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1,852,890

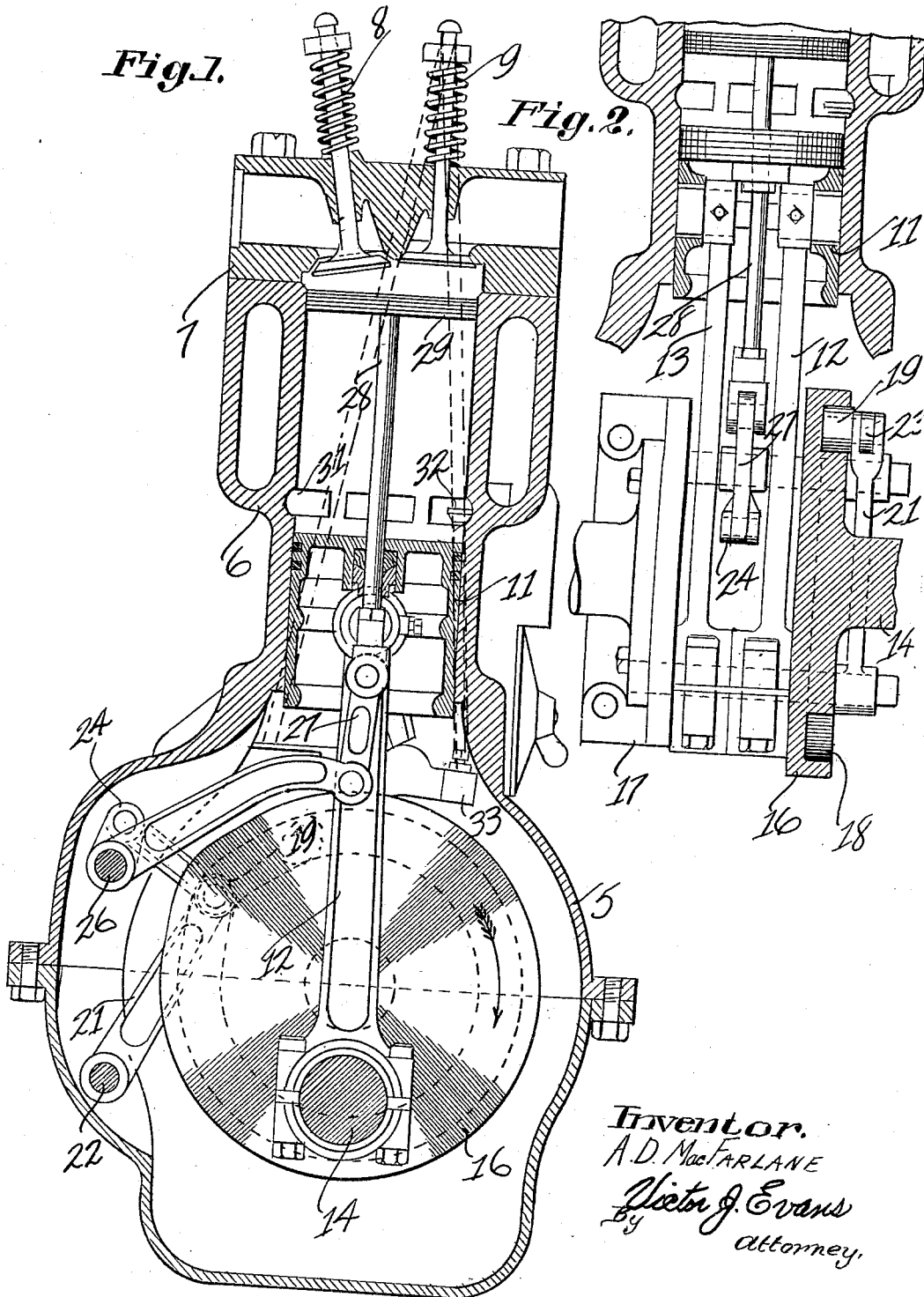
ENGINE

Filed March 7, 1930

2 Sheets-Sheet 1

*Fig. 1.*

*Fig. 2.*



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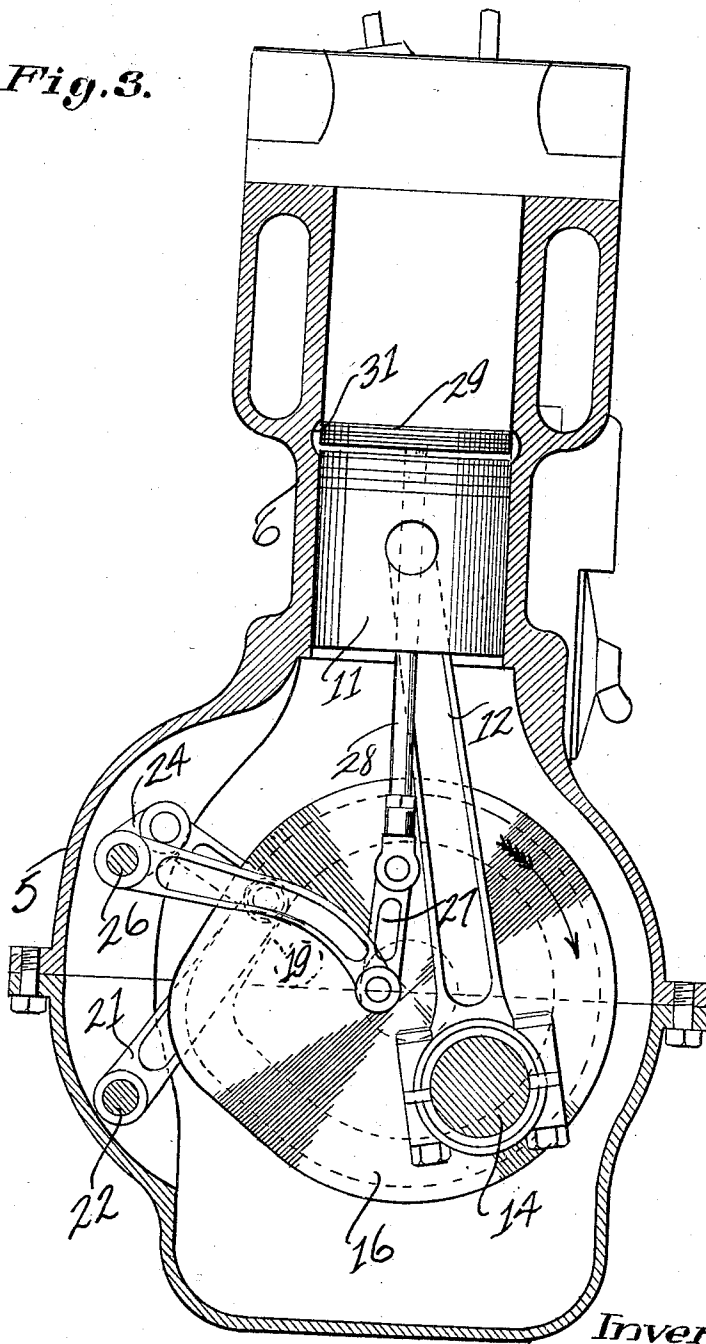
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*Fig. 3.*



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## UNITED STATES PATENT OFFICE

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## ENGINE

Application filed March 7, 1930. Serial No. 434,133.

This invention relates to improvements in engines.

The principal object of this invention is to produce an engine having a power stroke one exhaust and two intake strokes of the pistons for each revolution of the crank shaft.

Another object is to produce an engine which will function in the same manner as an ordinary internal combustion engine, namely by causing an explosion resulting in a power stroke and then exhausting the exploded gas to the atmosphere.

A further object is to produce a device which is relatively inexpensive to manufacture.

A still further object is to produce an engine which is positive in operation and therefore one which will function in proper sequence.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a vertical cross section of my engine,

Figure 2 is a fragmentary vertical cross section taken at right angles to that of Figure 1, in order to show the crank mechanism, and

Figure 3 is a view similar to Figure 1 but showing the pistons at substantially the bottom of the power stroke.

In the accompanying drawings wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 5 designates the customary crank case upon which is secured a cylinder 6 having a cylinder head 7 within which the exhaust valve 8 and intake valve 9 are positioned. Movable within the cylinder 6 is a piston 11 connected through the medium of connecting rods 12 and 13 to the crank of a crank shaft 14 (see Figure 2). Secured to the crank shaft 14 are cam discs 16 and 17. The cam disc 16 has cam grooves 18 formed therein, in which a roller 19 carried upon an arm 21 is pivoted as at 22 to the side of the crank casing 5. A

link 23 connects the free end of the arm 21 to a bell-crank 24 pivoted as at 26 to the crank case 5. The free end of the bell-crank projects between the connecting rods 12 and 13 and is connected by a link 27 to the lower end of a piston rod 28, which piston rod passes through the piston 11 and carries an auxiliary piston 29 upon its upper end.

A number of by-passes 31 is formed in the cylinder and at a point substantially even with the bottom of the power stroke. Within one of these by-passes is positioned an inlet valve 32 which operates simultaneously with the exhaust valve 8. These valves are operated through a lever 33 traveling on the cam 17.

The operation of my engine is as follows:—

Beginning at the end of the compression stroke, a spark occurs in the compression chamber above the pistons and ignites the gas compressed therein and as at this time the auxiliary piston remains upon the main piston. The result would be that both pistons will travel downwardly thus transmitting power through the crank 12 and 13 to the crank shaft 14. When the crank shaft approaches the point substantially forty-five degrees before lower dead center the roller 19 will approach a position in the cam groove 18 which will result in the auxiliary piston leaving the main piston and starting backwardly in an upward direction. At the same time the lever 33 riding upon the cam 17 will open the exhaust valve 8 and the inlet valve 32. As a consequence the burned gas will be exhausted and a fresh charge of gas will be drawn in at a point between the auxiliary piston 29 and the main piston 11. Upon reaching the lower dead center, the cam 17 operates to close the exhaust valve and the intake valve 32 and the intake valve 9 is opened. The auxiliary piston now starts to travel down drawing in a first charge through the valve 9, at the same time compresses the charge confined between the two pistons.

At thirty-five degrees beyond lower dead center the upper intake valve closes and as the auxiliary piston approaches the main piston the charge compressed therebetween will pass around the by-pass 31 and enter

into the cylinder at a point above the pistons. This double charge is now compressed by the upper movement of the pistons and when the pistons arrive at substantially top dead center a spark again occurs and the cycle has  
5 been completed.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the  
10 same and that various changes relative to the material, size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claim.

15 Having thus described my invention, I claim:—

In a device of the character described, a cylinder, a crank shaft positioned beneath said cylinder, a piston movable in said cylinder and connected to said crank shaft, a cam  
20 secured to said crank shaft, a second piston mounted in said cylinder, a rod extending thru said first mentioned piston and connected to said second mentioned piston, levers  
25 interposed between said rod and said cam whereby the movement of said second mentioned piston may be varied with relation to the movement of said first mentioned piston, a by-pass formed in said cylinder at a point  
30 adjacent the lower most point of movement of said pistons, an intake valve positioned in said by-pass, an intake valve positioned above said second mentioned piston, an exhaust valve positioned above said second mentioned piston, means for opening said first  
35 mentioned intake valve and said exhaust valve simultaneously, means for opening said second mentioned intake valve whereby a charge of gas may be delivered above said  
40 second mentioned piston to be mixed with a charge admitted thru said first mentioned intake valve in the manner and for the purpose described.

In testimony whereof I affix my signature.

45 ARTHUR D. MACFARLANE.

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