opposite direction of flux paths **87** and **86** passing through magnetic stripe **13**. Flux path **88** passes through magnetic stripe **15**.

[**0033**] Magnetic stripe **15** has flux paths **88** and **89** passing through it in opposite direction as a flux path **88** and **87** in magnetic stripe **14**. Flux path **89** also passes through magnetic stripe **20**.

[**0034**] Referring to **FIG. 5**, a magnetic field may be applied perpendicular to the longitudinal axis of the magnetic stripe such as perpendicular to axes **38** and **44** of magnetic stripes **12** and **13** shown on **FIG. 5**. An applied magnetic field H shown by arrow **95** perpendicular to the longitudinal axis will produce parallel alignment of the magnetization within magnetic stripes **12** and **13** when the demagnetization field of the magnetic stripe is overcome. The demagnetizing field B is shown in equation 1.

$$4\pi M=4\pi M_s h/(w+h) \quad (1)$$

[**0035**] In equation 1, h as shown in **FIG. 5** by arrow **93** is equal to the height of the magnetic stripe and W as shown in **FIG. 5** by arrow **94** is equal to the width of the magnetic stripe. The term M_s is the saturation magnetization. One advantage of applying a magnetic field H perpendicular to the longitudinal axis of the magnetic stripe is that the magnetic transition within the material is by rotation and therefore faster, more nearly linear, and free of hysteresis. The magnetic field B in a magnetic stripe such as magnetic stripe **12** shown on **FIG. 5** is given in equation 2 where H shown by arrow **95** is the applied field and 4 nM is a demagnetization field.

$$B=H+4\pi M \quad (2)$$

[**0036**] As shown in **FIG. 5**, for sufficiently small magnetic stripes with cross sections, less than 1000 square angstroms, domain walls will nucleate thermally. Then the magnetic response will not have a threshold, and hysteresis will be absent. In this regime, the permeable keepers **82** and **83** shown in **FIG. 4** will have less influence on the behavior of the magnetic stripes. Statistical correlation between positions of mutually attractive north (N) and south (S) magnetic domain walls will tend to preserve antiparallelism of neighboring magnetic stripe regions by way of magnetic flux paths in and between magnetic stripes **12** and **13** shown in **FIG. 5** by arrows **96** through **101**. Also, the magnetostatic coupling between magnetic stripes depends on the spacing between the magnetic stripes. The magnetic stripes will however be spaced to prevent exchange coupling.

[**0037**] Referring to **FIG. 6**, a magnetic array **110** of magnetic stripes **103** through **108** is shown spaced apart on surface **23** of substrate **22** which are generally parallel to one another. Magnetic stripes **103** through **108** may be spaced apart by a first distance shown by arrow **109**. Magnetic stripes **111** through **114** are shown spaced apart, generally parallel to one another and transverse to and over lapping magnetic stripes **103** to **108**. Magnetic stripes **111** through **114** may have a spacing from one another shown by arrow **115**. Non magnetic stripes **181** through **185** fill the space between magnetic stripes **103** and **108** to provide an electrical current path through magnetic stripes **103** through **108**. Crossed or over lapping magnetic stripes **111** through **114** function as permeable keepers as permeable keepers **82** and **83** in **FIG. 4**.

[**0038**] For optimal performance, a nonmagnetic electrically insulating spacer **116** must separate magnetoresistive stripes **103-108**, together with the intervening non-magnetic stripes **181-185**, from magnetic stripes **111-114** which function the same as keepers **82** and **83** in **FIG. 3**.

[**0039**] The magnetic stripes **103** through **108** have segments between intersections or cross stripes **111** through **114** to provide independent flux paths some as shown in **FIG. 4**. For example magnetic stripe segment **118** of magnetic stripe **104** has a flux path similar as shown for magnetic stripe **13** in **FIG. 4**. The magnetic flux shown by arrow **119** divides at cross magnetic stripe **111** with about one half of the magnetic flux going down shown by arrow **120** and one half of the magnetic flux going up shown by arrow **121**. The path of flux **120** follows magnetic stripe **105** and crossed magnetic stripe **112** shown by arrows **122** and **123**. The path of flux **121** is over magnetic stripe **103** and crossed magnetic stripe **112** shown by arrows **124** and **125**. The flux paths are formed by the magnetostatic coupling between cross magnetic stripes **111** and **112** to magnetic stripes **103** and **104** where they cross over. A magnetic field H may be applied in the plane of magnetic stripes **103** through **108** as shown by arrow **128** which will cause the magnetic field within magnetic stripes **103** through **108** to be aligned parallel and thus have lower resistance with respect to current passing through the array.

[**0040**] In one electrical arrangement for detecting the change in resistance across magnetic array **110** would be to have cross magnetic stripes **111** through **114** insulated from magnetic stripe **103** to **108** and to have conductive nonmagnetic material **181** through **185** between stripes **103** through **108** as shown in **FIG. 6**. The outside current could be applied by way of leads **131** and **132** across magnetic array **110**. When the magnetization in magnetic stripe **103** through **108** are aligned parallel, the magnetic array **110** will be in its low resistance state. When the magnetization is oppositely aligned from stripe segment to stripe segment as shown in **FIG. 6** by the arrows **119**, **122** and **124**, magnetic array **110** will be in the high resistance state.

[**0041**] **FIG. 7** shows a top view of magnetic device **136** for sensing a magnetic field. Device **136** consists of substrate **137** having a magnetic layer **138** formed thereover. Magnetic layer **138** has nonmagnetic regions **140** therein which may be formed by diffusing germanium or silicon into nickel, cobalt or alloys thereof which destroys the magnetic moment therein. Magnetic layer **138** is ferromagnetic. Arrows **143** through **146** show a flux path formed around nonmagnetic region **147**. The magnetic flux around nonmagnetic region **148** is shown by arrows **149** through **152**. Nonmagnetic regions may be sub-lithographic in dimension for example presently less than 350 nm. Nonmagnetic region **140** may be produced by bombarding a nickel-cobalt alloy layer having a film of germanium thereover with 100 KV Ge ions.

[**0042**] In operation of magnetic device **136** shown in **FIG. 7**, electrical current may be applied to magnetic layer **138** by way of leads **154** and **155**. When substantially no magnetic field H is applied, the magnetic flux paths around nonmagnetic region **140** will cause device **136** to be in the high resistance state. When a magnetic field H is applied to magnetic layer **138** as shown by arrow **157**, the applied magnetic field will cause the magnetization of magnetic layer **138** including magnetic flux paths around nonmagnetic region **140** to be aligned parallel with arrow **157**. Magnetic