UNITED STATES PATENT OFFICE.

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FUEL.

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To all whom it may concern:

Be it known that I, BURNELL R. TUNISON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Fuels, of which the following is a specification.

My invention relates particularly to fuels designed to be used in any desired manner. It has application especially to fuels adapted to be used alternatively for a wide variety of purposes, as for example, fuels to be used for burners under steam boilers, as well as for internal combustion engines of various kinds, Diesel engines and the like.

An object of my invention is to provide an efficient fuel for various uses, which fuel, although containing a comparatively heavy hydrocarbon, shall nevertheless contain such additional substance or substances as to enable the fuel to be used, alternatively or optionally, in the same manner as the light hydrocarbon fuels heretofore employed in internal combustion engines, or the like, said additional substances not being mere paraffin hydrocarbons.

Another object of my invention is to provide a fuel, or type of fuel, containing a relatively heavy hydrocarbon together with an additional lighter combustible ingredient of such a character that it will blend effectually with the relatively heavy hydrocarbon and notably modify the properties thereof.

A further object of my invention is to provide a fuel containing a heavy hydrocarbon and, blended therewith, a lighter constituent or constituents which may be substantially anhydrous.

A further object of my invention is to provide a fuel of this character which need ordinarily contain no other blending agent than such substantially anhydrous constituent or constituents.

In one of its broader aspects, my present invention may be said to aim at a wider availability, in the production of motive power, on the part of relatively heavy hydrocarbons, such as heavy distillates derived from crude oil, and having a gravity of less than 40° Bé., such wider availability resulting from the employment therewith of an ingredient or ingredients which shall contribute so notably to readiness of ignition that satisfactory ignition may be obtained without raising the Baumé density of the product even to the level of ordinary kerosene, and contribute to producing an improved combustion, and in one of its more restricted aspects my present invention may be said to aim at the production, from hydrocarbons that have already been deprived of their gasoline and kerosene fractions, of a product, presumably less costly than either of the mentioned fractions, which shall at the same time rival gasoline in its suitability for use in, for example, automobile engines.

In one aspect, the present invention may be said to proceed from a recognition of progress made and to be made in the design of engines and other devices for the utilization of the energy of fuels, and, in so far as it aims at a complemental advance in the perfecting of crude fuels for more exacting and important uses than those to which such fuels have heretofore been put, it may be said to aim at obviating a shortage in one of the prime necessities of modern manufacture and commerce, fuels for automobile engines and the like.

In one aspect, my present invention may be said to relate to a process or processes for the production of liquid fuel compositions, while in another aspect it relates to the resulting compositions. It is the intention to protect herein both of the foregoing inventions in their generic features.

The fuels herein referred to being essentially mere mixtures or solutions of one organic substance within another, it will be apparent that the sequence of operations by which they are produced may be varied, but the following may serve as typical examples.

Beginning with any ordinary mineral oil, such as a typical Pennsylvania crude oil, I may distill off for direct use in commerce the usual quantities of lighter products including gasoline and kerosene, proceeding with such distillation preferably until substantially all the gasoline and kerosene have been distilled off and until the residuum left in the still shall have a Baumé gravity less than 40°. I may then associate with this residual material, or with a fraction distilled therefrom, and in any convenient manner, as by pouring and agitating, or by distilling

directly thereinto, one or more relatively volatile combustible constituents satisfactorily miscible therewith, such as:

Alcohols (e. g. methyl, ethyl, propyl, butyl or amyl alcohol, or mixtures thereof).

Ethers (e. g. ethyl, methyl or ethyl methyl ether, or mixtures thereof).

Esters (e. g. esters made from any of above alcohols and any organic acid, or mixtures containing such esters).

Ketones (e. g. acetone, methyl ethyl ketone, or oils or other mixtures containing such ketones).

The foregoing types of relatively volatile combustible constituents may, for convenience, be generically referred to in this case Serial Nos. 373,307 and 373,308 and related cases as organic compounds containing an alkyl radicle and oxygen, the esters and ketones being somewhat more specifically referred to collectively as organic compounds containing a carbonyl group and an alkyl radicle.

Instead of, or in addition to the foregoing, I may associate with the heavier hydrocarbon material volatile combustible constituents in the form of organic compounds or mixtures of organic compounds containing aryl radicles, such as:

Aromatic hydrocarbons (e. g. benzol, toluol, xylol, or mixtures thereof).

Nitro-hydrocarbons (e. g. nitrobenzol, nitro-toluol, or mixtures thereof).

The proportions in which the respective volatile combustible ingredients referred to (or any analogous ingredients that may fall within the class hereinafter presented) may advantageously be incorporated with the heavier hydrocarbon or hydrocarbon mixture will, of course, depend not alone upon the exact character of the heavy hydrocarbon and upon the selection made among the volatile combustible ingredients, but also upon whether it is intended to produce in one product what might be termed a "versatile" or "universal" liquid fuel capable of a great variety of uses, or whether the manufacturing intent is rather to produce a fuel possessing, in the highest practicable degree, certain advantages or peculiarities adapting it to some specific use (such as use in vehicle engines, in stationary engines, in injection oil engines, or in oil burners), and an extremely wide range of variations will accordingly be understood to be included within the intended scope of the claims appended hereto. The following are offered merely as specific examples of compositions within the scope of my present invention, it being understood that wherever the expression "heavy oil" is employed in the said examples, this expression may refer to a petroleum distillate or residue which may consist of paraffin oils, and which might be heavier than 40° Bé., and which may, for example, be as heavy as 28° Bé. By the term, "petroleum distillates heavier than kerosene," I mean those petroleum distillates which have densities lying above the generally-accepted upper limit of the range of kerosene densities, which, as already mentioned, lies at about 40° Bé., or about .82 absolute density. The parts refered to therein are parts by volume:

GROUP I.

Example 1.

Heavy oil	75 parts.
Alcohol (of about 95% strength)	20 parts.
Ether	5 parts.

From this the ether may be omitted, if desired.

Example 2.

Heavy oil	75 parts.
Alcohol (of about 95% strength)	15 parts.
Ether	5 parts.
Ethyl acetate	5 parts.

Example 3.

Heavy oil	70 parts.
Alcohol (of about 95% strength)	20 parts.
Ether	4 parts.
Ethyl acetate	3 parts.
Acetone	3 parts.

It should be understood that in any of the examples of the foregoing Group I the alcohol may, within the scope of the present invention, be supplanted wholly or in part by a corresponding quantity of one or more of the alternative oxygen-containing volatile alkyl compounds mentioned in the same or another example.

GROUP II.

Example 4.

Heavy oil	75 parts.
Benzol	25 parts.

Example 5.

Heavy oil	75 parts.
Benzol	20 parts.
Nitrobenzol	5 parts.

It should be understood that in the examples of Group II, the benzol may be supplanted in whole or in part by nitrobenzol, and that nitrotoluol or nitroxylol might be used instead of nitrobenzol.

GROUP III.

Example 6.

Heavy oil	80 parts.
Ethyl acetate	20 parts.

Example 7.

Heavy oil	83 parts.
Acetone	17 parts.

It should be understood that in the preparation of fuels within Group III, the quantity of acetone recommended is slightly less than the quantity of ethyl acetate recom-

mended. Due allowance being made for this difference, acetone may be substituted for ethyl acetate in whole or in part, these mentioned volatile constituents being alike in containing the group CO, which justifies reference to them generically as compounds containing carbonyl and alkyl.

As already mentioned, and as will be apparent from the foregoing, while I have described in detail numerous specific embodiments of my invention in "universal" liquid fuels, each of which comprises a preponderating quantity of a heavy hydrocarbon, and each of which is suitable for uses as widely separated as are, on the one hand, employment (under suitable conditions of temperature and pressure and in due admixture with air or with oxygen) in explosion motors and, on the other hand, employment in direct generation of heat under steam boilers, many additional changes may be made without departing from the spirit of my invention, as indicated in the foregoing description and in the appended claims.

I claim:

1. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, and alcohol.

2. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, and an ether.

3. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, and ether.

4. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, an ether, and an ester.

5. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, an ether, and ethyl acetate.

6. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, an ether, an ester, and a ketone.

7. A liquid fuel which is more dense than kerosene, comprising a relatively heavy hydrocarbon of an aliphatic series, alcohol, an ether, an ester, and acetone.

8. A liquid fuel comprising a petroleum distillate heavier than kerosene, and an alcohol.

9. A liquid fuel comprising a petroleum distillate heavier than kerosene, and ethyl alcohol.

10. A liquid fuel comprising a petroleum distillate heavier than kerosene, an alcohol, and a ketone.

11. A liquid fuel comprising a petroleum distillate heavier than kerosene, ethyl alcohol, and acetone.

12. A liquid fuel comprising a petroleum distillate heavier than kerosene, an alcohol, and an ether.

13. A liquid fuel comprising a petroleum distillate heavier than kerosene, ethyl alcohol, and ethyl ether.

14. A liquid fuel comprising a petroleum distillate heavier than kerosene, an alcohol, a ketone, and an ether.

15. A liquid fuel comprising a petroleum distillate heavier than kerosene, ethyl alcohol, acetone, and ethyl ether.

16. A liquid fuel comprising a petroleum distillate heavier than kerosene, and an alcohol, the distillate being present in the proportion of about three-fourths of the mixture.

17. A liquid fuel comprising a petroleum distillate heavier than kerosene, and ethyl alcohol, the distillate being present in the proportion of about three-fourths of the mixture.

18. A liquid fuel comprising a petroleum distillate heavier than kerosene, an alcohol, and an ether, the distillate being present in the proportion of about three-fourths of the mixture.

19. A liquid fuel comprising a petroleum distillate heavier than kerosene, an alcohol, and a ketone, the distillate being present in the proportion of about three-fourths of the mixture.

20. A liquid fuel comprising a petroleum distillate heavier than kerosene, ethyl alcohol, and acetone, the distillate being present in the proportion of about three-fourths of the mixture.

21. A liquid fuel comprising a petroleum distillate heavier than kerosene, ethyl alcohol, ethyl ether, and acetone, the distillate being present in the proportion of about three-fourths of the mixture.

In testimony that I claim the foregoing, I have hereunto set my hand this 16th day of March, 1920.

BURNELL R. TUNISON.