and the closure of the circuit by resumed contact of the lever K' with the electrode k^5 is not followed by the production of a spark between the contact projection *k* and the contact-piece k^2 by reason of the distance attained between these two contact elements when the circuit shall have been closed within the cylinder.

When it is desired to start the engine, gas may be pumped into the power end of the cylinder either by a suitable pumping device or by rotation of the main crank-shaft of the engine when the size of the engine is so small as to permit. For use in connection with the larger sizes of engines I have provided an additional improvement, which will be described in connection with Figs. 5 and 6 and which shows the engine in horizontal form, although such mechanism may be used on the vertical type of engine.

M represents a pin which passes freely through the head *f* of the power end of the cylinder and is provided at its inner end with an enlargement fitted to a countersink in the inner surface of head *f* and serving as a valve to close the space around the freely-movable pin, the valve being normally held to its seat by means of a spring *m*, arranged externally to the cylinder-head, about the pin, and between the cylinder-head and a knob on the outer end of the pin. This pin M is adapted to be pushed inward against the long arm of the lever, so that the operator may by this means break the circuit and produce a spark by hand. This device will be employed mainly in connection with engines of the larger sizes, which will usually be provided with the charging-pump.

N represents a plug fitted to an opening ar-

ranged opposite to the sparking devices in the power end of the cylinder, by which from time to time these parts may be inspected without removal of the cylinder-head.

O is a valved oil-drip pipe leading from the lower end of the cylinder F.

In Figs. 5 and 6 I have shown my improved sparking mechanism connected with a horizontal type of engine. It will be understood that the construction of the cylinder and generally of the hidden parts shown in Figs. 5 and 6 corresponds with the same parts of the previously-described figures. In said figures, K designates the same disk on the crank-shaft shown in the previously-described figures, and k the short circuit-closing projection on said disk. In this improvement I have shown a movable electrode for giving a closed circuit when the crank-shaft is brought to a position past the dead-center by hand to enable the engine to be started by an explosion produced by breaking the circuit within the cylinder by hand and by inward thrust of the pin M, already described. In a preferred form of the movable contact-piece shown, P represents a bifurcated piece for contact with the projection k, said bifurcated or forked electrode having two arms $p\,p'$ and being adapted to oscillate as a whole in the axis of the arm or fork P. P′ is a rod in which the shank p^2 of the contact-piece P, arranged in a line with the fork p, is insulated, as most clearly seen in Fig. 6. Said rod P′ is mounted in fixed bearings, within which it may rock, and is provided with a laterally-projecting lever arm or handle P^2 at its end remote from the fork. P^3 is a fixed stud containing two notches, into either of which a latch-spring p^3, attached to the lever-arm P^2, may catch to hold the oscillating rod P′ in either of the positions to which it may be rocked. The axial fork p of the contact-piece P corresponds with the contact-piece k^2 in the construction shown in the preceding figures. The object of the offset-fork arm p' is to effect the closure of the sparking-circuit when the crank-shaft is off a dead-center in the direction it is to revolve, so that in a heavy engine a movement of the fly-wheel by hand to bring the crank-shaft thus a little beyond the dead-center may enable the engine to be started or initially put in motion by a spark-produced explosion. Preparatory to this explosion the contact-piece is rotated into the position shown in Fig. 5 and desirably locked by the catch p^3 or other suitable device. The fly-wheel is then turned forwardly to bring the projection k in contact with the offset fork-arm p', and with the parts in these positions explosive mixture is pumped into the cylinder by any suitable pumping device, after which the pin M is pushed inwardly by hand to break the circuit at the electrode k^5 within the cylinder and there produce the spark required. The crank-shaft being off and past the dead-center, as stated, the explosion which results from the spark thus produced sets the engine in motion. As soon as the engine has been put in motion the forked contact-piece P is rotated to bring the offset fork p' out of the path of the projection k, leaving the fork p only in the path of said projection, and thereafter the action is that described in connection with the preceding figures of the drawings. The last-mentioned position of the electrode is clearly illustrated in Fig. 6.

It will be understood that any suitable governing device—as, for instance, such as illustrated in my said prior application, Serial No. 691,629—may be employed with this type of engine.

I claim as my invention—

1. In a gas-engine having an electrical sparking device or devices, a movable contact-piece adapted to be moved into position for completing the circuit through a moving contact when the crank of the engine-shaft is past the dead-center, and to be retracted from said position after the engine has been started, in combination with means for breaking the circuit within the cylinder by hand.

2. In a gas-engine having an electrical sparking device or devices, a bifurcated contact-piece one arm of which is adapted to be temporarily moved into position for completing the circuit through a revolving contact when the crank is past the dead-center, in combination with means for breaking the circuit within the cylinder by hand.

3. In a gas-engine having an electrical sparking device or devices, a bifurcated contact-piece one arm of which is adapted to be temporarily moved into position for completing the circuit through a revolving contact when the crank-arm is past the dead-center, the other arm of the bifurcated electrode being permanently in position to give electrical contact when the crank-arm is approaching the dead-center in the direction of its operative revolutions, in combination with means for breaking the circuit within the cylinder by hand.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 1st day of June, A. D. 1899.

GEORGE W. LEWIS.

Witnesses:
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F. E. BECHTOLD.