

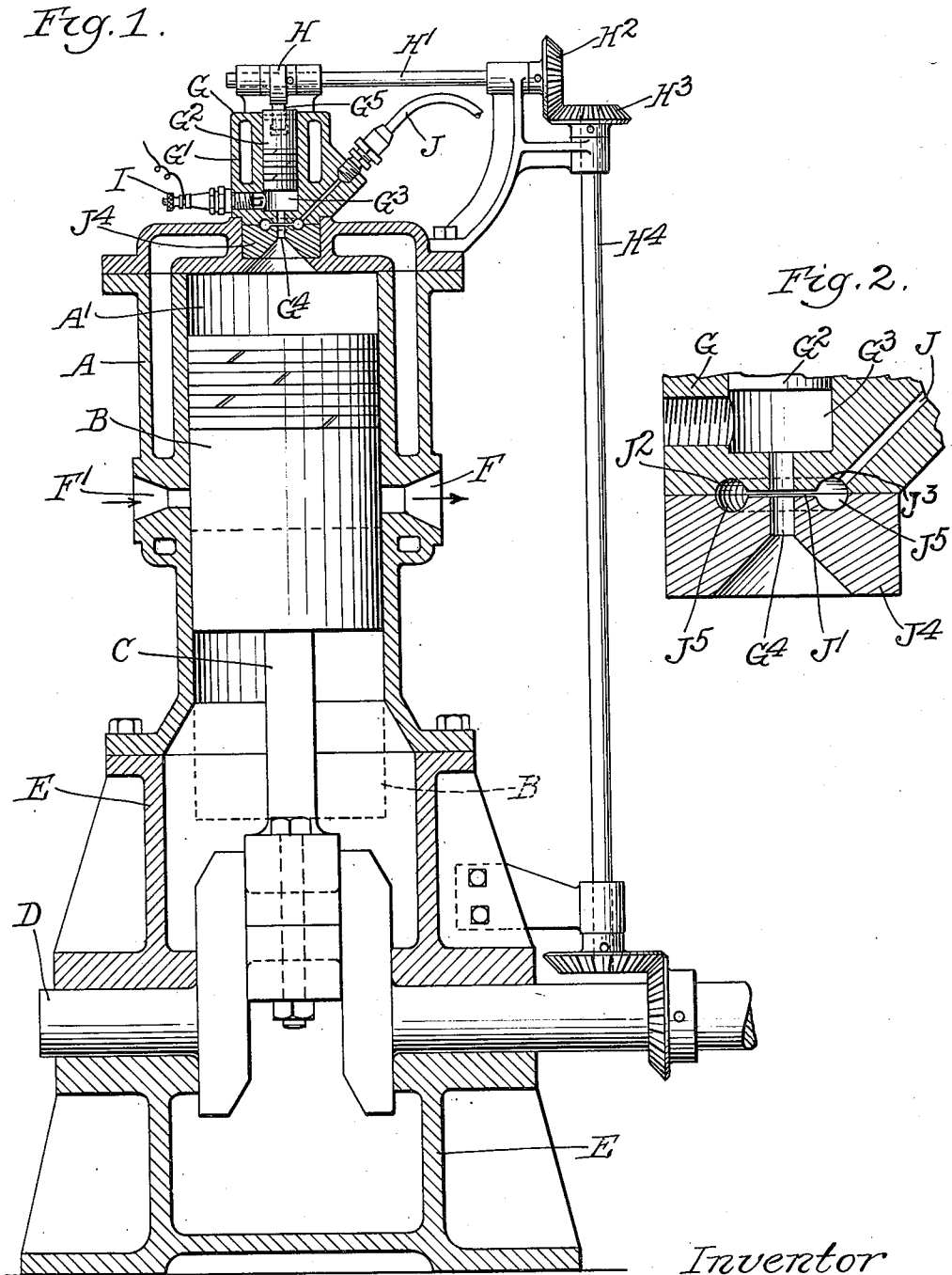
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P. L. SCOTT

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PROCESS OF MIXING AND BURNING FUEL

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Inventor
Philip Lane Scott
by Parker + Carter
Attorneys, s.

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PROCESS OF MIXING AND BURNING FUEL

Philip Lane Scott, San Mateo, Calif.

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7 Claims. (Cl. 123—33)

My invention relates to certain new and useful improvements in internal combustion engines, which are described as follows:

The invention relates particularly to the method of preparing a fuel-air charge for combustion in an internal combustion engine in which fuel is introduced into a rapidly moving air current caused by passage of a part of the air charge back and forth between the main cylinder and an auxiliary chamber promoting an intimate mixture between the air and fuel, the time of ignition and the subsequent rate of burning being under control, as well as the compression and rate of passage of air and fuel into and between the chambers. The invention relates particularly to engines having the conventional cylinder and piston and using a relatively non-volatile oil as fuel.

For convenience the system is shown diagrammatically, applied to a two-stroke cycle engine of conventional form, using heavy oil as fuel, but it is to be understood that it may be applied to a wide variety of engine forms and to the use of many different fuels.

My invention is illustrated more or less diagrammatically in the accompanying drawing, wherein—

Figure 1 is a vertical cross section through an engine;

Figure 2 is a detailed section on an enlarged scale, illustrating a portion of the fuel feeding mechanism.

Like parts are designated by like characters throughout the specification and drawing.

A is an engine cylinder with a main combustion space A^1 . B is a piston therein. C is a connecting rod joining the piston to the crank shaft D. E is a housing or crank case. F is the port through which burnt gases are exhausted and F^1 is the port through which air is forced by any well known means for the clearing of burnt gas and the recharging of the cylinder.

G is a mixer head, provided with a cooling jacket G^1 , which may be omitted, having a close fitting piston G^2 slidably mounted in the barrel G^3 . Connecting this barrel or mixing space G^3 with the combustion space A^1 is a throat G^4 into which opens the fuel atomizing port J^1 , supplied through a canal J^2 in the body. J is a fuel inlet supplying this system with fuel, which may be under pressure, as from a pump or other pressure source. The fuel inlet passage J^2 is shown as formed partially by means of an annular channel J^3 cut in the bottom of the mixer head G and as being completed by the head J^4 , provided with

an annular channel J^5 . The member J^4 is so formed that on the inner side it does not contact the bottom of the member G and thus a sufficient clearance is provided to form the fuel atomizing port J^1 . As shown this is an annular port extending entirely about the throat G^4 . It might, however, be of any suitable form and need not be continuous. In place of the fuel discharge arrangement shown, any suitable atomizing valve might be used to supply fuel to the mixing chamber. On the upper end of the piston G^2 is mounted a roller G^5 which is driven by a cam H, imparting axial motion to the piston. This cam is rotated by means of a shaft H^1 , upon which is a gear H^2 , meshing with a gear H^3 on a shaft H^4 driven by the engine. This drive is not shown in complete detail and may be of any suitable nature.

I is a spark plug or ignition device which may be used. For some purposes such an ignition device is desirable. For other purposes it is not and it is not an essential part of my invention.

It will be realized that whereas I have herewith shown and described a practical operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of my invention, and, therefore, I wish my showing to be taken as in a sense diagrammatic.

Particularly, the auxiliary or compression cylinder might be uncooled. The cooling jacket G^1 would thus be omitted.

The method of operation of my invention is as follows:

In the position of the parts shown in the figure, it is assumed that the exhaust has taken place and a fresh charge of air has been segregated or trapped in the cylinder. This charge is being compressed. At some point in the compression stroke, the piston G^2 in the mixing chamber is permitted to recede by the cam, being forced back by the pressure in the main chamber. The piston might be positively operated by any suitable mechanism, timed to cause its withdrawal at the appropriate period in the engine cycle. During this phase, fuel is fed into the moving air stream. The fuel may thus be fed through one or more discharge openings appropriately placed to act in conjunction with the moving air currents. The speed of the motion of the air, its drop in pressure and the resulting drop in temperature, is controlled partly by the rate of motion of the piston G^2 and as to temperature, partly by the degree of cooling applied to the chamber G^3 . The degree of atomization of the

fuel and the intimacy of its mixture with the air finally admitted to the mixing chamber, is controlled by the construction of the fuel admission orifice and by the air speed and pressure and temperature conditions just mentioned. The amount of air so mixed with the fuel, in proportion to the total amount of air originally entrapped within the main cylinder, is controlled by the size of the mixing chamber and the amount of recession of the piston lying therein. The amount of fuel mixed with this quantity of air is controlled by the fuel feeding mechanism. The proportion of air to fuel in this chamber may then be varied through a wide range, permitting mixtures all the way from too lean for combustion through combustible ratios to and including too rich for combustion. For the purpose of this description the expressions "lean mixture", "rich mixture" or "combustible mixture" are taken from the terminology commonly used in describing carbureting engines in referring to fuel air ratios, although in this case the fuel may not be, especially if the oils are relatively non-volatile, in a truly dry gas condition, as they are supposed to be in considering the carbureting engine.

This fuel air mixture in the chamber G³ is then discharged into the main chamber A¹ at a predetermined point in the engine cycle, inflammation occurring as the result of an increase in pressure due to evacuation of the chamber G³ or to further motion of the piston B or a combination of the two. It is also possible to cause initial inflammation by some auxiliary means, such as a spark or a hot wire. This discharging of the fuel air mixture further promotes mixing and atomization and further fuel may be added during this phase, providing further means for controlling the combustion process to secure the maximum release of energy in a given size of chamber. Depending on the condition of the mixture in the chamber and the temperature and pressure conditions prevailing, inflammation will occur either in the chamber G³ or in the chamber A¹ or in both, and may also be influenced by the motion of the piston G². The outward rush of the fuel air mixture from the mixing chamber into the charge of pure air promotes intimate mixing between this initial fuel air charge and the remaining air, for the purpose of securing complete combustion.

It is possible that conditions may make it desirable to have the evacuating stroke of the piston in the mixing chamber occur at or after the upward dead center position of the piston in the main cylinder.

I claim:

1. The method of mixing fuel and air for combustion in an internal combustion engine, which consists in compressing a body of air in a main cylinder, creating a current of air under pressure by moving a substantial portion of said compressed air to an auxiliary chamber in communication with the main cylinder, said current of air being timed and controlled independent of the compression of the air in the main cylinder, feeding fuel under substantial pressure to said current of air and igniting the fuel and air.

2. The method of mixing substantially all the fuel and air charge for combustion in an internal

combustion, which consists in compressing a body of air in a main cylinder, creating a current of air under pressure by moving a substantial portion of said compressed air to an auxiliary chamber in communication with the main cylinder, said current of air being timed and controlled independent of the compression of the air in the main cylinder, feeding fuel under substantial pressure to said current of air and igniting the fuel and air.

3. The method of mixing within a confined space fuel and air for combustion in an internal combustion engine, which consists in compressing a body of air in a main cylinder, creating a current of air under pressure by moving a substantial portion of said compressed air from the main cylinder to an auxiliary chamber through a relatively non-turbulent passage of substantial area, said current of air being timed and controlled independent of the compression of the air in the main cylinder, feeding fuel under substantial pressure to said current of air and igniting the fuel and air.

4. The method of mixing within a confined space substantially all the fuel and air charge for combustion in an internal combustion engine, which consists in compressing a body of air in a main cylinder, creating a current of air under pressure by moving a substantial portion of said compressed air to an auxiliary chamber in communication with the main cylinder, said current of air being controlled and timed independent of the compression of the air in the main cylinder, feeding fuel under substantial pressure to said current of air and igniting the fuel and air.

5. The method of mixing a liquid fuel charge with air and burning the resulting mixture, which comprises compressing the body of air in a chamber, setting up a rapidly moving current of air between said chamber and a communicating chamber, supplying liquid fuel to said current of air at its point of maximum velocity and igniting the mixture, said current of air being timed and controlled independent of the compression of the air in said first mentioned chamber.

6. The method of mixing a liquid fuel charge with air and burning the resulting mixture, which comprises compressing a body of air in a chamber, setting up a rapidly moving current of air between said chamber and a communicating chamber, supplying liquid fuel to said current of air at its point of maximum velocity, and igniting the mixture by the heat of compression, said current of air being timed and controlled independent of the compression of the air in said first mentioned chamber.

7. The method of mixing a liquid fuel charge with air and burning the resulting mixture, which comprises compressing a body of air in a chamber, setting up a rapidly moving current of air between said chamber and a communicating chamber, supplying liquid fuel to said current of air at its point of maximum velocity and igniting the mixture by auxiliary means, said current of air being timed and controlled independent of the compression of the air in said first mentioned chamber.

PHILIP LANE SCOTT.