No. 692,625. Patented Feb. 4, 1902.

D. P. CLARK.

SPARKING IGNITER FOR COMBUSTIBLE VAPOR ENGINES.

(Application filed Nov. 27, 1900.)

(No Model.) 2 Sheets—Sheet 1.

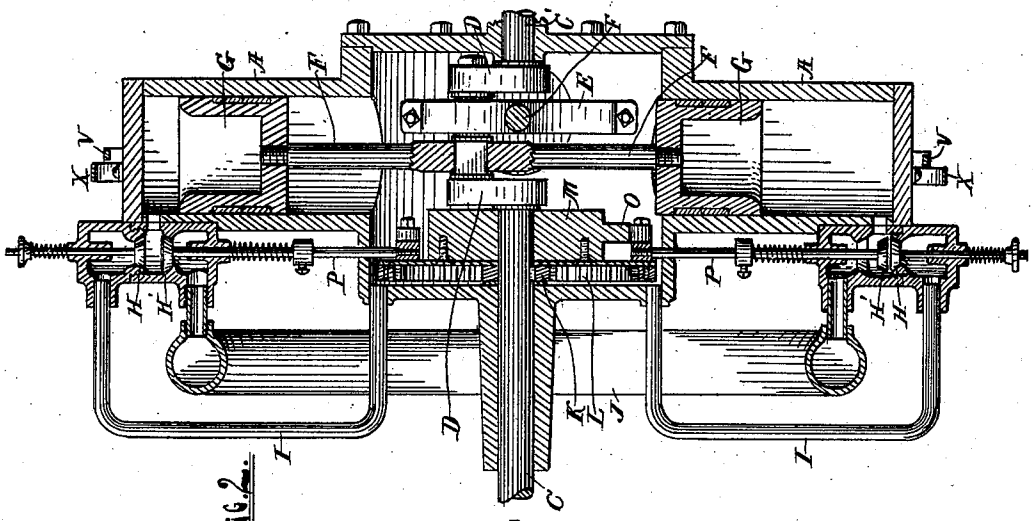


Fig. 2.

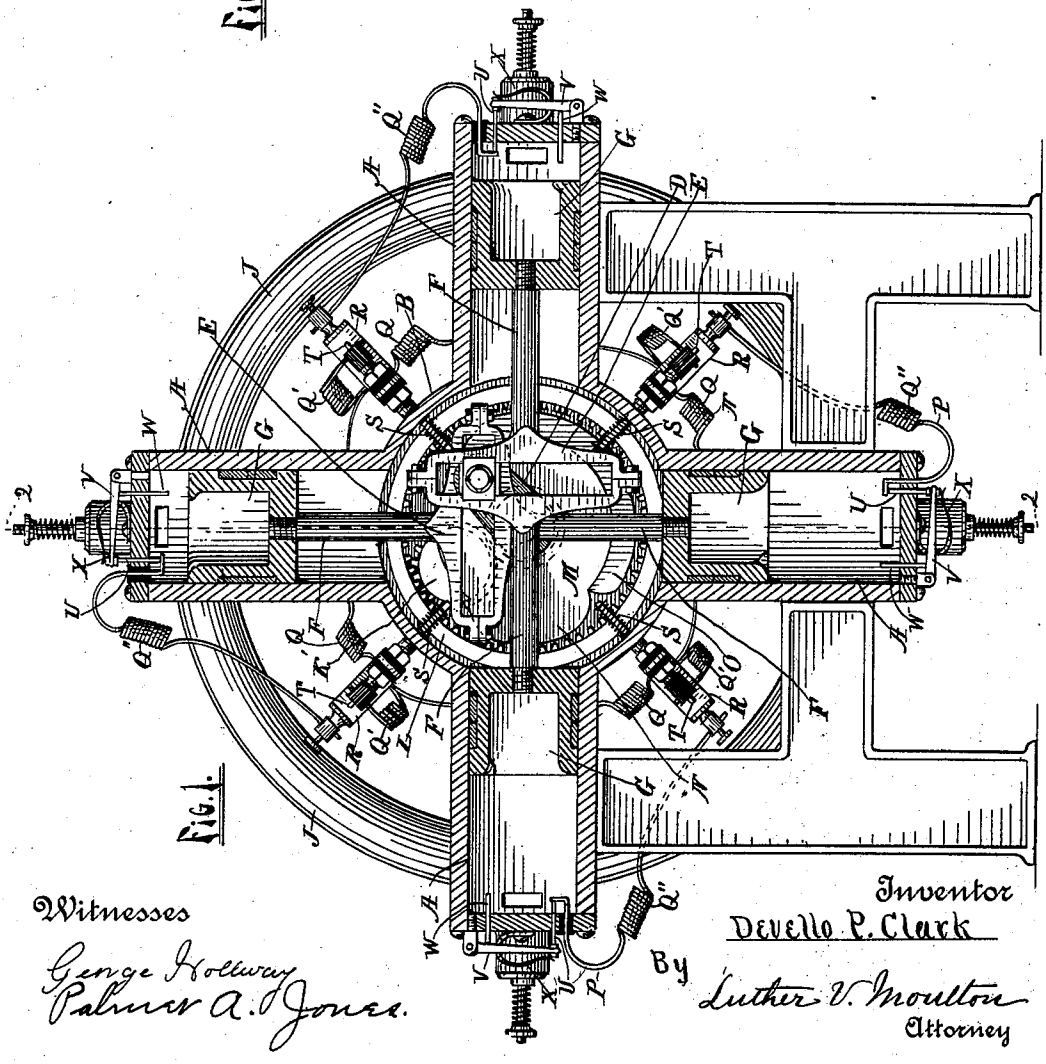


Fig. 1.

Witnesses

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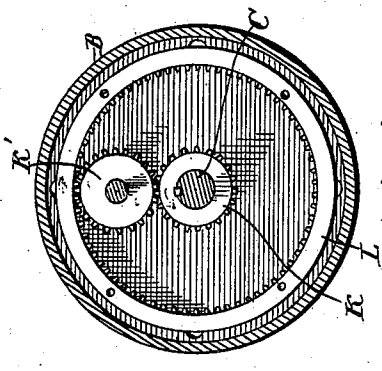


Fig. 4.

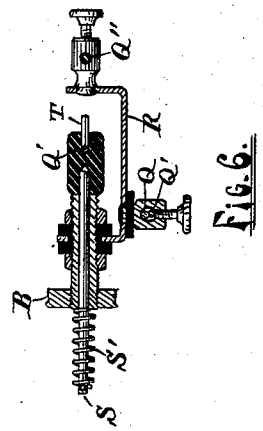


Fig. 6.

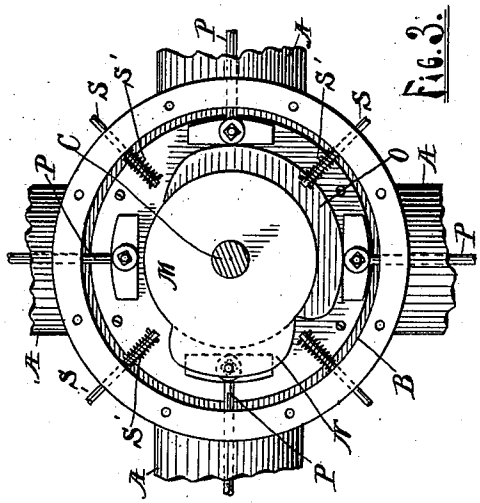


Fig. 3.

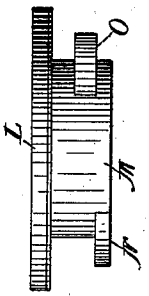


Fig. 5.

Witnesses
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UNITED STATES PATENT OFFICE.

DEVELLO P. CLARK, OF GRAND RAPIDS, MICHIGAN, ASSIGNOR OF ONE-HALF TO ALVAH W. BROWN, OF GRAND RAPIDS, MICHIGAN.

SPARKING IGNITER FOR COMBUSTIBLE-VAPOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 692,625, dated February 4, 1902.

Application filed November 27, 1900. Serial No. 37,947. (No model.)

To all whom it may concern:

Be it known that I, DEVELLO P. CLARK, a citizen of the United States, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Sparking Igniters for Combustible-Vapor Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in sparking igniters for combustible-vapor engines, and more particularly to such igniters for combustible-vapor engines having a series of cylinders operating in succession; and its object is to provide improved means for momentarily closing the circuit for each particular cylinder in succession, whereby greater economy of electric energy is secured, and to provide the device with certain new and useful features, all as hereinafter more fully described, and particularly pointed out in the claims.

My invention consists, essentially, in providing an engine having a series of cylinders operating in succession, with a cam-wheel loosely journaled on the crank-shaft and adapted to operate all of the exhaust-valves and all of the electric-circuit closers of the igniters, means for closing the electric circuit for each separate cylinder for a certain definite time just before the circuit is broken to ignite the charge in said cylinder, and in certain details of construction, as will more fully appear by reference to the accompanying drawings, in which—

Figure 1 is an elevation of a device embodying my invention with parts removed to better show the construction; Fig. 2, a vertical section of the same on the line 2 2 of Fig. 1; Fig. 3, a detail of the cams and rods operated thereby; Fig. 4, a detail of the cam-gearing; Fig. 5, a detail of the cams, and Fig. 6 a detail of the circuit-closing means.

Like letters refer to like parts in all the figures.

For the purpose of illustration I have shown an engine with four radial cylinders; but it is obvious that the number of cylinders and their relative positions may be varied without departing from my invention.

The invention herein claimed has relation solely to the electric igniting mechanism and parts coacting therewith, the construction of engine herein shown, aside from said mechanism, being reserved for a separate application, pursuant to the division of this application, as required by the office.

The four radial cylinders A are preferably cast integral with the central chamber B and arranged in pairs, the opposing cylinders being in line with each other. The axis of one pair of cylinders is at right angles to the axis of the other pair and offset the width of the bearing of the link on the crank.

C is a shaft journaled in the axis of the chamber B.

In each cylinder is a piston G, and the opposing pistons are connected by a rigid piston-rod F, having at the middle a transverse link E, slidably engaging a bearing-block on the crank-pin of the crank D. At the outer end of each cylinder is a port opening into a valve-chamber, in which chamber is an intake check-valve H and an exhaust-valve H'. These valves are closed by suitable springs on the valve-stems, and the spring on the intake check is made the weaker, so that when both valves are closed the check-valve only will open on the instroke of the piston. Pipes I extend from each intake check to the chamber B to convey the combustible vapor to the valve-chambers. Valve-rods P extend from the exhaust-valves through the wall of the chamber B and are engaged and moved longitudinally by the cam O on the wheel M to open the exhaust-valves.

J is an annular chamber connected to all of the exhaust-valves, which chamber receives the exhaust and also acts as a muffler for the same.

Q is an electric conductor attached to the positive pole of any suitable generator. A branch conductor Q' for each cylinder extends from this conductor Q to a circuit-closer,

consisting of a movable insulated electrode T on the outer end of a longitudinally-movable rod S, said rod extending through a suitable sleeve in the wall of the chamber B and moved outward by a cam N on the wheel M to close the circuit and moved inward by a spring S′ to open the circuit.

R is an insulated plate contacted by the electrode T to close the circuit. A wire Q″ extends from the plate R through the head of the cylinder, terminating within the cylinder and in contact with a movable electrode U, attached to a lever V, moved outward by a rod W, engaged by the piston G to break the circuit and moved inward by a spring X to close the circuit.

The cam-wheel M is loosely journaled on the shaft C and rotates oppositely thereto and is rotated by an internal gear L, attached to the cam-wheel and engaged by an intermediate gear K′, rotative on a fixed stud and driven by a pinion K, fixed on the shaft C. These gears are so proportioned that the wheel M rotates backward one-third as fast as the shaft C rotates forward, whereby the cycle of operation of the cylinders progresses backward one-fourth as fast as the engine revolves forward, thus giving one impulse to three-fourths of a revolution of the engine.

Any suitable combustible vapor is supplied in any convenient manner to the chamber B, from whence it passes through the pipes I, thence through the intake-checks, and thence to the cylinders, therein being compressed and fired by the spark produced by opening the electric circuit when the piston G strikes the rod W.

The operation of the engine is as follows: Referring to Fig. 1, the position of the parts as shown indicates that the upper cylinder is in action, a charge having been fired in it as the crank passed the upper center, the right-hand cylinder is exhausting a spent charge, the bottom cylinder is running with an open exhaust-valve, and the left-hand cylinder is taking in a fresh charge. This left-hand cylinder is the next to act. The cam N first closes the circuit of the igniter for this cylinder and holds it closed sufficiently long to insure a full spark at the igniter. As the piston strikes the rod W the circuit is broken in the cylinder and the charge ignited. The cam O releases the exhaust of the bottom cylinder as the crank passes the lower center. This exhaust being closed, this cylinder now takes a charge of combustible vapor through the intake check-valve, and by the time the charge in the left-hand cylinder has done its work the cam O opens its exhaust. Thus each cylinder comes into action successively from right to left.

By closing the circuit momentarily in advance of the ignition for each cylinder in succession I use the minimum electrical energy, and only when needed.

By operating the various valves and circuit-closers in succession by cams on a single cam-wheel I simplify the construction.

By the lever V and rod W, located near the pivot of said lever, I obtain a sudden opening of the circuit, thus insuring a good igniting-spark.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a crank-shaft, four combustible-vapor engines arranged radially about said shaft and connected thereto, an electric igniter to each engine, a normally open circuit to each igniter, a circuit-closer in each circuit, radial and longitudinally-movable rods to operate the circuit-closers, a cam-wheel loosely journaled on the crank-shaft and having a cam to successively engage the rods and close the circuits, and gears connecting the cam and shaft whereby the cam is revolved once to every three revolutions of the shaft, substantially as described.

2. The combination of a crank-shaft, a series of combustible-vapor engines arranged radially about said crank-shaft, an electric igniter and an exhaust-valve to each engine, an electric circuit having normally open branch circuits to each igniter, a circuit-closer in each branch circuit, radial and longitudinally-movable rods to operate the circuit-closers and exhaust-valves, a cam-wheel loosely journaled on the crank-shaft, a cam on the wheel to engage the circuit-closer rods, a second cam on the wheel to engage the valve-rods, an internal gear attached to the cam-wheel, a pinion attached to the crank-shaft, and a gear connecting the internal gear with the pinion and rotative on a fixed stud, substantially as described.

3. The combination of four combustible-vapor engines arranged radially about a common crank-shaft, an exhaust-valve and an electric igniter to each engine, an electric circuit having a branch to each igniter, an insulated electrode and an insulated plate in each branch, radial and longitudinally-movable rods supporting the electrodes, radial and longitudinally-movable rods operating the exhaust-valves, a cam-wheel loosely journaled on the crank-shaft, cams on the wheel to operate all of said rods, and means for rotating the wheel on the shaft, substantially as described.

4. The combination of a crank-shaft, four combustible-vapor engines arranged radially about the crank-shaft, an electric igniter and an exhaust-valve to each engine, an electric circuit having a branch circuit to each igniter, a fixed insulated plate in each branch, a movable insulated electrode in each branch circuit, radial and longitudinally-movable rods supporting the electrodes, springs on the rods to open the circuits, longitudinally-

movable rods to operate the valves, springs on the rods to close the valves, a cam-wheel loosely journaled on the crank-shaft, a cam on the wheel to engage the rods which close the circuits, a cam on the wheel to engage the rods which open the valves, an internal gear attached to the cam-wheel, a pinion attached to the shaft, a gear connecting the internal gear and the pinion, and rotative on a fixed stud, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses:

DEVELLO P. CLARK.

Witnesses:

PALMER A. JONES.

LUTHER V. MOULTON.