

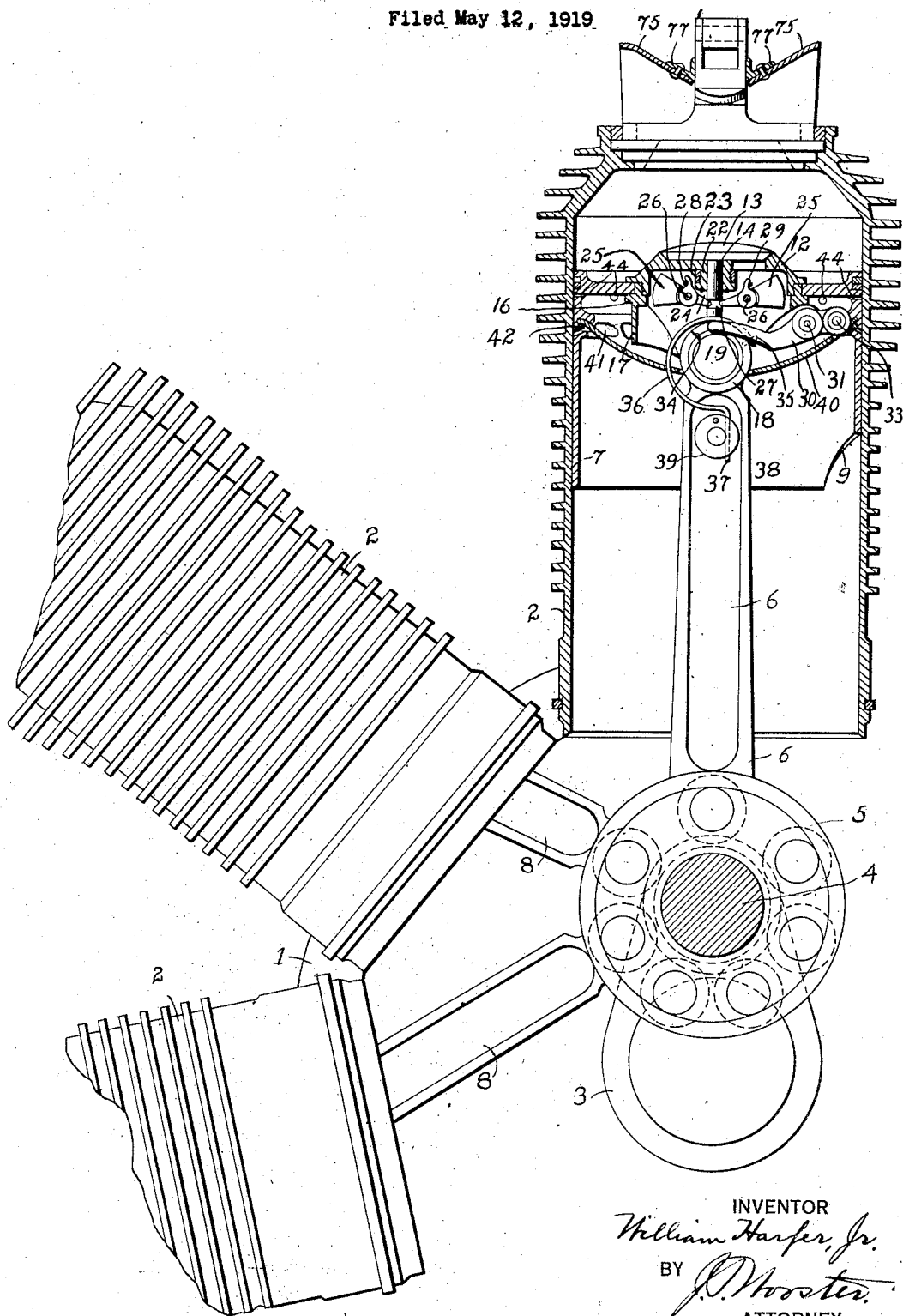
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METHOD FOR TREATING ENGINE FUEL

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METHOD FOR TREATING ENGINE FUEL.

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To all whom it may concern:

Be it known that I, WILLIAM HARPER, JR., a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods for Treating Engine Fuel, of which the following is a specification.

This invention relates to method and apparatus for producing and burning gaseous mixture, and has particular reference to a method and apparatus whereby the fuel required by a combustion engine can be more effectually gasified and consumed in the engine.

At the present time a device known as a carbureter, which is in substance a special form of aspirating atomizer, is used for producing the combustile gaseous mixture, but it is found in practice that although theoretically tending to produce a true gas or vapor, it in fact only produces a partial gas or vapor intermingled with unchanged spray particles. At the present time various efforts are made to eliminate these spray particles, as by the use of so-called "hot spots", and also various mechanical devices, such as movable vanes, have been put in the gas passage in an attempt to mix up or remove these spray particles. These devices are inefficient and wasteful and only partially overcome the trouble.

It is the object of this invention to provide a method and apparatus whereby it is insured that only gas or vapor, without spray, will pass into the engine cylinder, and obtain a large economy in fuel consumption, as well as a gain in power will be obtained, because it is well understood that spray particles do not have time to be completely consumed in a modern high speed engine, but are simply partially consumed and leave a residue of carbon, which is deposited on the cylinder and valve surfaces.

By the method of this invention a combined mixture of fuel gas or vapor, air and spray may be so separated by centrifugal action and heat as to completely eliminate all spray particles before entering the cylinder.

Unvaporized fuel, in the form of drops or minute spray, is heavier than gaseous vapor, so that if centrifugal force is imparted to a

mixture of air, vapor and spray, and the path of this mixture suddenly changed, it results that the heavier particles constituting the spray will be trapped, while the air and vapor, owing to their ability to more readily change their direction by reason of their less energy pass on into the engine. If now the space wherein the heavier particles are trapped be heated, a secondary vaporization of these condensed particles can be effected, so that a complete and uniform gas will be supplied to the engine. By this method it is possible to lubricate engines by spraying the lubricant into the centrifugally moving body of air, fuel, vapor and spray, permitting the lubricant to be condensed and fed to the moving surface without going into the engine cylinder, where it causes further deposition of carbon. Again, by this method it is possible to separate a heavy oil into gaseous fuel constituents which will be burned in the engine cylinder for power, and heavier lubricating constituents which will be condensed before passing into the cylinder, and supplied to the wearing surfaces.

The method is of special advantage for application to combustion engines of the rotary cylinder type, as heretofore it has been difficult to operate these engines either with economy of fuel, or economy of lubricating oil, or for any long period of time, because of only getting a combustile mixture by feeding excess of fuel and oil which did not completely burn in the cylinder and always left heavy deposits of carbon and tar. As castor oil has been considered to be most satisfactory for lubricating engines of this type, but does not burn completely in the cylinder, it has resulted in a very high fuel and oil consumption and also a comparatively short working period before taking down and cleaning. Furthermore the unsatisfactory nature of the mixture actually received in the cylinder has resulted in throttling difficulties, preventing the maximum development of power, and also preventing any wide variation in the range of throttle speed.

In the accompanying drawing is shown a form of rotary cylinder engine for carrying out the method, but the method is applica-

ble to various other forms of apparatus other than the particular engine illustrated.

The figure shows a vertical elevation partly in section of an engine embodying the invention.

1 is the rotary casing carrying air cooled cylinders 2, 3 the fixed hollow shaft having crank pin 4. 5 is the master-ring rotating on crank pin 4 and carrying the rigid connecting rod 6 connected to the piston 7 in the upper cylinder 2. The other pistons 7 are connected to the master-ring 5 by pivoted connecting rods 8 in the usual manner. Each piston is also provided with the usual non-interference notch 9.

The trunk and head of the piston may be made in any desired manner but are shown in one piece, the head being open in the center to receive a webbed valve ring seat 12 having segmental gas ports and carrying valve 13 with the usual stem 14. Threaded into the ring 12 is a ring 16 having a depending flange or skirt 17, which forms with the piston exterior thereof, the oil spray baffling chamber, as will be hereinafter explained. The ring 16 also carries heavy depending lugs 18 forming a yoke and bored to receive the wrist pin 19, the wrist pin being secured in the usual manner. The valve stem bushing 22 is threaded into the lug 23 carried by the valve seat ring 12, and the bushing 22 carries depending ears 24 in which are pivoted the valve stem counterweight levers 25 pivoting being effected by a U-shaped pin 26, and the inner ends of the counterweight levers projecting into a slot 27 in the valve stem 14. The valve is normally held seated under slight pressure by means of a double coil spring 28, which engages the arms 29 on the counterweight levers 25. The spring 28 acting through the levers 25 holds the valve seated when the engine is at rest with the valve in normal seated position, and when the engine is operating, the weights 25 slightly overbalance the centrifugal force of the valve itself and hold it seated, so that centrifugal force is not relied upon in any respect to open the valve in this engine.

30 is the valve rocker pivoted at 31 in extensions on the skirt 17, and having the counterweight 33. When the valve is seated, the end of the lever 30 rests between the end of the valve stem and the wrist pin 19, the upper end of the connecting rod being slotted through a sufficient arc 34 to permit this. To operate the rocker 30, a stiff double spring actuator 36 is provided, which straddles the valve stem and the rocker and passes under the rocker and is adjustably connected at its lower end 37 by bolt 38 and notched clamp washers 39 to the master-rod 6, and likewise in the other cylinders, to the respective connecting rods 8. Pins 35 hold the end of the actu-

ator 36 when not flexed, so as to damp it and prevent vibration of the end under the high engine speed.

When the valve is seated, with the piston at its extreme upward position, the yielding rocker actuator 36 is not under any stress but as the piston moves down in the cylinder owing to rotation of the cylinder to the left of the crank pin 4, the actuator 36 lifts the rocker 30 and imparts to the valve a multiplied movement, causing the valve to open if the cylinder is working on the suction stroke. During the working stroke, the cylinder pressure holds the valve seated against the lifting force of the yielding actuator 36, as in the intermediate cylinder shown on the drawing, which is part way through the working stroke. The exhaust occurs during the outward stroke while the actuator 36 is out of contact with the rocker 30. The actuator 36 is adjustable vertically in the clamping device so as to change the timing, it being seen that by adjusting the actuator upward the valve opens sooner than when it is adjusted so as to bring the part which engages with the rocker 30 slightly out of contact therewith. Also, the actuator can readily be bent to change the leverage or timing, if desired, and still hold it normally engaged with pin 35.

Within the piston is a dished plate 40 having ports 41 adjacent its periphery, for deflecting the fuel and oil spray outwardly, this plate being seated in the piston and held by an expanding spring ring 42, the ports 41 being above the bottom of the skirt 17, so that the mixture of firing charge and lubricating oil spray first strikes plate 40 and drops considerable oil, and then passes upwardly through the ports 41 and is again deflected around the lower edge of the skirt 17 before passing upwardly to and through the valve. The oil spray particles being heavier than the firing charge and having greater centrifugal velocity condense on these surfaces and run through lubricating holes 44 in the piston to the cylinder surface. The ports 41 are triangular, and have raised rims on the inner side towards the crank shaft, so as to prevent drops of oil forming on the edges of the ports and being drawn through.

In order to aid in the exhaust of the gases, a hood 75 is provided, this hood opening on one side in the direction in which the cylinder is rotating so as to take in air and cause it to blow across the exhaust valve and then out at the rear side of the hood, thus not only cooling the exhaust valve but aiding in the exhaust of the gases by eduction.

By applying the method of this invention to the above described engine, using an ordinary carbureter connected to the hollow shaft and an oil spray pump discharging into the air, gas and spray mixture pro-

duced by the carbureter, the horsepower output of a given size of engine has been more than doubled, and the fuel and lubricating oil consumption have been reduced approximately 50% as compared with other engines of similar displacement. This invention not only enables ordinary commercial gasoline to be used in aviation engines, but even heavier mixtures of gaseous constituents and lubricating oil, since when a mixture of fuel oil and lubricating oil spray and fuel gases is handled according to the method herein described, the fuel gas and vapor only pass into the engine, and liquid is trapped and condensed, owing to greater centrifugal velocity. In fact, a special mixture of gasifiable and lubricating constituents can be used by this invention through an ordinary carbureter, or even some grades of crude petroleum. When once condensed, the lubricant can run through the oil holes in the piston to the cylinder surface, while elements which are capable of being fractionated or vaporized by heat take up heat from the interior of the piston head until fractionated or vaporized, and then pass into the cylinder with the charge, the residue being lubricant. The volumetric efficiency is not decreased because the gas mixture does not become overheated.

At the same time that vaporized particles are fractionated by the hot piston surface of the piston is itself kept cooled to such an extent as not to cause preignition of the incoming charge, thus permitting a higher charge compression than has heretofore been feasible in rotary cylinder engines.

The method of this invention is to be distinguished from rotary vane devices heretofore proposed to be inserted in the intake manifold of combustion engines, in that by this method the entire charge, including spray (whether of fuel or lubricant, or both) is subjected to centrifugal forces, and then passed through or around baffling or other means so arranged as to trap the particles of heavy mass and consequently having greater centrifugal force, while readily permitting the reverse passage of gases and vapors, whereas the vane devices heretofore proposed primarily obstruct the flow by cutting across the path of the flow and simply break it into eddies and cross-currents, without effecting any centrifugal separation. In fact, these vane devices are frequently described as mixers, but are not even efficient as such, because spray particles cannot form a homogeneous mixture with gases or vapor solely by mechanical mixing.

Various modifications and changes may be made in the apparatus without departing from the scope of the appended claims.

What is claimed, is:

1. The method of supplying a rotary cyl-

inder combustion engine with fuel gas which consists in abruptly reversing the centrifugal flow of a fuel gas and oil spray mixture to condense out the heavier particles before reaching the inlet valve.

2. The method of supplying a rotary cylinder combustion engine with fuel gas which consists in abruptly reversing the centrifugal flow of a fuel gas and oil spray mixture to condense out the heavier particles before reaching the inlet valve, and conducting the condensed liquid to the cylinder bearing surface.

3. The method of supplying a rotary cylinder combustion engine with fuel gas which consists in abruptly reversing the centrifugal flow of a fuel gas and oil spray mixture to condense out the heavier particles before reaching the inlet valve, partially vaporizing the condensed liquid for fuel charge, and conducting the residue to the cylinder bearing surface.

4. The method of separating fuel vapor from spray carrying lubricant material which consists in imparting centrifugal force to the mixture, and baffling the mixture by a movable element in such manner that the fuel vapor is supplied for combustion and the condensed lubricant supplied to a wearing surface.

5. The method of separating fuel vapor from spray carrying lubricant material which consists in imparting centrifugal force to the mixture, and baffling the mixture by a movable element in such manner that the fuel is supplied for combustion and the condensed lubricant supplied to a wearing surface, the condensing being on a heated surface whereby volatile constituents are vaporized and mixed with the fuel vapor.

6. The process of treating a fuel charge for an internal combustion engine comprising a mixture of vapor and spray which comprises abruptly changing the direction of flow of said mixture to separate the spray and vapor within the engine and leading off some of the condensed spray portion from the place where the said direction of flow changes, said condensed spray portion being led off in a different direction from the path of the vapor.

7. The process of treating a fuel charge of vapor and spray for an internal combustion engine which comprises abruptly changing the direction of flow of said charge to separate the spray and vapor portions and subsequently lubricating the engine with some of the condensed spray portions.

8. The method of treating a fuel charge to an engine which comprises abruptly changing the direction of flow of the charge within the engine to separate the spray and vapor portions and leading off the condensed spray portions from the place where the direction of flow changes, said condensed

portion being led off in a different direction from the path of the vapor, and subsequently lubricating the engine with said condensed spray let-off.

- 6 9. The process of treating a fuel charge for an internal combustion engine which comprises abruptly changing the direction of flow of said charge to separate the spray and vapor portions thereof, igniting the

separated vapor portions, applying heat to 10 the separated spray portions to vaporize at least a part thereof and leading off some of the condensed spray portions for lubricating the engine.

Signed at New York city, in the county 15 of New York and State of New York, this 2nd day of April, A. D. 1919.

WILLIAM HARPER, Jr.