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Brief 69-10570

NASA TECH BRIEF

Automated Plotting of Equipotentials

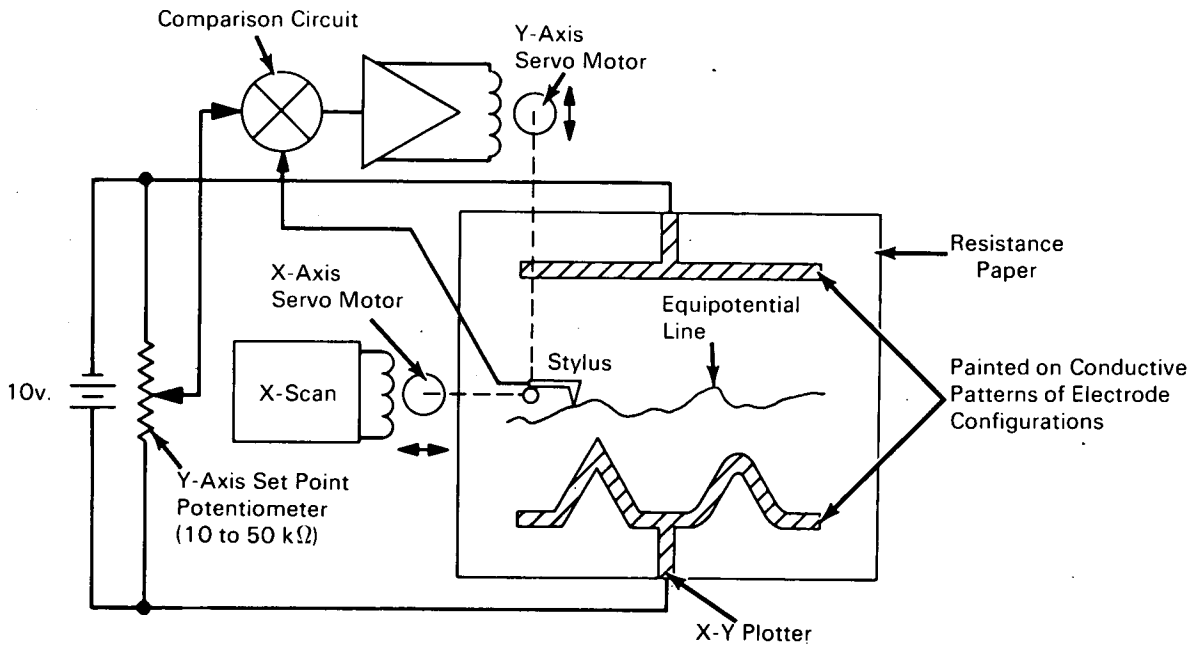

Fig. 1. Schematic of a prototype

The problem:

Development of a method of automated plotting of equipotential lines between high-voltage electronic components of complex configuration, for prediction of stress in the intervening insulation.

The solution:

By substitution of resistance paper for normal plotting paper, an *X-Y* plotter can be used to draw automatically the equipotential lines between components represented in planar form on the paper; earlier methods have been messy and laborious.

How it's done:

The lines are plotted as the pen scans the *X*-axis, if signals can be developed on the *Y*-axis representing points of equal potential. The pen is insulated from its carrier so that it can serve as a voltage-sensing probe as well as for inking. The electrodes are represented geometrically to a suitable scale on resistance paper with conductive silver ink, and a low voltage is applied between the representations. Through the ink column the pen senses the voltage at the point of its contact with the paper. The difference between the sensed voltage, and a preselected reference voltage, produces an error signal that is used to drive the pen

(continued overleaf)

to null position along the *Y*-axis as the plotter automatically carries the stylus carriage along the *X*-axis in scan mode.

For the stiff resistance paper, a suction hold-down would be better than the electrostatic hold-down used in the prototype (fig. 1). Ten volts was applied between the representations of the electrodes, with a potentiometer (10 to 50,000 ohms) for setting of the desired *Y*-axis reference point. The reference voltage was one input of a comparator circuit that is included in the drive electronics for the plotter. The pen, insulated from its carrier, was connected to another input of the comparator circuit. The black ink supplied with the plotter is suitable.

When the voltage sensed by the pen, contacting the resistance paper, equals the reference voltage, the *Y*-axis-drive servomotor comes to rest. Whenever the sensed voltage differs either positively or negatively, the comparator circuit develops an error signal that causes the *Y*-axis servomotor to move the stylus in such a direction that the voltages are balanced. This reaction is continual as the *X*-axis servomotor moves its stylus to scan the resistance paper along the *X*-direction; the result is a continuous plotted line through equipotential points.

Several different settings of the reference voltage result in a family of lines through equipotential points between the electrodes (fig. 2).

Notes:

1. Designers of electronic equipment may be interested.
2. No further documentation is available. Inquiries may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B69-10570

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

Source: E. R. Bunker, Jr. of
Caltech/JPL
under contract to
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(NPO-11134)

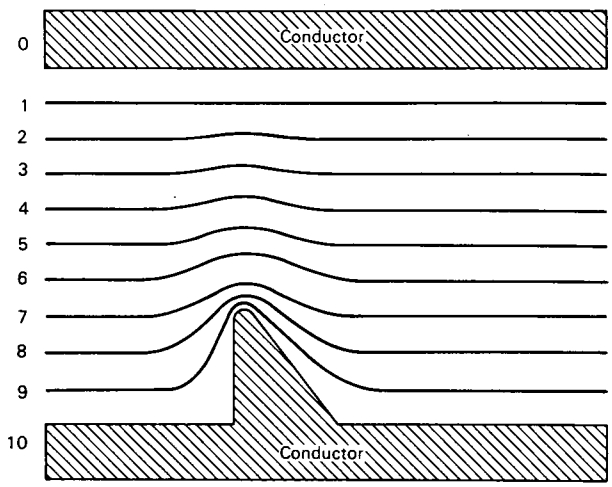

Fig. 2. Family of lines generated with different reference voltages.