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INTERNAL COMBUSTION ENGINE

Filed April 10, 1935

2 Sheets-Sheet 1

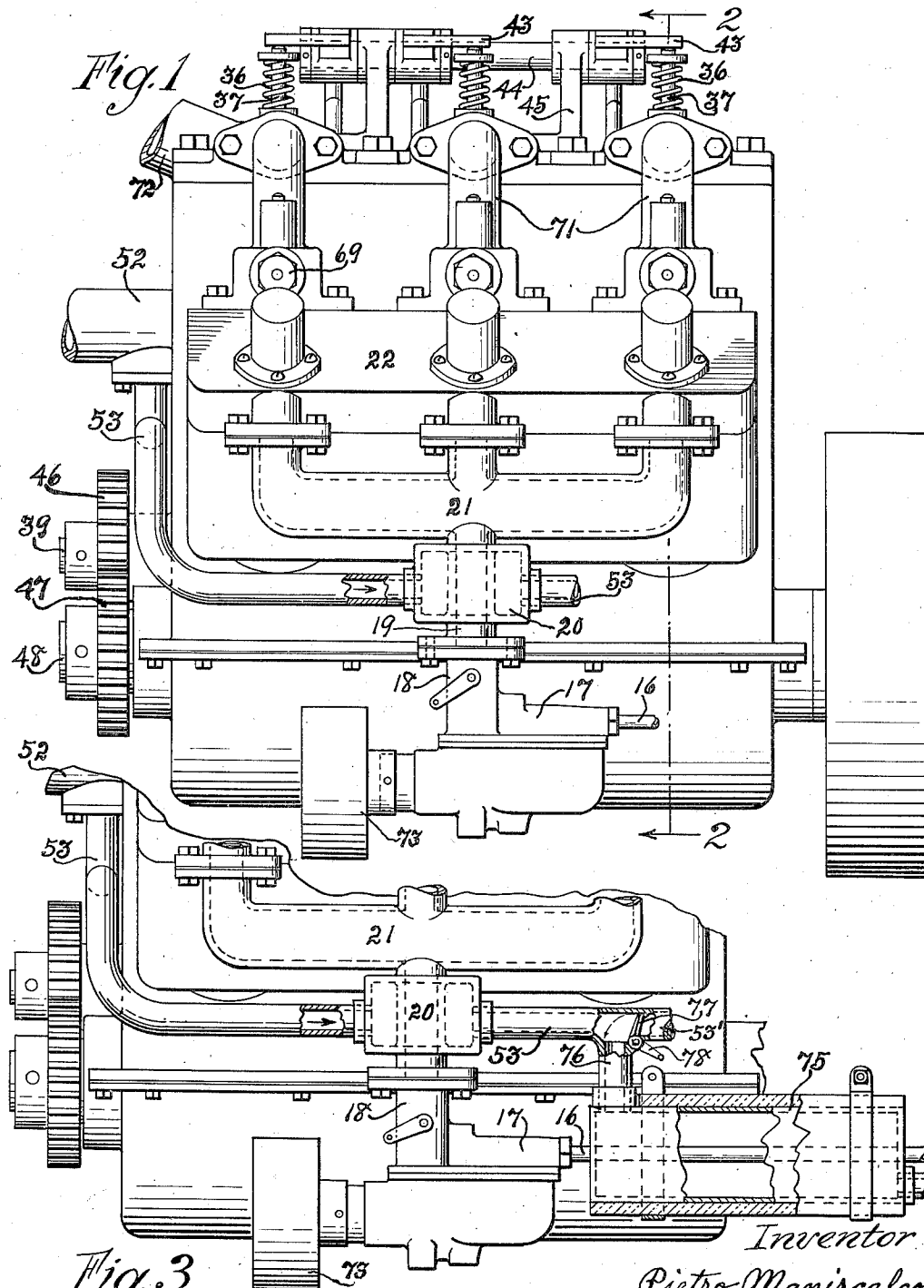


Fig. 3

Inventor
Pietro Maniscalco
by J. Daniel Stuewe
Attorney.

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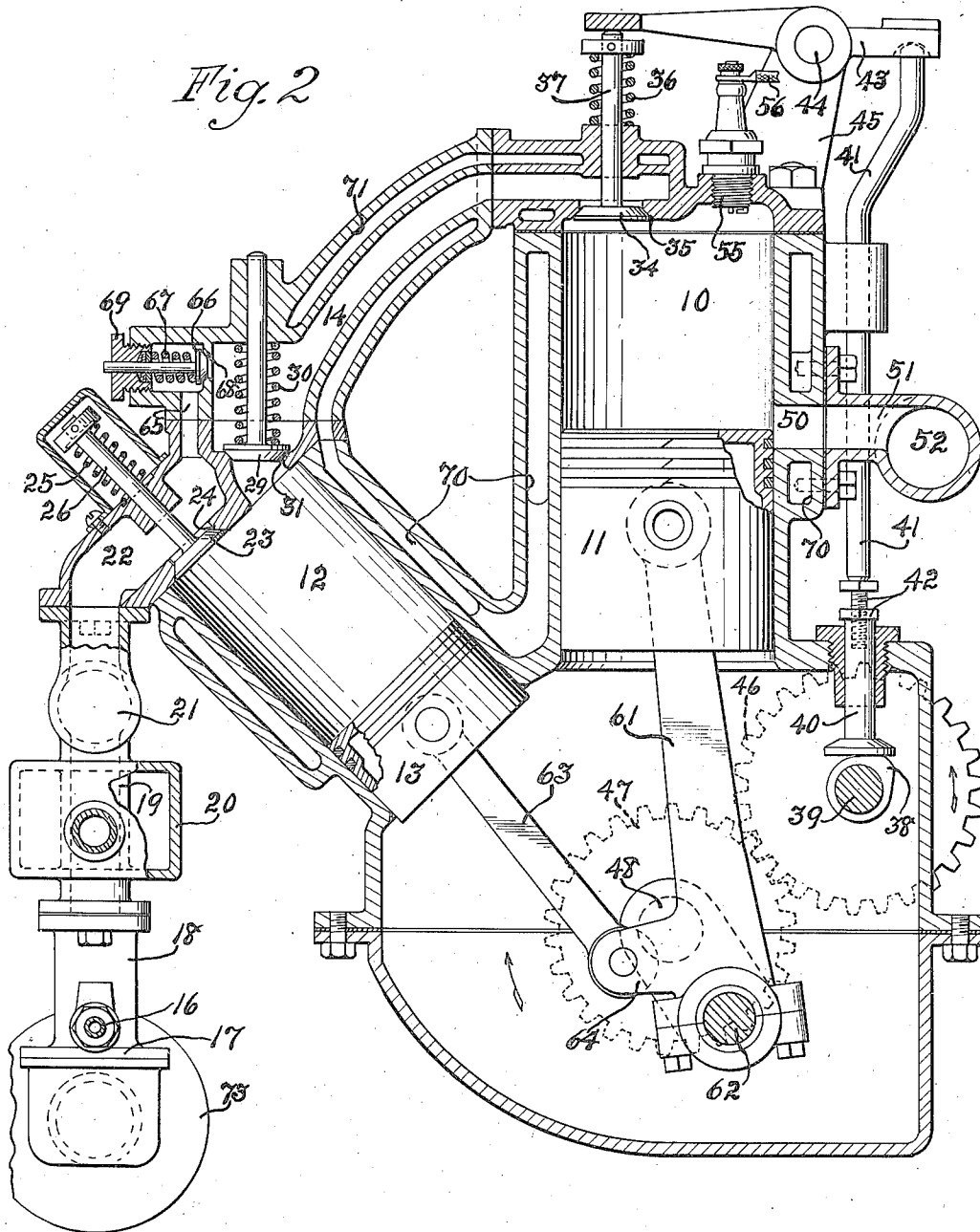
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Inventor
Pietro Maniscalco
by Daniel Stueve
Attorney

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INTERNAL COMBUSTION ENGINE

Pietro Maniscalco, Toledo, Ohio

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8 Claims. (Cl. 123—72)

This invention relates to a novel and improved internal combustion engine.

One of the main objects of this invention is to provide an improved internal combustion engine which is adapted to handle either high grade or low grade fuel and to utilize a lean mixture and feed it at a constant flow, so as to provide an uninterrupted power development at a maximum of efficiency.

Another object is to provide a two-cycle engine having means to precompress and preheat the fuel mixture before feeding it to the combustion cylinder, whereby to utilize a positive, constant and exactly measured amount of fuel under the various conditions of operation.

A further object is to provide such an engine which is provided with means for storing a certain amount of fuel mixture and admitting it to the combustion cylinder under pressure and heat and at the proper time to materially assist in clearing burnt gases from said cylinder and provide for a proper flushing of the cylinder area and a cleaner and more powerful mixture charge, consequently producing a longer action against the piston and a more powerful piston stroke.

A still further object is to provide such an engine adapted to use high grade or low grade fuel and which can be readily converted into a Diesel type or a semi-Diesel type of engine, by the mere addition or attachment of a preheating chamber to the fuel supply line, which utilizes the engine exhaust gases as the heating agent and from thereon operates the engine under Diesel principle.

These and various other objects and advantages will become apparent from the following description, taken in connection with the accompanying drawings, in which the invention is illustrated in its preferred form of construction, it being understood that various other arrangements and forms of construction may be resorted to for carrying out the objects and purposes of this invention.

In the drawings:

Fig. 1 is a side view of a two-cycle engine illustrating my invention in its preferred form of construction.

Fig. 2 is a vertical sectional view thereof, taken along line 2—2 of Fig. 1.

Fig. 3 is a partial side view showing my improved engine with the addition of a preheating chamber through which a part of the fuel supply line extends, thereby adapting this invention for a Diesel type of engine.

In the drawings my invention is illustrated in its preferred form of construction which comprises a combustion or ignition cylinder 10 wherein the fuel mixture is ignited and which contains a piston 11; and a supercharging cylinder 12 wherein the fuel mixture is precompressed and

preheated and which contains a piston 13; also a receiving chamber 14 which operatively connects the two cylinders and is of proper size to store the required and definite amount of precompressed and preheated fuel mixture received from cylinder 12 and to admit the same to cylinder 10 under the proper temperature and pressure to provide a positive feed and utilize all the available power stroke of piston 11.

The fuel charge is conducted through fuel supply line 16, from a suitable source of supply, to carburetor 17, and the premixed charge then enters mixing chamber 18 wherefrom it passes through conduit 19 which extends through a prewarming compartment 20 to intake manifold 21, wherefrom the charge flows to a passage or chamber 22 provided at the upper end of cylinder 12. A valve element 23 closes the opening in valve seat 24 and is movable therefrom into cylinder 12 to admit fuel charge thereto from passage 22.

The downstroke of piston 13 compels valve element 23 to move from its seat and admit the fuel charge by suction from passage 22 to supercharging cylinder 12, thereby depressing spring 25 on valve stem 26. When the downstroke of piston 13 is completed valve 23 automatically moves to closed position by the action of spring 25, and the mixing is confined in cylinder 12.

A valve element 29 is moved by a compression spring 30 to its closed position on valve seat 31 thereby closing the valve opening and stopping communication between cylinder 12 and storage passage 14. This spring is of sufficient strength to retain the valve closed during the main upward or return stroke of piston 13, so that the mixture in the supercharging cylinder will be compressed to the desired extent, and so that it will open when a predetermined pressure of the mixture is reached.

The fuel and air mixture is preheated and vaporized by such compression in the supercharging cylinder, and it then enters the receiving and storage passage 14, where it maintains its pressure and heat created by the compression stroke of supercharging piston 13 in cylinder 12. At the end of the upward stroke of piston 13 valve 29 closes due to the pressure of spring 30, and the preheated and precompressed mixture is retained in passage 14.

A mechanical valve 34 closes a valve seat 35 provided in the upper end of cylinder 10, thereby stopping communication between said cylinder and storage chamber 14. This valve is normally held closed by a spring 36, provided on valve stem 37, until it is opened mechanically by the valve actuating elements.

In the form illustrated these actuating elements include a cam 38 on a cam shaft 39 to actuate a stem 40 which is adjustably connected

to a rod 41 by threaded means 42, whereby to adjust the length of the rod. The upper end of said rod actuates a lever 43 pivoted at 44 on a bracket 45 provided on the cylinder casing, while the free end of lever 43 engages valve stem 37 whereby to open valve 34 against the action of spring 36, so as to open the valve at the proper time for admission of the fuel charge to cylinder 10, through the operation of the timing gears 46 and 47 mounted respectively on cam shaft 39 and crankshaft 48.

An exhaust port 50 is provided in the peripheral wall of cylinder 10, substantially midway of its length, and communicates through a channel 51 with exhaust manifold 52. A pipe 53 extends from the exhaust manifold to the prewarming compartment 20 and forms a bypass to conduct hot exhaust gases into said compartment for heating the mixture in conduit 19 which extends through said compartment.

Port 50 is so placed, and the mechanism for operating valve 34 is so arranged and timed, that the valve starts opening before exhaust port 50 is fully uncovered by the descending piston, thereby admitting the precompressed charge to combustion cylinder 10 in time to cause said charge to assist in clearing the cylinder of dead gases formed therein from the previous explosion. When these exhaust gases have thus been forced out of cylinder 10, and the exhaust port 50 is closed by piston 11 during its upward or compression stroke, the combustion cylinder will thereupon be filled with a clean mixture of fuel and air obtained from the storage chamber 14; whereupon valve 34 is released from pressure by lever 43, through the action of the timing mechanism, and spring 36 then closes said valve. The final compression then takes place by piston 11 completing its upward stroke; whereupon the highly compressed mixture is fired by the action of spark plug 55 which is mounted in the upper end of piston 10 and is provided with electric current through the electric conductors 56 connected with suitable current supplying means, whereby piston 13 is forced downward on its power stroke, until it clears the exhaust port 50 at the end of its stroke, whereupon the burnt gases are ejected into exhaust manifold 52.

A piston rod 61 is pivoted to piston 11 and is rotatably mounted on the crank pin 62 of crankshaft 43; and a piston rod 63 is pivoted to piston 13 and is pivotally connected to a bracket arm 64 which is offset or extends laterally from rod 61. Such offset connection of rod 63 of the supercharging piston to rod 61 of the main piston provides a definite advance of stroke of the former relative to the latter. This permits a dependable control of admission of fuel through either the automatic valve or the mechanical valve, for governing the interrelation with the combustion chamber and the timing of the power stroke and the precompression stroke, arranging same to be adjustable for different fuel mixtures.

A safety valve is provided to prevent accumulation of excessive pressure in storage chamber 14. This comprises a channel or bypass 65 formed in the top part of cylinder 12, connecting chamber 14 with chamber 22. Said bypass is normally held closed by a valve element 66 pressed by a spring 67 against its valve seat 68. The tension of the spring and the opening of said valve is adjustable by means of an adjusting nut 69, so that the valve will open to admit mixture from chamber 14 into chamber 22 when the pressure in chamber 14 becomes too great,

due to improper functioning of valves 29 and 34, etc.

Cooling jackets 70 are provided around the two cylinders and communicate with a cooling jacket 71 provided around the storage chamber 14, while a hot water return pipe 72 conducts the hot water from said jackets to a suitable radiator (not shown).

An air intake and filter 73 is also provided on carburetor 17 for admitting clean air thereto.

In Fig. 3 I have illustrated how this improved construction is adapted and arranged to be readily convertible from a light fuel or gasoline consuming engine to a Diesel or semi-Diesel type of engine for consuming heavy or low grades of fuel. As is indicated in the drawings, the various parts shown in Fig. 3 are identical with those shown in Fig. 1, and thereto is applied or added a preheating device, as for example a preheating chamber 75, which is connected with the fuel supply pipe 16 and with the exhaust bypass pipe 53, preferably by having the fuel pipe 16 extend through this chamber and by having the bypass pipe 53 conduct exhaust gases into said chamber, so as to utilize the hot exhaust gas of the engine as the heating agent, and from thereon to operate the engine under Diesel principle.

In order to make this device more easily convertible from a gasoline engine to a Diesel type of engine, a branch pipe 76 is extended from bypass pipe 53 to preheating chamber 75, and a valve 77 with means 78 for readily operating it is placed at the junction of the two pipes; so that the valve may be readily set to close branch 76 and conduct the hot exhaust gas through the outlet part 53' of bypass 53, when gasoline or light fuel is being used, or outlet 53' may be closed, as shown in Fig. 3, and the hot exhaust gas directed through branch 76, to preheat the heavy fuels which are therewith being used and are then conducted through fuel supply pipe 16 which extends through said chamber, for operating the engine under Diesel principle.

I claim:

1. An internal combustion engine comprising a combustion cylinder containing a piston having a rod thereon provided with an offset arm, a supercharging cylinder adjacent said cylinder and containing a piston having a rod thereon which is pivotally connected to said arm, a storage conduit provided at its two ends with a pair of spring-closed valves operatively connecting it with said two cylinders, mechanical means including a rod with adjustable means for operating and for regulating the action of the valve associated with the combustion cylinder, and means for operating the piston rods and said adjustable rod and valve, whereby to provide for a definite advance of stroke of the supercharging piston ahead of the other piston.

2. An internal combustion engine comprising a supercharging cylinder and a channel having an automotive valve adapted to admit fuel to said cylinder from the intake manifold, a combustion cylinder adjacent said cylinder, a piston in each cylinder and a pair of pivotally connected rods thereon for operating the same, a storage chamber between said cylinders having an automatic valve adapted to admit precompressed fuel thereto from the supercharging cylinder, said chamber having a mechanical valve adapted to admit fuel therefrom to the combustion cylinder, means including a lever and an adjustable member connected thereto to actuate the mechanical valve, and means for operating

the piston rods and the adjustable member and associated valve, thereby providing a properly measured precompressed and preheated fuel charge and a positive feed thereof to the combustion cylinder, and a relief valve operable to return excess charges of fuel in said storage chamber to the intake manifold to prevent excess pressure in said storage chamber.

3. An internal combustion engine comprising a supercharging cylinder and a combustion cylinder adjacent thereto, a piston in each cylinder and rods connected together and to the pistons for operating them together, a valve controlled channel for admitting fuel to said supercharging cylinder, a chamber in the form of a conduit having a valve at one end for admitting precompressed fuel thereto from the supercharging cylinder and having a valve at the other end for admitting said fuel from the chamber to the combustion cylinder, said chamber being adapted to store a proper amount of precompressed and preheated fuel and provide a positive feed thereof to the combustion cylinder, and a bypass provided in the head end part of the supercharging cylinder, said bypass leading from said chamber to said channel and provided with a spring-closed safety valve and with means for adjusting the spring tension to regulate the valve and prevent excessive pressure accumulating in said chamber.

4. An internal combustion engine comprising a combustion cylinder containing an exhaust port and a piston having a rod with an offset arm, a supercharging cylinder adjoining and integral with said cylinder and containing a piston having a rod pivoted to said arm, to provide a definite advance of stroke of the supercharging piston ahead of the other piston, a chamber having a spring-closed valve at one end for receiving a definite amount of precompressed fuel from the supercharging cylinder and having a mechanical valve at the other end for admitting the fuel to the combustion cylinder, a lever to actuate said mechanical valve, an adjustable rod to actuate said lever, and means for operating the piston rods and the adjustable rod so that said mechanical valve will begin to open before the exhaust port is fully uncovered, to aid in flushing burnt gas from said cylinder and have a clean succeeding charge.

5. In an internal combustion engine having an intake manifold and a carburetor and a conduit connecting the two, a fuel supply pipe connected to the carburetor, a combustion cylinder and an exhaust manifold connected thereto and provided with a bypass pipe for conducting exhaust gas from the cylinder, a cylinder receiving fuel mixture from said manifold and precompressing it, valve equipped means connecting said two cylinders adapted to receive and store a certain amount of precompressed and preheated fuel mixture from the precompressing cylinder and admitting it to the combustion cylinder, a prewarming compartment interposed in said bypass pipe and surrounding said conduit, and a preheating chamber adjacent the carburetor receiving exhaust gas from said bypass pipe and wherethrough said fuel supply pipe passes, whereby the hot exhaust gas from the engine is utilized as the preheating agent for the fuel to

enable the engine to be operated under the Diesel principle.

6. In an internal combustion engine having an intake manifold and a carburetor and a conduit connecting the two also a fuel supply pipe connected to the carburetor, a combustion cylinder provided with means including a pipe for conducting exhaust gas from the cylinder, a cylinder receiving fuel mixture from said manifold and precompressing it, means connecting said two cylinders adapted to receive and store a certain amount of precompressed and preheated fuel mixture from the precompressing cylinder and effecting a positive feed thereof to the combustion cylinder, a prewarming compartment connected with said exhaust gas pipe and surrounding said conduit to prewarm the fuel mixture admitted to the latter, a preheating chamber connected with said exhaust gas pipe and wherethrough said fuel supply pipe extends near its connection with the carburetor, whereby the hot exhaust gas from the engine is utilized as the preheating agent for the fuel to enable operating the engine under the Diesel principle, and control valve means connected with said exhaust gas pipe and preheating chamber operable to admit hot exhaust gas thereto and likewise to exclude it therefrom, whereby to use the engine interchangeably for heavy fuel or for light fuel.

7. An internal combustion engine including, a power cylinder and its piston, a valved inlet and an exhaust for said power cylinder, a charge forming cylinder and its piston, valved inlet and outlet ports therefor, means for reciprocating said pistons in their said respective cylinders, a fuel charge chamber intermediate said cylinders for receiving fuel charges from said charge forming cylinder through the valved outlet thereof and delivering the fuel charge to the power cylinder through the valved inlet thereof, and a relief valve for said fuel charge chamber operable to relieve fuel charges therein and return excess amounts thereof to the inlet side of the charge forming cylinder when pressure in the chamber exceeds a predetermined amount.

8. An internal combustion engine including, a power cylinder and its piston, a valved inlet and an exhaust for said power cylinder, means for controlling the operation of said inlet valve of the power cylinder so as to open at a predetermined period of the cycle of the engine, a charge forming cylinder and its piston, valved inlet and outlet ports therefor, means for reciprocating said pistons in their said respective cylinders, with the stroke of the piston in the charge forming cylinder at a definite advance of the stroke of the piston in the power cylinder, a fuel charge chamber intermediate said cylinders for receiving fuel charges from said charge forming cylinder through the valved outlet thereof and delivering the fuel charge to the power cylinder through the valved inlet thereof, and a relief valve for said fuel charge chamber operable to relieve fuel charges therein and return excess amounts thereof to the inlet side of the charge forming cylinder when pressure in the chamber exceeds a predetermined amount.