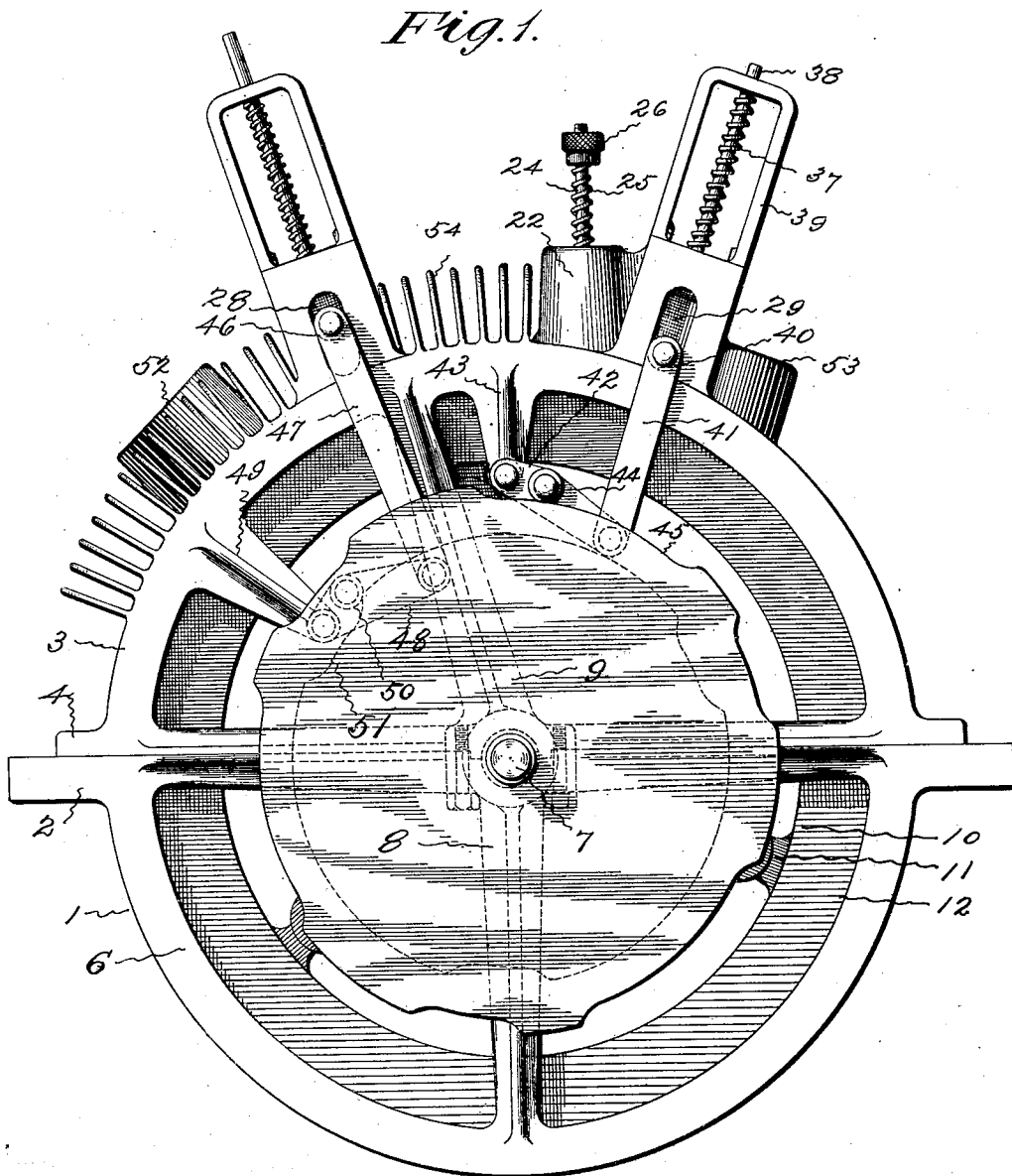


C. M. GREEN.
 ROTARY EXPLOSIVE ENGINE.
 APPLICATION FILED APR. 28, 1909.

955,155.

Patented Apr. 19, 1910.

4 SHEETS—SHEET 1.



Witnesses:

S. S. Grotta
Charles F. Stone

Inventor:

Charles M. Green
 by *Harry P. Williams* Atty.

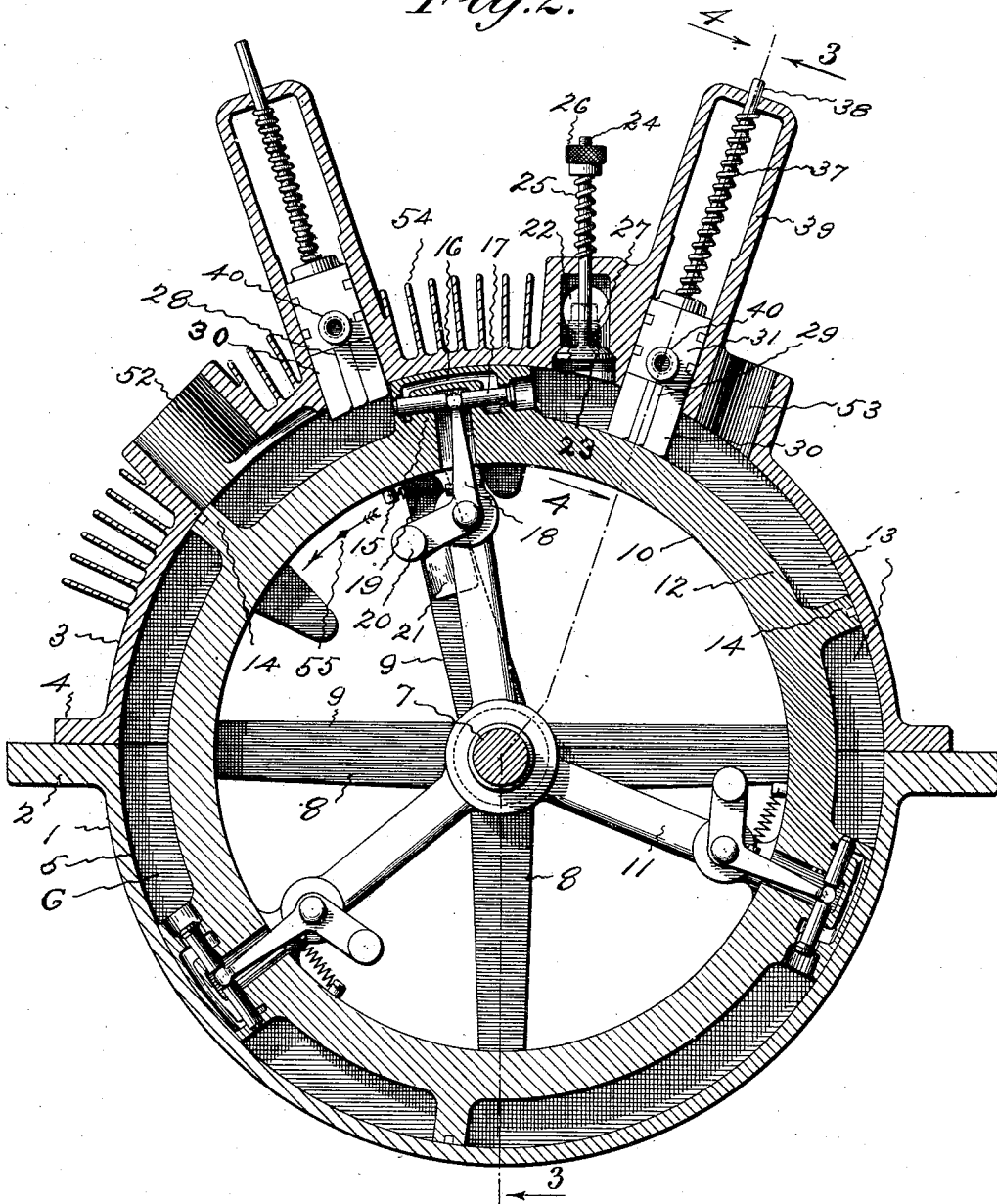
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4 SHEETS—SHEET 2.

Fig. 2.



Witnesses:

S. S. Grotta
Charles F. Stone

Inventor:

Charles M. Green
by Harry P. Williams Atty.

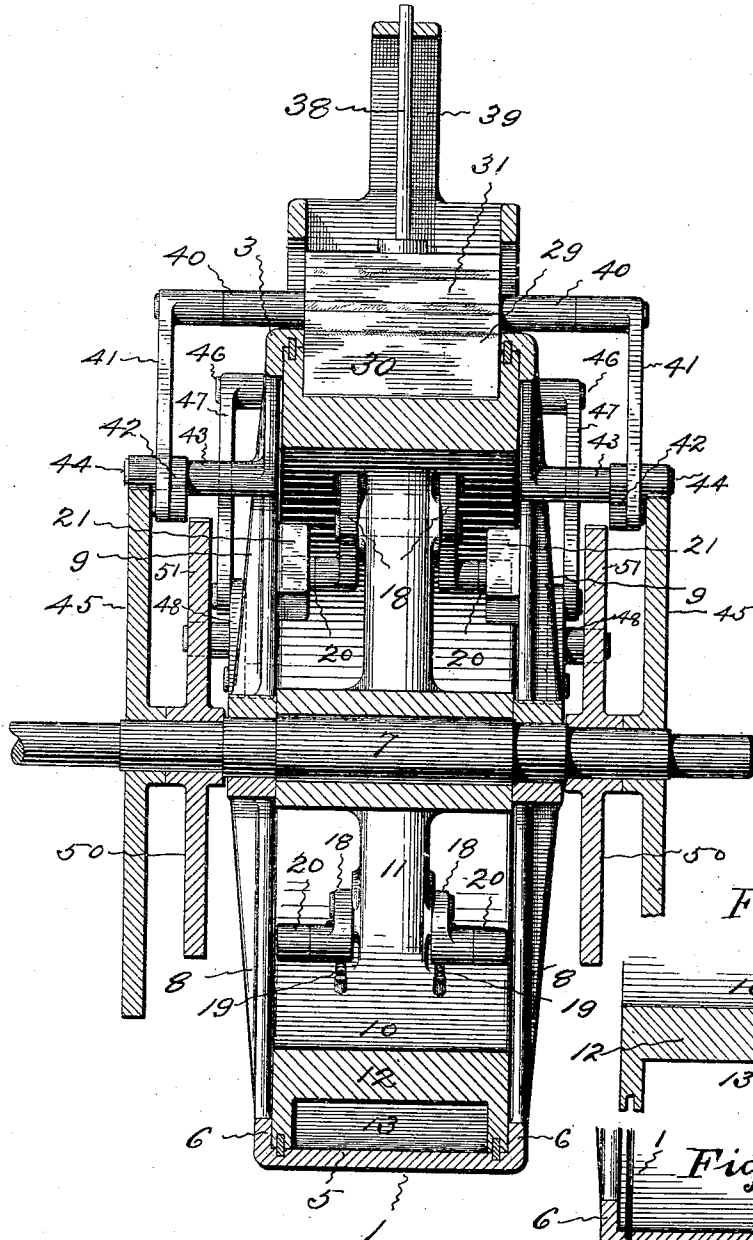
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4 SHEETS—SHEET 3.

Fig. 3.



Witnesses:

S. J. Grotta

Charles F. Stone

Inventor:

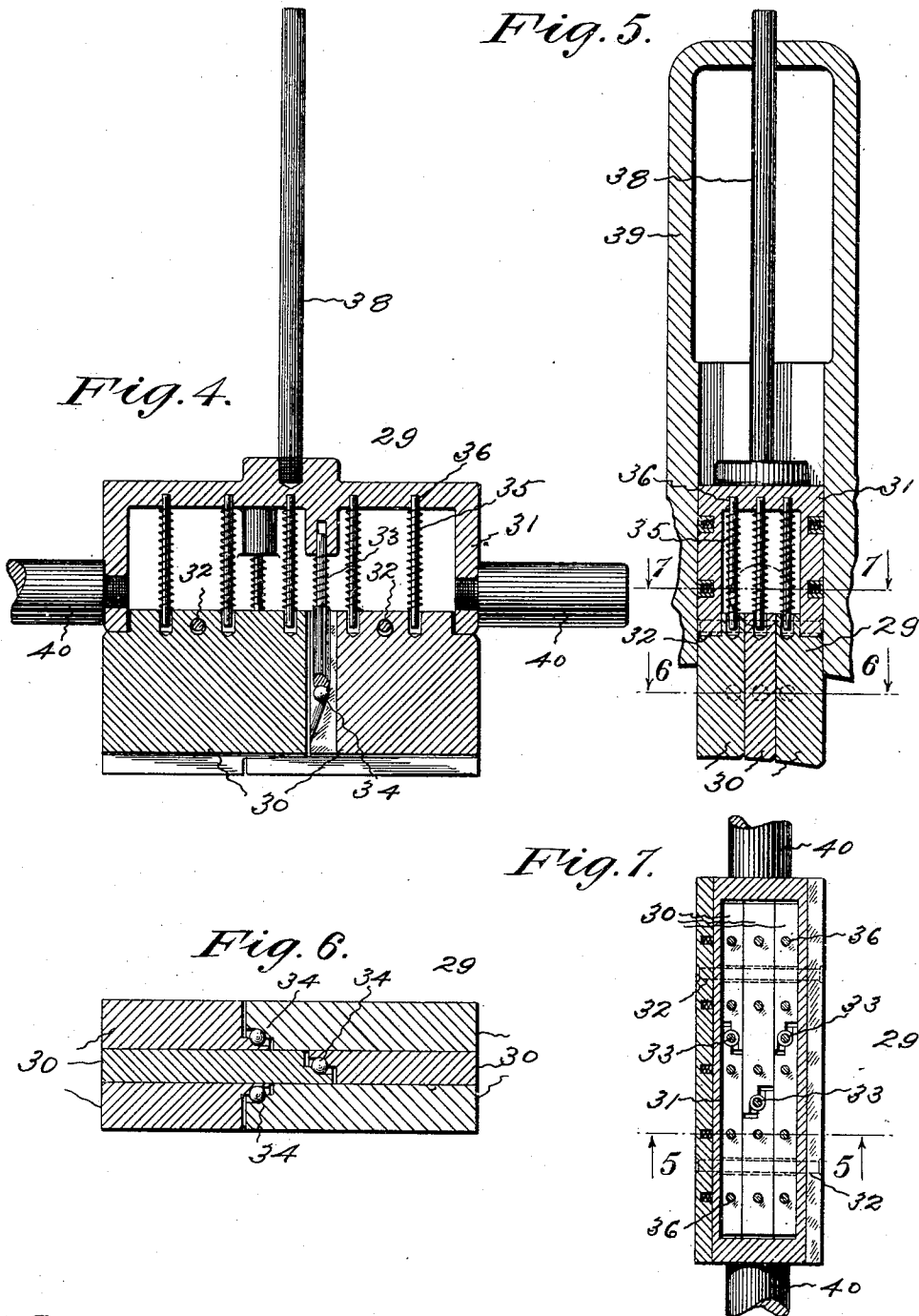
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Charles F. Stone

Inventor:

Charles M. Green
 by *Harry M. Williams* Att'y.

UNITED STATES PATENT OFFICE.

CHARLES M. GREEN, OF HARTFORD, CONNECTICUT.

ROTARY EXPLOSIVE-ENGINE.

955,155.

Specification of Letters Patent.

Patented Apr. 19, 1910.

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To all whom it may concern:

Be it known that I, CHARLES M. GREEN, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Rotary Explosive-Engines, of which the following is a specification.

This invention relates to a rotary internal combustion engine, that is, an engine in which the explosion of fluid, such as gasoline, is utilized to give a rotary motion to the driving shaft.

The object of the invention is to provide an engine of this nature having a light, simple and cheap construction, with but comparatively few joints that are necessary to pack, all of which are easily kept tight, and which owing to its lightness, openness and few joints runs cool at high speed.

This engine has a simple casing made up of semi-annular sections, having the necessary intake and exhaust ports and supporting movable compression and explosion abutments, which casing encircles and incloses only a small portion of the rim of a centrally mounted driving wheel that has outwardly opening recesses formed in its peripheral surface to provide the necessary gas chambers, the rotation of which chambered wheel, acting in connection with the abutments, sucks in and causes the compression of the live gas and expels the dead gas.

Figure 1 of the accompanying drawings shows a side elevation of an engine which embodies the invention. Fig. 2 shows a vertical longitudinal section of the engine. Fig. 3 shows a vertical transverse section of the engine, on the plane indicated by the dotted line 3—3 on Fig. 2. Fig. 4 shows a vertical longitudinal section of one of the movable abutments that are supported by the casing, taken on the plane indicated by the dotted line 4—4 on Fig. 2. Fig. 5 shows a vertical transverse section of the same abutment and a portion of the casing in which it is movable. Fig. 6 shows a horizontal section of the movable abutment, on the plane indicated by the dotted line 6—6 on Fig. 5. Fig. 7 shows a horizontal section of the abutment on the plane indicated by the dotted line 7—7 on Fig. 5. Fig. 8 shows a small section of the rim of the driving wheel. Fig. 9 shows a small section of the casing in which the edge of the rim of the driving wheel runs.

The casing is shown as formed of two semi-annular sections. The lower section 1 is provided with suspension flanges 2, and the upper section 3 is provided with supporting flanges 4. These flanges are designed to be fastened together by any suitable means. These semi-annular casing sections are preferably cast to shape of metal so as to have a channel-shaped cross section, that is, they have a circular peripheral wall and sides, or flanges 6, that extend inwardly a short distance from the peripheral wall. The shaft 7 is mounted in bearings supported by arms 8 which extend radially inward from the lower section of the casing. The upper section of the casing has radial arms 9 for strengthening that section.

Fastened on the shaft is the driving wheel 10, which has spokes 11 and an annular rim 12. This rim has annular outwardly opening channel-shaped recesses 13 around its peripheral surface to provide the compression and explosion chambers. Recessing the rim in this manner leaves partitions or abutments 14 and 15 which are utilized, as the wheel revolves, to, by suction, draw in the fresh charges of gas, cause the necessary compression of the charges sucked in, and expel the dead gases after explosion. There may be one or more of what may be termed the rotary suction and scavenging abutments 14, and one or more of what may be termed the rotary compression and explosion abutments 15. In the engine shown in the drawings there are three of each of these abutments, and in each of the rotary compression and explosion abutments there are one or more passages 16 from one side to the other. Each of these passages is controlled by a spindle valve 17, having its ends so shaped that when the valve is in one position, it closes the passage at both ends, and when it is in another position, the passage is open from one side of the abutment to the other. Each of these spindle valves is actuated at the proper time by an angle lever 18, that is pivoted to the wheel spoke and is drawn in one direction by a spring 19, and adapted to be moved in the other direction by the contact of, as the wheel rotates, a roll 20 on the inner end of the lever with a cam block 21 fixed to one of the supporting arms of the upper section of the casing. The engine shown in the drawings has two of these spindle valves in each of the explosion abutments, and two actuating

levers one mounted on each side of the wheel spoke, as shown in Figs. 2 and 3.

In the top of the upper casing section is the intake chamber 22, which is adapted to be connected with the carbureter, vaporizer or other apparatus which supplies the live charge of mixed gas and air for driving the engine. In this intake chamber is an inwardly opening valve 23, mounted on a spindle 24. The valve is normally kept closed by a spring 25, the tension of which may be adjusted by turning the thumb nut 26 on the threaded end of the spindle. Screwed into an opening in the top of the upper section of the casing adjacent to the intake chamber, is a common spark plug or other form of ignition means 27, which is designed to be connected with any suitable electrical generator or battery.

Movable radially with relation to the driving wheel, through openings in the upper part of the top section of the casing, are abutments 28 and 29. The abutment 28 is termed the compression abutment, as the mixture is compressed between its rear face and the front faces of the chamber-separating or partition walls that are perforated, and the abutment 29 is termed the explosion abutment as the charge is exploded between its front face and the rear faces of the chamber-separating or partition walls that are perforated. The front faces of the chamber-separating walls are, of course, those surfaces on their front sides as the walls rotate, and the rear faces are those on the reverse sides, while the terms front and rear faces as applied to the compression and explosion abutments are the surfaces which are in front and in back with respect to the direction of rotation of the chamber walls with which they cooperate in the compression and explosion of the mixture. The compression abutment 28 is located in advance of the intake chamber 22, and the explosion abutment 29 is located in the rear of the intake chamber 22. By this is meant that the compression abutment is on the front side of the intake opening, and the explosion abutment is on the back side of the intake opening, the terms advance and rear or front and back being used in this instance with relation to the forward movement of the walls of the chambered wheel. In the form of engine shown, these abutments have substantially the same construction. Each is made up of three leaves 30, and each leaf is divided into two sections, as shown in Figs. 5, 6 and 7. The leaves are made in sections in this manner so that they may be expanded edgewise to form close contact with the edges of the recesses in the periphery of the driving wheel, and also so that the combined lower edges of the leaves will fit and make a close joint with the bottom of the recesses in the pe-

riphery of the wheel with which they are in contact. These sectional leaves, which form the abutment proper are connected with a frame 31, by means of pins 32, Figs. 4 and 5. These pins extend through openings which are somewhat larger than the pins so that the parts, while moving together, will be loosely connected. Spring plungers 33 are forced downwardly from the frame against balls 34 arranged in wedge shaped pockets between the joints of the leaf sections of the abutment so as to force the sections apart edgewise in order that they may be properly expanded and keep the joints tight. Springs 35 are arranged on rods 36 that project downwardly from the abutment frame, so as to force the leaves downwardly and cause the lower edges of the abutments to independently make close contact with the peripheral surfaces of the wheel with which they engage. A spring 37 is arranged on a stem 38 which projects upwardly from the abutment frame and extends through the guiding frame 39. This spring thrusting in this manner, tends to force the abutment as a whole downwardly.

Extending outwardly from each side of the frame of the explosion abutment 29 are trunnions 40. Links 41 connect the outer ends of these trunnions with levers 42 that are pivoted to arms 43 which project inwardly from the upper section of the casing. The levers connected with the explosion abutment 29 are provided with rolls 44 that are in contact with the peripheral surfaces of cam disks 45, which in the engine shown in the drawings, are mounted upon the driving shaft. The compression abutment 28, as stated, is preferably constructed exactly the same as the explosion abutment 29. The compression abutment has its trunnions 46 connected by links 47 with levers 48 that are pivoted to arms 49 which project inwardly from the upper section of the casing. These levers have rolls 50 that are in contact with the peripheral surface of cams 51 which are mounted upon and rotated with the shaft, Figs. 1 and 3.

The upper section of the casing is provided with an outlet or exhaust opening 52, and also with a supplementary exhaust outlet 53. The upper section of the casing may be, if desired, as shown in the drawings, provided with ribs or spines 54 adjacent to that portion in which the explosion takes place, for the purpose of facilitating the radiation of heat from the casing.

In the operation of the engine, as the driving wheel rotates and the abutment 28 integral therewith, passes beneath the explosion abutment 29, that abutment, by means of the springs described, is forced down into the recess in the periphery of the wheel so as to make close contact with the

sides and bottom thereof, the rotatory cams which lift this abutment being at that time in such position as to allow the abutment to be then forced downwardly. When this abutment is down in this position, and the abutment 14 passes beneath the intake valve a charge of live explosive mixture is drawn past the valve by suction into the chamber in the periphery of the wheel between the wheel abutment 14 and the explosion abutment 29. As the wheel abutment 14 passes the compression abutment 28, which at that time, of course, is in its outer position, that abutment is forced down by its springs, the cam which lifts it out then allowing. When the abutment 28 is down, the live charge sucked in by the abutment 14 becomes compressed between the rear face of the abutment 28 and the front face of the abutment 15. At the proper time the spindle valves are opened by their levers and cam blocks so that this charge, which is thus compressed, flows through the passages 16 into the recess beneath the intake valve. When this charge has been forced into this recess it is fired. The explosion abutment cams 45 of course are so shaped that they lift the explosion abutment 29, while the wheel abutment 15 is passing, and then allow the former to drop as soon as the latter has passed. When the charge is exploded, the force of expansion is resisted by the front face of the explosion abutment 29, which closely fits the walls of the recess in the wheel, and is exerted on the rear face of the wheel abutment or chamber separating wall 15 and so impels the driving wheel in the direction indicated by the arrow 55, Fig. 2. The compression abutment 28 is of course raised by its cams so as to permit the passage of the wheel abutment 15, and as this abutment passes the exhaust outlet, the following fixed wheel abutment 14 expels the exploded gases through the exhaust outlet.

As stated, there may be as many of the compression and explosion abutments 15 with passages 16 and spindle valves 17 controlling those passages, as desired. In the form of engine shown in the drawings, there are three of these wheel abutments 15 and a corresponding number of suction abutments 14. The cams are timed to raise the movable abutments in the casing at the proper moment, and to allow them to be forced downwardly when necessary. These cams must always operate accurately for the reason that they turn with the driving wheel. The cam surfaces are extended, consequently there is but little wear and they operate upon levers so that the action is free and there is but little friction, allowing a quick action of the parts. Such dead gas as remains in a recess of the driving wheel, after it passes the exhaust outlet, is expelled through the supplementary exhaust outlet, so as to

thoroughly clear the recess of dead gas and to prevent the formation of an air cushion between the abutments as the wheel rotates.

An engine constructed in this manner is exceedingly light, for the casing is merely an annular channel formed in two sections, which are readily placed together when the organization is assembled, and which can be quickly separated when necessary for repairing or cleaning any of the parts. The driving wheel can also be made very light, for it is merely a wheel with recesses in its rim. Not only does this construction insure lightness, but it is open. There are no heavy masses of metal to retain heat, and the parts are so exposed that what heat is taken up is immediately radiated into the atmosphere. As the area of contact between the moving surfaces of the periphery of the wheel and the intumed edges of the casing is relatively small, but comparatively little machine work is required in fitting the parts and making them tight, and only a few packings of common form are necessary. There are no joints to pack between the wheel abutments and the wheel rim, for they are integral, or if not integral, fastened together so as to be practically integral. The reciprocating abutments make tight joints with the walls of the chambers in the periphery of the driving wheel as they are formed in sections and are expanded by light springs.

The invention claimed is:

1. A rotary explosive engine having a shaft, a wheel centrally mounted on the shaft, said wheel having an annular rim with outwardly opening chambers in the peripheral surface of the rim, and a passage through one of the walls separating one chamber from the other, a valve for controlling the flow of gas through said passage, from one chamber to the other, means for opening and closing said valve at the correct time, a casing encircling the outer edge of the rim of the wheel, said casing being formed of semi-annular sections with an inwardly opening channel in each section and gas intake and exhaust openings in the upper section, an inlet valve in said intake opening, a compression abutment movable radially in the casing into and out of said chambers in advance of the intake opening, an explosion abutment movable radially in the casing into and out of said chambers in the rear of the intake opening, means for reciprocating said compression and explosion abutments at the correct time, and means for exploding the gas between the face of the wall through which it is passed and the face of the explosion abutment.

2. A rotary explosive engine having a shaft, a wheel centrally mounted on the shaft, said wheel having an annular rim with outwardly opening chambers in the

peripheral surface of the rim, and a passage through each alternate chamber separating wall, a valve in each of said passages for controlling the flow of gas from one
 5 chamber to the other, means for opening and closing said valves at the correct time, an annular casing encircling a portion of the outer edge of the wheel rim and having gas intake and exhaust openings, an inlet
 10 valve in said intake opening, a compression abutment movable radially in the casing into and out of said chambers, in advance of the intake opening, an explosion abutment movable radially in the casing into and out of
 15 said chambers, in the rear of the intake opening, means for reciprocating said compression and explosion abutments at the correct time, and means for exploding the gas between the face of the wall through which
 20 it is passed and the face of the explosion abutment.

3. A rotary explosive engine having a shaft, a wheel centrally mounted on the shaft, said wheel having an annular rim
 25 with outwardly opening chambers in the peripheral surface of the rim, and a passage through one of the walls separating one chamber from the other, a valve for controlling the flow of gas through said passage, from one chamber to the other, means
 30 for opening and closing said valve at the correct time, an annular casing encircling and inclosing a portion of the outer edge of the wheel rim and having gas intake and exhaust openings, an inlet valve in said intake
 35 opening, a compression abutment movable radially in the casing into and out of said chambers, in advance of the intake opening, an explosion abutment movable radially in the casing into and out of said chambers in
 40 the rear of the intake opening, cams mounted on and rotatable with the shaft for reciprocating the said casing abutments, and means for exploding the gas between the
 45 face of the wall through which it is passed and the face of the explosion abutment.

4. A rotary explosive engine having a shaft, a wheel centrally mounted on the shaft, said wheel having an annular rim
 50 with outwardly opening chambers in the peripheral surface of the rim and a passage through one of the walls separating one

chamber from the other, a valve for controlling the flow of gas through said passage from one chamber to the other, a lever
 55 for moving said valve, a cam block fixed with relation to the casing for actuating said lever, an annular casing encircling and inclosing a portion of the outer edge of the wheel rim and having gas intake and ex-
 60 haust openings, an inlet valve in said intake opening, a compression abutment movable radially in the casing into and out of said chambers, in advance of the intake opening, an explosion abutment movable radially in
 65 the casing into and out of said chambers in the rear of the intake opening, means for reciprocating the said casing abutments at the proper time, and means for exploding the gas between the face of the wall through
 70 which it is passed and the face of the explosion abutment.

5. A rotary explosive engine having a shaft, a wheel centrally mounted on the shaft, said wheel having an annular rim
 75 with outwardly opening chambers in the peripheral surface of the rim, and a passage through a wall separating two of the chambers, a valve for controlling the flow of gas through said passage, an annular casing en-
 80 circling and inclosing a portion of the outer edge of the wheel rim and having gas intake and exhaust openings, an inlet valve in said intake opening, a compression abutment movable radially in the casing in advance of
 85 the intake, an explosion abutment movable radially in the casing in the rear of the intake, mechanism for reciprocating the abutments and the valve carried by the wheel, said mechanism being so timed that gas is
 90 compressed between the rear face of the compression abutment and front face of the chamber separating wall, and then passed through the passage to the following chamber between the rear face of said wall and
 95 the front face of the explosion abutment, and means for exploding the gas thus transferred, between the front face of the explosion abutment and the rear face of the wall it was passed through.

CHARLES M. GREEN.

Witnesses:

JOSEPHINE M. STREMPFER,
 HARRY R. WILLIAMS.