EARLY WARNING FIRE DETECTION

The problem
Following a fire in 1975 which caused considerable damage in a tunnel housing cabling for the 28 GeV proton synchrotron, techniques to give an early warning of incipient fires in cable runs were considered.

It was found that existing fire detection methods, which detect smoke or the light of flames or the occurrence of high temperatures, are inadequate to protect cables. The detectors operate at temperatures often well above the softening point of plastic insulation, and when this softening takes place there is already a risk of short circuits.

CERN tried to conceive a reliable indicator of temperatures around 80–90°C, which would warn of fire while cable insulation is still reasonably hard.

A solution
The method developed at CERN is the liberation at these temperatures of an easily detectable indicator gas by the rupture of capsules containing the indicator. The capsules are small enough to penetrate between cables and to ensure a good heat transfer.

Enquiries to manufacturers revealed that the microencapsulation of liquid Halogen C$_7$F$_4$Br$_2$ was feasible. This liquid is of low toxicity, is non-flammable, non-corrosive, and has a vapour pressure of 2.5 atmospheres at 96°C. This is approximately the bursting pressure of 200 μm diameter gelatine microcapsules.

The microcapsules can be scattered on cable trays as a pseudo-powder, or mixed into a paint and painted on. This latter technique gives a slight modification of the bursting pressure.

When a capsule bursts the liquid halogen evaporates and produces about 0.1 mm$^3$ of gas per capsule, or 0.7 cm$^3$ per cm$^2$ of capsule area. This is readily detectable by a halogen detector sensitive to 0.01 ppm of halogen in air. The halogen detector can be connected to a normal linear smoke detector system which samples the protected air volume.

It is also possible to detect the characteristic 'frying chips' sound of the bursting capsules. A cheap crystal microphone can be used to pick up this sound. It can be connected to a simple filtering circuit to avoid reaction to other noises. An alarm can be confirmed by switching to a loudspeaker output.

Detection
Both methods of detection were successfully tested in cable tunnels at CERN. The original CERN development has now been adopted for commercial applications. More detailed information can be obtained from CAPSALARM International, 1 rue du Village, 1214 Vernier, Genève.