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GASOLINE COMPOSITIONS

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This invention relates to an improved compound additive for gasoline and to gasolines containing the additive, and more particularly to an additive composition effective to reduce engine deposits and piston ring wear when incorporated into a gasoline.

This application is a continuation-in-part of my application S. N. 345,830, filed March 31, 1953, and now abandoned.

I have discovered that the performance of gasoline in respect of engine cleanliness and piston ring wear may be significantly improved by the addition thereto, in small but significant amounts, usually in the order of ¼ to 2 percent of a composition containing the following ingredients:

	Volume Percent
Light solvent refined hydrocarbon lubricating oil (100 S. U. S. @ 100° F.)	25–80
Benzol	4–12
Isopropyl alcohol	10–70
Dimerized linoleic acid	0.2–0.6
Dihexyl phenyl amine	0.2–0.7
Amyl nitrate	0.03–0.15

the dimerized linoleic acid being prepared according to the directions given in Journal of American Oil Chemist's Society 24,65 March, 1947. This acid will be hereinafter referred to as dimer acid.

While the ingredients may be mixed together in the above proportions, and added to a gasoline in the amounts specified, I have found that for summer driving, good results may be obtained by adding to a gasoline 0.5% of an additive having the following composition:

Additive A

Ingredient	Volume Percent of Additive	Volume Percent of Gasoline
Lubricating oil	75.40	0.3785
Benzol	11.60	.058
Isopropyl alcohol	11.60	.058
Dimer acid	0.60	.003
Dihexyl phenylamine	0.70	.0035
Amyl nitrate	0.10	.0005

For spring or fall I may increase the percentage of isopropyl alcohol to about 50%, and for winter driving to about 70%, decreasing the percentages of the other ingredients proportionately. In such cases, however, I increase the amount of additive so as to maintain in the gasoline approximately the same concentration of ingredients other than alcohol as when using 0.5% of additive A.

Gasolines containing 0.25% and 0.5% of additive A have been extensively tested for piston ring wear, combustion chamber deposits, and rusting characteristics.

In determining the effect of the additive on piston ring wear, tests were conducted in a Chevrolet engine under FL–2 conditions except for the following modifications.

(*a*) The top compression rings for cylinders 1, 2, 3, 4,

and 5 were exposed to 3×10^{12} neutrons per cm.^{2} per second flux for a period of one week in an atomic pile. Five "hot" rings were used in order to make the test as sensitive to wear as possible. A greater number were not used because five were considered to be the maximum number that could be safely handled.

(*b*) The engine was converted to run with a dry sump to facilitate flushing, reduce the oil charge required, and make possible continuous radioactive sampling throughout the test.

(*c*) The engine was operated under the following conditions.

Test duration, hours	10
Brake H. P	25
R. P. M	2500±20
Water outlet temperature, °F	100±5
Water inlet temperature, °F	90±2
Lube oil temperature, °F	165±5
Air-fuel ratio	14.5:1
Exhaust back pressure (in. water)	13.6±7.8
Ignition timing	38±3 BTC

The standard radioactive tracer technique was used. As the radioactive piston rings wore, the particles were suspended in the lubricating oil and the level of radioactivity recorded by a Geiger tube immersed in a constant volume of oil that was circulating through the system.

Final evaluation of the wear of each run was obtained by calculating the slopes of the wear curves during the last six hours and the last nine hours. The first part of each curve reflected the high wear rate coincident with a cold start under these conditions, the last six hours reflected a stable wear rate. Carry-over effect between each test was minimized by flushing first with a mixture of solvent and oil, and then with oil only.

An average of five tests on a reference gasoline indicated an average rise per hour in counts per minute for the last nine hours of 1014, and a rise for the last 6 hours of 973. When using the same reference gasoline, with 0.5% of additive A added, an average of four tests showed the rise for the last nine hours to be 952, and for the last 6 hours 868. It is felt that the 4 to 10 hour average is a more accurate yardstick than the 1 to 10 hour average, and this indicates that the additive fuel gives in the neighborhood of 10 percent less wear under the test conditions used.

In testing for engine cleanliness characteristics two sets of runs were made to compare the effects of a reference gasoline with gasoline containing 0.25% and 0.5% additive A in a Chevrolet engine. Before the start of each run the engine was flushed with a solvent, torn down, cleaned, reassembled, and filled with SAE 20 oil. The oil level was checked every 8 hours during the runs, and more oil was added as needed. At the conclusion of each run the engine head was removed, and the deposits were scraped from the top of the pistons and surrounding flat surface block areas and placed in crucibles. Oil and soluble products of combustion were removed by repeated washings with benzene. The deposits were then dried and weighed on an analytical balance. To determine the amount of ash, the crucibles were placed in a muffle, ashed, and reweighed.

The total time on each test was 60 hours of continuous operation divided into hourly no-load and 5.4 B. H. P. load cycles.

Results of the tests indicated that 0.25% of additive A resulted in a reduction of 6.7% in oil free deposits, while the addition of 0.5% of additive A resulted in a reduction of 13.5% in oil free deposits, and 24.8% in ash.

A series of road tests were also run in a 1952 DeSoto passenger car, using reference gasoline, and a gasoline containing 0.5% of additive A. It was found that use of

the additive reduced oil free deposits by 14%, and ash by 30%.

Rusting tests were also carried out on gasoline containing 0.5% additive A. These tests were carried out under ASTM D–665 test procedure using synthetic sea water with the following modifications.

(*a*) The test duration was increased until incipient rusting was experienced.

(*b*) The temperature was reduced from 140° to room temperature.

(*c*) Means were employed for replacing the gasoline lost by evaporation.

(*d*) The R. P. M. of the stirrer was reduced to 800 R. P. M.

It was found that under these conditions the test pieces immersed in gasoline containing 0.5% of additive A did not develop incipient rusting until a period of 68 hours had elapsed, whereas the average time to develop incipient rusting in test pieces exposed to a reference gasoline was 14½ hours.

The reason why my new additive should be so succesful in reducing wear and engine deposits is not known, since the various ingredients, with the exception of the lubricating oil, are present in the treated gasoline in such minute amounts that it could scarcely be believed that they would be of any value whatever. The addition of the small quantity of lubricating oil specified might be expected to decrease piston wear to a minor extent, but then only at a penalty of increased engine deposits due to cracking and incomplete combustion of the oil in the cylinder. As demonstrated, however, contrary to expectations the engine deposits are decreased rather than increased. It has also been noted that the engine deposits formed when using a gasoline treated with my additive are different in character from those formed when using untreated gasoline, being granular and easily removed from the various engine parts, whereas the deposits formed when using untreated gasoline are varnish like and removable only with difficulty.

It has been found that the octane number of the gasoline is not affected in any way by the incorporation of my

additive in the recommended amounts. This would also appear to be surprising, since amyl nitrate is used as a cetane improver in diesel fuels, and would normally be expected to have a detrimental effect on the octane number. It is speculated that the other ingredients of the additive must in some way neutralize the adverse effects of amyl nitrate on octane number, while preserving its useful characteristics in the composition.

Having now described my invention, what is claimed is:

1. A gasoline containing from about 0.25 to about 2 percent by volume of a composition comprising the following ingredients in the range of proportions set forth, all percentages being by volume.

	Percent
Solvent refined light hydrocarbon lubricating oil (100 S. U. S. at 100° F.)	25–80
Benzol	4–12
Isopropyl alcohol	10–70
Dimerized linoleic acid	0.2–0.6
Dihexyl phenyl amine	0.2–0.7
Amyl nitrate	0.03–0.15

2. A gasoline containing about 0.5% by volume of a composition comprising the following ingredients in approximately the proportions set forth, all percentages being by volume.

	Percent
Solvent refined light hydrocarbon lubricating oil (100 S. U. S. at 100° F.)	75.4
Benzol	11.6
Isopropyl alcohol	11.6
Dimerized linoleic acid	0.6
Dihexyl phenyl amine	0.7
Amyl nitrate	0.1

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