A. L. POWELL.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 8, 1920.

1,433,649. Patented Oct. 31, 1922.

Fig. 1.

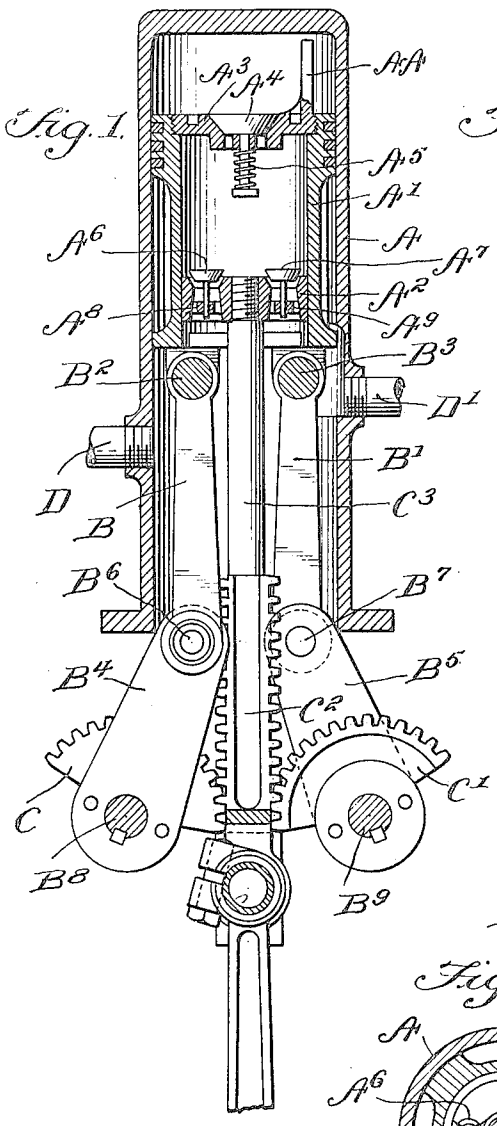


Fig. 2.

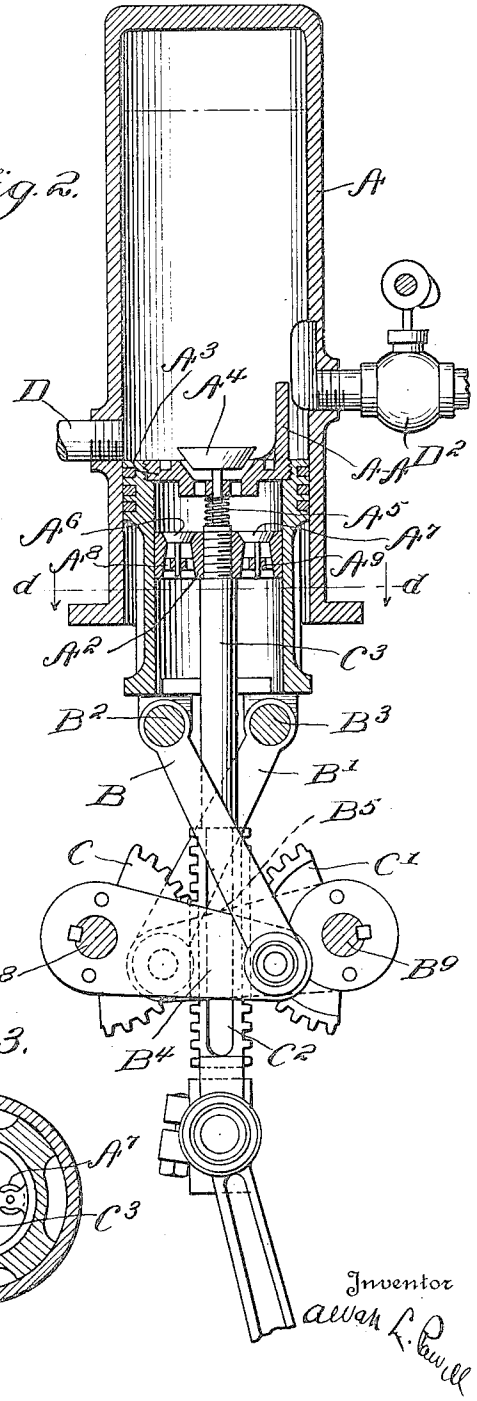
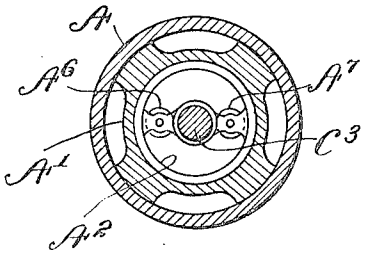


Fig. 3.



Inventor

Alvah L. Powell

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UNITED STATES PATENT OFFICE.

ALVAH L. POWELL, OF MILES CITY, MONTANA, ASSIGNOR TO THE A. L. POWELL POWER CO., OF MILES CITY, MONTANA, A CORPORATION.

INTERNAL-COMBUSTION ENGINE.

Application filed December 8, 1920. Serial No. 429,165.

To all whom it may concern:

Be it known that I, ALVAH L. POWELL, citizen of the United States, residing at Miles City, in the county of Custer and State of Montana, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines of the two cycle type, in which I provide simple and effective means for clearing the cylinder of the products of combustion, and introducing the fresh charge. I secure this by using an auxiliary piston, working inside of the power piston, but having a movement independent of it. I further introduce a novel transmitting member that transfers the power to the engine crank and, at the same time, maintains a relation between the aforesaid pistons that gives each a movement of its own, with reference to length of stroke.

In the annexed drawings Figs. 1 and 2 are elevations, in section, of an engine of my invention, only the essential parts being shown, or indicated, and Fig. 3, a section on *d—d*.

In Fig. 1 a piston, A^1, in a cylinder A, is bored to admit a second piston, A^2, that can freely move therein. The piston A^1 is closed at one end by a cap, A^3, that is threaded into piston A^1. In this cap is located a poppet valve, A^4, held in position by a spring A^5, on the valve stem. The piston A^1 is formed of a section that carries packing rings, and a section of the same diameter, but cut away, as indicated in Fig. 3, leaving surfaces having a diameter great enough to allow them to act as bearing parts against the walls of the cylinder bore. Between the sections described there are annular spaces that assist in cooling the piston by the air circulation to which they conduce on each outstroke. On the secondary piston, A^2, are shown two valves, A^6, A^7, the stems of which pass through guides, A^8, A^9, preferably forming part of the piston. The valves A^6, A^7, normally retain their seats by their own weight, until acted on by a variation of pressure that is to be described. On the lower end of piston A^1 are lugs, conveniently placed to which are attached links, B, B^1, by means of pins, B^2, B^3. These links connect with the crank levers B^4, B^5, by means of the pins B^6, B^7. The crank levers are pivoted on pins, B^8, B^9, supported, preferably, in the engine frame. On the pins B^8, B^9, are mounted segmental pinions, C, C^1, which are also keyed to the said pins. Between the segmental pinions there is placed a rack, C^2, the teeth of which mesh with those of the pinions. The rack C^2 terminates at the upper end in a bar, C^3, that joins it to the secondary piston A^2, by a threaded portion, which allows the bar to be screwed up to a shoulder, as shown. On the lower end of the rack is a yoke, shown in Fig. 2, and indicated by the sectional hatching in Fig. 1. This yoke is bored to fit a pin, to which it fitted one end of an engine crank rod. The other end of this rod connects with an engine crank, not shown.

In the cylinder A is located an exhaust port D, and an inlet port, D^1. The inlet port connects by a pipe to an intake valve, D^2, controlled by operable means from the engine shaft.

It will be noted that the connection from the pistons to the transmission members are at points giving a difference of stroke to each. The primary piston A^1 connects with the crank levers, B^4, B^5, while the secondary piston A^2 connects with the rack C^3, but the movement of the rack is governed by the pitch radius of the segmental pinions, C, C^1, and this is less than the radius of the crank levers, B^4, B^5. In an engine of six inch stroke, primary piston, the secondary piston would move four inches, with centers proportioned as shown in drawings. The engine crank will therefore move through four inches. This differential relation arises from the nature of the transmission means, which admit of any desired change of relative stroke. Having given the details of construction of an engine such as I have invented I will now describe its operation, through one cycle.

In Fig. 1 the piston A^1 is at end of compression, and is ready to start on the expansion stroke. The secondary piston has moved to the end of its own stroke, during which it took in air from the atmosphere, or the engine case. The valves A^6, A^7, are shown open, from the inrush of air, and are about to reseat themselves. As piston A^1 moves out, the valves A^6, A^7, close and, by reason of the difference in stroke of the two pistons, the secondary, A^2, lags, compressing

the air in the piston chamber. The valve A^4 remains closed, because the pressure due to the explosion is higher than that produced in the secondary chamber. Near the end of the out stroke the exhaust port D is uncovered, and also the inlet port, D^1. The pressure in the cylinder falls to atmospheric and the valve A^4 lifts, releasing the compressed air in the secondary chamber. As the piston A^1 dwells at end of stroke the inlet valve D^2 is operated from any means on the engine shaft, admitting a full charge having the pressure of the air in engine case, this being, normally, greater than atmospheric. The incoming charge is partly guided upward along the cylinder wall by the baffle A—A on piston A^1. This charge will further aid in the complete scavenging of the products of combustion of the previous explosion. As the piston A^1 moves back, on compression stroke, the secondary piston A^2 will lag, by reason of the differential movement of the pistons, and a partial vacuum will be created in the secondary chamber. The engine case pressure will force back the valves A^6, A^7, and a fresh charge will enter the chamber. This air will also act as a cooling agent on the walls of the larger piston.

I thus obtain a structure relatively simple, the various elements of which co-ordinate in securing efficiency. The firing charge will have a minimum of burned gases, while the air circulation incidental to the functional operations will serve to maintain a reasonable temperature of the parts most affected by heat and the pistons will operate without sideslap.

I do not limit myself to the exact arrangement described for it is evident that many departures from the construction given can be made without altering the principle of my invention.

What I believe is new and ask to have protected by Letters Patent, is—

Claims.

1. In an internal combustion engine, a power cylinder, inlet and exhaust means to said power cylinder, a power piston slidable in said power cylinder, a valve in said power piston, a secondary piston slidably fitted in said power piston, valves in said secondary piston, a piston rod, a rack on said piston rod, means for connecting said piston rod to said secondary piston, a power connecting rod, means for attaching said piston rod to said power connecting rod, a crank shaft, means for attaching said power connecting rod to said crank shaft, pins rotatably mounted intermediately to said power cylinder and said crank shaft, cranks on said pins, connecting rods, means for attaching said connecting rods to said cranks, means for attaching said connecting rods to said power piston, segmental pinions on said pins meshing with said rack, means for rigidly attaching said cranks and said segmental pinions to said pins, and means for proportioning the stroke of said cranks to the stroke on said crank shaft so that the secondary piston will move through a distance different from that of the primary piston, for the purpose and in the manner herein described.

2. In an internal combustion engine, a power cylinder, an operable inlet valve on said cylinder, an exhaust port in said cylinder, a power piston slidably fitted in said power cylinder, an outlet check valve in the head of said power piston, a secondary piston slidably fitted in said power piston, inlet check valves in the head of said secondary piston, a piston rod, racks on said piston rod, means for connecting said piston rod to said secondary piston, a power connecting rod, means for connecting said power connecting rod to said piston rod, an engine crank, means for connecting said engine crank to said power connecting rod, pins mounted intermediately to said engine crank and said power cylinder, cranks on said pins, segmental pinions on said pins, means for rigidly attaching said cranks and said segmental pinions to said pins, the said segmental pinions fitting in mesh with said racks; connecting rods, means for attaching said cranks on said pins to said connecting rods, means for connecting said connecting rods to said power piston, means for proportioning the stroke of said cranks on said pins and the pitch radii of the said segmental pinions so that the said secondary piston will move through a stroke shorter than that of the said power piston, and means for releasing said outlet check valve by the impact of said secondary piston, for the purpose and in the manner herein described.

In testimony whereof I affix my signature.

ALVAH L. POWELL.