EXHIBIT L

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(12) **United States Patent**
Armstrong

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(54) **3D CONTROLLER WITH VIBRATION**

(75) Inventor: **Brad A. Armstrong**, Carson City, NV (US)

(73) Assignee: **Anascape**, Carson City, NV (US)

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Related U.S. Application Data

(63) Continuation of application No. 08/677,378, filed on Jul. 5, 1996, now Pat. No. 6,222,525, which is a continuation-in-part of application No. 08/393,459, filed on Feb. 23, 1995, now Pat. No. 5,565,891, which is a continuation-in-part of application No. 07/847,619, filed on Mar. 5, 1992, now Pat. No. 5,589,828.

(51) **Int. Cl.**[7] **G09G 5/08**
(52) **U.S. Cl.** **345/161**; 345/156
(58) **Field of Search** ..... 345/156–172; 74/471 XY; 200/5 R, 6 A, 6 R, 9, 40, 41, 50.32–50.37, 61, 45 R, 61.46, 61.53, 512, 518–521, 530, 564; 341/20–35

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(Continued)

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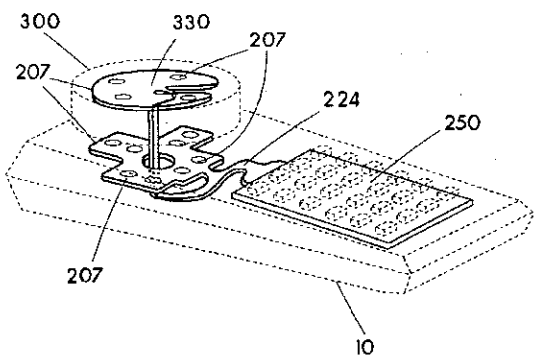
(57) **ABSTRACT**

A hand operated controller or converter structured for allowing hand inputs to be converted or translated into electrical outputs, the controller structured with a plate or platform moveable relative to a base or housing about two mutually perpendicular axes generally parallel to the platform to effect a plurality of sensors for defining output signal(s) based on movement of the platform. The sensors each have an electrically active activator spatially separated from an electric contact surface. A tactile feedback motor with shaft and offset weight is mounted as a component of the controller for providing vibration to be felt by a hand operating the controller. In some embodiments the sensors are pressure sensitive variable output sensors.

33 Claims, 40 Drawing Sheets



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Flightstck Pro by CH Products, San Marcos, Califonia USA, a joystick which uses a gimbal and rotary potentiometers, the joystick is prior art sold in stores.

Known prior art are rotary operated potentiometers which have an Off position usually in the far counterclockwise direction of rotation and an audible "click" is provided when rotated in or out of the Off position. Such potentiometers are variable output electrical devices controlled by rotation .

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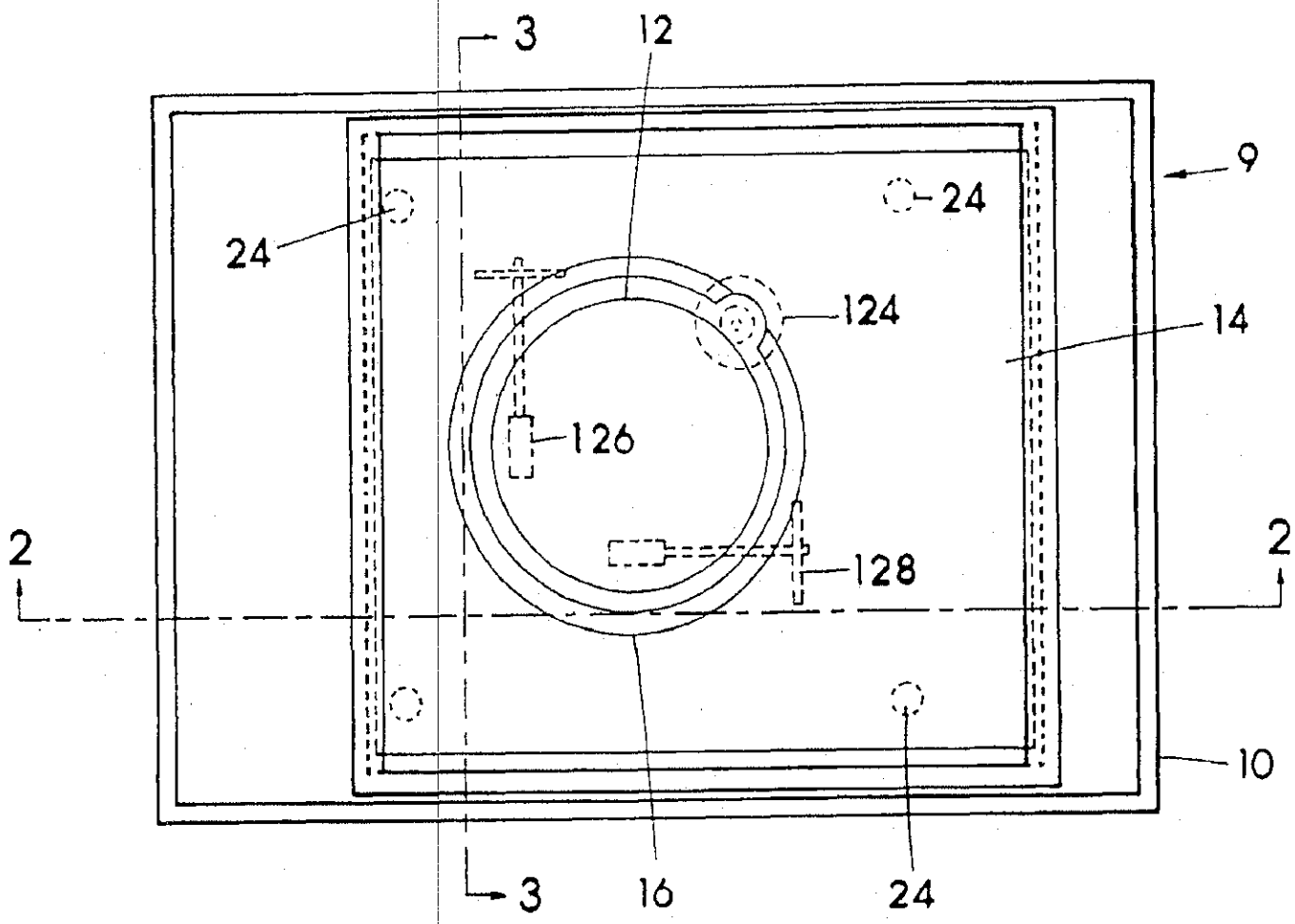

FIG. 1

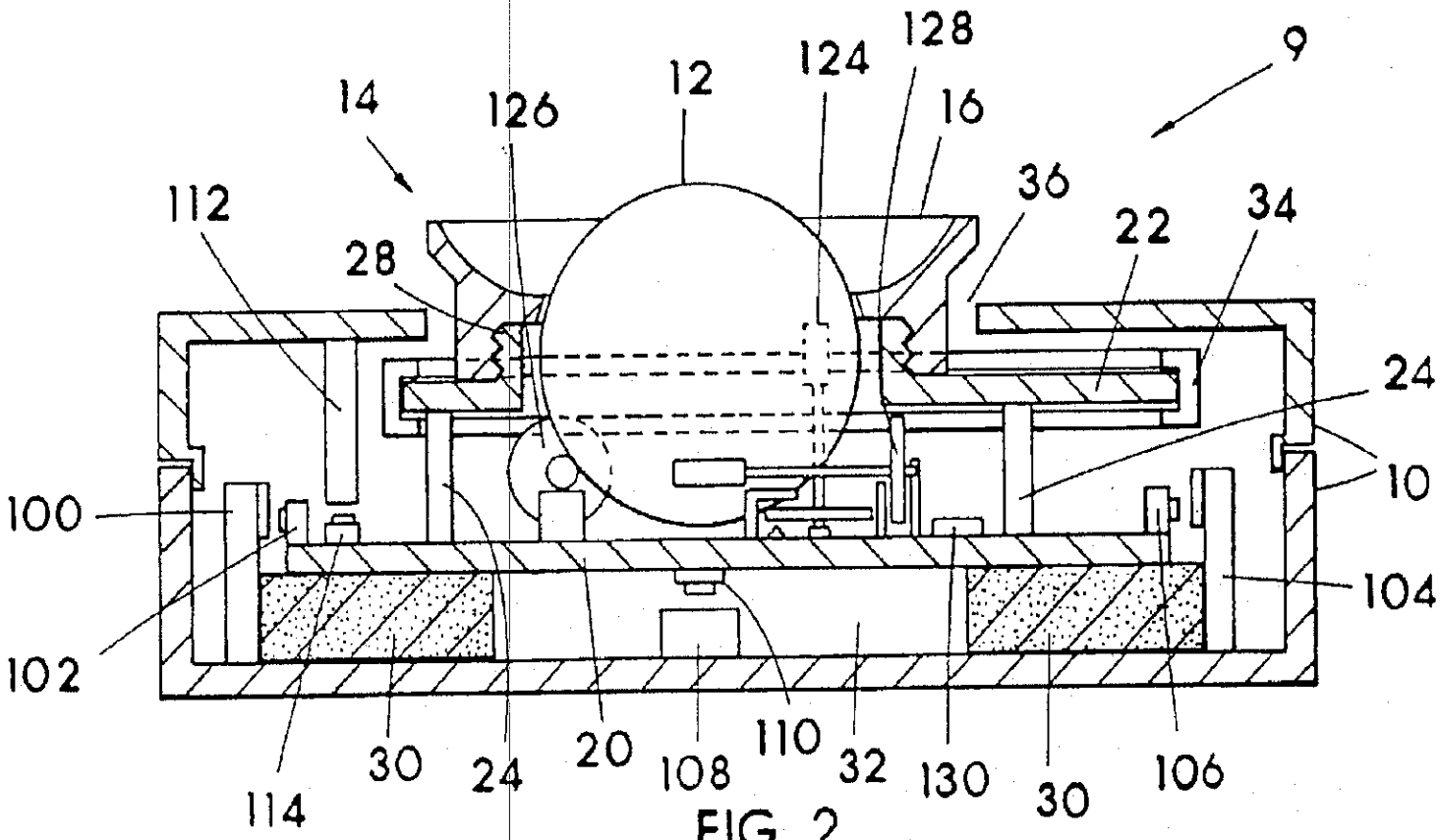
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FIG. 2

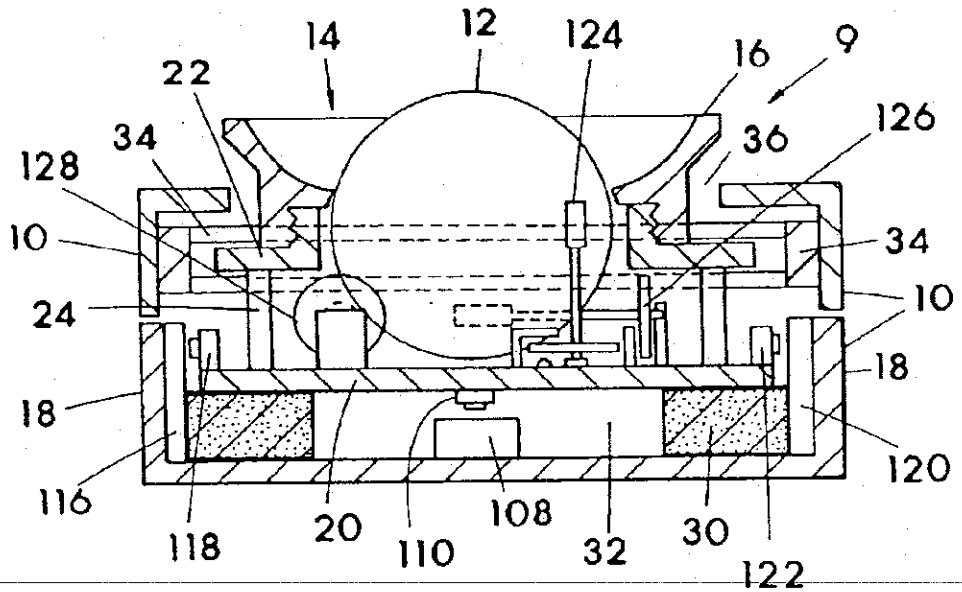
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FIG. 3

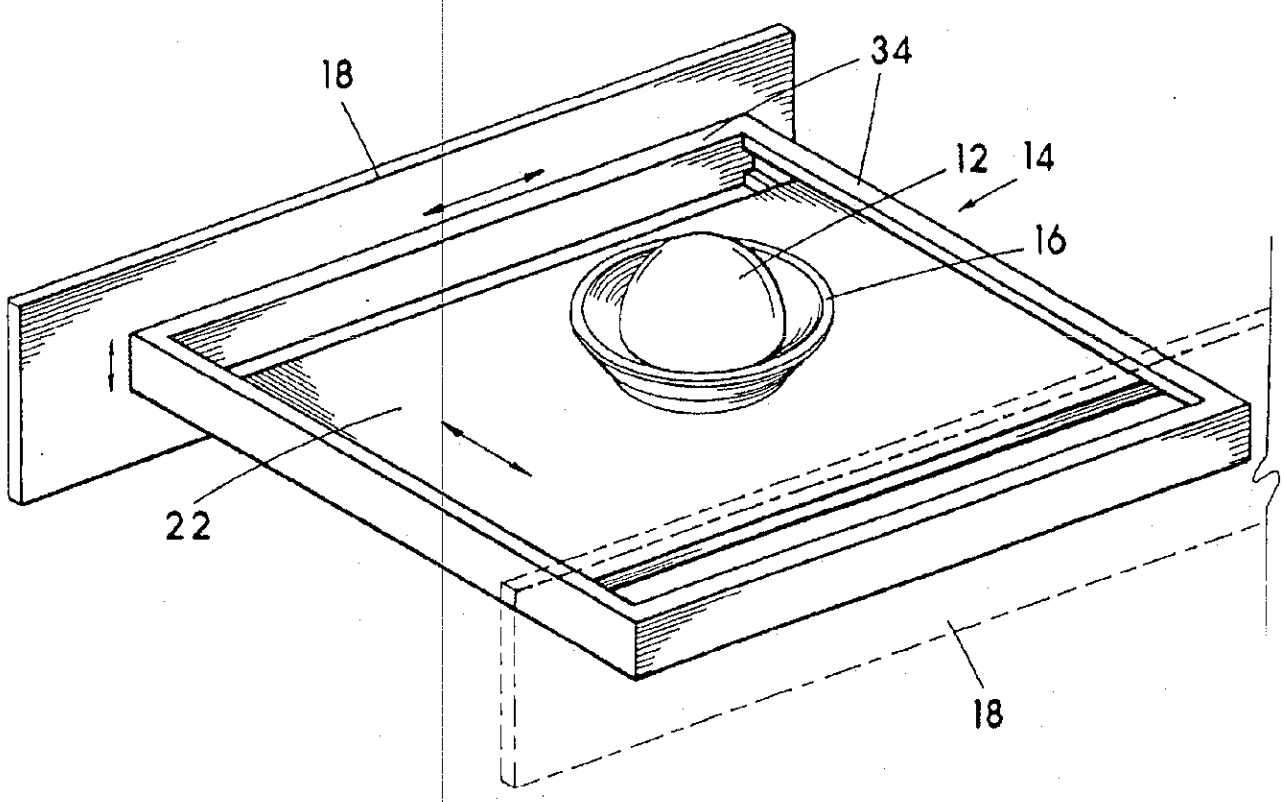

FIG. 4

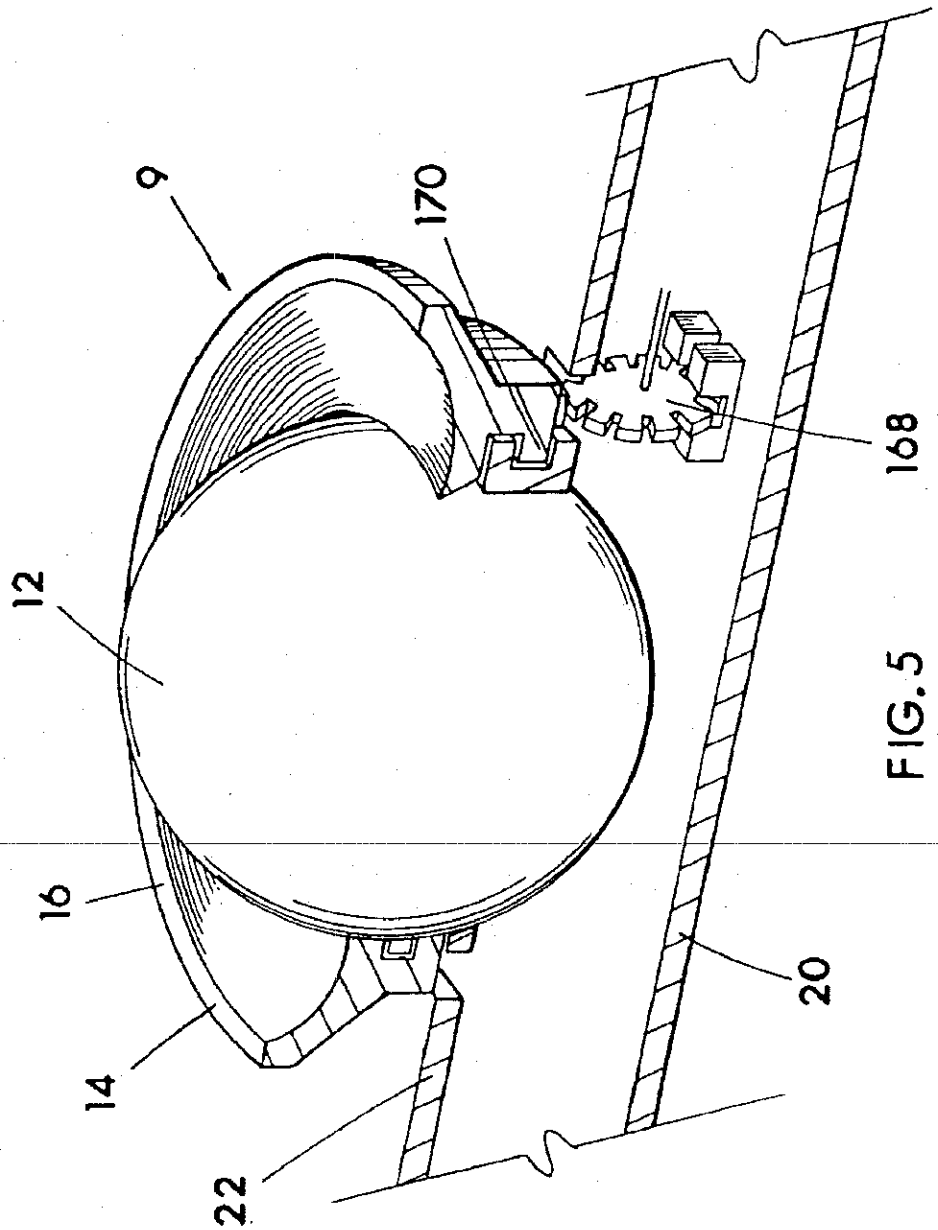

FIG. 5

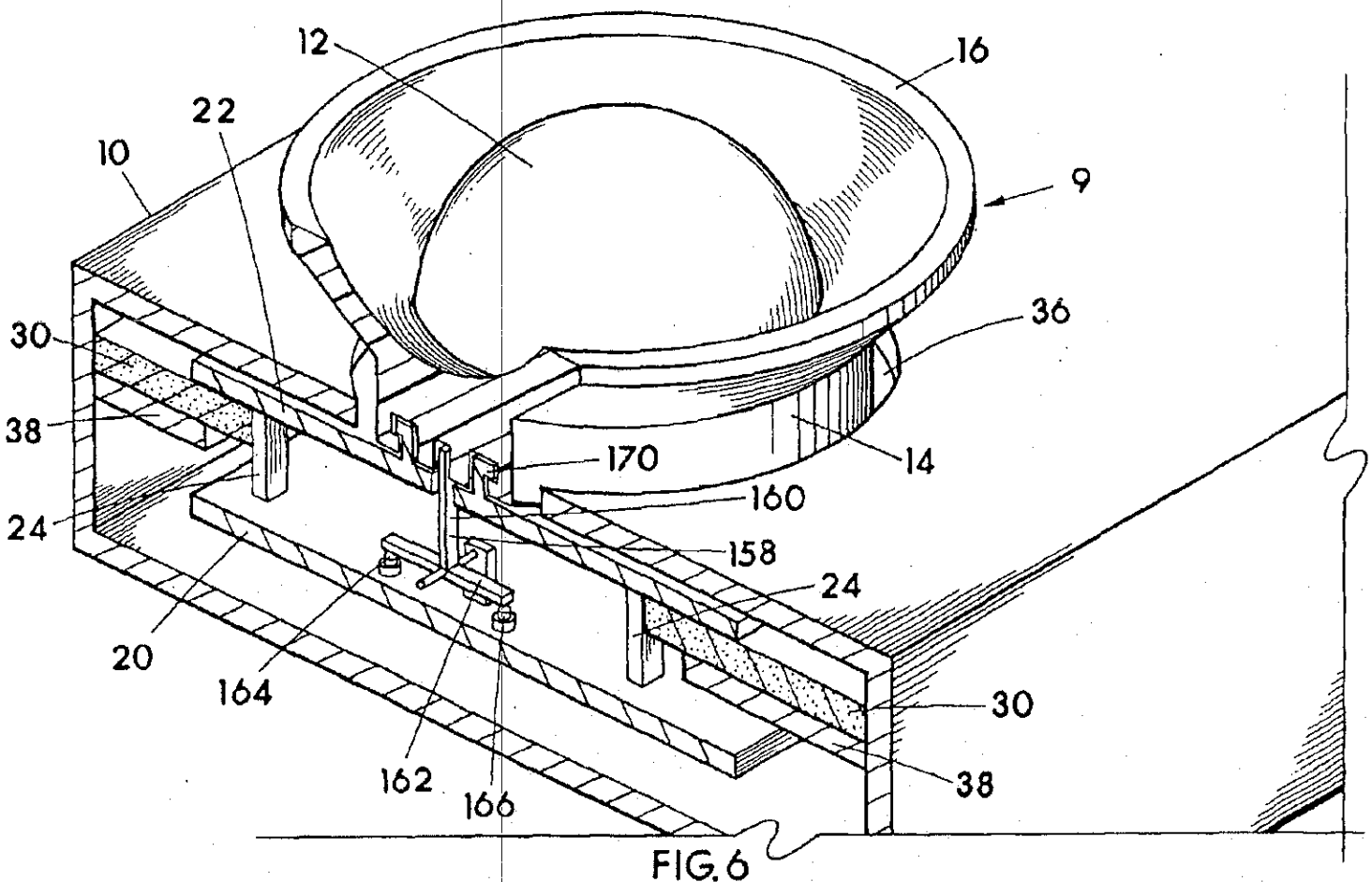

FIG. 6

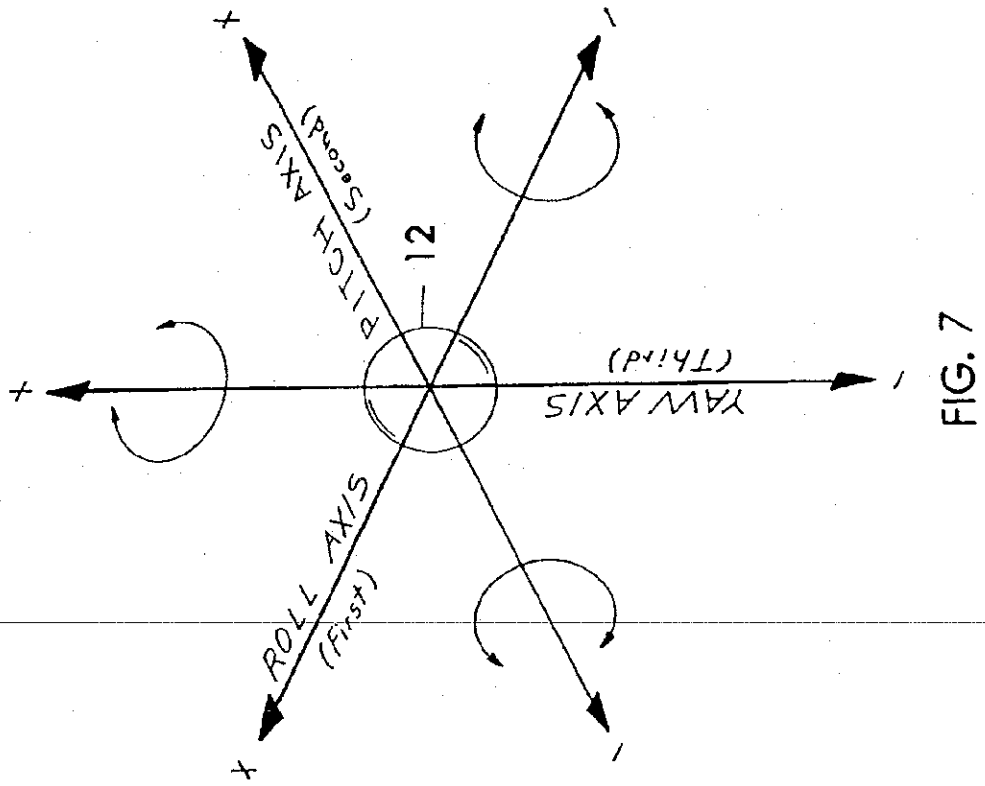

FIG. 7

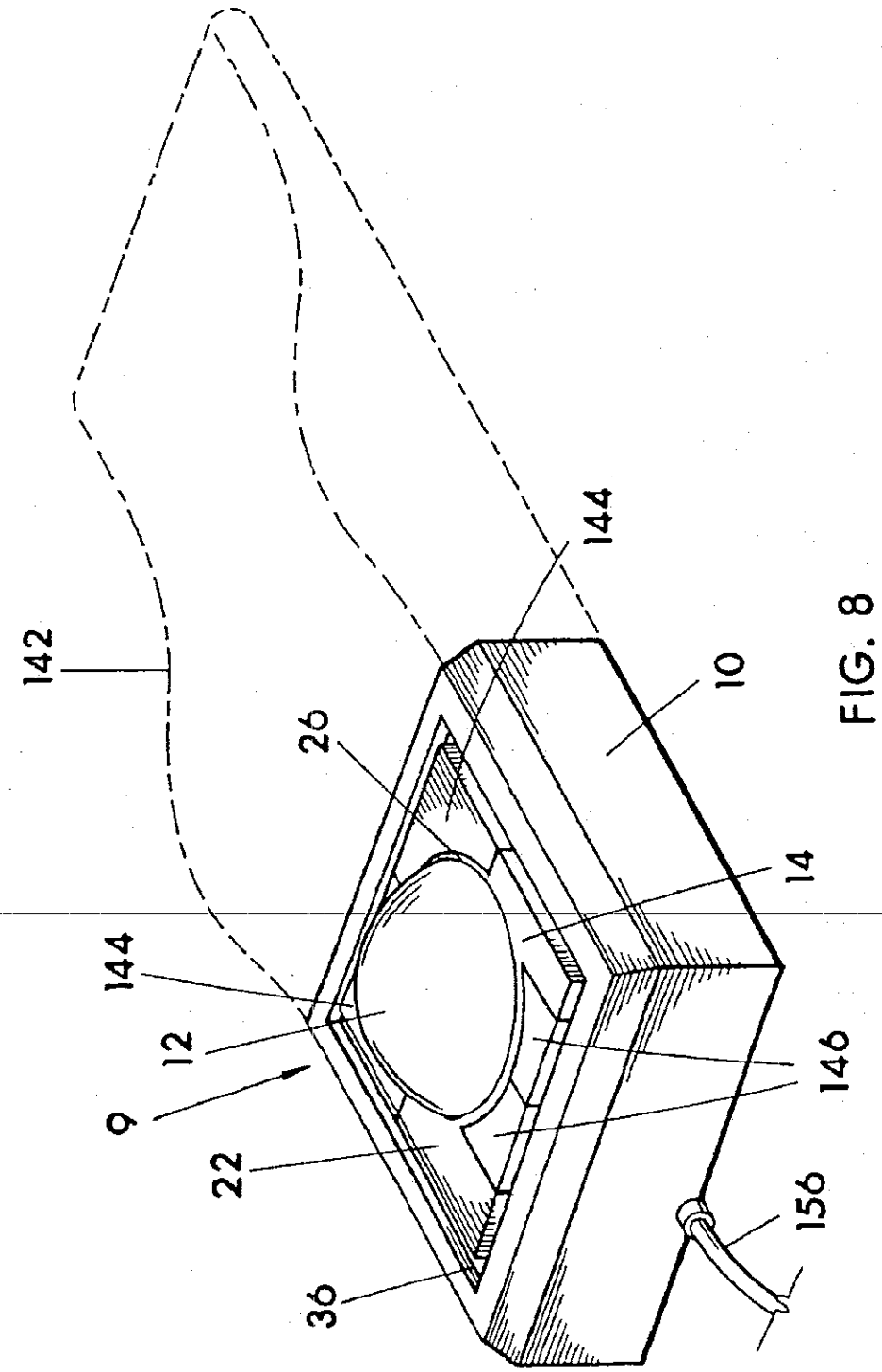

FIG. 8

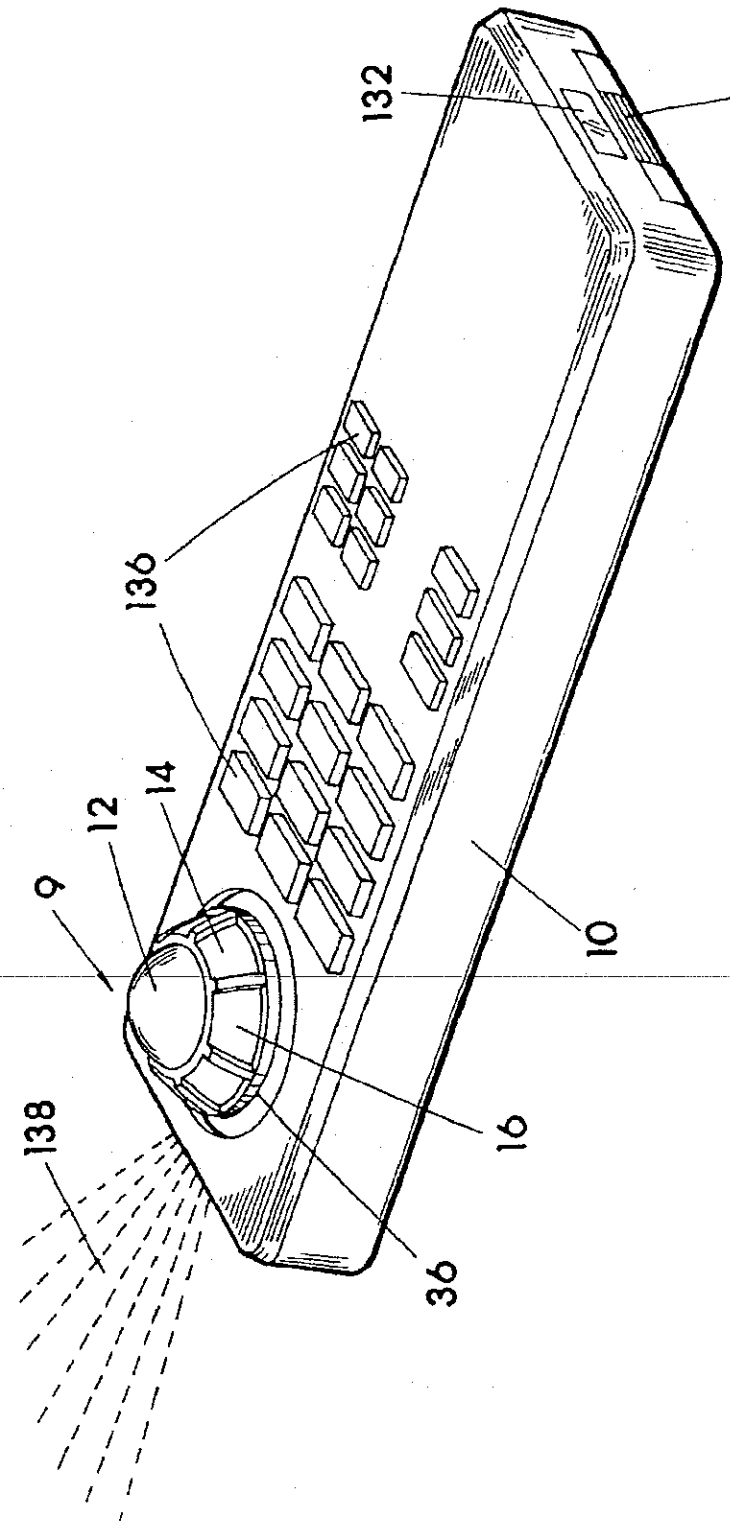

FIG. 9

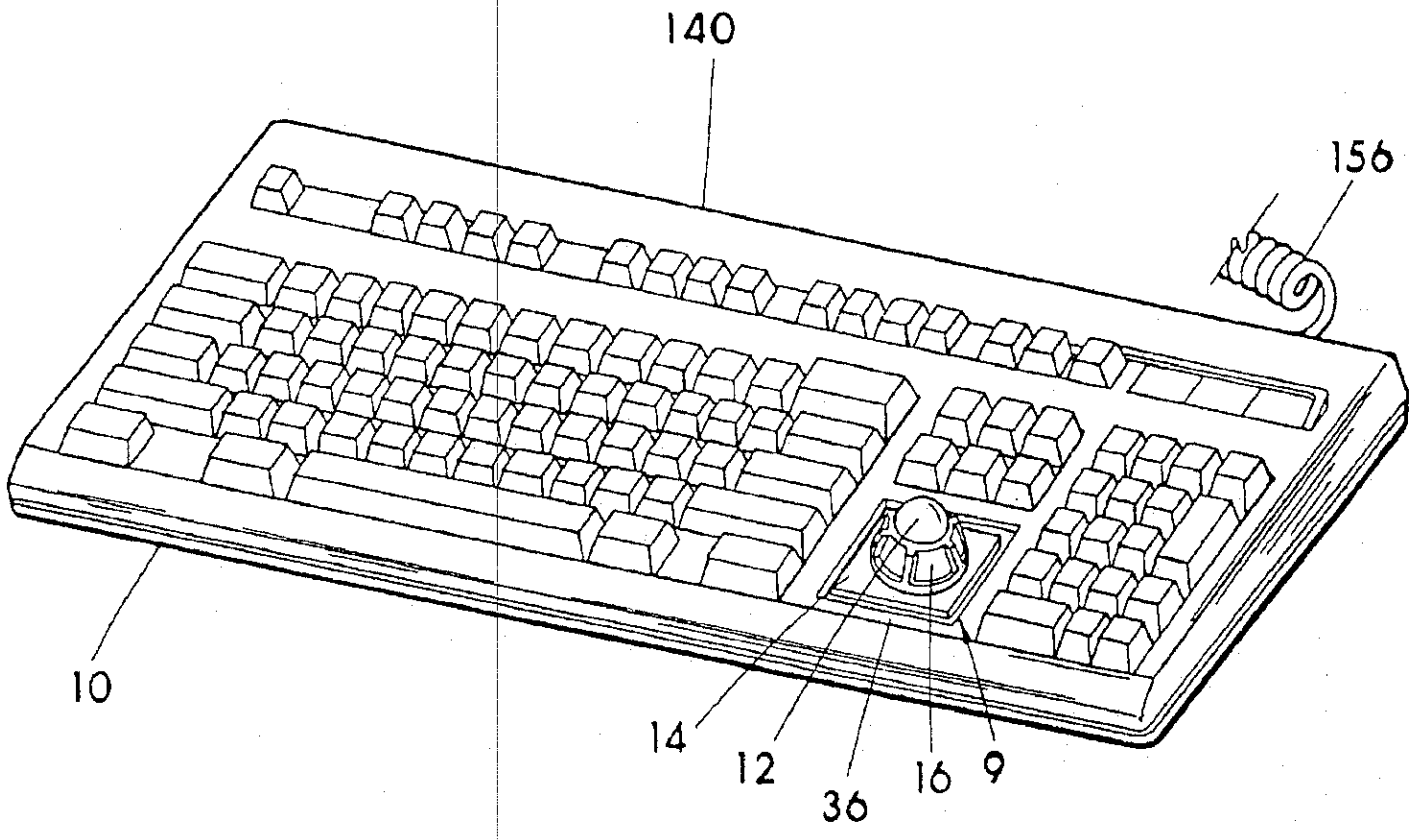

FIG. 10

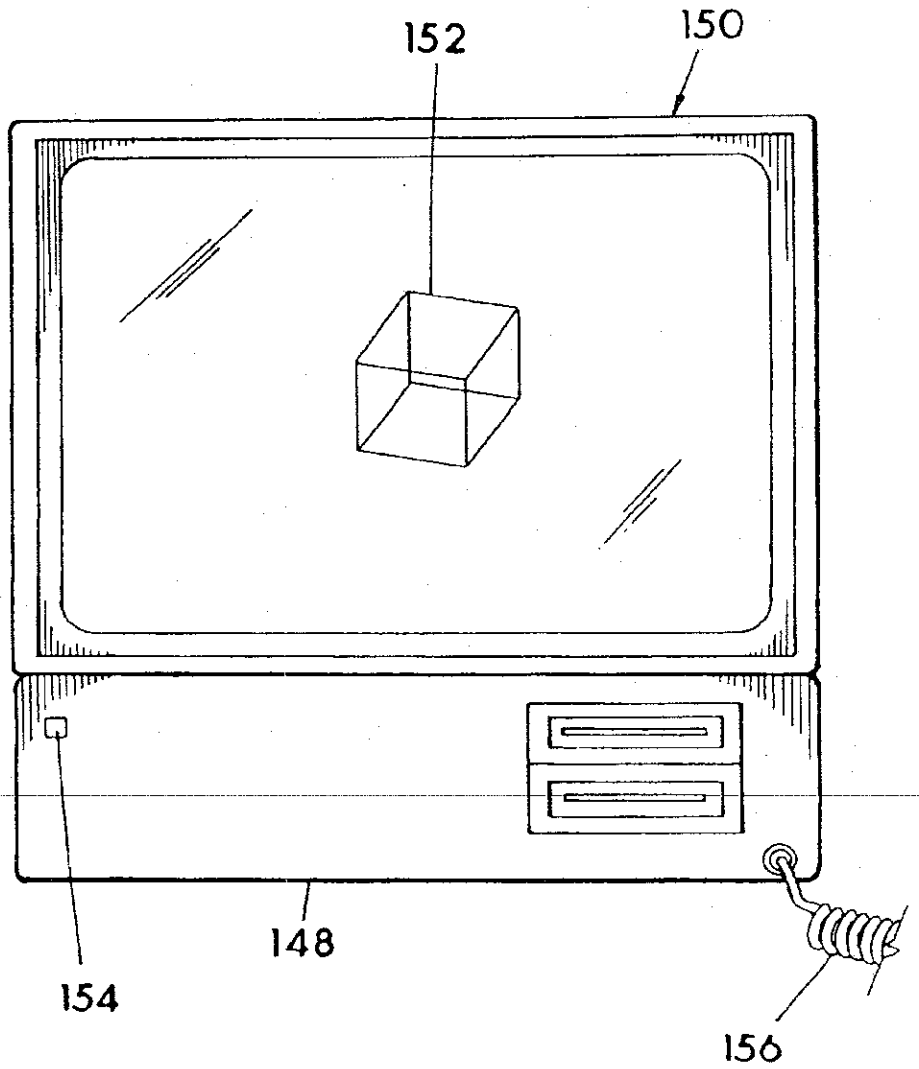

FIG. 11

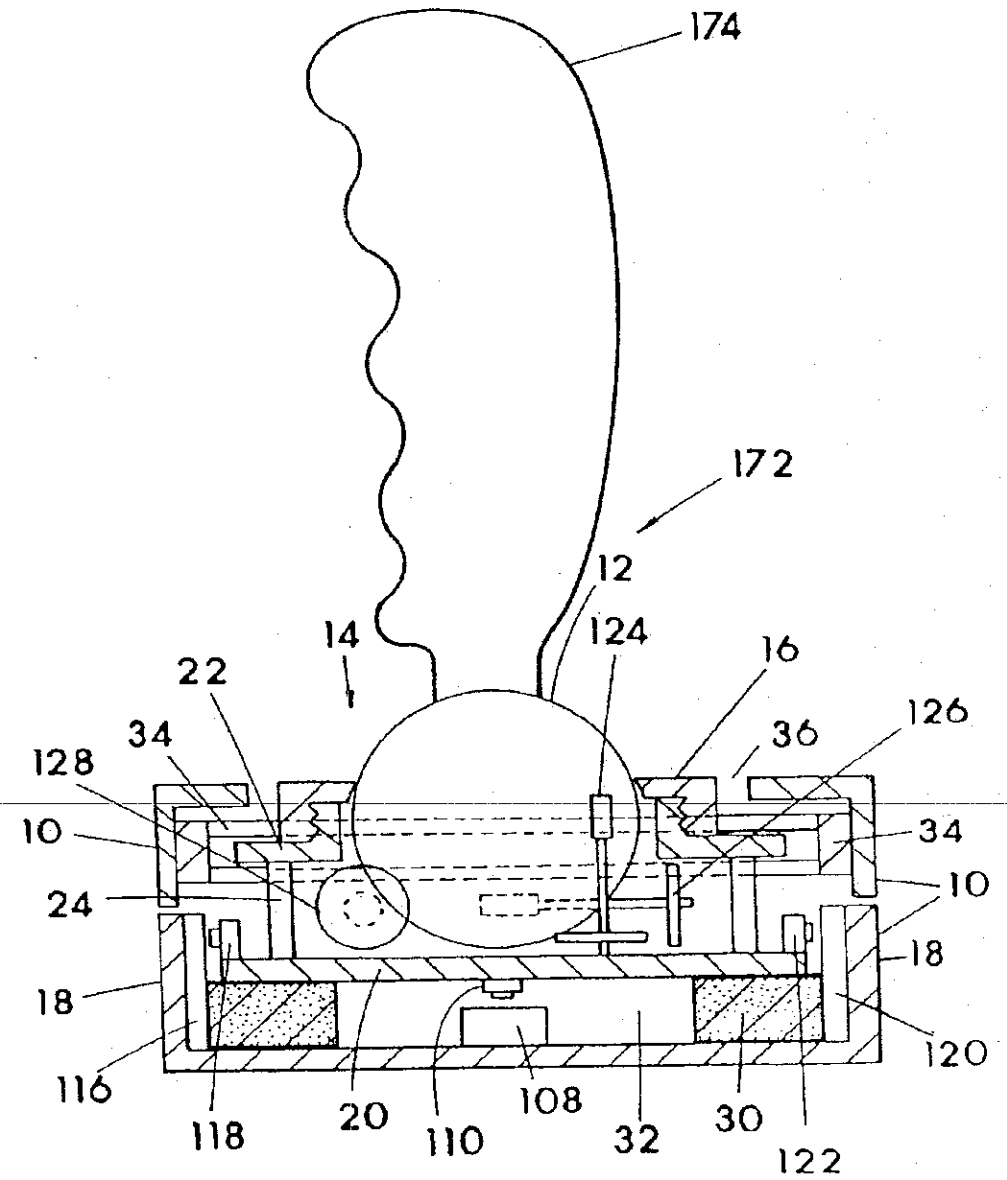
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FIG. 12

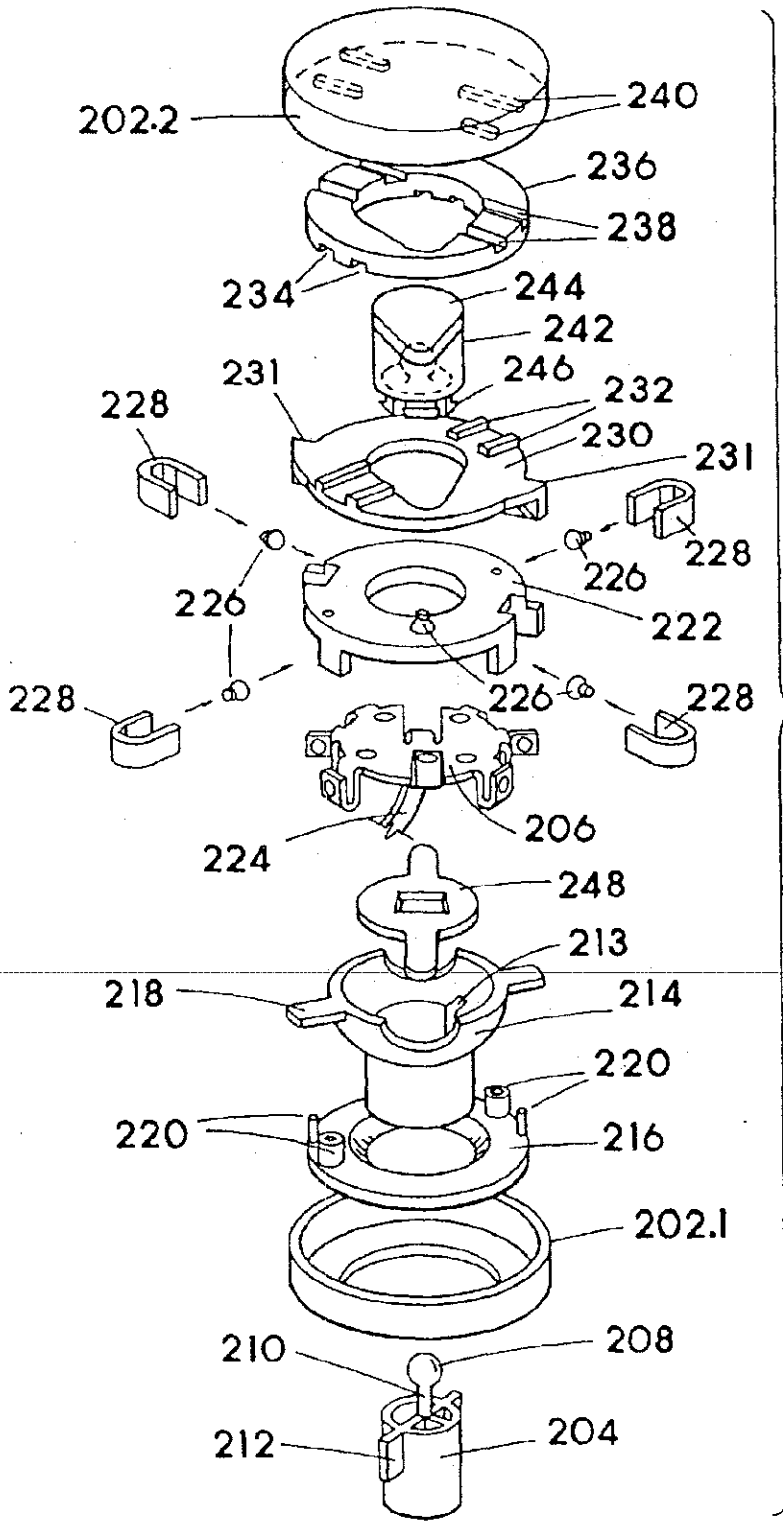
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FIG. 13

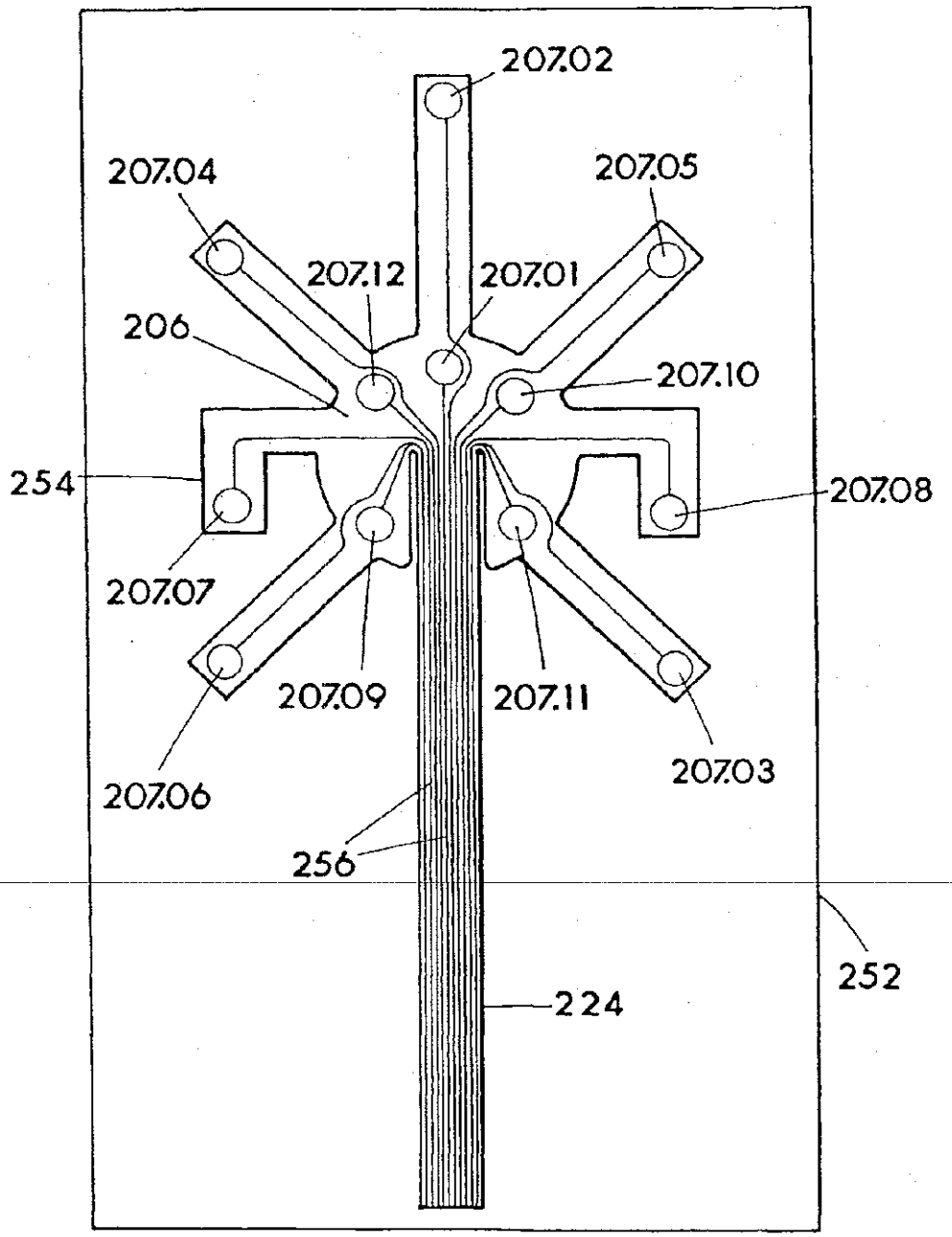
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FIG. 14

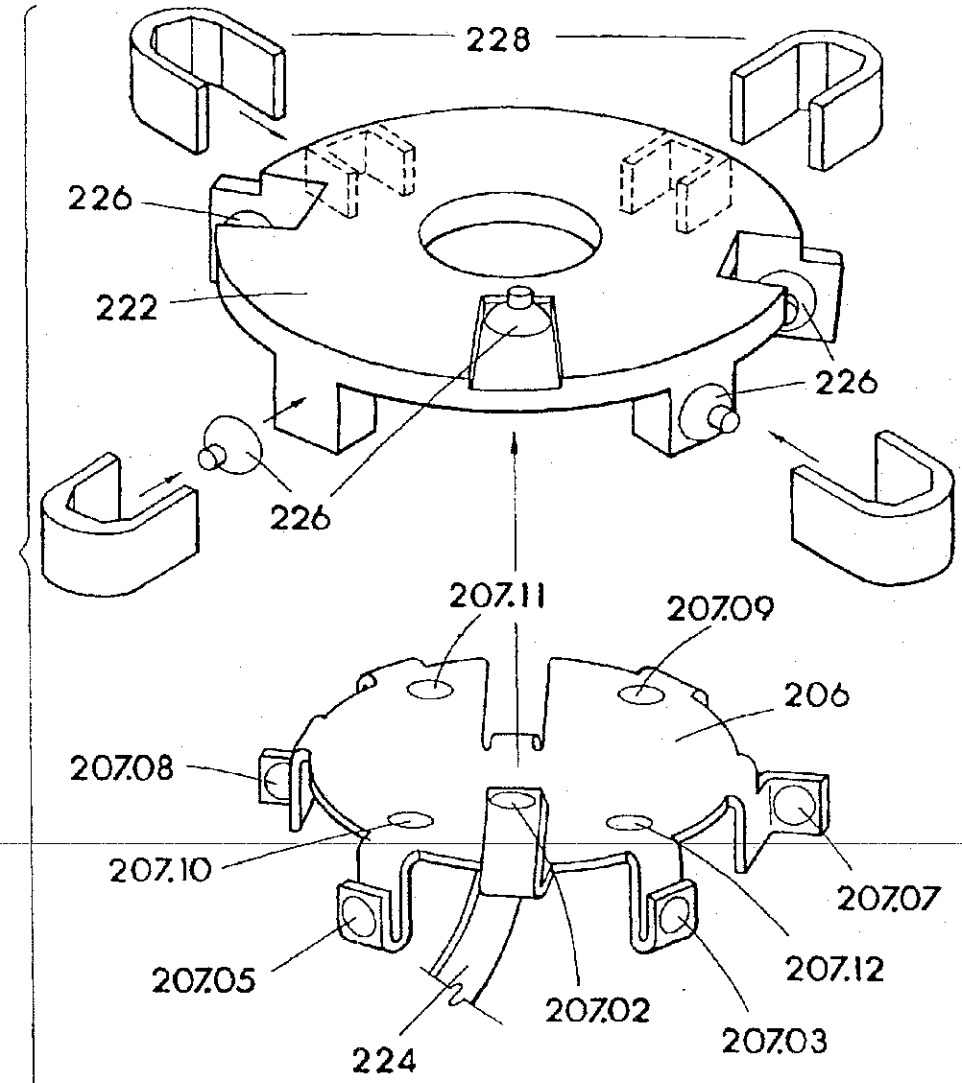
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FIG. 15

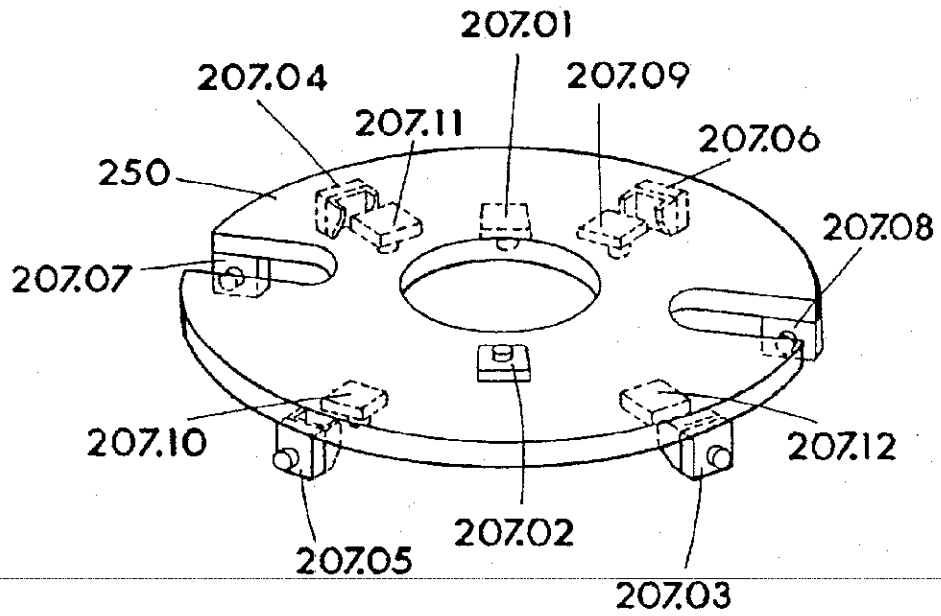
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FIG. 16