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#### (54) Apparatus for shaped magnetic field control for catheter, guidance, control and imaging

(57) A variable magnet system (1500) for manipulating a magnetic catheter is described. In one embodiment, a cluster (100,101) of electromagnets is configured to generate a desired magnetic field. In one embodiment, the catheter guidance system includes a closed-loop servo feedback system. A radar system is used to determine the location of the distal end of the catheter inside the body, thus, minimizing or eliminating the use of ionizing

radiation such as X-rays. The magnetic system used in the magnetic catheter guidance system can also be used to locate the catheter tip to provide location feedback to the operator and the control system. In one embodiment, a magnetic field source is used to create a magnetic field of sufficient strength and orientation to move a magnetically-responsive catheter tip in a desired direction by a desired amount.

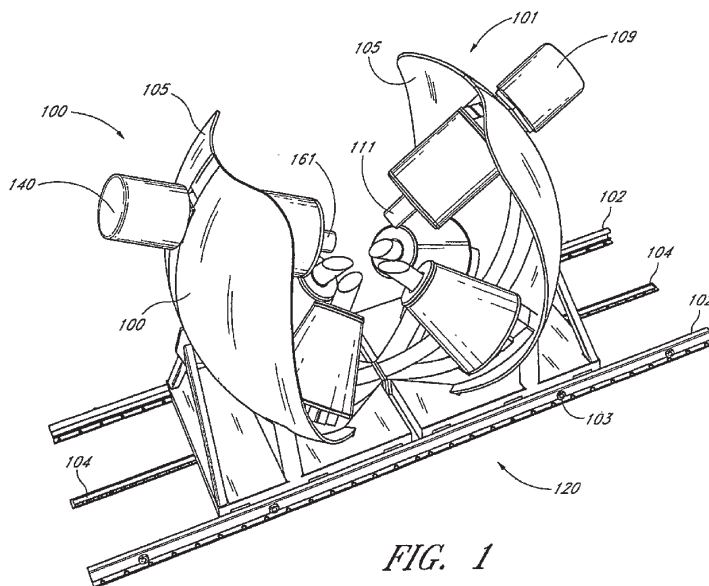


FIG. 1

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