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TEST STAND AND EXPRIMENTAL REZULTS USING WEAK MIXTURES GASOLINE-HYDROGEN AT DACIA 1300 AUTOMOBILE

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Abstract
In this paper there are being presented the testing device, the block-diagrams as well as the accommodations performed to determine, by comparison with the same engine 810-99 Dacia 1300, the energetically and economical performances and the investigation of the combustion process in weak mixtures with hydrogen addition.

The device on fig. 1 having as a block diagram, Fig. 2, allowed for some researches to be achieved with a view to verifying the possibility of raising the energetically and economical performance as well as the degree of reducing the exhaust gas harmfulness with the s.i. engine, by combusting weak mixtures with an addition of hydrogen 1,2,3,4,5,6,7,8 produced on board the car. The experimental researches also permitted us to obtain data concerning the parameters of the duty cycle and those of the combustion process in the test engine, by verifying the possibility to improve the combustion kinetics of the weak mixtures with the proposed solution in the sparking-ignition engines.

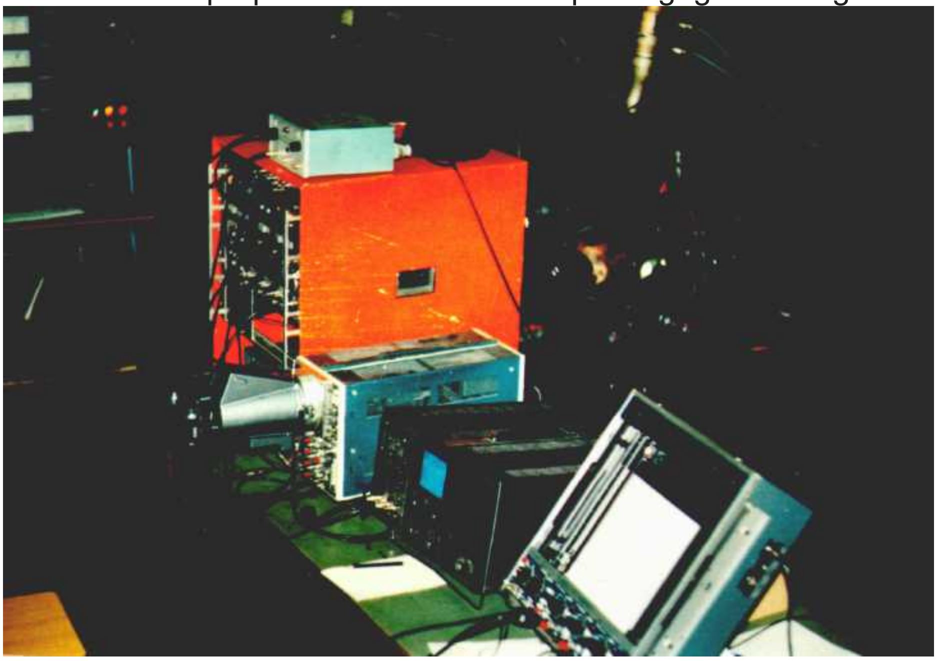
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Fig. 1. Measuring device for the indicated diagram

With that and in view it has bean studied the engine characteristic comparatively under standard condition and with weak mixtures and hydrogen addition under different operating conditions of the engine, respectively. The envisaged research program has been carried out by recording the following parameter required by the investigation:

- parameters concerning the specific real quantities of the engine;
- parameters concerning the specific indicated quantities of the engine;
- coefficient concerning the parameters of the combustion process;
- quantities concerning the level of the noxes in the exhaust gases;

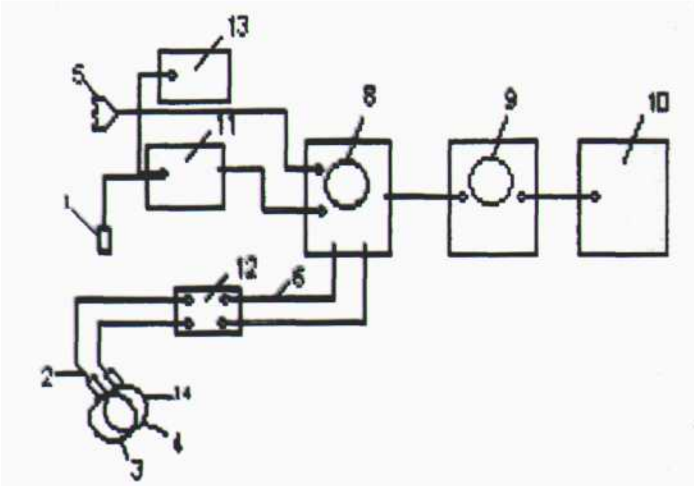

Fig. 2. Measuring device low chart for raising the indicated diagram.

1. KISTLER 601 piezoelectric transducer for measuring the pressure in the cylinder, Response 16,7 pc/bar.
2. Inductive transducers type AVL.
3. Denticulate disk for angle marketing.
4. Denticulate disk for releasing the oscilloscope input for angle marking.
7. Oscilloscope input for external sweeping.
8. Tektronix oscilloscope type 5113.
9. Nicolet digital oscilloscope.

The tests have been performed on the 810-99 engine in several stages. The first stage envisages the determination (9, 10, 11) of the engine effective and indicated parameters on the testing stand by means of a braking geir endowed with suitable metering equipments as well as with an electronic recorder of the indicated diagram in the engine cylinder, in (p_a) coordinates, concomitantly with the cyclical dispersion both by direct plotting and by photography on the oscilloscope.

The data obtained on these devices enabled us to process the indicated diagram in p-V coordinates and to determine the parameters of the combustion process.

The device consists of the KISTLER 601 piezoelectric transducer (1) with the M 14 fillet with a maximum limit of measurement of 100 bar. The transducer is mounted in the cylinder cover engine ratio of compression, in this way being possible to maintain a constant temperature as the transducer jacket passes the cooling space in the cover of the engine.

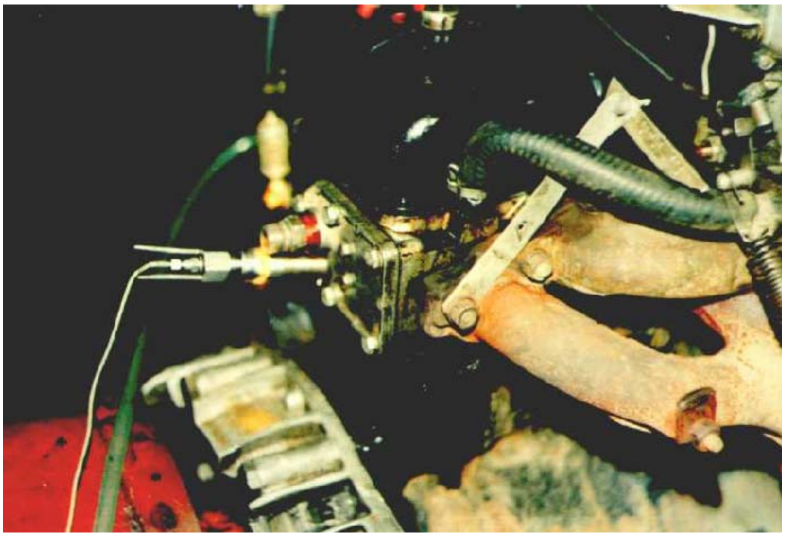

Fig. 3. Kistler 601 piezoelectric transducer for measuring the pressure in the cylinder

The correlation of the measured pressure depending on the rotation angle of the crankshaft as well as the opening of the inductive transducers type A.V.L. Fig. 4 firmly mounted on the cylinder block, those transducers taking over the impulses from two coaxial disks mounted on the crankshaft.

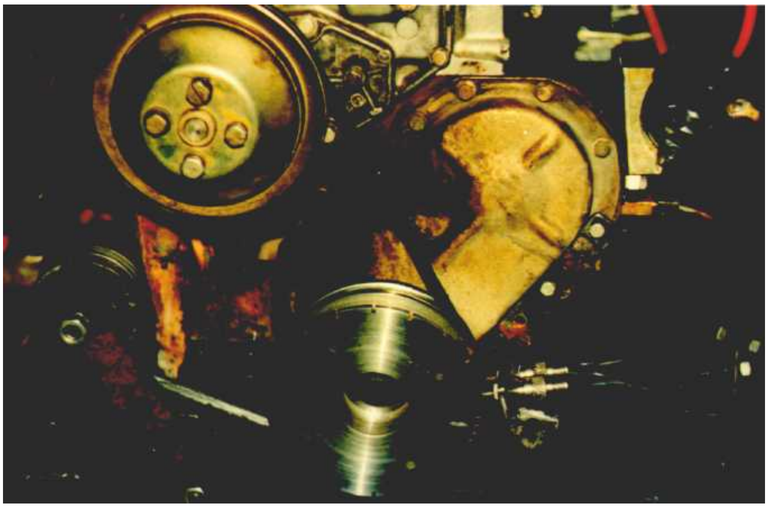

Fig.4 Inductive transducers type A.V.L.

The denticulate disk obtained through milling-work marking the angle has been made with a 20° RAC division, and near the upper dead centre has been made symmetrically every 5° in order to accurately pursuit the detachment points. The inductive transducer (5) to indicate the point of ignition Fig.5 was mounted on the cylinder high-tension lead (1) where the pressure transducer was mounted, too.

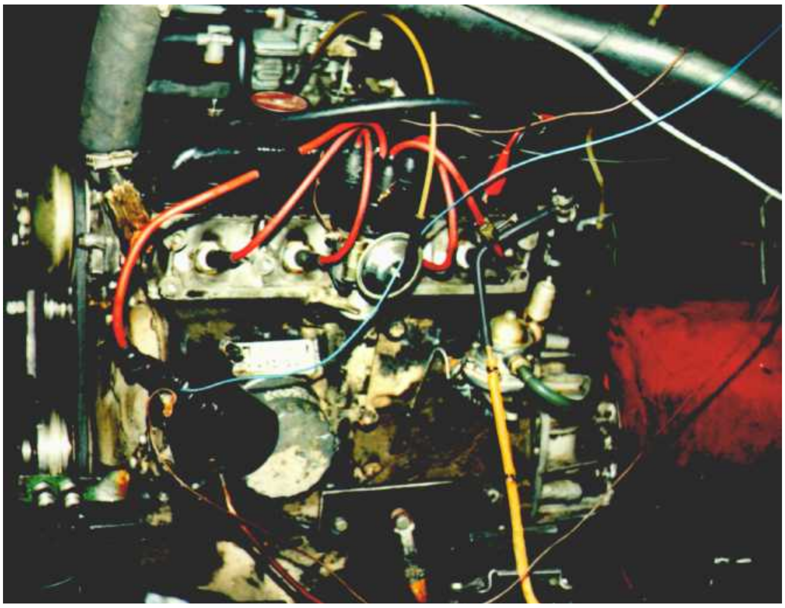

Fig. 5

The electrical signals obtained from the piezoelectric transducer (1) are introduced In the load amplifier AVL-3059 (11) which is coupled to the calibration unit AVL-3054 (13) The two inductive transducers AVL (2) are coupled to the time base control unit AVL-4004 (12). The inductive transducer (5) to indicate the point of ignition, together with the two units (11-12) are connected to the Tektronix oscilloscope type 5113 (8) that has several calibration positions dependent on the graduation of scale. This oscilloscope is provided with an obscure tube which allows for an EXATTA VAREX camera to be mounted on it, which has allowed the images to be recorded on the scale, dependent on the pressure and the angle of rotation of the crankshaft together with the point of releasing the electric spark, as well as for the cycle of dispersion to be photographed under ill the operating conditions Fig.6.

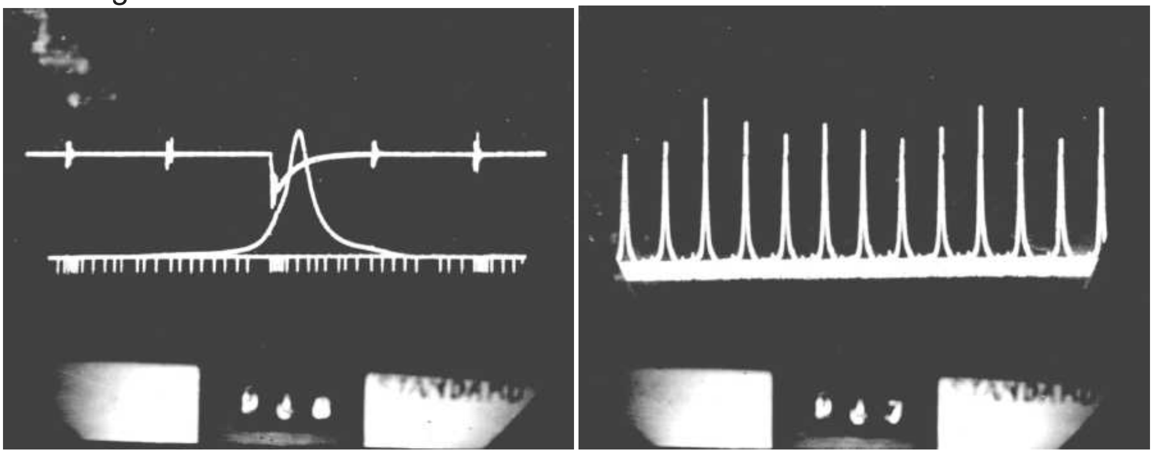

Fig.6 Cyclical dispersion at 100% loading without hydrogen addition

In order to obtain more accurate measurements of the pressure change in the cylinder and to determine the parameters of the combustion process, the device has been completed with a NICOLET digital oscilloscope (9) which allows all the elements to be accurately plotted through graphic transposition by means of the X-Y Riken recorder (10). This also permits on the same scale for the pressure curve to be recorded without any combustion under all the load and speed operating conditions.

The loggings of the indicated diagrams developed with several loads and speeds comparatively for the standard fuel-fed engine and the hydrogen addition fed engine have been made on the A4 sizes, and the pressure unique scale has been chosen 10 bars = 37,5 mm. From these loggings one can notice that the pressure change has been maintained lineal dependent on the height of the logging.

With the view of obtaining the zero pressure line the pressure of the outset of the compression has been approximated, the error not being bigger than 1%.

Under each operating condition of the engine there have been recorded graphically on A_4 sizes 8 diagrams indicated developed p for the standard fuel-fed engine and 8 diagrams for the modified fed engine, respectively. On the whole for the three operating conditions there have been recorded graphically 48 diagrams indicated developed pα, 8 pressure diagrams without any combustion, and for the cyclical dispersion there have been made 48 photos on the oscilloscope, each having 10-13 cycles for the three load and speed operating conditions. In order to maintain the operating conditions at the same values there has been adopted a mechanical block system at the load of 40%, 80% and the full opening of the throttle 100%.

The accidental deviations could be rectified by estimating the mean pressure of the mechanical loss that presents a constant value when the engine speed and load are constant.

In this way for the three load operating conditions with the division of 5oo rot/min there have been determined the most probable medium values of the medium pressure of the mechanical loss to which there have been compared all the other pressure diagrams under the respective operating condition of the engine.

Another stage has been the testing of the engine on the car at stabilized speeds on the track as well as in highway traffic. So, with the Dacia 1300 car, at the average speed of

72 km/h, on a 250 km distance, in street traffic we have obtained a fuel consumption of 5,3 l/100 km, at a loading of 50% from the maximum permitted load. The dynamic parameters have also been improved. Thus from 0-100 km/h we got to a 18,3" timing compared to the 22" obtained without our device.

The last testing was made on the roll stand in accordance with the norms 15 CEE as well as the polluting emissions standards. As can be seen in Fig.4 the test has been performed by comparison with a production car with the sane loading at stabilized speeds.

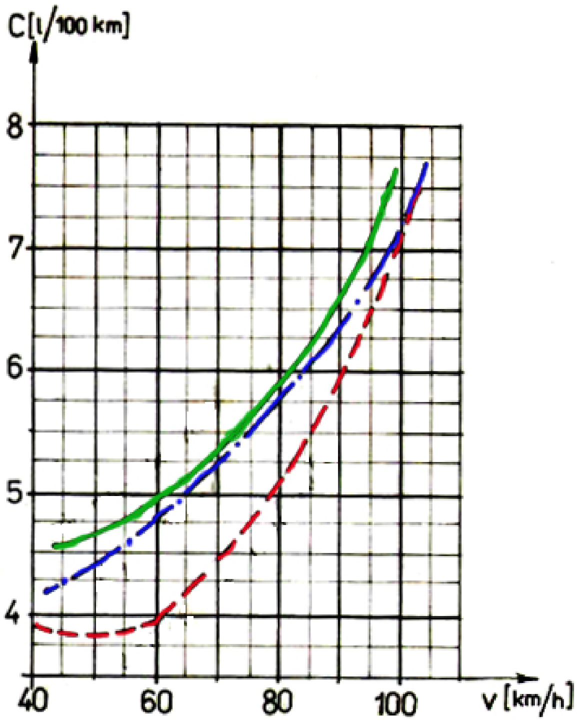

Fig. 7. Comparative consumption diagrams on the roll stand

At speeds of 40-50 km/h allowed by the highway traffic norms one can see a substantial reduction of the fuel consumption as well as of the CO between 0,8-1,2%, As a result of the tests performed there arises the necessity for modifying the advance characteristics.

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