

## **Lead Anti-knock Compounds**

### **Function and Composition**

**"Knock"** is a metallic clattering noise in internal combustion engines under stress. It is the result of a collision between the advancing flame front of gasoline ignited by the spark plugs in the cylinder and the flame front of a spontaneous explosion of gasoline from the opposite side of the cylinder caused by compression from the rising cylinder head.

**"Anti – knock"** Compounds act as a catalyst which suppresses secondary spontaneous explosions in the cylinder of internal combustion engines. The result is that a single flame front from the spark plugs sweeps unopposed across the cylinder head. The absence of two explosions means that there is no "knock" or loss of power.

Tetra Ethyl lead was investigated as an anti-knock by Thomas Midgely of Cornell University ca 1920. The first public sales of gasoline containing anti-knock were made in Dayton Ohio in Feb 1923.

Anti-knock Compound consists of an organic lead compound –Tetra Ethyl lead (or, from 1960, Tetra Methyl lead) and a scavenger. The lead compound suppresses the knock and acts as an octane enhancer. In order to prevent the deposits of lead oxide, which were formed in this process, from building up on the spark plugs and valve surfaces it was found necessary to convert the oxide to a more volatile substance. This substance had to be volatile at engine temperatures in order to be discharged with the exhaust gases.

Chloride and Bromide salts suggested themselves with the result that organic scavengers, Ethylene dibromide and Ethylene dichloride came into use, either singly or in combination. This became the largest single use for bromine world wide.

The finished compound thereafter was a mixture of Tetra ethyl (or tetra methyl) lead and either the organic dibromide or dichloride.

This remained the mix for as long as anti knocks were in use. They have now been phased out for motor gasoline and use in aviation gasoline is expected to cease by the end of 2017.

### **Recommended reading**

**"I KEPT NO DIARY"** An autobiography by Air Commodore F.R. (ROD) Banks

**AF. May 2014**