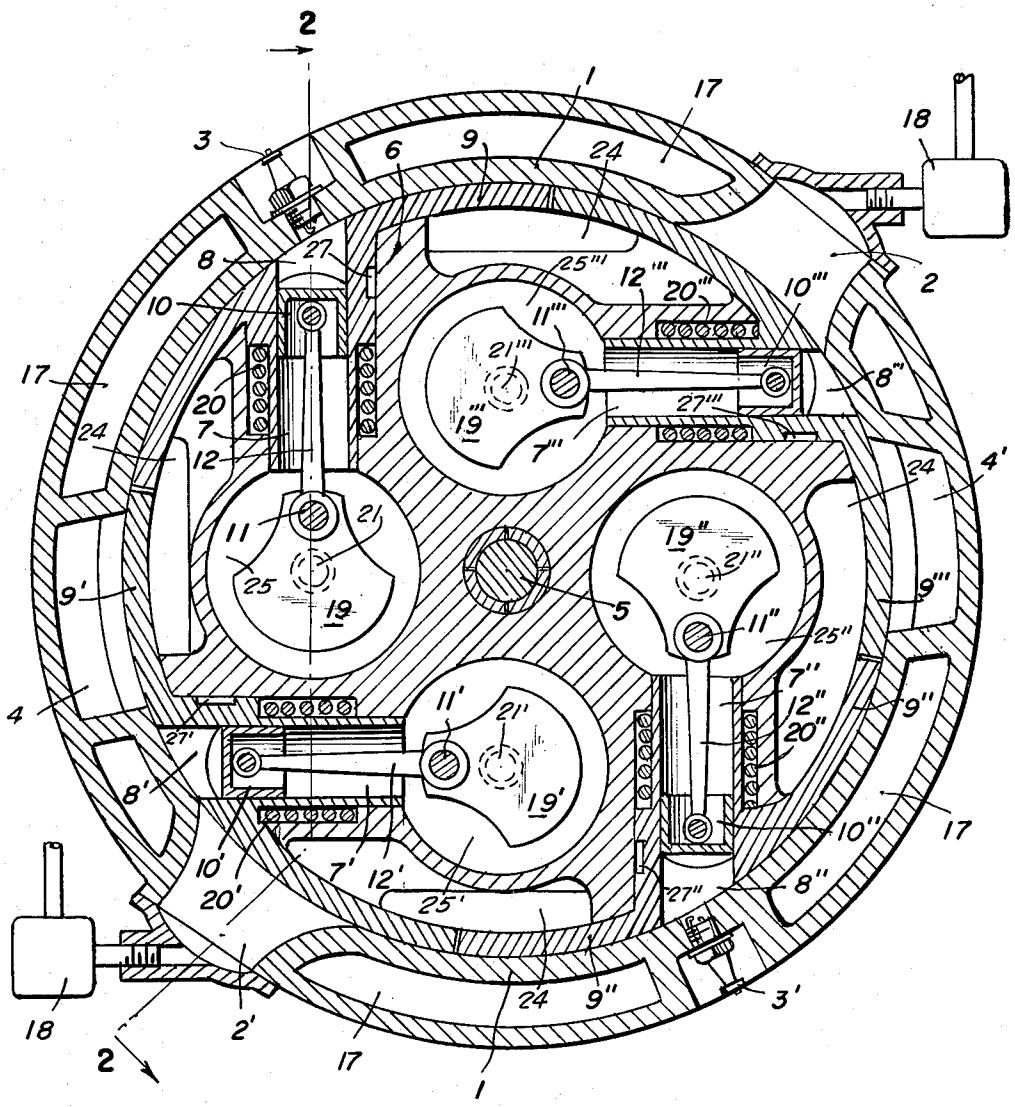
July 4, 1961 GENZO SAIJO 2,990,820

ROTATING MECHANISM OF MAIN SHAFT OF OIL ENGINE

Filed May 1, 1958 2 Sheets-Sheet 1

FIG. 1



INVENTOR
GENZO SAIJO

BY James M. Drysdale
ATTORNEY

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ROTATING MECHANISM OF MAIN SHAFT OF OIL ENGINE

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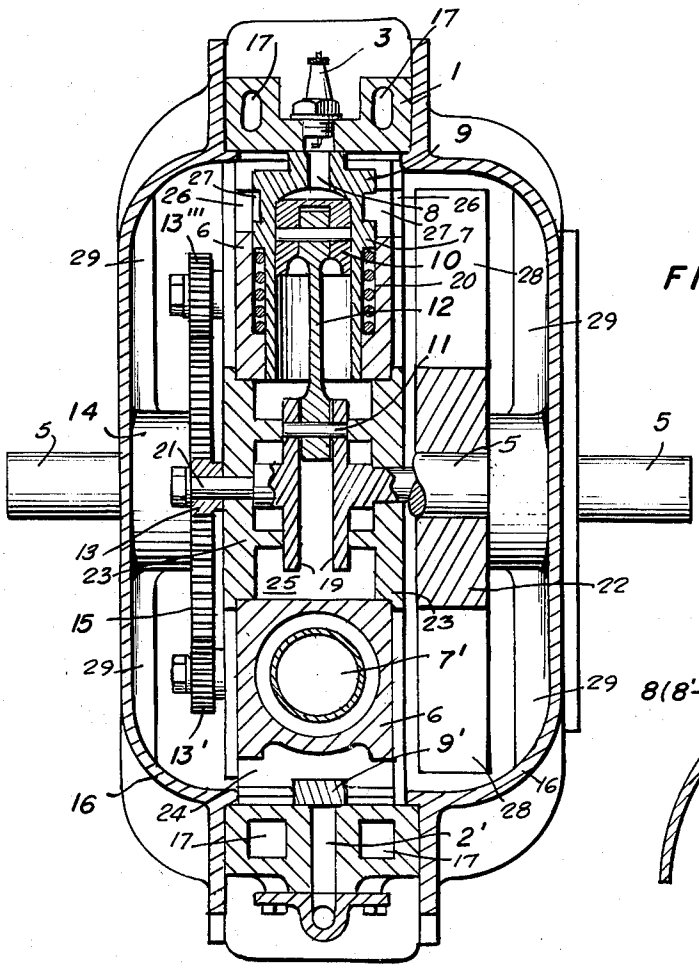


FIG. 2

FIG. 4

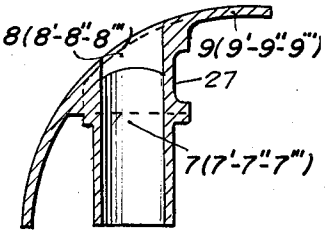


FIG. 3

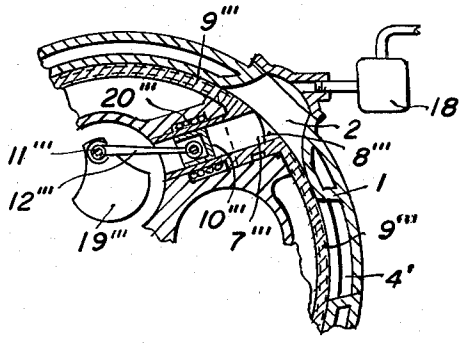
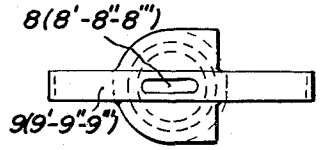


FIG. 5



INVENTOR
GENZO SAIJO

BY James M. Brydale
ATTORNEY

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2,990,820

ROTATING MECHANISM OF MAIN SHAFT OF OIL ENGINE

Genzo Saijo, 429 Takigahana-cho, Ichijo-dori, Shichihonmatsu, Nishi-iru, Kamikyo-ku, Kyoto, Japan

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1 Claim. (Cl. 123—43)

This invention relates to an internal combustion engine, the general object of the invention being to provide an engine so constructed that it will have great power, high speed and the maximum efficiency, with the minimum consumption of fuel.

Another object of the invention is to secure a more regular, smooth and positive movement of the engine, to obtain greater durability of structure, to effect at one time both a high piston and a slow rotary movement of the cylinder and connections, whereby the complexity of reducing gearing is avoided, and at the same time to provide a device that will not be so acted upon by centrifugal force that the movements of the pistons within the cylinders will be retarded or obstructed, and to secure other advantages and results, some of which may be referred to hereinafter in connection with the decription of the working parts.

The invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings wherein like characters denote like or corresponding parts throughout the several views, and in which:

FIG. 1 is a transverse section of my improved engine.

FIG. 2 is a transverse section along the line 2—2 of FIG. 1 looking in the direction of the arrows.

FIG. 3 is a fragmentary sectional view showing more clearly the more important parts such as the counterweight, combustion chamber, connecting rod and piston shown in a different relative position than shown in FIG. 1.

FIG. 4 is the longitudinal section of the combustion chamber.

FIG. 5 is a plan view showing the relative position of the combustion chamber to the inlet and outlet holes and the partition pieces.

In these drawings 1 is a circular casing. At diametrically opposite points on this casing are arranged suction holes 2, 2′ spaced 180° apart. On this casing 1 at mutually opposed position 180° apart are also arranged the ignition or spark plugs 3, 3′ and exhaust holes 4, 4′.

In the casing 1 is mounted a cylinder housing 6 in which the main shaft 5 is fixed and also equidistant from the main shaft in the cylinder housing 6 are mounted four combustion chambers or cylinders 7, 7′, 7″, 7‴, at 90° intervals.

Between the casing 1 and the cylinder housing 6 are mounted four partition pieces 9, 9′, 9″, 9‴ which have respectively small holes 8, 8′, 8″, 8‴ for gas inlet and outlet. These partition pieces lie flush with the inner surface of the casing 1 and slide freely thereon.

In the combustion chambers above mentioned, which are part of the partition pieces, are mounted pistons 10, 10′, 10″, 10‴. Two of these pistons 10, 10″ which are disposed at mutually opposed position form one pair and pistons 10′, 10‴ another pair.

Each piston is connected respectively to crank pins 11, 11′, 11″, 11‴, of crankshafts 21, 21′, 21″ and 21‴ respectively, by connecting rods 12, 12′, 12″, 12‴.

On each crank shaft 21, 21′ and 21‴, which are disposed at 90° intervals, are installed pinions 13, 13′, 13″, 13‴ respectively and each pinion meshes with the gear 15 which is rigidly fixed to and concentric with bearing housing 14. Bearing housing 14

contains the bearing within which main shaft 5 is rotatably journalled. The above mentioned pinions are each ¼ the diameter of the gear and when the pinion goes once around the gear, the pinion rotates four times and the piston reciprocates four times.

The cover 16 is clearly shown in section in FIG. 2 and in FIG. 1 is shown the water pocket 17, carburetor 18, counter weights 19, 19′, 19″, 19‴ which are part of crankshafts 21, 21′, 21″ and 21‴ respectively, and compressed helical springs 20, 20′, 20″ and 20‴ which are disposed around the outer surface of the combustion chambers 7, 7′, 7″, and 7‴, and act to press tightly the respective partition pieces 9, 9′, 9″ and 9‴ against the inner surface of the circular casing 1.

When the pistons 10, 10″ or 10′, 10‴ in the combustion chambers 7, 7″ or 7′, 7‴ which are disposed diagonally, are moved by the pressure of the explosion, the pressure is imparted to the crank pins 11, 11″ or 11′, 11‴ and rotates the rotating cylinder housing 6 shown in section in FIG. 1 and at the same time the pinions 13, 13′, 13″, 13‴ which are installed on the crank pins 11, 11′, 11″, 11‴ are moved around the fixed gear 15. Since the gear ratio between fixed gear 15 and pinions 13, 13′, 13″ and 13‴ is 4:1, each cylinder will make two four-stroke cycles for each revolution of cylinder housing 6 and shaft 5, rotation of the main shaft 5 is made smooth and constant and the torque is large due to the means of twice execution of four strokes of suction, compression working and exhaustion when the pinions go once around the gear 15.

As shown in FIG. 2 there is shown in section a plug 23 on each side of the opening 25 in which the individual crank shaft 21 rotates. Similar provisions are made for the other crankshafts 21′, 21″ and 21‴.

The detailed explanation of the operating cycle is as follows: The charge in each cylinder is fired by means of the ignition or spark plugs 3, 3′, after the compression stroke of pistons 10, 10″. The pistons 10, 10″ are moved by the pressure and the force is given to crank pins 11, 11″, and as the crank pins 11, 11″ rotate the pinions 13, 13″ go around the fixed gear 15 causing cylinder housing 6 and shaft 5 to rotate. When the combustion chambers 7, 7″ come to exhaust holes 4, 4″, the pistons 10, 10″ exhaust. While this stroke is taken place, another pair of pistons 10′, 10‴ suck fuel from the suction holes 2, 2′ and compress it and when they come to the position of the ignition or spark plugs 3, 3′, explode the fuel.

By this explosive force cylinder housing 6 rotates and therefore, pinions 13′, 13‴ rotate and move around, and through the medium of rotation of crank pins 11′, 11‴, pistons 10′, 10‴ suck fuel from the suction holes 2, 2′ and compress fuel, and when they come to ignitions or spark plugs 3, 3′ they finish their working stroke. That is, when a pair of pistons 10, 10″ finish their exhaustion stroke, another pair of pistons 10′, 10‴, finish their working stroke, and likewise when pistons 10, 10″ finish their working stroke, another pair of pistons 10′, 10‴ finish their exhaustion stroke.

Among four pistons, make pistons 10, 10″ which are disposed at mutually opposed positions, a pair, and 10′, 10‴ another pair, and then let the pair of pistons do the same motion simultaneously for example, when the pistons 10, 10″ come to the positions of the exhaust holes 4, 4′, let other pistons 10′, 10‴ come to the ignitions or spark plugs 3, 3′.

Also make the partition piece 9 curved to fit snugly the quarter of the inner circle of the casing as shown in FIG. 4 and narrow as shown in FIG. 5, and also make the surface area of the holes 8—8‴ for gas inlet and outlet, which is made at the center of the partition piece 9,

smaller than half of the section area of the inner circle of the combustion chamber 7—7'''.

The partition pieces 9, 9', 9'' and 9''' press against the inner wall of casing 1 and prevent leakage of exhaust gases from exhaust passages 4, 4' into intake passages 2, 2'; and the partition pieces also close off the intake and exhaust passages during the compression and combustion strokes of the cylinders. Ignition occurs when openings 8, 8'' or 8', 8''' are aligned with spark plugs 3, 3' which ignite the compressed charge. If a compression ignition cycle is to be used, fuel injectors would be substituted for spark plugs 3, 3'.

The holes for the gas inlet and outlet 8—8''' are small, the exploded gas gives pressure to the upper wall of combustion chambers 7, 7', 7'' and 7''' and presses them and partition pieces 9, 9', 9'' and 9''' tightly against the inner surface of the casing 1.

Flywheel 22 is carried on main engine shaft 5. In addition to the water passages 17 in casing 1 through which water is circulated for cooling by means not shown, provisions are made for additional engine cooling by circulating air. Circulating air passages are provided through covers 16. Passages 24 are provided in cylinder housing 6 for the passage of cooling air. In addition, passages 26 are provided in cylinder housing 6 which communicate with passages 27, 27', 27'' and 27''' which partially surround the end of their respective cylinders 7, 7', 7'' and 7''' to provide additional cooling of the combustion areas. The cooling air is circulated through passages 24, 26 and 27 by blades 28 attached to flywheel 22. The blades 28 may be chosen so cooling air will enter either cover 16 and leave by way of the other cover. Thus, either the right or left cover 16, as seen in FIG. 2, may contain the air inlet while the other cover contains the outlet.

The covers 16 are provided with stiffening ribs 29 which may be formed to perform the additional function of guiding the cooling air into and out of the cooling system.

It is thought from the foregoing description that the advantages and novel features of my invention will be readily apparent.

I desire it to be understood that I may make changes in the construction and in the combination and arrangement of the several parts, provided that such changes fall within the scope of the appended claim.

I claim:

An engine of the class described, a circular casing, a rotating cylinder housing mounted within said casing, a main shaft fixed to the center of said rotating cylinder housing, a bearing housing for said main shaft in said casing, two mutually opposed suction holes in said casing spaced 180° apart, two exhaust holes spaced 180° apart and two ignitions spaced 180° apart also mutually opposed in said casing, partition pieces mounted in said rotating cylinder housing, each having one small hole which serves as both gas inlet and outlet, the radially outer surface of said partition pieces being curved to fit and slide freely on the inner surface of the casing, the arcuate length of each said partition piece which is in contact with the inner surface of said casing being approximately 90° and each said partition piece further providing a cylinder communicating with said gas inlet and outlet hole, compression helical springs between said rotating cylinder housing and each said partition piece for keeping the partition pieces in contact with the inner surfacing of the casing, said four cylinders constituting combustion chambers which communicate with said ignition means through said small holes, a piston mounted in each combustion chamber, each piston being provided with a connecting rod to connect each piston to a crank shaft mounted on a counterweight, each counterweight positioned at 90° intervals around the main shaft, two pistons forming one pair disposed at mutually opposed positions and 180° apart, the other two pistons forming the other pair also disposed at mutually opposed positions 180° apart, a fixed gear mounted on the main shaft bearing housing and concentric therewith, a pinion mounted on each crankshaft, each pinion having one-fourth the diameter of the fixed gear and adapted to mesh with and rotate around the fixed gear.

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