Gas chromatographic principles of the GC955

In a gas chromatograph hydrocarbons are separated from each other so that they arrive one by one in a detector to be quantified.
The process requires 4 steps in all:
Sampling
(Often concentrating the sample)
Separating
Detection.

This section describes the separation of the hydrocarbons, which is the heart of the system. Two other downloads describe the sampling and the detectors.

A gas chromatograph for the automatic measurement of air samples and other gases has a special method to take a sample: not by injection, but by leading the sample through a loop. Either the sample is pumped, or the sample flows in under a slight overpressure. By switching a valve the sample is introduced into a gas chromatographic column where it is separated. Then the separated compounds are measured in the detector. The flow of carrier gas and sample through the system is complicated. By way of a sophisticated 10-port valve, which is switched between two modes -position 03 and 04 - they are sent in the right directions. Figure 3.1 and 3.2 give an overview of the gas lines in both modes of the valve.

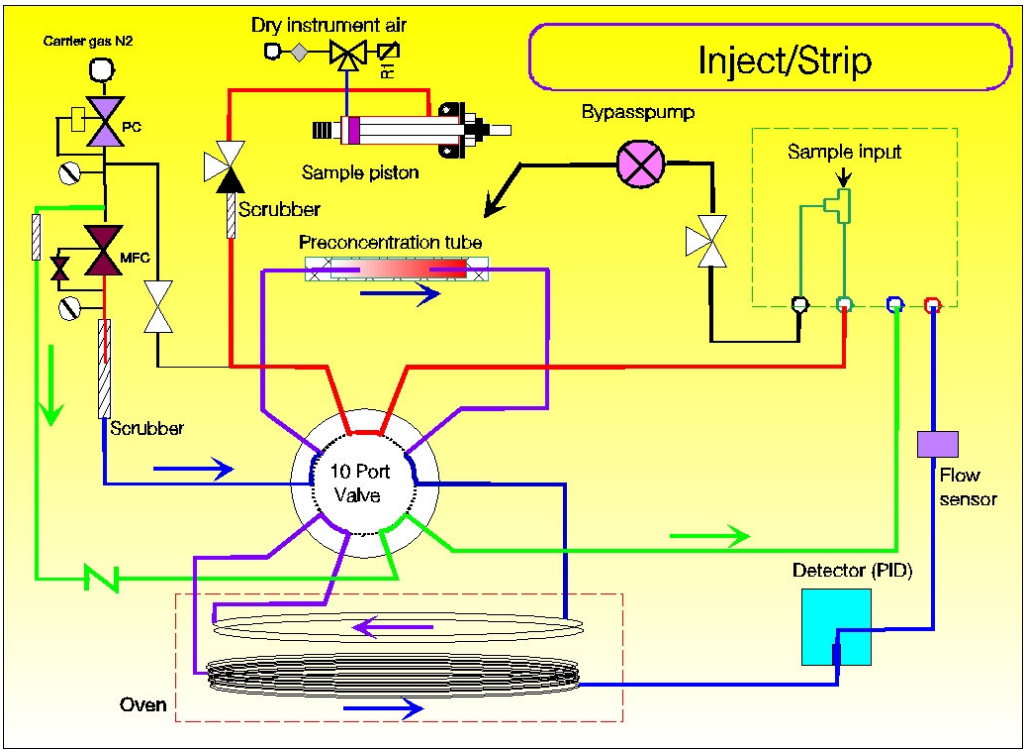

Fig. 3.1 Diagram of the GC955 injection mode

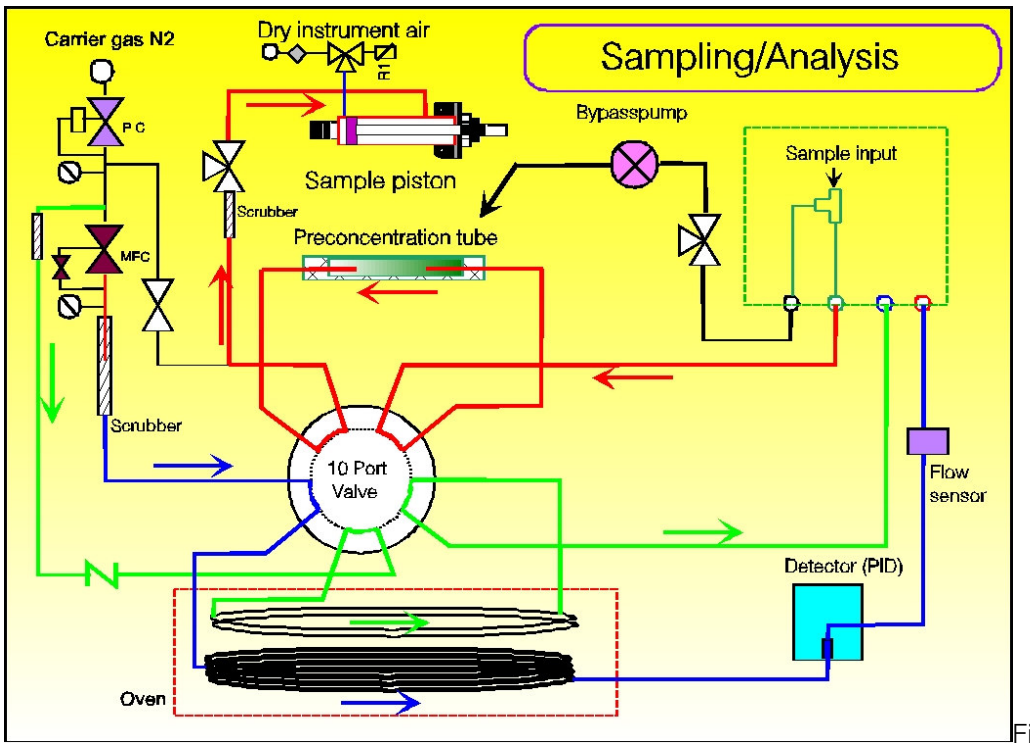

Fig. 3.2 Diagram of the GC955 analyzing/sampling mode

3.1.3 *Desorption and stripping*

The sample is desorbed in a short time by heating the preconcentration tube quickly, while flushing it with carrier gas. By way of the 10-port valve in position 03 the sample is brought on the separation column. (See the diagram 3.1)

The separation column consists of two parts : a stripper column and an analysis column. These are usually two identical columns, with different lengths. The goal is to prevent a prolonged analysis, which is normally caused by the necessity of waiting for elution of the highest boiling compound. Therefore the time is set for the slowest eluting compound of interest to get through the column. After this time the flow in the stripper column is reversed by switching the 10-port-valve.

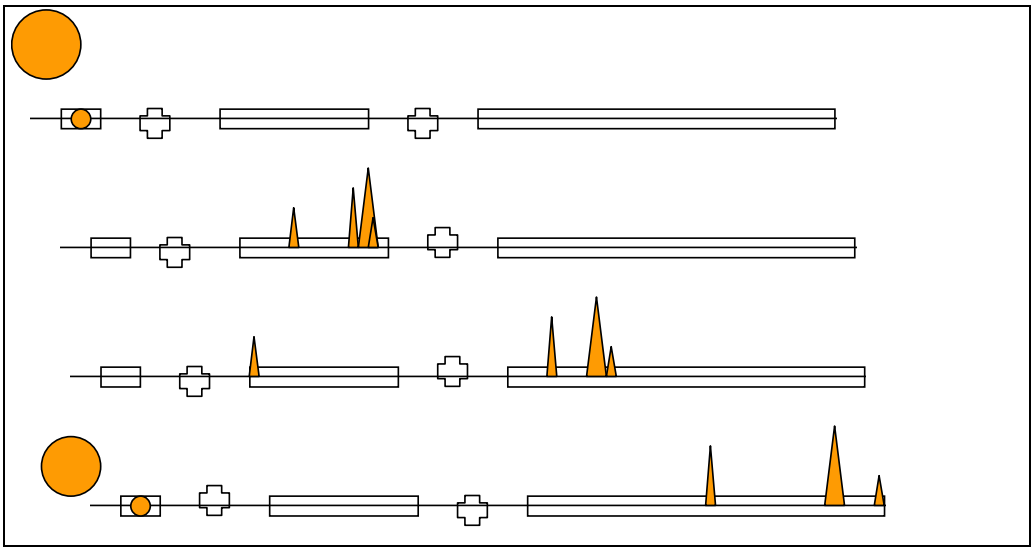

Figure 3.4: Gas chromatographic separation with a sample loop and stripper/analysis column: the air is pumped into the loop, after which the whole sample is brought onto the stripper column. After the passing of the desired compounds the rest is flushed back. The earlier compounds are separated on the analysis column.

3.1.4 *Separation*

The rest of the analysis is performed with the 10-way valve in position 04. (See the diagram 3.2) The compounds which already passed through the stripper column continue their way through the analysis column to the detector. (see 3.2) The gases, which already were separated somewhat in the stripper column, are separated as far as possible in the analysis column .

3.1.5 Temperature regulation

The analysis can be done at a constant temperature or with a temperature program. With a cyclic changing temperature compounds with more differing boiling points can be separated and determined within an acceptable cycle time. During separation the oven is heated , usually 15 - 60 °C above the basic temperature. After the heating phase cooling down has to take place before the next cycle can start. This takes a few minutes.

3.1.6 Cycle time

The cycle time depends on the following factors:

1 difference in boiling point of the compounds to be determined

2 flow velocity and column ID/coating quotient

3 basic temperature

During each cycle the sampling for the next cycle is performed.

3.1.7 Cleaning of the system

For automatic measurements with the GC the cleaning of the system is essential to prevent deterioration of the column, which would result in detoriation of the peaks. The backflush column is flushed every cycle for some minutes separately from the analysis column in the reversed direction. To clean the analysis column each cycle has to last until no more signals are detected.

The time setting for cleaning is done for normal ambient air. In a very dirty atmosphere a longer time may have to be set for to clean the stripper.