Nov. 3, 1925. 1,560,492

A. L. POWELL

INTERNAL COMBUSTION ENGINE

Filed Feb. 2, 1921

Fig. 1.

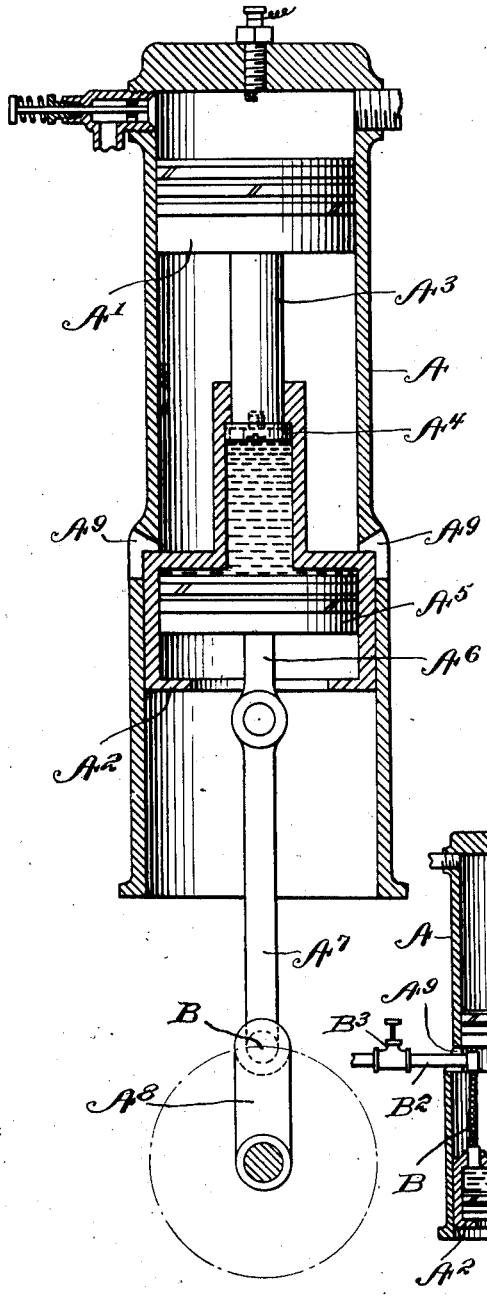


Fig. 2.

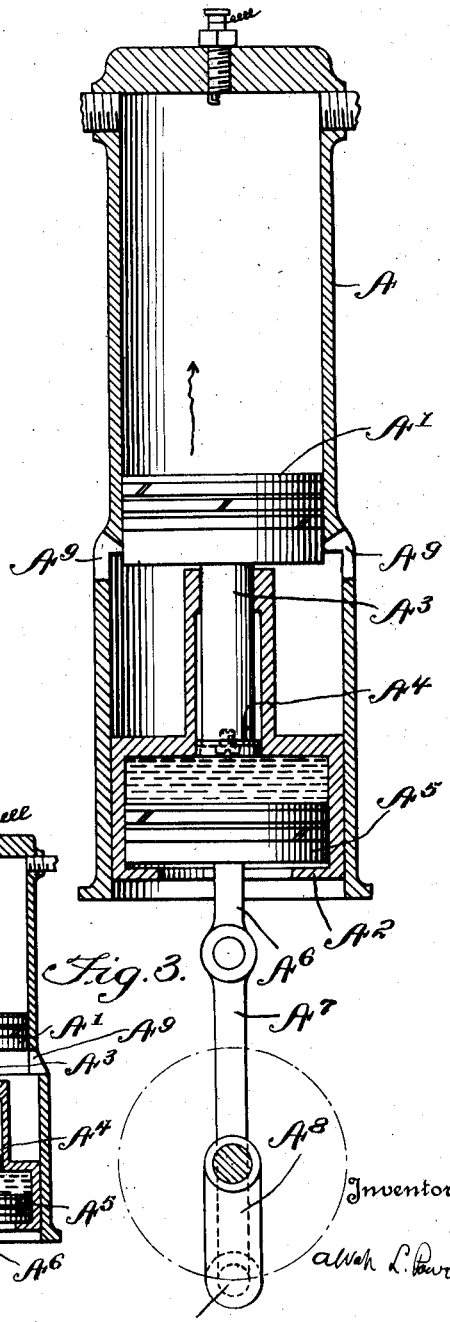
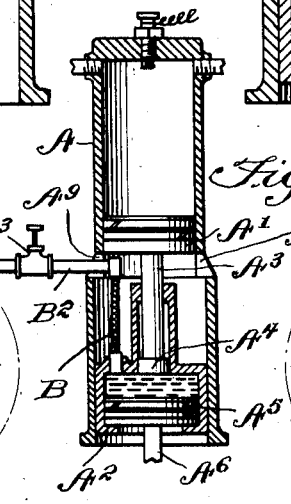


Fig. 3.



Inventor

Alvah L. Powell

Patented Nov. 3, 1925. 1,560,492

UNITED STATES PATENT OFFICE.

ALVAH L. POWELL, OF MILES CITY, MONTANA, ASSIGNOR TO THE A. L. POWELL POWER CO., INC., OF MILES CITY, MONTANA, A BODY CORPORATE.

INTERNAL-COMBUSTION ENGINE.

Application filed February 2, 1921. Serial No. 441,976.

To all whom it may concern:

Be it known that ALVAH L. POWELL, a citizen of the United States, residing at Miles City, in the county of Custer and State of Montana, has 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 in which I provide a fluid means for varying the effect of piston pressure with reference to load. In this way I obtain advantages in the operation of an engine when running at high load, speed automatically adjusting itself to the increased load by a leverage effect that reacts on a secondary piston, causing the crank pressure to rise for a part of the stroke. In the annexed drawings, I show an application of my invention, in which Figs. 1 and 2 are vertical elevations, in section, showing the operation of engine at extremes of stroke. Fig. 3 is a detail.

In Fig. 1 a cylinder A has a major and minor bore in which are fitted pistons, A^1, A^2. Piston A^1 has a minor diameter, A^3, that is slidable in a bored passage in piston A^2. On the end of A^3 there is fitted a cup leather, A^4. Piston A^2 is bored to allow A^3 to fit in it, and counterbored to allow a third piston, A^5, to be slidably fitted therein. Between the end of A^3 and the head of piston A^5 a fluid is introduced, as indicated in Figs. 1 and 2. From piston A^5 a piston rod A^6 extends to a connecting rod, A^7, which is attached to a crank, A^8. At A^9 I provide breathing holes to care for the effect of the difference in movement between pistons A and A^2.

On power outstroke the minor piston A^3 is forced forward against the fluid in the hollow piston A^2. It is evident that the pressure exerted against the second piston, A^5, will be governed by the relative areas of pistons A^1, A^3. Let it be assumed that A^1 has an area four times that of A^3, and piston A^5 an area equal to that of A^1. If the total pressure on A^1 equals 1,000 pounds, the pressure on A^3 will be the same but, by reason of the difference in areas, the pressure per square inch on A^3 will be greater than it is on A^1. This greater pressure will be transmitted to the piston A^5, by Pascal's law, and A^5 will move with a total pressure four times greater than that of A^1. It is also true that the movement of piston A^5 will be less than that of A^1. This is to be understood only of the movements of A^1 and A^5 as related to movement of A^3.

With engine running free, that is, without load, the effect of the improvement I have described will be small, for the relative incompressibility of fluid will cause the pistons to operate together, substantially as one piece; but as load increases the piston A^5 will receive a pressure from the crank and this will react against the fluid, increasing the pressure against pistons A^3 and A^1. This will be opposed by the power pressure on A^1; that is, the pressure due to heat of combustion, and as crank A^8 tends to lag the increased pressure between A^3 and A^5 will force A^5 outward, in the effort to balance the crank pressure. For a part of the outstroke of A^1 its pressure on crank pin B will be increased four times. This will be a leverage effect that, although operative for only a part of stroke, will, under conditions of heavy load, give such an engine a reserve force and consequent flexibility, not present in the usual direct coupled engines.

In Fig. 2 the related parts are shown at end of stroke. From this it is clear that piston A^1 will be forced back (direction of arrow) before the retaining piston A^5 moves.

In a multiple cylinder engine, the effect of this increase of leverage under load will be more marked, for the positive pressures will be distributed to various points of the crank circle, increasing the general efficiency and flexibility of the engine accordingly.

It is evident that an engine operable by any pressure means can be equipped with my improvement, and that the working effect will be the same as herein described.

In Fig. 3 I show a means for maintaining a supply of fluid in piston A^2. On suction stroke of A^1 it ceases moving for an instant at end of its own stroke but A^5 goes on, from the crank action on engine shaft. A suction effect is produced above A^5, and fluid is drawn into the space above it. This fluid enters through a flexible pipe, B, that is attached to A^2, connecting with a pipe B^2. On the latter pipe there is a needle valve, B^3, that controls the flow to the flexible pipe.

Many forms of the improvement I have

described may be made without departing from my invention. I do not wish to be limited to the form and construction shown.

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

1. In an internal combustion engine, a pressure developing means, a piston having major and minor diameters, an intermediate piston having major and minor bores, means for reciprocating the minor diameter of the first mentioned piston in the minor bore of said intermediate piston, a secondary piston slidable in the major bore of said intermediate piston, fluid means between said secondary piston and the minor diameter of said first mentioned piston, a power shaft, connecting means between said power shaft and said secondary piston whereby said power shaft is actuated by the pressure of the said fluid means.

2. In an internal combustion engine, a power means, an intermediate fluid means, a transmission means, and means whereby the pressure between said power means and said transmission varies with the engine load, substantially as described.

3. In an internal combustion engine, a cylinder, a power piston slidable therein having major and minor diameters, an intermediate piston having major and minor diameters and bores, means whereby the minor diameter of the power piston is slidable in said intermediate piston, a cup leather on the power piston of minor diameter, a piston, means whereby said piston is slidable in the major bore of intermediate piston, fluid means between the power piston of minor diameter and piston slidable in major diameter of intermediate piston, a piston rod, connecting means between said piston rod and the piston slidable in major diameter of intermediate piston, a crank, a power shaft, a crank rod, means for connecting said crank and said piston slidable in major diameter of intermediate piston, and means for maintaining the volume of said fluid, substantially as described.

4. In an internal combustion engine, a cylinder, a slidable piston having major and minor diameters, an intermediate slidable piston having major and minor bores, means whereby the minor diameter of the power piston is slidable in the minor bore of the intermediate piston, a power transmission piston, means for moving said piston in the major bore of the intermediate piston, a fluid means between the minor diameter power piston and the power transmission piston, a crank, means for transmitting movement of said power transmission piston to said crank, a power shaft, means for rotating said shaft by said crank, and means for maintaining the volume of fluid between said pistons, substantially as described.

5. In an internal combustion engine, a cylinder, a plurality of pistons slidable therein, means operatively connecting said pistons whereby each piston travels through a different distance than each of the other pistons.

In testimony whereof I affix my signature.

ALVAH L. POWELL.