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PROCESS OF DELEADING GASOLINE

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This invention relates to a process for deleading gasoline by treating said gasoline with an oxide of nitrogen.

It is a matter of common knowledge that practically all gasoline commercially available at the present time contains tetraethyllead. For certain purposes the use of leaded gasoline is inadvisable and in such cases an effort must be made to find unleaded gasoline, which frequently involves considerable difficulty. In the armed forces of the United States, particularly in foreign theatres of war, unleaded gasoline is ordinarily not available because it cannot be supplied separately in any practical way. When unleaded gasoline is needed for some special purpose the military personnel must delead the leaded gasoline that is used for vehicles, planes, etc.

One of the important instances in which lead-free gasoline is required is in cooking units of all descriptions, from the Army field range to the single burner portable stove of very small size. Army medical regulations forbid the use of leaded gasoline in connection with cooking equipment because of the danger of contamination of food being prepared, cooked or eaten nearby due to the lead in the vapors coming from the burners. The tendency of fine particles of metallic lead and lead oxide to clog the burners would also make the use of leaded gasoline in the stove units very burdensome if not impossible.

In order that Army units, particularly those in the field, may be able to provide themselves with lead-free gasoline when it is needed, the process presented herein has been devised, which can be practiced with a minimum of materials and equipment and which produces within a comparatively short time a supply of satisfactorily deleaded gasoline.

It is an object of our invention therefore to treat leaded gasoline to remove the lead therefrom and find a suitable method which can be used in the field by the military, farmers and others who have need for a lead-free gasoline but do not have direct access to such.

Nitrogen oxides which can be used are the inorganic oxides of nitrogen such as nitrogen dioxide, peroxide and nitric oxide. In general we accomplish the objects of our invention by bubbling an oxide of nitrogen through the gasoline at a temperature between −50° C. and +50° C.

The product of the reaction of tetraethyllead and NO_2 is apparently diethyllead dinitrate $(C_2H_5)_2Pb(NO_3)_2$, which has been prepared with a yield of 94 per cent from a chloroform solution.

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The X-ray diffraction pattern from the material prepared in the chloroform solution was the same as that from a hydrocarbon solution. The decomposition temperature of the freshly prepared material is 58.5–50.0° C. On standing at room temperature for several days it decomposes to yield crystalling $Pb(NO_3)_2$ which gives an excellent X-ray diffraction pattern. $(C_2H_5)_2PbCl_2$ has been prepared from the $(C_2H_5)_2Pb(NO_2)_2$ by reaction with excess HCl, thus adding further proof to the identity of the original compound. The reaction given above may be illustrated by the following equation:

$$(C_2H_5)_4Pb + 4NO_2 \rightarrow (C_2H_5)_2Pb(NO_3)_2 + \text{unknown product}$$

The amount of nitrogen dioxide used depends partly on the temperature employed and the nature of the gasoline but in the main depends on the amount of tetraethyllead present in the gasoline. The preferred amount is between 1.0 and 10 theories. A theory is the amount of nitrogen oxide theoretically required to completely react all the tetraethyllead present according to the above equation.

By our process complete removal of tetraethyllead has been effected and our process is successful both on aviation type fuels which are primarily saturated fuels and motor fuels containing a high percentage of unsaturated hydrocarbons. Our invention can be best understood by referring to the following working example.

Example

500 milliliters of an average aviation fuel containing 4.5 cubic centimeters of tetraethyllead per gallon are treated with 2 theories of nitrogen dioxide at room temperature for one hour. In this treatment the nitrogen dioxide was bubbled slowly through the leaded gasoline. After one hour of such treatment the tetraethyllead reacted substantially completely with the nitrogen dioxide and formed a precipitate which was filtered. The filtrate (the deleaded gasoline) was tested for tetraethyllead and none was found.

In another example similar to the one above except that a motor fuel containing a high percentage of unsaturated hydrocarbons was used and 4 theories of nitrogen dioxide were bubbled through the leaded gasoline for one hour at a temperature of 50° C., and all of the lead was removed by filtering. In operations similar to the last mentioned example except that the temperature was −50° C. in one case, 0° C. in another case, and +20° C. in a third case a tet-

raethyllead removal of 79 per cent, 96 per cent and 92 per cent respectively was obtained.

All the above tests were conducted at atmospheric pressure. If desired the reaction could be carried out with the oxides of nitrogen either in the form of liquids or gases, at atmospheric pressure or higher.

Nitrogen dioxide has a number of advantages over other materials which have been proposed as deleading agents. It is relatively inexpensive and would probably not be as critical as metallic reagents in time of national emergency. The reaction is rapid so that there need be no prolonged waiting period. Thus, the deleading could be carried out on short notice, an important consideration if the technique were to be adopted for military use. The precipitate is a heavy solid, and some of the excess NO_2 evaporates

from the fuel on standing, so that a second treatment such as water washing may not be necessary. However, the solid is water soluble and can be easily washed out of a container after decanting the deleaded gasoline.

We claim:

1. A process for deleading gasoline containing tetraethyllead which comprises treating said gasoline with an inorganic oxide of nitrogen.

2. A process for deleading gasoline containing tetraethyllead comprising treating said gasoline with from 1.0 to 10 theories of nitrogen dioxide at a temperature of between −50° C. and +50° C.

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No references cited.