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Oppanol as an additive for winter motor oils

A good winter motor oil must meet the following main specification:

1. The pour point must be so low that at the prevailing temperatures the oil will still flow through the pump.

2. The low temperature viscosity must not exceed a certain value, in order that the required start speed may be attained easily and rapidly with the available starter power.

The need for a very good low temperature characteristic causes the use of thin oil. This is however restricted because a certain minimum viscosity is essential at the high temperature of the warm engine. The first consideration is the good lubrication of bearing and piston, the second is low consumption. On the former we can say: In engine lubrication, as in all branches of engineering, attempts are made to work in the region of fluid lubrication. Numberous reports on bearing tests show that more viscous oils are a better guarantee against hydrodynamic and boundary lubrication, which should be avoided as far as possible because of the resulting wear and tendency to seizure. As to the oil consumption, it deserves particular attention. On the strength of present knowledge, oil consumption depends mainly on viscosity and vaporisability Fig. 1 shows the comparison of consumption for two oils of different viscosity, based on tests carried out here years ago. Recent Intava tests confirmed these results as well as throwing more light on the importance of vaporisability. It can well be assumed that consumption falls off as the viscosity rises, even if the results are strongly affected by other causes, such as the conditions of the engine, the mode of driving etc. The requirement of a good low temperature characteristic with low consumption and good lubrication can only be met by the use of oils with a flat viscosity temperature curve, i.e. with a high viscosity index or low polar height. There are various means to improve the viscosity temperature behaviour. Most popular is the Oppanol mixture B.15, called Paratone by the Americans which contains Oppanol B.15 developed by I.G. together with Standard Oil Company.

Oppanol is a clear colourless liquid having a molecular weight of between a few hundred and many thousand according to the manufacturing process. Its consistency ranges between that of a thin oil and that of a high viscosity polymer which hardly flows at all. It is a pure hydrocarbon of mainly saturated character with a H/C ratio of 2. It is soluble both in mineral and in synthetic oil in any proportion and it cannot be detected without elaborate chemical methods. This proves that it is not altogether of a different nature from lubricants as it is often assumed.

The influence of Oppanol on viscosity and viscosity temperature behaviour is shown on Fig. 2 after American tests. Oppanol in different degrees of concentration was added to two oils of equal viscosity at 99°C but of different V.I. With a 5% addition in oil 1, the V.I. rose from 26 to 111 and the polar height fell off from 3.9 to 1.7. The effect is less marked but still quite noticeable on oil 2., which had originally a good viscosity temperature characteristic. Although Oppanol produces such unusual variations of viscosity and viscosity temperature characteristics, the other physical and chemical constants are hardly affected. Specific gravity, ignition point, flash point, pour point, colour, Conradson test, acidification and saponification coefficient, there are generally the same as in the basic oil. Numerous recent American and German tests confirm this point. At high temperatures Oppanol produces no oil carbon: it burns and cracks without leaving a residue.

The view that Oppanol leads to gumming of the bearing surfaces, of piston and cylinder, etc. is wrong. This theory results from the fact that Oppanol was compared to rubber, which has been tentatively used in America as an oil additive. Evidently an Oppanol addition always implies thickening, especially at low temperature. The viscosity increase however is considerably greater at high than at low temperatures. Fig. 3 shows the effect of an Oppanol addition on the viscosity curve of an army motor oil, with 0.7% Oppanol. If we compare this with the original oil at equal viscosity, we find for a viscosity of 20 c.st. about 71°C in the basic oil against 80°C after the Oppanol has been added. This difference of 9°C grows with the temperature. At lower temperatures, e.g. at 600 c.st., the temperature difference is about 4° and at intense cold, 40,000 c.st., measurements in the Schwaiger apparatus showed 1.5 to 2°C. This example proves that at low temperatures oil thickens only to a small extent; the conclusion may therefore be drawn that Oppanol does not noticeably affect the start characteristic. If a viscous mineral oil is used instead of Oppanol, the superiority of the latter appears particularly clear. Thickening on oil was not pushed as far as on Oppanol, still this mixture behaves at low temperature worse than Oppanol oil. Breaking off tests in the I.G. cold cabinet gave similar results. Extensive engine tests on low temperature start characteristic were carried out in the U.S.A. They always proved that the results agreed with the extrapolated viscosity value, i.e. two oils of equal extrapolated viscosity always had the same start characteristic, independently of whether they contained Oppanol. No gumming was observed.

It can therefore be assumed from the above that as an additive to oils Oppanol has no negative properties. The positive effect, i.e. reduction of oil consumption, will be more clearly illustrated below.

According to American tests an oil of 1.88°E was thickened to 3.01°E at 99°C. In the process the viscosity index rose from 103 to 119, the consumption fell from 3.24 lt./1,000 km. to 2.28, i.e. to about 2/3 of the basic oil.

Similar tests were carried out by the Experimental Station as early as 1936 (Fig.4.) These tests on two 1.2 lt. Opel cars covered a run of 600 to 1,000 km. The oils used were Gargoyle A.F., Gargoyle Arctic without and with 1.5% Oppanol. The tests give a clear picture of the consumption figures. The very high oil consumptions in tests 1 & 2 are due to the fact that at the start the two engines were completely dry and the quantity corresponding to the initial oil film remained in the engine when it was drained, thus producing an additional apparent consumption. The graph shows clearly that Oppanol oil has a lower consumption than the basic oil or the reference oil of about double viscosity. We have repeated these tests on army winter oil, carrying out both laboratory and running tests. We were however, unable to show so clearly the positive action of Oppanol by reproducible tests. The variations of the consumption exceed the prevailing differences. We hope however to obtain reliable results by improving the test methods. Tests are continuing.

Fig. 1. Viscosity and oil consumption.

Fig. 2. Influence of Oppanol on viscosity and viscosity temperature characteristic.

Fig. 3 Effect of Oppanol addition on Viscosity curve.

Fig. 4 Effect of Oppanol addition on oil consumption.