No. 883,324. PATENTED MAR. 31, 1908.

F. F. MacLEAN.

ROTARY ENGINE.

APPLICATION FILED JULY 18, 1906.

Fig. 1.

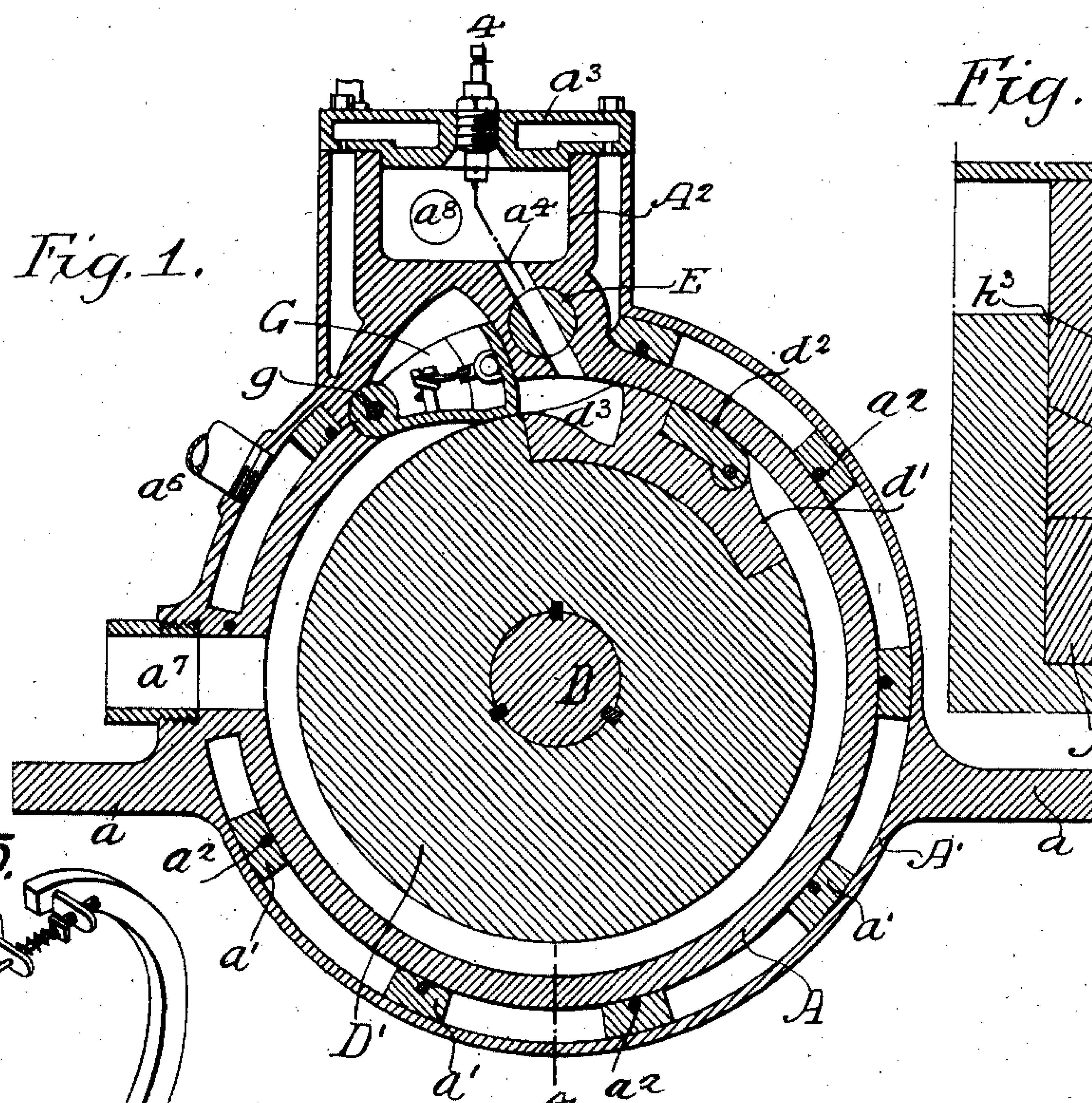


Fig. 3.

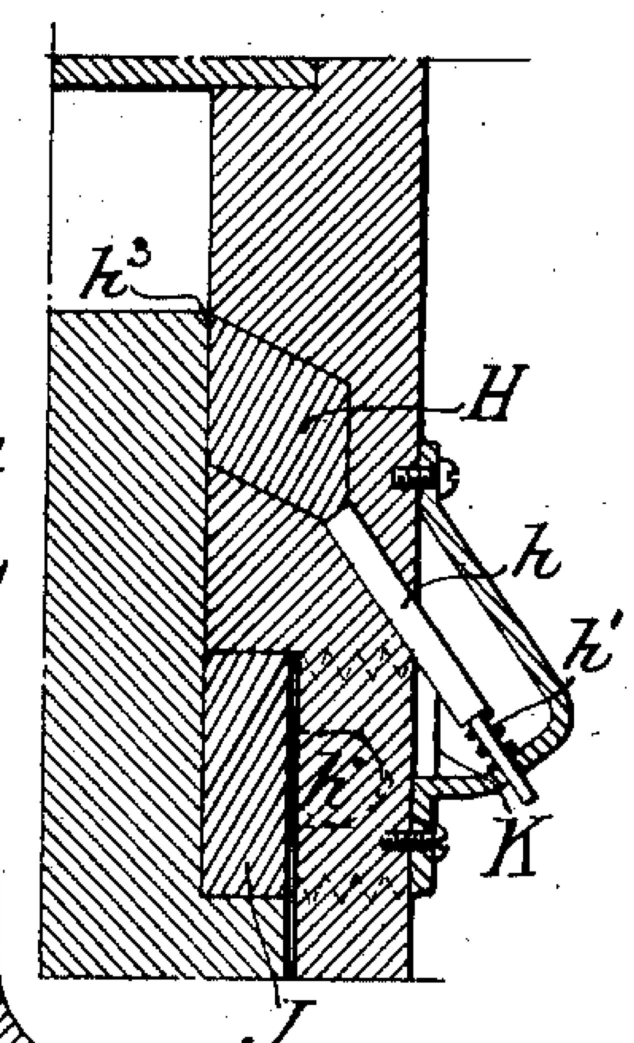
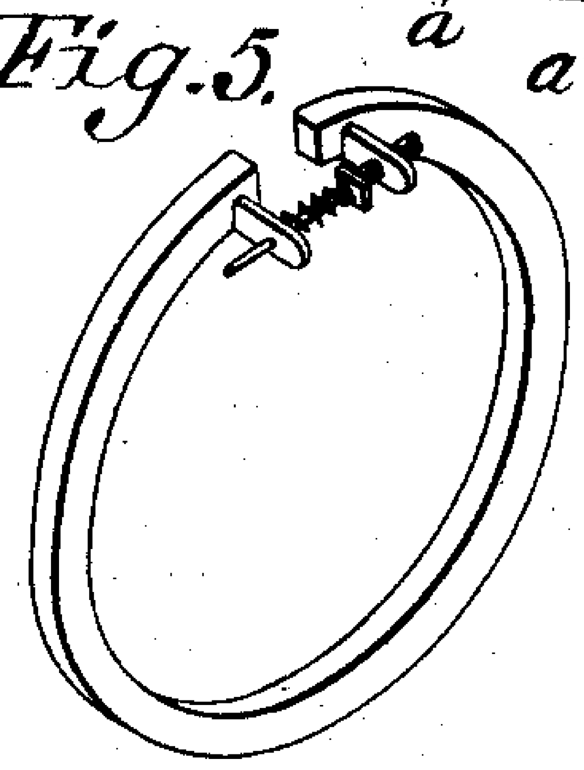


Fig. 5.



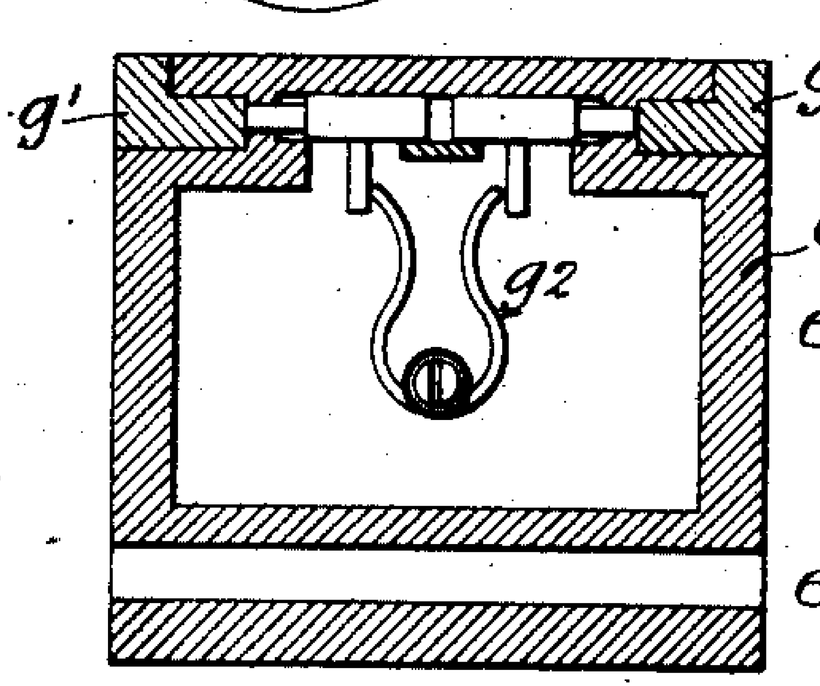
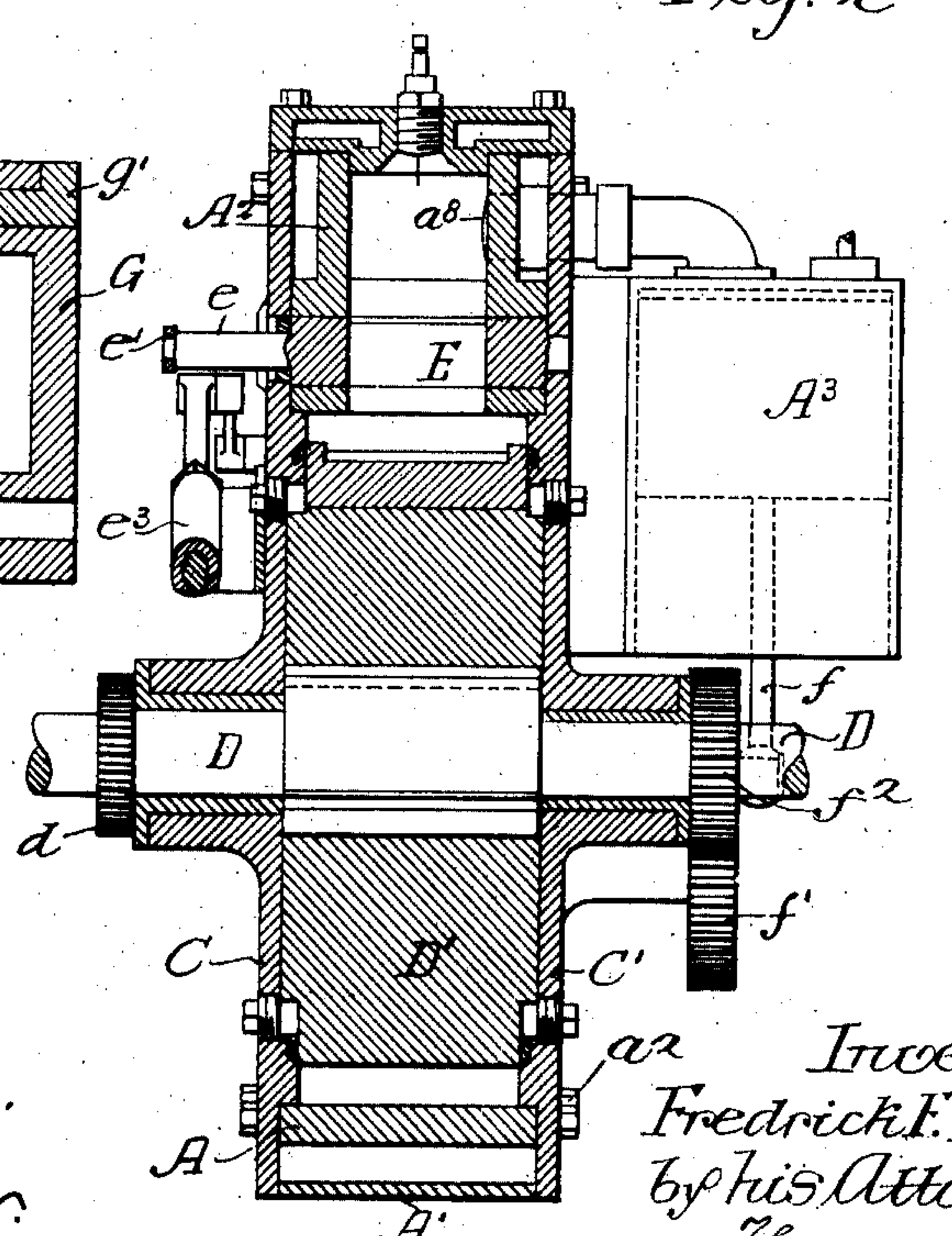


Fig. 4.

Fig. 2



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

No. 883,324. Specification of Letters Patent. Patented March 31, 1908.

Application filed July 18, 1906. Serial No. 326,765.

To all whom it may concern:

Be it known that I, FREDRICK F. MACLEAN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Rotary Explosion-Engines, of which the following is a specification.

One object of my invention is to provide a rotary engine designed to be operated by successive explosions of suitable fuel, with improved devices for preventing leakage of the motive fluid between the fixed and the moving parts of the engine. It is also desired to provide improved means of reducing the friction between the fixed and the moving parts of the engine, so that as a consequence of this and the above mentioned characteristics, the said engine shall operate at a higher efficiency than has hitherto been attainable in engines of this particular class. These objects and other desirable ends I attain as hereinafter set forth, reference being had to the accompanying drawings, in which:—

Figure 1, is a vertical section of my improved engine; Fig. 2, is a vertical section taken on the line 4—4, Fig. 1; Fig. 3, is a vertical section on an enlarged scale illustrating certain details of the packing between the piston and the sides of the piston chamber, and also the device for reducing the friction between these parts. Fig. 4, is a sectional plan of the movable abutment preferably employed by me in my engine, and Fig. 5, is a view of a modification of one of the rings.

In the above drawings A represents the body or main casting of my engine which is formed with a cylindrical cavity in order to provide a piston chamber, and which has an inclosing casing A′, from which extend supporting lugs *a*, whereby the engine may be properly supported upon suitable foundation structures. This inclosing casing is preferably so arranged relatively to the main casting A that there is a water space or spaces between said parts, and in said spaces are blocks *a*′ through which pass the bolts a^2, whereby the cylinder heads C, C′, are held in position. A suitable water inlet pipe is provided as at a^6 and an exhaust pipe a^7 communicates with the casing of the explosion chamber. Each of the cylinder heads is provided with a suitable bearing for the support of the main shaft D, and on this shaft is fixed a substantially cylindrical piston D′, designed to rotate within the cylindrical chamber formed by the main casting A and the cylinder heads C, C′.

A combustion chamber formed by a portion A^2 of the body A, having a cover or head a^3, communicates with the piston chamber through a passage a^4, such communication being controlled by means of a rotary valve E. Said valve has a stem *e* to which is fixed an arm *e*′, outside of the engine casing, operated from the shaft D in any desired manner.

The otherwise cylindrical piston D′ is recessed for the reception of a metallic piece *d*′, which projects beyond the surface of said piston adjacent to but substantially into contact with, the inside surface of the piston chamber. In order that there may be a gas tight joint between the outer portions of this piece *d*′ and the inside surface of the piston chamber, I provide a plate d^2 pivotally mounted in the recess of said piece *d*′ and extending across the entire face thereof, so that as the piston is turned this piece tends to fly out under the action of centrifugal force thereby preventing the passage of gas under pressure.

The opposite portion of the piece *d* is provided with a recess or pocket d^3 at the edges of which are guides d^4 designed to cause the gradual radially inward movement of an abutment piece G, pivoted at *g* within a recess formed inside the body portion A. This piece is designed to bear upon the cylindrical surface of the piston as this rotates, and to be automatically moved radially outward from the piston on the approach of the piece *d*′ carried thereby, at the same time forming a gas tight joint with said piston so that gas confined between the piece *d*′ and said abutment piece cannot escape back of said latter piece.

In order that the abutment piece G will form a gas tight joint with the heads C and C′ of the piston chamber, I provide it with two packing strips *g*′, one on each side, and force these against the respective cylinder heads by means of a spring g^2, as shown in Fig. 4.

An exhaust connection a^7 is provided to permit of the escape of expanded gases from the piston chamber, while in addition there is connected to the combustion chamber A^2 a compressor cylinder A^3, the piston of which is driven through a connecting rod *f* from a gear wheel *f*′. This latter meshes with a gear f^2 on the main shaft D, which is so proportioned that the piston makes but a single stroke for each two revolutions of the main shaft. As shown, the compressor is single acting, its upper end being connected to the combustion chamber A^2, as shown in Fig. 2.

In order to form a tight joint between the outer edges of the piston D′ and the adjacent sides of the piston chamber formed by the cylinder heads C and C′, I preferably employ a packing such as is shown in Fig. 5, consisting of a ring H of diamond shaped section placed in a suitably formed recess in the outer portions of the inner face of the two cylinder heads C and C′, adjacent to the outermost portions of the piston D′. Said ring is so arranged that it is free to move towards the face of the piston, with one of its flat sides in contact therewith, and it is forced to maintain this condition by a series of pins h, each pressed inwardly by means of a spring h'. The pins are preferably each guided by a bracket h^2 fixed to the outside of the cylinder head C or C′.

The above mentioned rings H are further so placed that their innermost, sharp edges h^3 are practically co-incident with the line of intersection of the cylindrical surface of the piston D′ with the faces of the cylinder heads, and it will be noted that the pins h and their springs tend to force said rings toward these lines. As a consequence of this construction it is not possible for gas under pressure to leak between the cylinder heads and the adjacent surfaces of the piston.

As further shown in Fig. 3, I form a shallow cylindrical recess in the inner face of each cylinder head and also so form the piston that it will project into said recess, interposing however a ring J of hard steel or equivalent material as shown in the above mentioned figure. From this latter ring in to the shaft D, the face of the piston is an appreciable distance from the adjacent face of the two cylinder heads, while from the ring J outwardly the fit between these parts is as perfect as possible. At intervals I place removable cup plugs K in each of the cylinder heads C and C′, so that the ball k carried by each of said plugs will engage the hard ring J and prevent the excessive friction which would otherwise occur between the surfaces of the piston and the heads.

Suitable charge igniting devices are provided in the combustion or explosion chamber A^2, and the parts are so arranged that when in the relative positions shown in Fig. 1, the compressor A^3 will have just forced a fuel charge into the explosion chamber A^2, there being a valve a^8 in order to prevent flow of gas from said chamber back into the compressor cylinder. Mechanism (not shown) is provided whereby the abutment piece G is automatically raised or moved into its recess in order to permit of the passage of the projection d' carried by the piston, though immediately after the passage of said piece, the abutment is lowered into the position shown in Fig. 1.

Under operating conditions, a charge is compressed in the cylinder A^3 and delivered therefrom into the combustion or explosion chamber A^2. Here it is ignited at the proper time, just as the valve E has been opened and the piston has reached the position illustrated. Ignition then takes place and the products of combustion pass into that part of the piston chamber defined by the abutment piece G, the projection d' and the two cylinder heads. The expansion of the gas causes revolution of said piston until the projection d' passes the opening into the exhaust passage a^7 when said gases escape. The abutment piece G is thereafter raised so that it is prevented from striking the projection d' on the piston.

If the engine is of the two cycle type, another charge would be admitted as soon as the projection passes the abutment piece G, but if it is of the four cycle type, then the charge would not be admitted until another full revolution of the main shaft had occurred.

In place of the mechanism illustrated in Fig. 3, for forcing the ring h^3 against the piston, a construction may be used as shown in Fig. 7, in which the ring is split, being provided with two posts, with an adjusting screw mounted in one post and extending through another and a spring tending to force the two ends of the ring apart causing it to form a tight joint. The split portion of the ring is placed at a point directly back of the abutment piece G.

From the above it will be seen that it is a practical impossibility for any gas under pressure to leak past either the abutment piece G or the projection d' on the piston and that it is equally difficult for such leakage to take place past the sides of the piston on account of the diamond shaped rings H. These latter always retain their efficiency in spite of wear owing to the fact that the sharp edge h^3 is always interposed between the piston and the adjacent face of the piston head.

I claim:—

1. An engine having a rotatable piston and a casing therefor, means for supplying motive fluid to said piston, a ring set in the flat interior face of the casing, and means pressing diagonally against the ring for forcing the same against the piston.

2. An engine having a rotatable piston and a casing therefor, means for supplying motive fluid to the piston, rings set in the flat interior faces of the casing, and means for forcing the rings against the piston, said means pressing against the rings in a direction other than perpendicular to the surface of the piston.

3. An engine having a rotatable piston

and a containing casing therefor, means for supplying motive fluid to the piston, and a ring of substantially diamond-shape cross-section set in each side of the casing adjacent to the outer portion of the piston, with springs acting on the rings to force them toward the piston, said springs acting against the rings in lines other than perpendicular to the surface of the piston.

4. An engine having a rotatable piston and a containing chamber therefor having plane walls, a portion of the ends of the piston being in substantial contact with said walls and the remainder at an appreciable distance therefrom, with anti-friction bearings interposed between the walls of the casing and the distant parts of the piston.

5. An engine having a rotatable piston and a containing chamber therefor, rings of relatively hard material carried by one of the members comprised by the piston and the casing, and ball bearings carried by the other of said members so as to engage said rings, with means radially beyond the rings for preventing the passage of gas under pressure.

6. An engine having a rotatable piston, and a casing therefor, means for supplying motive fluid to the piston, packing rings set in the interior side walls of the casing so that one face of each ring will bear against the piston, with devices placed to act diagonally on said rings at the intersection of two of their sides, to force them diagonally toward the piston.

7. An engine having a rotatable piston, and a casing therefor, so constructed as to provide a space between the periphery of the piston and the interior of the casing for the reception of fluid under pressure, said casing having annular recesses of diamond cross-section formed in the faces of its side walls adjacent to the periphery of the piston, rings set in said recesses, and means acting diagonally for yieldingly pressing said rings toward the piston.

8. The combination, in a rotary engine, of a casing, a rotatable member disposed within said casing and of such diameter as to provide a space between its peripheral wall and the inner wall of the casing, and a packing ring set in the flat side wall of the casing and maintained under pressure acting directly at an angle to the face of the casing so as to tend to move said ring diagonally toward said face, the effective packing portion of said ring being disposed at the point where the peripheral wall of the piston intersects the inner side wall of the casing.

9. The combination, in a rotary engine, of a casing, a rotatable member disposed within said casing and of such diameter as to provide a space between its peripheral wall and the inner wall of the casing, packing rings set in the flat side walls of the casing, and means in engagement with said rings tending to move them diagonally to the face of the casing, the effective packing portion of said rings being disposed at the point where the peripheral wall of the piston intersects the inner side wall of the casing.

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

FREDRICK F. MACLEAN.

Witnesses:
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WILL. A. BARR.