

July 3, 1928.

1,676,211

F. A. BULLINGTON

TRANSMISSION FOR ROTARY ENGINES

Filed June 2, 1923

2 Sheets-Sheet 1

Fig. 1.

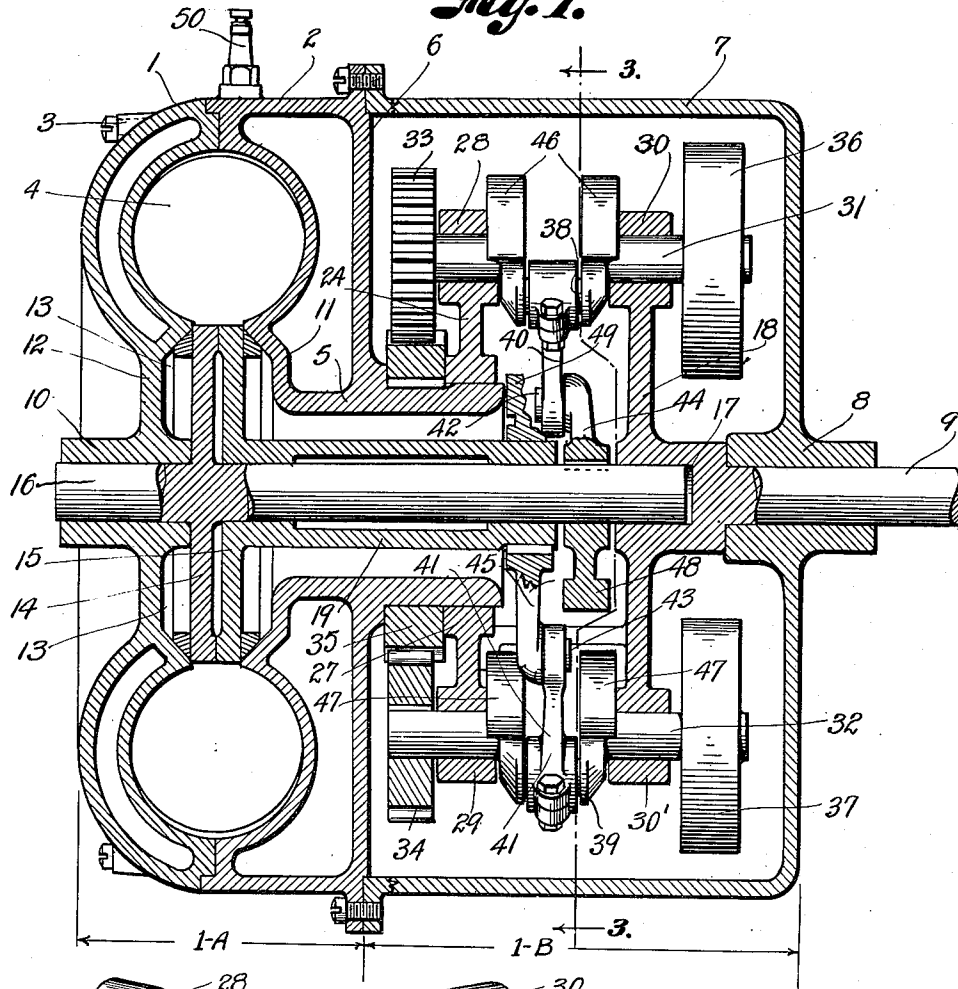
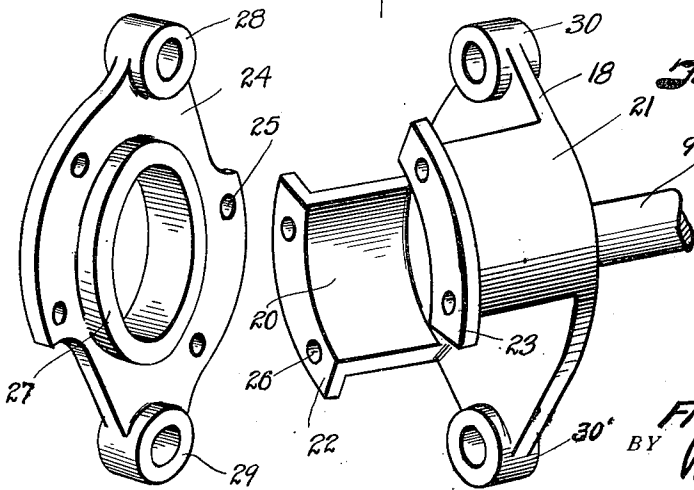


Fig. 2.



INVENTOR
Frank A. Bullington
BY *Wm. W. Orr*
ATTORNEY

July 3, 1928.

1,676,211

F. A. BULLINGTON

TRANSMISSION FOR ROTARY ENGINES

Filed June 2, 1923

2 Sheets-Sheet 2

Fig. 3.

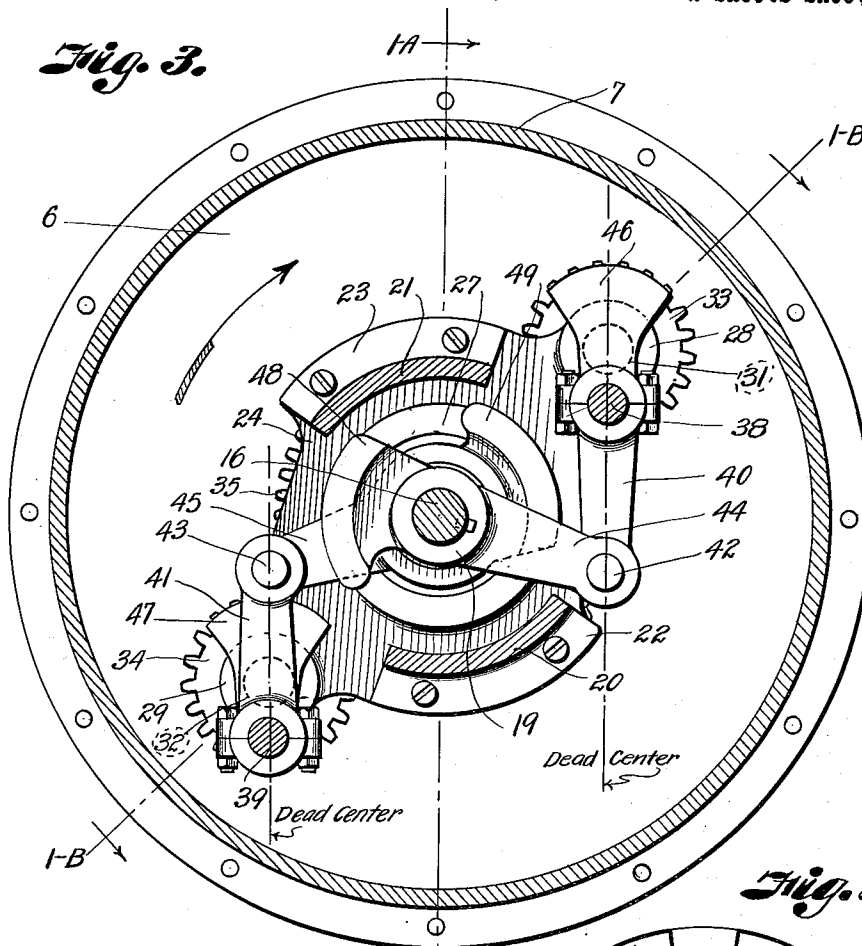


Fig. 4.

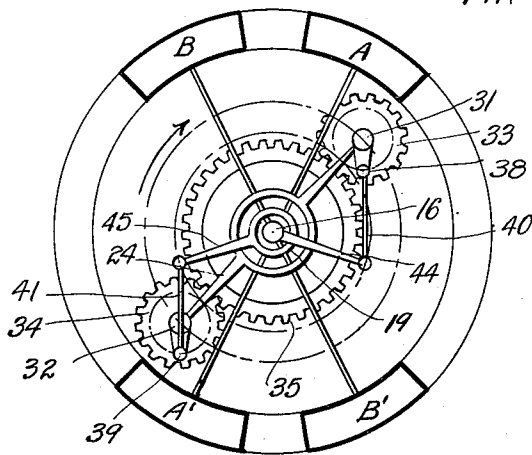
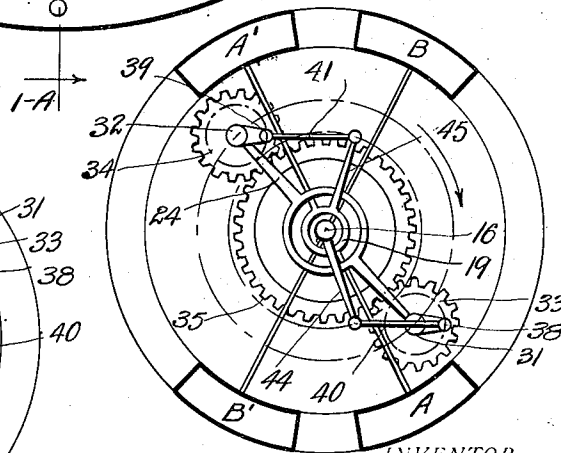


Fig. 5.



INVENTOR
Frank A. Bullington
 BY *Wm. W. Brown*
 ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK A. BULLINGTON, OF KANSAS CITY, MISSOURI, ASSIGNOR TO BULLINGTON MOTORS, OF KANSAS CITY, MISSOURI, A COMMON-LAW TRUST CONSISTING OF SOLOMON STODDARD, ERNEST E. HOWARD, AND FRANK A. BULLINGTON.

TRANSMISSION FOR ROTARY ENGINES.

Application filed June 2, 1923. Serial No. 643,095.

This invention relates to prime movers for generating power and particularly to a motor in which expansible motive fluid is employed to impart motion to pistons which rotate about a common axis.

The invention is shown as applied to a gas engine in which the pistons are arranged in pairs, the pistons of each pair being rigidly connected to a rotor at diametrically oppositely located points so that a movement of a piston of one pair will induce a corresponding movement of the other piston in that pair. The rotors carrying the pairs of pistons are so controlled that first one set of pistons and then the other becomes the accelerated pistons and vice versa in alternate relation throughout the repeated cycles of the motor.

Devices of the same generic principle as illustrated in the drawings have been provided heretofore but in so far as I am aware, they have proved unsatisfactory because the mechanism for controlling the pistons had certain inherent defects. One of the primary causes of failure of this type of engine is, I believe due to the fact that a proper linkage or controlling mechanism has not been provided for connecting the rotors to the driven shaft or power shaft of the motor. In some of my previous applications, I have devised novel forms of connecting mechanism, the present invention being a later development of some of the generic conceptions indicated in such former application and particularly in Letters Patent No. 1,579,207 issued to me April 6, 1926, and the present invention relates to novel balanced linkage mechanism for connecting up the movable parts so as to provide balanced operation during the working period of the motor.

The specific adaptation of my invention will be referred to hereinafter, reference being had to the accompanying drawings, in which:

Fig. 1 is a sectional view taken through the cylinder of the engine on the line 1^A—1^A of Fig. 3 and a section through the crank case on the line 1^B—1^B of Fig. 3.

Fig. 2 is a detail perspective view of the

crank shaft carrier and power delivering member.

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a diagrammatic view of the pistons and linkage therefor, showing the dead center position of the parts with pistons A and B ready to receive the force of the explosion of the charge.

Fig. 5 is a similar view showing the pistons A and B after they have moved their full working strokes with piston B now the acceleration piston in position to co-operate with piston A' to complete another working stroke.

The stator is shown as consisting of two members 1 and 2, which may be fastened together by suitable means; for example, bolts 3, to provide a circumferential cylinder or piston chamber 4. The member 2 has an extension or hub portion 5 projecting from the wall 6 thereof, the hub portion 5 carrying part of the piston-controlling linkage as will be apparent hereinafter.

Fastened to the wall 6 is a crank case 7 having a hub or bearing portion 8 for the power transmitting shaft 9. The member 1 has a hub or bearing portion 10. The hub portions 5 and 10 are connected to the cylinder portions of the webs 11 and 12 and together they form a rotor chamber 13 in which are located the rotors 14 and 15.

The rotor 14 is fixed on the shaft 16, one end of which is mounted in the hub or bearing 10, the other end being mounted in the bearing recess 17 in the crank carrier 18 and concentric with the shaft 9. The rotor 15 carries a hub portion 19 sleeved on the shaft 16. The hub portion 19 is really a hollow shaft which extends through the hub portion 5 to carry one of the piston arms, as will be explained hereinafter.

The method of packing the pistons, rotors and cylinder forms no part of the present invention so no reference will be made thereto.

The crank carrier member 18 includes an end plate in which is located the recess 17 and it has inwardly extending webs or spacing walls 20 and 21 provided with outstand-

ing flanges 22 and 23 which may be fastened to the end plate 24 by suitable fastening devices passing through the openings 25 in the end plate 24 and through the openings 26 in the respective flanges 22 and 23. The end plate 24 has a bearing collar or hub 27 which is mounted on the hub extension 5 so that when the members 18 and 24 are secured together, the crank carrier is supported by the shaft 9 and by the hub 5. The plate 24 has diametrically oppositely located crank bearings 28 and 29 which, when the members 18 and 24 are secured together, align with complementary bearings 30 and 30' in the member 18. The bearings 28 and 30 support a one-pin crank shaft 31 and the bearings 29 and 30' support a similar crank shaft 32. On the inner ends of the respective crank shafts 31 and 32 are pinion gears 33 and 34 which mesh with a gear 35 fixed to the hub portion 5; that is, the gears 33 and 34 planetate about the axis of a gear 35. The outer ends of the cranks 31 and 32 carry fly wheels 36 and 37.

The crank pins 38 and 39 carry connecting rods 40 and 41, which are connected to the pins 42 and 43 of the piston arms 44 and 45. The crank shafts 31 and 32 carry counter-balance weights 46 and 47. The piston arms 44 and 45 carry counter balance weights 48 and 49. The piston arm 44 is rigidly connected to the shaft 16 and the piston arm 45 is rigidly connected to the hollow shaft 19. Therefore, it will be apparent that when the pistons are in the position shown in Fig. 4 and an explosion takes place between pistons A and B, the piston A will be the accelerated piston and the piston B will be the retarded piston, moving in the direction of the arrow.

The piston movement will be such that the parts will assume the position shown in Fig. 5 at the end of the power stroke of the pistons A and B, at which time the piston B will be in position to become the accelerated piston and the piston A', a complementary to the piston A, will be the retarded piston. When the second explosion has taken place and the pistons B and A' have the full power stroke, the piston A will then move over to the position occupied by the piston B' in Fig. 5 and piston B' will assume the position occupied by piston A' in Fig. 5. Of course, this will result in moving piston A' to the position occupied by piston B in Fig. 5 and the linkage mechanism will change from the position shown in Fig. 5 to the position shown in Fig. 4 due to the fact that the crank pins are 180 degrees apart but the linkage for shafts 16 and 19 are in transposed relation.

It will be apparent that the connecting rods 40 and 41 will maintain parallelism at any period of the operating mechanism during a complete cycle to assist in maintaining

the balance of the linkage mechanism between the pistons and the driven shaft 9. The balance relation is maintained by the oppositely disposed, separate, single pin crank shafts, one for each piston rotor and as each rotor carries two pistons, it is apparent that there is a single pin crank shaft for each pair of pistons, that the crank shafts are balanced and that the cranks align with the piston crank pins so that parallelism between the connecting rods 40 and 41 will be maintained throughout the operating cycle of the engine. Furthermore, the piston arms are balanced and since there is a fixed gear on the cylinder end of the crank case about which the crank shafts 31 and 32 planetate due to the gears 33 and 34 and since the crank shafts 31 and 32 carry individual fly wheels 36 and 37, it will be apparent that these, together with the crank shaft carrier mounted on the cylinder end of the crank case all assist and co-operate in producing a balanced linkage mechanism between the pistons and the power delivery shaft and insure balanced uniform operation of the power elements during the working period of the motor.

By placing the separate fly wheels on the separate crank shafts, I am enabled to maintain uniform operation of the pistons with relation to each other, to bring about uniform rotation of the crank shafts and as a result maintain uniform pressure contact between the teeth of the pinions and the teeth of the fixed gear, thus insuring uniform rotation of the engine.

Balanced rotation of the engine is maintained by the disposition of the crank shafts, counter weights on the crank shafts, and counter weights on the piston arms providing a construction which insures balanced rotation of the assembly; but, of course, any suitable means can be provided for igniting the charge; for example, I have shown a spark plug 50, in Fig. 1.

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

In a rotary combustion motor, a fixed annular cylinder casing, and a fixed crank case at one side of the cylinder in axial alignment with the cylinder, pairs of pistons in the cylinder rotatable about a common axis, the pistons of one pair opposed to those of the other pair, to form working chambers between them and having relative movement to compress fuel charges to combustible pressures, means for igniting the compressed charges, two piston shafts, one concentric with the other, piston arms carried by the piston shafts, oppositely disposed single pin crank shafts, one for each pair of pistons, a crank shaft carrier mounted to rotate in the crank case and having the crank shafts rotatably mounted therein diametrically opposite to each other, piston arms on the pis-

ton shafts, connecting rods between the piston arms and the crank pins, the crank pins being so disposed that when they are on dead center positions they are at equal angular distances on one side of a plane passing through the axes of the crank shafts and of the piston shafts, with one crank pin a greater distance from the axes of the piston shafts than the other, the connecting rods on dead center positions and parallel one to the other.

In testimony whereof I affix my signature.

FRANK A. BULLINGTON.