

Description

The present invention relates to disk files for information storage and particularly to the air filtration systems of such files.

At the very small separations currently employed between the transducing heads and disks of a disk file, which may be of the order of 0.5×10^{-6} m, it is essential to enclose at least the head/disk assembly (HDA) completely and to provide within the enclosure a filter for filtering particulate and other contamination. Failure to remove particles of sizes comparable to the head/disk separation can lead to head crashes and damage to the recording medium.

Some typical filtration systems for earlier magnetic disk files are described in US Patents 3 489 800, 3 710 357 and 4 054 931. In the systems shown in these patents, fan blades, assisted to some extent by the rotation of the disks, were employed to produce a pressure differential to circulate air through a filter within the enclosure.

A more recent development in the design of disk file filtration systems has been the concept of the internally vented hub. By venting the hub assembly on which a stack of disks is mounted and slotting the spacers between the disks, the pressure differential created between the low pressure hub region and the high pressure region at the outer periphery of the disks is maximised causing a circulatory airflow around and between the disks. The filter must be located within this circulatory airflow. In such systems, scavenging of particles from between the disks is particularly effective and the pressure differentials obtainable are such that additional fan blades are usually not needed.

One example of this latter type of system is shown in published European Patent Application No EP 0 169 352-A2. The disk file described in this application has a stack of disks separated by slotted spacers and mounted on a bell-shaped hub assembly. The disk stack rests on an outer flange of the hub assembly which includes a deeply dished spring clamp to hold the stack in place. This clamp has openings in it to permit communication between the inter-disk spaces and an axial region at one end of the hub assembly. The filter employed is a cartridge in the form of an annular plenum encircling the top of the hub assembly above the extreme disk of the stack. Air enters the filter through peripheral openings in the plenum. Within the plenum is a double layer of filter paper, the lower layer being annular and sealed around a central outlet hole located above and around the vented hub assembly. Air entering the plenum can only exit after passing through one or both of the filter papers from where it is drawn into the low pressure region of the hub assembly. However, the clearance gap between the filter outlet and the hub assembly constitutes a leakage path by which air can bypass the filter assembly.

In the prior art, as has been mentioned above, the pumping action causing the pressure differential to drive air through a filter is produced by rotation of a stack of disks, sometimes assisted by fan blades. A disk file having only a single disk yet no fan is shown in published International patent appli-

cation, International Publication No WO 80/02768. To achieve an adequate pumping action, a stationary 'control plate' is positioned over and close to the single disk. The plate has an annular gap around the disk hub. Rotation of the disk causes an outward pumping action in the region between the control plate and the disk. This draws air through the annular gap from an upper chamber above the control plate and pumps it outwardly. A return path to the upper chamber is provided via a filter in one corner of the enclosure.

As discussed above, the vented hub and slotted spacer techniques employed in a disk file having multiple disks enable efficient circulation of air around the critical areas of an enclosed HDA and through a filter without the use of a fan. However, as disk files decrease in physical size, the pressure differentials achievable decrease with disk diameter leading in some cases to inadequate airflow through the filter. Also with decreasing enclosure volume, the space available for the filter and thus the cross-sectional area of filter medium presented to the airflow becomes limited. A filter adjacent and roughly co-extensive with the outer surface of an extreme disk is probably the most attractive choice in terms of space and filter area. However, prior art systems have not maximised the flow of air through such filters by minimising or preventing leakage of air to the hub assembly thus bypassing the filter.

Accordingly, the present invention provides a disk file comprising a disk enclosure; a disk stack within the enclosure comprising a plurality of annular information storage disks, adjacent disks of which are separated by a radially vented spacer; a plurality of transducing heads co-operable with the disks for writing information on and/or reading information from the disks; a rotatable hub assembly for supporting the disk stack for rotation therewith, the hub assembly including vents by way of which and said vented spacer an axial region of the enclosure adjacent an extreme disk of the stack communicates with the space between adjacent disks whereby, in operation, the pumping action of the disks creates a high pressure region at the periphery of the disk stack and a low pressure region adjacent the hub assembly to cause a circulatory airflow around and between the disks via said hub assembly vents and the vented spacer; and a filter assembly fixedly mounted in said axial region and extending circumferentially around the hub assembly, the arrangement of the filter assembly being such that communication between the axial region of the enclosure and the hub assembly vents is substantially via the filter assembly except for a clearance gap between the filter assembly and hub assembly to permit free rotation of the latter, characterised in that:- the filter assembly has a major planar surface closest to the surface of the extreme disk and at a uniform separation therefrom, the separation between the planar surface of the filter assembly and the extreme disk surface being smaller than the separation between the disks by an amount sufficient at least to reduce inward leakage of air through the clearance gap and to increase airflow through the filter assembly.

It will be clear that the invention is not necessarily restricted to magnetic disk files having flying heads but could also be applicable in other types of disk file employing optical or electrostatic recording, for example.

Preferably, the separation is sufficiently small that the filter assembly and extreme disk form a centrifugal viscous pump opposing the pressure differential between the high and low pressure regions. Ideally, this compensating pumping action would create a pressure differential just sufficient to stop inward airflow through the clearance gap but theoretical considerations indicate that, although the inward airflow is reduced, it cannot be stopped or reversed. Even so, a surprising improvement in the airflow through the filter assembly results.

A centrifugal viscous pump is one in which a rotating member entrains a fluid by means of viscosity alone and throws it outwardly. To operate as a pump, a co-rotating or, in this case, fixed member must confine a layer of fluid near to the surface of the rotating member so that substantially all the fluid in the layer is in motion.

The preferred range of separations has been found to be less than 1.1 mm, with the airflow through the filter being inversely related to the separation. The preferred separation range is 0.35 to 0.6 mm. Smaller separations than these can be contemplated but it would be difficult to maintain tolerances in quantity production.

Although, ideally, the filter assembly and medium should extend right around the hub assembly for maximum effectiveness, this is not compatible with access of a transducing head to the outer surface of the extreme disk adjacent the filter. It is thus a preferred feature of the invention that the filter assembly comprises an arcuate portion extending around a major portion only of the hub assembly circumference at the uniform separation from the extreme disk. The ends of the arcuate portion define a gap around a minor portion of the hub assembly circumference sufficiently deep relative to said uniform separation to accommodate at least one of the transducing heads for co-operation with the outer surface of the extreme disk.

Another advantage of limiting the circumferential extent of the closely spaced portion of the filter assembly in this way to accommodate one or more heads, is that the axial height of the file can be further reduced. To reduce excessive leakage of air via such a gap to the hub assembly it is further preferred that the file includes a barrier extending circumferentially across the gap inward of the transducing head position.

Such a barrier is preferably formed as a lip on the filter assembly which extends towards the extreme disk. Clearly, other forms of barrier are possible and need not necessarily constitute part of the filter assembly at all.

It is preferred that the filter assembly is not only arcuate but is in the form of an annular shallow trough and includes a laminar filter medium of corresponding shape covering the trough. The trough is apertured at its inner diameter to communicate with the low pressure region adjacent the hub assembly.

An annular shape enables the filter to be substantially co-extensive with the disk surface and thereby maximise the viscous pumping action. The aperturing of the trough at its inner diameter ensures that the pressure differential across the filter is maximised in that this is the portion of the filter closest to the low pressure region around the hub assembly.

Where the disk file is of the type comprising a drive motor having a mounting plate in which a spindle is supported for rotation with the hub assembly being mounted on one end of the spindle, it is preferred that the filter assembly is mounted on the motor mounting plate adjacent the extreme disk of the stack. As an alternative, where the enclosure comprises a base casting, the filter assembly can be mounted on the base casting.

In both cases, the important feature is that a rigid mounting of the filter assembly is needed to maintain the relatively fine tolerance on the small separation between the filter assembly and the extreme disk of the stack.

In cases where the hub assembly is mounted on one end of a motor drive spindle, it is preferred that the hub assembly includes a flanged bell portion supporting the disk stack and that the hub assembly vents are slots through the bell portion communicating with the radial slots in the spacers of the disk stack.

In an alternative construction of disk file in which the hub assembly includes an internal drive motor with an external cylindrical rotor casing, flanged to support the disk stack, it is preferred that the hub assembly vents include cross grooves and flutes in the outer surface of the rotor casing which communicate with the radial slots in the spacers of the disk stack.

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a cross section through a disk file according to the present invention taken on the line II-II of Figure 2;

Figure 2 is a plan view of the disk file of Figure 1 with the disk stack and clamp removed to reveal the filter assembly;

Figure 3 is an enlarged and simplified cross section through a portion of the disk file of Figure 1 including the filter assembly;

Figure 4 is a cross sectional detail of a breather filter portion of the filter assembly;

Figure 5 is a graph showing the relationship between airflow through the filter assembly and the separation of the filter assembly and disk stack;

Figure 6 is a cross section through an alternative construction of disk file according to the present invention; and

Figure 7 is a partly broken away and sectioned plan view of the disk file of Figure 6 to reveal a filter assembly employed therein.

The disk file shown in Figures 1 to 3 is a compact magnetic disk file consisting of an enclosed head/disk assembly 10 and an integral drive motor 11

external to the enclosure. The enclosure is formed by a base casting 12, cover 13 and a mounting plate 14 for motor 11.

A spindle 15 protrudes from the motor and is supported for rotation by bearings 16 seated in a housing formed in the mounting plate. Pressed onto the outer end of the spindle for rotation therewith is a hub assembly consisting of a bell-shaped hub 20 having a flange 21 and a sprung disk clamp 22. The flange 21 supports a two disks 25 separated by a spacer 26 which are clamped tightly together and onto the hub by the clamp 22.

The disk stack is rotated by the motor 11 to carry the disks 25 past four electromagnetic transducing heads 30. These heads write information on and read information from respective associated disk surfaces. The heads 30 are conventionally supported adjacent the disks by head support arms 31 (illustrated only schematically in Figure 1) each including a gimbal mount 32 and leaf spring flexure 33. The heads are urged towards their respective disk surfaces by load arm 34 and fly over and very close to the disk surfaces during rotation of the disk stack. When the disks are at rest, the heads 30 land on the disk surfaces.

To access different tracks on the disks the head/arm assemblies are mounted on the carriage 40 of an access mechanism which can move them approximately radially over the surfaces of the disks. The access mechanism is of the rack and pinion type in which a moving rack 41 is driven by the output pinion 42 of a stepper motor 43. The stepper motor is pivotally mounted and is spring biased to maintain engagement of the pinion with the rack. The carriage 40 moves linearly with the rack on a guide rod (not visible). A flexible cable 44 connects the moving head/arm assembly to a tape cable 45.

In order to provide filtration of the air within the enclosure, a filter assembly 50 is provided. As shown particularly in Figures 2 and 3, the filter assembly is moulded in the form of an annulus. It is bolted at three points 48 onto the mounting plate 14 of motor 11 immediately beneath the lower disk 25 of the stack.

The filter assembly moulding surrounds the hub assembly 20 completely but an active filter portion 51 extends only over about 270° of the annulus. Although the filter assembly portion 51 is sealed firmly against the mounting plate 14 by a rim 49 formed at its inner diameter, its lower surface is kept clear of the mounting plate by moulded stand-off features beneath bolting points 48. This active portion 51 is in the form of an inverted shallow trough which is ribbed as at 52, to divide it into several compartments. A three-quarters annular filter paper 53 is glued down to the ribs 52 and to the rim of the trough 51 to cover the trough completely.

Each compartment of the trough 51 includes an aperture 54 communicating between the volume enclosed by the trough and filter paper and a space 55 beneath the flange 21 of the hub assembly. This space 55 leads to the interior of hub 20. The hub 20 is provided with window passages 60 (only one of which is shown) which communicate in turn with castellation slots 61 in spacers 26.

In operation, rotation of the disks pumps air outwardly to the periphery of the enclosure creating a high pressure region at the periphery and a low pressure region within the hub assembly. As a result, air circulates from the hub assembly through windows 60 and spacer slots 61 to the periphery of the disks 25 and returns beneath the disks through the filter assembly 50 and passage 55 to the interior of the hub. This general circulation of air is illustrated by arrows in Figure 3.

To prevent leakage of air past the filter assembly 50 by way of the gap 62 between the filter assembly and the underside of the lower disk 25 and of the clearance gap 63 between the fixed filter assembly and rotating hub assembly 20, which is necessary to allow free rotation, the gap 62 is made very small. This has the effect of creating a centrifugal viscous pump between the lower disk surface and the filter assembly which tends to oppose inflow of air through gap 62 in the direction indicated by the small arrow 64 in Figure 3.

Although, ideally, this inflow should be stopped or reversed, theoretical considerations indicate that an outward pressure differential along gap 62 equal to or greater than the overall inward pressure differential between enclosure periphery and hub cannot be produced. Nevertheless, leakage is reduced and, more importantly, a significant improvement in the rate of airflow through the filter is achieved. The variation of filter airflow rate with separation of filter and lower disk is shown in Figure 5. As can be seen, filter airflow rate increases noticeably with decreased separation below about 1.1 mm. Measurements were taken over a range of 0.25 to 1.1 mm.

Moulding tolerances on the filter assembly and rigid support of the assembly on the motor mounting plate 14 allow a separation of 0.35 mm to be reliably achieved. In the small file illustrated, the corresponding flow rate of about 1 litre/minute is equivalent to about 6 air changes per minute.

Another aspect of the design of the filter assembly 50 is the provision of relieved sector 70 in a minor portion of the annular filter assembly 50. In this sector 70 there is no filter medium. The purpose of the relief gap is to accommodate the read/write heads 30 as they move to their innermost position over the outer surface of the lower disk 25. The filter medium is not made to bridge the sector 70 at an increase separation in order allow the axial height of the file to be minimised. To prevent the creation of a large leakage path in the region 70, in parallel with that through the filter, a barrier 71 is provided in the form of an upturned lip on the filter assembly.

In fact, as shown in Figure 2, air from the neighbourhood of the access mechanism can still reach the filter by passing beneath the lip 72 of the relieved sector 70 as shown by the arrows 74. Such air is channelled by the enclosure wall around the outer edge of the mounting plate 14 until it reaches the main filter portion 51 which stands clear of the mounting plate 14.

One final feature of the filter assembly 50 is the breather filter arrangement illustrated in Figure 4. A covered radially extending slot 80 in filter assembly 50 is located over a bleed hole 81 through a por-

tion of the motor mounting plate 14. The bleed hole 81 is surrounded by a foam seal 82 so that air entering the hole must pass through the filter paper 53 to reach slot 80. The space outside the seal below the filter paper is connected through a passage 84 to the gap 55 communicating with the hub assembly interior. Thus, the interior of the hub assembly is effectively maintained at or near to ambient pressure by the action of the breather filter. This has the advantage, in operation, that air is not drawn in through the bearings 16. It will be realised that, although the above discussion and the arrows shown in Figure 4 imply an inward flow of air, the breather system is also effective to equalise pressures if the interior pressure should be higher than ambient for any reason.

Turning now to Figures 6 and 7, an alternative construction of disk file is shown which employs a similar filtration principle. The file is of the type described in co-pending European patent application number 85307881.4 entitled "Disk File with In-Hub Motor." This file comprises a disk stack and two head positioning actuators 100 mounted on opposite sides of a central box frame 101. The disk stack consists of alternate disks 102 and slotted spacers 103 mounted for rotation on a hub assembly 104 which includes the rotor 105 of an in-hub electric motor 106. The stator 107 of the motor is mounted on a central non-rotating spindle 108. The hub assembly 104 is supported for rotation about the spindle by two bearings 109. Further details of the general construction of this file can be found in the above referenced application.

Circulation of air within the enclosure takes place as a result of the pumping action of the rotating disk stack. From the high pressure region at the periphery of the disks 102, air returns through a part annular filter assembly 120 to a lower pressure region above the disk stack, as shown by the arrows. Apertures 121 in the disk clamp 122 enable communication with cross grooves 123 and flutes 124 in the outer casing 125 of the rotor 105. These in turn lead to slots 126 in castellated spacers 103 to complete the return path to the inter disk space.

The filter assembly 120 which is also shown in plan view in Figure 7, consists of two mouldings 130 and 131 and a filter paper 132. One moulding 130 is largely a mounting plate for the moulding 131. Moulding 130 is bolted to a protruding flange of the box frame 101 (broken away in Figure 7) through bores 133. Two wing portions 134 of plate 130 provide a support surface for corresponding lip portions 135 extending from the part-annular moulding 131.

The part annulus 131 is again in the form of a compartmentalised shallow trough divided by ribs 136. The filter paper 132 is stuck over the ribs and to the rim of the trough so that the primary return airflow path to the hub is through the filter paper. Apertures 137 in each compartment connect the trough to the space above the hub assembly.

Leakage of air past the filter assembly 120 is reduced by minimising the separation between the lower planar surface of moulding 131 of the filter assembly 120 and the upper surface of the top disk 102. At a separation of 0.6 mm leakage is reduced and an in-

creased rate of airflow through the filter is achieved.

An increased clearance is provided between mounting plate 130 and the top disk 102 in order to allow space for access by the heads of the alternate actuator (not visible in Figure 6) which serve the top surfaces of the disks. A barrier to the resulting parallel leakage path around the filter is provided by a downwardly turned rim 138 on the portion 130

Claims

1. A disk file comprising a disk enclosure (12, 13, 14);
- a disk stack within the enclosure comprising plurality of annular information storage disks (25), adjacent disks of which are separated by a radially vented spacer (26);
- a plurality of transducing heads (30) co-operable with the disks for writing information on and/or reading information from the disks (25);
- a rotatable hub assembly (20,22) for supporting the disk stack for rotation therewith, the hub assembly including vents (60) by way of which and said vented spacer (26) an axial region of the enclosure adjacent an extreme disk (25) of the stack communicates with the space between adjacent disks (25) whereby, in operation, the pumping action of the disks (25) creates a high pressure region at the periphery of the disk stack and a low pressure region adjacent the hub assembly (20,22) to cause a circulatory airflow around and between the disks (25) via said hub assembly vents (60) and the vented spacer (26);
- and a filter assembly (50) fixedly mounted in said axial region and extending circumferentially around the hub assembly, the arrangement of the filter assembly being such that communication between the axial region of the enclosure and the hub assembly vents is substantially via the filter assembly (50) except for a clearance gap (63) between the filter assembly (50) and hub assembly (22, 22) to permit free rotation of the latter, characterised in that:-
- the filter assembly (50) has a major planar surface closest to the surface of the extreme disk (25) and at a uniform separation (62) therefrom, the separation (62) between the planar surface of the filter assembly (50) and the extreme disk surface being smaller than the separation between the disks (25) by an amount sufficient at least to reduce inward leakage of air through the clearance gap (63) and to increase airflow through the filter assembly (50).
2. A disk file as claimed in claim 1 further characterised in that the separation (62) between the filter assembly and the extreme disk (25) is sufficiently small that the filter assembly (50) and extreme disk (25) form a centrifugal viscous pump opposing the pressure differential between said high and low pressure regions.
3. A disk file as claimed in claim 1 or claim 2 in which the separation (62) between the filter assembly (50) and the extreme disk (25) is less than 1.1 mm.
4. A disk file as claimed in claim 3 in which the separation (62) lies in the range 0.35 to 0.6 mm.
5. A disk file as claimed in any preceding claim in

tion of the motor mounting plate 14. The bleed hole 81 is surrounded by a foam seal 82 so that air entering the hole must pass through the filter paper 53 to reach slot 80. The space outside the seal below the filter paper is connected through a passage 84 to the gap 55 communicating with the hub assembly interior. Thus, the interior of the hub assembly is effectively maintained at or near to ambient pressure by the action of the breather filter. This has the advantage, in operation, that air is not drawn in through the bearings 16. It will be realised that, although the above discussion and the arrows shown in Figure 4 imply an inward flow of air, the breather system is also effective to equalise pressures if the interior pressure should be higher than ambient for any reason.

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The filter assembly 120 which is also shown in plan view in Figure 7, consists of two mouldings 130 and 131 and a filter paper 132. One moulding 130 is largely a mounting plate for the moulding 131. Moulding 130 is bolted to a protruding flange of the box frame 101 (broken away in Figure 7) through bores 133. Two wing portions 134 of plate 130 provide a support surface for corresponding lip portions 135 extending from the part-annular moulding 131.

The part annulus 131 is again in the form of a compartmentalised shallow trough divided by ribs 136. The filter paper 132 is stuck over the ribs and to the rim of the trough so that the primary return airflow path to the hub is through the filter paper. Apertures 137 in each compartment connect the trough to the space above the hub assembly.

Leakage of air past the filter assembly 120 is reduced by minimising the separation between the lower planar surface of moulding 131 of the filter assembly 120 and the upper surface of the top disk 102. At a separation of 0.6 mm leakage is reduced and an in-

creased rate of airflow through the filter is achieved.

An increased clearance is provided between mounting plate 130 and the top disk 102 in order to allow space for access by the heads of the alternate actuator (not visible in Figure 6) which serve the top surfaces of the disks. A barrier to the resulting parallel leakage path around the filter is provided by a downwardly turned rim 138 on the portion 130

Claims

1. A disk file comprising a disk enclosure (12, 13, 14);
- a disk stack within the enclosure comprising plurality of annular information storage disks (25), adjacent disks of which are separated by a radially vented spacer (26);
- a plurality of transducing heads (30) co-operable with the disks for writing information on and/or reading information from the disks (25);
- a rotatable hub assembly (20, 22) for supporting the disk stack for rotation therewith, the hub assembly including vents (60) by way of which and said vented spacer (26) an axial region of the enclosure adjacent an extreme disk (25) of the stack communicates with the space between adjacent disks (25) whereby, in operation, the pumping action of the disks (25) creates a high pressure region at the periphery of the disk stack and a low pressure region adjacent the hub assembly (20, 22) to cause a circulatory airflow around and between the disks (25) via said hub assembly vents (60) and the vented spacer (26);
- and a filter assembly (50) fixedly mounted in said axial region and extending circumferentially around the hub assembly, the arrangement of the filter assembly being such that communication between the axial region of the enclosure and the hub assembly vents is substantially via the filter assembly (50) except for a clearance gap (63) between the filter assembly (50) and hub assembly (22, 22) to permit free rotation of the latter,
- characterised in that:-
- the filter assembly (50) has a major planar surface closest to the surface of the extreme disk (25) and at a uniform separation (62) therefrom, the separation (62) between the planar surface of the filter assembly (50) and the extreme disk surface being smaller than the separation between the disks (25) by an amount sufficient at least to reduce inward leakage of air through the clearance gap (63) and to increase airflow through the filter assembly (50).
2. A disk file as claimed in claim 1 further characterised in that the separation (62) between the filter assembly and the extreme disk (25) is sufficiently small that the filter assembly (50) and extreme disk (25) form a centrifugal viscous pump opposing the pressure differential between said high and low pressure regions.
3. A disk file as claimed in claim 1 or claim 2 in which the separation (62) between the filter assembly (50) and the extreme disk (25) is less than 1.1 mm.
4. A disk file as claimed in claim 3 in which the separation (62) lies in the range 0.35 to 0.6 mm.
5. A disk file as claimed in any preceding claim in



which the filter assembly comprises an arcuate portion (51) extending around a major portion only of the hub assembly circumference at said uniform separation from the extreme disk, the ends of the arcuate portion (51) defining a gap (70) around a minor portion of the hub assembly circumference sufficiently deep relative to said uniform separation (62) to accommodate at least one of the transducing heads (30) for co-operation with the outer surface of the extreme disk (25).

6. A disk file as claimed in claim 5 including a barrier (71) extending circumferentially across the gap (70) inward of the transducing head position to reduce leakage of air via the gap (70) to the hub assembly (20, 22).

7. A disk file as claimed in claim 6 in which the barrier (71) is formed as a lip (71) on the filter assembly (50) which extends towards the extreme disk (25).

8. A disk file as claimed in claim 5 or in either of claims 6 and 7 as dependent on claim 5 in which the arcuate portion (51) of the filter assembly (50) is an annular shallow trough and includes a laminar filter medium (53) of corresponding shape covering the trough, the trough being apertured (54) at its inner diameter to communicate with the low pressure region adjacent the hub assembly (20, 22).

9. A disk file as claimed in any preceding claim further comprising a drive motor (11) having a mounting plate (14) in which a spindle (15) is supported for rotation, the hub assembly (20, 22) being mounted on one end of the spindle (15) and the filter assembly being mounted on the motor mounting plate (14) adjacent the extreme disk of the stack.

10. A disk file as claimed in any preceding claim in which the enclosure comprises a base casting (101), the filter assembly (120) being mounted on the base casting (101).

11. A disk file as claimed in claim 9 in which the hub assembly includes a bell portion (20) mounted on the spindle end and having an outer flange (21) on which the disk stack (25, 26) is supported, spaced from the motor mounting plate (14), the hub assembly vents being slots (60) through the bell portion (20) communicating with the radial slots (61) in the spacers (26) of the disk stack.

12. A disk file as claimed in any preceding claim in which the hub assembly (104) includes an internal drive motor with an external cylindrical rotor casing (125), the motor casing having a flange on which the disk stack is supported, the hub assembly vents including cross grooves (123) and flutes (124) in the outer surface of the rotor casing (125) which communicate with the radial slots (126) in the spacers of the disk stack.

Patentansprüche

1. Plattendatei mit Plattenhülle (12, 13, 14);

Plattenstapel in der Hülle mit einer Mehrzahl ringförmiger Platten für die Speicherung von Informationen (25), von denen anliegende Platten durch ein radial belüftetes Abstandsteil getrennt sind;

eine Mehrzahl von Meßwandlerköpfen (30), die zusammen mit den Platten zum Schreiben von Infor-

mation auf und/oder zum Lesen von Information von den Platten (25) eingesetzt werden;

eine drehbare Nabenmontage (20, 22) für die Halterung des Plattenstapels zur Drehung, Nabenmontage, die Luftlöcher (60) enthält, mit denen zusammen mit dem besagten belüfteten Abstandsteil (26) eine axiale Zone der Hülle, an einer äußeren Platte (25) des Stapels anliegend, mit dem Raum zwischen benachbarten Platten (25) in Verbindung steht, wodurch während des Betriebs die Pumpwirkung der Platten (25) eine Hochdruckzone am Rand des Plattenstapels und eine Niederdruckzone an der Nabenmontage (20, 22) erzeugt, um einen um die Platten (25) und zwischen ihnen umlaufenden Luftstrom zu erzeugen, durch besagte Luftlöcher (60) der Nabenmontage und das belüftete Abstandsteil (26);

und eine Filtermontage (50), die in besagter Axialzone fest montiert ist und sich rund um die Nabenmontage erstreckt, wobei die Filter so angeordnet sind, daß die Kommunikation zwischen der Axialzone der Hülle und den Luftlöchern der Nabenmontage wesentlich durch die Filtermontage (50) erfolgt, mit Ausnahme eines Abstandsspalts (63) zwischen der Filtermontage (50) und der Nabenmontage (20, 22), um eine freie Drehung der letzteren zu gestatten, dadurch gekennzeichnet, daß die Filtermontage (50) eine größere ebene Fläche aufweist, die ganz nah an der Fläche der äußersten Platte (25) liegt, und an einer einheitlichen Trennung (62) davon, wobei die Trennung (62) zwischen der ebenen Fläche der Filtermontage (50) und der äußersten Plattenfläche kleiner ist als die Trennung zwischen den Platten (25), um einen Wert, der mindestens ausreicht, das Austreten der Luft durch den Abstandsspalt (63) zu reduzieren und den Luftstrom durch die Filtermontage (50) zu erhöhen.

2. Plattendatei gemäß Anspruch 1, ferner dadurch gekennzeichnet, daß die Trennung (62) zwischen der Filtermontage und der äußersten Platte (25) klein genug ist, so daß die Filtermontage (50) und die äußerste Platte (25) eine Fliehkraftpumpe bilden, die sich dem Druckunterschied zwischen den besagten Hoch- und Niederdruckzonen entgensetzt.

3. Plattendatei gemäß Anspruch 1 oder 2, in der die Trennung (62) zwischen der Filtermontage (50) und der äußersten Platte (25) weniger als 1,1 mm beträgt.

4. Plattendatei gemäß Anspruch 3, in der die Trennung (62) in einem Bereich von 0,35 bis 0,6 mm liegt.

5. Plattendatei gemäß einem der vorangehenden Ansprüche, in denen die Filtermontage einen bogenförmigen Abschnitt (51) enthält, der sich um einen größeren Abschnitt des Umfangs der Nabenmontage allein an besagter gleichmäßiger Trennung von der äußersten Platte erstreckt, wobei die Enden des bogenförmigen Abschnitts (51) einen Spalt (70) um einen kleineren Abschnitt des Umfangs der Nabenmontage bilden, der ausreichend tief in Bezug auf die besagte gleichförmige Trennung (62) ist, um mindestens einen der Meßwandlerköpfe (30) aufzunehmen, für die Zusammenwirkung mit der äußeren Fläche der äußersten Platte (25).

6. Plattendatei gemäß Anspruch 5, mit einer



Schranke (71), die sich rund um den Spalt (70) innerhalb der Meßwandlerkopfform erstreckt, um das Austreten der Luft durch den Spalt (70) an die Nabenmontage (20, 22) zu verringern.

7. Plattendatei gemäß Anspruch 6, in der die Schranke (71) als Lippe (71) an der Filtermontage (50) ausgebildet ist, die sich zur äußersten Platte (25) hin erstreckt.

8. Plattendatei gemäß Anspruch 5 oder Anspruch 6 oder 7, abhängig von Anspruch 5, in der der bogenförmige Abschnitt (51) der Filtermontage (50) eine ringförmige flache Mulde ist und ein Laminarfiltermedium (53) entsprechender Form, das die Mulde abdeckt, enthält, wobei die Mulde an ihrem Innendurchmesser geöffnet ist (54), um mit der an der Hubmontage anliegenden Niederdruckzone (20, 22) in Verbindung zu stehen.

9. Plattendatei gemäß einem der vorangehenden Ansprüche, ferner einen Antriebsmotor (11) enthaltend, der eine Montageplatte (14) besitzt, in der eine Spindel (15) drehbar gelagert ist, während die Nabenmontage (20, 22) auf ein Ende der Spindel (15) montiert ist, und die Filtermontage auf die Motor- montageplatte (14) montiert ist, die an der äußersten Platte des Stapels anliegt.

10. Plattendatei gemäß einem der vorangehenden Ansprüche, in der die Hülle einen Grundrahmen (101) und die Filtermontage (120) enthält, die auf den Grundrahmen (101) montiert ist.

11. Plattendatei gemäß Anspruch 9, in der die Nabenmontage einen Glockenabschnitt (20) enthält, der auf das Spindelende montiert ist und einen äußeren Flansch (21) besitzt, auf dem der Plattenstapel (25, 26) gelagert ist, in einem Abstand zur Motorhalterungsplatte (14), während die Luftlöcher der Nabenmontage Schlitze (60) im Glockenabschnitt (20) sind, die mit den radialen Schlitzen (61) in den Abstandsteilen (26) des Plattenstapels in Verbindung stehen.

12. Plattendatei gemäß einem der vorgangehenden Ansprüche, in der die Nabenmontage (104) einen internen Antriebsmotor enthält, mit einem externen zylindrischen Läufergehäuse (125), wobei das Motorgehäuse einen Flansch besitzt, auf dem der Plattenstapel gelagert ist, und die Nabenmontagenluftlöcher gekreuzte Nuten (123) und Rillen (124) in der äußeren Fläche des Läufergehäuses (125) aufweisen, die mit den radialen Schlitzen (126) in den Abstandsteilen des Plattenstapels in Verbindung stehen.

Revendications

1. Unité de disques comprenant une enceinte (12, 13, 14) entourant les disques;

une pile de disques à l'intérieur de l'enceinte, comprenant une pluralité de disques annulaires (25) de stockage d'information, les disques adjacents dans la pile étant séparés par une entretoise à passages d'air radiaux (26);

une pluralité de têtes de transduction (30) qui peuvent coopérer avec les disques pour écrire des informations et/ou lire des informations sur les disques (25);

un dispositif de moyeu rotatif (20, 22) pour sup-

porter la pile de disques en rotation commune, le dispositif de moyeu comportant des passages d'air (60) par l'intermédiaire desquels et de ladite entretoise à passages d'air (26) une région axiale de l'enceinte, adjacente à un disque extrême (25) de la pile, communique avec l'espace compris entre des disques adjacents (25) de sorte que, en fonctionnement, l'action de pompage des disques (25) engendre une région de haute pression à la périphérie de la pile de disques et une région de basse pression adjacente au dispositif de moyeu (20, 22) afin de provoquer une circulation d'air autour des disques (25) et entre ceux-ci, à travers lesdits passages d'air (60) du dispositif de moyeu et à travers l'entretoise (26) à passages d'air;

et un dispositif de filtre (50) monté de façon fixe dans ladite région axiale et s'étendant circonferentiellement autour du dispositif de moyeu, l'agencement du dispositif de filtre étant tel que la communication entre la région axiale de l'enceinte et les passages d'air du dispositif de moyeu s'effectue sensiblement à travers le dispositif de filtre (50) à l'exception d'un intervalle (63) laissé entre le dispositif de filtre (50) et le dispositif de moyeu (20, 22) pour permettre la libre rotation de ce dernier, caractérisée en ce que:

le dispositif de filtre (50) présente une surface principale plane très proche de la surface du disque extrême (25) et à une distance uniforme (62) de celui-ci, la séparation (62) entre la surface plane du dispositif de filtre (50) et la surface du disque extrême étant plus petite que la séparation entre les disques (25), d'une quantité suffisante au moins pour réduire la fuite d'air vers l'intérieur à travers l'intervalle (63) et pour augmenter le flux d'air à travers le dispositif de filtre (50).

2. Unité de disques suivant la revendication 1, caractérisée en outre en ce que la séparation (62) entre le dispositif de filtre et le disque extrême (25) est suffisamment petite pour que le dispositif de filtre (50) et le disque extrême (25) constituent une pompe centrifuge à écoulement visqueux s'opposant à la différence de pression entre lesdites régions de haute pression et de basse pression.

3. Unité de disques suivant la revendication 1 ou la revendication 2, dans laquelle la séparation (62) entre le dispositif de filtre (50) et le disque extrême (25) est inférieure à 1,1 mm.

4. Unité de disques suivant la revendication 3, dans laquelle la séparation (62) est dans la plage de 0,35 à 0,6 mm.

5. Unité de disques suivant l'une quelconque des revendications précédentes, dans laquelle le dispositif de filtre comprend une partie courbe (51) s'étendant autour d'une partie principale seulement de la circonférence du dispositif de moyeu, à ladite séparation uniforme par rapport au disque extrême, les extrémités de la partie courbe (51) définissant un intervalle (70) autour d'une partie mineure de la circonférence du dispositif de moyeu, suffisamment profond par rapport à la dite séparation uniforme (62) pour recevoir au moins une des têtes de transduction (30) en coopération avec la surface extérieure du disque extrême (25).

6. Unité de disques suivant la revendication 5,



comprenant une barrière (71) qui s'étend circonférentiellement en travers de l'intervalle (70) vers l'intérieur par rapport à la position de la tête de transduction, pour réduire la fuite d'air par l'intervalle (70) vers le dispositif de moyeu (20, 22).

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7. Unité de disques suivant la revendication 6, dans laquelle la barrière (71) est sous la forme d'une lèvre (71), prévue sur le dispositif de filtre (50), qui s'étend vers le disque extrême (25).

8. Unité de disques suivant la revendication 5 ou l'une ou l'autre des revendications 6 et 7 lorsqu'elles dépendent de la revendication 5, dans laquelle la partie courbe (51) du dispositif de filtre (50) est une cuvette annulaire peu profonde et comprend un support filtrant laminaire (53) de forme correspondante recouvrant la cuvette, la cuvette étant percée (54) à l'endroit de son diamètre intérieur pour communiquer avec la région de basse pression adjacente au dispositif de moyeu (20, 22).

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9. Unité de disques suivant l'une quelconque des revendications précédentes, comprenant en outre un moteur d'entraînement (11) qui possède une plaque de montage (14) dans laquelle une broche (15) est supportée en rotation, le dispositif de moyeu (20, 22) étant monté sur une extrémité de la broche (15) et le dispositif de filtre étant monté sur la plaque de montage (14) du moteur près du disque extrême de la pile.

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10. Unité de disques suivant l'une quelconque des revendications précédentes, dans laquelle l'enceinte comprend une pièce moulée de base (101), le dispositif de filtre (120) étant monté sur la pièce moulée de base (101).

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11. Unité de disques suivant la revendication 9, dans laquelle le dispositif de moyeu comprend une partie en cloche (20) montée sur l'extrémité de la broche et comportant une collerette extérieure (21) sur laquelle la pile de disques (25, 26) est supportée, espacée de la plaque de montage de moteur (14), les passages d'air du dispositif de moyeu étant des fentes (60) à travers la partie en cloche (20) qui communiquent avec les fentes radiales (61) ménagées dans les entretoises (26) de la pile de disques.

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12. Unité de disques suivant l'une quelconque des revendications précédentes, dans laquelle le dispositif de moyeu (104) comprend un moteur d'entraînement intérieur comportant un carter de rotor cylindrique extérieur (125), le carter de moteur étant pourvu d'une collerette sur laquelle la pile de disques est supportée, les passages d'air du dispositif de moyeu comprenant des gorges croisées (123) et des cannelures (124), ménagées dans la surface extérieure du carter de rotor (125), qui communiquent avec les fentes radiales (126) des entretoises de la pile de disques.

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