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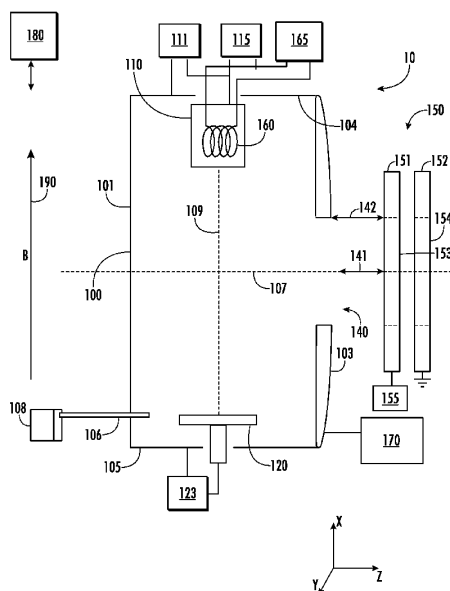


FIG. 1

(57) Abstract: An ion source capable of extracting a ribbon ion beam with improved vertical angular uniformity is disclosed. The extraction plate and extraction optics are designed such that there is at least one non-uniform gap between adjacent components. A non-uniform gap may be effective in reducing angular spread non-uniformity of the extracted ribbon ion beam. Specifically, for a given gap in the Z direction, ions extracted from regions with lower plasma density may have more vertical angular spread. A larger gap in the Z direction between components in this region may make the vertical angular spread closer to the vertical angular spread of ions extracted from regions with higher plasma density. The non-uniform gap may be created by having an extraction plate that is flat or curved and electrodes that are flat, convex or concave. In certain embodiments, the non-uniform gap is located between the extraction plate and the suppression electrode.

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