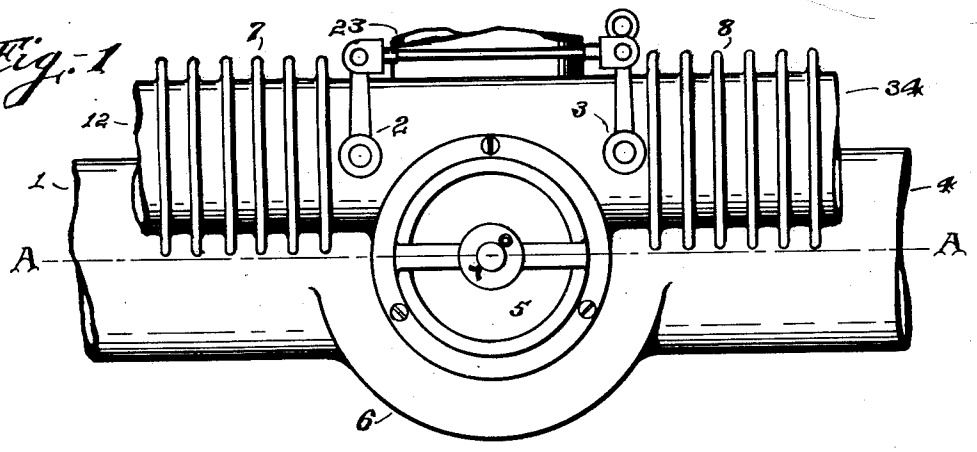
Dec. 12, 1933. E. L. RATHBURN 1,939,318

FLUID PRESSURE FUEL SYSTEM

Filed July 30, 1927

Fig. 1



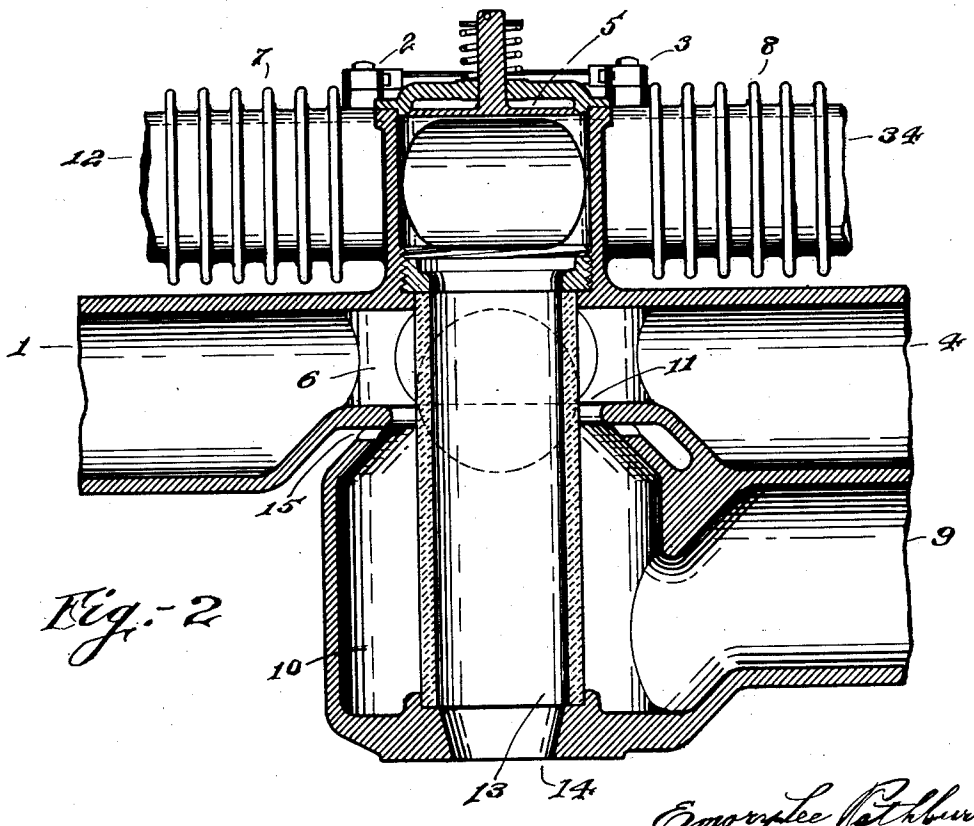


Fig. 2

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FLUID PRESSURE FUEL SYSTEM

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8 Claims. (Cl. 48—107)

My invention relates generally to the improved system of fuelizing the fluid hydro-carbons in connection with the operation of heat and power producing plants, being particularly adapted to incorporation in the more efficient portable types of internal combustion engines employed in rapid transportation means and more particularly where the exhausted gases are apt to contaminate the atmosphere being used by human beings for vital respiration.

Foremost among the objects of the present invention is the basal elimination, from the exhaust gases of such engines, of the poisonous carbonyl group of gases.

Additional major objects, such as improved cylinder lubrication, greater volumetric efficiency and the elimination of detonation are attained simultaneously and by this same means of complete fuelization of the essential hydro-carbon fluid.

It will be understood that in actual practice this invention is not restricted to any particular narrow range of light high gravity fluids, although the word 'petrol' will be used in convenience hereinafter to designate the element of raw fuel.

The accompanying drawing shows, more or less diagrammatically, one embodiment of the present invention and will serve to illustrate fundamentally the process and also provide a means of pointing out the sequence of operation of the essential apparatus.

Fig. 1 is a top plan view showing the apparatus as an integral part of a combined intake and exhaust manifolds adapted to the more common type of four cylinder and four-cycle automotive engine; Fig. 2 is a vertical central section of the same, taken through the line A—A of Fig. 1.

Similar characters refer to similar parts of the invention through the views.

In operation, for example in connection with an internal combustion engine, it will be understood that the passages 12 and 34, as shown in Figures 1 and 2, may communicate with the intake ports of an engine, not herein shown. The passages 1, 23 and 4 may be connected to the various exhaust ports of such engine. The engine is not shown since it does not of itself form a part of the present invention. 14 is adapted to communication with a suitable source of aerated petrol vapor, such as the conventional carbureter, which is required, while operating at maximum capacity, to pass an equivalent thirty per cent of the total capacity of the system. The tubular section 13 is shown herein as an intercepting wall forming structure of a refractory ceramic material, between the fuel and the exhaust fluids being passed by the apparatus, such structure having been suitably treated with a catalytic substance such as platinum black. It is characteristic of this arrangement, that while in contact with the combustible vaporous petrol mixtures, said catalytic structure will with initial starting temperatures at and exceeding four hundred degrees centigrade, rapidly develop and maintain a glowing bright red state, corresponding to temperatures at or above one thousand degrees centigrade, without any apparent tendency to inflame the combustible mixtures therein.

In starting, the engine induces a cold vaporous mixture of petrol and a part of the air necessary for its complete combustion through "14" and up through "13", after which the mixture is completed by dilution with cold air automatically admitted through the valve "5", and such complete mixture is distributed to the respective conduits "12" and "34". Assuming a normal operation of the engine, the heated combustion products thereof are conducted alternately through "1", "23" and "4", being temporarily accelerated through the annular restriction "11", passing into the lower chamber "10" and being released to the atmosphere through "9". Expansion of the accelerated flow at below "11" serves to effect the ingress of atmospheric air at "15". A cooperative double throttling means is indicated by "2" and "3". The active structure "13" is rapidly heated to the point where catalytic oxidation or partial combustion of the inner liquid hydrocarbon fuel sets in and by which means the desired glowing temperature is attained.

Neglecting the more complicated chemical effects of the catalytic agent, other than the property of preventing inflammation or ignition of the fuel stream at such high temperatures, the broader physical law that liquid hydrocarbon fuel compounds are combustible at a rate in direct relation to their degree of dispersion, indicates the desirable advantage of this improved fuel system in delivering to the engine the fluid fuel in molecular division or actual dry gaseous state, which is more completely oxidized therein with the theoretical amount of air present; which improved reaction within the engine very apparently provides the main cooperative means of attaining the main object of the present invention, that is to say the elimination by combustion of carbon-monoxid from the exhaust gases in a commercially practicable manner. Additional

means of insuring the attainment of this main object, consists of passing the exhaust gases back through this improved apparatus in contact with the outer wall surface "13" to appropriately heat and render active the catalytic substance, thereby super-heating to the ignition point, in the presence of additional air taken through "15", such undesirable products that may derive from misfiring or excessive lubrication in the engine cylinders and carried out in the exhaust gases.

During the development of the present invention by means of actual tests in connection with a standard type of automotive engine, the inventor has found that the cooling of the gaseous fuel to prevailing normal temperatures subsequent to the improved fuelization, by the cold air dilution and by means of extra cooling surfaces pointed out at "7" and "8" respectively, does not effect any appreciable precipitation of the fuel stream; a substantial increase in working compression pressures being attained in the engine cylinders. It is of course evident that the previously common diluent of the cylinder lubricant is not present in operation with this improved system and also that the main source of solid carbon deposite has been eliminated. It is also recorded by the inventor that full capacity operation is effected with the present system with no indication of knocking or detonation in the combustion chambers of the engine and without any prior treatment of the raw gasoline nor changes in the engine proper.

While it is entirely possible to operate, to some extent, this improved fuel system with the active element "13" in the form of a suitable metallic (massive) structure, the inventor prefers to use a type of refractory ceramic structure in accordance with the above description. The known properties of certain of the platinum group of metals in connection with the production of heat while in contact with hydrogen compounds, is old in the arts; but it is believed by the inventor that the present means of taking advantage of such and similar catalytic properties in combination with this improved fuel system is entirely novel, wherein the essential catalytic element has a controlled radiation characteristic and is adapted to the catalytic flameless combustion at the one or inner surface while simultaneously promoting normal flame combustion at the opposite outer wall surface; and in which improved system the hydro-carbon fluid is progressively treated in a process consisting of vaporization, gasifying the resulting vapors at radiant glowing temperatures of the conduit, without inflammation, diluting with air and cooling to attain a normal volumetric state, preceding the charging of the engine combustion chamber, and subsequently super-heating and aerating the products therefrom in order to ignite any incompletely oxidized fuels present therein prior to releasing the exhaust fluids to the atmosphere. The present invention is believed to be a vital departure from any previous system in the arts pertaining thereto and for the objects intended.

In the foregoing disclosure, the description has been more or less confined to the one embodiment shown herein but it will be understood that in actual practice a more compact arrangement to attain efficient cooperation of the various parts of the system will not constitute a departure from the broader scope of the invention. Certain of distinctive refinements which have occurred to the inventor will form the subject matter for subsequent applications.

Now that I have described my invention, what I claim is:

1. The method which includes subjecting a hydrocarbon fuel to the action of a catalyst in its passage to the zone of use and subjecting the by-products of its combustion to a catalyst after its explosion.

2. The method which includes mingling the by-products of the combustion of a hydrocarbon fuel with low pressure air and subjecting such by-products to the action of a catalyst.

3. The method which includes mingling hydrocarbon fuel with a primary air supply, subjecting such mixture to the action of a catalyst, subsequently adding to the mixture so formed secondary low pressure air sufficient for the production of a readily explosive mixture, exploding such mixture, and subjecting the by-products of its combustion to the action of a catalyst after its explosion.

4. A fuel system which includes a fuel inlet passage and an exhaust passage, and a catalytic partition member adapted to separate said passages.

5. A fuel system which includes a fuel inlet passage and an exhaust passage, the walls of each of said passage being in part catalytic.

6. A fuel system including a fuel intake passage and an exhaust passage, a catalytic structure communicated with said intake passage, said catalytic structure including a catalytic element adapted to produce flameless combustion of a part of the charge forming mixture passing therethrough, the exhaust passage communicating with one side of said catalytic element.

7. A fuel system which includes a fuel intake passage and an exhaust passage, a catalytic element communicated with the fuel inlet passage, said element being adapted, when initially heated, to maintain catalytic flameless combustion of a part of the charge forming fuel mixture, and means for directing the hot exhaust products of combustion into heating contact with said catalytic element.

8. A fuel system which includes means for mixing a hydrocarbon fuel and air, means for catalyzing and fixing the mixture, means for supplying low pressure air to the resulting product, an outlet for conveying said product to a place of combustion, and a passage for conveying the products of combustion to the catalyzing means.

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