The inventors have discovered that the micro-contact printing stamp can be attached to an air bearing roller and contacted with the substrate to print the patterns. In connection with the present invention, an air bearing roller with extremely low mechanical drag presents a potentially ideal environment for a micro-contact printing stamp support. It enables extremely low surface shear forces at the stamp / substrate boundary, which in turn allows an excellent surface speed match between the stamp's surface and the substrate. As disclosed~~In some embodiments~~, a thin shell is supported by an air bearing providing an air support cushion layer and low roller inertia to dramatically reduce the incidence of particular modes of print failure often observed when the stamp is mounted on a driven roll or on a roll with significant drag. By supporting the thin shell on a cushion of air, increased compliance may be~~is~~ present when contacting the micro-printing stamp with the substrate helping to prevent excessive compression of the thin traces present on the stamp's surface due to excessive nip loading, web tension variations, or out of round web rollers.

~~In one embodiment, the invention resides in a method of applying a pattern onto a web of indefinite length material comprising: applying a micro-contact printing stamp to a roll supported for rotation by at least one air bearing; contacting the roll with the web, and translating the web while in contact with the micro-contact printing stamp so as to repeatedly imprint a pattern onto the web.~~

~~In another embodiment, the invention resides in an apparatus for applying a pattern onto a web of indefinite length comprising: a roll comprising a sleeve positioned over a core with the sleeve supported for rotation by a layer of air between the sleeve and core; a micro-contact printing stamp mounted onto an outer surface of the sleeve, the micro-contact printing stamp saturated with thiol; and a web path along which the web is guided such that the web contacts the micro-contact printing stamp and rotates the sleeve.~~

According to an aspect of the present invention, there is provided a method of applying a pattern onto a web of indefinite length material comprising: applying a micro-contact printing stamp to an outer surface of a roll supported for rotation by at least one air bearing, wherein the roll comprises a sleeve positioned over a core and the air bearing comprises a layer of air between the sleeve and core such that the sleeve is supported for rotation; contacting the micro-contact printing stamp with the web; and translating the web

while in contact with the micro-contact printing stamp so as to repeatedly imprint a pattern onto the web such that the sleeve supported over the core by the layer of air rotates.

According to another aspect of the present invention, there is provided an apparatus for applying a pattern onto a web of indefinite length comprising: a roll comprising a sleeve positioned over a core with the sleeve supported for rotation by a layer of air between the sleeve and core; a micro-contact printing stamp mounted onto an outer surface of the sleeve, the micro-contact printing stamp saturated with thiol and being configured to contact the web such that the contact between the web and the micro-contact printing stamp rotates the sleeve supported by the layer of air and positioned over the core; and a web path along which the web is guided into contact with the micro-contact printing stamp along at least a portion of the outer surface, wherein the contact between the web and the micro-contact printing stamp rotates the sleeve.

As used herein, a micro-contact printing stamp is a member having raised stamping features with at least one dimension of the contacting surface of the raised stamping feature having a width less than 20, 10, or 5 microns. In many embodiments, a micro-contact printing stamp has a plurality of raised lines for printing electrical circuit patterns and the width of the raised lines and resulting printed traces is less than 20, 10, or 5 microns.