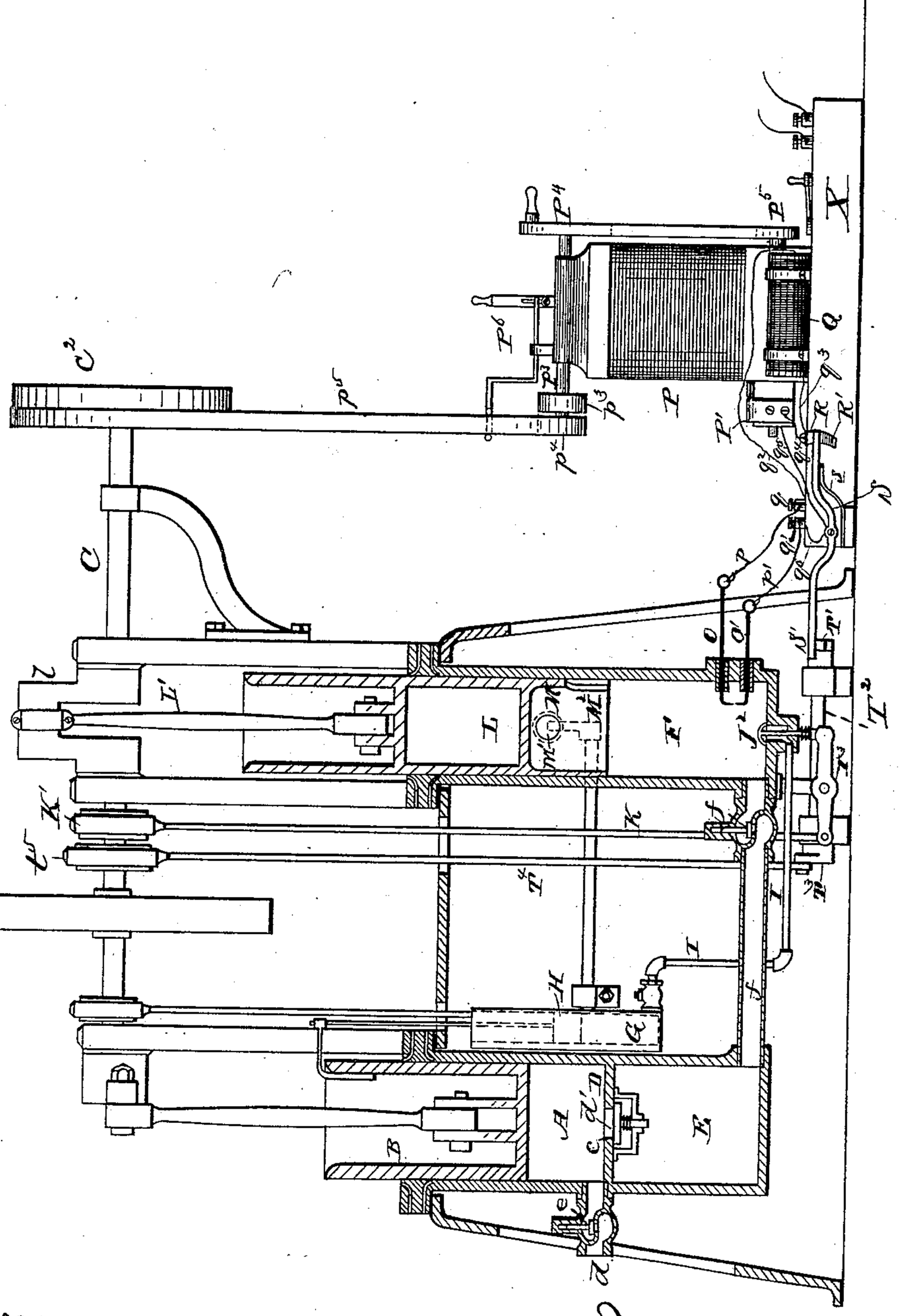
(No Model.)

A. K. RIDER.

ELECTRICAL IGNITING DEVICE FOR GAS ENGINES.

No. 267,458. Patented Nov. 14, 1882.



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ELECTRICAL IGNITING DEVICE FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 267,458, dated November 14, 1882.

Application filed July 20, 1882. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER K. RIDER, of Walden, in the county of Orange and State of New York, have invented certain new and useful Improvements in Electrical Igniting Devices for Gas-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 pertains to make and use the same.

My invention relates to an improvement in the igniting devices of explosive gas-engines, the object being to insure the prompt ignition of the charge of gas or mixed air and gas behind the piston in the motive cylinder.

To this end it consists generally in the combination, with a gas-engine, of a mechanical electrical generator arranged for operation by power transmitted from the engine, and having suitable conductors terminating inside the motive cylinder of the engine, and suitable devices for causing a spark to be produced between the terminals of said conductors by the current from said generator at the proper time for igniting the charge of gas, or mixed gas and air, as hereinafter fully described.

I am aware that galvanic batteries have been used in connection with current-intensifying devices for igniting the explosive or expansive charge of a suitable medium in the cylinders of explosive engines; but galvanic batteries are, as is well known, unreliable and expensive, and require a great deal of care to keep them in working order, and it is to overcome the many objections to their use, while still retaining the advantages of the electric spark as an igniter, that my present improvement is made.

In the accompanying drawing is shown a gas-engine partly in side elevation and partly in vertical section, and a dynamo-electric generator in side elevation connected with the engine according to my invention, as usually arranged.

I do not confine myself to any particular form of either gas engine or mechanical electric generator; but, for the purpose of illustration, I have shown in the drawing a view of the main parts of a gas-engine which is shown and described in Letters Patent No. 245,218, granted to me August 2, 1881, the igniter shown in the patent being omitted and replaced by electrical devices. The dynamo-electric machine shown is of an ordinary type, and requires no particular description, except as to the devices adapting it for use in connection with the engine.

In the drawing the letter F indicates the motive cylinder of the engine, the same as in my Letters Patent referred to; and L is the motive piston, which is connected to the crank-arm *l* on the main shaft C by the connecting-rod L′. The lower end of the motive cylinder is constructed with an inverted cup, M, having its wall comparatively thin and furnished with an opening, M′, which is arranged to register with an exhaust-opening in the motive cylinder when the piston has reached the limit of its upstroke.

The wall of the cup M is provided with an open slot, M^2, through which the igniting-electrodes O and O′ project into the motive cylinder below the piston. The electrodes O and O′ are small copper wires passed through apertures in the wall of the motive cylinder and each surrounded closely by an insulating porcelain tube, as shown at *o o′*, which snugly fills the aperture in which it is placed. The tips of the electrodes within the cylinder are bent toward each other, pointed and perfectly plated with platinum, or the electrodes may be made entirely of platinum. The tips of the electrodes approach quite closely to each other, but do not touch. Their outer ends are formed into rings for convenience in attaching the conducting-wires *p p′* of the dynamo-machine P. The conducting-wires *p p′* lead from the binding-posts *q q′*, the former of which is connected by a wire, q^2, with one terminal of a spark-coil, Q, arranged on the base X of the machine, the other terminal of said coil being connected by a wire, q^3, with a metal plate, R, secured to the edge of the base of the machine and connected by a wire, q^4, with one of the commutator-brushes, P′. The other commutator-brush (not visible in the drawing) is connected by wire q^5 with a metallic lever, S, which is pivoted to the edge of the base X and has one end arranged to bear against and play upon the metal plate R and a segmental extension, R′, thereof, formed of hard rubber, while the other end of said lever extends beyond the edge of the machine-base and terminates over and in the path of an arm, T′, which

projects from a rock-shaft, T^2, the opposite end of which is provided with a crank, T^3, to which is attached the lower end of an eccentric-rod, T^4, which is operated by an eccentric, t^5, on the main shaft C of the engine.

The lever S is connected by a wire, q^6, with the binding-post q', and the end of the shaft-arm of said lever, or that which extends inwardly along the edge of the base X, is kept normally in contact with the metallic plate R by means of a spring, *s*.

In a suitable bearing on the top piece, P^2, of the dynamo-electric machine is mounted a rotary shaft, P^3, carrying at one end a belt-wheel, P^4, which is provided with a crank-handle and connected by a belt with a pulley, P^5, fixed upon the armature-shaft. At its other end the shaft P^3 carries a fixed pulley, p^3, and a loose pulley, p^4, either of which may be connected by a belt, p^5, with a broad-faced belt-wheel, C^2, fixed upon an extension of the main shaft C of the gas-engine.

A belt-shifting device, P^6, of ordinary construction, may be operated to place the belt upon either the fixed or loose pulley, as desired.

When during the operation of the dynamo-electric machine the lever S is in its normal position—that is, with its end in contact with the metal plate R—the current generated by the machine is short-circuited, say, as follows: Passing from the commutator-brush P′, the current flows over wire q^4, metal plate R, lever S, and wire q^5 to the opposite commutator-brush. When, however, the end of the lever S is moved off the metal plate R the short circuit is broken and the current flows over the full exterior circuit of the machine, which in the present instance includes a spark-coil, as shown at Q, for the purpose of adding resistance to the circuit and tension to the current. When the short circuit is broken the route of the current is, say, as follows: From commutator-brush P′ over wire q^4, wire q^3, spark-coil Q, wire q^2, binding-post *q*, and wire *p* to electrode O, from the pointed tip of which it leaps in the form of an electric spark to the opposite pointed tip of the electrode O′, flowing from said electrode over wire p', binding-post q', wire q^6, and wire q^5 to the commutator-brush opposite that from whence it started. The current flows alternately in opposite directions over the circuit indicated, if the machine is not specially constructed for producing a continuous current in one direction. It is of no importance, however, whether a continuous or reversed current machine is used.

The spark-coil may be dispensed with, and a condenser or any other tension-accumulator may be used in the customary manner; or additional tension-producers may be omitted altogether from the circuit, a machine, in such case, being used which will generate directly a current of sufficient tension to produce the spark between the tips of the electrodes O O′ when the short circuit is broken. As before stated, the tips of the electrodes are pointed, this being for the purpose of preventing the collection of soot upon them as a result of the combustion of the gas.

I will now explain the operation of the dynamo-electric machine in connection with the gas-engine.

In preparing to start the engine, the belt p^5 is shifted to the loose belt-pulley p^4, and the fly-wheel of the shaft C is turned by hand to place the engine in proper condition to begin work. As the air-supply piston B moves through its upstroke it draws a charge of air through the air-inlet pipe *d* and check-valve *e* and into the supply-cylinder A below the piston, and as the piston H of the gas-supply cylinder G is worked from the air-supply piston a charge of gas will also be drawn into the gas-supply cylinder as the piston moves through its upstroke. On a still further operation of the engine by hand the air-supply piston descends and the charge of air beneath it flows downwardly through the opening *c* and past the check-valve d' in the partition D, and into the air-reservoir E, and from thence it flows into the lower end of the motive cylinder F, through the pipe *f*, and past the check-valve f'. The gas-supply piston H now descending, the charge of gas is forced through pipe I, and will enter the lower part of cylinder F on the opening of the spring check-valve J^2, the opening of which is controlled by an eccentric, K′, fixed on the main shaft and operating through rod K and lever I^3, as shown. An explosive mixed charge of gas and air being now in the lower end of the motive cylinder F, the motive piston L, which has already begun its descent, still further descends and compresses the charge until the said piston has reached its limit of its upstroke. While the motive piston is descending the eccentric t^5 on the main shaft, operating through the rod T^4, causes a partial rotation of the rock-shaft T^2, which swings upward the arm T′, and this arm raises the long arm S′ of the lever S, causing the end of the short arm to pass off the metal plate R and onto the non-conducting extension R′, (which is simply for the purpose of giving the end of the lever an easy movement to and from the metal plate,) thus breaking the short circuit, as heretofore explained.

The parts being in their several positions as now described, and the motive cylinder charged, the ignition of the charge is the final step necessary to start the engine into full operation, and this is performed by turning the wheel P^4 a few turns rapidly by hand by means of its crank, until a current is generated of sufficient tension to cause a spark to pass between the electrodes O O′. When this occurs the charge of mixed air and gas will be ignited by the spark, and its explosion will start the engine, at which time the belt p^5 must be shifted to the fixed pulley p^3, so that the further operation of the machine will be derived from the shaft C. The engine now being started will continue to work in the usual manner, the eccentric t^5 being timed to break the short circuit always at the proper

time to ignite the charge, which is supplied to the motive cylinder at proper intervals, as fully explained in my Letters Patent heretofore referred to, and to which reference is made for a more detailed description than here given of the construction of the gas-engine.

I have preferred to use a spark-coil in connection with a dynamo-electric machine, as shown in the drawing, for the reason that it enables me to use a very small and inexpensive mechanical generator by its furnishing a current of sufficient energy to pass a spark between the terminals of the electrodes when these are a considerable distance apart, thereby insuring a perfect working of the short-circuit device. The mechanical arrangement and details for carrying out the principle of my invention may obviously be greatly varied without materially affecting the efficiency or spirit of the invention. For instance, any mechanical generator may be used, whether magnetic, frictional, or inductive, and the short-circuit device described, together with the coil, may, when a dynamo is used, be entirely dispensed with by "breaking circuit" within the cylinder and causing the residual charge in the wires of the dynamo-machine to "pass the gap" of the broken circuit in a strong spark, in accordance with the well-known laws of electro-motive force.

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

1. The combination, with a gas-engine, of a mechanical electrical generator arranged for operation through suitable intermediate connections by power transmitted from the engine, and having suitable conductors terminating inside the motive cylinder of the engine, and suitable devices for causing the current from said generator to produce a spark between the terminals of said conductors, substantially as and for the purpose set forth.

2. In a gas-engine, the combination, with the motive cylinder and piston, of the insulated electrodes projecting into said cylinder, and slightly separated from each other at their tips, a mechanical electrical generator operated by connection with the engine and having opposite conductors connected with said electrodes, respectively, a short or shunt circuit arranged to connect said conductors outside of said motive cylinder, a circuit-breaker and shunting device arranged to break said short circuit, and mechanism deriving motion from the engine for operating said circuit-breaker and shunting device at predetermined intervals, substantially as and for the purpose set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALEXANDER KIRK RIDER.

Witnesses:
W. G. RUTHERFORD,
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