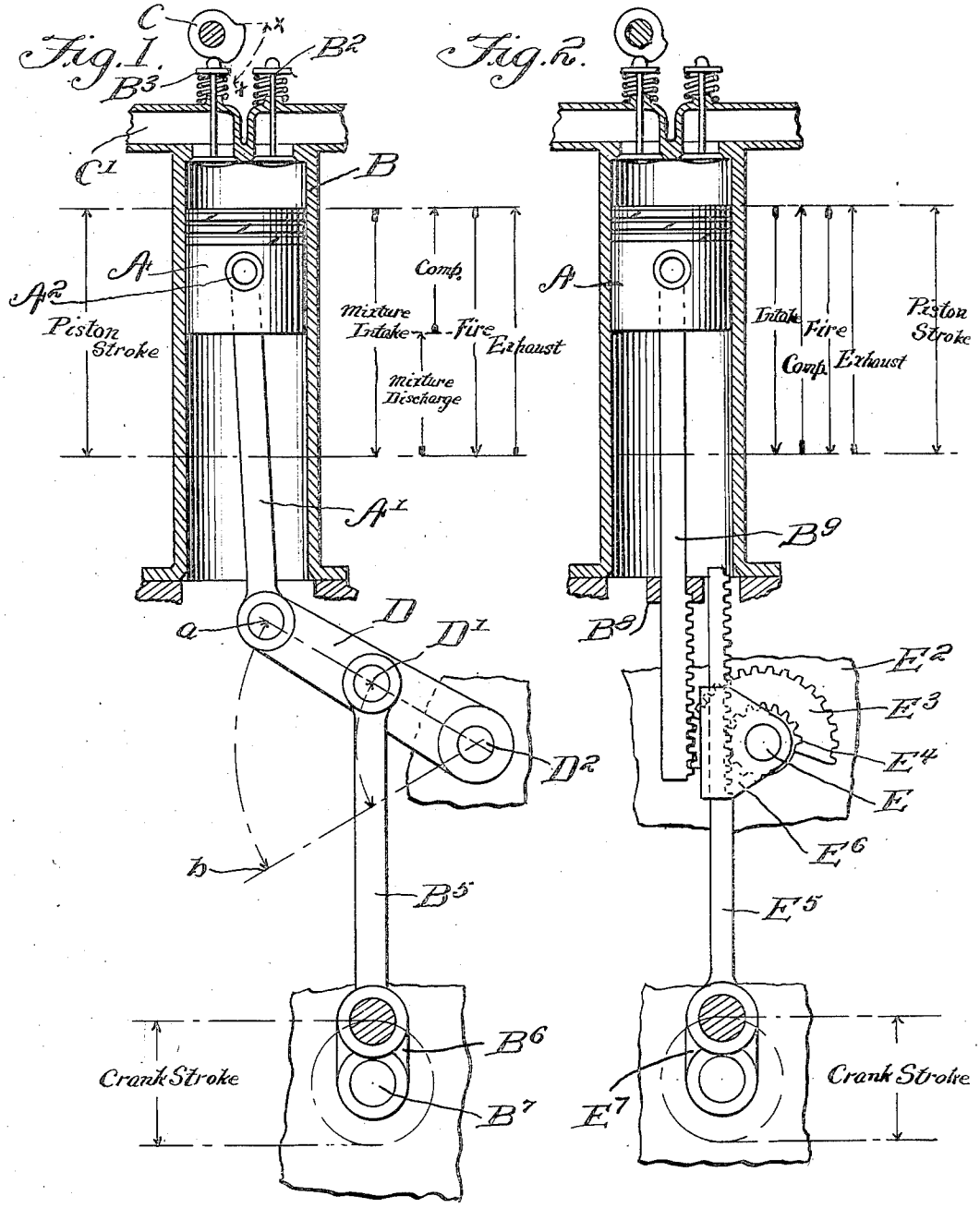
Dec. 29, 1925. 1,567,172

A. L. POWELL

INTERNAL COMBUSTION ENGINE

Filed Sept. 12, 1921 2 Sheets-Sheet 1



Inventor

Alvah L. Powell

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Fig. 3.

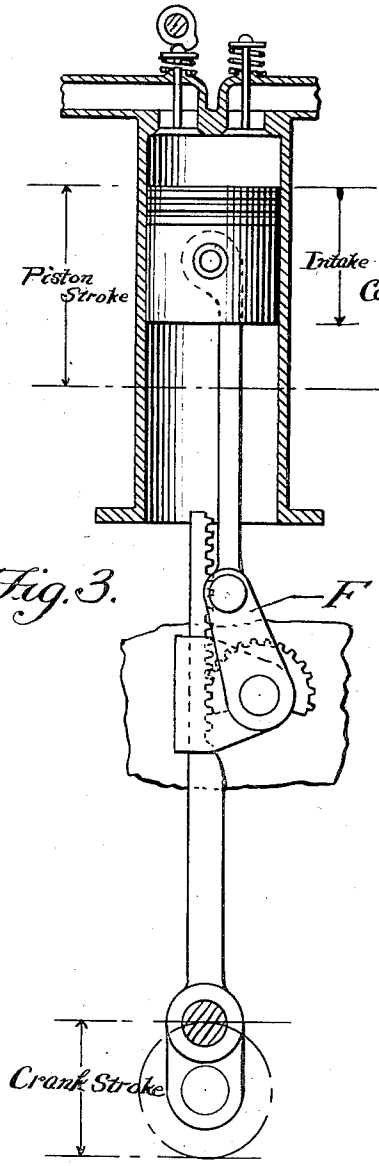
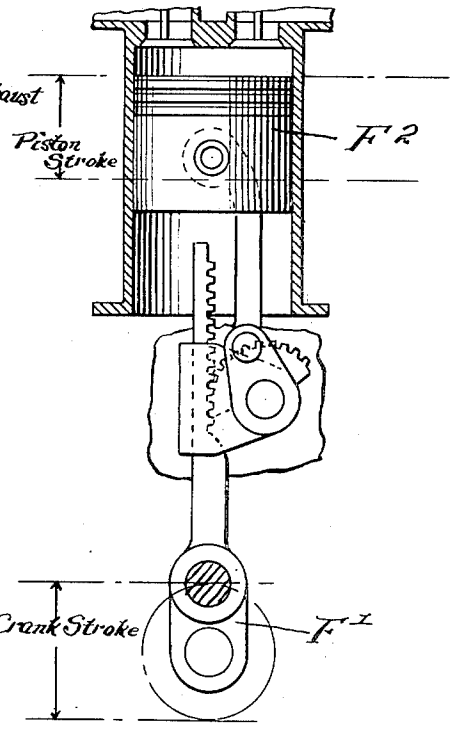


Fig. 4.



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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 CORPORATION.

INTERNAL-COMBUSTION ENGINE.

Application filed September 12, 1921. Serial No. 500,170.

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 in which I add to the efficiency of such engines. This I accomplish by arranging the diameter of cylinder and length of piston stroke with reference to an intermediate transmission, to permit an extreme expansion of the products of combustion, and a quicker propagation of the rate of this combustion over that accomplished hitherto. The intermediate transmission movement is substantially that shown in my patents, bearing the numbers 1,384,335 and 1,384,343. The object of this movement is to allow expansion against an arm that, moving in a longer radius than the radius of the shaft crank, gives a greater movement of the piston and a consequent improvement in the quality of the combustion. Although these points are alluded to in my patents, I did not undertake in them a specific declaration of all the results that would follow the use of my improvements, the said improvements then being at a development stage. Experience with an engine equipped with the said invention has shown a large increase in efficiency, this increase being more than twice that obtained before the invention had been attached to the said engine. As a result of tests that have extended over a reasonable period of time, I have developed a system of proportioning the cylinder volume with reference to stroke, combined with the improvements shown and herein to be described, by which a high efficiency is assured.

In the annexed drawings I show different arrangements of my improvements, in which,

Fig. 1 is a right elevation, in section, of a form of the invention. Fig. 2 is a right elevation of another form of the invention, in which piston sideslap is eliminated. Figs. 3 and 4 show different forms of the improvement.

In Fig. 1, a piston A, having a wrist pin A^2 is coupled to a lever D by a pin of any conventional form, and a piston rod, A^1. The lever D is pivoted on a pin D^2, preferably supported in the engine frame, not shown. At a point less than the radius of the arc a—b, there is a pin or stud, D^1, which transmits power to a crank rod, B^5. The said crank rod is operably connected to a shaft crank, B^6, on a power shaft B^7, the latter supported, preferably, in the engine frame. Piston A is slidably fitted in a cylinder B. Operable valves, B^2, B^3, are shown in the head of said cylinder. A cam C is shown in contact with the stem of the valve B^3.

The operation of the engine is as follows: On down stroke of piston A a firing charge is drawn in through the intake valve B^3. The cam C has a dwell surface x—y for more than a quarter of its circumference, permitting fuel intake to continue throughout stroke. On return, or upstroke, B^3 remains open and part of the indrawn mixture is returned to the inlet pipe C^1, through the valve B^3. The extent of this movement is indicated by dimension lines to the right of Fig. 1, marked "Mixture discharge." B^3 then closes and for the remainder of upstroke compression occurs.

It will be observed that by reason of the length of the lever D and the position of the pin D^1, the linear stroke of piston A is greater than the crank circle diameter of the crank B^6. By this means a leverage relation is established, the force of the piston being exerted against a lower average pressure than that of the crank B^6. The load on crank B^6 is reduced in its effect on the movement of the piston, the movement of which is freer than it would be otherwise. This condition favors more perfect combustion and expansion, the efficiency of the engine being very high.

In Fig. 2, the cylinder and piston construction is substantially as already described for Fig. 1, but to obviate piston sideslap I employ a mechanism similar to that shown in my application filed Dec. 8, 1920, Serial Number 429,165, except that in the improvement now being described I use a piston rod B^9 fitted in a guide B^8. The toothed portion of B^9 engages a major diameter segment E^3, mounted on a pin E, supported, preferably, in the engine frame, a section of which is indicated at E^2. On said pin there is also mounted a minor segment, E^4. The segments E^3, E^4, are so arranged with reference

to a pin E that they move synchronously. A crank rod E^5, toothed on one of its upper faces, engages the segment E^4. E^5 is operably attached to a crank, E^7, by any conventional means. E^5 is held in engagement with the segment E^4 by a guide E^6, that is freely mounted on the pin E.

In the operation of this engine the intake, power, exhaust and suction strokes are for full length of the stroke of piston A, (Fig. 2), but the segments and toothed piston and connecting rods give the same effect as to power and combustion development as has already been described in connection with Fig. 1.

In Fig. 3, the construction is substantially the same as in Fig. 2, but the piston movement is imparted to the intermediate toothed transmission by a lever F. In this form of engine, the intake of fuel is for only a part of the stroke, as shown by the lettering and dimension lines to the right of said drawing.

In Fig. 4, the construction is similar to that shown in Fig. 3, but the piston stroke is less than that of the power shaft crank F^1, but the diameter of cylinder F^2 is relatively larger than that of the cylinders shown in Figs. 1, 2, and 3.

By proportioning a series of engines relatively as shown in the four drawings submitted, the fuel combustion will be under conditions that will yield great efficiency, that of the forms shown in Figs. 1, 2, being the most efficient; but the form in Figs. 3 and 4, although less efficient than the others shown will be more efficient than those of the ordinary, direct coupled engine. This is because the combustion is freer, the transmitting members insuring rapid cylinder expansion, by reason of the relation of piston movement to that of the crank, the effect of which has already been described. In the case of the form shown in Fig. 4, the enlarged cylinder diameter for an engine of relatively short transmission stroke insures volume of intake, high compression and rapid and effective combustion. By varying the proportions of different engines to function substantially as herein described, there will be secured an increase of power over that of ordinary internal combustion engines of approximately the same piston area and stroke.

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

1. In an internal combustion engine, a cylinder, a piston slidable therein, a piston rod operatively connected to said piston, a rack forming an integral part of said piston rod, a pin, a segmental gear and a pinion carried by said pin, said gear having a greater radius than said pinion, a crank rod, a crank operated thereby, means to cause said gear to mesh with said piston rod and means operatively connecting said pinion and crank rod.

2. In an internal combustion engine, a cylinder, a piston slidable therein, a slidable rod operatively connected with said piston, means whereby said rod is guided in a rectilinear path, a rack carried by said rod, a pinion and a gear operatively connected together, said gear having a greater pitch radius than said pinion, said gear being adapted to mesh with said rack, a driven crank rod, a rack carried thereon and means whereby said last mentioned rack is caused to mesh with said pinion.

3. In an internal combustion engine, a cylinder, a piston slidable therein, a piston rod operatively connected to said piston, a rack forming an integral part of said piston rod, a pin, a gear and pinion carried by said pin, said gear having a greater radius than said pinion, a crank rod, a rack forming an integral part of said crank rod, a crank operated thereby, means to cause said gear to mesh with said piston rod, and means whereby said second rack is caused to mesh with the said pinion.

In testimony whereof I have affixed my signature.

ALVAH L. POWELL.