5. The Significance of Cetane Increase.

At the Technische Hochschule of Stuttgart, considerable work was done to determine, at various temperatures, the "critical compression ratio" of a diesel engine; that is, the compression ratio below which ignition of the diesel fuel cannot be entertained. The two charts show some of the results. In Figure 1 critical compression ratios are plotted against air temperatures for fuels of various ignitabilities and for ignition accelerating vapours in the air used for combustion. Figure 2 shows the correlation between cetane ratings and critical compression ratios at normal temperature (65°C) for various additions of ethyl nitrate.

Thus it would appear that an increase in cetane rating by permitting a reduction of the "critical compression ratio" at every temperature makes it possible to build an engine that develops more power per pound or, conversely, to obtain a greater output from an engine built for a given compression ratio.

In reviewing these laboratory efforts to raise the cetane rating of oils used as diesel fuels the following questions have been justifiably asked. "How high should the cetane rating of a fuel be raised? What can be gained? What seems to be the desirable cetane limit in the light of today's knowledge? What is the diesel engine manufacturer's position with regards to extremely high cetane ratings?

The German scientists and manufacturers interviewed seem to agree on the answer summarized below. For the present high speed diesel engine 50 cetane rating is satisfactory. For the engine of tomorrow the discussion revolved around the question of "efficiency versus compression ratio".

An examination of Figure 3 shows, in the range of the Otto gasoline engine, an increase in efficiency with an <u>increase</u> in compression ratio, the latter being made possible by an increase in the "octane rating" of the fuel. A further examination shows, in the range of the diesel engine, a somewhat smaller increase in efficiency with <u>decreasing</u> compression ratio. Such decrease, as shown above, is made possible by use of a fuel having a high ignition quality.

5. The Significance of Cetane Increase Cont'd

Therefore an increase in cetane rating, in ignitability instead of being used to further an "increase in compression ratio" is used in an entirely opposite direction, namely to make a smoother running with a "lower" compression ratio, and all the simplification in weight, material, lubrication friction losses, that such a reduction entails. The principle appears to be perfectly sound especially when friction losses are considered and will undoubtedly guide manufacturers on both sides of the ocean towards the construction of a lighter more economical engine that may eventually permit an engine intermeliate between Otto and diesel types.

6. Conclusions.

During the war it can be said that the Germans had no high quality diesel fuel as such, but blends of synthetic and natural products, each playing a definite part in the performance of the fuel. They explored the field of chemical additives but did not use them in practice. They developed certain treatments that resulted in cetane ratings of fantastic proportions. Gasolines had to be used at times when other diesel fuels were scarse. No innovations were found in the way of producing, storing or handling diesel fuels. The processes of nitration and ozonisation of diesel fuels and blends and the treatment of tar oil blends with gaseous SO2 for purification are of major importance and may well contribute to an improvement in, or extension of American diesel fuel supplies, with their further exploration and adoption.

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