the periphery of the aperture in the longitudinal direction;

a plurality of first serially-connected thin-film thermocouples, formed and disposed to have their respective cold junctions over the substrate and outside of said periphery of the through aperture and their respective hot junctions arrayed side-by-side overlying the through aperture;

a plurality of serially-connected second thin-film thermocouples, formed and disposed to have their respective cold junctions over the substrate and outside of the periphery of the through aperture on an opposite side thereof with respect to the hot junctions of the first thermocouples, with the respective hot junctions of the second thermocouples overlying the through aperture;

a plurality of resistor elements coupled in series at one end of said heater element, each said resister element having an electrical pad so that said micropotentiometer provides a plurality of output voltages; and,

at least one current return path arranged parallel to said heater element.

2. The integrated micropotentiometer according to claim 1, wherein said pluralities of first and second serially-connected thermocouples are symmetrically disposed on either side of said heater element.

3. The integrated micropotentiometer according to claim 1, wherein said first layer or SiO_2 is formed in compressive stress, said first layer of Si_3N_4 is formed in tensile stress and said second layer of SiO_2 is formed in compressive stress so that said stresses are balanced to result in a net stress close to zero in value.

4. The integrated micropotentiometer according to claim 3, further comprising:

a second layer of Si_3N_4 formed on the rear surface of the substrate so as to entirely surround a periphery of the through aperture at the rear surface of the substrate.

5. The integrated micropotentiometer according to claim 1, wherein the Thompson effect is reduced by uniform position of said first and second serially connected thin-film thermocouples.

6. The integrated micropotentiometer according to claim 3, further comprising a plurality of current return paths.

7. The integrated micropotentiometer according to claim 3 wherein at least one said current return path is arranged outside of said pluralities of said first and second serially-connected thermocouples.

8. The integrated micropotentiometer according to claim 3, further comprising two symmetrically disposed current return paths between said pluralities of said first and second serially-connected thermocouples constituting a trifilar micropotentiometer.

9. The integrated micropotentiometer according to claim 3, further comprising:

first low impedance electrical pads respectively connected to the first and second ends of the heater element and to said return path to enable provision of a controlled electrical current to the heater element; and

second electrical pads connected to extreme ends of each of said pluralities of first and second serially-connected thin-thermal couples to enable electrical connection thereof to an external circuit, wherein said heater element has a length of 20 μm to 800 μm, a width of 1 μm to 1200 μm and a length to width ratio of 4 to 800, and said first electrical pads have an area of $50\times50\ \mu m^2$ to $400\times400\ \mu m^2$.

10. The integrated micropotentiometer according to claim 5, further comprising guard thermocouples arranged on both sides of and in alignment with said pluralities of said first and second serially-connected thermocouples, said guard thermocouples having electrical pads separate from those of said first and second pluralities of thermocouples.

11. The integrated micropotentiometer according to claim 1, wherein the material of said substrate is selected from a group including silicon, ceramic, silicon dioxide, silicon nitride, polyamide and similar materials.

12. The integrated micropotentiometer according to claim 1, wherein said pluralities of said first and second serially-connected thermocouples and heater element are arranged to have a cumulative thermal time constant between 5 msec. and 300 msec.

13. The integrated micropotentiometer according to claim 5, wherein an output of 10–200 mv is contained at said electrical pads connected to said pluralities of said first and second serially-connected thermocouples.

14. The integrated micropotentiometer according to claim 5, further comprising at least one additional layer of SiO_2 formed over said pluralities of said first and second serially-connected thermocouples, said heater element and said output resistors.

15. The integrated micropotentiometer according to claim 3, further comprising:

first low impedance electrical pads respectively connected to the first and second ends of the heater element and to said return path to enable provision of a controlled electrical current to the heater element; and

second electrical pads connected to extreme ends of each of said pluralities of first and second serially-connected thin-film thermocouples to enable electrical connection thereof to an external circuit, wherein said heater element has a length of 20 μm to 8000 μm, a width of 20 μm to 6000 μm and a length to width ratio of 0.1 to 10.

16. The integrated micropotentiometer according to claim 1 wherein said heater element is selected from a group including Evanohm TM, nickel-chromium alloys and similar materials with small Thompson effect and low temperature coefficients of resistance.

17. The integrated micropotentiometer of claim 14 further comprising a plurality of openings in said additional layer of SiO_2.

18. The integrated micropotentiometer according to claim 3, further comprising a mounting substrate for holding said substrate, and wiring between said heater element, said output resistors said cold junctions of said first and second thin-film thermocouples and external devices.

19. The integrated micropotentiometer according to claim 1, further comprising:

a ceramic lid arranged over said first and second pluralities of serially-connected thin-film thermocouples, said heater element, said output resistors, said wiring and said mounting substrate.

20. The integrated micropotentiometer according to claim 1, wherein said heater element comprises two longitudinally arranged resistive elements connected to the output resistor at a first end and connected to separate electrical pads at a second end forming a bifilar structure.