No. 813,284. PATENTED FEB. 20, 1906.

G. E. ECKLER.

ROTARY ENGINE.

APPLICATION FILED JAN. 3, 1905.

2 SHEETS—SHEET 1.

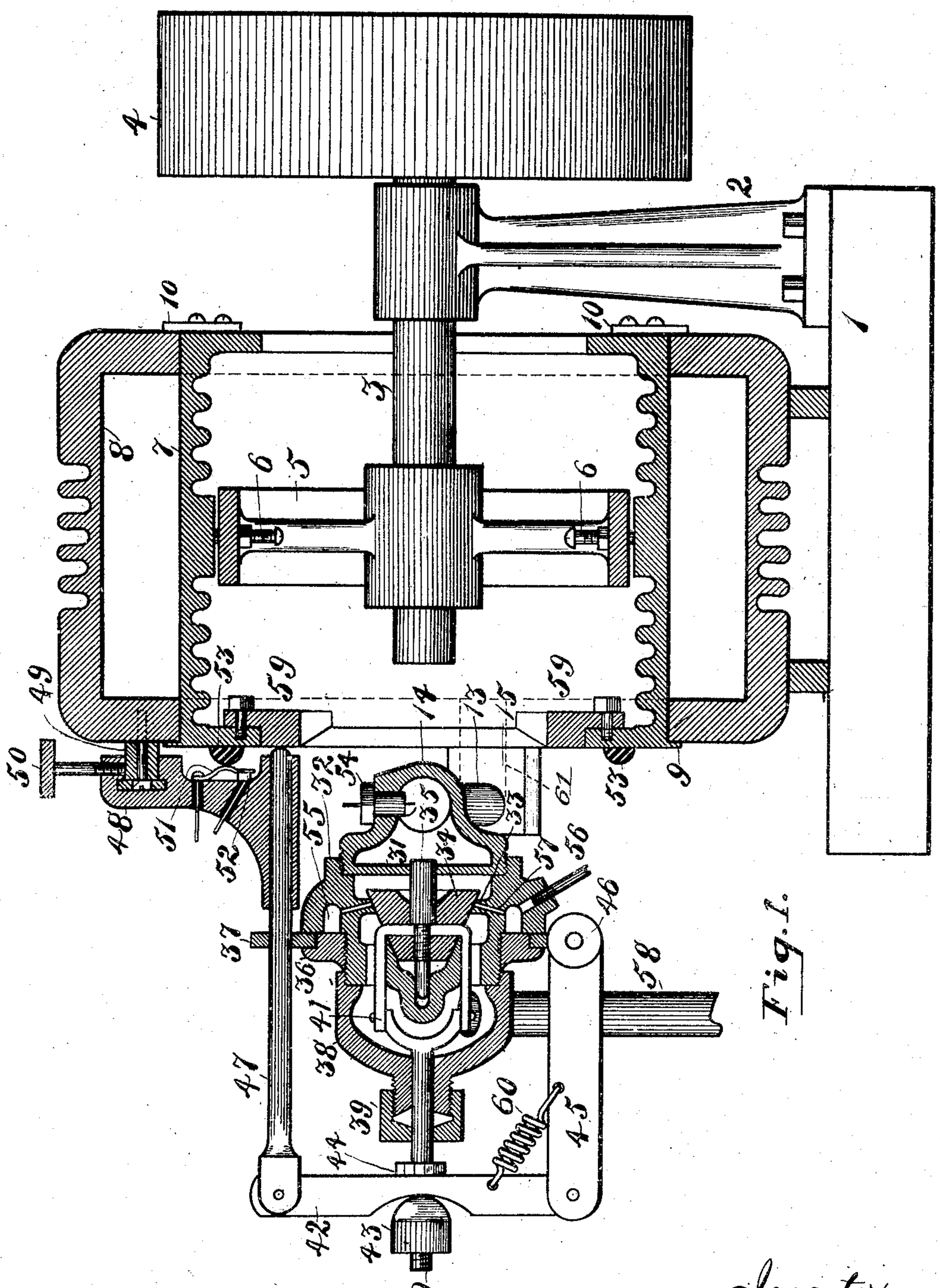

Fig. 1.

Witnesses:
L. C. Knight
Glenara Hop

Inventor.
G. E. Eckler,
by C. E. Humphrey
Atty.

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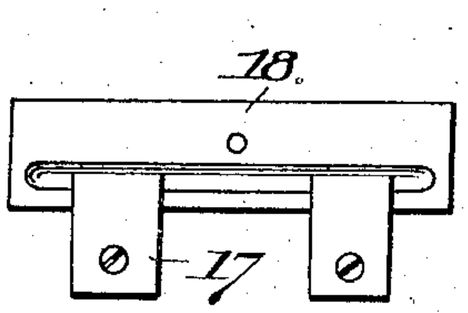

Fig. 4.

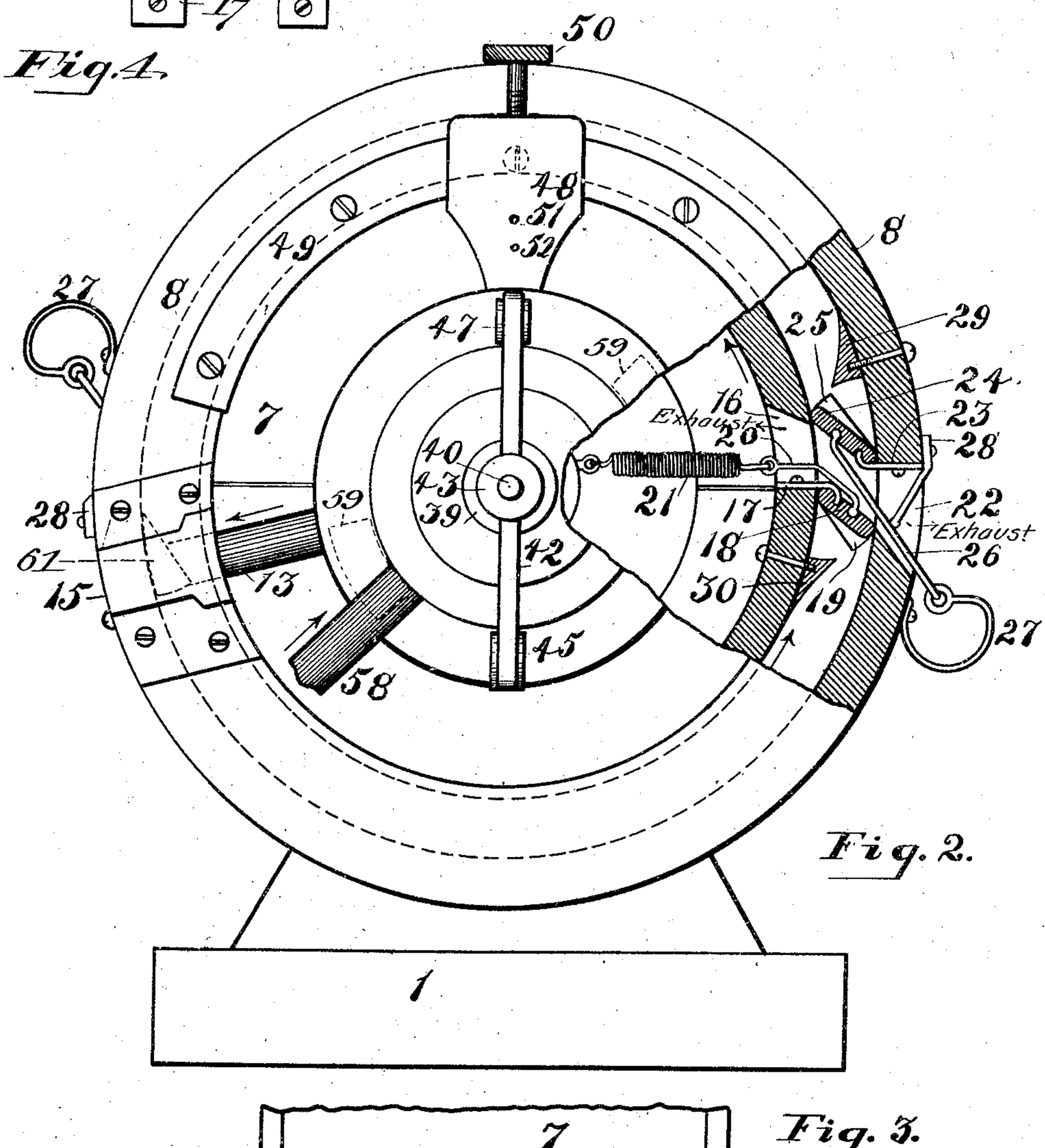

Fig. 2.

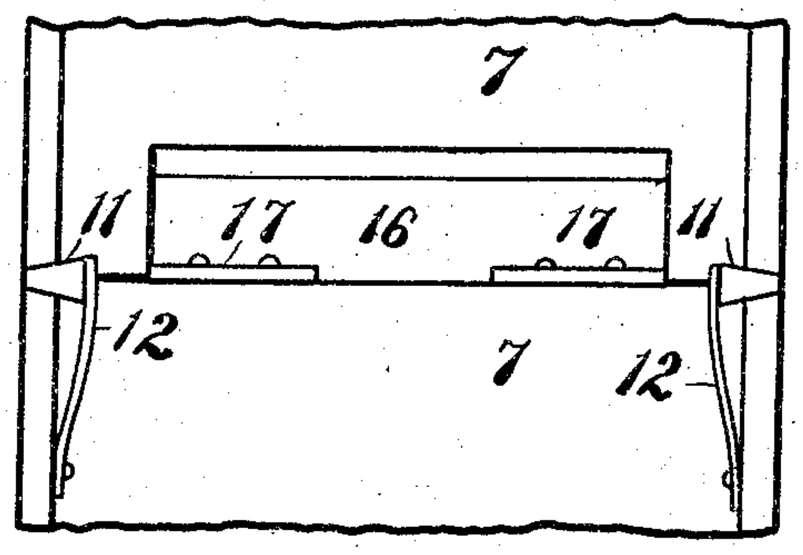

Fig. 3.

Witnesses:
L. C. Wright
Glenara Fox

Inventor,
G. E. Eckler,
by C. E. Humphrey,
Atty.

UNITED STATES PATENT OFFICE.

GEORGE E. ECKLER, OF AKRON, OHIO

ROTARY ENGINE.

No. 813,284. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed January 3, 1905. Serial No. 239,454.

To all whom it may concern:

Be it known that I, GEORGE E. ECKLER, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented a certain new and useful Improvement in Rotary Engines, of which the following is a complete specification.

My invention relates to rotary engines; and it has for its object the production of an engine of the type named of great efficiency and economy and in which the motive power employed may be gas, gasolene, or steam, as the convenience or necessities of the case dictate, and in which when using gas or gasolene as a power the capacity of the explosion-chamber and the amount of the charge of fluid exploded may be readily regulated to adapt it to the various requirements to which the engine may be put.

In accomplishing the before-mentioned object I employ certain mechanism, a description of one form of which is hereinafter given, and illustrated in the accompanying drawings, in which drawings similar reference-numerals indicate like parts in the different figures.

In the drawings, Figure 1 represents a vertical central section of my improved gas-engine with the piston at the point where the inlet-valve is closed and the explosion takes place. Fig. 2 is a side elevation from the left of Fig. 1 with a portion of the casing broken away to better illustrate the internal construction of the engine. Fig. 3 is a detail of a portion of the interior of the piston, showing the means for constantly compensating for the wear on the piston incident to the use of the engine; and Fig. 4 is a plan view of one of the blades hereinafter more fully described.

In the drawings, 1 is a bed-plate on which is mounted an upright bracket, in the top of which is journaled a horizontal shaft 3, having on its outer end a wheel 4, over which may pass a belt for conveying power to any suitable machinery to which it is desired to convey power, and this wheel 4 may act as a balance-wheel if made heavy enough. On the inner end of the shaft 3 is a wheel or spider 5, to which is attached by bolts 6 the inner surface of a rotary piston 7. This piston has a cylindrical exterior and is adapted to rotate in a cylindrical opening cut longitudinally through an inclosing cylinder 8. The piston 7 is provided at one end with a flange 9 and at the other end with detachable plates 10 to constantly maintain the piston in proper position in the opening in the cylinder 8. This piston 7 is split at diametrically opposite points, (see Fig. 3,) and through the inturned flanges at the ends of the piston are drilled conical holes partly in in each half of the piston, and into these openings are placed cone-shaped pins 11, which are constantly forced outward by springs 12, so that by means of the springs 12 and cone-shaped pins 11 the two halves of the piston will be forced apart as far as the opening in the cylinder 8, in which the piston rotates, will permit, thus taking up all wear incident to the rotation of the piston 7 in the cylinder 8. Allowance is made for this expansion by making the rim of the wheel or spider 5 separate from the piston 7 and connecting them by bolts 6.

The motive power, consisting of the products of exploded gas or gasolene, is introduced to the annular space between the cylinder and the piston by means of two pipes 13, which unite with a T 14 at their inner ends, and their outer ends are connected with hollow blocks 15, the openings of which are each in turn connected by a triangular opening 61 with the annular space surrounding the piston. Attached to the T 14 is a valve which will be later described.

At approximately diametrically opposite points in the outer faces of the piston 7 are openings or exhaust ports 16, hereinafter referred to as "inner" exhaust ports or openings. These openings 16 do not extend across the entire face of the piston, but their width is approximately illustrated in Fig. 3. On the lower face of the inner openings 16 are fastened hinges 17, having downwardly-turned hooked ends which enter correspondingly. shaped grooves in the faces of blades 18, whose width is greater than the width of the annular space around the piston and whose lengths are equal to the longitudinal length of that annular space around the piston. The edges of these blades 18 are rounded, and they are provided at one end with wings 19, which serve to make their union or contact with the inner sides of the heads of the cylinder tighter and less liable to leakage of the operating fluid. These blades are held, as before described, at one side by the hinges 17, and are drawn upward to rest against the inner periphery of the cylinder 8 by means of rods 20, which are pivotally attached in the faces or other convenient points to the blades 18, and are provided with springs 21, at-

tached to the hub of the wheel 5. At diametrically opposite points there are cut through the wall of the cylinder 8 openings or exhaust-ports 22, hereinafter referred to as "outer" exhaust ports or openings, and these openings are usually so formed as to have one face radial to the shaft 3. To these radial faces are fastened hinges 23 with hooked ends similar to the hinges 17, and these hinges 23 support pivotally blades 24 in exactly the same manner as the blades 18 are supported, and the blades 24 are provided with wings 25 at their ends for the same reason that the wings 19 are provided for the blades 18. Preferably in the face of each of the blades 24 is fastened pivotally one end of a rod 26, to the opposite ends of which is fastened a spring 27, which constantly tends to draw the free ends of the blades 24 against the outer periphery of the piston 7. A steadying-bar 28 is bolted to the outside of the cylinder and extends into the opening 22 and bears against the rod 26 with a view of holding it steady at all times.

It is obvious from the description heretofore given that the blades 18 in their travel with the piston 7 will ride over the blades 24 and both be pressed inward in order to allow the passage of one over the other, and in order to render smoother the return of the free or swinging edges of these blades 18 and 24 to their normal positions there are fastened to the inside of the cylinder immediately above the point where the blades 24 swing wedge-shaped blocks 29, over which the free edge of the blades 18 run in returning to their normal position after being pressed backward by the blades 24. It will be obvious upon inspection of Fig. 2 that the blades 18 and 24 are at the position they will occupy just before the discharge of the used fluid from the annular space between the piston 7 and cylinder 8 takes place through the outer exhaust-ports 22, and as soon as the blades 18 have passed over the blades 24 and start on their descent down the incline of the blocks 29 they will produce a suction in the inlet-pipes 13 sufficiently strong to draw into the explosive-chamber in the T 14 an explosive such as gasolene, and the means by which this charge or explosive charge is fired and the point where such ignition shall take place is determined by the following mechanism, which also operates in connection with the valve governing the inlet of the explosive fluid. The T 14, into which run the two inlet-pipes 13, is provided at one side with an unusually large opening across which extends a perforated bar 31. Onto the threads on this T 14 is screwed a valve-casing 32, having a valve-seat 33 therein, in which is a cone-shaped valve 34, having longitudinally through it a pin 35, one of the ends of which passes through the perforation in the bar 31 of the T 14, and the other end rests in a suitably-shaped opening in the valve-casing 32. The outside face of the valve-casing 32 is threaded, and on these threads is placed a ring 36, having a rabbet cut in one of its faces, and in this rabbet is placed a ring 37 for a purpose to be later described. The valve-casing 32 is closed at this end by a cap 38, provided with a packing-gland 39, and through this cap 38 passes a shaft 40 in alinement with the pin 35 of the valve 34. The end of the shaft 40 within the valve-casing 32 is yoked and provided with two hooks 41 or a suitably-shaped frame, the central portion of which passes through the valve 34. The outer end of the shaft 40 passes through a vertical lever 42 and is threaded and provided with adjusting-nuts 43 and 44. The lower end of the lever 42 is pivoted to one end of an arm 45, which in turn is pivoted to an ear 46 on the rim 37. A slidable bar 47 is pivotally attached to the upper end of the lever 42 and passes through a suitable opening in the rim 37, as well as an opening provided for it in the foot or inner portion of an adjustable carriage 48. This adjustable carriage is adapted to slide radially on a T-headed rail 49, fastened to the outer face of the cylinder 8 and to be retained in position at a desired point by a set-screw 50. The inner face of the carriage 48 is hollowed out sufficiently to permit the placing therein of an insulated contact-finger 51 and a contact-plate 52, which are caused to connect or electrically contact by a pair of bosses 53, placed on the flange of the piston 7. It is obvious, therefore, that the point of closing of the electrical contact for firing the explosive charge can be determined and regulated by the position the carriage 48 is caused to assume.

An ordinary sparking plug 54 is placed in the T 14 and is electrically connected by the ordinary wiring employed in explosive-engines with the contact-points 51 and 52. This arrangement is such that the terminals of the sparking plug 54 are within the hollow body of the T 14, and the pressure exerted by the explosion causes the products thereof to pass approximately equally through both the pipes 13 to the openings 61 and from thence to the annular space existing between the outer periphery of the piston and the inner periphery of the cylinder.

Within the body of the valve-casing 32 is an annular cored opening 55, into which extends a pipe 56, by which a supply of gas from a service-pipe under pressure can be introduced to the interior of the valve-chamber and the T 14 by means of small inlet-holes 57, normally closed by the valve 34.

In employing either gasolene or steam it is customarily introduced through the pipe 58 to the interior of the valve-casing, from whence it passes through the valve 34 to the T 14.

The device for closing the valve just previ-

ous to firing and then opening it after the explosion is as follows: It will be obvious from the foregoing description and an inspection of the drawings that it will be necessary that the valve 34 be closed during the instant of firing the explosive charge in the T 14, which is accomplished by attaching two members 59 to the flange of the piston 7 in such a position that their outer faces, to which is given a cam shape, will encounter the outer end of the bar 47 and force it backward, thereby forcing backward the lever 42 and drawing out the shaft 40, and through this connective mechanism closing the valve 34. The pressure in the pipes 13 and T 14 will effectually keep the valve 34 closed after the bar 47 is passed over and out from contact with the members 59. As soon as the pressure of exploded gas acting on the base portion of the valve 34 has diminished sufficiently the valve will be opened automatically by a spring 60, extending between the lever 42 and the bar 45.

A brief detailed description of the operation of this device is as follows: Assuming that the piston is in the position shown in Fig. 2 and is rotating in the direction indicated by the arrows, the instant that the blades 18 pass the outer exhaust-ports 22 the products of combustion constituting the motive power of the device will escape outwardly through the exhaust-ports 22 and after passing these exhaust-ports the blades 18 will encounter the blades 24, which while being pivotally mounted are stationary and do not revolve with the piston, and both blades 18 and 24 will be pressed backward sufficiently to allow them to pass by each other. Immediately after the blades 18 have passed the blades 24 both blades return to the position shown in Fig. 2. By this is meant that the blades 18 will swing outwardly to encounter the inner periphery of the cylinder and the blades 24 will swing inward to encounter the outer periphery of the piston. When the blade 18 (shown in Fig. 2) has reached the position occupied in that drawing by the reference-numeral 25, it will pass the triangular opening 61 existing on that side corresponding to the triangular opening indicated by dotted lines on the opposite side of the device, and at a definite time after the passage of this blade 18 past the mouth of the triangular opening 61, which exists on the right side of the machine in Fig. 2, the explosion of gas or gasolene takes place in the T 14, and the inlet-pipes 13 convey the products of this explosion to the annular space in the rear of the blades 18 and force them in a circumferential direction in company with the piston, and thereby causes the rotation of the same. The blades 24 at the time of this entrance of exploded gas into the annular space will be in the position indicated in Fig. 2, and thereby prevent the gas from passing backward out through the exhaust-ports 16 and 22. The pressure of exploded gas or gasolene exists within the annular space until the blades 18 make a semi-revolution and pass over the exhaust-ports 22 on the opposite side of the cylinder, at which time the exploded gases pass out, as already described. The ports 16 and 22, being always open, no pressure of gas or products of the explosion thereof can exist in front of the blades 18, and consequently any fluid which might exist in advance of the blades 18 is free to pass out through these exhaust-ports readily, and therefore exert no retarding pressure against the blades 18.

What I claim, and desire to secure by Letters Patent, is—

1. The combination in an engine of the class described, of an outer inclosing cylinder having inturned annularly-formed heads, each provided with an opening therein, said openings being in longitudinal alinement with each other, a longitudinally-split cylindrically-formed piston arranged in said openings, whereby an annular space will exist between said cylinder and the outer periphery of said piston, means to retain said piston in said openings, means to constantly force the portions of said piston against the walls of said openings in said cylindrical heads, a plurality of blades in said annular space a portion of which are hinged to the piston and the balance to the inside of said cylinder, said blades arranged to pass each other during the rotation of said piston, means to hold the blades hinged on said cylinder against said piston, and means to hold the blades mounted on said piston against the inside surface of said cylinder.

2. The combination in an engine of the class described, of an outer inclosing cylinder having inturned annularly-formed heads, each provided with an opening therein, a piston arranged in said openings, whereby an annular space will exist between said cylinder and the outer periphery of said piston, means to retain said piston in said openings, means movable in said annular space and attached pivotally to said piston to receive the impact of a propelling fluid introduced to said annular space, means to convey a propelling fluid to said annular space at diametrically opposite points thereof, an explosion-chamber arranged in connection with said induction means, an igniting device placed in said explosion-chamber, a carriage mounted on said cylinder radially adjustable in position with respect thereto, a circuit-breaker mounted on said carriage and suitably connected with said igniting device, and means on said piston to close said circuit-breaker.

3. The combination in an engine of the class described, of an outer inclosing cylinder having inturned annularly-formed heads, each provided with an opening therein, said

openings being in longitudinal alinement with each other, a piston arranged in said openings, whereby an annular space will exist between said cylinder and the outer periphery of said piston, means to retain said piston in said openings, means movable in said annular space and attached pivotally to said piston to receive the impact of a propelling fluid introduced to said annular space, means to introduce a propelling fluid to said annular space at opposite points thereof, an explosion-chamber arranged in connection with said induction means, an igniting device in said explosion-chamber, a carriage mounted on said cylinder and adjustable in position with respect to the position of said induction means, a circuit-breaker on said carriage suitably connected with said igniting device means on said piston to close said circuit-breaker, and means to close the inlet of fluid to said explosion-chamber.

4. The combination in an engine of the class described, of an outer inclosing cylinder having inturned annularly-formed heads, each provided with an opening therein, said openings being in longitudinal alinement with each other, a piston arranged in said openings, whereby an annular space will exist between said cylinder and the outer periphery of said piston, means to retain said piston in said openings, means movable in said annular space and attached pivotally to said piston to receive the impact of a propelling fluid introduced to said annular space, means to introduce a propelling fluid to said annular space at opposite points thereof, an explosion-chamber in said induction means, an igniting device in said explosion-chamber, a circuit-breaker suitably mounted and connected with said igniting device, means on said piston to close said circuit-breaker, and means to change the position of said circuit-breaker with respect to the position of said induction means.

5. The combination in an engine of the class described, of an outer inclosing cylinder provided with oppositely-disposed exhaust-ports, a piston arranged to rotate within said cylinder and separated therefrom to form an air-space, means to introduce to said air-space a propelling fluid equally at diametrically opposite points, an explosion-chamber mounted in said induction means, a valve to control the inlet of the propelling fluid to said explosive-chamber, a carriage mounted on said cylinder and adjustable in position with respect to the exhaust-ports of said cylinder, means mounted in said carriage to operate said valve, and means mounted on said piston to operate said last-named means and close said valve substantially as shown and described.

6. The combination in an engine of the class described, of an outer inclosing cylinder provided with oppositely-disposed exhaust-ports, a piston arranged to rotate within said cylinder and separated therefrom to form an air-space, means to introduce to said air-space a propelling fluid, an explosive-chamber in said induction means, a valve to control the entrance of the propelling fluid to said explosive-chamber, a carriage mounted on said cylinder and adjustable in position with respect to the position of the exhaust-ports of said cylinder, means on said carriage to operate said valve, means on said piston to operate said last-named means, a circuit-breaker mounted on said carriage, and means on said piston to close said circuit-breaker substantially as shown and described.

In testimony that I claim the above I hereunto set my hand in the presence of two subscribing witnesses.

GEORGE E. ECKLER.

In presence of—
C. E. HUMPHREY,
GLENARA FOX.