

Description

This invention relates to recording disk cartridges and, more particularly, to a cartridge having a hub sealing arrangement for protection against contaminants when the cartridge is not in use.

Recording disk cartridges commonly are used in computer systems to provide a removably replaceable medium for the mass storage of data.

For computers employing 3.5 inch flexible magnetic disk drives, the disks are constructed of a thin sheet-like carrier, such as a polymeric film coated on its exterior surfaces with magnetic recording material such as a gamma ferric oxide, barium ferrite or the like. A rigid hub attached the center of the carrier of recording material permits connection of the disk to a drive which rotates the disk past one or more recording heads which serve to write magnetically data onto the disk and to read magnetically data from the disk. The disk is enclosed within a thin semi-rigid case having opposed walls with disk cleaning liners of soft non-woven material disposed on opposite sides of the disk.

For other applications, such recording disk cartridges may employ a rigid magnetic disk or an optical data storage disk as the storage medium.

A disk cartridge, comprising a case with recording disk therein, is readily transported from one location to another. The previously mentioned 3.5 inch flexible magnetic cartridge is sufficiently small and thin so as to be carried in a person's shirt pocket. Recorded data is readily read from the disk, or is written or altered, by simply inserting the cartridge into a disk drive connected to a computer or other device which employs the data.

Disk drive components, such as the read/write heads and a hub engaging rotor for spinning the disk, obtain access to the disk through apertures provided in the walls of the case. For example, in a standard 3.5 inch flexible magnetic disk drive which is often employed for computer applications, the drive is provided with a rotor comprising a rotatable plate which abuts the disk hub and includes a central spindle which protrudes through a central aperture of the hub, and a pin which is offset from the spindle and engages within a pin receiving slot of the hub. The rotatable plate of the disk drive fits through an access opening in a bottom wall of the plastic case to engage with the hub, and lifts the hub away from peripheral portions of the access opening to free the disk for rotation between the liners of the case. If desired, a wear-resistant pad may be disposed on the inner surface of the top wall of the case to rest against the tip of the spindle, whereby the spindle serves to support the central portion of the top wall so as to overcome any warp in the semi-rigid plastic material of the

upper wall and insure proper clearance for the disk between the case liners.

Access for the heads to interface with the disk is provided by a pair of radially extending slots formed, respectively, in the top and bottom walls in overlying registration with each other. It is well known that dust, dirt, lint or other contaminants on the recording surfaces of the disk can lead to data read/write errors and, accordingly, the liners are provided to wipe the disk surfaces to remove contaminants as the disk rotates. To minimize entry of contaminants through a pair of head access slots when the cartridge is not located in a disk drive, the case is provided with a spring biased sliding shutter that automatically moves to a position covering the head access slots when the cartridge is removed from its operative position on the disk drive.

Patent Abstracts of Japan, Vol. 8, No. 58 (P-261) [1495] March 16, 1984, relating to JP-A-58-205967, describes a containing case for a disc having an aligning member and a plate spring which provides an air tight seal whilst the disk is being stored.

However, the disk contamination problem is not completely solved because the opening in the bottom wall allowing access of the rotatable drive plate to the hub, and the aperture in the centre of the hub which receives the spindle can serve as entrances for contaminants, such as dust and lint, into the cartridge. Also, if the hub is constructed such that the offset slot for receiving the drive pin extends completely through the hub and is not otherwise closed, this slot provides yet another entrance for contaminants when the cartridge is not in use.

In accordance with the present invention, a disk cartridge for use with a disk drive having a rotor including a spindle, for rotating a disk comprises a disk having a recording medium thereon and including a hub having a spindle receiving central aperture through which the spindle protrudes when the hub is an engagement with the rotor and a case enclosing the disk and comprising first and second walls disposed on opposite sides of the disk, the first wall having an access opening therein providing access for the rotor to engage the hub when the cartridge is operatively positioned in the disk drive; characterized by means, within the case disposed in a first position engaging the disk when the cartridge is not operatively positioned in the disk drive, for urging the disk toward the first wall so that the hub closes the access opening and the urging means closes the central aperture to prevent entry of disk contaminants therethrough, the urging means being displaceable from the first position by the spindle, when the cartridge is operatively positioned in the disk drive, to a second position wherein the urging means is disengaged

from the disk to free the disk for rotation, whereby the urging means applies a compressive force of a given magnitude to the disk when the urging means is in the first position; characterised in that the urging means applies a compressive force of less than the given magnitude to the protruding spindle when the spindle displaces the urging means to the second position.

In one example, a disk cartridge comprises a disk having a recording medium thereon and including a circular hub having a spindle receiving central aperture through which the spindle protrudes when the hub is in engagement with the rotor; a case enclosing a disk, and comprising first and second walls disposed on opposite sides of the disk, the first wall having a circular access opening therein providing access for the rotor to engage the hub when the cartridge is operatively positioned in the disk drive, the access opening having a diameter smaller than the diameter of the hub; a circular dish shaped spring disposed between the second wall and the disk alignment with the central aperture, the spring being in a first position engaging the disk, when the cartridge is not operatively positioned in the disk drive, for urging the disk toward the first wall so that a peripheral portion of the hub engages a facing portion of the first wall surrounding the access opening to close the access opening and a central section of the spring engages a facing portion of the disk surrounding the central aperture to close the central aperture to prevent entry of disk contaminants therethrough, the spring being displaceable from the first position by the spindle, when the cartridge is operatively positioned in the disk drive, to a second position wherein the spring is disengaged from the disk to free the disk for rotation.

In the preferred example, a spring is disposed between the disk and the top wall of the case for urging the hub towards the bottom wall of the case which normally faces the rotor when the cartridge is at its operative position in a disk drive. The spring has a generally dish shaped form and is symmetrically disposed about a central axis of the hub. It includes a central section which closes off a central spindle receiving aperture in the hub. By urging the hub towards the bottom wall, the spring forces the rim of the hub against a sealing lip encircling the hub access opening in the bottom wall, thereby closing off this opening upon ejection of the cartridge from a disk drive. The closure of the central spindle aperture of the hub, and the closing of the hub access opening in the bottom wall prevents the entry of contaminants from an external environment, such as a person's pocket, into the cartridge. Thereby, the spring serves as a mechanism for sealing the cartridge in the hub access area when the cartridge is ejected from a

disk drive. When the cartridge is inserted in a disk drive, the spring is adapted to be displaced from its normal or first position, establishing the hub seal, by the spindle protruding through the hub central aperture, to a second position wherein the spring is disengaged from the disk to free the disk for rotation within the case by the rotor in the drive.

The spring is a composite monolithic structure comprising a concave shell including an array of radially extending fingers formed in an outer peripheral section of the spring. The central section of the spring is designed to have an oil-can type of spring action in response to an axially directed force applied to the spring by the spindle. The concave surface of the central section shell faces the top wall, and the end portions of the fingers contact the top wall. The compressive force exerted by the spring varies in accordance with displacement of its centre section towards the top wall. During a sealed condition, wherein the hub presses against the bottom wall of the cartridge, the compressive force of the spring is greater by a factor of approximately five than the residual compressive force when the spring is displaced to its second position by the spindle. This residual force causes the spring to snap back automatically to the hub sealing first position when the spindle is withdrawn in response to removing the cartridge from the drive. In the second position, the spring assumes a compact configuration wherein a portion of the central section engages the interior of the top wall and a depending dimple of the spring is positioned to serve as a wear pad for the top of the spindle which, through the spring, provides an upwardly directed force for supporting a central portion of the top wall to insure flatness of the wall which may tend to bow inwardly if not so supported.

The configuration of the spring with the array of fingers spaced by slots can be readily manufactured to a high degree of precision to insure a desired spring force at each position of the hub.

It is also noted that the generally flat configuration of the spring permits use of the spring in other enclosures wherein a mechanical action is required against a spring force which varies rapidly with displacement of a mechanical element.

An example of a disk cartridge according to the invention will now be described and contrasted with a known cartridge with reference to the accompanying drawings, in which:-

Fig. 1 is an exploded view of an example of a cartridge incorporating the invention;

Fig. 2 is a sectional view, partially stylized, of a recording disk cartridge of the prior art, the figure indicating also components of a disk drive, in block diagram form, adapted to be employed in the operation of the cartridge;

Fig. 3 is a sectional view, partially stylized, of an example of a recording disk cartridge embodying the invention, the figure showing also components of a disk drive, in block diagram form, adapted to be employed in the operation of the cartridge;

Fig. 4 is an enlarged sectional fragmentary view of a central portion of the cartridge of Figure 3 along with a drive plate or rotor of a disk drive, the drive plate shown in a position of disengagement from the recording disk;

Fig. 5 is a plan view of the rotatable drive plate of Fig. 4;

Fig. 6 is an enlarged sectional fragmentary view of the cartridge of Figure 3 showing engagement of the rotatable drive plate of Fig. 4 with the cartridge; and

Figs. 7 and 8 show, respectively, plan and sectional views of a spring employed in the construction of the cartridge of Figs. 4 and 6.

Figs. 1 and 3, show an example of a cartridge 20 of the invention, the cartridge 20 including a recording disk 22 enclosed within a thin molded plastic case 24. The case 24 comprises a top shell 26 and a bottom shell 28. The shells 26 and 28 include, respectively, top and bottom walls 30 and 32 which are parallel to the disk 22, and sidewalls 34 and 36 which maintain a desired spacing between the top wall 30 and the bottom wall 32. The terms "top" and "bottom", as used herein, refer to the relative positions of components as portrayed in the figures, and are not to be construed as implying a specific orientation for the cartridge 20 since, as is well known, the cartridge may be used in a horizontally or vertically oriented disk drive.

The disk 22 comprises a circular flexible sheet-like carrier 38 of recording material on opposite sides thereof, a hub 40, in the form of a circular plate, for coupling the carrier 38 to a disk drive rotor, and an annular disk or ring 42 of plastic film, preferably mylar, for attaching hub 40 to carrier 38. A portion of the carrier 38 has been deleted in Fig. 1 to expose the hub 40. The hub 40 is adapted to be attached to the bottom side of the carrier in centrally disposed concentric relation to the axis of the carrier 38. The carrier 38 is provided with a series of apertures 44 communicating with the top surface of the hub 40, and the bottom surface of the annular disk or attachment ring 42 which is provided with an adhesive layer 46 on its underside. The annular disk 42 serves to secure the carrier 38 to the hub 40 by means of the adhesive layer 46, the adhesive of the layer 46 penetrating through the apertures 44 to the hub 40 to secure the carrier 38 between the annular disk 42 and the hub 40. Those portions of adhesive layer 46 surrounding the apertures 44 serve to attach the disk 42 to the top surface of carrier 38. The annular disk

42, the carrier 38 and the hub 40 are each provided with a central aperture which, upon the securing of the disk 42 to the carrier 38 and the hub 40 produce a central aperture 48 (Fig. 3) of the central hub section of recording disk 22 for receiving a spindle on the disk drive rotor. In the illustrated embodiment the hub section comprises the hub 40, attachment ring 42 and that portion of carrier 38 therebetween. For a more detailed description of this type of hub construction, reference may be had to commonly assigned, copending application, U.S. Serial No. 101,995, filed September 28, 1987, by Richard Gulbrandsen and entitled "Flexible Disk Cassette", said application being specifically incorporated by reference herein.

It should be understood that alternative hub structures may be used for disk 22. For example, the carrier 38 may be provided with a central aperture that is larger than aperture 48 and the periphery of hub 40 may be directly bonded or adhesively coupled to that portion of the carrier 38 surrounding its central aperture. This type of construction eliminates the need for the attachment ring 42 and the central aperture of hub 40 alone serves as the means of the disk hub section for receiving the spindle on the disk drive rotor.

In the preferred embodiment of the invention, the recording medium on opposite sides of the carrier 38 is a magnetic medium, it being understood that the principles of the invention apply also to the situation wherein the carrier is configured for optical data storage or disk 22 is a rigid rather than a flexible disk.

A top liner 50 and a bottom liner 52 are located within the case 24 on opposite sides of the disk 22, the top liner 50 being secured to the interior surface of top wall 30, and the bottom liner 52 being secured to the interior surface of bottom wall 32. The liners 50 and 52 are formed of a nonwoven fabric such as rayon, and are secured to the respective walls 30 and 32 by conventional means, such as by heat sealing or ultrasonic sealing. The liners 50 and 52 serve to wipe the recording surfaces to remove automatically any dust or contaminants which may be deposited on the disk 22, to prevent abrasion of the disk 22 and to prevent the build-up of static electricity at the disk 22.

The bottom wall 32 is provided with a central opening 54 which serves as an access opening or port for the disk spinning rotor of a disk drive, such as a disk drive 56 indicated schematically in Fig. 3, to engage to hub 40. Four arc-shaped ribs 58 may be arranged concentrically about the access opening 54 on the bottom wall 32 about the periphery of the liner 52 to stiffen the bottom wall 32, with a corresponding set of the ribs (not shown) being located on the top wall 30. The bottom liner 52 is also provided with a central aperture 60 to clear the

rotor of disk drive 56 upon engagement of the drive with the disk 22. A moveable lug 62 may be provided in the bottom wall 32, as is common practice, to select whether disk recording or writing is to be allowed or prohibited during operation with the disk drive 56.

The disk drive 56 includes rotor 63 comprising a circular plate 64 which is fixed to and rotates with a central shaft 66 that includes an upstanding portion or spindle 68 which is received by the central aperture 48 of the disk 22, and an upstanding drive pin 70 which is radially offset from the spindle 68 and is received by a drive pin slot 72 (Fig. 1) in the hub 40 for imparting torque for rotation of the disk 22. It will be noted that in the illustrated embodiment, slot 72 is covered by an overlying portion of carrier 38, therefore it is not an entry point for contaminants. Alternatively, if the previously mentioned alternative hub construction is employed, the slot 72 may be formed so that it does not extend through to the upper surface of hub 40 to preclude entry of contaminants therethrough.

The shaft 66 is mechanically coupled to an electric motor 74 which imparts rotation to the shaft 66. The disk drive 56 also includes a movable interior frame which is adapted to receive and support the cartridge 20, to lower the cartridge inserted into the drive to an operative position wherein the rotor engages the hub, and upon manual actuation after drive operation to raise, and thereby disengage the cartridge, and partially eject the cartridge from the drive. Such a frame mechanism is well known to those familiar with standard 3.5 inch flexible disk drives and need not be described further here. In the drawings this type of frame mechanism is schematically shown as a block designated support/ejector 76.

Also included within the disk drive 56 are top and bottom recording heads 78 and 80 which interact magnetically with the magnetic medium on the top and the bottom surfaces of the carrier 38 for the recording or playback of data. Electrical excitation of the heads 78 and 80 are provided by a well-known record/playback circuit 82.

Access for the top head 78 to the disk 22 is provided by slots 84 and 86, respectively, in the top wall 30 and the top liner 50, the two slots 84 and 86 being in registration with each other. Access for the bottom head 80 to the bottom surface of the disk 22 is provided by slots 88 and 90, respectively, in the bottom wall 32 and the bottom liner 52, the slots 88 and 90 being in registration with each other. A shutter 92 rides in a guide 94 of the top shell 26, and a similar guide (not shown) in the bottom shell 28 for closing off the slots 84 and 88 to prevent entry of disk contaminants therethrough when the cartridge 20 is not in use. The shutter 92 includes a pair of apertures 96 for ex-

posing the apertures 84 and 88 upon a sliding of the shutter 92 within the guides 94 during operation of the disk drive 56.

With reference also to Fig. 2, there is provided a comparison of a cartridge 98, which is intended to be a schematic representation of a standard 3.5 inch flexible magnetic disk cartridge that is well known in the prior art, with the cartridge 20 of the invention. The cartridge 98 includes a disk 100 having a carrier 102 of magnetic recording material, the carrier 102 having attached thereto a central hat-shaped magnetically attractable metal hub 104. The disk 100 is enclosed by a thin molded plastic case 106. It is noted that the overall dimensions of the case 106 of the prior art are essentially the same as the overall dimensions of the case 24 employed in the construction of the invention. Also, the configuration of the useful portions of the carrier 102 of the prior art is essentially the same as that of the carrier 38 employed in the construction of the invention.

In Fig. 2, there is provided a disk drive 108 comprising the motor 74, the support/ejector mechanism 76, the recording heads 78 and 80, and the record/playback circuit 82 employed in the disk drive 56 of the invention. The disk drive 108 of Fig. 2 includes a rotor 109 comprising a plate 110 fixed on a shaft 112 driven by the motor 74, the plate 110 having a central upstanding spindle 114 and a pin 116 radially offset from the spindle 114. The spindle 114 and the pin 116 engage with the hub 104 upon a bringing together of the rotor 109 and the hub 104 by the mechanism 76. Typically, the plate 110 is made of magnetic material, or carries an annular magnet on its upper surface (not shown) for magnetically attracting and releasably holding the hub 104 in contact with plate 110.

By comparison of the disk drives 56 and 108 disclosed in Figs. 2 and 3, it is appreciated that the cartridge 20 of the invention is operative with essentially the same disk drive components as are employed in the prior art.

It should be noted that in the cartridge of Fig. 2, the hub 104 has a peripheral rim section 117 and a depending crown section 118 that is accessible to the rotor 109 through the access opening 119. The outside diameter of rim 117 is larger than the diameter of opening 119 so the rim may bear against that portion of the case bottom wall when the cartridge is not in a drive. The outside diameter of the crown section 118 is smaller than the diameter of opening 119 so there is a loose fit of the crown with respect to the opening 119. This loose fitting construction permits the entry of contaminants into the case through the edges of opening 119 when the cartridge is not in a drive. Also, the central spindle receiving aperture 120 and the offset drive pin slot 121 are not closed or blocked so

that contaminants also may enter the case through these two hub openings.

The cartridge 20 avoids the problem of contamination entry through or around the hub by including a force generation means in the form of a dish shaped spring 124 (Fig. 1) located within the case 24 between the disk 22 and the top wall 30. The spring 124 extends from the top wall 30 to engage the central hub section of disk 22 through an aperture 126 in the top liner 50. The spring 124, in its normal or first position provides a compression force, and urges the disk 22 away from the top wall 30 toward the bottom wall 32. A central section of the spring 124 engages the upper side of the annular disk 42, on the top or opposite side of the disk from hub 40, to close the central aperture 48 and urge the hub 40 into closing relation to the access opening 54, and a peripheral section of the of the spring 124 contacts the interior surface of top wall 30.

With reference to Figs. 4 and 6-8, there is provided a description of the configuration and operation of the spring 124. The spring 124 is generally dish shaped and is formed as a circular disk 128 flared symmetrically about a central axis of the spring 124, the disk 128 having radially extending slots 130. Eight slots 130 are symmetrically positioned about a center of the disk 128, as shown in Fig. 7, it being understood that more or fewer slots 130 might be provided. In the preferred embodiment of the invention, the sides of each slot 130 are substantially parallel to each other and are symmetrically positioned about a corresponding bisecting radius of the disk 128. The set of slots 130 define a set of fingers 132, each of the fingers 132 having symmetry about a corresponding bisecting radius of the disk 128. The outer end of a finger 132 has greater width than the inner end of the finger 132. The inner end of each of the slots 130 terminated in a circular arc.

In the manufacture of the spring 124, the circular disk 128 is deformed, as by swaging, to produce a dish shaped central section or shell 134 symmetrically disposed about the central axis of disk 128 and having a depending dimple 136 in the center of section 134, shown best in the sectional view of Fig. 8. The fingers 132 extend as substantially straight rays, as seen in section, from the periphery of the central section 134 along a frustoconical surface to define the outer or peripheral section 137 of spring 124. The concave central section 134 may be referred to as an oil-can section of the spring 124 as will be explained later herein.

The spring 124 is fabricated, in the preferred embodiment of beryllium copper, 3/4 hard. The beryllium copper provides an excellent bearing surface against which a stainless steel spindle can

press as shown in Fig. 6. The spindle 68 is fabricated of stainless steel so as to provide for a wear-resistant contact with the dimple 136 during rotation of the spindle 68.

For use in a 3.5 inch format cartridge, the following dimensions are employed in the manufacture of the spring 124. The diameter of the blank circular disk 128, prior to the formation of the spring 124, indicated by dimension A in Fig. 7, is 0.870 inch (22.1mm). Inner and outer diameters bounding the arcuate ends of the slots 130, indicated by legends B and C in Fig. 7, are 0.300 (7.62mm) inch and 0.320 inch (8.13mm) respectively. B, 0.300 inch (7.62mm)

The height of the dimple 136, dimension D, in Fig. 8, is 0.010 inch (0.254mm). The total height of the spring 124, dimension E in Fig. 8, is 0.085 inch (2.16mm). Sidewalls of the dimple 136 are inclined at an angle of 45 degrees to a central axis of the spring 124, as shown in Fig. 8. The width of the dimple 136, dimension F in Fig. 8 is 0.050 inch (1.27mm). The concave upper surface of central section 134 is formed about a constant radius, dimension G in Fig. 8, of length 0.375 inch (9.53mm). The width of a slot 130, dimension H in Fig. 7, is 0.040 inch (1.02mm). The thickness of the blank circular disk 128, dimension J in Fig. 8, is 0.004 inch (0.102mm).

The operation of the spring 124 before and during engagement of the rotor 63 of a disk drive with the disk 22 of the cartridge 20 is shown in Figs. 4 and 6, respectively.

Fig. 4 shows the position of the rotor 63 relative to the cartridge 20 prior to engagement of the spindle 68 and the pin 70 with the hub section of disk 22. Fig. 6 shows the cartridge 20 at its operative position in the drive with rotor 63 in engagement with hub 40. The pin 70 is received in the slot 72, and the spindle 68 is received in the central aperture 48 so that the protruding tip of the spindle 68 presses against the dimple 136 in the center of the spring 124 to axially displace the spring from its first position of Fig. 4 to its second position of Fig. 6. The plate 64, in Fig. 6, lifts the hub 40 away from a lip 138 of the aperture 54 in the bottom wall 32, the hub 40, in Fig. 6, being shown at its final position in which the carrier 38 is spaced equally relative to the upper liner 50 and the lower liner 52. In contrast, in Fig. 4, the compressive force provided on the hub section of the disk urges the center of the disk toward bottom wall 32 so that the periphery of the hub 40 is pressed in engagement with the lip 138 of the access opening 54 to close or block this opening and prevent the entry of contaminants therethrough and the bottom surface of central section 134 surrounding dimple 136 engages the hub section to close or block the central spindle receiving aperture 48 to prevent the entry

of contaminants therethrough.

In Fig. 4, the configuration of the spring 124 is flattened somewhat from the unstressed curved configuration in Fig. 8 to develop, in its first position, a loading force on the hub section of approximately 115 grams. This force is due to compression of the spring 124 between the top wall 30 and the hub section of the disk, the compressive force compressing the bottom surface of the periphery of the hub 40 against the top surface of the lip 138.

In Fig. 6, the upward axial displacement of the dimple 136 by spindle 68 has introduced a deformation of the spring 124 thereby moving it to its second position. The deformation of the spring 124 transforms the concave surface of the central section 134 surrounding dimple 136 and facing the top wall 30 to a convex surface which faces the top wall 30. In this second position, that portion of the center section at the periphery of dimple 136 engages the interior surface of top wall 30 in bearing relation thereto. In the configuration shown in Fig. 6, the spring 124 still exerts a residual compressive force, the compressive force being between the top wall 30 and the top of the spindle 68. This residual compressive force has been reduced to a loading of approximately 22 grams exerted by the spring 124 against the spindle 68 and serves to cause the spring to return automatically to its first position when the spindle 68 is disengaged from the spring 124 when the cartridge is removed from the drive. In particular, it is noted that, in Fig. 6, the spindle 68 has lifted the spring 124 away from the hub section so that the spring 124 no longer exerts a force upon the disk thereby freeing the disk for rotation. The fingers 132 serve as an extension of the central section 134 and flex in response to the oil-can action to increase the vertical displacement of the center of the spring to insure that the spring 124 is completely disengaged from the disk when it is moved to its second position by the spindle 68.

The depending dimple 136 is provided so that when the spring 124 is in its second position, the dimple 136 is in the correct vertical position within the case for the tip of the spindle in engagement therewith to provide an upwardly directed force through the spring 124 on the central region of the top wall 30 serving to urge the top wall 30 upwardly, and to support the central portion of the top wall 30 upon the spindle 68 in the manner of a tent pole supporting a tent. As is well known, the top wall 30, as well as other components of the case 24 (Fig. 3) is fabricated of a polymer plastic such as an ABS plastic which is semirigid and subject to warping or bending due to handling of the cartridge 20. The lifting of the central portion of the top wall 30 by the spindle 68 and the spring 124 adjusts the position of the top wall 30 relative to the bottom

wall 32 and the disk 22 so as to assure proper clearance between the liners 50 and 52 relative to the carrier 38 of the recording medium. This supporting function corresponds to the supporting function in the prior art cartridge 98 of Fig. 2 wherein a wear-resistant pad 140 is secured to the midpoint of the top wall of the case 106 and rests against the top end of the spindle 114 during rotation of the disk 100 by the drive 108. Thus the spring 124 in its second position serves as a wear pad or bearing surface for the spindle 68 thereby preventing the rotating spindle 68 from making contact with and causing damage to the interior surface of the plastic wall 30.

When the cartridge 20 is ejected from the drive, the spindle 68 is withdrawn from aperture 48 and disengages from the dimple 136. As a result of the residual compressive force in spring 124, the oil-can central section 134 automatically snaps back from the second position to the first position of Fig 4.

With reference to Figs. 4 and 5, a further feature of the invention is described, this feature relating to the magnetic holding of the disk hub 40 upon the plate 64. The plate 64, which may be fabricated of stainless steel, is provided with the annular magnet 122, the magnet 122 being held within an annular trough 142 formed in a top surface of the plate 64.

The hub 40 is preferably fabricated of a magnetically attractive metal, such as steel or the like, or it may be formed of particles of magnetic material disposed in a plastic binder. Thereby, the magnetism of the magnet 122 induces a magnetic field in both the plate 64 and the hub 40 for attracting the hub 40 to the plate 64. The magnetic field secures the hub 40 to the plate 64 during rotation of the plate 64 and the hub 40, and insures precise positioning and orientation of the disk 22 during rotation of the disk 22.

An additional feature of the invention, useful in the placement of the spring 124 in the cartridge 20 during construction of the cartridge 20 is described with reference to Figs. 1, 4, and 8. Prior to assembly of the cartridge 20, the various components are arranged as shown in Fig. 1. The spring 124 is secured to the top wall 30 by two tabs 144 which are located on the top wall 30 at points of convenience for receiving and holding the outer ends of the fingers at the periphery of the spring 124. The tabs 144 need not be located at the ends of a diameter of the spring 124, it being sufficient to locate the tabs 144 on generally opposite sides of the spring 124 so as to engage with two of the fingers 132 and hold the spring 124 to the top shell 26 during assembly of the cartridge 20. The tabs 144 may be produced readily during a molding of the top shell 26 by providing for mold component

access apertures 146 in wall 30 at the sites of the tabs 144. After assembly, an adhesive paper or plastic label may be attached to the exterior of wall 30 for covering the apertures 146 to prevent the entry of contaminants therethrough.

The drive pin 70 may be mounted fixedly to the plate 64, or, as shown in Figs. 4 and 6, preferably may be mounted slidably in the plate 64 with spring-loading to urge the pin 70 upward towards the disk 22. For the slidable mounting, the plate 64 is provided with a passage 148 offset and parallel to an axis of the spindle 68. The passage 148 is provided with a shelf 150 which engages with a collar 152 of the pin 70 to hold the pin 70 within the passage 148 against the force of a spring 154. The spring 154 is of spiral form, and includes an enlarged lower portion secured within a transverse channel 156 in a wall of the passage 148. A top end of the spring 154 contacts a bottom surface of the pin 70 to exert a compressive force between the pin 70 and the channel 156. In the manufacture of the rotor 63, the pin 70 is inserted from the bottom of the passage 148, and the spring 154 is inserted after the pin 70 and secured within the channel 156. During engagement of the rotor 63 with the cartridge 20, the pin 70 contacts a bottom surface of the hub 40 and then, under pressure of the spring 154, is urged into the slot 72 of the hub 40. The use of the spring loading of the pin 70 facilitates engagement of the pin 70 with the slot 72 as the plate 64 and the hub 40 approach each other during an engagement process. The slot 72 may be provided with a chamfer 158 along the lower portion of the slot 72 to facilitate insertion of the pin 70 into the slot 72. A chamfer 160 may also be provided for the central aperture 48 of the hub 40 to facilitate entry of the spindle 68.

An important feature of the invention is shown in Fig. 4, this feature being the closure of the central aperture 48 of the hub 40 by the central portion 134 of the spring 124, and also the closure of the access opening 54 in the bottom wall 32 by pressure of the hub 40 against the lip 138.

In conventional cartridges, such as the cartridge 98 of Fig. 2, the central aperture 120 and pin slot 121 of the hub, and the access opening in the bottom wall of the case 106 are open during periods of nonuse of the cartridge 98, these open apertures providing access for the entry of contaminants such as dust and lint.

In contrast, in the cartridge 20 of the invention as depicted in Fig. 4, the spring 124 provides the dual functions of closing off both aperture 48 and opening 54. The slot 72 (Fig. 1) in the hub 40 is closed off on the top side of the hub 40 by the overlying portion of carrier 38 and annular disk 42 to prevent entry of contaminants therethrough.

In addition, the higher compressive force provided by the spring 124, during the first position distended configuration of the central portion 134, with the concave surface pointing up, provides increased security against entry of contaminants. The spring 124 generates a relatively small force, when the spring 124 is displaced to its compact second position, providing its automatic return to the first position when the cartridge is removed from the drive.

The unique properties of the spring 124 are due in part to the composite structure of the spring 124 wherein the central portion 134 is formed as an oil-can section which can be transformed from the concave to convex shape in response to axial displacement of the central section between the normal first position of the spring shown in Fig. 4. and its second position shown in Fig. 6 while the concave surface of the flare of the fingers 132 remain oriented upward towards the top wall 30 independently of a displacement of the dimple 136 along the axis of the spindle 68. Both the peripheral finger section 137 and the central section 134 of the spring 124 are formed out of a single blank circular disk to attain a monolithic construction of the spring 124. Thereby, the spring 124 can be manufactured in large quantities while retaining precise control of the relatively large rest force, when the cartridge is in non-use, and the relatively small running force when the disk is rotating.

Claims

1. A disk cartridge (20) for use with a disk drive having a rotor (63), including a spindle (68), for rotating a disk, the cartridge (20) comprising: a disk (22) having a recording medium (38) thereon and including a hub (40) having a spindle receiving central aperture (48) through which the spindle (68) protrudes when the hub (40) is in engagement with the rotor and a case enclosing the disk and comprising first and second walls (30,32) disposed on opposite sides of the disk, the first wall (32) having an access opening (54) therein providing access for the rotor to engage the hub (40) when the cartridge is operatively positioned in the disk drive; and means (124), within the case disposed in a first position engaging the disk (22) when the cartridge is not operatively positioned in the disk drive, for urging the disk (22) toward the first wall (32) so that the hub (40) closes the access opening (54) and the urging means closes the central aperture (48) to prevent entry of disk contaminants therethrough, the urging means being displaceable from the first position by a spindle (68), when the cartridge is operatively positioned in the disk

access apertures 146 in wall 30 at the sites of the tabs 144. After assembly, an adhesive paper or plastic label may be attached to the exterior of wall 30 for covering the apertures 146 to prevent the entry of contaminants therethrough.

The drive pin 70 may be mounted fixedly to the plate 64, or, as shown in Figs. 4 and 6, preferably may be mounted slidably in the plate 64 with spring-loading to urge the pin 70 upward towards the disk 22. For the slidable mounting, the plate 64 is provided with a passage 148 offset and parallel to an axis of the spindle 68. The passage 148 is provided with a shelf 150 which engages with a collar 152 of the pin 70 to hold the pin 70 within the passage 148 against the force of a spring 154. The spring 154 is of spiral form, and includes an enlarged lower portion secured within a transverse channel 156 in a wall of the passage 148. A top end of the spring 154 contacts a bottom surface of the pin 70 to exert a compressive force between the pin 70 and the channel 156. In the manufacture of the rotor 63, the pin 70 is inserted from the bottom of the passage 148, and the spring 154 is inserted after the pin 70 and secured within the channel 156. During engagement of the rotor 63 with the cartridge 20, the pin 70 contacts a bottom surface of the hub 40 and then, under pressure of the spring 154, is urged into the slot 72 of the hub 40. The use of the spring loading of the pin 70 facilitates engagement of the pin 70 with the slot 72 as the plate 64 and the hub 40 approach each other during an engagement process. The slot 72 may be provided with a chamfer 158 along the lower portion of the slot 72 to facilitate insertion of the pin 70 into the slot 72. A chamfer 160 may also be provided for the central aperture 48 of the hub 40 to facilitate entry of the spindle 68.

An important feature of the invention is shown in Fig. 4, this feature being the closure of the central aperture 48 of the hub 40 by the central portion 134 of the spring 124, and also the closure of the access opening 54 in the bottom wall 32 by pressure of the hub 40 against the lip 138.

In conventional cartridges, such as the cartridge 98 of Fig. 2, the central aperture 120 and pin slot 121 of the hub, and the access opening in the bottom wall of the case 106 are open during periods of nonuse of the cartridge 98, these open apertures providing access for the entry of contaminants such as dust and lint.

In contrast, in the cartridge 20 of the invention as depicted in Fig. 4, the spring 124 provides the dual functions of closing off both aperture 48 and opening 54. The slot 72 (Fig. 1) in the hub 40 is closed off on the top side of the hub 40 by the overlying portion of carrier 38 and annular disk 42 to prevent entry of contaminants therethrough.

In addition, the higher compressive force provided by the spring 124, during the first position distended configuration of the central portion 134, with the concave surface pointing up, provides increased security against entry of contaminants. The spring 124 generates a relatively small force, when the spring 124 is displaced to its compact second position, providing its automatic return to the first position when the cartridge is removed from the drive.

The unique properties of the spring 124 are due in part to the composite structure of the spring 124 wherein the central portion 134 is formed as an oil-can section which can be transformed from the concave to convex shape in response to axial displacement of the central section between the normal first position of the spring shown in Fig. 4, and its second position shown in Fig. 6 while the concave surface of the flare of the fingers 132 remain oriented upward towards the top wall 30 independently of a displacement of the dimple 136 along the axis of the spindle 68. Both the peripheral finger section 137 and the central section 134 of the spring 124 are formed out of a single blank circular disk to attain a monolithic construction of the spring 124. Thereby, the spring 124 can be manufactured in large quantities while retaining precise control of the relatively large rest force, when the cartridge is in non-use, and the relatively small running force when the disk is rotating.

Claims

1. A disk cartridge (20) for use with a disk drive having a rotor (63), including a spindle (68), for rotating a disk, the cartridge (20) comprising: a disk (22) having a recording medium (38) thereon and including a hub (40) having a spindle receiving central aperture (48) through which the spindle (68) protrudes when the hub (40) is in engagement with the rotor and a case enclosing the disk and comprising first and second walls (30,32) disposed on opposite sides of the disk, the first wall (32) having an access opening (54) therein providing access for the rotor to engage the hub (40) when the cartridge is operatively positioned in the disk drive; and means (124), within the case disposed in a first position engaging the disk (22) when the cartridge is not operatively positioned in the disk drive, for urging the disk (22) toward the first wall (32) so that the hub (40) closes the access opening (54) and the urging means closes the central aperture (48) to prevent entry of disk contaminants therethrough, the urging means being displaceable from the first position by a spindle (68), when the cartridge is operatively positioned in the disk



- drive, to a second position wherein the urging means is disengaged from the disk to free the disk for rotation, whereby the urging means applies a compressive force of a given magnitude to the disk (22) when the urging means is in the first position; characterised in that the urging means applies a compressive force of less than the given magnitude to the protruding spindle (68) when the spindle displaces the urging means to the second position.
2. A disk cartridge according to claim 1, wherein the urging means is configured to be engaged by the spindle for displacement from the first to the second position.
 3. A disk cartridge according to claim 1 or claim 2, wherein, the urging means is configured to return automatically from the second to the first position upon disengagement from the spindle.
 4. A disk cartridge according to any preceding claim, wherein the walls are semi-rigid, and when the urging means is in the second position, the spindle (68) applies a force through the urging means (124) to the second wall (30) to support the second wall (30) in a substantially flat configuration thereby preventing the second wall (30) from bowing towards the first wall (32).
 5. A disk cartridge according to claim 4, wherein the urging means (124) in the second position serves as a wear pad in engagement with the tip of the spindle (68) to protect the inner surface of the second wall (30) against contact by the spindle tip.
 6. A disk cartridge according to any of the preceding claims, wherein the urging means includes a spring (124) disposed between the second wall (30) and the disk (22) in alignment with the central aperture (48).
 7. A disk cartridge according to claim 6, wherein the spring is a circular generally dish shaped spring (124).
 8. A disk cartridge according to claim 7, wherein the spring includes a central section (134) which is aligned with and blocks the hub central aperture (48) when the spring (124) is in the first position, and central section being adapted to be engaged by the protruding spindle for displacing the spring to the second position.
 9. A disk cartridge according to claim 8, wherein the spring further includes an outer peripheral section (137), adapted to engage an inner surface of the second wall (30), the peripheral section (137) being joined to and surrounding the central section (134), the sections cooperating to define a generally concave surface facing the second wall (30) when the spring is in the first position, the concave surface being resiliently deformed when the spring is displaced to the second position such that the central section assumes a generally convex surface configuration facing the second wall.
 10. A disk cartridge according to claim 9, wherein the outer peripheral section (137) has a plurality of radially extending slots (130) symmetrically disposed about a central axis of the spring, the slots defining fingers (132) between the next adjacent slots, the fingers being adapted to have outer ends thereof in engagement with the second wall.
 11. A disk cartridge according to any of claims 8 to 10, wherein the central section is configured for oil-can type of spring action.
 12. A disk cartridge according to any of claims 7 to 11, wherein the disk has a circular hub (40), and wherein the access opening (54) in the first wall (32) is circular, the access opening having a diameter less than the diameter of the hub (40).

Patentansprüche

1. Disketten-Kassette (20) zur Benutzung in Verbindung mit einem Diskettenantrieb, der einen Rotor (63) mit einer Spindel (68) zur Drehung der Diskette aufweist, wobei die Kassette (20) folgende Teile aufweist: eine Diskette (22) mit einem auf ihr angeordneten Aufzeichnungsmedium (38) und mit einer Nabe (40) mit einer die Spindel aufnehmenden Mittelöffnung (48), durch die die Spindel (68) vorsteht, wenn die Nabe (40) in Eingriff mit dem Rotor steht, und mit einem Gehäuse, welches die Diskette umschließt und eine erste und eine zweite Wand (30, 32) auf gegenüberliegenden Seiten der Diskette aufweist, wobei die erste Wand (32) eine Zugriffsöffnung (54) aufweist, durch die der Rotor auf die Nabe (40) angreifen kann, wenn die Kassette betriebsmäßig im Diskettenantrieb angeordnet ist; und Mittel (124) innerhalb des Gehäuses, die in einer ersten Stellung an der Diskette (22) angreifen, wenn die Kassette nicht betriebsmäßig im Diskettenantrieb befindlich ist, um die Diskette (22) gegen



die erste Wand (32) so vorzuspannen, daß die Nabe (40) die Zugriffsöffnung (54) schließt und die Vorspannmittel die Mittelöffnung (48) schließen, um das Eindringen von Diskettenverunreinigungen durch diese Öffnungen zu verhindern, wobei die Vorspannmittel von einer ersten Stellung bei im Diskettenantrieb betriebsmäßig eingelegter Kassette in eine zweite Stellung versetzbar sind, in der die Vorspannmittel von der Diskette freikommen, damit sich die Diskette frei drehen kann, wobei die Vorspannmittel eine Kompressivkraft gegebener Größe auf die Diskette (22) ausüben, wenn die Vorspannmittel in der ersten Stellung befindlich sind, dadurch gekennzeichnet, daß die Vorspannmittel eine Kompressivkraft von weniger als der gegebenen Größe auf die vorstehende Spindel (68) ausüben, wenn die Spindel die Vorspannmittel in die zweite Stellung versetzt.

2. Disketten-Kassette nach Anspruch 1, bei welcher die Vorspannmittel von der Spindel erfaßt werden, um von der ersten in die zweite Stellung überführt zu werden.
3. Disketten-Kassette nach den Ansprüchen 1 oder 2, bei welcher die Vorspannmittel bei Freigabe von der Spindel automatisch von der zweiten Stellung in die erste Stellung zurückkehren.
4. Disketten-Kassette nach einem der vorhergehenden Ansprüche, bei welcher die Wände halbstarr ausgebildet sind und bei der die Spindel (68) eine Kraft über die Vorspannmittel (124) auf die zweite Wand (30) ausübt, wenn die Vorspannmittel in der zweiten Stellung befindlich sind, um die zweite Wand (30) im wesentlichen flach zu halten, wodurch verhindert wird, daß die zweite Wand (30) nach der ersten Wand (32) hin durchgebogen wird.
5. Disketten-Kassette nach Anspruch 4, bei welcher die Vorspannmittel (124) in der zweiten Stellung als Abnutzungskissen dienen, das sich in Eingriff mit der Spitze der Spindel (68) befindet, um die innere Oberfläche der zweiten Wand (30) gegen Berührung durch die Spitze der Spindel zu schützen.
6. Disketten-Kassette nach einem der vorhergehenden Ansprüche, bei welcher die Vorspannmittel aus einer Feder (124) bestehen, die zwischen der zweiten Wand (30) und der Diskette (22) ausgerichtet auf die Mittelöffnung (48) angeordnet ist.

7. Disketten-Kassette nach Anspruch 6, bei welcher die Feder als kreisförmige Tellerfeder (124) ausgebildet ist.

8. Disketten-Kassette nach Anspruch 7, bei welcher die Feder einen Mittelabschnitt (134) aufweist, der auf die Mittelöffnung (48) ausgerichtet ist und diese absperrt, wenn die Feder (124) in ihrer ersten Stellung befindlich ist, wobei der Mittelabschnitt dazu dient, von der vorstehenden Spindel erfaßt zu werden, um die Feder in die zweite Stellung zu überführen.

9. Disketten-Kassette nach Anspruch 8, bei welcher die Feder außerdem einen äußeren Umfangsabschnitt (137) aufweist, der an einer inneren Oberfläche der zweiten Wand (30) angreift, wobei der Umfangsabschnitt (137) mit dem Mittelabschnitt (134) verbunden ist und diesen umschließt, und der Umfangsabschnitt eine allgemein konkave Oberfläche definiert, die auf die zweite Wand (30) hin gerichtet ist, wenn die Feder in der ersten Stellung befindlich ist, wobei die konkave Oberfläche elastisch deformiert wird, wenn die Feder in die zweite Stellung überführt wird, so daß der Mittelabschnitt eine allgemein konvexe Gestalt annimmt, die auf die zweite Wand weist.

10. Disketten-Kassette nach Anspruch 9, bei welcher der äußere Umfangsabschnitt (137) mehrere radial verlaufende Schlitze (130) aufweist, die symmetrisch um eine Mittelachse der Feder herum angeordnet sind, und die Schlitze Finger (132) zwischen den nächst benachbarten Schlitzen definieren und die Finger äußere Enden aufweisen, die an der zweiten Wand angreifen.

11. Disketten-Kassette nach einem der Ansprüche 8 bis 10, bei welcher der Mittelabschnitt eine ölkannenartige Federwirkung (Schnappfeder) aufweist.

12. Disketten-Kassette nach den Ansprüchen 7 bis 11, bei welcher die Diskette eine kreisförmige Nabe (40) besitzt und die Zugriffsöffnung (54) in der ersten Wand (32) kreisförmig ist und einen Durchmesser aufweist, der kleiner ist als der Durchmesser der Nabe (40).

Revendications

1. Cartouche de disque (20) destinée à l'utilisation avec un dispositif d'enregistrement et/ou de lecture de disque possédant un rotor (63), comprenant un arbre rotatif (68), pour faire tourner un disque, la cartouche (20) compor-



- tant : un disque (22) possédant un support d'enregistrement (38) sur celui-ci et comprenant un moyeu (40) possédant une ouverture centrale de réception d'arbre rotatif (48) à travers laquelle fait saillie l'arbre rotatif (68) lorsque le moyeu (40) est engrené avec le rotor et un boîtier enfermant le disque et comportant des première et deuxième parois (30, 32) disposées sur les côtés opposés du disque, la première paroi (32) possédant une ouverture d'accès (54) à travers elle, offrant un accès au rotor pour qu'il s'engrène avec le moyeu (40) lorsque la cartouche est positionnée de façon opérationnelle dans le dispositif d'enregistrement et/ou de lecture de disque ; et des moyens (124), à l'intérieur du boîtier disposé dans une première position d'engrènement avec le disque (22) lorsque la cartouche n'est pas positionnée de façon opérationnelle dans le dispositif d'enregistrement et/ou de lecture de disque, pour pousser le disque (22) en direction de la première paroi (32), de telle sorte que le moyeu (40) ferme l'ouverture d'accès (54) et que les moyens de poussée ferment l'ouverture centrale (48) afin d'empêcher l'entrée de contaminants du disque à travers celle-ci, les moyens de poussée pouvant être déplacés de la première position par un arbre rotatif (68), lorsque la cartouche est positionnée de façon opérationnelle dans le dispositif d'enregistrement et/ou de lecture de disque, à une deuxième position dans laquelle les moyens de poussée sont désengrenés vis-à-vis du disque afin de libérer le disque pour permettre sa rotation, grâce à quoi les moyens de poussée appliquent une force de compression d'une valeur donnée au disque (22) lorsque les moyens de poussée sont dans la première position ; caractérisée en ce que les moyens de poussée appliquent une force de compression, d'une valeur inférieure à la valeur donnée, sur l'arbre rotatif saillant (68) lorsque l'arbre rotatif déplace les moyens de poussée dans la deuxième position.
2. Cartouche de disque selon la revendication 1, dans laquelle les moyens de poussée sont configurés de façon à venir en situation d'engrènement avec l'arbre rotatif pour être déplacés de la première à la deuxième position.
 3. Cartouche de disque selon la revendication 1 ou la revendication 2, dans laquelle les moyens de poussée sont configurés de façon à revenir automatiquement de la deuxième à la première position lors du désengrènement d'avec l'arbre rotatif.
 4. Cartouche de disque selon l'une quelconque des revendications précédentes, dans laquelle les parois sont semi-rigides, et, lorsque les moyens de poussée sont dans la deuxième position, l'arbre rotatif (68) applique une force, par l'intermédiaire des moyens de poussée (124), à la deuxième paroi (30), de façon à supporter la deuxième paroi (30) sous une configuration substantiellement plane, afin d'empêcher par conséquent la deuxième paroi (30) de s'incurver en direction de la première paroi (32).
 5. Cartouche de disque selon la revendication 4, dans laquelle les moyens de poussée (124) servent, dans la deuxième position, de tampon d'usure en engrènement avec l'extrémité de l'arbre rotatif (68) afin de protéger la surface intérieure de la deuxième paroi (30) contre le contact de l'extrémité de l'arbre rotatif.
 6. Cartouche de disque selon l'une quelconque des revendications précédentes, dans laquelle les moyens de poussée comprennent un ressort (124) disposé entre la deuxième paroi (30) et le disque (22), en alignement avec l'ouverture centrale (48).
 7. Cartouche de disque selon la revendication 6, dans laquelle le ressort est un ressort circulaire ayant une forme générale de cuvette (124).
 8. Cartouche de disque selon la revendication 7, dans laquelle le ressort comporte une section centrale (134) qui est alignée avec l'ouverture centrale (48) du moyeu et bloque celle-ci lorsque le ressort (124) est dans la première position, la section centrale étant adaptée par ailleurs pour s'engrèner avec l'arbre rotatif saillant de façon à déplacer le ressort dans la deuxième position.
 9. Cartouche de disque selon la revendication 8, dans laquelle le ressort comporte de plus une section périphérique extérieure (137), adaptée pour s'engrèner avec une surface intérieure de la deuxième paroi (30), la section périphérique (137) étant réunie à la section centrale (134) et entourant celle-ci, les sections coopérant afin de définir une surface globalement concave faisant face à la deuxième paroi (30) lorsque le ressort est dans la première position, la surface concave étant déformée élastiquement lorsque le ressort est déplacé dans la deuxième position de telle sorte que la section centrale adopte une configuration de surface globalement convexe faisant face à la deuxième paroi.



10. Cartouche de disque selon la revendication 9, dans laquelle la section périphérique extérieure (137) possède une pluralité d'encoches s'étendant radialement (130) disposées symétriquement autour d'un axe central du ressort, les encoches définissant des pattes (132) entre les encoches voisines qui se suivent, les pattes étant adaptées pour avoir leurs extrémités extérieures engrenées avec la deuxième paroi.

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11. Cartouche de disque selon l'une quelconque des revendications 8 à 10, dans laquelle la section centrale est configurée pour une action de ressort du type burette à huile.

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12. Cartouche de disque selon l'une quelconque des revendications 7 à 11, dans laquelle le disque possède un moyeu circulaire (40), et dans laquelle l'ouverture d'accès (54) dans la première paroi (32) est circulaire, l'ouverture d'accès ayant un diamètre inférieur au diamètre du moyeu (40).

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