1997 Patents Issued

The following pages contain a list of all patents issued by the U.S. Patent Office to Draper engineers during the 1997 calendar year.

Bernstein, Jonathan J.

Patent #5596222 Date Issued: January 21, 1997
Wafer of transducer chips

Patent #5684324 Date Issued: November 4 , 1997
Acoustic transducer chip

Patent #5693181 Date Issued: December 2, 1997
Method of making transducer chips with grooves on the wafer for easy separation of the chips

Disclosed is a wafer and a method of making a wafer containing a plurality of severable transducer chips, including a wafer; a plurality of transducer chips formed on the wafer; and a grid of longitudinal and latitudinal grooves in the wafer for separating the chips from each other and enabling them to be easily, individually severed from the wafer, as well as a transducer chip and a method of making it, having integral raised contacts adapted for a flip chip or beam lead interconnection, with a transducer formed on the chip; and a plurality of raised contacts integrally formed with the chip and electrically interconnected with the transducer.

Fyler, Donald C.

Patent #5624110 Date Issued: April 29, 1997
Cut segment pick-up assembly

A segment pickup apparatus for handling material segments is disclosed. The apparatus includes a frame and at least one pair of picker assemblies coupled to the frame. Each of the picker assemblies includes a linear array of carding elements, and each of the carding elements is resiliently coupled to one of the picker assemblies and is positionable relative to the frame in a resting position and in a picking position. Each of the carding elements includes a base portion and a linear array of substantially parallel, elongated, resilient needle-like elements extending from the base portion to a distal tip. When a carding element is positioned in the resting position, the distal tips of that carding element lie above a picking plane, and when a carding element is positioned in the picking position, the distal tips of that carding element lie substantially in the picking plane. The picker assemblies are disposed such that the carding elements are arranged in pairs. In each pair, the needle-like elements of one carding element slant toward a first direction and the needle-like elements of the other carding element slant toward a second direction. The segment pickup apparatus further includes a carding actuator device for positioning pairs of carding elements in the resting position and in the picking position, and also includes a picker actuator device for displacing the picker assemblies relative to the frame in the first direction and in the second direction.

Greiff, Paul

Patent #5605598 Date Issued: February 25, 1997
Monolithic micromechanical vibrating beam accelerometer with trimmable resonant frequency

A monolithic, micromechanical vibrating beam accelerometer with a trimmable resonant frequency is fabricated from a silicon substrate that has been selectively etched to provide a resonant structure suspended over an etched pit. The resonant structure comprises an acceleration-sensitive mass and at least two flexible elements having resonant frequencies. Each of the flexible elements is disposed generally collinear with at least one acceleration-sensitive axis of the accelerometer. One end of at least one of the flexible elements is attached to a tension relief beam for providing stress relief of tensile forces created during the fabrication process. Mass support beams having a high aspect ratio support the mass over the etched pit while allowing the mass to move freely in the direction collinear with the flexible elements. Also disclosed is a method for fabricating such an accelerometer. Further disclosed is an alternative embodiment of the aforementioned accelerometer characterized by a low profile, and alternative planar processing methods for fabrication of these and other embodiments.

Greiff, Paul; Antkowiak, Bernard M.

Patent #5650568 Date Issued: July 22, 1997
Gimballed vibrating wheel gyroscope having strain relief features

A gimballed vibrating wheel gyroscope for detecting rotational rates in inertial space is disclosed. The gyroscope includes a support oriented in a first plane and a wheel assembly disposed over the support parallel to the first plane. The wheel assembly is adapted for vibrating rotationally at a predetermined frequency in the first plane and is responsive to rotational rates about a coplanar input axis for providing an output torque about a coplanar output axis. The gyroscope also includes a post assembly extending between the support and the wheel assembly for supporting the wheel assembly. The wheel assembly has an inner hub, an outer wheel, and spoke flexures extending between the inner hub and the outer wheel and being stiff along both the input and output axes. A flexure is incorporated in the post assembly between the support and the wheel assembly inner hub and is relatively flexible along the output axis and relatively stiff along the input axis. Also provided is a single semiconductor crystal fabrication technique and a dissolved wafer fabrication technique. In one embodiment, the gyroscope includes comb drive electrodes. Also described is a box-shaped strain relief structure for use in the spoke flexures and additional strain relief features.

Greiff, Paul; Boxenhorn, Burton

Patent #5635639 Date Issued: June 3, 1997
Micromechanical tuning fork angular rate sensor

A micromechanical tuning fork gyroscope includes a suspended structure comprising at least first and second vibratable structures. Each vibratable structure is energizable to vibrate laterally, within a first plane, along an axis normal to the rotation-sensitive axis. The lateral or inplane vibration of the first and second vibratable structures effects simultaneous vertical or rotational movement of at least a portion of the suspended structure upon the occurrence of angular rotation of the gyroscope about the rotation-sensitive axis. Vertical or rotational movement of the suspended structure is sensed, and a voltage proportional to the movement is generated, for providing an indication of angular rate of rotation by the gyroscope.

Greiff, Paul; Sohn, Jerome B.

Patent #5646348 Date Issued: July 8, 1997
Micromechanical sensor with a guard band electrode and fabrication technique therefor

An electrostatically actuated micromechanical sensor having a guard band electrode for reducing the effect of transients associated with a dielectric substrate of the sensor is disclosed. A proof mass, responsive to an input, is suspended over the substrate and one or more electrodes are disposed on the substrate in electrostatic communication with the proof mass to sense the input acceleration and/or to torque the proof mass back to a null position. A guard band electrode is disposed over the dielectric substrate in overlapping relationship with the electrodes and maintains the surface of the substrate at a reference potential, thereby shielding the

proof mass from transients and enhancing the accuracy of the sensor. A dissolved wafer process for fabricating the micromechanical sensor is described in which the proof mass is defined by a boron doping step. An alternative fabrication technique is also described in which the proof mass is defined by an epitaxial layer.

Greiff, Paul; Boxenhorn, Burton; Weinberg, Marc S.

Patent #5635739 Date Issued: June 3, 1997
Micromechanical angular accelerometer with auxiliary linear accelerometer

A micromechanical accelerometer comprises a mass of monocrystalline silicon in which a substantially symmetrical plate attached to a silicon frame by flexible linkages is produced by selective etching. The plate has a plurality of apertures patterned and etched therethrough to speed further etching and freeing of the plate and flexible linkages, suspending them above a void etched beneath. The plate is capable of limited motion about an axis created by the flexible linkages. An accelerometer comprised of a substantially symmetrical, linkage supported plate configuration is implemented as an angular accelerometer paired with an auxiliary linear accelerometer, which is used to compensate for the linear sensitivity of the angular sensor to achieve an instrument that is insensitive to linear acceleration and responds to angular acceleration.

Laznicka, Jr., Oldrich M.

Patent #5686990 Date Issued: November 11, 1997
Optical source isolator with polarization maintaining optical fiber and aspheric collimating and focusing lens

An optical component for use in optical devices, such as an interferometer fiber-optic gyroscope, including a polarizing beamsplitter and a non-reciprocal optical device mounted on a common substrate; and an optical transceiver is disclosed. The optical component may be used in a low-loss configuration with an optical source and a photodetector and associated focusing lenses and a fiber-optic ring or coil sensor for a gyroscope. The non-reciprocal device rotates the polarization plane of light, transmitted from the source through the beamsplitter to the sensor, and light returned from the sensor toward the beamsplitter, by 45 degrees in the same direction so that substantially all return light incident on the beamsplitter is reflected toward the photodetector.

Luniewicz, Michael F.; Woodbury, Dale T.; Tuck, Paul A.

Patent #5694015 Date Issued: December 2, 1997
Hunting suppressor for polyphase electric motors

The disclosed hunting suppressor is for use with n-phase electric motors, including a stator having n windings and a rotor. The hunting suppressor is responsive to a reference clock signal characterized by a frequency f_c and an associated phase angle ϕ_c. A controlled frequency oscillator generates n drive signals, where the drive signals are mutually shifted in phase by 180/n degrees. The drive signals are each coupled to drive a respective one of the n windings of the motor. A phase-locked loop network locks the frequency and phase of one of the drive signals to that of an applied clock reference signal. With that configuration, the rotor is controlled to rotate at the frequency of the clock reference signal with substantially no hunting.

Martin, Jacob H.

Patent #5610431 Date Issued: March 11, 1997
Covers for micromechanical sensors and other semiconductor devices

A cover for a micromechanical device through which input/output connections to the device are made is disclosed. The cover includes at least two doped semiconductor standoffs supporting an insulative layer. One or more metalized vias extend from a top surface of the insulative layer, or from a bottom surface of the base, to a respective standoff. Electrical connection is made to the covered device through the metalized vias and doped semiconductor standoffs. The covered chip may be vacuum sealed by providing a ring-like standoff that borders the covered device when the cover is bonded to the base. The resulting covered chip is adaptable for various chip mounting techniques, including flip chip mounting, side mounting combined with either Tape Automated Bonding (TAB) or conductive epoxy connections, or epoxy chip attachment with wire bonding connections. In one embodiment, conductive bumps are formed on the top surface of the insulative cover layer to accommodate flip chip mounting. In another embodiment, conductive traces are run across the top surface of the insulative layer to interconnect the vias to respective edge-positioned pads that are electrically interconnected by one of various techniques to pads on a wiring board.

Mullen, Frank E.; Robbins, William L.

Patent #5682167 Date Issued: October 28, 1997
Mesa antenna

The current invention provides an antenna including a relatively thin, substantially planar, electrically conductive first layer substantially lying in a first plane, and a relatively thin, substantially planar, electrically conductive second layer substantially lying in a second plane. The first and second layers are disposed such that the first and second planes are substantially parallel and such that they are separated by a distance d. The second layer is smaller than and overlies the first layer and defines a first region extending between the second layer and a portion of the first layer underlying the second layer. The antenna further includes a first dielectric medium having a relatively high dielectric constant and disposed in the first region, and a second dielectric medium having a relatively low dielectric constant and disposed in a second region extending between the first layer and portions of the second plane overlying the first layer and excluding the first region.

Trainor, Christopher V.; Cho, Steve T.; Hopkins, III, Ralph E.

Patent #5656785 Date Issued: August 12, 1997
Micromechanical contact load force sensor for sensing magnitude and distribution of loads and tool employing micromechanical contact load force sensor

A micromechanical contact load force sensor is disclosed. The force sensor comprises an array of capacitive load cells on a substrate. The force sensor is able to sense high loads, on the order on 109 N/m^2, and distribute the load over a suitable number of the cells of the array while minimizing crosstalk between adjacent cells. The force sensor is useful in biological and robotic applications.

Ward, Paul A.

Patent #5703292 Date Issued: December 30, 1997
Sensor having an off-frequency drive scheme and a sense bias generator utilizing tuned circuits

Electronics for use in Coriolis and other sensors for reducing errors in the sensor output signal is disclosed. The electronics includes an off-frequency drive scheme for reducing in-band drive signal coupling to the output signal and techniques for reducing errors in the sensor output signal due to quadrature and phase shift. The off-frequency drive scheme includes a frequency translation circuit in the excitation feedback loop of a sensor system to suppress components of the sensor drive signal at a predetermined frequency so that coupling of the drive signal to the sensor output signal can be readily removed by conventional filtering techniques. The sensor system includes a nonlinear input transducer for converting the drive signal to a force signal such that the force signal has a component at the predetermined frequency while the drive signal does not. A tuned circuit amplifies and filters the frequency-shifted output signal of the translation circuit to provide the drive signal. Also provided is a sense bias generator, including a tuned circuit for amplifying the available bias supply voltage to enhance sensitivity.

Ward, Paul A.

Patent #5600064 Date Issued: February 4, 1997
Electronics for Coriolis force and other sensors

Patent #5604309 Date Issued: February 18, 1997
Electronics for Coriolis force and other sensors

Patent #5608351 Date Issued: March 4, 1997
Electronics for Coriolis force and other sensors

Patent #5672949 Date Issued: September 30, 1997
Electronics for Coriolis force and other sensors

Electronics for use in Coriolis and other sensors for reducing errors in the sensor output signal is disclosed. An off-frequency drive scheme includes a frequency translation circuit in the excitation feedback loop of a sensor system to suppress components of the sensor drive signal at a predetermined frequency so that coupling of the drive signal to the sensor output signal can be readily removed by conventional filtering techniques. An amplifier circuit having a bandpass circuit in cascade with the forward loop gain is provided, with the bandpass circuit having a transfer function approximating one plus a bandpass characteristic, the passband of which corresponds to the information band. This arrangement increases the open-loop gain of the amplifier circuit around the information frequency without affecting the open-loop gain at DC and crossover so as to reduce phase and gain errors around the information frequency. A quadrature nulling system is provided for an in-plane micromechanical gyroscope. A signal having an in-phase component due to Coriolis induced out-of-plane motion and a quadrature component due to mechanical misalignments is mixed with a voltage in-phase with motor position. The mixer output is used to apply a DC potential to motor drive electrodes and is automatically adjusted by the integral compensator until the mixer output is zero, resulting in a nulled quadrature component.