order to enhance the current-force sensitivity of a Lorentz-force actuator, and to increase the generated force.

SUMMARY

In accordance with a first aspect of the present invention, there is provided a cylindrical-shape electromagnetic actuator comprising a plurality of pairs of magnets, the magnets of each pair being held at a distance from each other with an effective air gap formed therebetween for accommodating a coil structure for translational movement of the coil structure under a Lorentz force; and a substantially cylindrical frame structure for supporting the pairs of magnets, the frame structure being configured such that substantially separate closed loop magnetic paths are provided for the respective pairs of magnets.

Said pairs of magnets may be configured in a mutually attracting orientation.

Said closed loop magnetic paths may be formed by a ferrous material of the frame structure.

Said closed loop magnetic paths may comprise magnet elements of side portions of said frame structure.

The actuator may further comprise an air-core coil disposed within said effective air gaps between said pairs of magnets.

Said moving air-core coil may be connected to at least one flexure-based bearing to form a nanopositioning actuator.

The actuator may comprise the flexure-based bearing connected to the frame structure.

The flexure-based bearing may be connected between a periphery of the frame structure, and one or more shafts coupled to the moving air coil.