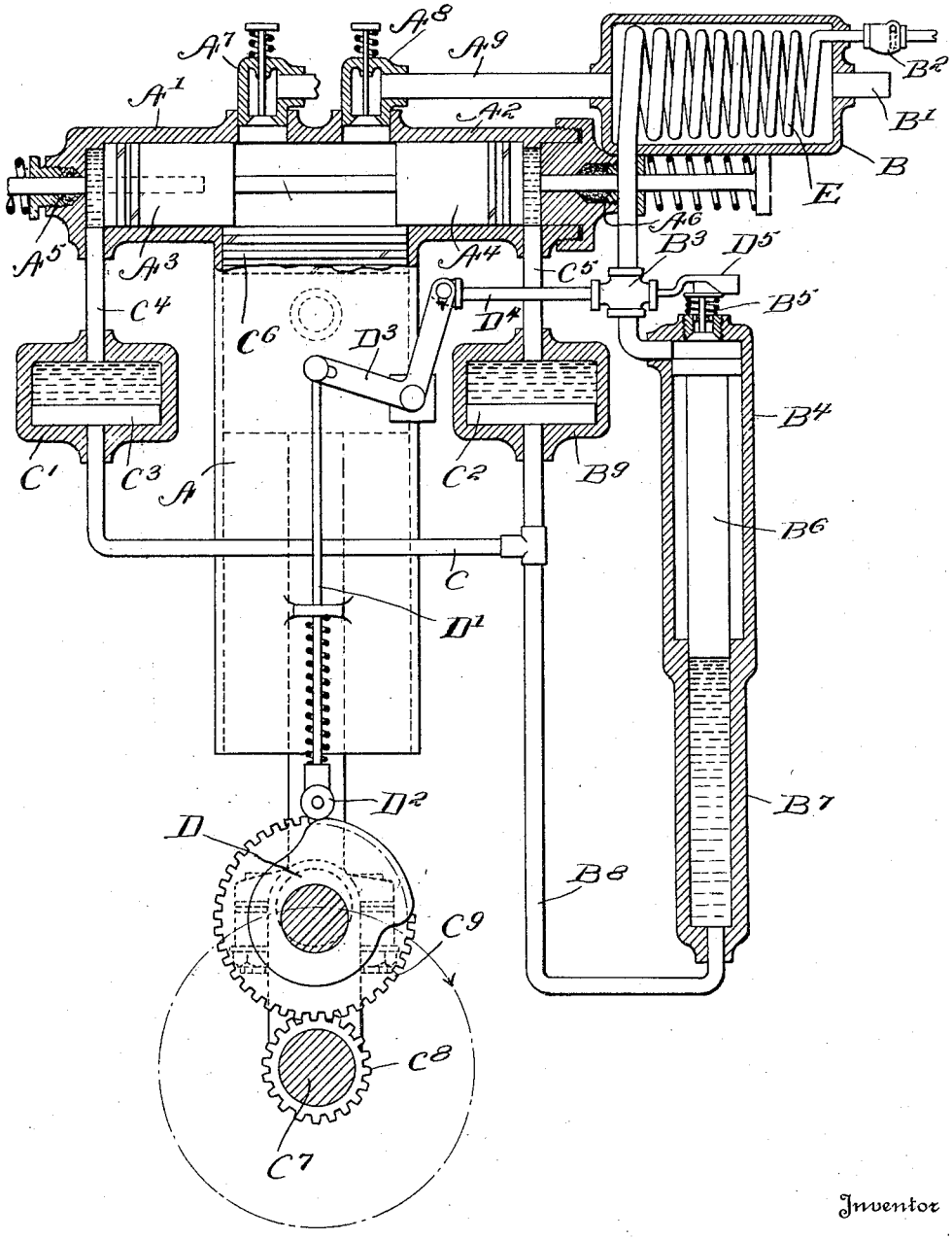
April 1, 1924. 1,489,004

A. L. POWELL

INTERNAL COMBUSTION ENGINE

Filed Dec. 24, 1920



Inventor

Alvah L. Powell

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UNITED STATES PATENT OFFICE.

ALVAH L. POWELL, OF MILES CITY, MONTANA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE A. L. POWELL POWER COMPANY, INC., OF MILES CITY, MONTANA, A CORPORATION OF MONTANA.

INTERNAL-COMBUSTION ENGINE.

Application filed December 24, 1920. Serial No. 433,032.

To all whom it may concern:

Be it known that I, ALVAH L. POWELL, a 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 by which I provide means for utilizing the heat contained in the exhaust gases, thereby raising the thermal efficiency of such an engine, while adding to the mechanical effectiveness by reason of the elimination of preignition. In the accompanying figure I show a vertical section, giving a form of my invention and showing the operative parts in their relative positions.

On the end of a cylinder A are cylindrical passages, A^1, A^2, in which are slidable pistons, A^3, A^4. From these pistons there project stems that pass through glands, A^5, A^6, on which are mounted spiral springs, as shown. These springs cause the pistons to return to the position shown in the drawing after making the movement herein to be described. Between the pistons a space is formed, by their relative positions, this being the ordinary combustion chamber. To this I show inlet and outlet valves, A^7, A^8. From valve A^8 a pipe, A^9, leads to a cylindrical chamber, B, an outlet being shown at B^1. In said chamber there is a coil of pipe, preferably of copper, having at one end an inlet check valve, B^2. The other end of the coil leads to an operable valve, B^3, to be further described. From the valve a pipe passes to a cylinder B^4, having, at its upper end, an exhaust valve, B^5. In cylinder B^4 there is a piston, B^6, having a major and minor diameter, the latter fitting in the minor cylinder diameter shown at B^7. A pipe, B^8, leads from B^7 to a short cylinder, B^9, and a secondary pipe, C, passes from pipe B^8 to another cylinder, similar in all respects to B^9. The additional cylinder is lettered C^1. In each of the said cylinders are fitted slidable pistons, C^2, C^3. From cylinders B^9, C^1, pipes, C^4, C^5, connect to the crosshead piston chambers, A^1, A^2, as shown.

In the power cylinder A is fitted a conventional piston, C^6, that communicates power to a crank shaft, C^7, in the usual way. On the said crank shaft a gear, C^8, communicates motion to a second gear, C^9, that rotates a cam, D. A cam rod, D^1, having an anti-friction roller, D^2, transmits the movement due to the cam surface to a bell crank. D^3, said bell crank being pivoted at any convenient point in the engine frame. From the valve B^3, a rod, D^4, extends to and engages the end of an arm on the bell crank D^3. From the said valve a second rod, D^5, formed as shown, engages a cam shaped member on the stem of valve B^5.

The operation of the engine is as follows:

In the position shown in the drawing, the piston C^6 is at end of upstroke and is about to begin its downward, or power movement. During the exhaust stroke which preceded the compression stroke, the exhaust gases had passed through operable valve A^8, thence to the cylinder B, escaping through the pipe B^1. During this period the coil (E) in the said cylinder becomes heated, the temperature of the air therein rising. As the inlet valve B^2 acts as a check valve with reference to the coil E, the pressure in the latter is increased under the conditions described. The pressure of the air is communicated to piston B^6 on its major diameter, the total pressure there exerted reappearing on the minor diameter. The lower part of cylinder B^7 is filled with fluid, this flowing through the pipes B^8, C, to the lower sides of pistons C^2, C^3. As previously described, the piston C^6 is at beginning of power stroke, but ignition has not taken place. On the movement of cam D the cam rod D^1 is moved, and the bell crank D^3 operated (as shown in the position given in drawing). The air pressure of the coil E in cylinder B is admitted to cylinder B^4, causing the piston B^6 to move downward, the pressure forcing the pistons C^2, C^3 upward. The spaces above said pistons being also fluid filled, the pressure is communicated to the pistons A^3, A^4, causing them to move inward, in the direction of the combustion chamber. As the areas of the major and minor diameters of piston B^6 are calculated with reference to a compression high enough to effect combustion by reason of an extreme compression, the charge in cylinder A is fired as the piston C^6 moves downward. On the further action of the cam, the valve B^5 is opened by means of the cam-stem D^5 and the partly expanded

air from the coil E, exhausts into the atmosphere. The maintenance of a minimum of atmospheric pressure in the coil E is assured by the inlet check valve B^2, fresh air entering as the pressure drops below atmospheric to be, in turn, increased in pressure by the heat of an escaping exhaust charge through chamber B.

It will be seen that I thus derive a specific result from using the heat of the exhaust gases, adding a positive amount to the heat efficiency of an engine equipped with my invention. To the usual piston compression I add a secondary compression obtained entirely by the application of hitherto wasted heat. I also increase the pressure of the burning charge, by reason of the higher initial pressure, and secure purely mechanical ignition, no electric auxiliary being necessary. The time in the cycle at which this secondary compression is effected precludes any possibility of back-firing from preignition. I obtain, as a consequence, a self contained power generator of great mechanical and thermal efficiency.

Many changes may be made in the construction shown in this application without departing from the idea of my invention, and other arrangements of parts can be made that will still be within range of the principles involved.

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

1. In an internal combustion engine, the combination of a power developing means, a driven means actuated thereby, a mechanical igniter adapted to be operated by the heat of the exhaust gases from the power developing means, said igniter including a fluid pressure means.

2. In an internal combustion engine, the combination of a power cylinder, inlet and exhaust valves, a power piston, auxiliary compression pistons, a heat absorption chamber, a coil in said chamber, an inlet valve on said coil, a fluid pressure transmission cylinder, a piston in said transmission cylinder having major and minor diameters, auxiliary fluid pressure transmission cylinders, pistons in said auxiliary cylinders, communicating fluid filled means between said pressure transmission cylinder and said auxiliary fluid transmission cylinders, communicating means between said auxiliary fluid transmission cylinders and the said auxiliary compression pistons, means for augmenting the pressure in said coil by the exhaust gases from the said power cylinder, means for communicating said pressure to said piston in the transmission cylinder, a power shaft, and communicating means for actuating said power shaft by the movement of said power piston, substantially as described.

3. In an internal combustion engine, the combination of a power developing means, a driven means adapted to be actuated thereby, a mechanical igniter adapted to be operated by the heat of the exhaust gases from the power developing means, said igniter including a secondary piston and fluid pressure means embracing the principle of Pascall.

4. In an internal combustion engine, a combination of a power cylinder, a piston slidable therein, a secondary cylinder, a secondary piston slidable therein, fluid pressure means whereby said secondary piston is operated, said fluid pressure means being actuated by the heat of the exhaust gases from the power cylinder, said fluid pressure means including a cylinder having major and minor diameters, a piston having major and minor diameters adapted to reciprocate in the last mentioned cylinder and means whereby the pressure means may be automatically relieved.

In testimony whereof I affix my signature.

ALVAH L. POWELL.