E. O. HOELL.

ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED FEB. 12, 1906.

903,470.

Patented Nov. 10, 1908.

4 SHEETS—SHEET 1.

Fig. 1

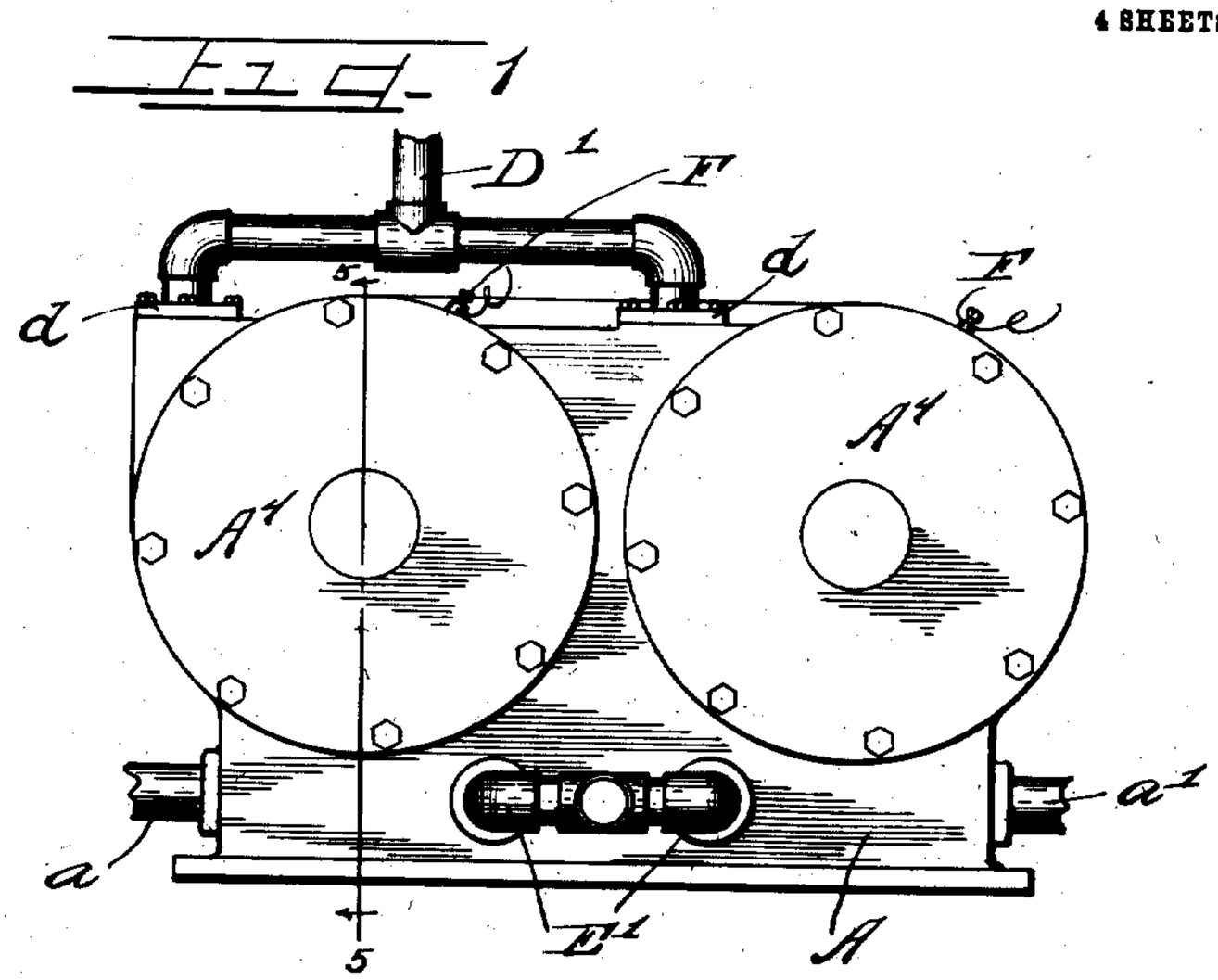
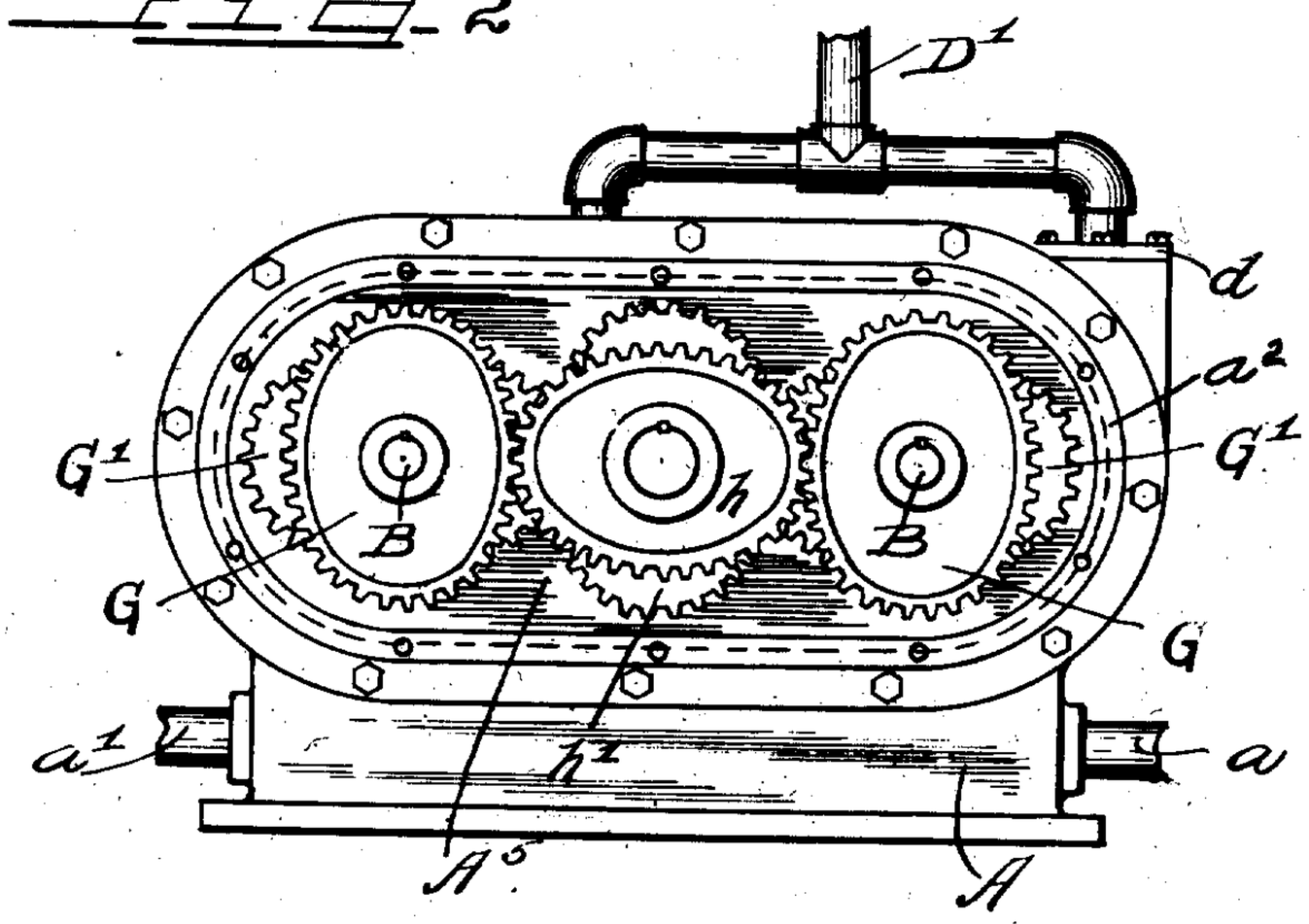


Fig. 2



Witnesses

J. W. Angell

W. W. Witherbury

Inventor

Edward O Hoell.

by Charles W. Hines Atty.

E. O. HOELL.

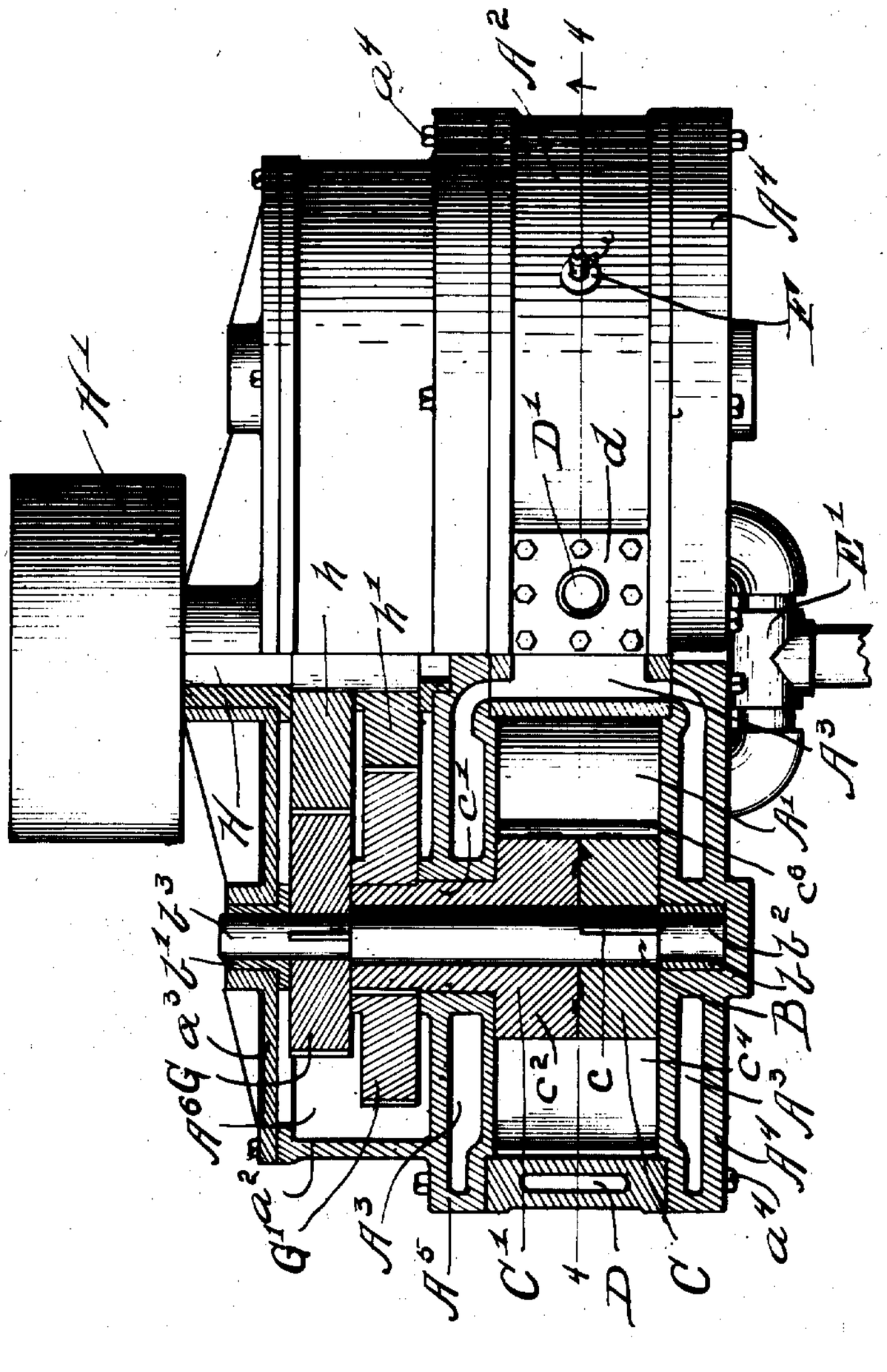
ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED FEB. 12, 1906.

903,470. Patented Nov. 10, 1908.

4 SHEETS—SHEET 2.

Fig. 3.



Witnesses

J. N. Angell

H. O. Withenbury

by

Inventor

Edward O. Hoell.

Charles C. Hull Atty.

E. O. HOELL.

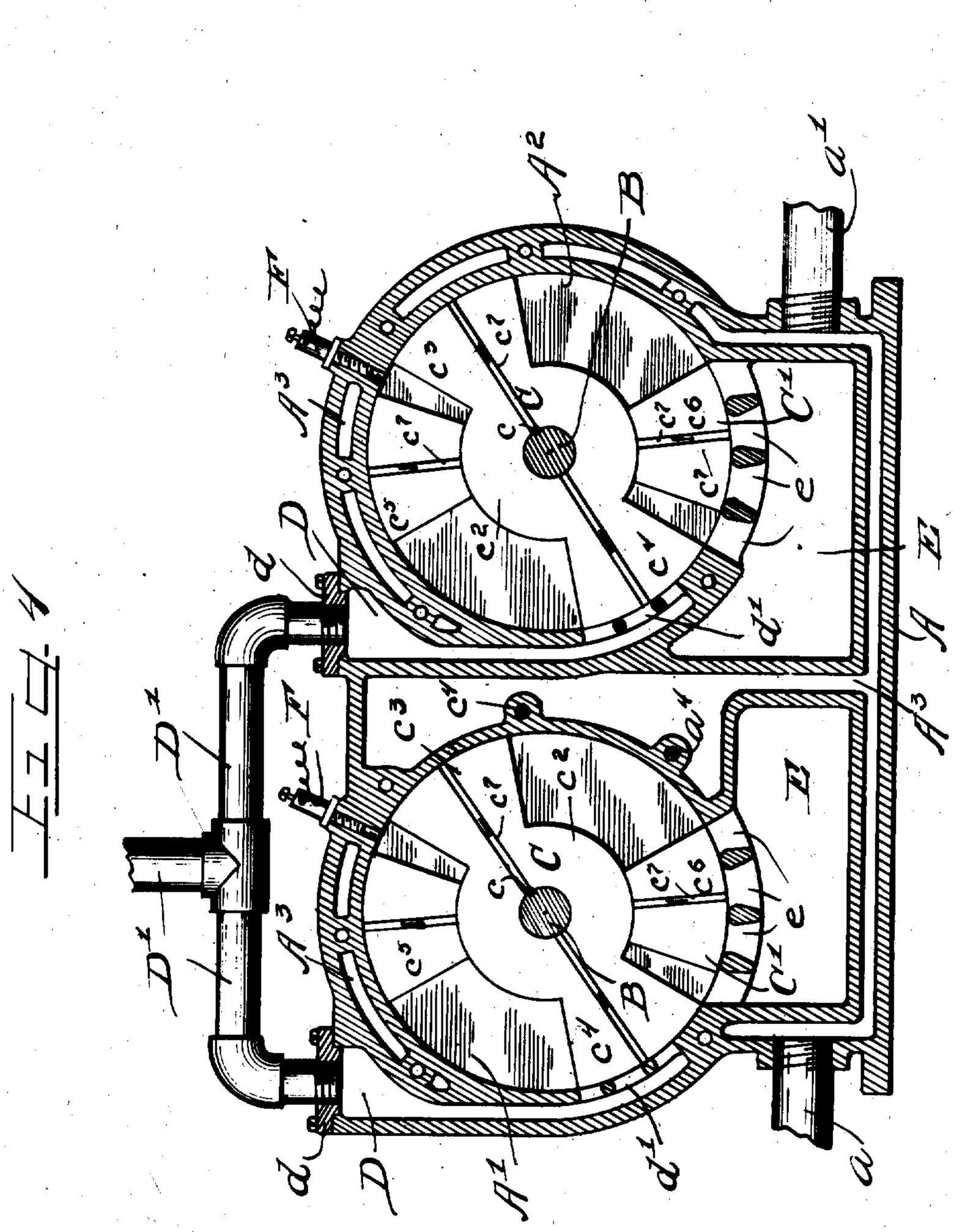
ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED FEB. 12, 1906.

903,470.

Patented Nov. 10, 1908.

4 SHEETS—SHEET 3.



Witnesses
J. H. Angell
H. H. Wildenbury

Inventor
Edward O. Hoell.
by Charles W. Hills Atty.

E. O. HOELL.

ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED FEB. 12, 1906.

903,470. Patented Nov. 10, 1908.

4 SHEETS—SHEET 4.

Fig. 5

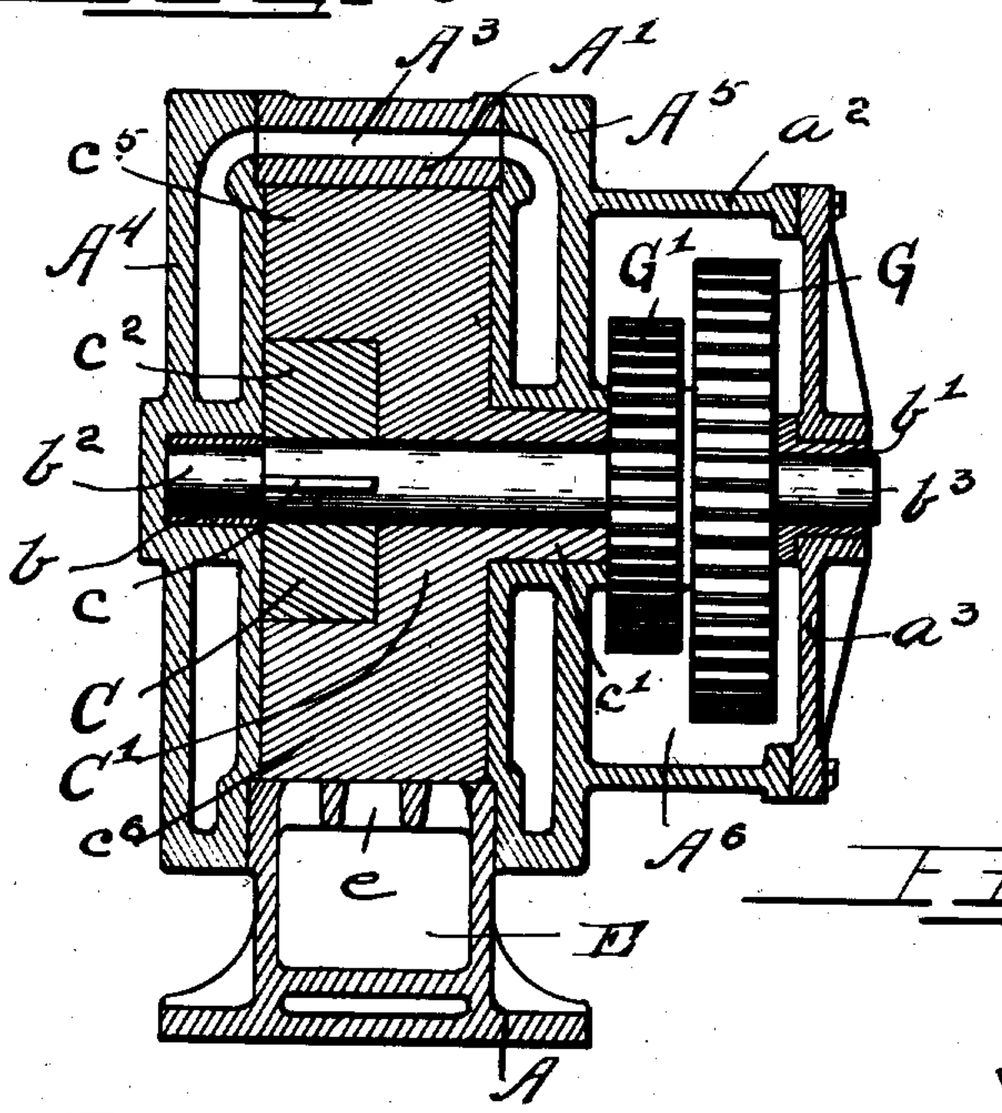
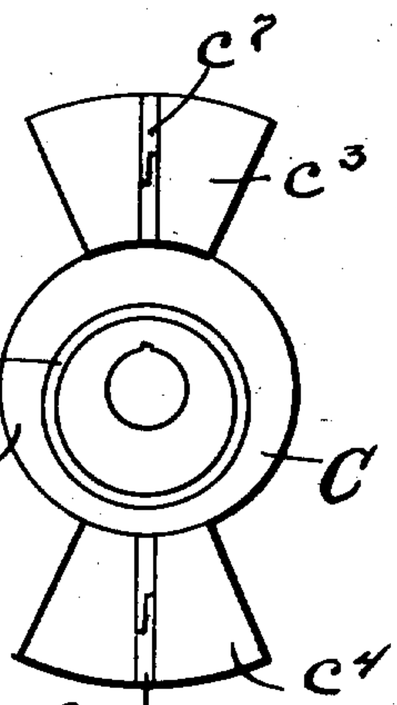


Fig. 6

Fig. 7



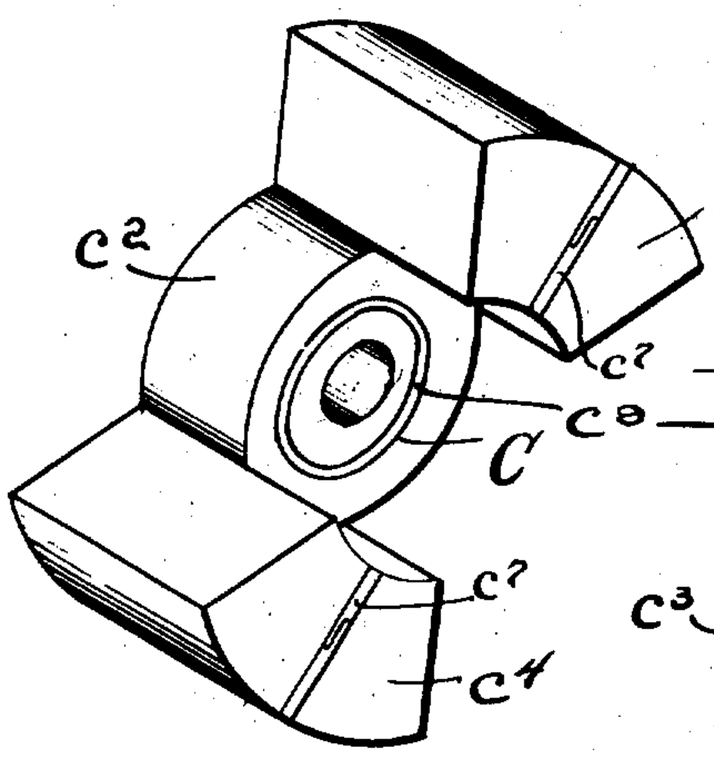
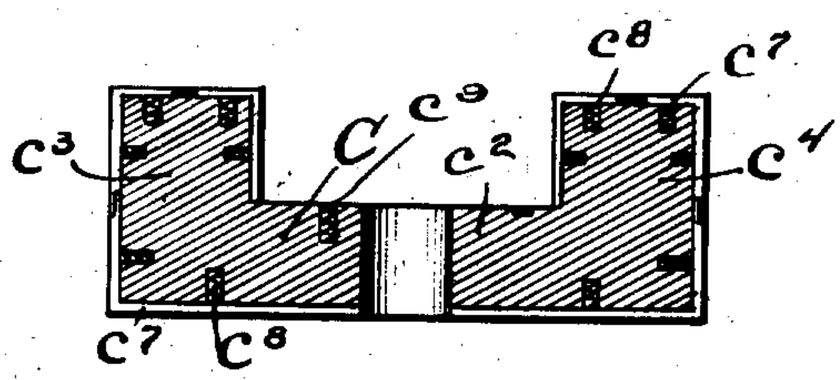


Fig. 8



Witnesses

J. W. Angell.

H. H. Withenbury

Inventor

Edward O. Hoell.

by Charles Goslee. Atty.

UNITED STATES PATENT OFFICE.

EDWARD O. HOELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO ATLANTIC TOOL & MACHINE CO., A CORPORATION OF ILLINOIS.

ROTARY EXPLOSIVE-ENGINE.

No. 903,470. Specification of Letters Patent. Patented Nov. 10, 1908.

Application filed February 12, 1906. Serial No. 300,611.

To all whom it may concern:

Be it known that I, EDWARD O. HOELL, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Explosive-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in rotary explosive engines and more particularly to an explosive engine in which the tendency to wear is reduced to a minimum.

Heretofore engines of this class have usually been provided with more or less complicated valve mechanisms having many movable parts, requiring constant care and frequent repairs. Furthermore in engines in which a rotary piston or driving element has been employed the explosion abutments have been carried on the walls of the cylinder or casing and past which the piston heads must pass. This has necessitated making one of the parts movable in order that it may be retracted while passing or being passed by the other. The rapidity with which such parts must operate causes great wear and consequent loss of power.

The object of this invention is to provide an engine in which all the valve mechanisms as such, both for the intake and exhaust is dispensed with and in which the rotary element acts to regulate both the admission of the explosive mixture and the exhaust of the products of combustion.

It is a further object of the invention to provide an engine in which the rotary element provides both the explosion abutments and the piston heads thereby greatly simplifying the construction.

It is also an object of the invention to provide an engine of such simple construction that the wear and consequent loss of power is reduced to a minimum.

The invention consists in the matters hereinafter described and more fully pointed out defined in the appended claims.

In the drawings: Figure 1 is a side elevation of a device embodying my invention. Fig. 2 is a side elevation of the opposite side of the engine with part of the casing removed. Fig. 3 is a view partly in plan and partly in horizontal section. Fig. 4 is a section taken on line 4—4 of Fig. 3. Fig. 5 is a section taken on line 5—5 of Fig. 1. Fig. 6 is a perspective view of one of the piston elements. Fig. 7 is a side elevation of the same. Fig. 8 is a longitudinal section thereof.

As shown in said drawings: the invention is embodied in a compound rotary engine though obviously it is equally adaptable for use in a single unit and as shown comprises a casing or frame A of any preferred construction but which may conveniently be a casting, cored to provide the cylinders A′ and A^2 and a water jacket A^3 which extends through said casing and about and between the cylinders for the circulation of the cooling fluid.

Rigidly engaged on the ends of said cylinders and ground to afford a true joint therewith are the cylinder heads A^4—A^5 which are also cored as shown more clearly in Figs. 3 and 5, and communicate with and form part of the water chamber or jacket A^3 of the casing thereby affording a complete and free circulation of cooling fluid to all parts of the engine subject to heat. An inlet and an outlet pipe a and a' for the cooling fluid are connected in said jacket and with any suitable supply and discharge and afford means for maintaining a circulation about the cylinders.

The cylinder head A^5 as shown covers both of said cylinders and is provided with an outwardly directed peripheral flange a^2 on which is rigidly engaged by bolting or in any preferred manner a head a^3 affording a closed gear casing or chamber A^6.

Journaled in suitable bearings b—b' in the cylinder heads A^4 and head a^3 respectively are the shafts B—B which extend axially of the cylinders and the ends of which b^2—b^3 as shown are reduced in diameter to provide shoulders to take the lateral thrust.

Carried on each of said shafts B and rotative within its cylinder are the pistons C and C′ of which the piston C is rigidly engaged upon the shaft by means of a spline or feather c and the piston C′ is rotative on said shaft and is provided with a tubular shaft or sleeve c' in which said shaft B is journaled and which extends through the head A^5. Said pistons C and C′, which are duplicate in all respects with the exception that the piston C′ is provided with the tubu-

lar shaft c' as before described, comprise as shown more clearly in Figs. 4, 5, and 6 a central hub c^2 of a width approximately equal to one half of the width of the cylinder and fitting closely at one end against the cylinder head and at the other against the hub of the adjacent piston. Formed integrally on each hub and at diametrically opposite points thereon are the heads which serve both as piston heads and explosion abutments dependent upon the position of the piston at the time of the explosion, that is to say, whether the particular head is immediately in advance of or at the rear of the point of ignition of the charge. Said heads are indicated on the piston C as c^3 and c^4 and on the piston C′ as c^5 and c^6 and as shown are segment shaped and have their peripheries in close contact with the peripheral wall of the cylinder. The length of said heads is such that they extend entirely across the cylinders thereby overlapping the hub of the adjacent piston and their width is such that when the pistons are assembled upon the shaft B there is provided between adjacent heads, chambers which serve both as compression and explosion and expansion chambers dependent upon the position of the pistons with respect to their rotation. Said pistons as shown more clearly in Figs. 7 and 8 are provided with packing strips c^7 of any desired material which are seated in the wearing surfaces which contact with the walls of the cylinders and with the hubs c^2. As shown springs c^8 are seated in recesses in said pistons and bear against the packing strips and act to force said strips outwardly and form fluid tight joints with the cylinder. Similar spring pressed packing strips c^9 are seated in the inner faces of the hubs c^2 eccentric with the shaft B and act to prevent the passage of pressure fluid between said hubs.

For the purpose of supplying the explosive fluid to said cylinders the casing as shown is cored to provide an inlet chamber or passage D for each cylinder which opens through the casing at the top and is closed with a cap d rigidly engaged thereon and provided with a screw threaded aperture in which is connected the supply pipe D′ leading from any suitable source of supply. The lower ends of said passages open through suitable ports d' into the cylinders and supply the explosive fluid to the chamber formed between the heads.

Exhaust ports e open from the bottom of the cylinders into exhaust chambers E from whence the exhaust pipes E′ lead. As shown each cylinder is tapped through its peripheral wall at a point where the charge has reached its maximum compression and an igniter F of any preferred construction is inserted therein to ignite the charge.

Rigidly engaged on the reduced end b^3 of each shaft B and on the tubular shaft c' of the pistons C′ respectively are the elliptical gears G and G′ which as shown more clearly in Figs. 2, 3 and 5 are so positioned relatively to each other that at the time of ignition of the charge their longer axes are at approximately right angles to each other. Journaled in suitable bearings and centrally between the shafts B in the heads a^3 and A^5 is the drive shaft H on which, within the gear casing A^6 are rigidly engaged elliptical gears h—h' identical with the gears G and G′ and adapted to intermesh therewith. Said gears h and h' are arranged on the shaft H with their corresponding axes at right angles to each other and are so positioned relatively to the gears G and G′ that at the time of explosion the one which is receiving the driving force of the piston head will have its longer axis in alinement with the shorter axis of the gear with which it intermeshes and the other will have its shorter axis in alinement with the longer axis of its intermeshing gear which is connected with the head forming the abutment. Inasmuch as the force of the explosion acts equally upon the adjacent heads it is obvious that since at the time of the explosion the gear connected with the head forming the piston head is presenting its shorter axis to its intermeshing gear, the leverage of said piston head is greater than the leverage of the explosion abutment and consequently drives the shaft H against the force exerted on said abutment.

The outer end of the shaft H is provided with a drive wheel H′ by means of which the power generated in the engine is utilized.

The operation is as follows: Inasmuch as the piston C is rigidly engaged on the shaft B and the piston C′ is rotative thereon it is evident that they are capable of independent rotation to a certain extent. As shown more clearly in Fig. 4 the pistons are at explosion point and the chamber afforded between the heads c^4 and c^5 has just received its charge of gas through the port d' which is now closed by the head c^4. The charge in the chamber between the heads c^5 and c^3 has been compressed and as it now ignites the force acts equally upon the head c^5 which now serves as the explosion abutment and upon the head c^3 which serves as the piston head. The force tends to move said heads oppositely but owing to the fact that the gear G which is connected with the piston head c^3 is at the time of the explosion presenting its shortest axis to the longer axis of the gear h on the drive shaft and the gear G′ which is connected with the abutment head c^5 is presenting its longer axis to the gear h' greater power is produced by the gear G than the gear G′ because of the difference in leverage produced in said gears

thereby driving the shaft H through the gear h and causing the gear h' to move the head c^5 forwardly at less speed than the head c^3. This movement causes the head c^4 to approach the head c^5 compressing the charge therebetween which is ignited as it passes the igniter, repeating the operation with the head c^5 now acting as the piston head and the head c^4, as the explosion abutment. The products of combustion are carried forwardly between the heads until the exhaust ports c are reached and are then discharged into the chamber E and through the exhaust pipe E'.

Obviously an engine constructed in accordance with my invention is capable of high efficiency because of the number of impacts given at each revolution of the piston and the efficiency may be varied by varying the ratio of the diameters of the gears.

While I have shown my engine as a water cooled engine it is obvious that it may be cooled by any other preferred method and obviously it may be constructed as a single engine if preferred without departing from the principles of my invention and while I have described my invention as embodied in a rotary engine it is obvious that the device is equally adaptable for use as a rotary pump if desired.

I claim as my invention:

1. In an explosive engine the combination with a cylinder of an inlet and an exhaust chamber adjacent thereto, having ports communicating therewith, a shaft journaled in said cylinder, a piston rigidly engaged thereto, a second piston in said cylinder and rotatable on said shaft and provided with a forwardly directed shaft concentric therewith, an elliptical gear rigidly engaged to each shaft, a drive shaft and elliptical gears thereon intermeshing with the elliptical gears on the piston shafts.

2. In an explosive engine the combination with a cylinder of an exhaust and an inlet chamber rigidly engaged thereto, ports opening from the inlet and exhaust chambers into the cylinder, a shaft journaled in the cylinder, pistons in said cylinder, one rigidly engaged to said shaft, and one rotatable thereon, a shaft rigidly engaged to the last named piston, a drive shaft journaled in the casing and intermeshing elliptical gears on said driving shaft and piston shafts having their corresponding axles at right angles thereby driving one piston at a greater rate of speed than the other.

3. In a device of the class described the combination with a cylinder, a casing rigidly engaged thereto, a shaft extending through the cylinder and casing, a rigid piston on said shaft in the cylinder, a piston independently rotatable thereon, a hollow shaft engaged to said last named piston concentric with the first named shaft and extending into said casing, a gear rigidly engaged on each shaft in said casing, a shaft journaled in the casing and gears thereon intermeshing with the gears on said piston shafts and adapted to drive one piston at a greater rate ahead than the other.

4. In an explosive engine the combination with a plurality of cylinders of a casing engaged thereto, a shaft journaled in each cylinder and casing, a piston keyed to one shaft, a piston rotatable on the shaft, a forwardly directed shaft engaged on said independently revoluble piston and extending into the casing, a driving shaft journaled in the casing intermediate said piston shafts and means connecting each piston shaft and driving shaft adapted to drive said pistons at varying rates.

5. In an engine a plurality of cylinders, each having an inlet passage cored on one side thereof and ported through a wall of the cylinder of an exhaust casing below each cylinder, exhaust ports opening thereinto, a casing integral with one of the cylinder heads, shafts journaled in the cylinders and extending through said casing, a plurality of pistons on each shaft in the cylinders, one rigidly secured on each shaft and one independently rotatable on each shaft, a shaft integral with each independently rotatable piston also extending into said integral casing, elliptical gears on the shafts in the integral casing arranged at right angles to each other, a driving shaft arranged intermediate the cylinders and elliptical gears thereon arranged at right angles and meshing with the elliptical gears on the shafts in both cylinders.

6. In a device of the class described the combination with a plurality of cylinders provided with inlet and exhaust ports of a gear casing rigidly secured to one side of the cylinders, concentric shafts in each cylinder extending through the gear casing and independently rotatable, interfitting pistons, one rigidly secured to each shaft, elliptical gears on the shafts in the gear casing, those on corresponding shafts having their axes parallel and at right angles with the axes of the gears on the other shaft, a drive shaft between the piston shafts having a plurality of elliptical gears thereon, each meshing with all the gears on corresponding piston shafts and having their axes at right angles with the gears with which meshing.

7. In a device of the class described the combination with a casing of a cylinder engaged to the side thereof one at each end, an inlet and an exhaust chamber integral with each cylinder, and having ports communicating therewith, independently movable pistons in each cylinder controlling said ports, concentric shafts engaged to said pis-

tons and extending into the casing, a driving shaft in said casing and intermeshing elliptical gears on said piston shafts and driving shafts having their corresponding axles at right angles adapted to drive one piston faster than the other dependent upon the position thereof.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

EDWARD O. HOELL.

Witnesses:
C. W. HILLS,
W. W. WITHENBURY.