Patented Oct. 21, 1930 1,779,061

UNITED STATES PATENT OFFICE

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HIGH-COMPRESSION-MOTOR FUEL

No Drawing. Application filed September 26, 1927. Serial No. 222,197.

This invention relates to a motor fuel for internal combustion engines, and refers more particularly to a fuel that can be used at normal or higher engine compression ratios without causing the motor to knock.

The hydrocarbon motor fuels now in use all have a very definite break-down or detonating point at or slightly beyond normal compression pressures beyond which the fuels cannot be used without serious trouble arising in the operation of the internal combustion engines. Some motor fuels will knock under certain operating conditions in motors having normal compression ratios which are usually considered to be less than 5 to 1. Other fuels which are satisfactory at compression ratios of 5 to 1 cannot be used at higher compression ratios without knocking. This knocking, evidenced by a pinking sound in the motor combustion chamber, is accompanied by loss of power, overheating, and eventually by preignition which, if severe, will stop the motor. It is found that with a given fuel, this knock is a direct function of the compression ratio.

The principal object of the present invention is to provide a motor fuel for use in internal combustion engines which possesses less detonating properties than fuels now in use.

It has been demonstrated heretofore that any one of several volatile hydrocarbon soluble metallic compounds may be added in small amounts to the average motor fuel or gasoline with a very marked improvement in its operation at high compression pressures. One of the most effective of such anti-knock compounds is iron pentacarbonyl, but this compound has a serious disadvantage in that when it is exposed to light, it is rapidly decomposed, forming iron enneacarbonyl which is practically insoluble in gasoline and therefore comes down as a heavy precipitate. The precipitate not only removes the effective anti-knock compound from the fuel but also causes difficulty due to clogging of the fuel supply lines and carbureting device. Most of the other metallic carbonyls are also unstable, particularly in the presence of light, water, and air.

The ordinary metallic carbonyls appear to have a point of high reactivity in their molecular structure. We have found that by combining metallic carbonyls with ammonia compounds or amines, the high reactivity of the molecular structure of the carbonyls can be removed with the production of metallic amino carbonyls which, as a class, are generally stable. In our copending application, Serial No. 222,198, filed September 26, 1927, there is described a process by which the new series of compounds can be prepared from metallic carbonyls and ammonia compounds. These metal amino carbonyls can be added to hydrocarbon motor fuels, such as gasoline to reduce or eliminate the tendency of such hydrocarbon motor fuels to knock at ordinary compressions or to permit the use of increased compression pressures. Certain of these metal amino carbonyls are as efficient as iron pentacarbonyl and are superior thereto in that they are stable on exposure to light and air.

Metal amino carbonyls can be prepared from various metal carbonyls and ammonia compounds. The metal carbonyls which can be used include iron tetracarbonyl, iron pentacarbonyl, iron enneacarbonyl, cobalt tricarbonyl, cobalt tetracarbonyl, nickel tetracarbonyl, molybdenum hexacarbonyl, etc. The ammonia compounds which may be used are ammonia or the substituted ammonias known as amines and preferably the aliphatic amines or the aliphatic-aromatic amines. Various metal amino carbonyls can be prepared from the mixtures of the foregoing metal carbonyls and ammonia compounds, all of which increase the non-detonating value of a motor fuel. Owing to the fact that some of the metal amino carbonyls are more soluble than others in hydrocarbon motor fuels, such as gasoline, we prefer to use an iron aliphatic amino carbonyl and prefer the compound which we term iron diethyl amino pentacarbonyl, having the probable formula of $Fe(CO)_5.NH(C_2H_5)_2$.

The choice of an individual metal amino carbonyl from the foregoing group depends somewhat upon the particular conditions of operation under which the motor fuel is to be used. In general, the lighter the molecule of this series, the less soluble the material will be in gasoline but the more volatile it will be. We have found that while the simple unsubstituted amino carbonyls and the lower mono substituted compounds may be added to gasoline to prevent knocking. These compounds are not sufficiently soluble at normal operating temperatures and we, therefore, prefer to employ with them a blending agent to increase their solubility in gasoline. We find that small amounts of alcohols, ketones, etc., may be used as blending agents.

The disubstituted amino compounds are sufficiently soluble in gasoline under ordinary conditions of temperature and may be used without the addition of a blending agent, although a blending agent may be added if desired.

Of the various iron amino carbonyls, we find that iron diethyl amino pentacarbonyl is the most satisfactory as this compound entirely satisfies the requirements of solubility, volatility and anti-knock value, and does not introduce any new complications. The iron diethyl amino carbonyl may be added to gasoline in various amounts ranging from 0.1 per cent. to 1 per cent. or more by weight. The motor fuel thus produced can be used in internal combustion engines having compression ratios greater than 5 to 1. For example, the addition of 0.42 per cent. by weight of this substance to a hydrocarbon motor fuel will permit the use of compression ratios as high as 5.6 to 1. Larger amounts of the iron diethyl amino pentacarbonyl will, of course, permit the use of still higher compression ratios, or the use of hydrocarbon motor fuels which could not otherwise be used at normal compression pressures. We have operated an internal combustion engine having a compression ratio of 6.5 to 1 on ordinary motor grade gasoline to which there had been added 1.4 per cent. by weight of iron diethyl amino pentacarbonyl, the operation even at such high compression pressure being entirely free from any signs of detonation or knocking.

A preferred process of producing iron pentacarbonyl and diethyl amine may be given. The iron pentacarbonyl and diethyl amine in substantially equal molecular proportions are placed in a suitable vessel capable of withstanding a pressure up to 10 atmospheres and heated to a temperature of approximately 210° F. by a suitable means, for example, a steam jacket. Under these conditions, a reaction proceeds which is accompanied by a change of color of the liquor and a change of pressure on the system. The color of the admixture at the start of the reaction is light amber but it changes slowly to a deep crimson as the reaction proceeds. The initial pressure is preferably about 3 atmospheres at the start of the reaction and gradually falls until it is slightly more than atmospheric when the reaction is complete. The reaction proceeds in the production of the new compound, iron diethyl amino pentacarbonyl. If a slight excess of the amine is used, the formation of iron diethyl amino pentacarbonyl from the iron pentacarbonyl and diethyl amine is substantially complete and equal to the theoretical in about 2 to 8 hours. The molecular weight of the product produced is found to be 259±20. This is determined by the cyroscopic method using solutions in benzol and in cyclohexane. The refractive index is between 1.469 and 1.475 with the lower value the more probable. The melting point is between −68° to −74° F., the lower value being the more probable one.

This new compound has been found particularly suitable for use in motor fuel.

While the motor fuel herein described is well adapted to carry out the objects of the present invention, it is understood that the present invention includes all such changes as come within the scope of the following appended claims.

We claim:

1. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and a metal amino carbonyl compound.

2. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and an iron amino carbonyl compound.

3. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and an iron aliphatic amino carbonyl compound.

4. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and an iron ethyl amino pentacarbonyl compound.

5. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and an iron diethyl amino carbonyl compound.

6. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and an iron diethyl amino pentacarbonyl compound.

7. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel, a metal amino carbonyl compound, and a blending agent.

8. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel, a metal amino carbonyl compound, and alcohol as a blending agent.

9. A motor fuel for internal combustion engines comprising a hydrocarbon motor fuel and a metal aliphatic amino carbonyl compound.

Signed at Richmond, Calif., this 7th day of September, 1927.

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