Reel 103 P.A.W. Item 11

reel 103

H.16

A STROBOSCOPE FOR NOZZLE RESEARCH.

Ref. No. H.16 Report No. 418

Origin: I.G. Oppau Author: Schuch

Date: 26. 4. 40. Contents: 9 Text Pages
6 Figure Sheets

SUMMARY

A stroboscope is described which enabled fuel sprays to be observed and photographs of them to be taken. The source of light was a high tension spark obtained from a powerful induction coil, the primary circuit of which was interrupted by a specially developed mercury contact breaker. The contact breaker was driven in synchronism with the fuel pump and the time of break could be altered while running to observe any phase of the spray pattern.

The spacing of the spark electrodes was 50 mm., corresponding to about 50,000 volts, and it was estimated that the duration of the spark was less than 10^{-6} seconds. The timing of the spark repeated to within $\pm$ 1 degree of crank angle. For the photographs a Leica camera with a Xenon f 1.5 lens was used; the film was Agfa Isopan-Ultra.

The use of the apparatus is illustrated with spray photographs which show the formation of the jet and the atomisation of the liquid. The speed of the jet could also be measured.

The author concluded that the operation of a particular nozzle could be judged from observations with the stroboscope.

J.G.W.

reel 103

H.19

MEASUREMENT OF CETANE NUMBERS DOWN TO ZERO.

Ref. No. H.19 Report No. 422

Origin: I.G. Oppau Author: Dipl. Ing. Köhler

Date: 5. 6. 40 Contents: 2 Text Pages
2 Figure Sheets

SUMMARY

Formerly fuels of cetane number below 20 or 15 could not be precisely tested in the I.G. Test diesel. However, fuels below this ignition quality (e.g. tar oil and middle oil from hydrogenation) were used in certain diesel engines (e.g., Motor-bituminous coal tar oil engine and Humboldt-Deutz engines). Hence it was necessary to be able to estimate the ignition quality of such fuels. This was achieved by increasing the maximum compression ratio from 22.5 : 1 to about 27 : 1 by means of decreasing the recess in the piston crown. The pintle of the injection nozzle was adjusted so that good mixing with the compression air took place and no fuel was thrown onto the walls; the engine consequently gave a clean exhaust and good combustion. The new piston could be interchanged with the original without modification to the engine. The original nozzle-pocket was retained and the method of test was unaltered.

The cetane number of fuels ranging from 6 to 14 were measured under the new conditions.

The validity of the mixture-rule for calculating the cetane-number of poor ignition quality fuels was investigated by determining the cetane number of mixtures of gas oil (C.N. = 46) with iso-octane (C.N. = 15), with tetralin (C.N. = 11.5), and with bituminous coal middle oil (C.N. = 9). The cetane number of iso-octane and gas oil mixtures followed a linear relationship; whilst for gas oil with the other two substances, curves on either side of the straight line were obtained. Thus for a 50/50 gas oil-coal middle oil mixture the observed cetane number was 2 units below the value calculated by the linear rule; whilst for a 50/50 gas oil-tetralin mixture the observed value was 4 units higher.

It was concluded that very low cetane numbers can only be precisely found by direct measurement.

J.A.E.M.

reel 103

IGNITION DELAY MEASUREMENT WITH THE FKFS IGNITION-DELAY INSTRUMENT.

Ref. No. H.22 Report No. 426

Origin: I.G. Oppau Author: Dr. Schuch

Date: 30. 7. 40. Contents: 13 Text Pages
3 Figure Sheets

SUMMARY

Various methods of measuring commencement of ignition such as those based on the measurement of pressure, ionisation and radiation are discussed.

The FKFS instrument is based on the measurement of the commencement of inflammation. A quartz window is mounted in the engine cylinder head and a photocell used to detect the onset of radiation. At the commencement of injection a contact on the spray valve closes and starts a current in a circuit; this current is stopped on activation of the photocell. The current impulse is a measure of the delay period and its value can be observed on a heavily damped meter. An advantage claimed was that of being able to obtain a direct reading. The accuracy was about ± 0.3 degrees of crank angle.

The apparatus was used to determine cetane numbers in comparison with similar determinations using a piezo-electric pressure indicator. Repeatability was good but there were consistent differences between the two methods which increased with increase of cetane number, reaching a value of about 8 cetane numbers in the range 80 - 100.

J.G.W.

reel 103

RELATIONSHIP BETWEEN CETANE NUMBERS DETERMINED IN THE I.G. TEST DIESEL AND IN THE HWA ENGINE.

Ref. No. H.25

~~Origin:~~ I.G. Oppau

Date: 21. 8. 40.

Report No. 429

Author: Dr. Singer

Contents: 3 Text pages
1 Figure Sheet

SUMMARY

In five series of tests which were independent of one another the cetane numbers of diesel fuels were determined in both the I.G. Test diesel and in the HWA Engine. In spite of the different types of test engine and different methods, the sequence of results for the fuels is in all cases practically the same in both engines, even though the absolute values showed differences.

From these tests the following relation between the two sets of measured values was found to exist:-

C.N. I.G. Test Diesel = 0.92 C.N. HWA Engine

The I.G. Test diesel determinations were made at Oppau, whilst those in the HWA engine were obtained at various other testing stations. The factor relating the results in the two types of engine was found to be 0.88, 0.89, 0.94, 0.93 and 0.96 in each of the five series respectively, giving the average value of 0.92. The range 0.88 to 0.96 for the correlating factor represents a difference in cetane number for a fuel of 50 cetane number of 2 units. This difference was of the same order as the accuracy of the determination of cetane number.

J.A.E.M.