No. 785,229. PATENTED MAR. 21, 1905.

W. C. & M. W. RISBRIDGER.

EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 28, 1903.

2 SHEETS—SHEET 1.

FIG. 1.

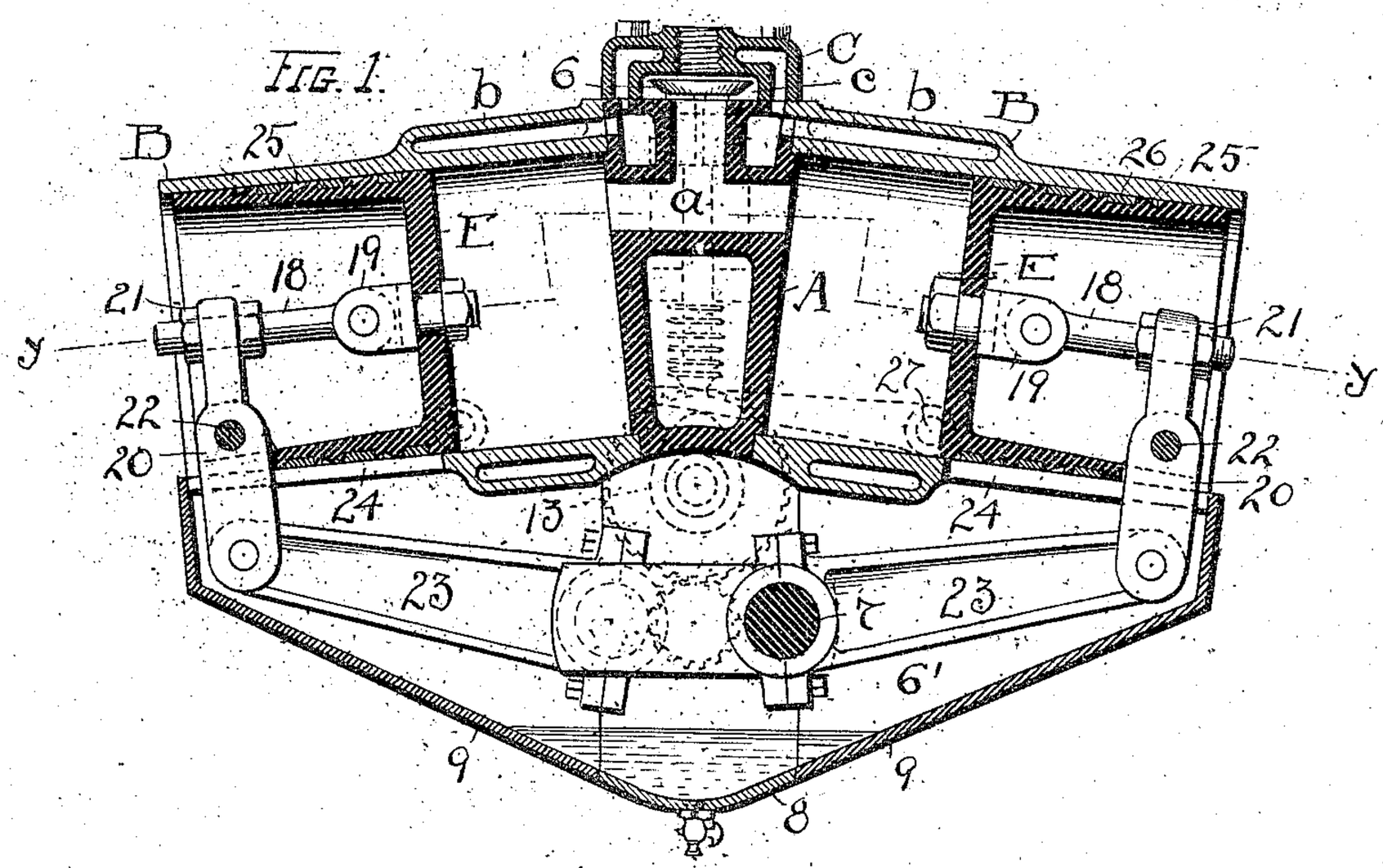
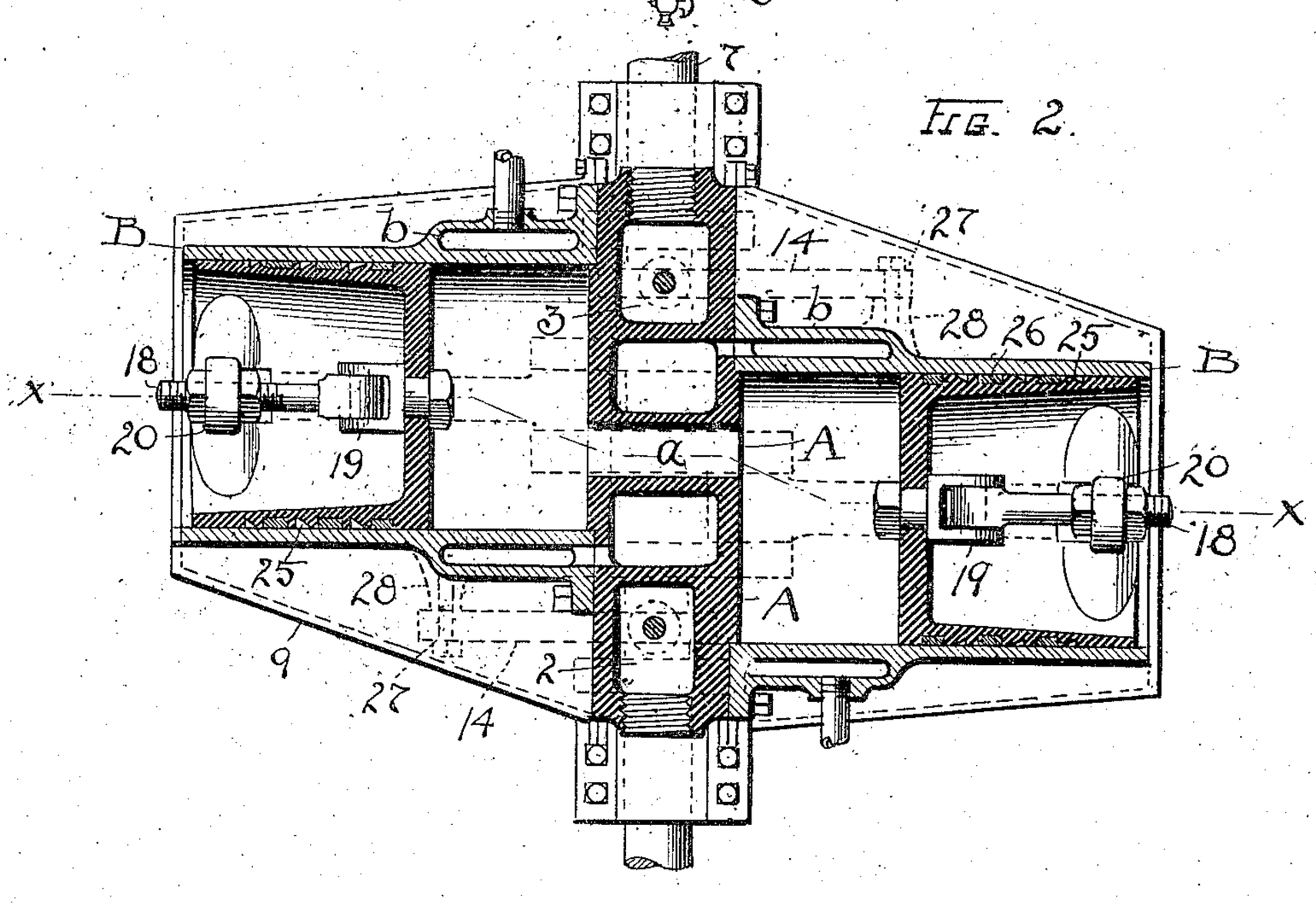


FIG. 2.



ATTEST.

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2 SHEETS—SHEET 2.

FIG. 3.

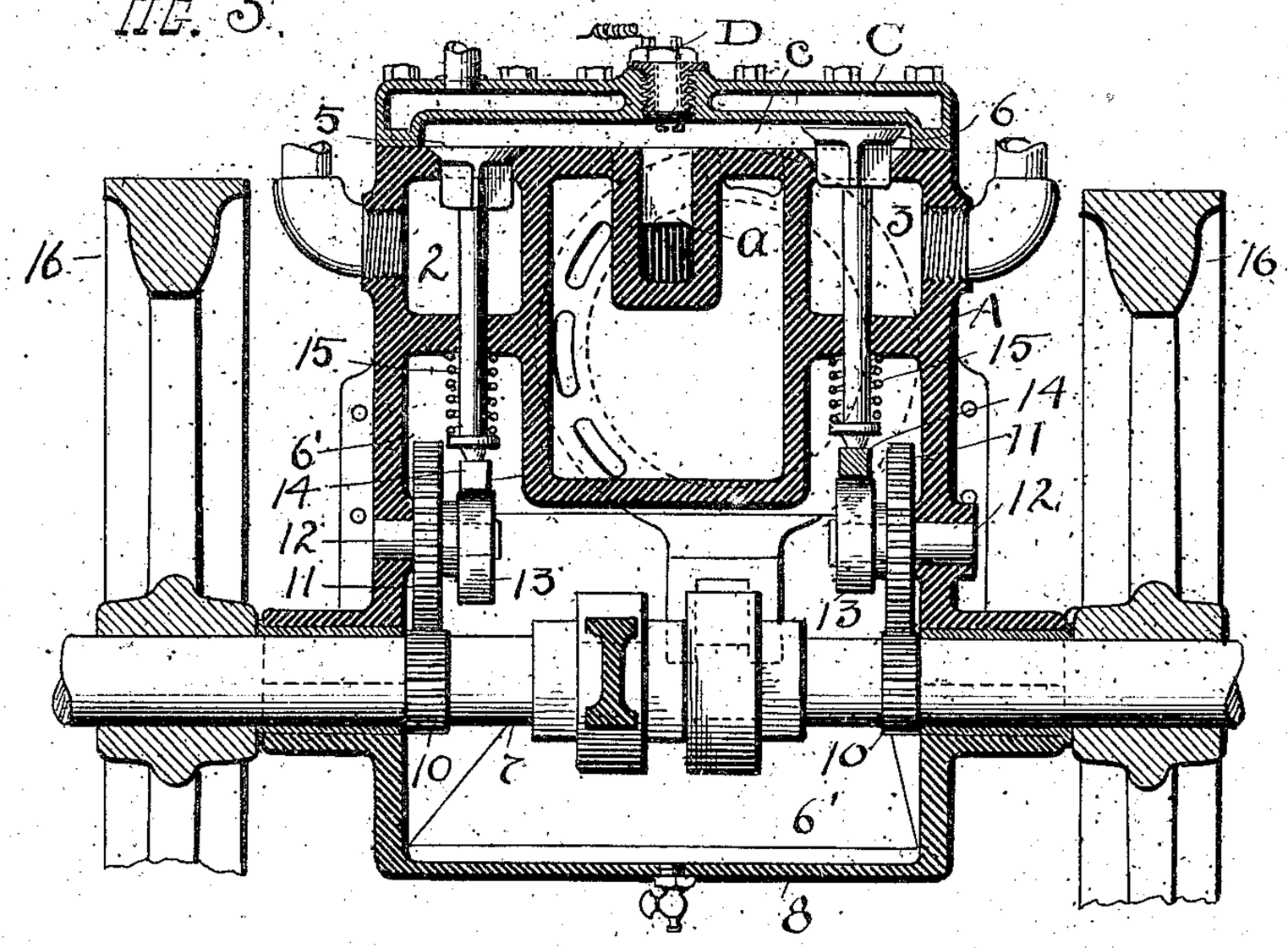
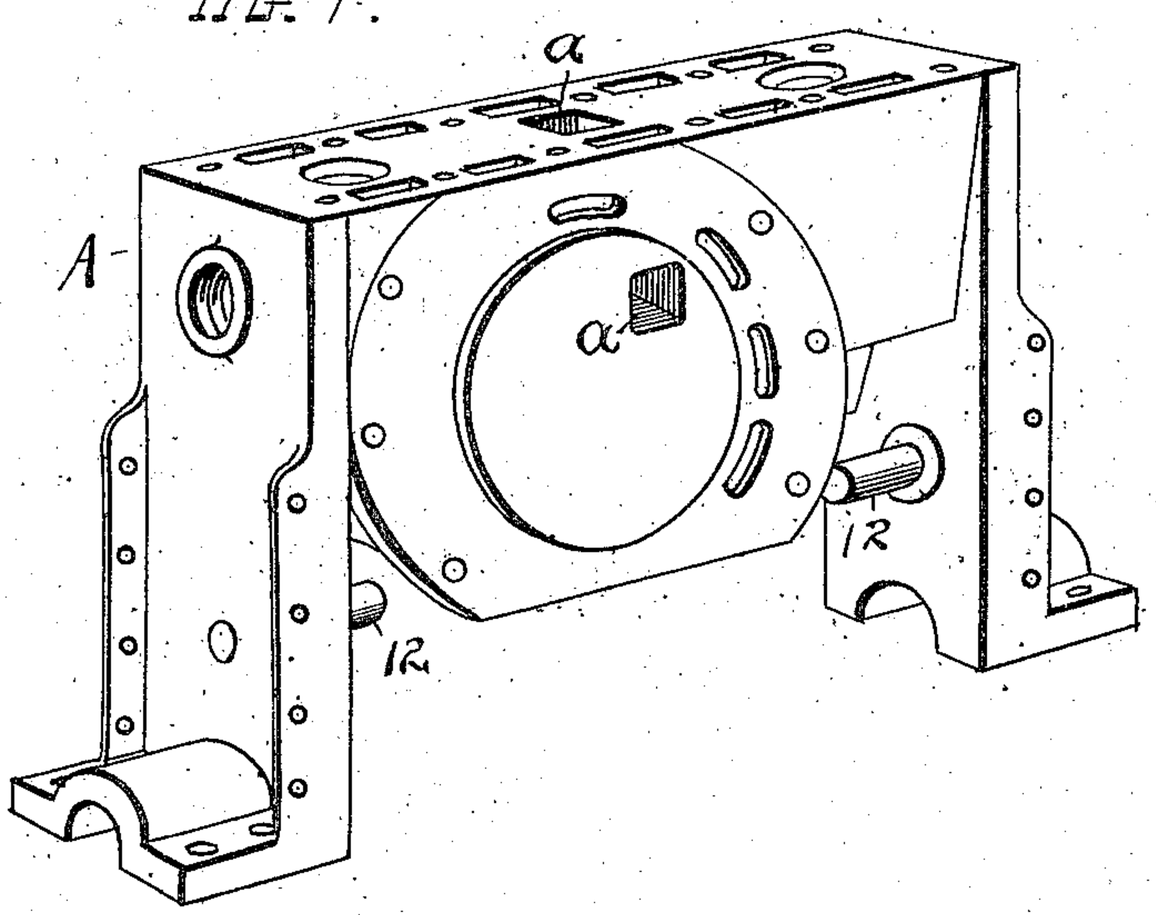


FIG. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM C. RISBRIDGER AND MILTON W. RISBRIDGER, OF CLEVELAND, OHIO.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 785,229, dated March 21, 1905.

Application filed October 28, 1903. Serial No. 178,922.

To all whom it may concern:

Be it known that we, WILLIAM C. RISBRIDGER and MILTON W. RISBRIDGER, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines; and we do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in explosive-engines; and the improvements consist in the construction and arrangement of parts, substantially as shown and described, and more particularly pointed out in the claims.

One object of this invention is to provide an engine of simple construction, with all parts perfectly balanced to obtain free and easy running and to reduce the vibration and jar to a minimum.

Another object is to provide means to adjust the piston in respect to its travel within the cylinder of the engine, whereby the compression of the explosive mixture can be varied to suit various grades of mixtures or gaseous fluids.

Another object is to provide a central head for supporting a set of cylinders and within which a compression or mixing chamber is formed and which head is cast in one piece to provide housings for the valves and journals for the crank-shaft.

Another object is to provide an inclosing casing for the crank-shaft and connecting-rods adapted to contain oil for lubricating the crank-shaft, valve-gears, pistons, and cylinders, all of which are open thereto.

A further object is to provide the pistons with a novel form of annular grooves to carry the oil inward upon the inward travel of the pistons.

Figure 1 is a vertical sectional elevation taken on line $x\,x$, Fig. 2. Fig. 2 is a longitudinal sectional elevation in plan on line $y\,y$, Fig. 1, showing the staggered relation of the cylinders and pistons therein. Fig. 3 is a central cross-section of the supporting-head for the cylinders, showing the valves, crank-shaft, and operating mechanism leading from the shaft to said valves. Fig. 4 is a perspective view of the cylinder supporting-head.

Referring to the drawings, A represents a centrally-arranged supporting-head, with a pair of cylinders B mounted at an angle to each other and projecting from opposite faces of said head and disposed in staggered relation as viewed in plan. Head A is provided with a removable cap C at its top, and a passage or chamber *c* is formed therein which has open communication through passage *a* in head A with the interior of both cylinders B. Inlet and exhaust chambers 2 and 3, respectively, are cored out at either side of head A, and suitable supply and exhaust pipes tap into said chambers at either side of the head. An inlet and exhaust valve 5 and 6, respectively, open and close ports leading to compression-chamber *c*, and said valves are each provided with a stem slidably supported within head A and with their lower ends projecting into compartment 6′ of the head. The upper half of the journals for crank-shaft 7 are cast integral with the head at either side, and the lower half of the journals are formed by the cross-bracket 8, which also forms part of the bottom of the inclosing casing 9 to provide a reservoir or oil-compartment within which the cranks of shaft 7 are adapted to rotate. Each valve is operated by a separate line of geared mechanism, which is driven from shaft 7 at each side within compartment 6′, all of which is open and exposed to the oil as it is splashed about by the rotation of the cranks. The mechanism for each valve is identical, except that the parts are set in different relation to open and close the valves in their proper time and place, and therefore the same reference-letters will apply to each. A set of pinions 10 are mounted upon or cut upon shaft 7, and each pinion meshes with a gear 11, supported upon a stud 12, journaled in the sides of head A. A cam 13 is rigidly affixed to gear 11 and engages pivoted bar 14, which bar rests upon the top edge of the cam and is

always in contact with the lower end of the stems of valves 5 and 6, which contact is maintained by coil-springs 15 bearing upon a washer on the stems. Actuating-arms 14 for valve-stems 5 and 6 are pivoted at 27 upon suitable lugs 28, rigid or integral with cylinders B.

Head A and cap C are cored out in a suitable manner to provide water-passages which open into the water-jacket *b* of each cylinder B.

An igniter D of any suitable construction is screwed through the center of cap C and projects into compression-chamber C at a point above central passage *a* in the head.

Each piston E has a threaded rod 18 pivotally engaged at its inner end with bracket 19, and an arm 20 is pivotally mounted at the outer and lower end of the pistons and is adjustably connected with rod 18 by means of nuts 21. The lower end of arm 20 below pivot 22 is connected with the cranks of the crank-shaft by connecting-rods 23 within compartment 6'. Arm 20 projects through slot 24 at the bottom of cylinder B, and this slot runs back substantially one-half the length of cylinder or as far back as the travel of the piston requires.

It will be understood that the same grade or quality of gasolene or gaseous fluid is not always obtainable in different parts of the country or even in the same sections at times, and it is a very desirable advantage to have an engine which can be adapted to different makes and grades of combustible products in order to get the best working results from the engine. We therefore have provided an adjustable connection for the piston whereby any degree of compression can be obtained within the cylinder. With our device adjustment of the piston can be effected at any time, as nuts 21 are accessible at all times through the open end of the cylinder and piston. It will be understood that with our construction a rigid connection with the pistons for connecting rods 23 is obtained. Slot 24 in the cylinder permits a certain amount of oil to go through the same and come in contact with the bottom of each piston as the oil is thrown about through the revolution of the crank-shaft. In order that the lubricating-oil be carried inward within the cylinders, we provide a series of annular grooves or channels 25 between the packing-rings 26 of the pistons. The peculiarity of groove 25 consists in its V-shaped formation and which in detail comprises a substantially vertical face and an inclined face leading from the bottom of the vertical face in a direction toward the center of the engine, or, in other words, toward head A. This formation of groove carries oil toward the head within the cylinders, and the inclined face permits the oil to spread and escape to a limited degree as the piston travels outward.

Cylinders B are preferably arranged at an angle to each other, as seen in Fig. 1, in order that a more direct or line thrust from the cranks to the piston-arm 20 be obtainable.

In operation the explosive mixture is drawn in past valve 5 by the outward travel of the pistons, and upon their return said mixture is compressed within chamber C and passage *a*, whereupon ignition occurs through igniter D, which is controlled or timed to act by suitable mechanism. (Not shown.) The explosion and expansion of gases now acts equally upon both pistons B and drives them outward, and upon their return the waste products are expelled through exhaust-chamber 3. We prefer to use a pair of fly-wheels 16, one at either side of the engine upon crank-shaft 7, to more equally balance the structure as a whole and to provide a freer running of the engine. All vibration and jar are practically eliminated when an explosion occurs, because the force of the explosion is equally expended upon the oppositely-moving pistons and the parts are running in balance at all times.

What we claim is—

1. In explosive-engines, a hollow central supporting-head and water-chamber provided with opposite walls forming the inner ends of the explosion-chambers, and a cylinder at either side of said central head closed against said walls and having a water-jacket open to said water-chamber, pistons within said cylinders and connecting-rods and means therefrom uniting the same to said pistons and constructed to travel bodily back and forth with the pistons, and a crank-shaft and cranks for said connecting-rods.

2. In explosive-engines, a central supporting-head provided with a water-chamber, a pair of cylinders mounted on opposite sides of said head at a downward inclination therefrom at their outer ends and provided with a slot at their lower and outer portions, pistons for said cylinders, a centrally-arranged crank-shaft between said pistons, and connecting-rods and parts therefrom to said pistons constructed and arranged to travel bodily back and forth with said pistons and connecting-rods, said rods arranged on converging lines with said cylinders and said parts adapted to travel and be guided within said slots.

3. In explosive-engines, the combination of a pair of cylinders oppositely disposed and a central supporting member provided with walls forming the inner heads for said cylinders, and a cross-passage between said cylinders in said supporting member, a water-chamber surrounding said cross-passage, a removable cap upon said member having a port open to said passage and provided with a water-passage open to said chamber, an inlet and exhaust valve mounted in said port, pistons for said cylinders and a crank-shaft and connecting-rods to operate same.

4. In engines, a set of oppositely-disposed cylinders and a support therefor, a centrally-

arranged crank-shaft, pistons for said cylinders, and adjustable crank connections for said pistons to change the degree of compression, said connections comprising the connecting-rods, and an arm pivotally supported on the piston and adapted to travel bodily with the piston and connected at one end with the connecting-rods and at the other end adjustably connected by a threaded part with the piston, said arm forming a rigid part of said piston when adjusted.

5. In engines, a set of oppositely-disposed cylinders and pistons therein, water-jackets for said cylinders, a separate central supporting member for said cylinders having inner heads therefor and provided with a central water-chamber open to said water-jackets, an inlet and outlet valve in the top of said member for both cylinders, a crank-shaft at the bottom of said member, an adjustable arm operatively connected with each piston and forming a rigid part thereof when adjusted, and connecting-rods engaging said arms and crank-shaft.

6. In engines, the cylinders provided with slots at their bottom, a crank-shaft, pistons within said cylinders and an arm mounted upon and adjustably connected with each piston, means to adjust the piston in respect to said arm and fix the compression-space, and a connecting-rod between said crank-shaft and said arm.

7. In engines, a central supporting-head having oppositely-inclined faces, a set of cylinders mounted at right angles to said faces and pistons in said cylinders, a crank-shaft supported in the bottom of said head, slots within said cylinders and arms mounted upon said pistons and adapted to travel within said slots and connecting-rods for said cranks and arms.

Witness our hands to the foregoing specification this 3d day of October, 1903.

WILLIAM C. RISBRIDGER.
MILTON W. RISBRIDGER.

Witnesses:
R. B. MOSER,
H. T. FISHER.