from a single substrate using a self aligned technique as described in cross-referenced application 60/192,097. The self-aligned fabrication method typically involves the steps of providing a multi-layer structure having first and second conductive layers separated by an insulating layer, and etching a top pattern in the first and second conductive layers and insulating layer to define the moving and stationary comb fingers. The substrate may also have additional layers that are etched to define the bottom surfaces of the fingers. Because the fingers are fabricated together, the difficult alignment of the moving and stationary fingers, required for fabricating conventional vertical comb-drive actuators, may be avoided. Alignment is a direct result of the mask used in fabrication. Electrical conduction between the different layers in this structure may be achieved by etching narrow trenches vertically through multiple layers and filling the trenches with electrically conductive material.

In structures where the fixed and moving combs interdigitate in their rest positions, both the moving and fixed comb fingers may be fabricated in the same step from the same layer of device material by a single patterning and etching step. It is important to insulate the comb drives from each other so that they can support a voltage difference and therefore be used for sensing and/or actuating. This can be achieved by etching narrow trenches in the layer from which the comb-fingers and the gimbaled structure has been fabricated, and filling these trenches with insulating material. The insulating material mechanically attaches the structural material on either side of the trench, while keeping them electrically isolated.

It will be clear to one skilled in the art that the above embodiment may be altered in many ways without departing from the scope of the invention.

What is claimed is:

1. A two-dimensional scanner comprising:

a) a base;

b) an outer frame rotatably attached to the base for rotation about a first axis substantially parallel to a plane containing the outer frame and/or the base;

c) an inner part rotatably attached to the outer frame for rotation about a second axis substantially parallel to a plane containing the inner part and/or the outer frame;

d) a first set of comb fingers attached to the outer frame; and

e) a second set of comb fingers attached to the base, wherein the first and second sets of comb fingers interdigitate in a substantially co-planar fashion at some rotation of the outer frame relative to the base about the first axis.

2. The scanner of claim **1**, further comprising means for applying a voltage between the first and second set of comb fingers, whereby the comb fingers may act as a comb-drive actuator.

3. The scanner of claim **2**, further comprising means for applying a constant biasing force between the outer frame and the base.

4. The scanner of claim **2**, further comprising means for sensing an angular position of the outer frame relative to the base.

5. The scanner of claim **4**, wherein the means for sensing angular position are chosen from the group consisting of gap-closing electrodes and piezoresistive sensors.

6. The scanner of claim **4**, wherein the means for sensing angular position comprises a capacitance sensor electrically coupled between the first and second sets of comb fingers, whereby the comb fingers may act as both a comb-drive actuator and a sensor.

7. The scanner of claim **1**, further comprising means for sensing an angular position of the outer frame relative to the base.

8. The scanner of claim **7**, wherein the means for sensing angular position includes a capacitance sensor electrically coupled between the first and second sets of comb fingers.

9. The scanner of claim **7**, further comprising drive means for rotating the outer frame relative to the base.

10. The scanner of claim **9**, wherein the drive means is chosen from the group consisting of gap-closing electrodes, magnetic drives, and piezo drives.

11. The scanner of claim **1**, further comprising:

e) a third set of comb fingers attached to the inner part; and

f) a fourth set of comb fingers attached to the outer frame, wherein the third and fourth sets of comb fingers interdigitate at some rotation of the inner part relative to the outer frame about the second axis.

12. The scanner of claim **11**, further comprising:

g) means for applying a voltage between the first and second sets of comb fingers, whereby the first and second sets of comb fingers may act as a comb-drive actuator; and

h) means for applying a voltage between the third and fourth sets of comb fingers, whereby the third and fourth sets of comb fingers may act as a comb-drive actuator.

13. The scanner of claim **12**, further comprising:

g') means for measuring a capacitance between the first and second sets of comb fingers, whereby the first and second sets of comb fingers may act as both a comb-drive actuator and a position sensor; and

h') means for measuring a capacitance between the third and fourth sets of comb fingers, whereby the third and fourth sets of comb fingers may act as both a comb-drive actuator and a position sensor.

14. The scanner of claim **12**, further comprising:

g") means for measuring a capacitance between the first and second sets of comb fingers, whereby the first and second sets of comb fingers may act as a position sensor; and

h") means for measuring a capacitance between the third and fourth sets of comb fingers, whereby the third and fourth sets of comb fingers may act as a position sensor.

15. The scanner of claim **14**, further comprising drive means for rotating the inner part relative to the outer frame.

16. The scanner of claim **15**, wherein the drive means is chosen from the group consisting of gap-closing electrodes, magnetic drives, and piezo drives.

17. The scanner of claim **14**, further comprising drive means for rotating the outer frame relative to the base.

18. The scanner of claim **17**, wherein the drive means is chosen from the group consisting of gap-closing electrodes, magnetic drives, and piezo drives.

19. The scanner of claim **1**, wherein the outer frame is rotatably attached to the base by means selected from the group consisting of torsional flexures, cantilever-like flexures, serpentine flexures, and pin-and-staple type hinges.

20. The scanner of claim **19**, wherein the torsional flexures have cross-sections selected from the group consisting of rectangular cross-section, I-shaped cross-section, and T-shaped cross-section.