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GASOLINE FUEL COMPOSITIONS

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This invention relates to gasoline fuel compositions that contain a small amount of a dialkyl acid orthophosphate wherein one of the alkyl groups contains at least 6 carbon atoms and the total number of alkyl carbon atoms is not greater than 20.

When an internal combustion engine is operated under cool, humid atmospheric conditions, using a gasoline fuel having a relatively low 50 percent ASTM distillation point, e. g., 210° F., 220° F., excessive engine stalling is apt to be encountered at idling speeds during the warm-up period, especially where engine idling occurs following a period of light load operation. Engine stalling under such conditions has been attributed to the partial or complete blocking of the narrow air passage that exists between the carburetor throat and the carburetor throttle valve during engine idling, by ice particles and/or solid hydrocarbon hydrates that deposit upon and adhere to the metal surfaces of the carburetor parts. Such icing of carburetor parts occurs as a result of the condensation of moisture from the air drawn into the carburetor and as a result of the solidification of such condensed moisture. The aforesaid condensation and solidification of moisture are caused by the refrigerating effect of rapidly evaporating gasoline. Accordingly, excessive engine stalling due to carburetor icing occurs as a practical matter only in the instance of gasolines containing a large proportion of relatively highly volatile components.

Excessive engine stalling is, of course, a source of annoyance owing to the resulting increased fuel consumption, battery wear and inconvenience of frequent restarting. It is therefore important that the inherent engine stalling characteristics of gasoline fuels be reduced substantially, where the 50 percent ASTM distillation point of such gasoline fuels is sufficiently low to cause a problem in this respect.

We have found that the stalling characteristics of gasoline fuel compositions that normally tend to promote engine stalling due to carburetor icing are markedly improved by the incorporation therein in a ratio of 3 to 30 pounds per thousand barrels of gasoline of a dialkyl acid orthophosphate wherein one of the alkyl groups contains at least 6 carbon atoms, and the total number of carbon atoms in the alkyl groups is not greater than 20. We have also found that valuable corrosion inhibiting properties are imparted to the gasoline compositions of this invention by the above-indicated amounts of the foregoing class of additives.

The dialkyl acid o-phosphates included by this invention are oil-soluble, polar, surface active materials. While the invention is not limited to any theory of operation, it appears that by virtue of their polarity and surface activity the dialkyl acid o-phosphates of this invention tend to orient themselves upon the metal surfaces of the throttle valve and other critical carburetor parts contacted by the gasoline composition, thus forming a moisture-displacing, residual coating on said carburetor

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parts, which coating tends to prevent the adherence to said metal surfaces of accumulations of ice of magnitudes sufficient to block the narrow air passages that exist in carburetors at engine idling conditions. It is also considered that the dialkyl acid o-phosphates of this invention may orient themselves about small, individual water or ice particles, thus tending to prevent the formation of macrocrystals of ice of a size sufficient to block carburetor air passages at engine idling conditions.

The herein disclosed dialkyl acid o-phosphates can be utilized in gasoline compositions that contain a small amount of a light lubricating oil. In such instances, the o-phosphates, by virtue of their affinity for the lubricating oil, are believed to attract the oil to the same critical carburetor surfaces referred to above and concurrently to increase the spreading and metal-wetting characteristics of the oil, thus promoting the formation of an adherent oil film on the metal surfaces of the carburetor parts. The oil film thus appears to function similarly as the dialkyl acid o-phosphates themselves, but the superior metal-wetting properties imparted to the oil by the additive enable the oil to displace moisture from the metal carburetor surfaces that it would not thoroughly displace alone.

As previously indicated, the materials which are suitable for addition to gasoline fuel compositions in accordance with the principles of this invention are dialkyl esters of orthophosphoric acid, i. e., dialkyl acid o-phosphates, wherein one of the alkyl groups contains a normal carbon chain of a length such as to impart oil-solubility to the composition, i. e., at least 6 carbon atoms, and the total number of alkyl carbon atoms in both alkyl groups is not greater than 20. The members of the above-defined class of dialkyl acid o-phosphates are considered superior to dialkyl phosphates that have no alkyl group containing 6 or more carbon atoms, or that have a total number of alkyl carbon atoms in excess of 20. The dialkyl acid o-phosphates of this invention are also considered distinctly superior to the mono- and tri-esters of orthophosphoric acid, since they are considerably less acidic and less susceptible to water leaching than the former, and since they possess greatly superior anti-stalling properties as compared with the latter. Dialkyl acid o-phosphates wherein one alkyl group contains 8 to 12 carbon atoms and the other contains 3 to 8 carbon atoms are considered especially effective materials for the purposes of this invention. An example of a preferred dialkyl acid o-phosphate is 3-methylbutyl, 2-ethylhexyl acid o-phosphate. Examples of other dialkyl acid o-phosphates included by the invention and having properties suitable for the purposes thereof are di-n-octyl acid o-phosphate, di-isooctyl acid o-phosphate, di-2-ethylhexyl acid o-phosphate, di-n-capryl acid o-phosphate, n-amyl n-dodecyl acid o-phosphate, and isoamyl n-dodecyl acid o-phosphate.

The preparation of the dialkyl acid o-phosphates included in the scope of this invention is conventional and forms no part of the invention. For this reason, the various methods of preparation of these compounds need not be disclosed in detail, and it will suffice to note that dialkyl acid o-phosphates can be prepared according to one conventional method by reaction of a monohydric saturated aliphatic alcohol with phosphorus pentoxide.

The dialkyl acid o-phosphates included in the scope of this invention are useful when incorporated in gasoline compositions in the proportion range of about 3 to about 30 pounds per thousand barrels of gasoline, which range corresponds approximately to 0.001 to 0.01 percent by weight of the composition. Normally, a major improvement in anti-stalling properties, as well as corrosion-inhibiting properties, is obtained by the use

of amounts of at least about 10 pounds of dialkyl acid o-phosphate per thousand barrels of gasoline (approx. 0.003 weight percent). It is important that the amount of dialkyl acid o-phosphate employed should not be so great as to increase the "gum"-forming tendencies of the gasoline to an undesirable extent. Excessive amounts of the acid o-phosphates can increase the gasoline gum content to an undesirable extent, promoting oxidation and/or polymerization of the olefinic components that are present in gasolines, for example, of the type containing cracked constituents. Polymerization of olefins is undesirable not only from the standpoint of the increase in gum content, but also in that it can lower the octane rating of the gasoline. In general, we have found that amounts of dialkyl acid o-phosphates not greater than about 30 pounds per thousand barrels of gasoline do not increase the gum content of the gasoline to an unsatisfactory extent, or promote an unsatisfactory degree of oxidation or polymerization. Where the nature of the gasoline and the conditions of its use permit, it is preferred that no more than about 20 pounds of the dialkyl acid o-phosphate per thousand barrels of gasoline be employed, in order still further to minimize any gum-forming or octane-reducing tendencies. Thus, the greatest benefits are obtainable by employing the dialkyl acid o-phosphates of this invention in gasoline compositions in the preferred proportions of 10 to 20 pounds per thousand barrels.

With respect to the particular concentration ranges discussed above, it will be appreciated that the optimum concentration of dialkyl acid o-phosphate can vary according to the specific nature of the alkyl groups and according to the severity of the atmospheric conditions encountered in the area in which the gasoline is used. With regard to the last mentioned factor, the problem of engine stalling due to carburetor icing resulting from the refrigeration by evaporating gasoline of moisture condensed from the atmosphere has been observed to be significant at atmospheric temperatures of between about 30° and 60° F., e. g., 35°, 40°, 45°, 50° F., and when the relative humidity is in excess of about 65 percent, e. g., 75, 85, 95, 99 percent. The optimum concentration of anti-stalling additive should be sufficient to effect a substantial reduction in the stalling tendencies of the fuel at the atmospheric conditions of temperature and humidity which are likely to be encountered in service.

In addition to the foregoing factors, the optimum concentration of the anti-stalling additive material varies principally according to the particular gasoline employed, since the problem of engine stalling is a function of the 50 percent ASTM distillation point of the gasoline fuel. Greater concentrations of the additive combination are normally desirable with decreasing 50 percent distillation points.

Practically speaking, the problem of engine stalling due to carburetor icing during rapid evaporation of gasoline occurs only in connection with gasolines having a 50 percent ASTM distillation point of not greater than about 235° F. While occasional engine stalling may occur as a result of carburetor icing at severe atmospheric conditions of temperature and humidity with gasolines having somewhat higher 50 percent ASTM distillation points, experience has indicated that the problem does not assume major importance except with gasolines of the character indicated. The problem of engine stalling due to carburetor icing is especially severe in connection with gasolines having a 50 percent ASTM distillation point of less than about 220° F. The invention is particularly useful in connection with such gasolines. The term "gasoline" is used herein in its conventional sense to include hydrocarbon mixtures having a 90 percent ASTM distillation point of not more than about 392° F. and a 10 percent ASTM distillation point of not more than about 140.

As previously indicated, the gasoline compositions of

this invention are additionally benefited with respect to non-stalling characteristics by the inclusion therein of a small amount of a lubricating oil having a viscosity of 100° F. of between about 50 and about 500 Saybolt Universal seconds; for example, an oil having a viscosity of about 100 S. U. S./100° F. can be used with advantage. Although highly paraffinic lubricating distillates can be used, lubricating distillates obtained from Coastal or naphthenic type crude petroleum oils are preferred because of their superior solvent properties. The lubricating oils utilized in the gasoline compositions of this invention can have been solvent-treated, acid-treated or otherwise refined prior to incorporation into the gasoline compositions of this invention. The lubricating distillates referred to are useful in the gasoline compositions of this invention in amounts of about 0.25 to about 0.75 percent by volume of the composition, for example 0.5 volume percent. Greater amounts of the lubricating oil can be used, but the amount of lubricating oil used should not be so great as to adversely affect the volatility and combustion characteristics of the ultimate gasoline compositions.

The dialkyl acid o-phosphates included by this invention can be incorporated into the base gasoline fuel compositions in any suitable manner. Thus, the acid o-phosphates can be added as such or in the form of dispersions or solutions in solvents such as butanol, isopropanol, ethanol, methanol, 2-butoxyethanol, diethylene glycol monobutyl ether, benzene, toluene, heptane, kerosene, gasoline, mineral oil or the like, which solvents may or may not themselves additionally contribute to the anti-stalling characteristics of the ultimate composition. If desired, the dialkyl acid o-phosphates included by this invention can be incorporated in gasoline fuel compositions in admixture with other materials designed to improve one or more properties of the gasoline, such as antioxidants, anti-knock agents, ignition control additives, dehazing agents, corrosion inhibitors, dyes and the like.

Gasoline compositions of this invention are further illustrated by the following representative specific examples.

EXAMPLE I

An anti-stalling concentrate was prepared by dissolving 1 percent by weight of a mixture, consisting of a mineral lubricating oil solution containing 75 percent by weight of 3-methylbutyl,2-ethylhexyl acid o-phosphate, in 99 percent by weight of a gasoline described below in detail. A typical sample of the lubricating oil solution containing 75 percent 3-methylbutyl,2-ethylhexyl acid o-phosphate had the following inspections:

Gravity, ° API	15.3
Sp. gr., 60°/60° F	0.964
Lb./gal., 60° F	8.03
Viscosity, SUV. sec.:	
100° F	113.1
210° F	43.2
Mol combining wt.	375
Flash, P-M, ° F	166
Flash, OC, ° F	170
Pour, ° F	<-80
Appearance, room temp	Bright
Color	Amber
Color, ASTM union	1.75
Physical state	Liquid
Odor	Isoamyl alcohol
Water by distillation, percent	Nil
Phosphorus, percent	8.04
Neutralization value, ASTM D-974-52T, total acid No	189

The foregoing gasoline solution was incorporated in separate samples of a gasoline that had a strong tendency to promote engine stalling due to carburetor icing in the respective amounts of 1.0 and 0.8 percent by weight of the compositions so as to provide two samples containing

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respectively 0.0075 and 0.006 percent actual inhibitor concentration. A typical sample of the base gasoline employed in this example had the following inspections:

Gravity, ° API	68.0
Sp. gr. 60°/60° F	0.709
Knock rating, motor method, octane No.	81.6
TEL, ml./gal.	0.48
Heat of combustion, B. t. u./lb. (net)	19,020
Vapor pressure, Reid: lb	6.8
Distillation, gasoline:	
Over point, ° F	122
End, ° F	290
10% evap. at, ° F	145
40	172
50	180
90	220

EXAMPLE II

Another gasoline composition in accordance with the principles of this invention was obtained by admixture of 0.8 percent by weight of the composition of an anti-stalling concentrate, consisting of a 1 percent solution of diisooctyl acid orthophosphate in the gasoline of Example I, with 99.2 percent of another sample of the gasoline of Example I to which there had been previously added 0.5 percent by volume of an approximately 100 S. U. S./100° F. Texas lubricating distillate, a typical sample of which had the following inspections:

Gravity, ° API	24.5
Lbs./gal., 60° F	7.55
Viscosity, SUV, sec.:	
70° F	235
100° F	106.0
130° F	63.9
210° F	38.3
Viscosity index	16
Flash, P-M, ° F	315
Flash, OC, ° F	320
Fire, OC, ° F	355
Pour, ° F	-60
Color, ASTM union	2.0
Carbon residue, Conradson, percent	0.02
Copper strip test, 212° F. 3 hr	0
Neutralization value ASTM D-974-51 T, total acid No.	0.05

The diisooctyl acid orthophosphate of this example was prepared from a commercial mixture of octyl alcohols consisting mostly of isomeric branched-chain octyl alcohols.

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II, there can be substituted di-n-octyl acid o-phosphate, di-2-ethylhexyl acid o-phosphate, di-n-capryl acid o-phosphate, n-amyl n-dodecyl acid o-phosphate, and isoamyl n-dodecyl acid o-phosphate.

As heretofore indicated the dialkyl acid o-phosphates included by this invention produce an appreciable improvement in the stalling characteristics of gasolines that normally tend to promote engine stalling due to carburetor icing. To illustrate the nature of the improvement obtained, in the table following there are presented the results obtained with engine tests made upon gasoline fuel compositions prepared in accordance with Example I above. In order to demonstrate the superior nature of the dialkyl acid o-phosphates included by the invention there are also presented in the following table the results obtained with engine tests carried out on similarly prepared gasoline compositions containing, respectively, a tri-substituted o-phosphoric acid ester and a di-substituted ester containing no substituent having 6 or more carbon atoms.

According to the test procedure followed, the fuel compositions to be tested were fed to a standard 216 cubic inch, six cylinder, overhead valve, Chevrolet engine, drawing air through a bed of approximately 2 inch chunks (initial size) of cracked ice packed in a standard ASTM-CFR ice tower. The engine was equipped with a standard Carter Model W-1 carburetor having a standard power glide type throttle damper. The carburetor and fuel system were insulated from the engine by means of a ¼ inch thick asbestos cement board shield, 10 inches in width, which extended the length of the manifold.

The conditions at which the engine was operated are set forth below:

Cooling water temperature, °F.:	
In	75-80
Out	90-95
Crankcase oil temperature, °F	140-150
Carburetor air intake temperature, °F	39-41
Relative humidity, percent	82-85

The operating cycle of the engine included, after temperatures became stabilized, operation for five minutes at 1500 R. P. M. at 5 brake horsepower (B. H. P.) load. During this period the carburetor throttle plate becomes chilled and ice formations are allowed to build up. After this five-minute run, the throttle was closed to the pre-set position to allow 450 R. P. M. idle speed. If the engine idled satisfactorily for 30 seconds the fuel was considered non-stalling during that operating cycle.

Table A

Composition	Base Fuel	Additive	Concentration, Active Ingredient, Percent by Wt.	Engine Test: Stalls per 5 Operating Cycles
1	Base Gasoline, 180° F. 50% ASTM Distillation Point (Example I Base Fuel).			5
2	Base Gasoline	3-Methylbutyl,2-ethylhexyl o-Phosphoric Acid of Example I.	0.0075	0
3	do	do	0.006	2
4	Base Gasoline plus 0.5 Vol. Percent 100 Texas Oil.	Diisooctyl o-Phosphoric Acid of Example II.	0.008	0
5	Base Gasoline	Tricresyl Phosphate	0.01	5
6	Base Gasoline plus 0.5 Vol. Percent 100 Texas Oil.	Diisoamyl Orthophosphate	0.01	5

The foregoing specific embodiments of the compositions of this invention are considered illustrative only, and other suitable compositions can be prepared by substitution of other dialkyl acid o-phosphates disclosed herein into the foregoing specific embodiments in the same or equivalent proportions. Thus, for example, for the 3-methylbutyl,2-ethylhexyl acid o-phosphate of Example I, or the diisooctyl acid o-phosphate of Example

From the results presented in Table A above it will be seen that uninhibited gasolines having a relatively low 50 percent ASTM distillation point possess poor stalling characteristics and that such gasolines are markedly improved by incorporation therein of small amounts of the dialkyl acid o-phosphates included by this invention. Thus, comparison of the results obtained with compositions 2, 3 and 4 with the results obtained for

the uninhibited gasoline, Composition 1, demonstrates the improvement in stalling characteristics obtained by the invention. Comparison of the results obtained with compositions 2, 3 and 4 with those obtained for compositions 5 and 6 demonstrates the marked superiority of the class of di-substituted o-phosphoric esters included by this invention.

The results set forth in the foregoing table for composition 2, 3 and 4 are considered illustrative only, and good results can also be obtained with gasoline compositions containing other dialkyl acid o-phosphates disclosed herein.

In addition to effecting a reduction in engine stalling tendencies due to carburetor icing, the herein disclosed dialkyl acid o-phosphates are effective corrosion inhibitors

temperature oil bath. A 30 ml. portion of synthetic sea water is added to the beaker and the mixture is stirred continuously throughout the test period of 24 hours by a mechanical stirrer provided for the purpose. At the end of the test period the steel rod is removed from the test fuel, drained and examined for rusting. In the herein disclosed test results the steel test rods were rated according to the following scale, depending upon the amount of rust, 0=none; 1=trace to 5 percent; 2=6 percent to 25 percent; 3=26 percent to 50 percent; 4=50 percent to 100 percent. The corrosion inhibitor under test is regarded as passing if the test rod shows not more than 6 rust spots of 1 mm. or less in diameter for an inhibitor concentration not exceeding 20 pounds per thousand barrels.

Table B

Run No.	Stock	Additive	Concentration, Lbs./1,000 BBls.	Salt Water Corrosion at 100° F. after 10% Water Wash, 24 Hours
1-----	Depolarized Isooctane	3-Methylbutyl, 2-ethylhexyl o-Phosphoric Acid (75% solution in lubricating oil).	20	4 (100%).
2-----	Same-----	3-Methylbutyl, 2-ethylhexyl o-Phosphoric Acid (75% solution in lubricating oil).	20	0.
3-----	Same-----	3-Methylbutyl, 2-ethylhexyl o-Phosphoric Acid (75% solution in lubricating oil).	20	0.
4-----	Same-----	Same as Run 3.	10	1 (%).

in gasoline, notwithstanding the small proportions contemplated, even under extremely severe service conditions. For example, the dialkyl acid o-phosphates of this invention, when used in gasoline in very small concentrations, are capable of inhibiting the rusting of ferrous metal surfaces even in the presence of sea water. Moreover, the dialkyl acid o-phosphates included by this invention are not highly susceptible to water leaching.

Corrosion inhibiting properties and resistance to water leaching are important, since gasoline compositions are exposed to leaching by moisture condensed from the atmosphere in contact with the gasoline and by accumulated water in the storage tanks. Storage tanks, pipe lines and other metal surfaces contacted by wet gasoline are subject to corrosion by the moisture contained therein. Outstanding corrosion inhibiting characteristics and resistance to water leaching are especially important in the case of gasolines transported by marine vessels, since such gasoline is often shipped in direct contact with large volumes of highly corrosive sea water used as ballast.

In order to illustrate the corrosion inhibiting properties of gasoline compositions containing small proportions of the disclosed dialkyl acid o-phosphates of this invention, and which have been subjected to water leaching, there are presented in the table below the results obtained according to the standard test for corrosion inhibitors proposed by the Departments of the Navy and Air Force Aeronautical Standards Group, MIL-I-4.4.2-4.4.2.3. Briefly, according to this test the test fuel, isooctane, is depolarized by vigorous shaking in contact with 8-14 mesh activated alumina in the proportion of 100 g. alumina per gallon of isooctane. A 350 ml. sample of the filtered, depolarized isooctane containing the selected concentration of the corrosion inhibitor to be tested is placed in a separatory funnel with 35 ml. of distilled water. The mixture is shaken for 1 minute and allowed to separate in layers. After removal of the water layer, 300 ml. of the isooctane layer is used as the test fuel in a corrosion test procedure that corresponds substantially to ASTM test D 665-52 T, Procedure B. Thus, the 300 ml. sample of water-washed isooctane is placed in a 400 ml. beaker and a previously polished cylindrical steel test specimen is immersed therein. The temperature of the isooctane is raised to 100° F. by immersion in a constant

From the results presented in the foregoing table it is apparent that the gasoline compositions of the invention have excellent corrosion inhibiting properties and that they are extremely resistant to water washing.

In order to demonstrate the importance of the low concentrations of dialkyl acid o-phosphates used in the gasoline compositions of this invention, gasoline samples containing additive concentrations within the scope of this invention were compared with others containing substantially greater concentrations of the same additive to determine their tendencies toward gum formation. In these tests separate gasoline samples containing 3-methylbutyl, 2-ethylhexyl acid o-phosphate in amounts varying from 0 to 70 pounds per thousand barrels were prepared using a 94.5 octane commercial premium grade gasoline base, inhibited against oxidation, and containing catalytically cracked, straight run and polyformed distillates, and containing 2.87 ml. of tetraethyl lead per gallon. The gasoline samples were tested according to a modification of the procedure of the standard accelerated gum test MIL-F-5572A. Briefly, this test involves oxidation of a 200 ml. sample of gasoline in an oxidation bomb for 4 hours at 212° F. under 100 p. s. i. initial cold oxygen pressure. The quantity of gum formed is determined by evaporation of the oxidized gasoline in a Pyrex dish. The gum is reported as mg. gum/100 ml. gasoline. The results of the tests are presented in the following table:

Table C

	Sample 1	Sample 2	Sample 3
Make-up, percent: Base Gasoline-----	100	100	100
Additive Agents, Lbs./1,000 Bbls.: 3 - Methylbutyl, 2 - ethylhexyl o-Phosphoric Acid (75% solution in lubricating oil)-----		18	70
Inspection: Accelerated Gum, 4 Hrs., Mg./100 Ml.-----	7	33	249

The data set forth in the foregoing table show that gasoline compositions containing dialkyl acid o-phosphate concentrations within the scope of this invention are greatly superior to compositions containing larger concentrations of dialkyl acid o-phosphate in that the former will exhibit much less tendency to form gum during storage.

As already indicated briefly, the dialkyl acid o-phosphates included by the invention form a superior class of gasoline additives because of their desirable solubility and volatility characteristics. The latter property is significant in that the phosphate esters of this invention do not themselves tend unduly to increase the existing gum content of the gasoline. This property was shown by comparing the existent gum content of samples of the premium grade gasoline described in the preceding tests that contained, respectively, 0 and 18 pounds per thousand barrels of a dialkyl acid o-phosphate of this invention. The existent gum content was determined by the standard procedure of ASTM test D 381-52 T. Briefly, this test involves the air-jet evaporation of a 50 ml. sample of gasoline. Existent gum is reported as mg./100 ml. There are presented in Table D, below, the results of these determinations. By way of further comparison there is also presented in Table D the existent gum content of another sample of the test gasoline that contained a comparable amount of a commercial dilauryl acid o-phosphate.

Table D

	Sample 1	Sample 2	Sample 3
Make-up, percent: Base Gasoline.....	100	100	100
Additive Agent, Lbs./1,000 Bbls.: 3-Methylbutyl, 2-ethylhexyl o- Phosphoric Acid (75% solution in lubricating oil).....		18	
Dilauryl o-Phosphoric Acid.....			14
Inspection: Existent Gum, ASTM D 381-52 T, Mg./100 Ml.....	3	4	10

The results presented in the foregoing table show that the existent gum content of gasoline compositions containing the dialkyl acid o-phosphates of this invention remains essentially unchanged, whereas the existent gum content of gasoline compositions containing relatively high molecular weight dialkyl acid o-phosphates is several hundred percent as great as that of the blank gasoline.

To the gasoline fuel compositions of the present invention there can be added one or more additional additive agents designed to improve one or more characteristics of the gasoline fuel. For example, antioxidants, anti-knock agents, ignition control additives, other de-icing agents, anti-rust agents, dyes, lead scavenging agents and the like can be added to the gasoline compositions of this invention, and the invention specifically includes gasoline compositions containing such additives.

Numerous additional embodiments of the invention will readily suggest themselves to those skilled in the art. Accordingly, we do not intend to be limited by the foregoing description, but rather only by the terms of the claims appended hereto.

We claim:

1. A gasoline composition comprising a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and having incorporated therein in a ratio of about 3 to 30 pounds per thousand barrels of said gasoline composition a dialkyl acid o-phosphate, wherein one of the alkyl

groups contains at least 6 carbon atoms, and the total number of carbon atoms in both alkyl groups is not greater than 20.

2. The composition of claim 1 wherein the hydrocarbon mixture contains additionally about 0.25 to 0.75 percent by volume of the composition of a light lubricating oil whose viscosity at 100° F. is about 50 to about 500 Saybolt Universal seconds.

3. A gasoline composition comprising a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and having incorporated therein in a ratio of about 3 to 30 pounds per thousand barrels of said gasoline composition a dialkyl acid o-phosphate, wherein one of the alkyl groups contains 8 to 12 carbon atoms, and the other contains 3 to 8 carbon atoms.

4. A gasoline composition comprising a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and having incorporated therein in a ratio of about 3 to 30 pounds per thousand barrels of said gasoline composition 3-methyl-butyl,2-ethylhexyl acid o-phosphate.

5. A gasoline composition comprising a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and having incorporated therein in the ratio of about 3 to 30 pounds per thousand barrels of said gasoline composition diisooctyl acid o-phosphate.

6. A gasoline composition comprising a major amount of a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and tending to promote stalling of internal combustion engines, and a minor amount, sufficient to reduce the stalling tendencies of the composition, of 3-methyl-butyl,2-ethylhexyl acid o-phosphate, said minor amount being about 10 to 20 pounds of said acid o-phosphate per thousand barrels of gasoline.

7. A gasoline composition comprising a major amount of a hydrocarbon mixture boiling in the gasoline range, having a 50 percent ASTM distillation point of less than 220° F., and tending to promote stalling of internal combustion engines, and a minor amount, sufficient to reduce the stalling tendencies of the composition, of diisooctyl acid o-phosphate, said minor amount being about 10 to 20 pounds of said acid o-phosphate per thousand barrels of gasoline.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,851,343

September 9, 1958

Troy L. Cantrell et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 7, for "0.48" read -- 0.49 --; columns 7 and 8, Table B, opposite Run No. 4, column 5 thereof, for "1(%)" read -- 1(1%) --.

Signed and sealed this 4th day of November 1958.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents