STABILIZER BLOCK FOR A DISC DRIVE UNIT

The invention relates generally to a disc drive unit to transfer information between a disc and a reading and/or writing head for recording and/or reproducing information and, more specifically to establishing stability of relationship between a flexible disc and a reading and/or writing head during recording and/or reproducing information on the disc.

Patent specification US-A 4,600,955 and Patent specification US-A-4,620,250 disclose so-called "contacting" type information transfer technology for recording and/or reproducing information on a flexible magnetic disc. Both of these specifications propose employment of a head-to-disc stabilizing unit stably to establish head-to-disc contact. In the proposed technology, a flexible disc is rotatably housed within a disc cartridge in such a manner that successive radial portions of the disc move over an opening formed through the disc cartridge. The opening of the disc cartridge is disposed to provide limited radial access to the disc. The head-to-disc stabilizing unit seals the opening to cause formation of a Bernoulli drawing force to form the successive radial positions of the disc as each portion is rated over the opening. Such a drawing force momentarily deflects each portion of the rotating disc toward the opening, causing a deflected portion of the disc to remain substantially in contact with a magnetic recording or reproducing head movable along the opening and thus ensuring stability of head-to-disc contact.

In order to exert the drawing force, vacuum pressure is generated around the head. The disc is forced toward the head to establish firm contact with the head so as to enable steady transfer of information between the head and the disc. Such an arrangement to establish head-to-disc contact can be successful in ensuring head-to-disc contact. However, the magnitude of vacuum pressure generated varies around the head. Thus, fluctuation of the vacuum pressure is caused by tolerance of surface flatness of a stabilizer block which determines sealing ability. The sealing ability may be influenced not only by surface flatness of the stabilizer block but also by waving of the flexible disc during rotation. Due to such fluctuation of magnitude of vacuum

generated around the magnetic head, the contacting force between the head and the disc can fluctuate and cause variations in information transfer performance.

According to the invention there is provided a stabilizer block for a contact-type disc drive unit, in which information to be recorded and/or reproduced is transferred between a storage medium disc and a reading and/or writing head being held in contact with each other, the stabilizer block comprising:

a stabilizer block body defining a head receptacle opening in which the reading and/or writing head is secured;

a contact surface incorporated in the stabilizer block body and oriented at one end of the stabilizer block body, to define a contact area for establishing contact with the flexible storage medium disc; and

at least one void formed in said one end of the stabilizer block body and surrounding the reading and/or writing head to define a vacuum chamber in cooperation with the flexible storage medium disc to generate a Bernoulli drawing force to draw the flexible storage medium disc so as to establish steady head-to-disc contact when the flexible storage medium disc is rotatingly driven, the void including a radially extending groove having its outer end exposed to ambient air to establish communications between the inside of the void and the outside thereof and the radially extending groove having a bottom wall declining toward its outer end.

Thus the disc drive unit can incorporate means to control vacuum pressure generated around the head to establish head-to-disc contact with a contact force to achieve stability of head-to-disc contact and constant performance of information transfer between the head and the disc.

The disc stabilizer block thus has a surface sealingly to contact a mating surface of the disc. The at least one void formed on the disc stabilizer block defines a chamber around the reading and/or writing head, in which a Bernoulli drawing force is generated to draw the flexible storage medium disc theretowards. The void reduces the contact area between the stabilizer block and the disc to avoid influence of tolerance in production of the stabilizer block and influence of waving of the disc during rotation.

According to another aspect of the invention, there is provided a disc drive unit to transfer information between a flexible storage medium disc and a reading and/or writing head, comprising:

a disc drive means rotatingly to drive the flexible storage medium disc;

a carriage means to carry the reading and/or writing head in the radial direction of the flexible storage medium disc to access recording tracks;

a stabilizer block supporting the reading and/or writing head and mounted on the carriage means to be radially shifted therewith, the stabilizer block including means to define a limited area of contact surface to make contact with the flexible storage medium disc, and a chamber having a surface oriented away from the mating surface of the flexible storage medium disc to generate a drawing force therein to draw the flexible storage medium disc onto the reading and/or writing head when the flexible storage medium disc is rotatingly driven for steady transfer of information between the flexible storage medium disc and the reading and/or writing head, the chamber being exposed to ambient air through a radially extending groove and the radially extending groove having a bottom wall declining toward its outer end.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:-

Figure 1 is a fragmentary illustration of a preferred embodiment of a disc drive unit according to the invention;

Figure 2 is a fragmentary illustration of a head carriage employed in the disc drive unit of Figure 1;

Figure 3 is a plan view of a first embodiment of an assembly of a recording and/or writing head and a disc stabilizer block employed in the preferred embodiment of the disc drive unit according to the invention;

Figure 4 is a section taken on line IV - IV of Figure 3;

Figure 5 is a plan view of a second embodiment of an assembly of a recording and/or writing head and a disc stabilizer block, according to the invention;

Figure 6 is a section taken on line VI - VI of Figure 5;

Figure 7 is a plan view of a third embodiment of an assembly of a recording and/or writing head and a disc stabilizer block, according

to the invention;

Figure 8 is a section taken on line VIII - VIII of Figure 7;

Figures 9 and 10 are enlarged sections of the circumferential edge portion of a stabilizer block showing effects obtained by two respective embodiments of radially extending groove therein;

Figure 11 is a section of a fourth embodiment of an assembly of a recording and/or writing head and a disc stabilizer block employed in the preferred embodiment of the disc drive unit according to the invention; and

Figure 12 is a section of a fifth embodiment of an assembly of a recording and/or writing head and a disc stabilizer block employed in the preferred embodiment of the disc drive unit according to the invention.

Referring to the drawings, and firstly to Figures 1 and 2, a disc drive unit 4 is specifically designed to be employed in an electronic still camera which records and/or reproduces video and/or audio signals on a flexible magnetic disc A as an information storage medium. As is known in the art, a magnetic disc used in an electronic camera is formed with a predetermined number of circumferentially and coaxially extending recording tracks. Each recording track can record one field of a video signal or a predetermined period of an audio signal. In the known art, the audio signal is recorded on the relevant recording track in time-axis compressed fashion. As will be appreciated, the disc A may be housed within a cartridge casing to form a disc cartridge. The disc cartridge is formed with a disc access opening P, through which the magnetic disc A can be accessed while it is rotatingly driven on a turntable 7 associated with a spindle motor. The disc access opening P extends radially over the recording tracks formed on the disc A.

A magnetic head assembly includes a magnetic head 2 and a stabilizer block 1 supporting the head. The magnetic head assembly is mounted on a movable carriage 5. As can be seen in Figure 2, the carriage 5 is formed into an L-shaped configuration having a radially extending section extending in parallel to the shifting direction of the head assembly and a transversely extending section extending transversely to the radially extending section. The radially extending section of the carriage 5 slidably engages a guide rail 8a mounted on an upper chassis 6a. The end of the transverse section remote from the

radially extending section engages a guide-rail 8b mounted on the upper chassis 6a. The guide rails 8a and 8b extend in radial directions and in parallel relationship to each other. Therefore, the carriage 5 can slidingly shift along the guide rails 8a and 8b to place the head assembly at the desired radial position for accessing a desired recording track on the disc A.

The carriage 5 is associated with a driving mechanism which can radially shift it along the guide rails 8a and 8b. The driving mechanism is mounted on a lower chassis 6b and comprises an electric motor 9 which has a driving shaft driving a relatively small diameter gear 9a. The small diameter gear 9a engages a larger diameter gear 10. The larger diameter gear 10 is thus driven by the driving torque transmitted through the small diameter gear 9a. The larger diameter gear 10 carries a cam member 10a for rotation therewith. The cam member 10a engages with a generally pin-shaped cam follower 5a which extends from the carriage 5. The driving mechanism thus constructed drives the carriage 5 with the head assembly over the recording tracks on the disc A so that the magnetic head 2 can access the appropriate recording track via the disc access opening P of the cartridge casing.

Figures 3 and 4 shows a first embodiment of a head assembly comprising the magnetic head 2 and the stabilizer block 1. The stabilizer block 1 is formed into a generally disc-shaped configuration and made of a metallic material. The disc-shaped stabilizer block 1 is bonded onto the carriage 5 by adhesive 3 at one axial end. As can be seen in Figure 3, the magnetic head 2 is oriented at the centre of the stabilizer block 1 and extends slightly beyond the other axial end of the stabilizer block 1. The stabilizer block 1 is formed with an essentially rectangular head receptacle opening 1b at the centre thereof. The magnetic head 2 is received within the head receptacle opening 1b and secured therein by means of adhesive 3. The axial end of the stabilizer block 1 from which the magnetic head 2 extends, mates with the flexible disc A, which axial end will be hereafter referred to as the "disc mating end". The disc mating end of the stabilizer block 1 has circumferentially extending and mutually coaxial annular projections 1a' and 1a". The inner annular projection 1a" has a substantially flat surface to mate with the flexible magnetic disc A and defines a recess 1c" surrounding the head 2. The outer annular

projection 1a' also has a substantially flat surface to mate with the disc A. The surfaces of the inner and outer annular projections 1a" and 1a' are axially oriented on a common plane. An annular groove 1c' is also defined between the inner and outer annular projections 1a" and 1a'. The recess 1c" and the groove 1c' serves to define vacuum chambers to generate vacuum pressure therein while the disc A is rotatingly driven at high speed.

It should be appreciated that, in the practical projection of the head assembly, the recess 1c" and the groove 1c' may be formed by spot facing.

The width and depth of the recess 1c" and the groove 1c' are experimentarily determined so as appropriately to adjust vacuum pressure as a Bernoulli pull down force to be exerted on the flexible magnetic disc A. In the embodiment shown, the depth of the recess 1c" and the groove 1c' is preferably in the range 50μm to 20μm.

During information recording or reproducing operation, the flexible magnetic disc A is driven to rotate with the turntable 7 by means of the spindle motor. By high speed rotation of the disc, air flow is generated to cause vacuum pressure in the recess 1c" and the groove 1c' which define enclosed and sealed chambers in cooperation with the disc A which contacts the surfaces of the inner and outer annular projections 1a" and 1a'. By the vacuum pressure generated in the recess 1c" and the groove 1c', the flexible magnetic disc A is drawn toward the stabilizer block 1 so as to establish firm contact with the magnetic head 2 for steady transfer of information therebetween.

At this time, since the areas to generate the vacuum pressure are specified by the presence of the recess 1c" and the groove 1c' and the stabilizer block 1 has no contact surface to contact the disc in the vicinity of the magnetic head, the magnitude of vacuum pressure as the drawing force substantially corresponds to the rotational speed of the disc irrespective of waving of the disc or so forth which otherwise might cause fluctuation of the magnitude of vacuum pressure to be generated. Stability of the vacuum pressure to be generated in the recess 1c" and the groove 1c' makes it possible to establish head-to-disc contact with contact force.

Furthermore, because the surface of the stabilizer block to

contact the flexible magnetic disc is substantially limited due to the presence of the recess 1c" and the groove 1c', the requirement for accuracy of surfacing can be lowered to make production of the stabilizer block easier. This helps to lower the production cost.

Figures 5 and 6 show a second embodiment of head assembly wherein a single circular recess 1c is formed by a circumferentially extending annular projection 1a. The annular projection 1a extends along the circumferential edge of the stabilizer block 1 to define the recess 1c inside thereof and surrounding the head 2. A radially extending groove 1d is formed through the annular projection 1a to establish communication between the recess 1c and ambient air. The radially extending groove 1d is oriented at the downstream side relative to the rotating direction of the flexible magnetic disc as indicated by arrow R.

Figures 7 and 8 show a third embodiment of a head assembly having generally the same construction as that of the first embodiment set forth above, except for radially extending grooves 1d" and 1d'. The radially extending grooves 1d" and 1d' serve to establish communication between the recess 1c", the groove 1c' and ambient air.

In the second and third embodiments set forth above, vacuum pressure is generated in the recesses 1c and 1c" and the groove 1c' in the same manner as set out with respect to the first embodiment when the disc is driven to rotate at high speed. Since the radially extending grooves 1d, 1d" and 1d' are formed at the downstream side relative to the rotational direction of the disc, the presence of these radially extending grooves will not affect generation of vacuum pressure. On the other hand, the radially extending grooves 1d, 1d" and 1d' serve to introduce ambient air to reduce the pressure difference and raise pressure in the recess and the groove so as quickly to release the drawing force exerted on the flexible magnetic disc when the rotational speed of the disc is decelerated to a standstill. Quick release of the drawing force upon stopping of the disc is advantageous to reduce load on the motor 9 which radially shifts the head assembly and on the spindle motor to start rotation of the disc.

In the second and third embodiments described above, the circumferential edge portion of the radially extending grooves 1d and

1d' can be narrowed at the end exposed to ambient air by inclination of the bottom wall 1e as shown in Figure 9. In such case, air flow from the inside of the recess 1c to ambient air is generated to raise the pressure at the narrowed end and possibly to generate dynamic pressure. This clearly reduces the magnitude of vacuum pressure to reduce drawing force to draw the flexible magnetic disc A onto the contact surface of the annular projection or projections. This may cause releasing of the disc from the contacting surface of the annular projections as shown by a dotted line in Figure 9 and clearly makes the head-to-disc contact unstable.

In view of this, improvement of the configuration of the radially extending groove 1d and 1d' is effected as shown in Figure 10. As can be seen from Figure 10, the bottom 1f of the radially extending groove 1d declines towards the circumferential edge of the stabilizer block 1. This provides a wider air flow path area at the radially outer end of the radially extending groove 1d than that at the radially inner end thereof and increases vacuum pressure to be generated at the radially outer end portion of the radially extending groove 1d when the disc is driven to rotate. Greater vacuum generated in the radially outer end portion of the radially extending groove 1d ensures drawing of the flexible magnetic disc A onto the contact surface of the annular projection. Therefore, with this improvement, further stable head-to-disc contact can be established.

Figures 11 and 12 respectively show fourth and fifth embodiments as respective modifications of the second and third embodiments of the head assembly as described above. As can be seen, both of the fourth and fifth embodiments of Figures 11 and 12 employ the radially extending groove 1d and 1d' as illustrated in Figure 10. Therefore, these embodiments will provide higher stability of head-to-disc contact for further stable information transfer operation between the head and disc.

While the invention has been disclosed in terms of preferred embodiments in order to facilitate better understanding, it should be appreciated that the invention can be embodied in various other ways.

For example, although the shown embodiment is specifically directed to electronic still camera technology, the technology herewith disclosed may be applicable to any of contact type data transfer

technology between a flexible storage medium disc and a reading and/or writing head. Furthermore, although a specific construction for the disc drive unit including the head shifting mechanism has been disclosed in terms of the preferred embodiments, the construction of the head shifting mechanism per se is not essential to the invention and can be replaced with any appropriate constructions. For example, the construction of the head shifting mechanism described in the aforementioned Patents specification US-A-4,600,955 may be employed to implement the invention.



CLAIMS

1. A stabilizer block for a contact-type disc drive unit, in which information to be recorded and/or reproduced is transferred between a storage medium disc and a reading and/or writing head being held in contact with each other, the stabilizer block comprising:

a stabilizer block body defining a head receptacle opening in which the reading and/or writing head is secured;

a contact surface incorporated in the stabilizer block body and oriented at one end of the stabilizer block body, to define a contact area for establishing contact with the flexible storage medium disc; and

at least one void formed in said one end of the stabilizer block body and surrounding the reading and/or writing head to define a vacuum chamber in cooperation with the flexible storage medium disc to generate a Bernoulli drawing force to draw the flexible storage medium disc so as to establish steady head-to-disc contact when the flexible storage medium disc is rotatingly driven, the void including a radially extending groove having its outer end exposed to ambient air to establish communications between the inside of the void and the outside thereof and the radially extending groove having a bottom wall declining toward its outer end.

2. A stabilizer block structure according to claim 1, wherein the void is defined by a bottomed recess formed around the reading and/or writing head.

3. A stabilizer block structure according to claim 1, wherein the void is defined by a bottomed recess formed around the reading and/or writing head and a bottomed annular groove formed around the recess.

4. A stabilizer block structure according to claim 1, wherein the void is provided of a predetermined depth in the range 50μm to 20μm.

5. A stabilizer block structure according to claim 3, wherein the depth of the recess and of the annular groove is in the range 50μm to 20μm.

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6. A disc drive unit to transfer information between a flexible storage medium disc and a reading and/or writing head, comprising:

a disc drive means rotatingly to drive the flexible storage medium disc;

a carriage means to carry the reading and/or writing head in the radial direction of the flexible storage medium disc to access recording tracks;

a stabilizer block supporting the reading and/or writing head and mounted on the carriage means to be radially shifted therewith, the stabilizer block including means to define a limited area of contact surface to make contact with the flexible storage medium disc, and a chamber having a surface oriented away from the mating surface of the flexible storage medium disc to generate a drawing force therein to draw the flexible storage medium disc onto the reading and/or writing head when the flexible storage medium disc is rotatingly driven for steady transfer of information between the flexible storage medium disc and the reading and/or writing head, the chamber being exposed to ambient air through a radially extending groove and the radially extending groove having a bottom wall declining toward its outer end.

7. A disc drive unit according to claim 6, wherein the stabilizer block comprises:

a stabilizer block body defining a head receptacle opening in which the reading and/or writing head can be secured;

a generally annular contact surface incorporated in the stabilizer block body, extending in a circumferential direction and oriented at one end of the stabilizer block body to define the limited contact area to establish contact with the flexible storage medium disc; and

at least one void formed in said one end of the stabilizer block body to define the chamber, the chamber being designed so as to generate a Bernoulli drawing force to draw the flexible storage medium disc to establish steady head-to-disc contact when the flexible storage medium disc is rotatingly driven.

8. A disc drive unit according to claim 7, wherein the chamber is formed into a generally circular configuration centred at the reading

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and/or writing head.

9. A disc drive unit according to claim 8, wherein the chamber is separated into a first circular section oriented around the reading and/or writing head and a second annular section oriented around the first circular section and separated from the first circular section by an annular projection formed therebetween.

10. A disc drive unit according to claim 9, wherein the annular projection is provided with a surface mating with the flexible storage medium disc, which surface lies flush with the contacting surface.

11. A disc drive unit according to claim 7, wherein the chamber is provided of a predetermined depth in the range 50μm to 20μm.

12. A stabilizer block for a contact-type disc drive unit substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

13. A disc drive unit to transfer information between a flexible storage medium and a reading and/or writing head substantially as hereinbefore described and illustrated with reference to the accompanying drawings.