photoresist structure. As will be seen, this second mask defines the track width dimension. With the second mask **34** in place, the lead material is deposited. As can be seen with reference to **FIG. 4**, since the second mask **34** is narrower, than the first mask **30**, the lead material can be deposited directly onto the sensor at side portions of the sensor extending inward from the inner edges of the hard bias material **22**. This step of forming the second mask **34** and forming the leads **24** is referred to in the industry as "K5". With the lead layer formed, the second mask layer **34** can be removed and a cap layer (not shown) can be deposited to protect the sensor from subsequent manufacturing process that will be familiar to those skilled in the art.

[**0011**] As will be appreciated from the above, the track width is defined by the second mask **34**.

[**0012**] However, as can be seen, this critical photolithographic step is performed on a surface having a severe topography rather than on planar surface as would be desired. This makes accurate photolithography difficult, and as a result makes accurate definition of the track width difficult. In addition, the thickness with which the leads can be deposited is limited, because depositing too much lead material would completely cover the resist structure **34** making it impossible to remove.

[**0013**] From the above it will be appreciated that there remains a need for a magnetic sensor design that provides for very accurate track width definition, while utilizing presently implemented manufacturing techniques. There also remains a need for a lead overlay design, and method of manufacture, that will minimize the effects of hard bias birds beaks.

SUMMARY OF THE INVENTION

[**0014**] The present invention provides a self aligned mangnetoresistive sensor having a well defined track width as well as an extremely symetrical cross section. The sensor of the present invention includes a layer of magnetoresistive sensor material having a central active region and end regions at opposite ends of the sensor. According to the present invention, the end regions have substantially equal lateral widths as viewed from the ABS. The end regions terminate at first and second portions of the sensor. First and second electrically conductive pads are formed on each of the end regions and terminate at the first and second sides. First and second hard bias layers are formed at the first and second sides of the sensor material, and first and second lead layers are formed over at least a portion of the first and second electrically conductive pads, and the first and second hard bias material.

[**0015**] The present invention can be formed by a method wherein, photoresist mask is deposited over a full film of sensor material, the mask being formed with openings to expose regions on the full film material intended to be the end regions of the sensor. An electrically conductive material such as Rh can then be deposited over the mask and sensor layer so as to be deposited on the exposed portions of the sensor material. This can be followed by deposition of a mill resistant material such as for example Ta.

[**0016**] This mask can then be lifted off leaving a full film of sensor material having a pair of electrically conductive lead tabs thereon having a space therebetween. A second photoresist mask is then formed so as to cover a portion of each of the lead tabs and the space therebetween. A Reactive Ion Etch (RIE) or other material removal process is then performed to remove sensor material not covered by the photoresist and the lead tabs. Advantageously, using the lead tabs as a mask to define the width of the sensor allows the sensor to be self aligned. This means that the resulting senor will be extremely symetrical.

[**0017**] Furthermore, the first photolithographic step defines the track width of the invention by defining the width between the laterally opposed lead tabs. Advantageously, this photolithographic step is performed on a planar surface and as such can be performed very accurately, allowing the sensor to be constructed with a smaller, more controllable trackwidth. Furthermore, the electrically conductive material deposited in conjunction with the first lithographic process can be deposited as a very thin layer. This allows a thinner mask to be used in the first photolithographic step, further facilitating narrower, more controllable track width definition.

[**0018**] After the second photolithographic procedures has defined the sides of the sensor, the sensor could be described as having a flat upper surface terminating at first and second edges with laterally opposed sensor sides extending downwardly from the edges. The sensor sides may be sloped at an angle. The electrically conducitive lead tabs formed on the flat upper surface terminate at the first and second edges The space between the lead tabs defines the active region or track width of the sensor, and may be described as the central, active region of the sensor.

[**0019**] Hard bias material layers may be formed to extend from and contact the side of the sensor, and may or may not slightly overlap the thin lead layers. It is an advantage of the present invention, the that the thin lead layers deposited onto the sensor prevent the hard bias material from contacting the flat upper surface of the sensor and thereby limit contact to only the sides of the sensor. Contact between the hard bias layers and the upper surface of the sensor (known in the art as a "birds beak") results in magnetic instability of the sensor, by interfering with the magnetic properties of the free layer of the sensor.

[**0020**] With the hard bias material deposited, another layer of electrical material may be deposited onto at least a portion of the first and second thin lead pads and onto at least a portion of the hard bias material. This second layer of lead material may be significantly thicker than the layer used to form the first and second pads, and is deposited by a photolithographic process resulting in lead portions that contact the electrically conductive pads and extend laterally outwardly from the sensor. It will be appreciated that the photolithographic process used to define the thicker, later applied lead material is much less critical than that of the first two lithographic processes which defined the track width and the sensor width. It is an advantage of the invention that this less critical photolithographic step is conducted on a non-planar surface, while the more critical track width defining photolithography is performed on a planar surface.

[**0021**] Another advantage of the present invention is that by using a thin layer of lead material, the track width defining inner edge of the thin lead pads can be formed with a well defined edge rather than a loosely defined tapered edge.