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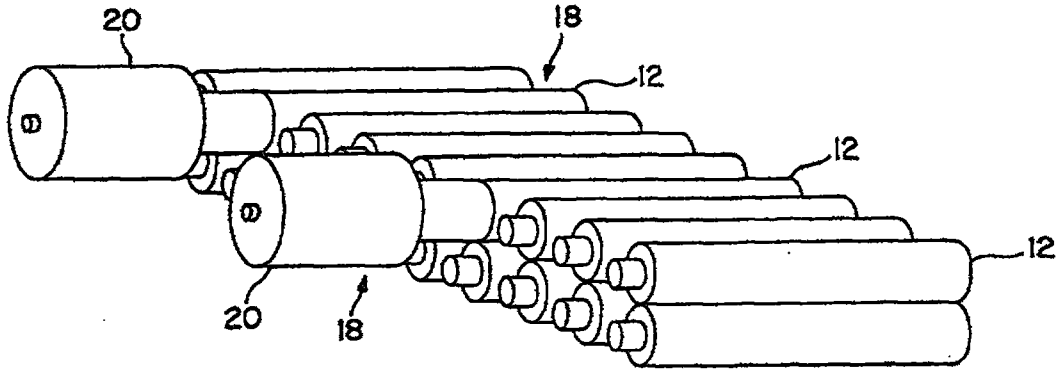
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(54) Title: METHOD AND APPARATUS FOR ENHANCED CLEANING OF A WORKPIECE WITH MECHANICAL ENERGY



(57) Abstract

An improved cleaning apparatus for cleaning semiconductor wafers, rigid memory disks, flat panel displays, and other workpieces employs vibrational mechanical energy in addition to contact mechanical cleaning. The cleaning apparatus includes a cleaning element configured to contact and scrub a workpiece during a cleaning process. The cleaning element is coupled to a mechanical energy emitter that generates low frequency mechanical vibrations (or ultrasonic mechanical energy) at a predetermined frequency. The mechanical energy is conducted through the cleaning element and to the workpiece to facilitate removal of particulate and debris from the surface of the workpiece. Use of ultrasonic energy also causes the cleaning solution to cavitate, thus providing ultrasonic cleaning to the workpiece via the cleaning solution.