Sept. 9, 1930. A. R. BAKER 1,775,303

INTERNAL COMBUSTION ENGINE

Filed Sept. 10, 1928

Fig. 1.

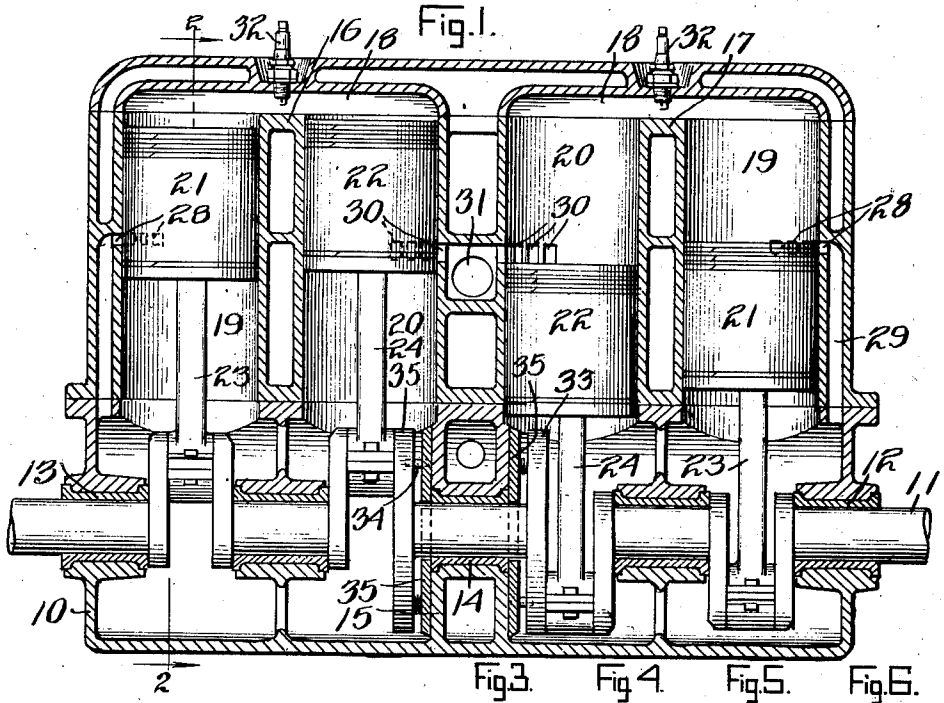


Fig. 2.

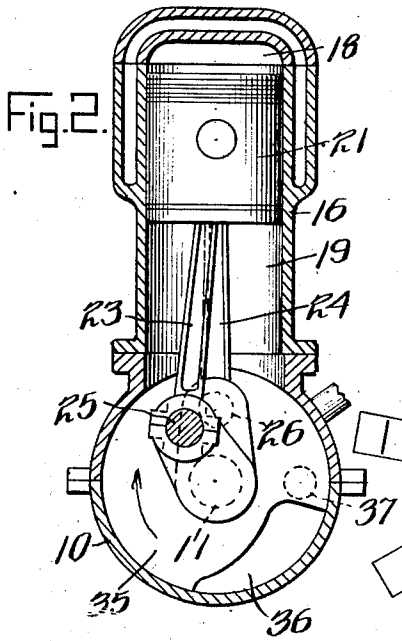


Fig. 3. Fig. 4. Fig. 5. Fig. 6.

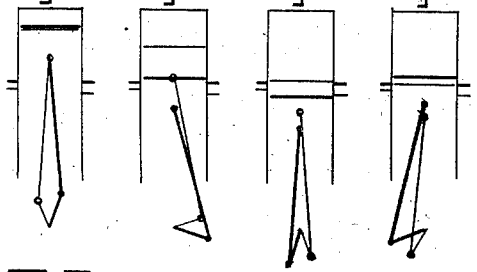
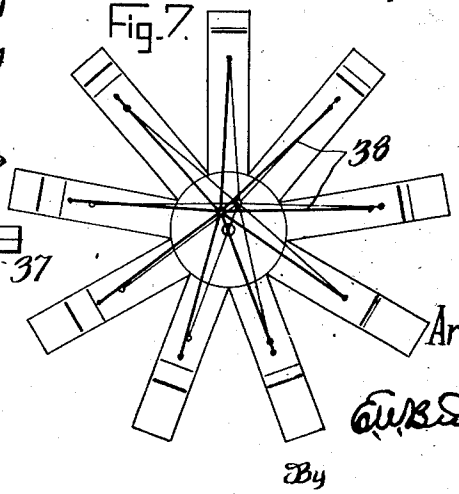


Fig. 7.



Inventor

Arthur R. Baker

By

Attorney

Patented Sept. 9, 1930 1,775,303

UNITED STATES PATENT OFFICE

ARTHUR R. BAKER, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO IRA T. SWARTZ, OF INDIANAPOLIS, INDIANA

INTERNAL-COMBUSTION ENGINE

Application filed September 10, 1928. Serial No. 305,041.

My invention relates to two stroke cycle internal combustion engines. An object of the invention is to provide a two stroke cycle internal combustion engine having four combustion cylinders which develop the same power as a four cylinder engine but which is much simpler in construction and much lighter.

A further object is to provide an engine which is valveless and in which the cylinders are arranged parallel in order to minimize air resistance against the cylinders.

A further object is to provide an engine of the kind described in which the connecting rods are mounted upon separate crank pins whereby a slightly different throw may be provided for the pistons in each pair of cylinders in order to permit the exhausting piston to travel through a greater distance than the charging piston.

In internal combustion engines designed for use particularly with aeroplanes the air resistance is very great with engines which have the pair of cylinders arranged at different radial positions with respect to the crank case as in Patent #1,624,581, for example, the resistance is four times as much as it would be if the cylinders were all parallel.

By aligning all the cylinders in parallel relation, I eliminate a large percentage of this resistance. But in order to locate the cylinders parallel to each other and at the same time provide for having the piston of one cylinder in each pair travel slightly in advance of the piston in the other cylinder of the pair, I attach the connecting rods to crank pins which are off-set at a slight radial angle with respect to the corresponding crank pins. This provides a slight lead of the exhausting piston which is attached to the advance crank pin, and secures the same result that would be secured by having the connecting rods connected to a single crank pin and the cylinders placed at a slight radial angle.

Further objects and advantages will appear as the description proceeds.

Referring to the accompanying drawings, which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a vertical section through the cylinders and crank case,

Figure 2 is a vertical section on line 2—2 of Fig. 1,

Figures 3, 4, 5 and 6 are diagrammatic views showing relative positions of the two pistons in each cylinder, with the position somewhat exaggerated in order to illustrate their movements; and

Figure 7 is a diagrammatic view of my invention as applied to a well-known whirl wind motor.

In the drawings, numeral 10 indicates a common crank case for the four cylinders, in which is mounted a crank shaft 11 in bearings 12, 13 and 14. The bearing 14 is positioned in a wall 15 common to the two pairs of pistons. Secured upon the crank case is a double casting having chambers 16 and 17, in each side of which are provided two cylinders having a common connecting firing chamber 18 in the head of the casting. Chambers 16 and 17 are identical in construction and the cylinders and pistons therein are likewise identical with the exception that the connecting rods are attached to crank pins positioned 180 degrees apart. It will therefore be necessary to describe only one pair of cylinders and pistons in order to have a complete understanding of the engine.

In the chamber 17 are provided bores 19 and 20 which provide cylinders for pistons 21 and 22. Connecting rods 23 and 24 connect these pistons to crank pins 25 and 26 respectively on the crank shaft 11. The crank pin 26 is not in the same plane as the crank pin 25, but is positioned slightly in advance of 25 as shown in Fig. 2. The piston 22 therefore travels slightly in advance of the piston 21. I may have the crank pin 26 positioned slightly further from the axis of the crank shaft than is the pin 25, in order to provide a slightly longer stroke to the piston 22. Entering in the side of the cylinder 19 at 28 is a series of inlet ports. These are open to a passage 29 which connects the interior of the cylinder 19 with the interior of the crank case. A series of ports 30 in the

cylinder 20 open into an exhaust port 31. A spark plug 32 is positioned in the top of the casting and enters into the chamber 18, which may be called the firing chamber. Secured to the crank pin 26 or made integral therewith is a plate 33. Pins 34 are secured in this plate and extend into bores in a disk valve 35. This disk operates to control communication from a super-charger, not shown, into the crank case. The disk 35 has a cut away portion as shown at 36, which opens communication with a port 37 from the supercharger. The disk rotates in the direction of the arrow shown in Fig. 2, so that the port 37 is opened gradually as the narrow end of the port 36 passes over.

The operation of this form of the invention is as follows: A fuel charge under pressure is delivered into the crank case from the super-charger and passes through passage 29 and port 28 into the cylinder 19. As the piston 21 moves up, the fuel charge is compressed in the cylinders in advance of the pistons 21 and 22. Since the piston 22 moves slightly in advance of the piston 21 exhaust ports 30 are closed slightly in advance of the inlet ports 28. As the pistons move up toward the end of the cylinders the fuel charge is again highly compressed in advance of the pistons. When the pistons reach their upper limit of travel the charge is exploded and the pistons are driven back under the impact of the explosion. The piston 22 continuing to travel in advance of the piston 21, the exhaust ports 30 will be opened and the exploded gases under pressure will exhaust therethrough before the inlet ports 28 are opened. The inlet ports 28 however are opened just before the piston 22 closes the port 30, and the movements of these pistons are so timed that the incoming fuel charge will practically drive out the dead gases in the cylinders before the exhaust port is closed by the upwardly moving piston 22. The fuel gases under compression in the crank case will enter the cylinder 19 under pressure and then will be highly compressed again as the upwardly moving piston 21 closes the inlet port and continues to move upwardly against the gas contained in the cylinders. The disk 35 may be held against the face of the partition by means of springs if desired.

The diagrammatic views in Figs. 3, 4 and 5 show the advancing and the following pistons in somewhat exaggerated relation, in order to give a better understanding of the relation of these two pistons. In Fig. 7 my invention is shown applied to the Wright whirlwind motor. This motor consists of nine radial cylinders operated from connecting rods connected to a single crank pin. As applied to this type of motor I provide double the number of cylinders with the same frictional resistance, since I position two cylinders in parallel relation. The heavy lines shown in Fig. 7 at 38 indicate the connecting rods for the charging piston. The lightly shaded lines indicate the head of the exhausting piston, or the piston which travels in advance. It should be obvious that I have provided an engine having eighteen cylinders with no more air resistance than is encountered in the Wright whirl-wind motor having nine cylinders.

It will be obvious to those skilled in the art that various changes may be made in my device without departing from the spirit of the invention, and I, therefore, do not limit myself to what is shown in the drawings and described in the specification, but only as set forth in the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. An internal combustion engine comprising a plurality of pairs of cylinders, each pair having a common head and a common combustion chamber communicating with the cylinders, spaced inlet ports in one cylinder of each pair, spaced exhaust ports in the other cylinder of each pair, pistons in the cylinders arranged to control said inlet and exhaust ports, a crank shaft, crank pins on said crank shaft arranged in offset radial relation, connecting rods connecting the said pistons to said crank pins, the crank pin which controls the movement of the exhaust pistons having a greater throw than the crank pin which controls the movement of the inlet piston the said pistons operating on their return stroke to force a fuel charge into the cylinders, substantially as set forth.

2. An internal combustion engine comprising a plurality of pairs of cylinders having an intercommunicating chamber at their outer end to provide a common firing chamber, spaced inlet ports on one cylinder and spaced exhaust ports in the other cylinder, a piston in each cylinder, a crank shaft having pins thereon, the said pins being arranged in different axial planes, connecting rods connecting said crank pins to the said pistons one of said pins being a greater radial distance from the shaft than the other whereby one of the pistons moves through a longer distance than does the other piston, substantially as set forth.

3. An internal combustion engine comprising a plurality of pairs of cylinders each pair having an inter-communicating chamber at their outer end to provide a common firing chamber, spaced inlet ports in one cylinder of each pair and spaced exhaust ports in each of the other pistons of the pair, a piston in each cylinder, a common crank case for each pair of cylinders, a crank shaft having its crank pins arranged in different axial planes, connecting rods connecting said crank pins with said pistons one of said pins of each pair being a greater radial distance from the

shaft than the other whereby one of said pistons of each pair moves through a longer distance than does the other, an inlet port in each crank case, and means for opening said port slowly and closing the same rapidly, substantially as set forth.

In witness whereof I have hereunto set my hand at Washington, District of Columbia, this 30th day of August, A. D. nineteen hundred and twenty-eight.

ARTHUR R. BAKER.