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A New Platinum-Wired Air Flow Meter

FUEL ECONOMY OF PETROL INJECTION ENGINES IMPROVED

The possibility of determining the velocity of air by measuring the electric current required to keep a resistance wire at a given temperature was suggested early this century by A. E. Kennelly and his colleagues, and was soon developed independently by a number of investigators. In 1914 work by Professor L. V. King of McGill University on the convection of heat from small cylinders in a stream of fluid was reported to the Royal Society (*Philos. Trans. R. Soc., London*, Series A, 1914, **214**, 373). His experiments had been undertaken to study the laws of convection of heat from thin platinum wires heated by an electric current, in order that the results could be used in the design of an anemometer capable of accurately measuring wind velocity. However his linear anemometer was considered to be useful for a number of applications including studies of turbulent flow and of air velocities in the neighbourhood of aeroplane surfaces and revolving blades, and for the measurement of temperatures and velocities of heated gases, or of flames.

Since that time the principle involved has been applied to an increasing number of uses. Now a hot wire air mass meter is being developed by Robert Bosch GmbH of Stuttgart, West Germany to measure the mass of air drawn into automobile petrol injection engines and thus, with appropriate systems, to optimise the air to fuel ratio and hence fuel economy while limiting exhaust emissions (R. Sauer, S.A.E. Technical Paper 800468).

In the new meter a 70 micron diameter platinum wire forms part of a Wheatstone bridge circuit where the output voltage is held steady by regulating the heating current. Any increase in air flow cools the wire and causes a resistance drop. This is corrected within milliseconds as a controlled increase in the heating current signals the mass flow rate of the air and brings the platinum wire back to its former temperature. To allow for changes in the temperature of the intake air a temperature compensating resistor is located in the air stream. This has to be stable, corrosion-proof and fast responding, therefore a platinum film resistor is employed.

A disadvantage of the hot wire anemometer has always been the effects of dirt building up on the wire. Now the quality of the platinum employed enables this problem to be overcome by a process that burns off the organic matter, and removes any inorganic particles embedded in it. This involves heating the platinum anemometer wire to a temperature of 800 to 1000°C for one or two seconds immediately after the engine has been stopped. A most important contribution to the overall performance is the quality control of the platinum wire by automatic and continuous monitoring of mechanical integrity, electrical resistance and its temperature coefficient. The process is now being optimised by vehicle testing.