Description

This invention relates to a magnetic head slider for a magnetic recording apparatus, and more particularly to a magnetic head slider which develops an air bearing to maintain a close spacing between the magnetic head and a recording surface of the apparatus.

Magnetic head sliders that fly relative to magnetisable media have been used extensively. These sliders provide a non-contact transducing relationship between a magnetic transducer and a magnetisable recording medium, such as a rotating magnetisable disk, so that a stable constant spacing can be maintained between the transducer and the disk. In magnetic recording technology it is continually desired to improve the areal density at which information can be recorded and reliably read. This desire has led to a trend toward greater bit density along a recording track and a shrinking track width. The greater bit density requires increasingly narrow transducing gaps, so it becomes more difficult to achieve the low flying height constant to the degree required to reliably record and read data at the higher data rates.

Three rail sliders are known such as the three rail taper flat slider shown in commonly assigned US-A- 3,823,416 in which all three rails have uniform widths over their length and each of the rails has a tapered section at the leading end of the slider. The magnetic transducer is formed by a core aligned with the centre rail at the trailing end of the slider.

US-A- 4,555,739 describes a three rail slider in which all three rails are connected by a cross-rail at the leading end of the slider and the cross-rail has a leading tapered section. A recessed area is provided back of the cross-rail which extends to the trailing end of the slider. Each of the three rails has a width which is less at the trailing end of the slider than at the cross-rail, and the transducer is formed at the trailing end of the middle rail.

Japanese Kokai No. 54-8514 discloses a three rail slider in which all three rails have uniform width over their length. The two side rails are at an angle θ to the longitudinal centre line of the slider, in which the angle θ is about 15 degrees. The transducer is mounted near the end of the centre rail.

Japanese Kokai No. 61-170922 discloses a three rail slider in which all three rails have uniform width over their length. Each of the rails has a tapered section at both the leading and the trailing ends of the slider. A small step is provided in the tapered section of all three of the rails near the trailing end to reduce the dust deposited at the trailing end of the slider.

Two rail tapered flat sliders have been used more recently, and a recent example according to the preamble of claim 1 is shown in US-A-4,734,803 (EP-A-0237 752). This slider has two side rails which are wider at the leading end of the slider and extend to the trailing end of the slider where the magnetic transducer is mounted. A tapered section is provided at the leading end of the slider, and the area between the side rails is open from the leading to the trailing ends of the slider.

The anonymous publication No. 25946 shown in RESEARCH DISCLOSURE, November, 1985, Number 259 discloses a magnetic head slider which has side rails connected by a front rail at the leading end to form a recessed section which produces a negative pressure. The side rails do not extend all the way to the trailing end of the slider and the magnetic transducer is mounted on an island at the center of the trailing end of the slider.

The above described sliders were designed and optimized for magnetisable disk file recording apparatus which used large disks and in which the transducers were also larger. For disk files using smaller disks it is desirable to reduce the slider size to permit more data capacity of each disk by increasing the data band. None of the prior art references addresses the problems encountered in the design of a smaller slider.

The principal object of the invention is to provide magnetic recording apparatus including a magnetic head air bearing slider which produces a pressure profile which causes the slider to fly at a chosen flying height and at a desired pitch angle with respect to a moving magnetisable medium in a reduced size format.

According to the present invention a magnetic recording apparatus comprises a movable magnetisable recording medium having a recording surface, a magnetic transducer and an air bearing slider supporting the transducer, head arm means for supporting the air bearing slider with the magnetic transducer closely adjacent to the recording surface of the magnetisable recording medium, and accessing means for moving the head arm means relative to the recording surface of the magnetisable recording medium, the air bearing slider having leading and trailing ends and an air bearing surface.

The slider also comprises side rails disposed along the sides of the air bearing surface, the side rails being substantially coplanar and extending from the leading end of the slider towards the trailing end of the slider, and the side rails each having a tapered section formed on the air bearing surface at the leading end, and each having a maximum width measured normal to the leading end to trailing end dimension of the slider which does not substantially exceed the width of the side rails at the leading end of the slider.

The apparatus is characterised in that each of the side rail extends only part way to the trailing end of the slider and in that the slider further comprises a centre rail disposed along the central region of the air bearing surface, the centre rail being spaced from the side rails by recessed sections which extend from the leading end to the trailing end of the slider, the centre rail having a tapered section at the leading end, and a width measured normal to the leading end to trailing end dimension of the slider which is smallest at the leading end and which is greatest at the trailing end of the slider, whereby the rails and the recessed sections produce a combined pressure profile when the slider is positioned adjacent to the moving magnetisable recording medium so that the slider assumes an orientation having a predetermined pitch angle and a predetermined spacing with respect to the moving magnetisable recording medium in which the minimum spacing between the slider and the magnetisable medium occurs at the trailing end of the slider.

In order that the invention may be more readily understood an embodiment will now be described with reference to the accompanying drawings in which:

Fig. 1 is a schematic perspective view of a magnetisable disk storage system,

Fig. 2 is a bottom plan view of an air bearing slider embodying the present invention,

Fig. 3 is a bottom plan view of an alternative embodiment of an air bearing slider embodying the present invention,

Fig. 4 is a bottom plan view of a further embodiment of an air bearing slider embodying the present invention,

Fig. 5 is a view of the trailing end of the slider illustrated in Fig. 2, and

Fig. 6 is a side elevation view of the sliders illustrated in Figs. 2, 3 and 4.

With reference to Fig. 1, a magnetic disk storage system comprises a magnetic head arm 17, and at least one magnetic head suspension assembly is attached to head arm 17. In the embodiment shown, one magnetic head suspension assembly 13 is attached to the top of the head arm and another magnetic head suspension assembly 13 is attached to the bottom of the head arm 17. Each suspension assembly supports at its end a head slider 10, and each head slider 10 has one or more magnetic transducer means, generally called magnetic heads, disposed so that the transducing gap may be in transducing relation with the surfaces of magnetisable disks 21, only one of which is shown in the drawing. Electrical signals can be conducted from the magnetic heads to a computer host system for use in the host system. Head arm 17 is attached to a conventional actuator 19 such as a voice coil motor, for example, for accessing the magnetic heads to various tracks on the magnetisable disk 21.

The slider 10 is preferably a small slider since reduction of the slider size has many advantages such as cost, greater volumetric efficiency and performance. However, as the slider size is reduced, the flying height tolerances resulting from the manufacturing tolerances increase. The most significant contributions to the increase in flying height tolerances are from the pitch and roll parameters. For example, when the width of the slider is reduced by one half, the contribution from the roll sensitive parameters to the flying height approximately doubles, and, when the length of the slider is reduced by one half, the contribution from the pitch sensitive parameters to the flying height increases by approximately five times. It is the goal of the small slider design to reduce the size of the slider to approximately one half the presently used size in both the length and width directions. There is described below a design that produces superior performance in terms of maintaining a predetermined flying height tolerance in a small slider format.

With reference to the Figures of the drawing, the air bearing surface (ABS) of the magnetic head slider 10 is formed with two side rails 12 and 14 and a centre rail 16. The inner sides of the side rails 12 and 14 and the sides of the centre rail 16 border on recessed sections 18 that are formed by etching, ion milling, or other machining techniques, for example. The recessed sections 18 extend from the leading end 20 of the slider to the trailing end 22 of the slider. A magnetic transducer 24, preferably of the thin film type, is bonded at the trailing end of the centre rail 16 with its transducing gap flush with the rail surface. Both side rails 12 and 14 and the centre rail 16 all have tapered height sections 11 at their leading ends.

The side rails 12 and 14 do not extend all the way to the trailing end of the slider. The ratio of the length of the side rails to the length of the slider is less than 0.9 and preferably within the range of 0.5 to 0.8. In the embodiments shown in Figs. 2 and 3 the side rails are narrower at their trailing ends than at their leading ends. In the embodiment shown in Fig. 4, the side rails are of a uniform width over their length. Other shapes of the side rails may also be suitable so long as they maintain a relatively high pressure at the leading end 20 of the slider and a relatively low pressure in the middle area of the slider.

In the embodiment shown in Fig. 2, each of the side rails includes a wide section 26, 28 at the leading end 20 of the slider having substantially parallel sides and a flared section 30, 32. Each flared section 30, 32 extends to a break point from

which it is followed by a narrow section 34, 36 having substantially parallel sides and a width that is less than the width of side section 26, 28. Each narrow section 34, 36 extends to the trailing end of the side rail.

The embodiment shown in Fig. 3 has side rails 12 and 14 each of which has a straight taper extending along the full length of the side rail with the side rail being widest at the leading end 20 of the slider and narrowest at the trailing end of the side rail 12, 14.

Centre rail 16 in each of the above arrangements comprises a tapered section 11 at the leading end 20 of the slider and a width which is small at the leading end and increases progressively toward the trailing end 22 of the slider. Should any contaminants be present in the air bearing adjacent to the ABS 15 of slider 10, the shape of the centre rail causes the contaminants to be directed along recesses 18 so that they are moved away from the transducer 24 at the trailing end of the centre rail 16.

The configuration of the slider which is shown in the drawings and described above has different pressure zones. The pressure zones are formed when the ABS 15 of the slider is positioned adjacent to a magnetisable recording surface 38 of magnetic disk 21 (Fig. 6) moving in the direction of arrow 40 to provide load forces on the slider assembly that are balanced in such a manner that the desired flying characteristics for the slider can be achieved. The pressure components are combined so that the slider 10 flies at a desired pitch angle θ relative to the moving magnetisable disk surface 38 with an attitude by which the trailing end of slider 10, where the transducer is mounted, is closest to the disk surface and assured to be spaced at a flying height distance d from the magnetic recording medium 38.

The design approach to reduce the contribution to flying height tolerance from the pitch and roll sensitive parameters is accomplished, in the described embodiments, by having a larger load carried by the centre rail at the trailing end, which is also the minimum spacing location with respect to the disk because of the shorter side rails, in balanced equilibrium with the large load carried by the side rails near the leading end of the slider. The pressure from the side rails is high at the leading end of the slider due to the taper sections 11 and the greater width at the leading end of the slider. The pressure from the side rails is progressively decreased and ceases to exist prior to reaching the trailing end of the slider. The centre rail 16 generates very little pressure at the leading end 20 of the slider, but the pressure from the centre rail 16 progressively increases and is highest near the trailing end 22 of the slider.

The resulting combined pressure profile has high pressure near the leading end 20 of the slider 10, a relatively low pressure in the middle of the slider, and a relatively high pressure near the trailing end 22 of the slider. This design approach ensures that the minimum spacing between the slider and the disk, on which recording performance and head/disk interface reliability depend, is very insensitive to roll parameters, thus slider width can be significantly reduced. Furthermore, the high air bearing pressure at the centre rail trailing end and the side rail leading ends ensures sufficiently high air bearing pitch and vertical stiffness, so that the length can also be significantly reduced. This design approach has-made possible the design of sliders with lengths significantly smaller than was otherwise possible.

Claims

1. A magnetic recording apparatus comprising:

a movable magnetisable recording medium (21) having a recording surface,

a magnetic transducer (24) and an air bearing slider (10) supporting said transducer,

head arm means (17) for supporting said air bearing slider with said magnetic transducer closely adjacent to the recording surface of said magnetisable recording medium, and

accessing means (19) for moving said head arm means relative to the recording surface of said magnetisable recording medium,

said air bearing slider having leading and trailing ends, an air bearing surface and side rails (12,14) disposed along the sides of said air bearing surface, said side rails being substantially coplanar and extending from the leading end of said slider towards the trailing end of said slider, and said side rails each having a tapered section (11) formed on the air bearing surface at said leading end, and each having a maximum width measured normal to the leading end to trailing end dimension of said slider which does not exceed the width of said side rails at said leading end of said slider,

characterised in that

each of said side rails (12,14) extends only part way to the trailing end of said slider,

and in that

said slider further comprises a centre rail (16) disposed along the central region of said air bearing surface, said centre rail being spaced from said side rails by recessed sections (18) which extend from said leading end to said trailing end of said slider, said centre rail having a tapered section at said leading end, and a width measured normal to the lead-

which it is followed by a narrow section 34, 36 having substantially parallel sides and a width that is less than the width of side section 26, 28. Each narrow section 34, 36 extends to the trailing end of the side rail.

The embodiment shown in Fig. 3 has side rails 12 and 14 each of which has a straight taper extending along the full length of the side rail with the side rail being widest at the leading end 20 of the slider and narrowest at the trailing end of the side rail 12, 14.

Centre rail 16 in each of the above arrangements comprises a tapered section 11 at the leading end 20 of the slider and a width which is small at the leading end and increases progressively toward the trailing end 22 of the slider. Should any contaminants be present in the air bearing adjacent to the ABS 15 of slider 10, the shape of the centre rail causes the contaminants to be directed along recesses 18 so that they are moved away from the transducer 24 at the trailing end of the centre rail 16.

The configuration of the slider which is shown in the drawings and described above has different pressure zones. The pressure zones are formed when the ABS 15 of the slider is positioned adjacent to a magnetisable recording surface 38 of magnetic disk 21 (Fig. 6) moving in the direction of arrow 40 to provide load forces on the slider assembly that are balanced in such a manner that the desired flying characteristics for the slider can be achieved. The pressure components are combined so that the slider 10 flies at a desired pitch angle θ relative to the moving magnetisable disk surface 38 with an attitude by which the trailing end of slider 10, where the transducer is mounted, is closest to the disk surface and assured to be spaced at a flying height distance d from the magnetic recording medium 38.

The design approach to reduce the contribution to flying height tolerance from the pitch and roll sensitive parameters is accomplished, in the described embodiments, by having a larger load carried by the centre rail at the trailing end, which is also the minimum spacing location with respect to the disk because of the shorter side rails, in balanced equilibrium with the large load carried by the side rails near the leading end of the slider. The pressure from the side rails is high at the leading end of the slider due to the taper sections 11 and the greater width at the leading end of the slider. The pressure from the side rails is progressively decreased and ceases to exist prior to reaching the trailing end of the slider. The centre rail 16 generates very little pressure at the leading end 20 of the slider, but the pressure from the centre rail 16 progressively increases and is highest near the trailing end 22 of the slider.

The resulting combined pressure profile has high pressure near the leading end 20 of the slider 10, a relatively low pressure in the middle of the slider, and a relatively high pressure near the trailing end 22 of the slider. This design approach ensures that the minimum spacing between the slider and the disk, on which recording performance and head/disk interface reliability depend, is very insensitive to roll parameters, thus slider width can be significantly reduced. Furthermore, the high air bearing pressure at the centre rail trailing end and the side rail leading ends ensures sufficiently high air bearing pitch and vertical stiffness, so that the length can also be significantly reduced. This design approach has-made possible the design of sliders with lengths significantly smaller than was otherwise possible.

Claims

1. A magnetic recording apparatus comprising:

a movable magnetisable recording medium (21) having a recording surface,

a magnetic transducer (24) and an air bearing slider (10) supporting said transducer,

head arm means (17) for supporting said air bearing slider with said magnetic transducer closely adjacent to the recording surface of said magnetisable recording medium, and

accessing means (19) for moving said head arm means relative to the recording surface of said magnetisable recording medium,

said air bearing slider having leading and trailing ends, an air bearing surface and side rails (12,14) disposed along the sides of said air bearing surface, said side rails being substantially coplanar and extending from the leading end of said slider towards the trailing end of said slider, and said side rails each having a tapered section (11) formed on the air bearing surface at said leading end, and each having a maximum width measured normal to the leading end to trailing end dimension of said slider which does not exceed the width of said side rails at said leading end of said slider,

characterised in that

each of said side rails (12,14) extends only part way to the trailing end of said slider,

and in that

said slider further comprises a centre rail (16) disposed along the central region of said air bearing surface, said centre rail being spaced from said side rails by recessed sections (18) which extend from said leading end to said trailing end of said slider, said centre rail having a tapered section at said leading end, and a width measured normal to the lead-

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ing end to trailing end dimension of said slider which is smallest at said leading end and which is greatest at said trailing end of said slider,

whereby said rails (12,14,16) and said recessed sections (18) produce a combined pressure profile when said slider (10) is positioned adjacent said moving magnetisable recording medium (21), so that said slider assumes an orientation having a predetermined pitch angle and a predetermined spacing with respect to said moving magnetisable medium in which the minimum spacing between said slider and said magnetic medium occurs at the trailing end of said slider.

2. Apparatus as claimed in claim 1 characterised in that the ratio of the length of each side rails to the length of said slider is less than 0.9.

3. Apparatus as claimed in either of the preceding claims characterised in that the ratio of the length of each side rails to the length of said slider is within the range of 0.5 to 0.8.

4. Apparatus as claimed in any one of the preceding claims characterised in that each side rail comprises a first part (26,28) having a first predetermined width, as measured normal to the leading end to trailing end dimension of said slider, at said leading end of said side rail structure and a width that decreases to a second part (34,36) having a second predetermined width at a break point, said break point being located between said leading end and said trailing end of said side rail, wherein said width of said side rail does not exceed said second predetermined width between said break point and said trailing end of said side rail.

5. Apparatus as claimed in Claim 4 characterised in that the parts of said side rail having said first and said second predetermined widths are connected by a flared section (30,32).

6. Apparatus as claimed in Claim 5 characterised in that said parts of said side rail having said first and said second predetermined widths (26,28; 34,36) have sides that are substantially parallel.

Patentansprüche

1. Ein magnetisches Aufzeichnungsgerät, folgendes aufweisend:
ein bewegliches magnetisierfähiges Aufzeichnungsmedium (21) mit einer Aufzeichnungsfläche,
einen magnetischen Wandler (24) und einen luftkissengelagerten Gleitkörper (10), auf dem dieser Wandler ruht,
Kopfarm-Mittel (17) zum Abstützen des genannten luftkissengelagerten Gleitkörpers mit dem genannten magnetischen Wandler in knappem Abstand zu der Aufzeichnungsfläche des genannten magnetisierfähigen Aufzeichnungsmediums und
Zugriffsmittel (19), um das genannte Kopfarm-Mittel in bezug zu der Aufzeichnungsfläche des genannten magnetisierfähigen Aufzeichnungsmittels zu bewegen,
wobei der genannte luftkissengelagerte Gleitkörper vordere und hintere Enden aufweist, eine Luftkissenfläche und Seitenschienen (12, 14), die entlang der Seiten der genannten Luftkissenfläche angeordnet sind, wobei die genannten Seitenschienen im wesentlichen koplanar sind und vom vorderen Ende des genannten Gleitkörpers zum hinteren Ende des genannten Gleitkörpers verlaufen, und die genannten Seitenschienen jeweils einen konischen Abschnitt (11) aufweisen, der auf der Luftkissenflache am genannten vorderen Ende gebildet wird, und jede Schiene eine maximale Breite aufweist, gemessen senkrecht zum Maß zwischen dem vorderen und dem hinteren Ende des genannten Gleitkörpers, welche die Breite der genannten Seitenschienen am genannten vorderen Ende des genannten Gleitkörpers nicht überschreitet,
dadurch gekennzeichnet, daß
jede der genannten Seitenschienen (12, 14) nicht ganz bis an das hintere Ende des genannten Gleitkörpers heranreicht,
sowie dadurch, daß
der genannte Gleitkörper desweiteren eine Mittelschiene (16) umfaßt, die entlang dem mittleren Bereich der genannten Luftkissenflache angeordnet ist, wobei die genannte Mittelschiene von den genannten Seitenschienen durch Vertiefungen (18) getrennt ist, die vom genannten vorderen Ende zum genannten hinteren Ende des genannten Gleitkörpers verlaufen, wobei die genannte Mittelschiene einen konischen Abschnitt am genannten vorderen Ende aufweist, und eine Breite, gemessen senkrecht zum Maß zwischen vorderem Ende und hinterem Ende des genannten Gleitkörpers, welche am genannten vorderen Ende am kleinsten und am genannten hinteren Ende des genannten Gleitkörpers am größten ist,
wodurch die genannten Schienen (12, 14, 16) und die genannten Vertiefungen (18) ein kombiniertes Druckprofil erzeugen, wenn der genannte Gleitkörper (10) über dem genannten

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beweglichen magnetisierfähigen Aufzeichnungsmedium (21) positioniert wird, so daß der genannte Gleitkörper eine Ausrichtung mit einem vorbestimmten Teilungswinkel und einem vorbestimmten Abstand zu dem genannten beweglichen magnetisierfähigen Medium einnimmt, bei der der geringste Abstand zwischen dem genannten Gleitkörper und dem genannten magnetischen Medium am hinteren Ende des genannten Gleitkörpers auftritt.

2. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß das Verhältnis der Länge jeder Seitenschiene zur Länge des genannten Gleitkörpers unter 0,9 liegt.

3. Gerät nach jedem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das Verhältnis der Länge jeder Seitenschiene zur Länge des genannten Gleitkörpers im Bereich 0,5 bis 0,8 liegt.

4. Gerät nach jedem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß jede Seitenschiene einen ersten Teil (26, 28) mit einer ersten vorbestimmten Breite, gemessen senkrecht zum Maß zwischen dem vorderen Ende und dem hinteren Ende des genannten Gleitkörpers, am genannten vorderen Ende der genannten Seitenschienen-Konstruktion umfaßt, und eine Breite, die zu einem zweiten Teil (34, 36) hin abnimmt, mit einer zweiten vorbestimmten Breite an einem Knickpunkt, wobei der genannte Knickpunkt zwischen dem genannten vorderen Ende und dem genannten hinteren Ende der genannten Seitenschiene liegt, wobei die genannte Breite der genannten Seitenschiene die genannte zweite vorbestimmte Breite zwischen dem genannten Knickpunkt und dem genannten hinteren Ende der genannten Seitenschiene nicht überschreitet.

5. Gerät nach Anspruch 4, dadurch gekennzeichnet, daß die Teile der genannten Seitenschiene mit der genannten ersten und der genannten zweiten vorbestimmten Breite durch einen sich verjüngenden Abschnitt (30, 32) verbunden sind.

6. Gerät nach Anspruch 5, dadurch gekennzeichnet, daß die genannten Teile der genannten Seitenschiene mit der genannten ersten und der genannten zweiten vorbestimmten Breite (26, 28; 34, 36) Seiten aufweisen, die im wesentlichen parallel verlaufen.

Revendications

1. Un appareil d'enregistrement magnétique comprenant:
   - un support d'enregistrement magnétisable mobile (21) comportant une surface d'enregistrement,
   - un transducteur magnétique (24) et un coulisseau sur coussin d'air (10) portant ledit transducteur,
   - un bras porte têtes (17) portant le coulisseau à coussin d'air avec ledit transducteur magnétique adjacent et très proche de la surface d'enregistrement dudit support d'enregistrement magnétisable, et
   - un moyen d'accès (19) pour déplacer ledit bras porte têtes par rapport à la surface d'enregistrement dudit support d'enregistrement magnétisable,

   ledit coulisseau sur coussin d'air comportant des bords d'attaque et de fuite, une surface de portée pneumatique et des rails latéraux (12, 24) disposés le long des cotés de ladite surface de portée pneumatique, lesdits rails latéraux partant du bord d'attaque dudit coulisseau et étant pratiquement disposés dans le même plan que ce dernier et orientés vers le bord de fuite dudit coulisseau, et lesdits rails latéraux présentant chacun une partie amincie (11) formée sur la surface de portée pneumatique audit bord d'attaque, et présentant chacun une largeur maximale mesurée normalement à la dimension du bord d'attaque au bord de fuite dudit coulisseau, qui n'excède pas la largeur desdits rails latéraux audit bord d'attaque dudit coulisseau,

   caractérisé en ce que:
   - chacun desdits rails latéraux (12, 14) ne s étend qu'en partie jusqu'au bord de fuite dudit coulisseau,

     et en ce que:
   - ledit coulisseau comprend en outre un rail central (16) disposé le long de la région centrale de ladite surface de palier pneumatique, ledit rail central étant séparé desdits rails latéraux par les parties évidées (18) qui s'étendent dudit bord d'attaque audit bord de fuite dudit coulisseau, ledit rail central comportant une partie amincie audit bord d'attaque, et une largeur mesurée normalement à la dimension du bord d'attaque au bord de fuite dudit coulisseau qui est plus petite audit bord d'attaque et qui est plus grande audit bord de fuite dudit coulisseau,

   ce qui fait que lesdits rails (12, 14, 16) et lesdites parties évidées (18) produisent un profil de pression combinée lorsque ledit coulis-

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seau (10) est positionné adjacent audit support d'enregistrement magnétisable mobile (21), si bien que ledit coulisseau prend une orientation avec un angle de pas prédéterminé et un espacement prédéterminé par rapport audit support magnétisable mobile dans lequel l'espacement minimal entre ledit coulisseau et ledit support magnétique apparaît au bord de fuite dudit coulisseau.

2. Appareil selon la revendication 1 caractérisé en ce que le rapport entre la longueur de chaque rail latéral et la longueur dudit coulisseau est inférieur à 0,9.

3. Appareil selon l'une ou l'autre des revendications précédentes caractérisé en ce que le rapport entre la longueur de chaque rail latéral et la longueur dudit coulisseau est compris entre 0,5 et 0,8.

4. Appareil selon l'une quelconque des revendications précédentes caractérisé en ce que chaque rail latéral comprend une première partie (26, 28) ayant une première largeur prédéterminée mesurée normalement à la dimension du bord d'attaque au bord de fuite dudit coulisseau, audit bord d'attaque de ladite structure de rail latéral et une largeur qui diminue à une seconde partie (34, 36) ayant une seconde largeur prédéterminée à un point de flambage, ledit point de flambage étant situé entre ledit bord d'attaque et ledit bord de fuite dudit rail latéral, dans lequel ladite largeur dudit rail latéral n'excède pas ladite seconde largeur prédéterminée entre ledit point de rupture et ledit bord de fuite dudit rail latéral.

5. Appareil selon la revendication 4 caractérisé en ce que les parties dudit rail latéral ayant lesdites première et seconde largeurs prédéterminées, sont connectées par une partie évasée (30, 32).

6. Appareil selon la revendication 5 caractérisé en ce que lesdites parties dudit rail latéral ayant lesdites première et seconde largeurs prédéterminées (26, 28; 34, 36) ont des côtés qui sont pratiquement parallèles.