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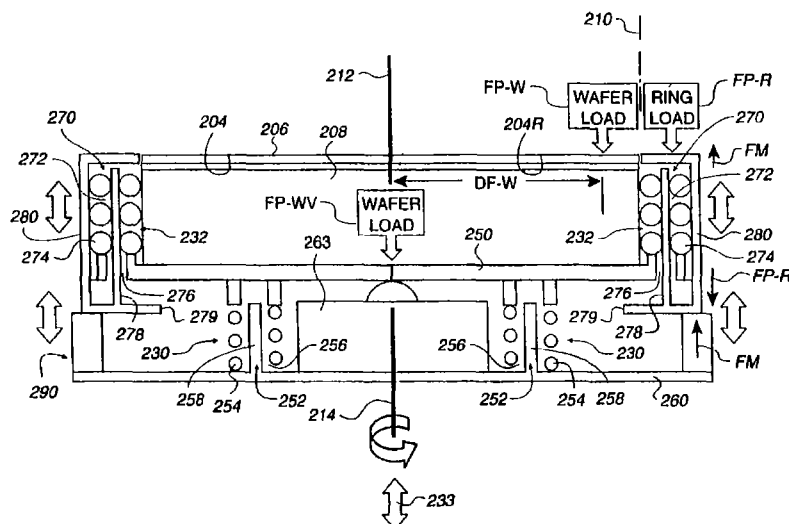
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(54) Title: CMP APPARATUS AND METHODS TO CONTROL THE TILT OF THE CARRIER HEAD, THE RETAINING RING
AND THE PAD CONDITIONER



(57) Abstract: A CMP system make repeatable measurements of eccentric forces applied to carriers for wafer or conditioning pucks. Force applied to the carrier may be accurately measured even though such force is eccentrically applied to such carrier. An initial coaxial relationship between an axis of rotation and a carrier axis (212) is maintained during application of the eccentric force (FP-W), such that a sensor (263) is enabled to make repeatable measurements, of the eccentric forces, and the carrier (208) may be a wafer or a puck carrier. Such initial coaxial relationship is maintained by a linear bearing assembly (232) mounted between the carrier (208) and the sensor (263). The linear bearing assembly is provided as an array of separate linear bearing assemblies, wherein each separate linear bearing assembly is dimensioned independently of the diameter, of a wafer or puck carried by the carrier. The linear bearing assembly may be assembled with a retainer ring (282).

WO 02/24410 A1