therefore rendered ineffective. The smoke particles on the catalyst are continuously removed by catalytic oxidation during the operating life of the catalyst.

Complete Exhaust Emission Control

Under the conditions existing in diesel exhaust gases, namely those of excess oxygen, THT catalyst neither increases nor decreases the nitrogen oxide concentration. It is possible with a two-stage catalyst system, one operation under reducing conditions to remove nitrogen oxide, and a second under oxidising conditions to remove carbon monoxide and hydrocrabons, to achieve complete exhaust gas purification. However, it is probably more practical to achieve these ends by a combination of engine modifications to reduce smoke and nitrogen oxide levels, plus a catalytic combustion unit to reduce the concentration of the other exhaust emissions, including those causing the odour problem.

We conclude that for those applications when diesel engines are used in enclosed locations, the exhaust gases can be made safe and acceptable to people working in the area by incorporating a THT catalytic combustion unit into the exhaust system. Also, the incorporation of catalytic combustion units in the exhaust systems from public transport and other vehicles operating in heavily congested areas would reduce the nuisance caused by exhaust odours.

Acknowledgements

The results obtained for catalytic diesel exhaust purification on the Gardner IL2 laboratory engine were obtained for Johnson Matthey by the Ministry of Technology at their Warren Spring Laboratory (4).

References

1 H. Skala, F. G. Padrta and P. C. Samson, *Chem. Engng News*, 1968, **46**, 14
2 B. W. Millington, "The Nature and Cause of Diesel Emissions", *Proc. Inst. Mech. Eng.*, 1968–69, **183**, part 3E
3 G. J. K. Acres, *Platinum Metals Rev.*, 1970, **14**, 2
4 *Min. Tech. Rept CR 334 (AP)*, unpublished.

Measurement of Lunar Heat Flow

A NEW PLATINUM RESISTANCE THERMOMETER

One object of the Apollo programme of lunar exploration is to study lunar heat flow by measurements with temperature probes at depths up to three metres into the Moon's surface. The thermometers for this work must have stability better than 2×10^{-3} deg K/year together with the ability to withstand the shocks of launching into space and landing on the Moon. Workers at Rosemount Engineering Co and Arthur D. Little Inc have developed a rugged differential platinum resistance thermometer for the task (*Rev. sci. Instrum.*, 1970, **41**, (4), 541–544).

The design provides a ± 2 deg K differential over the range 200 to 270 K. Isolation from the effects of mechanical and thermal strains is achieved by attaching the platinum wire in the form of a helix to its supporting platinum mandrel by glass insulation of a type which has a similar thermal expansion coefficient. Only 10 per cent of each wire loop is embedded in the glass so that the wire is free to expand or contract while being rigidly supported. To complete the thermometer both wire and mandrel are encased in a platinum tube, the ends of which are sealed hermetically with pure gold solder after the connecting leads of platinum have been passed out through one end.

Each thermometer unit has been calibrated at 42 points (nine differential temperatures and five absolute temperatures between 200 and 250 K). A stability testing programme over one year indicated an average drift of only $+0.45 \times 10^{-3}$ deg K/year.

Each element has an ice-point resistance of 500 ± 1 ohm. This figure was a compromise between concerns of wire purity, individual coil rigidity, sensitivity, self-heating, and volume.

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