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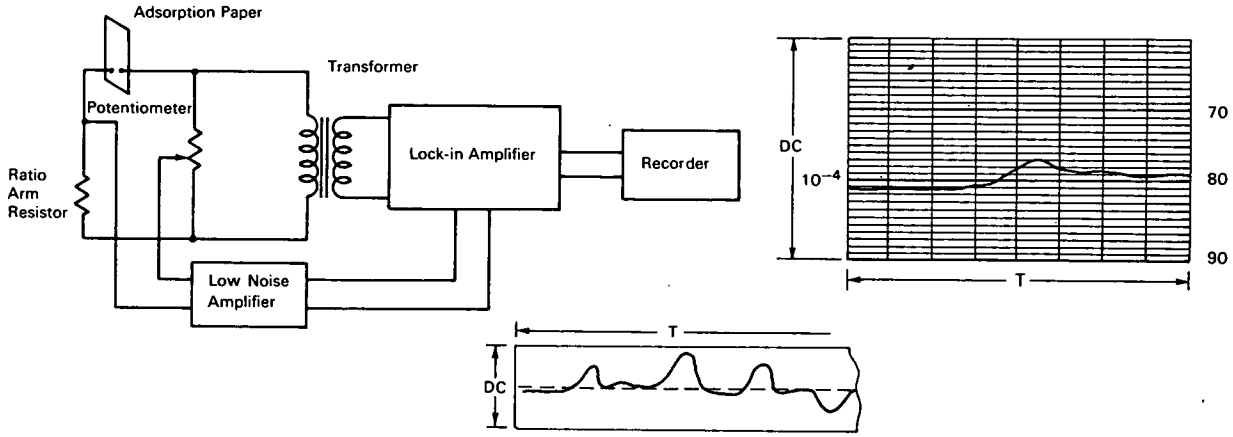
NASA TECH BRIEF

Electronic Circuitry Used to Automate Paper Chromatography



The problem:

To provide a convenient, easily operated paper chromatograph instrument that exhibits excellent sensitivity and furnishes a printed record of each test.

The solution:

An electronic circuit that measures and records changes in conductivity in a strip of chromatographic paper as different solutions are placed on it.

How it's done:

Gold electrodes are attached to each side of the adsorption paper and this combination is wired into a Wheatstone bridge circuit as one of its resistance elements. The bridge is completed by a potentiometer and ratio arm resistor, is excited by a 1-kc signal generated in a lock-in amplifier, and is connected in a balanced input through a transformer. Balance of the bridge circuit is detected by the combination of low noise amplifier, lock-in amplifier, and strip chart recorder. The system is phase coherent in that the output of the lock-in amplifier is a positive or negative dc voltage derived by comparing the reference phase through the transformer with the signal output of the low noise amplifier. The dc voltage from the lock-in amplifier moves a pen in the strip chart recorder in a direction corresponding to the polarity of the signal. The circuit is shown in the figure at the left.

In operation, a 1 microliter sample is placed on the paper and its passage down the paper is recorded as electrical output versus time from start. The figure at the right illustrates the chart readout of the passage of a 1 microliter sample of 10^{-4} mole/liter copper sulfate. A flow of water carrier down the paper is established and the potentiometer adjusted for zero bridge output as indicated on the recorder. A drop of the $CuSO_4$ is then placed on the paper and its passage down the paper is indicated by a trace of the recorder pen.

(continued overleaf)

The lower figure represents separation of constituents of a mixture. As an example, the first peak could indicate a salt of copper, the second, one of iron, the third, one of manganese, and the fourth, a substance less conductive than the water carrier.

Notes:

1. In practice, this device has detected different mineral content in drinking water from two different buildings at the Jet Propulsion Laboratory.
2. This instrument could be used in analysis of plating baths to establish the relative concentration of constituents. It would also be useful for solution control in hydroponics.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B67-10201

Patent status:

No patent action is contemplated by NASA.

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(JPL-840)