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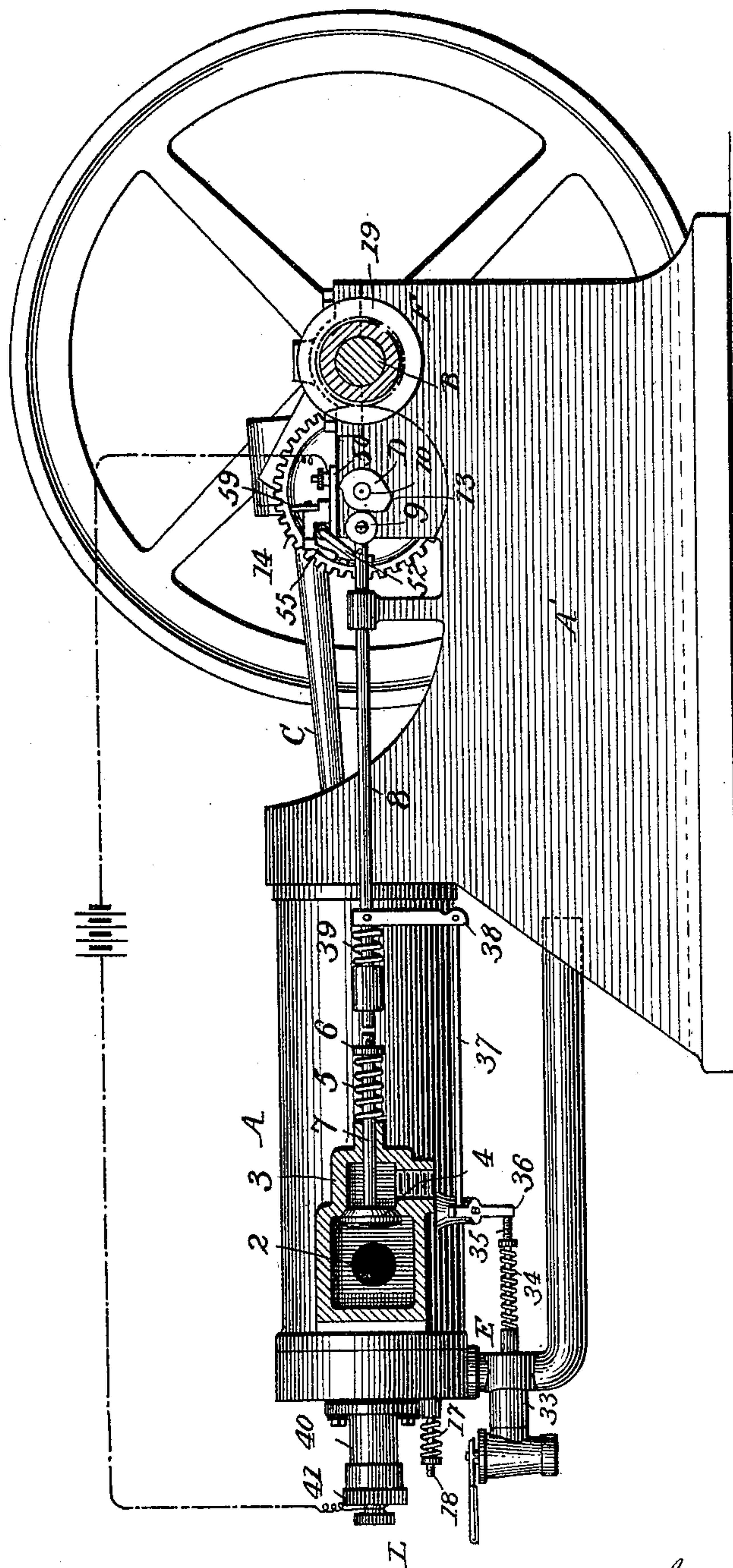
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J. A. CHARTER.
GAS ENGINE.

No. 582,620.

Patented May 18, 1897.

Fig. 1.



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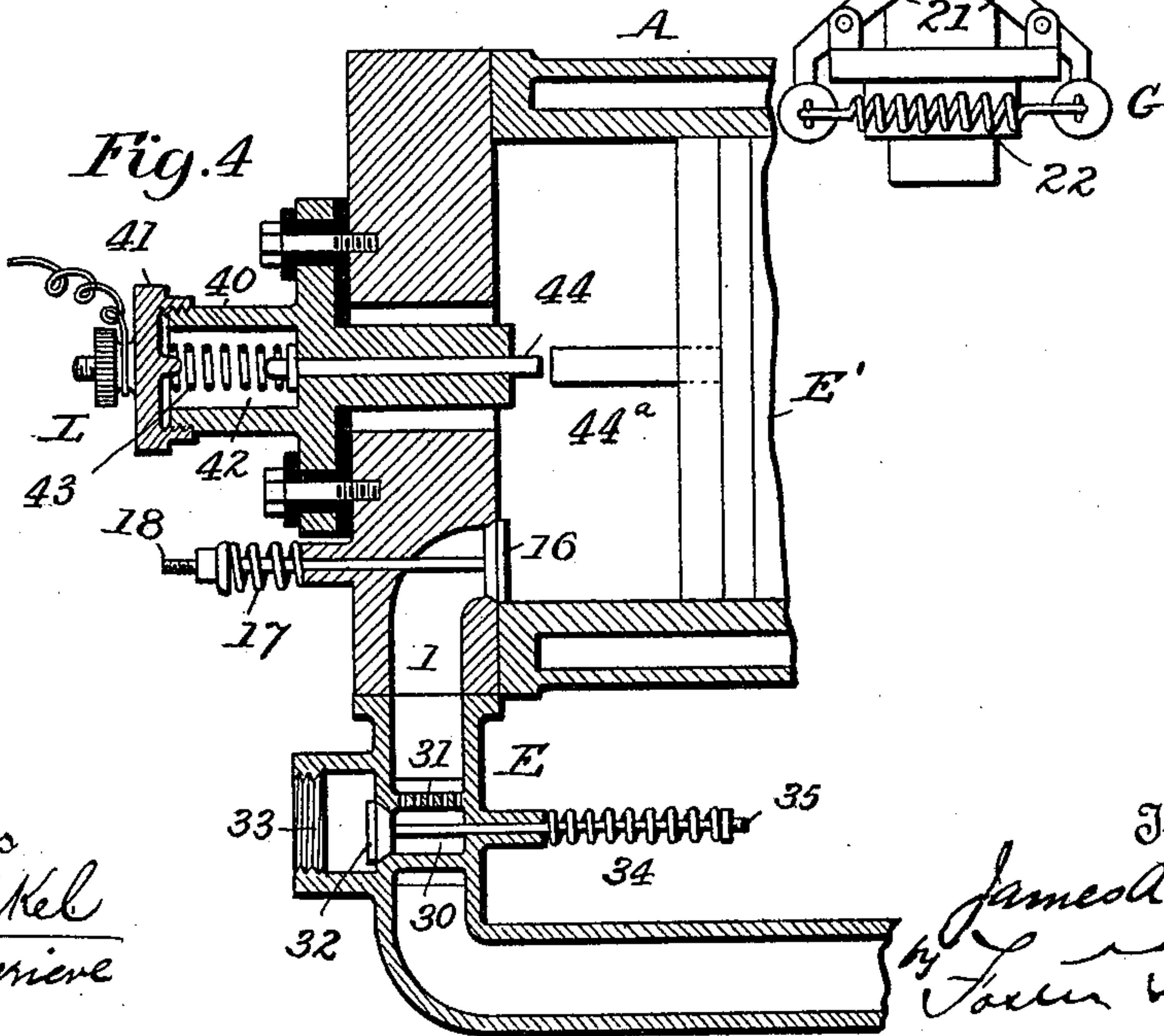
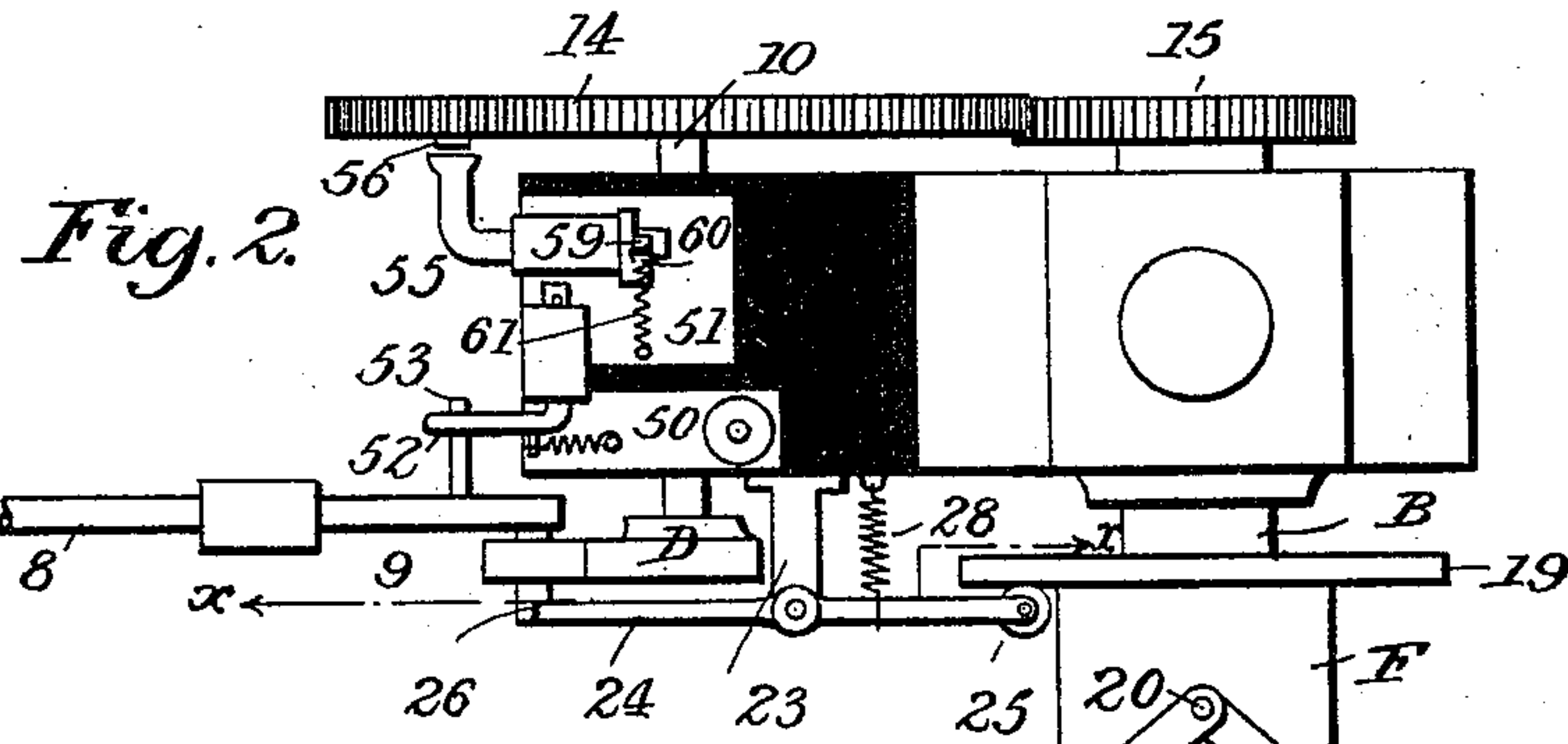
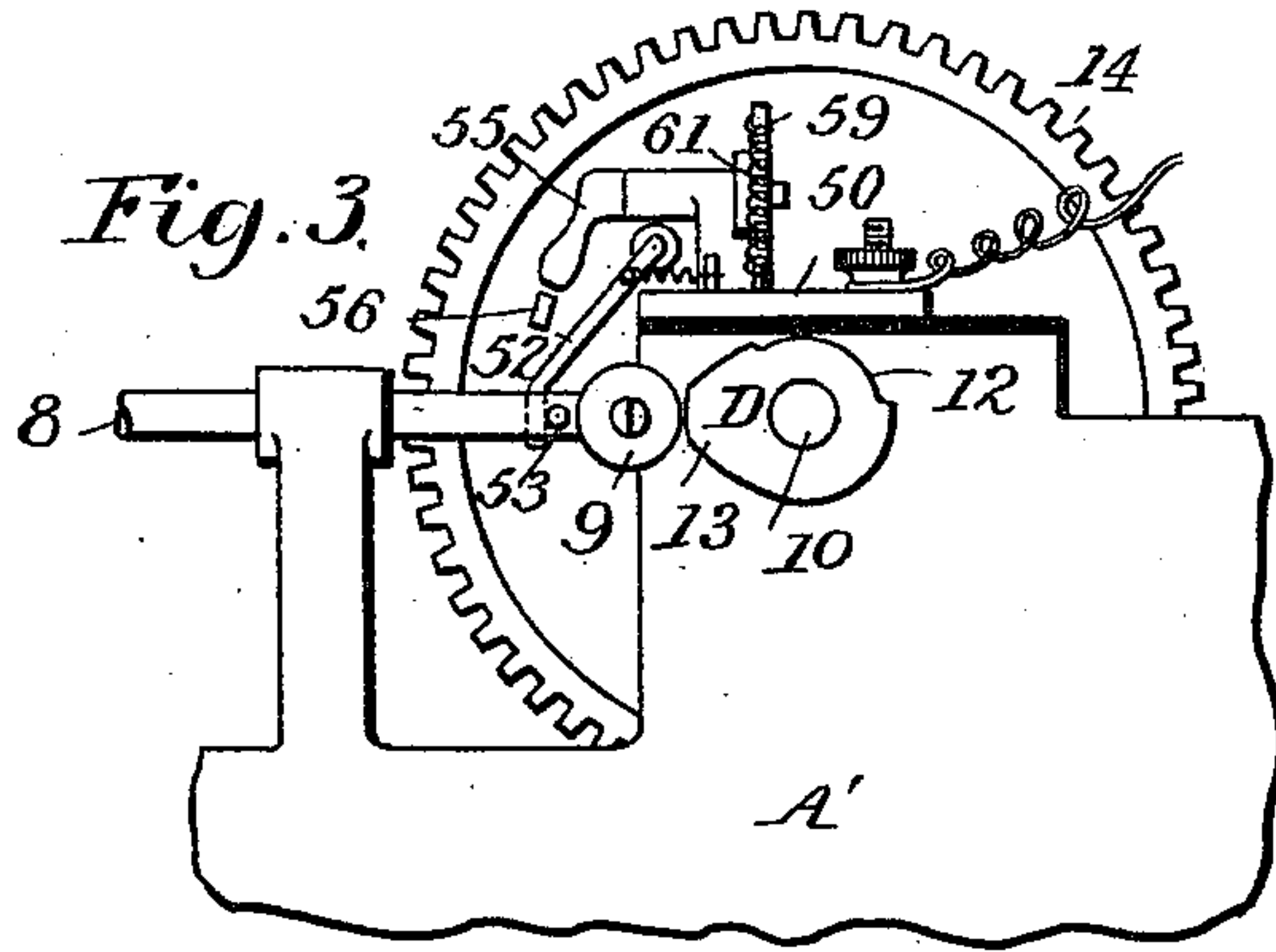
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UNITED STATES PATENT OFFICE.

JAMES A. CHARTER, OF BELOIT, WISCONSIN.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 582,620, dated May 18, 1897.

Application filed April 11, 1895. Serial No. 545,374. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. CHARTER, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to gas-engines; and it has for its object to improve the construction and arrangement of such devices and to simplify and render them certain of operation and not liable to get out of order under varying conditions.

In the accompanying drawings, forming a part of this specification and in which like letters and figures of reference indicate corresponding parts, Figure 1 is a side elevation of a portion of the invention, parts being in section. Fig. 2 is a plan view of a portion of the crank-shaft and the mechanism for actuating the supply and exhaust valves and for controlling the circuit of the igniter. Fig. 3 is a side elevation of the same, taken on the line *xx* of Fig. 2. Fig. 4 is a detail sectional view of the inlet-passages and an adjacent portion of the cylinder and electrodes.

The invention is here shown as applied to a typical gas-engine consisting of the usual cylinder A, mounted upon a suitable base A', with supports for a crank-shaft B and the other regular parts of engine. A connecting-rod C connects the crank-shaft to the piston within the cylinder A, and this cylinder is provided with an inlet-port 1 and an exhaust-port 2, arranged near the rear end of the cylinder. These parts are so constructed, arranged, and operated that as the piston is on its forward stroke it draws a charge of combustible fluid through the inlet-port into the combustion-chamber, which charge is compressed upon the return or back stroke of the piston. The charge is then exploded, causing the piston to move forward and drive the crank-shaft. The valve controlling the exhaust-port is then opened, and as the piston moves back the spent gases are expelled from the engine-cylinder.

In the exhaust-casing 3 an exhaust-valve 4 is so seated as to normally close the exhaust-port 2. A spring 5, bearing upon a washer 6 on the exhaust-valve stem 7, tends to hold the valve 4 in its seat.

A rod 8, adapted to slide toward and away from the exhaust-valve stem 7, is mounted in suitable bearings of the base A', and said rod carries a friction-roller 9 at its outer end, which roller is arranged in the path of movement of a cam D. This cam is carried upon a shaft 10 and is cut away at 12 and provided with a toe 13.

The shaft 10 is rotated from the crank-shaft, to which it is connected by means of gears 14 and 15, the gear 15 being one-half the circumference of the gear 14 in order that there will be two revolutions of the crank-shaft to one revolution of the shaft 10. Thus the toe 13 of the cam D is brought into engagement with the roller 9 to open the exhaust-valve only once during two revolutions of the crank-shaft.

Within the inlet-port 1 is located a self-acting valve 16, normally held closed under the slight pressure of a spring 17, which encircles the stem 18 of said valve and bears upon a nut upon the end of said stem and upon the rear face of the cylinder A, through which the valve-stem passes. The spring 17 exerts only enough pressure upon the valve 16 to prevent its opening when the outflow of the spent gases through the exhaust-port takes place.

When the exhaust-valve is closed and the piston is moving forward, the valve 16 will be opened by the vacuum formed in the rear of the piston, and a sufficient charge of combustible material and air will be drawn into the cylinder through the supply-port 1. If, however, the exhaust-valve 4 is opened at the time the piston moves forward, then the air will be drawn in through the exhaust-port 2, and consequently the engine will run without a charge and without explosion. In view of this fact all mechanisms for controlling the flow of combustible fluid to the cylinder are dispensed with, it being only necessary to hold the exhaust-valve 4 open whenever the engine acquires a rate of speed in excess of the maximum.

To effect the proper operation of the exhaust-valve, suitable governing devices are employed in connection with a detent, which will be thrown into position to hold the exhaust-valve open by the action of the governor when the engine attains an excess of speed,

said detent being restored to its initial position when the speed of the engine is reduced to normal.

Any suitable means may be employed to control the operation of the exhaust-valve, but, as shown, these means consist of a sleeve F, adapted to slide on the crank-shaft B and provided with a flange or collar 19. This sleeve is connected by means of a pin 20 with the crank-arms 21 21 of a governor G, the balls of which are connected by a spring 22.

Pivoted upon a bracket 23 of the base A' is a detent 24, having one end beveled and carrying a friction-roller 25 at its other end, which is engaged by the flange 19 of sleeve F. The beveled end of the detent 24 is adapted to take into a notch in a pin 26 upon the end of rod 8. In operation the toe 13 of the cam D will always push the rod 8 sufficiently to prevent the beveled end of the detent 24 to be moved into engagement with the notch of the pin 26. This result will always take place when the engine moves too fast or at a speed which will cause the balls of the governor to fly out and carry the sleeve F outward, thus bringing its flange 19 to bear upon the roller at the end of the detent 24. The detent will remain in engagement with the pin 26 to hold the exhaust-valve 4 open as long as the engine runs at excessive speed, and will only be withdrawn from such engagement when the speed of the engine is decreased sufficiently to permit the balls of the governor to be drawn together sufficiently to slide the sleeve F back to its normal position.

The detent will not be disengaged from the pin 26 immediately after the balls of the governor draw together, but will continue to keep the valve 4 open until the speed of the engine is sufficiently reduced. When, however, the toe 13 of the cam D next comes in contact with the roller 9, it will force the pin 26 away from the beveled end of the detent, when the opposite end of said lever will be drawn by means of a spring 28 into engagement with the flange 19, the operation continuing as before.

E is a valve-casing through which the air and combustible fluid is directed to the inlet-port 1 after they have been mixed within said casing. A chamber 30 is formed within the casing E and communicates with the chamber of the casing E through perforations 31. A combustible-fluid-supply pipe 33 communicates with the chamber 30 through an intermediate port, which is controlled by a valve 32. This valve is normally held in its seat by means of a spring 34 bearing upon a washer upon the valve-stem 35, said valve-stem being connected to one end of a centrally-pivoted lever 36, which is connected at its opposite end to a rod 37, which is in turn connected to a short arm 38, rigidly mounted upon the rod 8. A spring 39 upon the rod 8 tends to maintain the roller 9 thereon in contact with the cam D. By this arrangement it will be noted that at every forward move-

ment of the rod 8 the valve 32 will be raised from its seat, permitting a sufficient quantity of fluid to enter the chamber 30 for the next charge, this fluid, together with the desired quantity of air, being drawn into the cylinder through the port 1 at the next suction-stroke of the piston. If, however, the engine should attain an undue speed, the rod 8 is pushed backward by the governing mechanism hereinbefore described and retained in such position during the continuance of the excessive speed of the engine. This backward movement of the rod 8 causes the valve 32 to be closed, and it will therefore be evident that no charge is admitted to the engine while it continues to run beyond the desired speed limit.

Means are employed in connection with the invention whereby the ignition of the charge is effected by an electric spark, and while any suitable appliances may be used for this purpose I have found those which I have illustrated and will now describe to be the most effective.

Briefly stated, the operation of these igniting devices is as follows: After a charge has been admitted to the rear end of the cylinder and compressed it is ignited by a spark generated by the separation of two terminal electrodes, one of which is located in the rear end of the cylinder and the other on the piston, said electrodes being arranged to make contact at each return or back stroke of the piston.

Automatic current-controlling devices are used in connection with and form a part of the igniting mechanism, the purpose of said devices being to so regulate the electric current that only at every alternate stroke of the piston will a spark be generated.

Secured to and passing through an opening in the rear of the end of the cylinder is a casting L, provided with a rearwardly-extending portion 40, adapted to receive a cap 41. This rearward extension 40 is provided with a chamber 42, formed for reception of a spring 43, bearing at one end against the cap 41 and at the other against a washer upon the end of a rod 44. This rod, which forms the positive electrode of the igniting mechanism, extends through the casting L into the cylinder and is adapted to slide against the action of the spring 43. The casting L is insulated from the cylinder A and is connected to the positive wire from a battery or other source of electrical supply. The negative electrode 44^a is secured rigidly to the rear of the piston E', which, together with the frame of the engine, constitutes part of the electric circuit and is adapted to make contact with the positive electrode 44 at each back stroke of the piston.

It will be noted that as the piston moves on its back stroke the two electrodes come in contact, resulting in the yielding of the electrode 44 against the action of the spring 43. When the piston has reached the limit of its back stroke, however, the tension of the spring

43 holds the yielding electrode in contact with the stationary electrode until after the piston has started on its forward or out stroke, when the separation occurs and the spark is generated. By this means all liability of a premature explosion is obviated and all danger of causing the engine to run backward or to stop on its dead-center avoided.

Secured to and insulated from the base A' are two separated plates 50 51, connected together by means of a rocker-arm 52, supported in a bearing of the plate and adapted to normally contact with the plate 50, to which plate the negative wire from the source of electrical supply is connected. One end of the rocker-arm 52 is arranged to be engaged by a pin projection 53 from the rod 8 in such manner that the said arm will be lifted from contact with the plate 50 whenever the rod 8 is moved backward by the toe 13 of the cam D, thus breaking the current to the negative electrode whenever the exhaust-valve is open to prevent the generation of a spark in the cylinder during the period the exhaust-valve remains open.

A rocker-arm 55 is mounted in a bearing of the plate 51, the outer end of said rod being disposed to make contact with a lug 56 on the inner face of the gear 14, which is moved beneath said rocker-arm once during each revolution of the gear 14 or during each two revolutions of the crank-shaft. It will therefore be apparent that at each alternate rearward stroke of the piston the circuit from the source of electrical supply to the negative electrode is completed and a spark generated to ignite the charge in the rear of the piston.

The outer end of the rocker-arm 55 is prevented from contacting with the face of the gear 14 by means of a lug 59, held in contact with a shoulder 60 by means of a spring 61.

The igniting devices above described may be used in connection with an engine supplied with both gas and air or in connection with engines in which there is a volatile fluid supplied, the engine herein shown, however, being designed for the use of gas and air.

Without limiting myself to the precise construction and arrangement of parts described, I claim as my invention—

1. In a gas-engine, the combination with the cylinder, of a valve, a pivoted lever for operating the valve, a rod and means for actuating the same, a valve operated by said rod, an arm carried upon the rod and an auxiliary rod connecting said arm and the lever, substantially as described. 50 55

2. In a gas-engine igniter, the combination with the cylinder and piston, of two electrodes, two separated plates, two arms movable upon one of the plates, one of said arms being adapted to bear upon the adjacent plate, means for throwing the arm out of contact with said plate and a lug for making contact with the other arm at predetermined intervals, substantially as described. 60 65

3. In a gas-engine igniter, the combination with the cylinder and piston, of two electrodes, two separated plates, an arm movably connected to one of the plates and adapted to bear upon the other, automatic means for throwing the arm out of contact with said plate and for holding it out of contact whenever the engine attains an excessive speed, and connections between the other plate and one of the electrodes, substantially as described. 70 75

4. In a gas-engine, the combination with the cylinder and piston, of two electrodes, plates 50, 51, arm 52 pivotally mounted upon the plate 51 and bearing upon the plate 50, means for throwing said arm out of contact with the plate 50, an arm 55 pivotally connected to the plate 51, and a gear 14 carrying a lug adapted to make contact with the arm 55 at every rotation of the gear, substantially as described. 80 85

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

JAMES A. CHARTER.

Witnesses:

EDWARD SALMON,
O. R. FOSTER.