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FUEL.

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To all whom it may concern:

Be it known that I, GRANT HAMMOND, of New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Fuels, of which the following is a specification.

My invention relates to that class of fuels more especially prepared for use in internal combustion engines, this application being a continuation in part of my prior application Serial No. 569,134, filed June 17, 1922. An object of my present invention, among others, is the production of a fuel consisting largely of substances which, up to the present time, have not proved eminently successful for consumption in engines of the class above mentioned, and which fuel, embodying my invention, shall produce results in operation equal to, or even better, than are obtained at the present time by the use of gasolene now commonly employed; and a further object of my invention is the production of such a fuel at a minimum and reasonable cost.

It has heretofore been proposed to use kerosene as a fuel in internal combustion engines, and especially those of the type now universally employed for propelling vehicles of various kinds, and also for producing power for other purposes, and while many compounds have been suggested for such use, none of them, so far as I am aware, have proved satisfactory for use under all conditions.

It has heretofore further been proposed to employ, for the purposes above stated, a mixture of quick igniting substances, as gasolene or benzol, with kerosene, but my experiments in this line have demonstrated to my satisfaction that in the use of such a mixture the kerosene does not explode as a unit with the quicker igniting substances, and there is consequently an unburned quantity of kerosene that is driven off through the exhaust, and therefore any beneficial results that may be obtained from such use of the kerosene are greatly minimized, if, in fact, they may not be substantially eliminated.

With the use of my improved fuel, as disclosed herein, I obtain results that are highly satisfactory in the operation of internal combustion engines, and especially those used in automobiles equipped with the ordinary types of carbureters, an engine starting as readily as with the gasolene in common use, and little carbon trouble being experienced, as elements are introduced into the mixture tending to consume the carbon during combustion.

In carrying out my experiments it has been my aim to find some way to cause the kerosene to unite in solution with substances that are, under ordinary conditions, incompatible therewith, as it appeared to me that if this could be done the mixture would explode as a unit and the beneficial results of all of the ingredients would thereby be obtained. After extended trial, comprising several thousand experiments and tests, I have demonstrated to my satisfaction that butanol (C_4H_9OH) also known as butyl alcohol, when combined with kerosene will cause the latter to act with highly increased efficiency as a fuel for internal combustion engines, this being demonstrated by the quick starting of such engines and their continued running without the usual "knocking" experienced with kerosene alone. According to my investigations, it seems probable that the knocking produced when kerosene is used alone is due to the fractional or successive combustion of various hydrocarbons therein which have different ignition points and which consequently do not burn or ignite simultaneously. I have found that solutions of kerosene and butanol employed in almost any relative proportions may be employed to overcome these disadvantages and one mixture which I have found to produce very satisfactory results is composed of four parts butanol in one hundred parts of kerosene.

While a mixture of kerosene and butanol has produced results beyond my anticipations, my experiments have demonstrated that even better results may be obtained with a mixture composed of kerosene and butanol, together with other, preferably quick igniting, substances, and I have been able to do this, as I have found that butanol is capable of rendering a large number of substances incompatible with kerosene miscible with the same. This is especially true in a solution composed of kerosene and a

saturated hydrocarbon of the homologous series corresponding to $C_nH_{2n}+2$ and of higher or lower volatility than kerosene when mixed with substances incompatible with kerosene, the butanol causing a homogeneous solution of the components. In fact, I have demonstrated that the use of butanol in mixtures composed of different kinds of saturated hydrocarbons of the homologous series, especially when mixed with air under the heat of compression in a motor cylinder and then ignited, such mixtures being in varying proportions, will produce satisfactory results in the propogation of rapid flame, and the combustion as a unit between such substances.

A mixture compounded on the lines above indicated, and that I have found to produce satisfactory results, is composed of kerosene and gasoline, together with butanol that may be used in varying proportions, preparations which have been used in specific instances being hereinafter stated, this mixture producing a fuel in the use of which in an internal combustion engine practically removes the collection of carbon therein.

In producing a fuel for internal combustion engines having carburetors now in common use, it is important that such fuel, in order to meet all the conditions of such use, shall possess a reasonably high degree of volatility, and I have found that by introducing benzol free from thiophen (C_4H_4S) into a mixture of the ingredients hereinbefore mentioned, a degree of volatility to an increased extent will be obtained, or, in other words, the degree of viscosity will be reduced.

It is of importance that the benzol shall be free from thiophen, as the presence of the latter will render the mixture objectionable owing to results flowing from its use.

As an example of substances that may be used in the embodiment of my invention, it may be mentioned that ethyl and methyl alcohols are both miscible with kerosene when mixed in equal proportions (cold solution) with butanol, and larger proportions of ethyl and methyl alcohol may be used when the kerosene is heated. A mixture in which these ingredients are employed will have beneficial results.

The use of butanol will also render water miscible with kerosene, and therefore I am enabled to introduce water into a mixture with the attendant beneficial results to be obtained thereby.

It is also mentioned that acetone may be added at any stage of the mixing process of substances hereinbefore mentioned, if desired, its use adding to the bulk of the mixture without decreasing its efficiency.

In making a solution of kerosene, combined with gasoline, benzol or water, or other substances herein mentioned, and comprising any of the combinations of such substances with the kerosene, it is preferable, but not absolutely essential, that the ingredients apart from the butanol shall be thoroughly mixed, as by stirring or by shaking, after which the butanol may be added, and the whole then mixed by stirring or agitating until the mixture shows a clear solution after standing for a few minutes.

Up to this point I have set out generally the ingredients of which my improved fuel may be composed, and while these ingredients may be united in varying proportions, my invention therefore not being confined to compounds of specific proportions, I have found compounds composed of the following ingredients in the proportions set forth to produce highly satisfactory results.

Kerosene, gasoline and butanol in the proportions of 46 parts kerosene, 52 parts gasoline, and 4 parts butanol, these proportions being approximate.

For the kerosene, gasoline, butanol and benzol preparation the proportions are from 40 to 50 parts substantially of kerosene, 50 to 60 parts substantially of gasoline (commercial), 1 to 4 parts substantially of butanol, and 3 to 12 parts substantially of benzol. To be more specific these proportions may consist of substantially 48 parts of kerosene, substantially 48 parts of gasoline (commercial), substantially 1 part of butanol, and substantially 3 parts of benzol, but as hereinbefore stated, it is not essential to my invention that the preparation shall consist of the specific proportions above set forth.

I claim—

1. A fuel comprising of kerosene, gasoline, butanol and benzol.

2. A fuel comprising kerosene substantially 40 to 50 parts, gasolene (commercial) substantially 50 to 60 parts, butanol substantially 1 to 4 parts, and benzol substantially 3 to 12 parts.

3. A solution composed of a saturated normally liquid hydrocarbon of the homologous series corresponding to $C_nH_{2n}+2$ and of a volatility in the vicinity of that of kerosene, mixed with inflammable liquid hydrocarbons normally of different volatility and about 3 per cent of butanol to produce unitary combustion thereof.

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