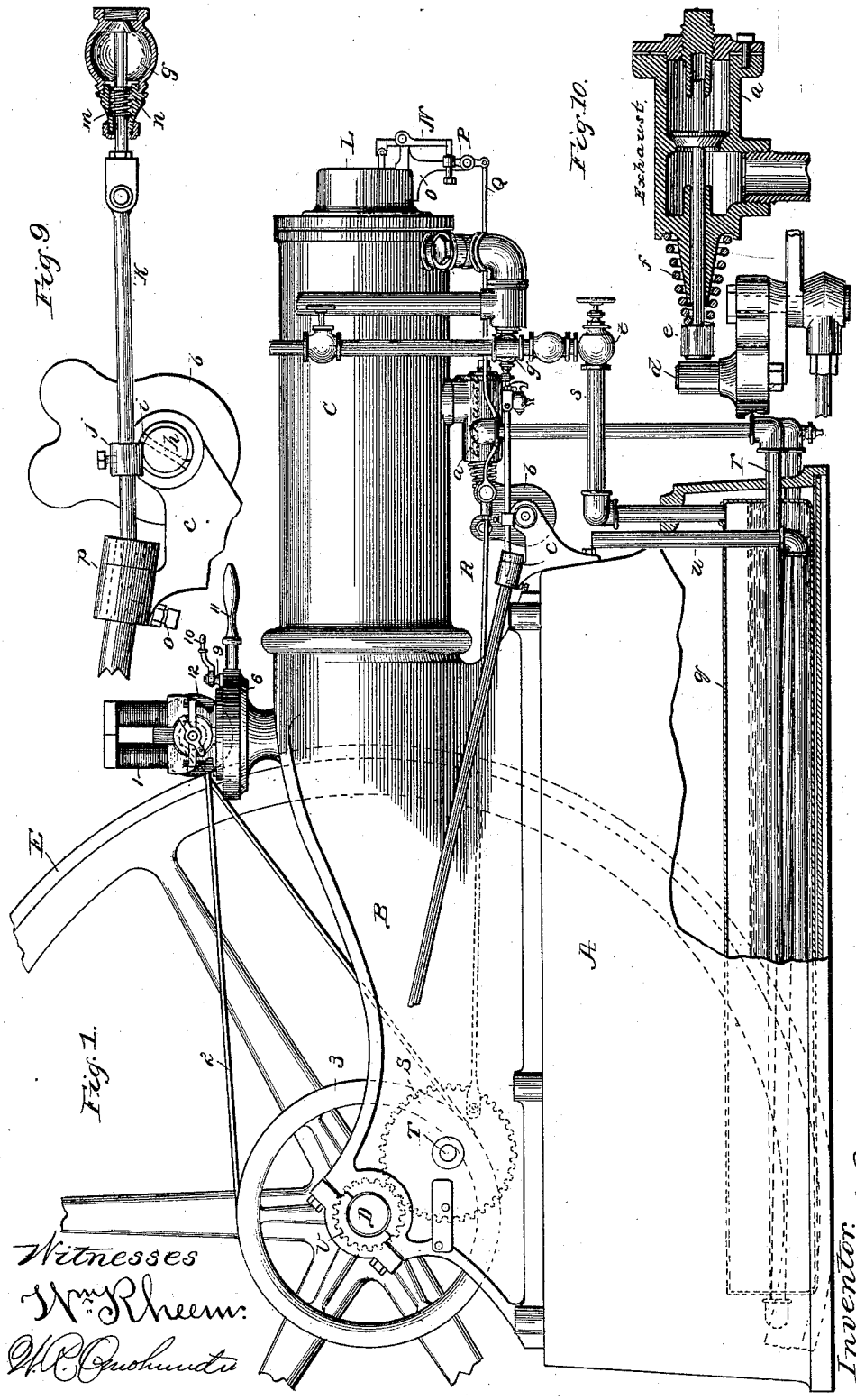
(No Model.) 3 Sheets—Sheet 1.

H. J. BAKER.

GAS ENGINE.

No. 421,473. Patented Feb. 18, 1890.



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(No Model.) 3 Sheets—Sheet 2.

H. J. BAKER.

GAS ENGINE.

No. 421,473. Patented Feb. 18, 1890.

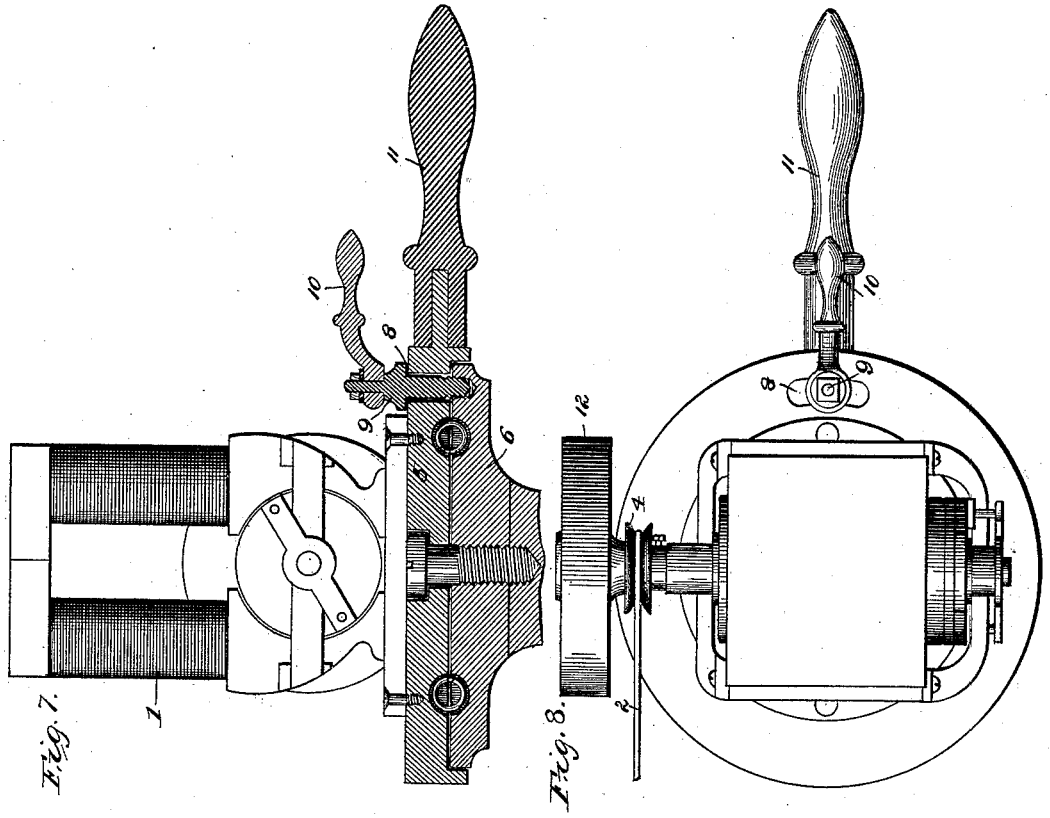

Fig. 7.

Fig. 8.

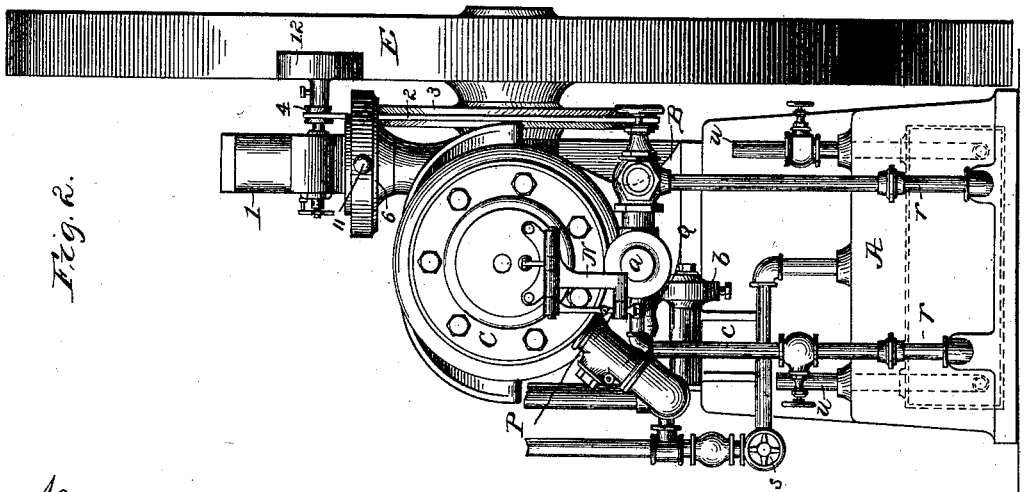

Fig. 2.

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Fig. 4.

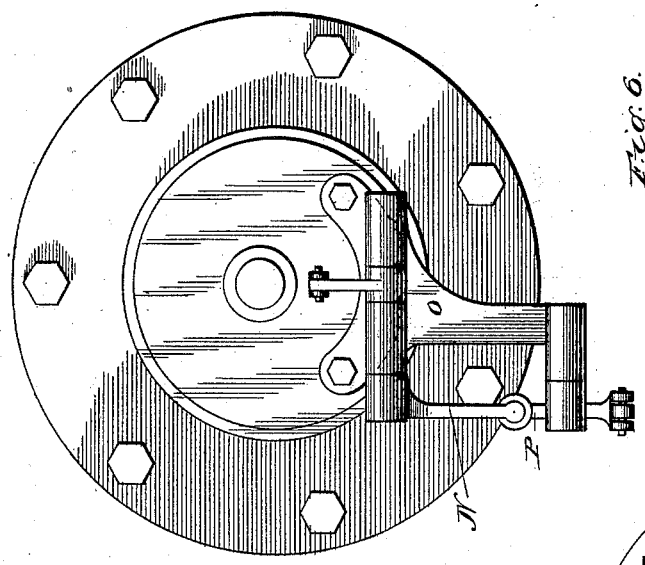


Fig. 6.

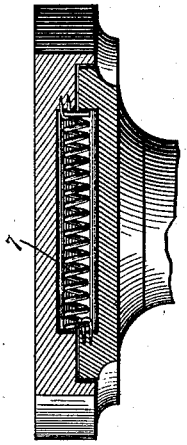


Fig. 5.

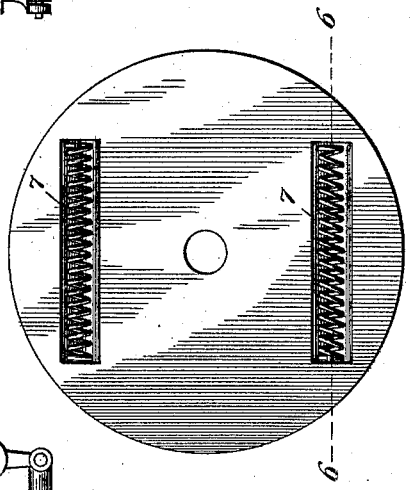
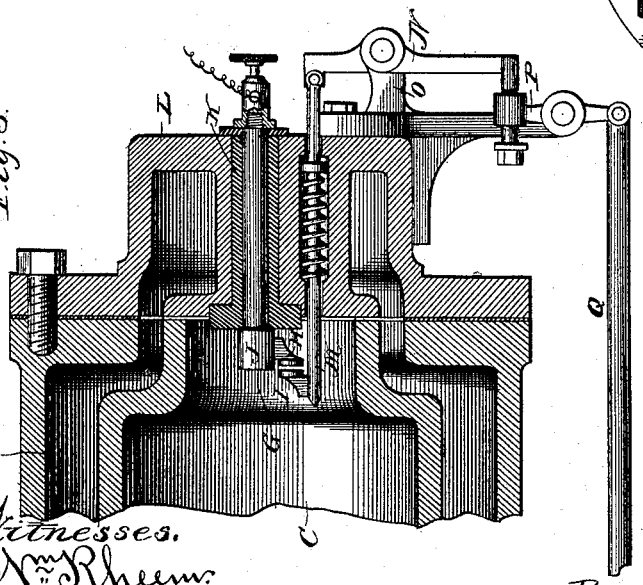


Fig. 3.



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UNITED STATES PATENT OFFICE.

HARRISON J. BAKER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE ELECTRO-CARBON MOTOR COMPANY, OF ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 421,473, dated February 18, 1890.

Application filed April 28, 1888. Serial No. 272,199. (No model.)

To all whom it may concern:

Be it known that I, HARRISON J. BAKER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to improvements in gas-engines, and more particularly to that class in which an electric spark is employed for igniting the gas, and has for its prime object to have the contact-points of the ignitor so located relatively to each other that the force of the explosion will tend to hold said points in contact, whereby breaking of the electric circuit between explosions and the consequent reduction in the size of the spark will be avoided.

Another object is to combine with a gas-engine a carburetor of such a character that atmospheric air introduced therein will be forced through the hydrocarbon, thereby producing the maximum volume of explosive mixture.

A further object is to combine with a gas-engine a dynamo for generating electricity to produce the exploding-spark, so connected therewith that the normal maximum speed thereof may be attained immediately the engine is started, whereby in starting up the electric current may be in full force simultaneously with the first filling of the exploding-chambers with the gas.

A further object is to have the dynamo in gear with the drive-shaft, but movably connected with the engine in such manner that a friction-wheel on the shaft thereof may be brought into contact with the fly-wheel of the engine and the normal speed of the said shaft thereby imparted to it, and before the speed of the engine is sufficient to produce the normal speed of the dynamo through the medium of the usual gear-connection.

I attain these objects by the device illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation, partly in section, of a gas-engine embodying my invention; Fig. 2, a rear elevation thereof; Fig. 3, an enlarged detailed central section through the exploding-cylinder; Fig. 4, a rear elevation thereof; Fig. 5, a plan view of the bed-plate supporting the dynamo; Fig. 6, a sectional view on line 6 6 of Fig. 5, showing the bed-plate and base-plate of the dynamo. Fig. 7, a detailed central section through the dynamo-supports, showing the dynamo mounted thereon in elevation; Fig. 8, a plan view of the same; Fig. 9, a detailed sectional elevation of the supply-valve and its operating mechanism, and Fig. 10 a similar view of the exhaust-valve.

Similar letters and figures of reference indicate the same parts in the several figures of the drawings.

Referring by letter to the accompanying drawings, A indicates the engine-base, and B the frame mounted thereon, to the forward end of which is secured by bolts or otherwise the cylinder C, in which works the piston, connected by means of a pitman and crank with the drive-shaft D of a fly-wheel E, as usual in this class of machines, which connection is so well known as not to require illustration.

The cylinder C is surrounded by the usual water-jacket F, for reducing the temperature thereof resulting from the frequent explosions, and has at the forward end thereof, beyond the stroke of the piston, a reduced portion G, in which are located the electric igniting devices, consisting of two contact-points H and I, the former secured to the end of a fixed metallic rod J, which has an insulated bearing K in the head L of the cylinder, to the outer end of which rod, projecting through the cylinder-head, is connected one of the line-wires from the dynamo. The other contact-point I is attached to the end of a spring-actuated rod M, also journaled in the cylinder-head, the tension of which spring tends to hold the point I normally in close contact with the point H, the separation of which points produces the spark which causes the explosion in the chamber C forward of the piston and while the gas in the cylinder is under the greatest compression. The separation of these points at regular intervals, and, as I prefer, at every other stroke of the piston, is accomplished by means of a lever N, pivoted to the cylinder-head upon a suitable bracket O, one end of which lever is pivot-

ally attached to the end of the rod M, projecting through the cylinder-head, while the opposite end of said lever is engaged by the free end of a second lever P, also pivoted on the bracket O, to the opposite end of which said lever P is pivotally secured one end of a connecting-rod Q. The rod Q is in turn connected with the pitman R, and the latter eccentrically connected with a cog-wheel S, journaled on a short shaft T, bearing in the engine-frame, with which meshes a smaller cog U, mounted on the shaft D of the fly-wheel, the said cogs being of such a size that it requires two revolutions of the smaller to one of the larger, and hence the piston will make two complete strokes to each explosion. The pitman R also operates the exhaust-valve *a*, located beneath and about the center of length of the cylinder, by means of a wrist-plate *b*, pivoted on a suitable bracket *c*, from one arm of which wrist-plate projects laterally a lug *d*, adapted and arranged to strike the end of the valve-rod *e* and unseat said valve during the forward movement of the pitman and in the interval between the separation of the contact-points, and consequently between the explosions, the said rod being returned to its normal projected position and the valve thereby seated by means of a coiled spring *f*, confined between the head of said rod and the valve-casing, all as clearly shown in Fig. 10. The valve *g*, controlling the supply of the explosive mixture of gas and air to the cylinder, is also operated by the same pitman through the medium of the pivoting-bolt *h* of the wrist-plate, which said bolt is keyed to the wrist-plate and revolves loosely in the bracket O, and on which bolt is provided a radial projection *i*, which engages a stop *j*, mounted on a rod *k*, hinged or pivotally connected to and which constitutes an extension of the valve-stem, the said rod and stem being yieldingly opposed to the action of said bolt by means of a coiled spring *m*, confined between the valve-casing and a shoulder or collar *n* on the valve-rod, the tendency of which spring causes the valve to normally seat; hence at every oscillation of the wrist-plate, and consequently the pivot-bolt thereof, the projection *i* on said bolt will engage the stop *j* on the rod *k*, force the latter backwardly, and unseat the valve, permitting the gas to flow into the cylinder, and the duration of the flow of gas is preferably controlled by means of an adjustable throw-off for lifting the hinged rod, so as to free the stop therein from the said projections, consisting of a screw-bolt *o*, projecting into a socket *p*, cast on the bracket *c* in the path of movement of the rod *k*, the free end of which is inclined on the under side, so that as it engages the said stop the end of the rod will be thereby elevated, so as to free the stop *j* from the projection *i*, when the spring *m* will return the rod to its normal position and cause the valve to seat, and thereby cut off the flow of gas to the cylinder.

Either the ordinary coal-gas used for illuminating purposes or a hydrocarbon gas may be employed in connection with my engine; but I prefer to use the latter, and obtain it by means of a carburetor *q*, located in the base of the engine, consisting of a closed tank for containing the hydrocarbon, through which passes exhaust-pipes *r*, connected with the exhaust-valve *a*, by means of which any desired quantity of the exhaust or exploded gas may be utilized for heating the hydrocarbon contained in the carburetor, which is only partially filled thereby, the gas generated rising to the top of the tank, and from thence through pipes *s*, in which may be located a controlling-valve *t* to the supply-valve *g*, from whence it is admitted into the cylinder in the manner previously described. With this gas is mixed atmospheric air, admitted to the carburetor through pipes *u*, opening above the tank and outside of the engine-base, which said pipes extend along the bottom of the tank and are perforated, so as to permit the escape of the air into the tank to supply the place of the air and gases drawn off by the action of the piston and without the aid of a pump, for the atmospheric pressure from the outside up through the hydrocarbon forces the air as rapidly as a vacuum is created, thereby effecting a thorough mixture of the air and hydrocarbon and producing the maximum volume of combustible gas. The major portion of the exhaust, or such portion thereof as may not be needed in the carburetor, may be led off and discharged at any desired point in the same manner as usual.

Another important feature of my invention is the manner of supporting and operating the dynamo that supplies the electric current to the ignitor, which differs from the prior construction in that the dynamo is movable and adjustable.

The dynamo 1, which may be of any ordinary construction, is driven from the shaft of the fly-wheel by means of a belt-connection 2 between a large pulley 3 on said shaft and a small pulley 4 on the commutator-shaft, the difference in the size of which pulleys giving to the commutator a sufficiently-rapid rotation to produce the required amount of electricity—that is, when the engine is in operation; but it is well known that in starting up the engine (which is usually done by giving the fly-wheel a few turns by the hand) sufficient electricity to produce a spark cannot be possibly generated, and as a result a large and frequently dangerous quantity of gas is exhausted in the efforts to start the engine, and to overcome this objection numerous devices, more or less complicated, have heretofore been employed for giving to the dynamo a sufficient number of rotations to produce the required amount of electricity before the speed of the engine could accomplish that result; but most of these devices involve complicated gearing, requiring considerable power to operate, and all of them involve

such expensive construction as to almost preclude their use. I accomplish this device by movably supporting the dynamo upon its base in such manner that a friction-gearing may be established between the shaft thereof and the fly-wheel, and have illustrated in the drawings one of the forms by which this end is attained.

The dynamo is mounted upon a base-plate 5, pivotally and axially connected with a fixed bed-plate 6, secured to the frame of the engine, at a suitable point between which plates is a spring-connection which tends to revolve the base-plate 5 upon its pivot. This connection consists of two coiled springs 7, lying in opposing grooves in the said base and bed-plates and attached at their opposite ends to the said plates, respectively, so that the two springs operate in unison.

In the upper or base plate is formed a concentrically-curved slot 8, through which freely works a clamping-screw 9, engaging the bed-plate and operated by a handle 10, secured to the end thereof, the shoulder or head of which screw, whenever the latter is operated, bears upon and clamps the base-plate to the bed-plate, so that the former cannot be moved; but when the screw is turned in the opposite direction the base-plate may be revolved upon its pivot, and is provided with a handle 11 for convenience of manipulation.

Upon one end of the dynamo-shaft is mounted a small friction-wheel 12, adapted and arranged, when the base-plate is revolved upon its pivot, to bear against the periphery of the fly-wheel, and thereby have a rotary motion imparted thereto at a high rate of speed, regulated by the difference in the size between the pulley and the fly-wheel, and the same movement which brings this pulley in contact with the fly-wheel also slacks up the belt 2, so that the lesser speed thereof will not interfere with the rotation of the dynamo-shaft, although traveling in the same direction.

In practice the tension of the springs 7 is designed to throw and hold the said friction-wheel in contact with the fly-wheel whenever the screw 9 is loosened; but when the engine has attained its normal speed the friction-wheel is withdrawn from contact with the fly-wheel by means of the handle 11 and secured by the screw 9, the speed of the machine from that time on being sufficient to produce the required amount of electricity through the medium of the belt-connection, as before described. I may here state that this feature of my invention consists, broadly, of a movably-supported dynamo, whereby frictional contact between the shaft thereof and the fly-wheel may be established, whether the movement is accomplished by a rotating support, as shown, by a sliding reciprocating support, an oscillating or lever support, or in any other manner which would accomplish the same purpose.

The speed of the engine, or rather the maximum speed, may be controlled by a governor of any desired construction, operating upon the principle of lessening or cutting off the supply of gas to the exploding-cylinder, thereby lessening the number or force of the explosions, so that the momentum of the fly-wheel will be gradually lessened; but as the construction or operation of the governor does not form a part of this invention and the general operation thereof is so well understood I have not deemed it necessary to illustrate the same herein.

One of the particular advantages derived from an ignitor constructed and operating as herein described is that the force of the explosion, by reason of the movable contact-point being between the piston and the fixed contact-point, tends to hold the said points more firmly in contact, instead of separating them, as is the case with the contact-points heretofore employed, and this difference is of great importance, because otherwise at each explosion the contact-points would be separated, producing a useless spark and covering the opposing faces thereof with the products of combustion, frequently to such an extent as to prevent the production of a spark without cleaning, and it is well known that the more frequently the contact, and consequently the current, is broken the less will be the sparking-power when the contact-points are separated. In conclusion, I may state that the fixed contact-point being insulated from the frame of the cylinder which supports it, the circuit to the other contact-point may be completed by attaching the other line-wire from the dynamo to any part of the engine-frame.

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

1. In a gas-engine, the combination, with the exploding-cylinder, a pair of contact-points located in said cylinder, one of which is fixed and the other movable, and mechanism for actuating said movable point, of the supply-valve, a spring normally seating the same, a stop on the stem of said valve, an oscillating wrist-plate, a projection on said plate engaging the stop on the valve-stem, a pitman connecting said plate with the drive-shaft for actuating the same, and a rod also connecting said plate, and a mechanism for actuating the movable contact-points, substantially as described.

2. In a gas-engine, the combination, with the exploding-cylinder, the piston thereof, a pair of contact-points located in said cylinder, one of said points being fixed and the other movable toward the piston, a spring for normally maintaining said points in contact, and a pivoted lever engaging and actuating said movable points, of the supply-valve, a spring normally seating the same, the stem thereof, an adjustable stop on said stem, an oscillating wrist-plate, a projection on said plate engaging the stop on the valve-stem, a

pitman connecting said wrist-plate with the drive-shaft, and a rod also connecting said wrist-plate and the lever operating the movable contact-points, substantially as described.

3. In a gas-engine, the combination, with the exploding-cylinder, the piston thereof, a pair of contact-points located in said cylinder, one of which is fixed and the other movable toward the piston, a spring-actuated rod supporting said movable point, a pivoted lever, a pivot-connection between said lever and rod, an oscillating wrist-plate, and a rod-and-lever connection between said plate and the lever operating the spring-actuated rod, of the supply-valve, a spring normally seating the same, an adjustable stop on the stem thereof, a projection on the wrist-plate engaging the stop on said stem, a pitman connected with said wrist-plate at one end, and a gear-connection between said pitman and the drive-shaft at the opposite end, substantially as described.

4. In a gas-engine, the supply-valve, a spring normally seating the same, the jointed valve-stem, and a stop on said stem, in combination with a reciprocating projection engaging said stop, and means for elevating the free end of said valve-stem and thereby disengaging the stop from said projection, substantially as described.

5. In a gas-engine, the supply-valve, a spring normally seating the same, the stem thereof, and an adjustable stop on said stem, in combination with the wrist-plate, means for oscillating the same, and a projection on said plate engaging the stop on the valve-stem, substantially as described.

6. In a gas-engine, the supply-valve, a spring normally seating the same, and a stop on the stem of said valve, in combination with a wrist-plate, a loosely-journaled pivot-bolt keyed thereto, a projection on said bolt for engaging the stop on the valve-stem, and a pitman for oscillating said wrist-plate, substantially as described.

7. In a gas-engine, the supply-valve, a spring normally seating the same, a jointed valve-stem, and an adjustable stop on said stem, in combination with a wrist-plate, a loosely-journaled pivot-bolt keyed thereto, a projection on said bolt engaging said stop, an adjustable projection engaging the inclined end of the valve-stem, and the pitman for actuating said wrist-plate, substantially as described.

8. In a gas-engine, the supply and exhaust valves and springs normally seating the same, in combination with an oscillating wrist-plate and projections thereon alternately engaging and actuating said valves, substantially as described.

9. In a gas-engine, the supply and exhaust valves having elongated stems, springs normally seating said valves, and an adjustable stop on the stem of the supply-valve, in combination with an oscillating wrist-plate, and projections thereon alternately engaging said stop and the exhaust-valve stem for unseating said valves, substantially as described.

10. The combination, with a gas-engine, of a dynamo movably supported thereon, and a belt-connection between said dynamo and the drive-shaft, substantially as described.

11. The combination, with a gas-engine and the fly-wheel thereof, of a dynamo movably supported on the frame thereof, and a friction-wheel mounted on the shaft of said dynamo, adapted and arranged to have frictional contact with the said fly-wheel, substantially as described.

12. The combination, with a gas-engine and the fly-wheel thereof, of a dynamo, a friction-pulley on the shaft thereof, adapted and arranged to have frictional contact with said fly-wheel, the movable base-plate, the fixed bed-plate, and an adjustable connection between said base and bed plates, substantially as described.

13. The combination, with a gas-engine and with its fly-wheel, of a dynamo, a friction-wheel on the shaft thereof, adapted and arranged to have frictional contact with said fly-wheel, the pivoted base-plate, the bed-plate, a spring-connection between said plates, and a slot-and-screw connection between said plates, whereby they may be secured at any point of adjustment, substantially as described.

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