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~~What is claimed is:~~CLAIMS

1. A multi-vane throttling valve (200) for a vacuum process chamber having a throttle chamber body (220) with a through-opening (223), an inside exposed to the vacuum process chamber and an outside exposed to atmospheric pressure, a plurality of rotatable vanes (240) mounted within the through-opening (223) for controlling a flow of gases through the through-opening (223), and a drive mechanism (80) for rotating the plurality of rotatable vanes (240), the valve comprising:

   a reciprocal vane (300) pivotally connected to a back side (242) of each of the plurality of rotatable vanes (240) and extending backwardly away from each of the respective rotatable vane (240); and

   a stationary reciprocal vane angling assembly (350) fixed in a predefined position, the vane angling assembly (350) having an assembly pin (352) extending transversely toward the reciprocal vane (300) a predefined distance sufficient to support the reciprocal vane (300);

   whereby the stationary angling assembly (350) causes the reciprocal vane (300) to pivot in a range between a substantially parallel position with the respective rotatable vane (240) and a transverse position with the respective rotatable vane (240) when the respective rotatable vane (240) is rotated to control the flow of gases through the through-opening (223).

2. The multi-vane throttling valve (200) of Claim 1 wherein the stationary angling assembly (350) further includes an assembly arm (354) extending backwardly a predefined distance from the axis of rotation of a respective rotatable vane (240) wherein the assembly pin (352) is fixedly attached to a distal end portion (355) of the assembly arm (354).

3. The multi-vane throttling valve (200) of Claim 2 wherein the stationary angling assembly (350) further includes an assembly clamp (360) connected to a proximal end portion (356) of the assembly arm (354) wherein the

assembly clamp (360) is fixed to a non-moving element within the throttle valve (200).

4. The multi-vane throttling valve (200) of Claim 1 wherein the reciprocal vane (300) is offset from an axis of rotation (400) of the respective rotatable vane (240).

5. The multi-vane throttling valve (200) of Claim 1 further comprising a reciprocal vane bracket (370) having a reciprocal vane portion (372) ~~and a rotatable vane portion wherein the reciprocal vane portion and the reciprocal vane are~~ pivotally connected to the reciprocal vane (300) ~~each other~~ and the rotatable vane portion (372) is fixedly attached to the rotatable vane (240).

6. The multi-vane throttling valve (200) of Claim 1 further comprising a pin magnetic element (353) disposed on and fixedly attached to the assembly pin (352), and a reciprocal vane magnetic element (303) disposed on and fixedly attached to a supported side portion (302) of the reciprocal vane that is opposed to the assembly pin (352), the pin magnetic element (353) and the reciprocal vane magnetic element (303) having the same magnetic pole facing each other to thereby repel each other providing non-contact, reciprocal vane angling adjustment.

7. (Canceled)~~The multi-vane throttling valve of Claim 1 wherein each of the plurality of rotatable vanes includes a coolant block disposed concentrically on the axis of rotation of the rotatable vane and containing a cooling fluid pathway defining a cooling conduit disposed longitudinally along the rotatable vane~~.

8. (Canceled) ~~The multi-vane throttling valve of Claim 7 wherein the cooling conduit is selected from the group consisting of a straight conduit, a sinusoidal conduit, a square-wave shaped conduit, a pair of longitudinal conduits with a transverse conduit connecting the pair of longitudinal~~

~~conduits on one end, a pair of concentric conduits defining a flow path between an inner conduit and an outer conduit, and a longitudinal heat pipe.~~

9. (Canceled) ~~The multi-vane throttling valve of Claim 1 further comprising a vacuum feedthrough supporting each of the plurality of rotatable vanes between the vacuum chamber process inside and the atmospheric pressure outside of the throttling valve.~~

10. (Canceled) ~~The multi-vane throttling valve of Claim 9 wherein the vacuum feedthrough is a magnetic fluid vacuum feedthrough.~~

~~11~~7. A method of modifying a throttling valve (200) to preventing heat and deposition particles in an electron beam vacuum deposition system from entering a vacuum pump of the deposition system during a vacuum chamber process ~~using a throttling valve~~, the method comprising:

obtaining a multi-vane throttling valve (200) for use with a vacuum process chamber wherein the multi-vane throttling valve (200) has a plurality of rotatable vanes (240) disposed in a vane chamber (220a) ~~housing~~ of a throttle chamber body (220) wherein the vane chamber (220a) ~~housing~~ has a through-opening (223) and wherein each of the plurality of rotatable vanes (240) has an axis of rotation (400); and

configuring each of the plurality of rotatable vanes (240) with a reciprocal vane (300) pivotally connected to a back side (252) of each of the plurality of rotatable vanes (240) and extending backwardly away from each respective rotatable vane (240); ~~and~~,

whereby rotatably adjusting the orientation of each rotatable vane (240) ~~to thereby cause~~ causesthe reciprocal vane (300) to pivot in a range between a substantially parallel position with the respective rotatable vane (240) and a transverse position with the respective rotatable vane (240) when the respective rotatable vane (240) is rotated to control the flow of gases through the through-opening (223) to provide linear

conductance control during vacuum processing in the vacuum process chamber.

~~12~~8. The method of Claim ~~11~~ 7 further comprising offsetting the reciprocal vane (300) from the axis of rotation (400) of the rotatable vane (240).

~~13~~9. The method of Claim ~~11~~ 7 wherein the configuring step includes attaching a stationary reciprocal vane angling assembly (350) fixed in a predefined position wherein the vane angling assembly (350) has an assembly pin (352) extending transversely toward the reciprocal vane (300) a predefined distance sufficient to support the reciprocal vane (300).

~~14~~.10 The method of Claim ~~13~~ 9 wherein the configuring step further include disposing an assembly arm (354) extending backwardly a predefined distance from the axis of rotation (400) of a respective rotatable vane (240) wherein the ~~an~~ assembly pin (352) is fixedly attached to a distal end portion (355) of the assembly arm (354).

~~15~~11. The method of Claim ~~14~~ 10 wherein the attaching of the vane angling assembly (350) includes fixedly securing an assembly clamp (360) to a proximal end portion (356) of the assembly arm (354) and to a non-moving element within the throttle valve.

~~16~~12. The method of Claim ~~11~~ 7 wherein the configuring step includes securing a ~~rotatable~~ reciprocal vane portion (372) of a reciprocal vane bracket (370) to the rotatable vane (240) and pivotally connecting ~~a reciprocal vane portion of~~ the reciprocal vane bracket (370) to the reciprocal vane (300).

~~17~~13. The method of Claim ~~13~~ 9 wherein the step of attaching an angling assembly (350) includes disposing on and fixedly attaching a pin magnetic element (353) to the assembly pin (352) and disposing on and fixedly attaching a reciprocal vane magnetic element (303) to the supported side

portion (302) of the reciprocal vane (300) wherein the pin magnetic element (353) and the reciprocal vane magnetic element (303) have the same magnetic pole facing each other to thereby repel each other and to provide non-contact, reciprocal vane angling adjustment.

18. (Canceled) ~~The method of Claim 11 wherein the obtaining step include obtaining a plurality of rotatable vanes wherein each of the rotatable vanes has a coolant block disposed concentrically on the axis of rotation of the rotatable blade and containing a cooling fluid pathway defining a cooling conduit disposed longitudinally along the rotatable vane.~~

19. (Canceled) ~~The method of Claim 11 wherein the obtaining step includes obtaining a multi-vane throttling valve having a vacuum feedthrough supporting each of the plurality of rotatable vanes between the vacuum chamber process inside of the throttling valve and the atmospheric pressure outside of the throttling valve.~~

20. (Canceled) ~~The method of Claim 19 wherein the obtaining step includes obtaining a multi-vane throttling valve having a vacuum feedthrough supporting each of the plurality of rotatable vanes that is a magnetic fluid vacuum feedthrough.~~

~~21~~14. A method of preventing heat and deposition particles in an electron beam vacuum deposition system from entering a vacuum pump of the deposition system during a vacuum chamber process using a throttling valve (200), the method comprising:

rotatably adjusting the orientation of a rotatable vane (240) disposed within the throttling valve (200) causing a reciprocal vane (300) pivotally connected to a back side (242) of the rotatable vane (240) to pivot to a transverse position with respect to the rotatable vane (240) wherein the reciprocal vane (300) extends backwardly away from the rotatable vane (2401) and is supported by a stationary angling assembly (350) having

an assembly pin (352) that supports the reciprocal vane (300) to thereby deflect heat and deposition particles directed toward the throttling valve (200) away from the vacuum pump of the deposition system.

~~22~~15. The method of Claim ~~21~~ 14 further comprising selecting a stationary angling assembly (350) and a reciprocal vane (300) that further include a pin magnetic element (353) disposed on and fixedly attached to the assembly pin (352), and a reciprocal vane magnetic element (303) disposed on and fixedly attached to a supported side portion (302) of the reciprocal vane (300) that is opposed to the assembly pin (352) wherein the pin magnetic element (353) and the reciprocal vane magnetic element (303) have the same magnetic pole facing each other to thereby repel each other and to provide non-contact, reciprocal vane angling adjustment.