No. 894,492. PATENTED JULY 28, 1908.

W. H. FULTON.

ROTARY EXPLOSION ENGINE.

APPLICATION FILED JUNE 8, 1906.

5 SHEETS—SHEET 1.

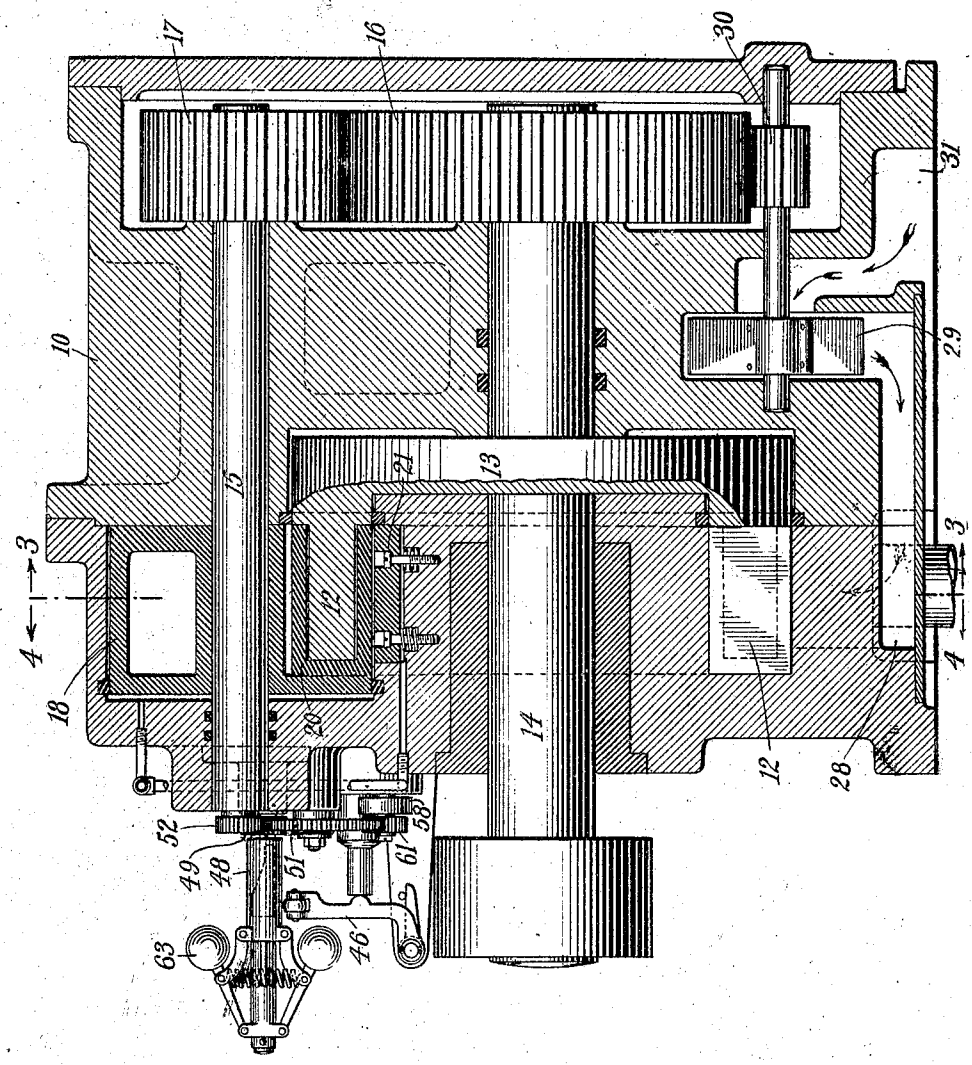


Fig. 1

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5 SHEETS—SHEET 2.

Fig. 2

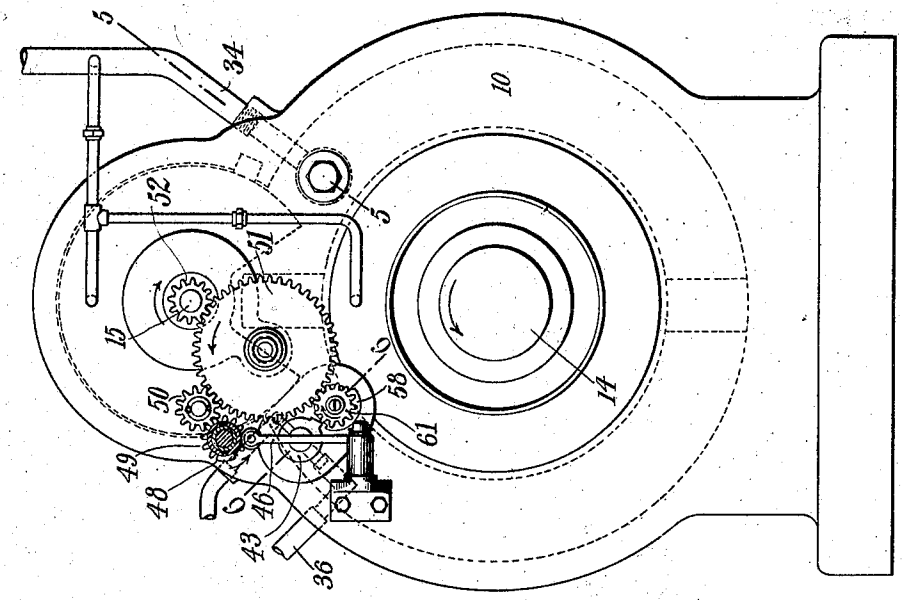
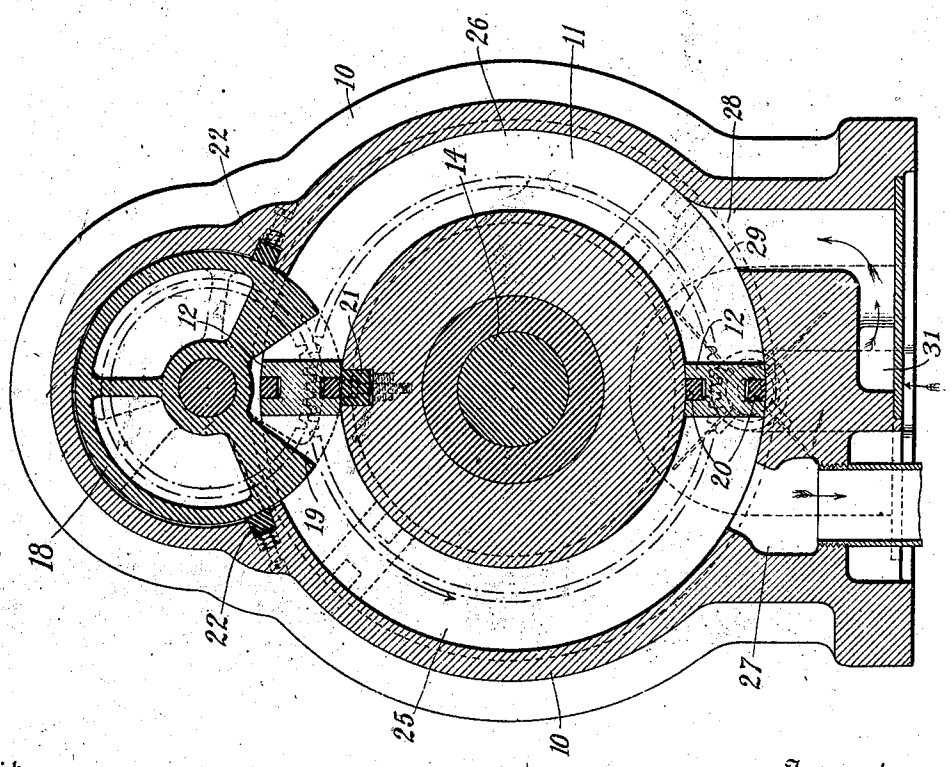


Fig. 3



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5 SHEETS—SHEET 3.

Fig. 4

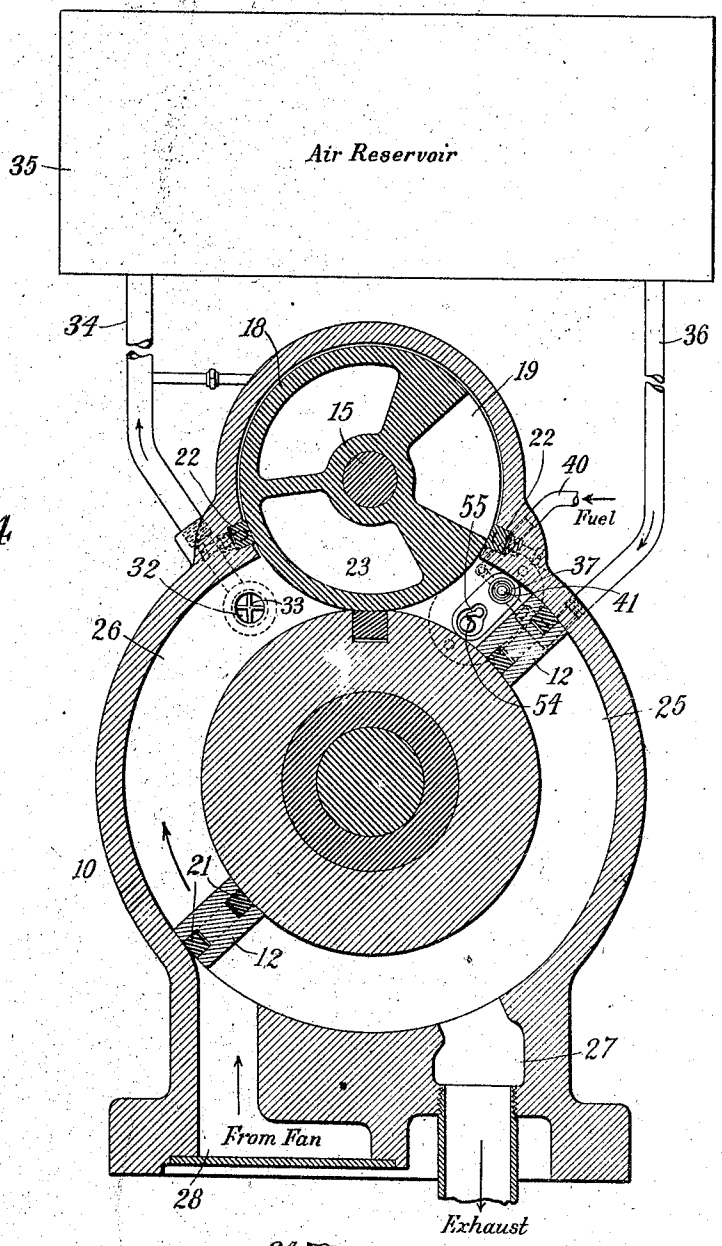
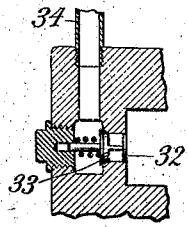


Fig. 5



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5 SHEETS—SHEET 4.

Fig. 6

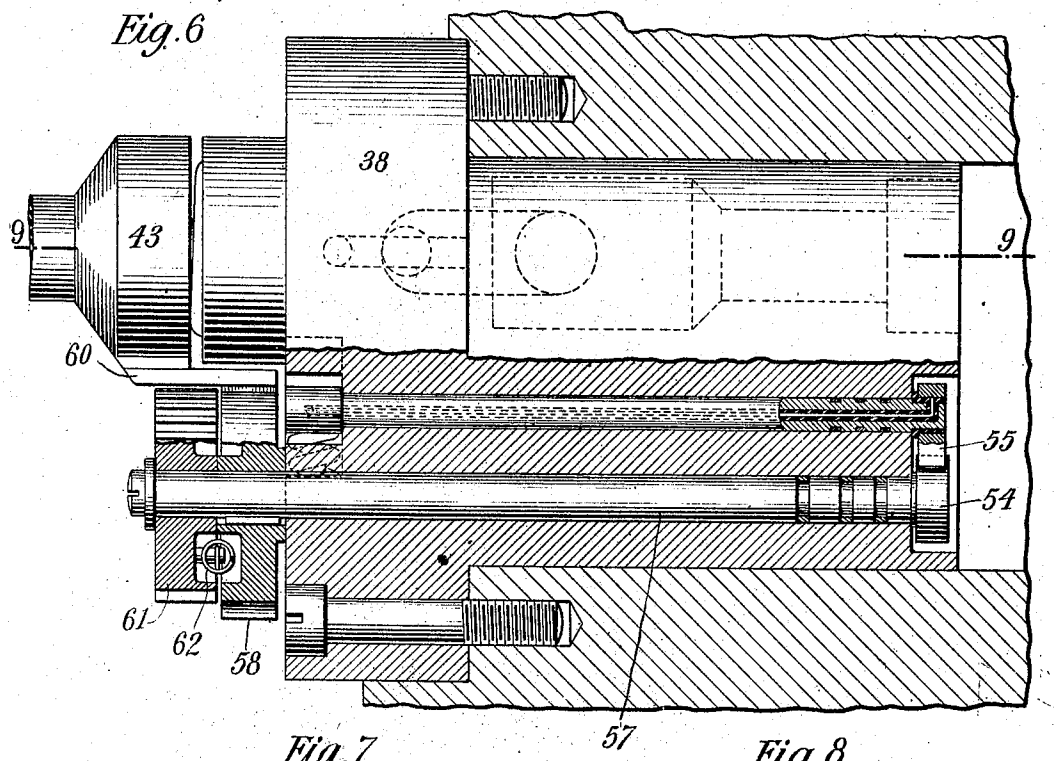


Fig. 7

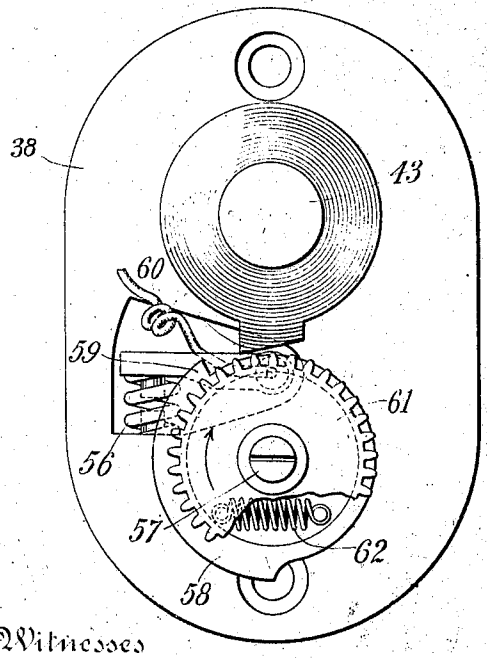
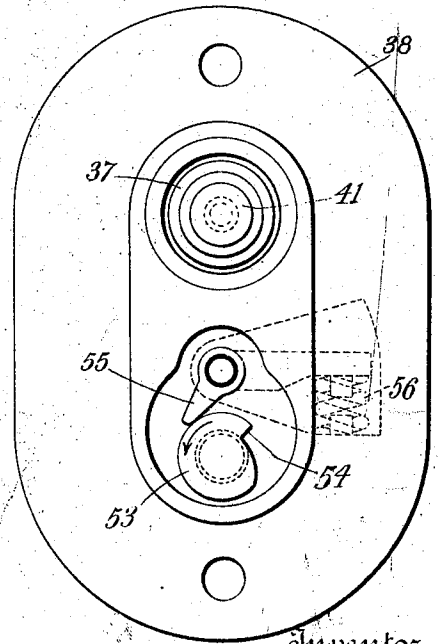


Fig. 8



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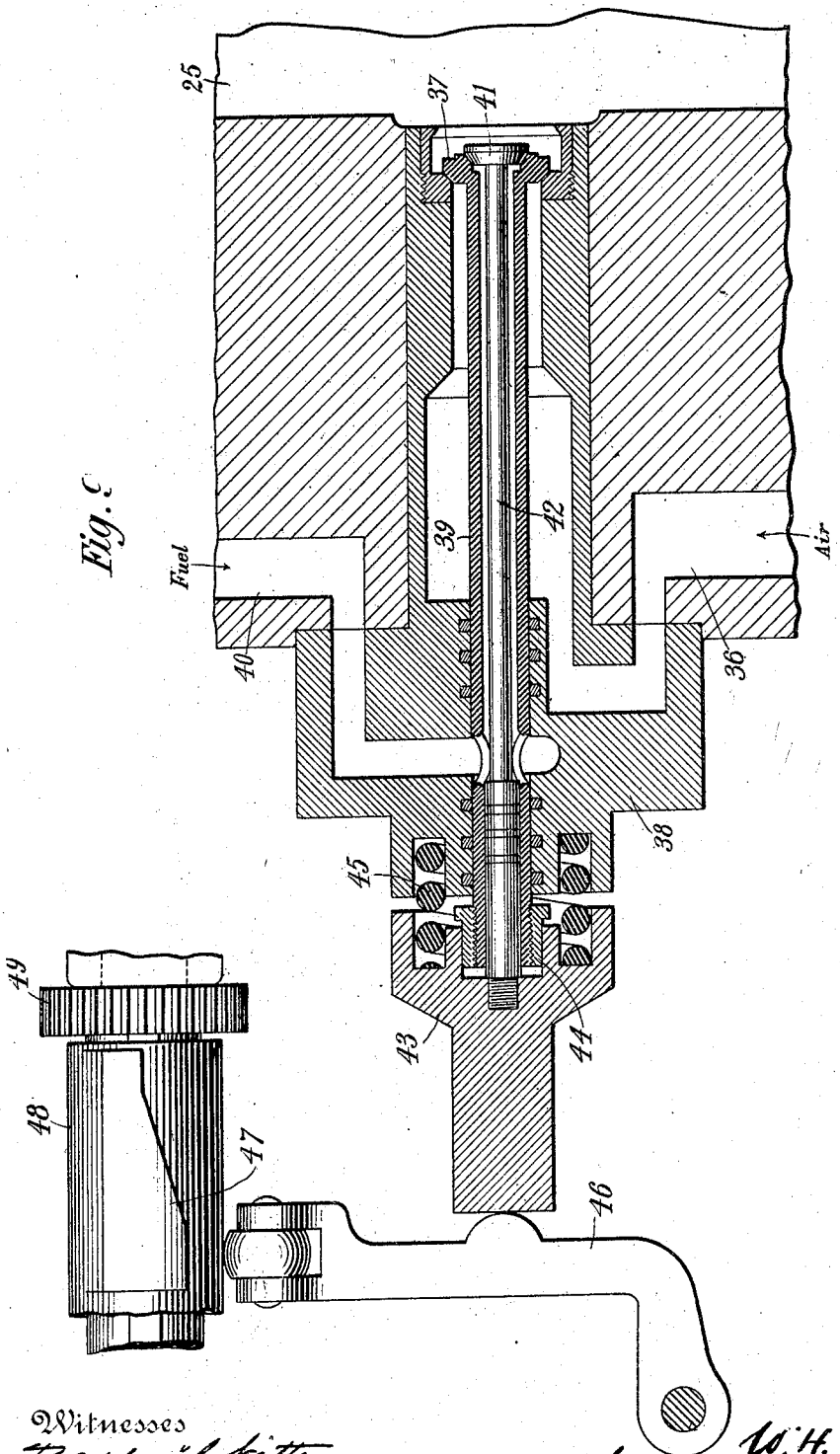
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ROTARY EXPLOSION ENGINE.

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5 SHEETS—SHEET 5.

Fig. 6



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UNITED STATES PATENT OFFICE.

WILLIAM H. FULTON, OF ALBANY, NEW YORK.

ROTARY EXPLOSION-ENGINE.

No. 894,492. Specification of Letters Patent. Patented July 28, 1908.

Application filed June 8, 1906. Serial No. 320,710.

To all whom it may concern:

Be it known that I, WILLIAM H. FULTON, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Rotary Explosion-Engines, of which the following specification and accompanying drawings illustrate the invention in a form which I now regard as the best out of the various forms in which it may be embodied.

This invention relates to rotary explosion engines and especially those in which the charge, either of air or fuel or both, is raised in pressure prior to firing.

In the ordinary reciprocating gas engine of the Otto type which employs its explosion cylinder for a compressor it is possible to compress the charge and explode it in the same cylinder with a comparatively simple mechanism. In a rotary engine, however, the conditions are somwhat different, since the piston usually rotates continuously in one direction and accordingly the problem of compression is a serious one.

My present invention provides a very simple expedient for compressing the charge in a part of the same annular space which is employed for exploding the charge.

The invention further consists in an improved means for controlling the cut-off of the charge admitted into the explosion chamber and controlling the time of ignition, in order that ignition may, if desired, always take place at substantially the same pressure.

I further provide improved means for charging the compression chamber and certain improvements in the general construction of the engine, as will hereinafter appear.

Of the accompanying drawings, Figure 1 represents a vertical axial section of a rotary explosion motor, constructed according to this invention, Fig. 2 represents an elevation thereof, Figs. 3 and 4 represent two sections on the plane 3—3 4—4 of Fig. 1 looking in opposite directions, Fig. 5 represents a section of the air compressor discharge taken on the line 5—5 of Fig. 2, Fig. 6 represents an enlarged section on the line 6—6 of Fig. 2, showing the admission valves and igniter for the explosion chamber, Figs. 7 and 8 represent elevations, showing the outer and inner ends of said parts respectively, Fig. 9 represents an axial section, showing the admission valves and their actuating mechanism.

The same reference characters indicate the same parts in all the figures.

In the drawings, 10 is a casing composed of forward and rear parts bolted together and provided with suitable arrangements, not shown, such as a water jacket or radiating fins, for carrying away the heat. The forward part of this casing contains an annular space 11 in which operate the pistons 12 12. Two of these are shown mounted upon a disk or piston support 13 on the main shaft 14.

15 is a parallel counter-shaft connected by gears 16 17 therewith so as to run twice as fast as the main shaft, said counter-shaft carrying a rotary abutment-wheel, valve or gate 18 forming one end each of the explosion and compression chambers and containing a pocket or recess 19 which allows the pistons 12 12 to pass said abutment-wheel. I am aware that this abutment-wheel and the rotary pistons broadly are not new in rotary engines but I make use of and mount the mechanism in a certain improved manner, as will appear. The pistons might be mounted radially on a central support or wheel rolling in contact with the abutment-wheel, but two rolling surfaces are somewhat difficult to pack properly and I prefer the arrangement shown, wherein both the inner and outer walls of the annular chamber 11 are stationary. The pistons 12 are provided with packings 20 on both their inner and outer edges and the periphery of the abutment-wheel 18 coöperates with a packing 21 in the inner wall of the annular space. Packings 22 22 also coöperate with the periphery of said wheel on the outer side of the annular space. These packings are suitably held against extreme outward movement and they preferably receive behind them the fluid pressures through suitable ducts, such as the duct 23 leading from the compressed-air pipe. A similar duct carries the compressed-air pressure to the back of the abutment-wheel 18 to maintain end-pressure between said wheel and the piston-packings 20, as seen in Fig. 1.

On one side of the abutment-wheel 18 is the explosion chamber 25 and on the other side is the air-compression chamber 26, both forming parts of the annular space 11. Near the lower end of the explosion chamber is an

exhaust port or outlet 27 and each piston 12 acts as its own valve uncovering said exhaust port after the completion of the expansion stroke. Near the lower end of the compression chamber 26 is an inlet port or opening 28 for charging said compression chamber and each piston likewise acts as its own admission valve for shutting off said port and trapping the charge of air between the piston and the abutment-wheel 18. For the purpose of charging the air-compression chamber 26 and also clearing the space in front of each piston successively of the remnant of burned gases, I connect the compressor admission port 28 with the discharge of a centrifugal fan 29 (best shown in Fig. 1) connected by a gear 30 with the gear 16 and receiving atmospheric air through a suction port 31. I could dispense with the fan 29 or its equivalent by duplicating the abutment-wheel 18 on the lower side of the motor, in which case each piston would suck in an atmospheric charge behind it which would become compressed by the next piston, on passing port 28. I prefer the arrangement shown, however, as being less complicated. I might also get along with only one piston, one side of which would receive the explosion pressure and the other side would perform the compression. The two-piston arrangement, however, is preferable in many respects, for, among other things, it enables each piston to act as its own valve, and also affords a pressure balance.

Near the upper end of the compression chamber 26 is an outlet port 32 provided with a check-valve 33 and continuing in a pipe 34 to an air reservoir 35. From the latter a pipe and duct 36 lead to the outer side of the air admission valve 37 controlling the entrance of compressed air into the explosion chamber 25. This valve is mounted to slide in a removable piece or cage 38 which also holds the igniting mechanism. The air valve stem 39 is hollow and constitutes a part of the fuel duct to which fuel is supplied from a conduit 40. The air valve 37 is formed with the seat for the fuel valve 41 whose stem 42 extends through the hollow air valve stem and is provided on its outer end with a head 43. The air valve stem has a smaller head 44 adapted to be engaged by the head 43 on the in-stroke of the latter. A spring 45 sufficiently heavy to overcome the compressed air pressure engages the head 43 and draws both valves to their seats, said spring acting on the air valve 37 through the fuel valve 41. The concentric arrangement of valves provides an efficient mixture of air and fuel on entering the explosion chamber.

The valves 37 41 are operated by means of a bent lever 46 abutting the head 47 and having a roller engaged by a cam 43 on a sleeve 48 splined to a rotating gear 49. Said gear is connected in train through gears 50, 51 and 52 (Fig. 2) with the counter-shaft 15, so as to open the air and fuel valves 37 and 41 in time with said shaft, that is, once for every cycle of a piston 12.

The ignition device comprises a pair of electrodes, one of which is a rotary electrode 53, having a snap shoulder 54, while the other is an oscillating electrode 55, having a spring 56. These are suitably connected in a sparking circuit and a spark takes place when the shoulder 54 wipes past the electrode 55. Fast on the stem 57 of the rotary electrode 54 is a block 58, having a stop shoulder 59 adapted to be engaged by a complemental shoulder 60 formed on the head 43 when cam 47 opens the two admission valves. Loose on the electrode stem 57 is a gear 61 meshing with gear 51 and yieldingly connected with the block 58 by means of a spring 62. Accordingly when the head 43 moves inwardly and arrests block 58 the gear 61 continues to rotate and when abutment 60 releases abutment 59 on the closing of the admission valves, the shoulder 54 on the rotary electrode snaps past the oscillating electrode 55 and produces the spark. Thus the igniting spark is always timed with the admission of the charge to the explosion cylinder and if the admission valves cut off earlier or later with respect to the travel of one of the pistons 12, the spark will correspondingly occur earlier or later. I have shown the cut-off and ignition timed automatically in accordance with the load on the engine, by means of a centrifugal governor 63 acting on the sleeve 48 to shift the cam 47 axially and bring different parts of its inclined edge into coöperation with the lever 46. The ignition might, of course, be controlled separately from the cut-off and might be caused to occur earlier or later than said cut-off.

The operation is as follows: Assuming the parts to be in the position shown in Fig. 4, the uppermost piston 12 has just passed the admission valves and these will be opened by the engine and admit a charge of explosive mixture of air and fuel into the space back of the retreating piston. At a suitable point determined by the governor 63 this charge is cut off and ignited by a spark produced between the electrodes 54 55. The inflamed charge expands until said piston passes the exhaust port 27, whereupon the waste gases escape into the atmosphere. In the meantime the other piston 12 has entrapped a charge of atmospheric air between itself and the abutment-wheel 18 and compresses this into the air reservoir 35. Preferably this reservoir is large enough to hold several charges and prevent any substantial diminution of pressure when a charge is withdrawn into the explosion chamber and I prefer also to have the compression chamber 26 larger in volume than the volume of the

explosion chamber at the latest cut-off, so that pressures will pick up at starting and tend to rise. Indefinite rise of pressures is avoided by reason of the clearance space existing in front of the compressing piston after it passes the discharge port 32, or may be prevented by other suitable means. This clearance air becomes trapped in the pocket 19 of the abutment-wheel and is discharged forward into the explosion chamber, which is then open to the exhaust port 27 as indicated in Fig. 3. A scavenging action thus takes place, clearing out the exhaust gases and cooling the explosion chamber for the next charge. If any dead gases remain they are swept out by the blast of the fan 29 when the pistons reach the positions shown in Fig. 4, said fan also serving to charge the space between the two pistons with fresh air, which thereafter becomes compressed in chamber 26 as already described.

This engine is adapted to burn any of the fuels commonly employed in explosive engines. If gas fuel is employed it may be compressed by a suitable rotary or other compressor. Oil fuels directly injected will preferably be first pumped to or above the air compression pressure. If volatile hydrocarbons are vaporized this may be done by means of an ordinary carbureter, operating as usual except that it should preferably work under full compression pressure.

The motor operates efficiently, under all loads, since the initial pressure in the explosion chamber is substantially constant at varying cut-offs and may be as high as desired. The engine also of course possesses the advantage of substantial freedom from reciprocating parts.

What I claim as new and desire to secure by Letters Patent is:

1. A rotary explosion motor comprising stationary concentric inner and outer walls forming an annular space, a rotary piston-support axially remote from said space and having a piston projecting into the space and provided with packing on its outer and inner edges, a rotary abutment-wheel formed to permit the passage of the piston, a removable adjustable packing on the inner wall of the annular space coöperating with the periphery of said abutment wheel, means for admitting air to be compressed in said annular space by the piston, and means for admitting a charge to said annular space, exploding the charge, and exhausting the exploded charge.

2. A rotary explosion motor comprising a concentric annular chamber, means whereby one portion of said chamber is devoted to charge compression and another portion to charge explosion, a plurality of revolving pistons operating successively through said portions and acting as exhaust valves for the explosion chamber and admission valves for the compression chamber, and means whereby compressed charges of air and fuel are admitted to the explosion chamber.

3. A rotary explosion motor comprising a concentric annular chamber, means whereby one portion of said chamber is devoted to charge compression and another portion to charge explosion, a plurality of revolving pistons operating successively through said portions and acting as exhaust valves for the explosion chamber and admission valves for the compression chamber, and a rotary abutment-wheel separating the explosion chamber from the compression chamber.

4. A rotary explosion engine comprising a structure formed with a stationary-walled annular explosion and compression space, a piston-structure operating in said space, and means to charge the compression part of said space through the stationary wall thereof with partially-compressed fresh air.

5. A rotary explosion motor comprising a stationary-walled annular space including explosion and compression parts, a revolving piston-structure operating in said space, and a fan operated by the motor and discharging air through the stationary wall of said space for charging said compression part.

6. A rotary explosion motor comprising explosion and compression chambers forming an annular space, a revolving piston-structure operating in said space, a charge reservoir supplied by the compression chamber and supplying the explosion chamber, and separate automatic admission-valve mechanism between said reservoir and the explosion chamber, the casing of the motor having an exhaust opening and a port for the admission of fresh air after the piston passes said exhaust opening.

7. A rotary explosion motor comprising explosion and compression chambers forming an annular space, a revolving piston-structure operating in said space, a charge reservoir supplied by the compression chamber and supplying the explosion chamber, and separate automatic admission-valve mechanism between said reservoir and the explosion chamber operated by the engine, the casing of the motor having an exhaust opening and a port for the admission of fresh air after the piston passes said exhaust opening.

8. A rotary explosion motor comprising a structure formed with an annular space, a piston-structure operating therein, a movable abutment dividing said space into explosion and compression chambers, means for exhausting the burned charges from the explosion chamber, and means whereby a scavenging charge of compressed air is admitted by said abutment directly to the explosion chamber when the exhaust is open.

9. A rotary explosion motor comprising a structure forming an annular space which includes an explosion chamber and an air-com-

pression chamber, a piston operating in said space, means for admitting charges of compressed air and fuel to the explosion chamber, and a rotary abutment separating said chambers and having a recess permitting the passage of the piston and arranged to carry a scavenging charge of compressed air into the explosion chamber ahead of the piston.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses, the 21st day of May 1906.

WILLIAM H. FULTON.

Witnesses:
W. C. PETRASKE,
GEO. H. DIACK.