"A MAGNETIC HEAD SLIDER AND A METHOD OF MANUFACTURING THE SAME"

THIS INVENTION relates to a magnetic head slider and a method of manufacturing the same and more particularly to a magnetic head slider incorporated in a slider assembly.

One of the aims of the disk drive industry is to achieve very high recording densities. To achieve this aim, the distance between a read/write transducer head and a recording medium, such as a magnetic disk, must be very small. Proximity recording and contact recording methods have been achieved which use new magnetic head slider assembly designs.

Because the recording medium, i.e. the disk, is rotating at a high speed during read/write operations, contact between the magnetic head slider and the disk results in wear of both the magnetic head slider and the disk. Such wear problems are accentuated when using magnetic head sliders of relatively large mass or when the magnetic head slider is biased toward the disk by a relatively high contact force. Thus, it is desirable to reduce the weight of the slider and/or reduce the contact force between the magnetic head slider and the disk surface.

Conventionally, magnetic heads are deposited on a slider body. When the disk is rotating, the surface of the slider body adjacent the disk creates an area of pressure underneath the slider body which is higher than the ambient pressure around the slider, thus causing a so-called air bearing. The air bearing maintains the slider at a substantially constant distance away from the disk surface, the flying height. The slider is suspended above the disk by a suspension unit which is spring loaded to bias the slider toward the disk surface. The flying height is determined by the point at which the lift force, or air bearing force, created by the air bearing

equals the opposite load force being applied by the spring loaded suspension unit. If the air bearing force is to be overcome to enable contact recording, then the friction force on the magnetic head slider between the magnetic head slider and the disk becomes high creating severe wear problems.

U.S. Patents 5,483,025 and 5,111,351 disclose integrated slider-suspension designs which supports contact recording. The designs allow the loading force applied to the magnetic slider head to be significantly reduced. However, the surface of a disk is not normally perfectly flat (see Figure 9 of the drawings accompanying this description) and there can be variations in the order of several microns between the height of the disk at a particular point and the plane of rotation of the disk. Thus, the contact force between the disk surface and the magnetic head slider will vary. In such cases, the wear rate of the disk at various points around the disk will be different, some areas of the disk becoming more worn, over time, than other areas.

Further, such integrated slider-suspension designs cannot take advantage of conventional slider-suspension designs and manufacturing processes since they are crafted in such an individual manner.

U.S. Patent 5,223,998 discloses a method to achieve contact recording with a magnetic head unit movable relative to a micro-suspension attached to slider body. However, the magnetic head body slides up and down in such a design so it is not easy to keep the positioning accuracy of the head relative to disk surface while still keeping the design robust enough for high track density contact recording. Furthermore, the contact force in such a design is higher than that in the above-mentioned integrated design.

U.S. Patent number 5,327,310 discloses a small read/write pad which generates a relatively small air bearing force compared to conventional magnetic head sliders. Thus, the loading force necessary to overcome the air bearing force is reduced. Using such a design, proximity recording can be achieved. However, the contact force between the read/write pad and the disk surface is relatively high and is also sensitive to manufacturing and assembly tolerances.

It is an object of the present invention to seek to provide a magnetic head slider assembly which does not suffer from the above-mentioned problems.

A further object of the present invention is to seek to provide a magnetic head slider which maintains a substantially constant and low contact force between the magnetic head slider and the disk surface.

Accordingly, one aspect of the present invention provides a slider for a magnetic head slider assembly for use with a disk drive assembly including a rotatable disk, the slider comprising: a slider body having means to generate, during rotation of the disk, an air bearing between the slider body and the rotatable disk, the air bearing holding the slider above the disk by a flying height; and a substantially resilient proximity or contact strip attached to and projecting from the slider body toward the disk, the strip comprising two or more layers of material, one said layer of material being contactable with respect to the other such that the strip is bent with respect to the slider body and terminates in a free end which has means for carrying a read/write transducer.

Another aspect of the present invention provides a slider for a magnetic head slider assembly for use with a disk drive assembly including a rotatable disk, the slider comprising: a slider body having means to generate, during rotation of the disk, an air bearing between the slider body and the rotatable disk, the air bearing

holding the slider above the disk by a flying height; and a substantially resilient proximity or contact strip attached at one end to project from the slider body toward the disk, the strip being straight along its entire length and terminating in a free end which has means for carrying a read/write transducer.

A further aspect of the present invention provides a method of manufacturing a slider comprising the steps of: providing a slider body having a pair of rails defining therebetween a bleed slot; depositing a temporary layer on a surface of the bleed slot to fill substantially the bleed slot; masking the temporary layer except for a portion thereof; removing the unmasked portion of the temporary layer to create a void; depositing a contact strip support material in the void; depositing a layer of a first contact strip material over at least a portion of the contact strip support material; depositing a layer of a second contact strip material over at least a portion of the first contact strip material; and removing the remainder of the temporary layer, the layers of the first and second contact strip materials defining a contact strip spaced apart from the bleed slot surface by the contact strip support material.

Another aspect of the present invention provides a method of manufacturing a contact strip for a slider comprising the steps of: depositing a first contact strip material on a substrate to create a first layer of a contact strip; and depositing a second contact strip material having a higher thermal coefficient of expansion than the first contact strip material over at least a part of the first layer to create a second layer of the contact strip, the second contact strip material being deposited at a higher temperature than the normal operating temperature of the slider such that, at the normal operating temperature, the second contact strip material is contracted with respect to the first contact strip material and thus the contact strip is bent away from the substrate.

A further aspect of the present invention provides a method of manufacturing a contact strip for a slider comprising the steps of: providing a substrate; depositing a temporary layer on a surface of the substrate; masking the temporary layer except for a portion thereof; removing the unmasked portion of the temporary layer to create a void; depositing a contact strip support material in the void; depositing a layer of a first contact strip material over at least a portion of the contact strip support material; depositing a layer of a second contact strip material over at least a portion of the first contact strip material; and removing the remainder of the temporary layer, the layers of the first and second contact strip materials defining a contact strip spaced apart from the substrate surface by the contact strip support material.

In order that the present invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a conventional disk drive system;

Figure 2 is a schematic perspective view of a magnetic head slider and suspension assembly;

Figure 3 is a schematic perspective view of a conventional magnetic head slider;

Figure 4 is a schematic perspective view of a magnetic head slider embodying the present invention;

Figures 5(a) to 5(i) are schematic side views of the manufacturing steps to produce a magnetic head slider embodying the present invention;

Figure 6 is a side view of the magnetic head slider of Figure 4 suspended on a suspension unit and in contact with a disk surface;

Figures 7(a), 7(b) and 7(c) are schematic side views of a trailing end of a magnetic head slider embodying the present invention;

Figure 8 is an enlarged view of the trailing end of a magnetic head slider embodying the present invention in which the size of the wear pad has been minimised;

Figure 9 is a schematic side view of a disk surface and a magnetic head slider shown in various positions along the disk surface;

Figure 10 is a side view of a magnetic head slider embodying the present invention;

Figure 11 is a further embodiment of a magnetic head slider embodying the present invention;

Figure 12 is a side view of yet another magnetic head slider embodying the present invention;

Figures 13, 14, 15(a) to 15(d) and 16 are views of sliders provided with a contact strip embodying the present invention;

Figures 17(a) and 17(b) are respective side views of a magnetic head slider before and after installation of a contact strip embodying the present invention; and

Figures 18(a) and 18(b) are respective side views of a magnetic head slider before and after installation of a different contact strip embodying the present invention.

Referring to Figure 1, a magnetic disk drive system 30 comprises a disk 1, or a plurality of disks, mounted on a common hub or spindle 2. The disks 1 are driven by a spindle motor (not shown). Typically, data is recorded on both sides of each disk by means of two opposite head-suspension assemblies.

A head-suspension assembly comprises a slider unit 3 held on a free end of a suspension unit 4 which is attached at the other end to and controlled by an electro-magnetic motor 5. The suspension unit 4 is operable to locate the slider unit 3 of the head-suspension assembly over a track on the disk surface. The slider unit 3 is pivotally mounted with respect to the suspension unit 4 so that it can pivot through a predetermined angular range.

Figure 2 is a more detailed view of a conventional slider-suspension assembly. The assembly comprises the suspension unit 4 being a downwardly depending arm formed of resilient material and terminating in a gimbal 8 to which the magnetic head slider 6 is pivotally attached. The gimbal 8 allows the magnetic head slider 6 to pitch but not to roll or yaw relative to the rotational movement of the disk surface.

Since the suspension unit 4 is resilient, the suspension unit 4 can be used to bias the magnetic slider head 6 toward the disk surface 1 and thereby

balance with or overcome any aerodynamic air bearing forces created between the magnetic head slider 6 and the disk surface 1 during rotation of the disk.

Figure 3 shows a conventional double rail slider 6. The slider 6 comprises a substantially rectangular block having two rails 10 raised proud of a main surface 11 of the slider 6. The raised rails 10 define therebetween a bleed slot 9. The rails 10 are each provided with a sloped ramp surface 12 at one end to promote the creation of an air bearing between the disk surface 1 and the slider 6. Magnetic transducer heads 13 are located in the rails 10. In operation, air is compressed under the two rails 10, which comprise air bearing surfaces, due to the high speed of relative motion between the slider 6 and the disk surface 1. The lift force created by the air bearing counteracts the load force of the suspension unit 4 making the slider 6 fly a small distance, the flying height (see Figure 6), above and clear of the disk surface 1.

Referring to Figure 4, a slider unit 3 embodying the present invention comprises a slider 6 of substantially conventional construction. The same reference numerals as used in Figure 3 refer to like components. However, the slider unit 3 embodying the present invention is provided with a transducer head 13 located at a free end 14 of a cantilevered strip 15 which is attached to the slider 6 by a raised boss 16. Advantageously, the cantilevered strip 15 is located in the bleed slot 9. Preferably, the cantilevered strip 15 is slightly flexed out of the bleed slot 9 such that the transducer head 13 is prouder than the rails 10. In fact, in use, the transducer head 13 is positioned out of the rails 10 by a distance which is slightly greater than the normal flying height of the slider 6 such that the transducer head 13 makes contact with the disk surface 1 whilst the slider 6 maintains a substantially constant distance away from the disk surface 1 because of the action of the air bearing.

Preferably, the cantilevered strip 15 is manufactured as a multi-layer structure which is designed so that the strip 15 bends away from the slider 6 at its free end 14. The amount of displacement of the transducer head 13 due to the bend in the cantilevered strip 15 out of the rails is greater than the flying height F of the slider and specifically the trailing edge of the slider 6 (see Figure 6). Thus, the transducer 13 is forced against the disk surface 1 and contact recording is thereby achieved.

The slider 6, the raised boss 16 and the cantilevered strip 15 are made using conventional masking and etching techniques. Figures 5(a) to 5(i) show the various steps involved in the manufacture of a magnetic head slider unit 3 embodying the present invention.

Referring to Figure 5(a), a conventional double rail slider 6 is provided. Referring to Figure 5(b), the bleed slot 9 of the slider 6 of Figure 5(a) is filled with a temporary layer 17 by a deposition process. The layer 17 is referred to as a temporary layer 17 because, at the end of the production process, this layer 17 will have been totally removed. The temporary layer 17 is masked except for a space in which the raised boss 16 is to be located in the bleed slot 9. The temporary layer 17 is then etched to remove the temporary layer at the desired location to create a void 18 for the raised boss 16 as shown in Figure 5(c).

Referring to Figure 5(d), a layer of material is then deposited within the void 18 vacated by the prior etching process to produce the raised boss 16 in the void 18. In this manner, the raised boss 16 is attached to the slider 6.

Referring to Figure 5(e), a layer 19 of a first contact strip material, the first layer, is then deposited on the temporary layer 17 and covers at least a part of the raised boss 16. The first layer 19 is thus attached to the raised boss 16. This

first layer 19 comprises a first laminate of the cantilevered strip 15. As shown in Figure 5(f), a layer 20 of a second contact strip material, the second layer, is deposited over the first layer 19. These two contact strip materials are selected so that the second material has a higher coefficient of thermal expansion than that of the first material. The second layer 20 is deposited at a higher temperature than the temperature at which the slider 3 is designed to operate.

As shown in Figure 5(g), a wear pad 21 is formed at the free end 14 of the cantilevered strip 15 on top of the end of the first layer 19. In this example, it should be noted that the second layer 20 is somewhat shorter than the first layer 19 so as to leave a space for the wear pad 21 to be deposited on the first layer 19 as shown in Figure 5(g). Alternatively, the wear pad 21 may be formed on top of the end of the second layer 20.

As shown in Figure 5(h), a protective layer 22 may be deposited at the end of the manufacturing process of the slider 3 embodying the present invention or after the attachment of a read/write transducer head 13 to the wear pad 21. The protective layer 22 would be of high hardness and wear resistance and would provide good protection to the slider and would cover the entire slider.

The temporary layer 17 is then fully etched away to leave the cantilevered strip 15, comprising the first and second layers 19,20, suspended over and separated from the bleed slot 9. As the cantilevered strip 15 cools down, owing to the different coefficients of thermal expansion of the contact strip materials, the second layer 20 contracts with respect to the first layer 19 causing the cantilevered strip 15 to bend out of the bleed slot 9 and project past the rails 10 as shown in Figure 5(i).

The distance D (see Figure 5(i)) by which the end 14 of the cantilevered strip 15 projects from the rails 10 can be controlled during the manufacturing process by determining the temperature at which the contact strip layers are deposited, the relative thickness of the two layers 19,20 and the length of the cantilevered strip 15. Thus, the distance D (or bending displacement D) and the load force applied thereby can be controlled in the manufacturing process.

To effect contact recording, the distance D must be equal to or greater than the flying height F.

It is, of course, possible to use more than two layers of strip material to achieve the desired bending displacement.

The amount of deflection at the end of the cantilevered strip 15 is given by:

$$D = \frac{3L}{2\delta} \cdot \Delta L = \frac{3}{2\delta} L^2 \cdot \Delta t \cdot \rho_{diff}$$

where L is the length of the cantilevered strip 15, d is the thickness of the cantilevered strip and ρ_{diff} is the difference between the thermal expansion coefficients of the materials making up the two contact strip layers 19,20, assuming equal thicknesses of each material are deposited at the same temperature. For example, if Poly-Si is chosen as the first layer material with Thermal Expansion Coefficient 0.55×10^{-6}/°C while SiO_2 as the second layer material with Thermal Expansion Coefficient 2.33×10^{-6}/°C, and the Poly-Si layer is produced at 600°C with N_2 carrier gas, whilst the SiO_2 layer is produced at 600°C with N_2 carrier gas, the deflection at the end with L=500μm and d=5μm will be 24.5μm.

The wear pad 21 provides two functions, that of a wear pad and that of a platform to receive a magnetic read/write transducer head 13. The pad 21 is

configured to have a minimal contact surface area. This is for two reasons: firstly to reduce the size of the wear area on the disk surface 1; and secondly to reduce the air bearing force generated by the pad 21 so that contact is continuously maintained between the pad 21 and the disk surface 1 at a minimum contact force.

It is possible to deposit the read/write transducer head 13 onto the cantilevered strip 15 either during the manufacturing process or afterwards.

As illustrated in Figure 6, the distance D by which the cantilevered strip projects from the rails 10 is equal to or greater than the trailing edge flying height F of the slider 6 when the slider 6 is flying over the disk surface 1. Thus, the free end 14 of the cantilevered strip 15 carrying the read/write transducer head 13 is forced against the disk surface 1. The cantilevered strip 15 is less rigid than the conventional gimbal 8 and suspension unit 4 which supports the slider 6. Thus, the amount by which the cantilever strip 15 is bent during use is mainly determined by the flying height of the slider 7 which is about 25nm to 100nm (1μin to 4μin). The cantilevered strip 15 has a length in the region of 0.3mm to 1.5mm.

Referring to Figure 7, the read/write transducer head 13 itself can be formed in a number of positions to the free end 14 of the cantilevered strip 15. Examples of such positions are shown in Figures 7(a), 7(b) and 7(c). In Figure 7(a), the transducer head 13 is bonded to the free end 14 of the cantilevered strip 15 adjacent the wear pad 21. In Figure 7(b), the transducer head 13 is L-shaped, a portion thereof resting on a top surface of the cantilevered strip 15, another portion extending downwardly to a position adjacent the wear pad 21. In Figure 7(c), the transducer head 13 is bonded directly onto the wear pad 21.

The size of the wear pad 21 is minimised so as to minimise the surface area of the wear pad 21. The air bearing force created by the wear pad 21 is

proportional to the surface area of the wear pad 21. Thus, a minimal air bearing force opposing the contact force being applied by the cantilevered strip 15 is generated by the wear pad 21. As shown in Figure 8, conventional masking and etching techniques can be used to shape the wear pad 21.

Similarly, the surface area of the transducer head 13 is also minimised both to reduce the air bearing force generated thereby and to reduce the size of the contact area with the disk surface.

In use, the conventional air bearing surfaces comprising the rails 10 of the slider 6 generate a lifting force and the trailing edge flying height F of the slider 6 is within the region of 20-100nm and varies by approximately $\pm$20% therefrom. This enables the slider 6 to follow the contours of the disk surface 1 at a substantially constant distance as the disk surface 1 rotates. Since the slider 6 maintains a certain flying height with small variation from the disk surface 1, the force applied by the cantilevered strip 15 pressing the transducer head 13 against the disk surface 1 can be very small compared with the forces applied on the slider assemblies of US Patents 5,483,025 and 5,111,351. The force applied by the cantilevered strip 15 is also substantially smaller than the force exerted by the suspension unit 4 to counter the air bearing force generated by the slider 6.

As illustrated in Figure 10, the thin design of the cantilevered strip 15 means that movement in the Z axis normal to the plane of the disk 1 is possible and is resisted only by the resilience of the strip 15 in this direction. However, substantial movement of the strip 15 in the X and Y axes is not possible, the strip being relatively stiff in these directions. In Figure 11, the strip has been reinforced with a number of transverse ribs 22 which serve to reduce or eliminate any roll motion or torsional twisting of the cantilevered strip 15 which can be caused during track seeking operations of the disk drive.

It is envisaged, as shown in Figure 12, that the cantilevered strip 15 may extend from the back of the bleed slot 9 past the trailing end of the slider 6. In such an embodiment, it is not necessary to build in as much bend in the cantilevered strip 15 since the slider 6 is, in any event, angled with respect to the disk surface 1 by the pitch of the flying slider 6.

For convenience of manufacturing, another method of producing a slide embodying the present invention is to deposit the cantilevered strip 15 on another substrate, i.e. not the slider 6, and then to attach the pre-produced cantilevered strip 15 on a conventional slider. Such an embodiment is shown in Figure 13. The pre-produced and bent cantilevered strip 15 is attached to the bleed slot surface of the conventional slider with the help of a hole 31 in the bleed slot 9 of the slider 6. The ratio value of x/X_0 is from 10% to 90% and the cantilevered strip can extend past the trailing edge of the slider 6 when x is less than y, or not when x is greater than y, where: x is the distance from the route of the cantilevered strip 15 at the raised boss 16 to the trailing edge of the slider 6; y is the length of the cantilevered strip 15; and X_0 is the length of the slider 6.

In another embodiment shown in Figure 14, a slot extends along the middle of the bleed slot 9 parallel to the rails 10. The pre-produced bent cantilevered strip 15 is attached to the bottom of the slot in the slider 6. Also, the ratio value of x/X_0 is from 10% to 90%, and the cantilevered strip 15 can extend past the trailing edge of the slider 6 when x is less than y, or not when x is greater than y.

In a further embodiment shown in Figure 15, the pre-produced cantilevered strip 15 is attached to the trailing edge of a conventional slider. The bottom surface 20 of the cantilevered strip 15 can be at the same surface level as

the bleed slot (as shown in Figure 15(b)) or the rails (as shown in Figure 15(c)) or between both (as shown in Figure 15(a)). In Figures 15(a) and (b), the cantilevered strip 15 should be appropriately bent to maintain a suitable free end contact force whilst the cantilevered strip shown in Figure 15(c) can be strictly flat so that the free end of the cantilevered strip 15 touches the disk with an appropriate contact force because of the pitch of the flying slider. The advantage of these embodiments shown in Figures 15(a), (b), (c) and (d) is that the attachment of the cantilevered strip 15 to the conventional slider does not alter the conventional sliders air bearing surface or bleed slot surface.

In another embodiment shown in Figure 16, a groove 32 is formed along the middle of the bleed slot 9 of the slider 6, parallel to the rails 10. The groove 32 extends along the entire length of the slider 6, but has two portions, each of a different depth. A rearward groove portion 33 extends from the trailing end of the slider 6 and terminates at a position slightly behind the leading end of the slider 6 substantially above the sloped ramp surfaces 12. A forward groove portion 34 then continues from the end of rearward groove portion 33 to the leading end of the slider 6. Rearward groove portion 33 has a depth greater than that of forward groove portion 34 such that the groove is formed with a step 35 at the leading end of the slider 6. The step 35 serves to secure a pre-produced cantilevered strip 15 to the slider 6 in much the same way as boss 16 in previously described embodiments.

In a further embodiment shown in Figures 17a and 17b, a shallow groove 36 is formed along the middle of the bleed slot of the slider 6, parallel to the rails 10. The shallow groove 36 extends for a small distance from the leading end of the slider 6 to a position slightly behind the leading end of the slider 6 and vertically above the sloped ramp surfaces 12, where it terminates with a deeper recess 37. As shown in Figure 17b this arrangement allows the use of a substantially straight cantilevered strip 15 constructed from only one type of

material. Angle setting means 38 are provided which are adapted to support and secure the cantilevered strip 15 to the slider 6 at an angle thereto such that the cantilevered strip 15 is angled downwardly and the free end 14 projects out of the bleed slot 9 past the rails 10. The angle setting means 38 may take the form of a plug sized to fit within the recess 37 and having a lower surface angled with respect to the bleed slot 9. The plug may be adhesively or otherwise secured within the recess and then a cantilevered strip 15 may be secured to the angled lower surface. Alternatively, the cantilevered strip 15 may have a projection, sized to be a relatively loose fit within the recess 37, formed at a position slightly behind its leading end corresponding to the relative position of the recess 37 with respect to the leading end of the slider 6. The projection may thus be inserted within the recess 37, the projection being a loose fit within the recess 37, and the cantilevered strip 15 angled downwardly, thereby rotating the projection slightly within the recess 37. The projection may then be secured within recess 37 by the use of a suitable adhesive. The shallow groove 36 accommodates the other end length of the cantilevered strip 15 in front of the plug or projection.

Another embodiment illustrated in Figures 18a and 18b utilises the same slider structure as the embodiment of Figures 17a and 17b. However, in this embodiment, the cantilevered strip is again of a multi-layer structure designed to introduce a bend into the cantilevered strip. However, in this embodiment, the layers of contact strip material 19,20 are reversed such that the top layer 20 contracts with respect to the bottom layer 19, thereby causing the cantilevered strip 15 to bend inwards towards the bleed slot 9. Such an arrangement results in the cantilevered strip 15 applying a smaller contact force towards the disk. An air bearing may thus form beneath the wear pad 21 maintaining a substantially constant distance between the wear pad 21 and hence the transducer head 13 from the disk 1. Careful design of the wear pad 21 therefore enables this embodiment to be used as a proximity slider.

It is to be appreciated that whilst the invention has been described with reference to various specific embodiments, various modifications could be effected to any of these embodiments without departing from the scope of the invention. For example, instead of using a cantilevered strip manufactured as a multi-layer structure, each layer having a substantially different coefficient of thermal expansion, or using a substantially straight cantilever strip 15 constructed from only one material, it is possible to use a cantilevered strip 15 of a multi-layer construction made from piezoelectric materials, for example, zinc oxide (ZnO). The contraction and expansion of piezoelectric materials in response to electric signals, and vice versa, make it possible to provide an active cantilevered strip 15 in the sense that the cantilevered strip 15 may sense and react to variations in bending displacement or forces applied to the cantilevered strip. For instance, some layers of the piezoelectric material may be arranged so as to sense the bending displacement due to collision between the free end 14 of the cantilevered strip 15 and the disk surface and produce an electric field which, in turn, may act upon further layers of piezoelectric materials so as to produce mechanical deformation of the material and hence produce a bending force in the cantilever strip 15. Likewise, the free end 14 can be urged into constant contact with the disk surface by bending movements caused by piezoelectric forces.

CLAIMS:

1. A slider for a magnetic head slider assembly for use with a disk drive assembly including a rotatable disk, the slider comprising: a slider body having means to generate, during rotation of the disk, an air bearing between the slider body and the rotatable disk, the air bearing holding the slider above the disk by a flying height; and a substantially resilient proximity or contact strip attached to and projecting from the slider body toward the disk, the strip comprising two or more layers of material, one said layer of material being contractable with respect to the other such that the strip is bent with respect to the slider body and terminates in a free end which has means for carrying a read/write transducer.

2. A slider according to Claim 1, wherein said layers of material comprising the strip have different thermal coefficients of expansion such that one layer of material is contracted with respect to the other.

3. A slider according to Claim 1, wherein one of said layers of material comprising the strip comprises a piezoelectic material, said piezoelectric material layer being contractable or expandable with respect to the or each other layer.

4. A slider according to Claim 1, 2 or 3 wherein, at the point of attachment to the slider body, the strip is substantially parallel with an adjacent surface of the slider body.

5. A slider according to any preceding claim, wherein the strip is attached to the slider body by a raised boss.

6. A slider according to Claim 4 or 5, wherein the strip, between the point of attachment to the slider body and the free end, is bent away from the slider body such that strip projects from the slider body.

7. A slider for a magentic head slider assembly for use with a disk drive assembly including a rotatable disk, the slider comprising: a slider body having means to generate, during rotation of the disk, an air bearing between the slider body and the rotatable disk, the air bearing holding the slider above the disk by a flying height; and angle setting means adapted to support a substantially resilient proximity or contact strip attached at one end to project from the slider body toward the disk, the strip being straight along its entire length and terminating in a free end which has means for carrying a read/write transducer.

8. A slider according to Claim 7, wherein the strip, between the point of attachment to the slider body and the free end, is bent towards the slider body.

9. A slider according to Claim 7 or 8, wherein the angle setting means comprises a plug securable to the slider body, the plug having an angled surface to which the strip is secured.

10. A slider according to Claim 9, wherein the plug is received within a recess formed in the slider body.

11. A slider according to Claim 7 or 8, wherein the angle setting means comprises a projection at the end of the strip attached to the slider body, said projection being received within a corresponding recess formed in the slider body.

12. A slider according to Claim 11, wherein said projection is a loose fit within said recess enabling the strip to be angled with respect to the slider body.

13. A slider according to any one of Claims 10 to 12, wherein the plug or projection is adhesively secured within the recess.

14. A slider according to any one of Claims 10 to 13, wherein said projection or plug is offset slightly behind the extreme end of the strip attached to the slider body, and a groove is provided adjacent and in front of said recess to receive said end of the strip attached to the slider.

15. A slider according to any preceding claim, wherein the means for carrying a read/write transducer comprises a wear pad.

16. A slider according to any preceding claim, wherein the strip comprises a contact strip and the slider body has a rail surface, the contact strip projecting from the slider body toward the disk from the rail surface by a distance equal to or greater than the flying height of the slider.

17. A slider according to Claim 16, wherein the distance by which the free end of the strip projects from the slider body toward the disk is in the region of 100nm or greater.

18. A slider according to any preceding claim, wherein the strip is elongate.

19. A slider according to Claim 18, wherein the strip is formed with one or more transverse strips to provide torsional strength to the strip.

20. A slider according to any preceding claim, wherein the air bearing generation means comprises a pair of substantially parallel elongate rails which

define a bleed slot therebetween, the strip being located in the bleed slot, the rails defining the depth of the bleed slot and the width of the bleed slot.

21. A slider according to Claim 20, wherein the strip occupies between 5% to 95% of the maximum width of the bleed slot.

22. A slider according to Claim 20 or 21, wherein the strip has a thickness of between 5% to 200% of the maximum depth of the bleed slot.

23. A slider according to any one of Claims 1 to 19, wherein the air bearing generation means comprises a design which does not incorporate parallel double rails.

24. A slider according to any preceding claim, wherein the slider body has a leading edge and a trailing edge with respect to the rotation of the disk, the strip extending from the slider body beyond the trailing edge of the slider body.

25. A magnetic slider head assembly comprising a slider according to any preceding claim in combination with a gimbal supported by a suspension unit, the slider being hingedly mounted on the gimbal.

26. A disk drive system comprising the magnetic slider head assembly of Claim 25.

27. A method of manufacturing a slider comprising the steps of: providing a slider body having a pair of rails defining therebetween a bleed slot; depositing a temporary layer on a surface of the bleed slot to fill substantially the bleed slot; masking the temporary layer except for a portion thereof; removing the unmasked portion of the temporary layer to create a void; depositing a contact strip support

material in the void; depositing a layer of a first contact strip material over at least a portion of the contact strip support material; depositing a layer of a second contact strip material over at least a portion of the first contact strip material; and removing the remainder of the temporary layer, the layers of the first and second contact strip materials defining a contact strip spaced apart from the bleed slot surface by the contact strip support material.

28. A method according to Claim 27, wherein the second strip material has a higher thermal coefficient of expansion than the first strip material and the second strip material is deposited at a higher temperature than the normal operating temperature of the slider such that, at the normal operating temperature, the second strip material is contracted with respect to the first strip material and thus the strip is bent away from the bleed slot surface.

29. A method according to Claim 27, wherein one of said contact strip materials is a piezoelectric material which is contractable or expandable with respect to the other contact strip material.

30. A method of manufacturing a contact strip for a slider comprising the steps of: providing a substrate; depositing a temporary layer on a surface of the substrate; masking the temporary layer except for a portion thereof; removing the unmasked portion of the temporary layer to create a void; depositing a contact strip support material in the void; depositing a layer of a first contact strip material over at least a portion of the contact strip support material; depositing a layer of a second contact strip material over at least a portion of the first contact strip material; and removing the remainder of the temporary layer, the layers of the first and second contact strip materials defining a contact strip spaced apart from the substrate surface by the contact strip support material.

31. A method of manufacturing a slider comprising the steps of providing a slider body having a pair of rails defining therebetween a bleed slot; and attaching a proximity or contact strip in the bleed slot of the slider body.

32. A method according to Claim 31, wherein the strip is attached to a slot extending along the bleed slot parallel to the rails.

33. A method according to Claim 31, wherein the strip support material is located in a hole formed in the bleed slot.

34. A method according to any one of Claims 31 to 33, wherein the strip is attached to the trailing edge of the slider body.

35. A method according to Claim 31, wherein the strip is attached to a step formed in a groove extending along the bleed slot parallel to the rails.

36. A method of manufacturing a contact strip for a slider comprising the steps of: depositing a first contact strip material on a substrate to create a first layer of a contact strip; and depositing a second contact strip material having a higher thermal coefficient of expansion than the first contact strip material over at least a part of the first layer to create a second layer of the contact strip, the second contact strip material being deposited at a higher temperature than the normal operating temperature of the slider such that, at the normal operating temperature, the second contact strip material is contracted with respect to the first contact strip material and thus the contact strip is bent away from the substrate.

37. A method according to Claim 36, wherein the substrate is a part of a slider body.