Description

Background of the Invention

This invention relates to optical recording media, and in particular, to such media in which means are provided for protecting the surface of an optically recordable layer from scratches, dirt, oxidation or other forms of chemical attack, or the like, which could optically interfere with recording and playback operations.

Various materials, configurations and methods have been earlier proposed to protect optical recording media. For example, in U.S. Patent No. 4,037,251 (Bricot et al.) an optical recording medium is depicted in which a transparent protective layer is provided on top of a layer in which information, in the form of relief impressions, has already been formed. Not only must such a medium be formed in multiple steps, the last step being the application of the protective layer, but further, such a step must be performed after the medium is recorded upon, such as by a customer to whom recordable record blanks are provided, rather than allowing a protected record blank to be provided to begin with. Also, once the recordable layer is so protected, additional information cannot be readily recorded thereon, as is desirable with direct-read-after-write (DRAW) media, since the protective layer interferes with optical recording processes involving physical or chemical changes, to wit, ablation, gas evolution, bubble formation, etc.

In U.S. Patent No. 4,308,545 (Lehureau et al.) an optical record disc is depicted which would avoid some of the limitations noted above, since a protective cover is provided as an integral part of the blank record disc. Such a cover, purportedly made by inexpensively punching and shaping a metal sheet, provides an air gap between the inner surface of the cover and the surface of the light sensitive layer. Since the cover is metal, it is opaque and hence its use is restricted to an optical recording medium having a transparent substrate through which a record and/or playback light beam may pass.

In U.S. Patent No. 4,331,966 (Moe), an optical record disc is depicted in which glass protective layers and an outer annular ring are combined to enclose a base member having a recessed annulus within which an information storage region is positioned, which top protective layer thus forms a protected space over the information storage region and a circumferential gap is provided to avoid stresses due to differential expansion effects. The assembly depicted is complex and requires numerous precisely machined or punched components, while the incorporated glass members are subject to shock induced breakage.

A simpler protected optical recording medium is depicted in U.S. Patent No. 4,074,282 (Balas), wherein a disc shaped member having a radiation sensitive layer on one surface is maintained in a spaced relationship from a top protective transparent member via concentric sealing rings, which assembly fails to provide any protection against stress, differential expansion effect and the like.

Summary of the Invention

In contrast to the prior art structures discussed above, the present invention is a cover and optical recording medium and cover for use therewith which is simple in construction and which yet provides exceptional protection and stability for the enclosed optical recording medium. The medium with which the cover is adapted for use includes a disk-shaped substrate including a central aperture and outer periphery, and having an optically recordable coating on at least one major surface thereof extending at least between the aperture and the outer periphery. Preferably, the substrate of such a record medium is a substantially planar disc such as may be formed from a polymer such as polymethylmethacrylate (PMMA), glass, metals, such as aluminum, or fiber filled polymers. Such a substrate will be provided with an optically sensitive coating on one or both major surfaces.

In one aspect of this invention there is provided a cover and optical recording medium assembly said optical recording medium having a disk-shaped substrate including a central aperture and outer periphery and having an optically recordable coating on at least one major surface thereof extending at least between the central aperture and outer periphery, characterised by said cover comprising two substantially identical disk-like halves each of which is a single, integrally molded construction having a central aperture and outer periphery,

(a) the inner surface of each half including

(i) a first substantially planar annulus adjacent to the central aperture (24 or 26) thereof bonded to a like planar annulus on said substrate,

(ii) a second substantially planar annulus extending radially outward from said first annulus and off-set relative thereto, slightly spaced from a said substrate surface over an annular region on which a said optically recordable coating extends, said cover half in the region of said second annulus being formed of a material which is substantially transparent and has substantially no birefringent characteristics at the wavelength of the light to be used for subsequent recording and playback, thereby allowing a light beam having said wavelength to pass substantially unimpeded therethrough,

(iii) a third substantially planar annulus adjacent to said outer periphery for partially supporting said substrate upon assembly therewith, and a portion on

(iv) the outer periphery bonded to a corresponding member of an opposing half to thereby enclose the space between said substrate and said second annulus, and

(b) the outer surface of each half including a raised, substantially planar annulus adjacent to the central aperture thereof for supporting the assembly, thereby minimising contact with the

portion of the halves overlying the recordable coating to prevent scratches and the like which would otherwise interfere with subsequent optical recording and playback.

In another aspect of this invention there is provided a cover for use with an optical recording medium having a disk-shaped substrate (14) including a central aperture and outer periphery (18) and having an optically recordable coating on at least one major surface thereof extending at least between the central aperture and outer periphery, characterised by said cover comprising two substantially identical disk-like halves each of which is a single, integrally molded construction having a central aperture and outer periphery,

(a) the inner surface of each half including

(i) a first substantially planar annulus adjacent to the central aperture thereof for bonding to a like planar annulus on the substrate,

(ii) a second substantially planar annulus extending radially outward from said first annulus and off-set relative thereto, adapted to be slightly spaced from a said substrate surface over an annular region on which a said optically recordable coating extends, said cover half in the region of said second annulus being formed of a material which is substantially transparent and has substantially no birefringent characteristics at the wavelength of the light to be used for subsequent recording and playback, thereby allowing a light beam having said wavelength to pass substantially unimpeded therethrough,

(iii) a third substantially planar annulus adjacent to said outer periphery for partially supporting said substrate upon assembly therewith, and

(iv) a portion on the outer periphery adapted to be bonded to a corresponding member of an opposing half to thereby enclose the space between said substrate and said second annulus, and

(b) the outer surface of each half including a raised, substantially planar annulus adjacent to the central aperture thereof for supporting the cover halves when assembled with the recording medium, thereby minimising contact with the portion of the halves over-lying the recordable coating to prevent scratches and the like which would otherwise interfere with subsequent optical recording and playback.

Description of the Drawing

The drawing is a perspective view of a protected optical recording medium, cut away to show a cross section thereof.

Description of Preferred Embodiments

As shown in the drawing, the cover and recording medium assembly 10 encloses and thereby protects an optical recording medium 12 which comprises a substrate 14 having a central aperture 16 and an outer periphery 18. The substrate 14 further has an optical recording layer on one or both surfaces thereof (not shown). Such an optical recording medium 12 would typically comprise a reflector layer directly on the surface of the substrate, for example a layer of copper or silver, followed by a spacer layer, for example SiO_2 or an organic layer, and finally followed by a light-absorbing layer such as carbon. Numerous additional materials and alternative configurations are well known in the art. The substrate 14 may also consist of a variety of materials, including both metals and polymeric materials. Preferably, the substrate will be formed of a polymeric material such as polymethylmethacrylate (PMMA) or polycarbonate.

The cover initially, i.e., before assembly, is in the form of two substantially identical disk-like halves 20 and 22 respectively, and is preferably constructed of a polymeric, injection moldable, material having a low coefficient of optical birefringence. Polymeric materials suitable for such injection molding purposes would typically include PMMA and polycarbonate. As shown in Figure 1, each half of the cover extends laterally between an inner aperture 24 and 26 respectively to an outer periphery 27 and 29 respectively. The inner surface of each half, i.e., that surface which upon assembly will face a respective surface of the substrate 14 of the optical recording medium 12 enclosed therein includes, in a progression extending radially outward, the following regions:

A first substantially planar annulus 29 and 30, respectively, adjacent to the central apertures 24 and 26, which are adapted to be bonded to a like planar annulus on the substrate 14. Thus, for example, if both the substrate 14 and each respective cover half 20 and 22 are formed from a similar polymeric material such as PMMA, the respective elements may be solvent or heat fused together over that annular region.

The inner surface of each half of the cover next includes a second substantially planar annulus 32 and 34 respectively, which extends radially outward from the first annulus and is slightly off-set relative thereto, such that when the first annuluses 29 and 30 are bonded to the substrate 14 the second annuluses 32 and 34 will be slightly spaced from the substrate surface. It is within the region on the substrate encompassed by the second annuluses 32 and 34 that an optically recordable coating on the substrate will extend. To enable light to pass through the cover to enable recording or playback from the enclosed optical recording medium, it is necessary that at least that portion of each cover within the second annuluses 32 and 34 be formed of a substantially transparent material having substantially no birefringent characteristics in the infrared, that being the range of wavelengths desirably utilized during record and playback operations using a laser diode. In a preferred case, such a material will exhibit a birefringence of less than $\lambda/10$ in a single pass. Thus the remainder of each respective half of the cover outside of the second annuluses 32 and 34 may be constructed of a different material altogether, or may be formed of a similar polymeric material appropriately dyed or pigmented to intentionally obscure other por-

tions of the enclosed optical recording medium. It may also be preferred that each half of the cover be injection molded of a single polymeric material such as PMMA exhibiting a low degree of birefringence over the entire covers.

The inner surface of each half 20 and 22 of the cover next includes a third substantially planar annulus 36 and 38 respectively, each of which is substantially coplanar with the first respective annuluses 29 or 30, and is adapted to be substantially coplanar with the substrate 16 of an enclosed optical recording media. In one embodiment, the third annular regions 36 and 38 are desirably not to be bonded to the adjacent substrate surface, thereby enabling the presence of a minute gap between the assembled cover halves and the enclosed substrate 16. The combined members of each respective cover half and the enclosed substrate thus provide mutual support, and the gap allows limited independent movement of the peripheral portions of the substrate relative to the respective outer peripheral regions of the cover notwithstanding that the inner aperture regions of both are bonded together, to relieve stresses as could otherwise arise from differential expansion effects or the like.

Finally, each inner surface of each half 20 and 22 includes an outer annular portion 40, adjacent the outer periphery 27 and 28 respectively, which may extend beyond the periphery of the substrate 14. The outer portions 40 and 42 are adapted to be bonded to each other to thereby seal the substrate therebetween. In one embodiment, the outer portions 40 and 42 are dimensioned to extend beyond the outer periphery 18 of the substrate 14 to provide a circumferential gap 44 between the outer periphery of the substrate and the bonded portions 40 and 42 to allow slight radial expansion of the substrate as discussed above. In an alternative embodiment in which the third annular regions 36 and 38 are bonded to adjacent substrate surface upon assembly, the outer portions 40 and 42 may clearly be dimensioned to eliminate the gap 44.

Finally, as is further shown in Figure 1, the outer surface of each of the halves 20 and 22 of the cover include a raised, substantially planar annular portion 46 and 48 adjacent to the central apertures 24 and 26. Such an annular portion may be integrally molded with the remainder of each cover half. These raised portions provide support for the entire assembly while in use, thereby minimizing contact with the portion of the halves overlying the recordable coating, and further functions to prevent scratches and the like which would otherwise interfere with subsequent optical recording and playback operations.

In a typical embodiment, an optical recording medium to be enclosed within the cover halves described in conjunction with Figure 1 include a substrate having an outer diameter of approximately 300 mm, a central aperture of approximately 35 mm diameter and a thickness of approximately 1.2 mm. As the dimensions of each half of the cover are adapted as appropriate, depending on the dimensions of the optical recording medium to be enclosed therein, a matching cover would have an inner aperture approximately 68 mm in diameter, and an outer diameter of approximately 305.5 mm. The thickness of each cover half in the region extending between the inner surfaces 29 and 30 and the outer surfaces 46 and 48 respectively, is typically approximately 2.6 mm such that the total dimensions of the assembly, including a substrate of approximately 1.2 mm thickness, is approximately 6.4 mm.

The annular regions defined by the inner surfaces of the annulares 32 and 34 typically extend between an inner diameter of approximately 140 mm and an outer diameter of approximately 290 mm and are offset from the first regions 29 and 30 to provide an air gap between the recording medium and cover in the range of 0.1 to 1.0 mm, preferably extending between 0.2 and 0.6 mm. The thickness of each respective cover in the region of the second annulus is preferably in the range of 1.2—1.5 mm, but may be as thin as 0.5 mm and as thick as 5.0 mm the assembled cover halves together with an enclosed substrate is preferably in the range of 4.05 ± 0.2 mm.

Finally, the dimensions of each cover half in the region of the third annulus 36 or 38 extend between an inner diameter of approximately 290 mm and an outer diameter of approximately 302 mm. The third annular region is desirably unbonded from the substrate, and partially supports the substrate in the outer peripheral regions, a small circumferential gap 44 is desirably left between the outer peripheral edge of the substrate and the inner surface of the contacted halves. Each cover half extends beyond the edge of the substrate and terminates with a peripheral portion 27 or 28 adapted to be bonded to the respective matching portion on the opposite half to seal therebetween the substrate.

In one embodiment, each respective cover half may be constructed of a polymeric material such that the respective halves may be bonded at the outer peripheral portion 27 and 28 via thermal fusion techniques. Similarly, a layer of adhesive may be provided at that interface 40 and if desired, the thickness of such an adhesive layer may be tailored together with the extent of off-set between the third annuluses 36 and 38 and interface 40 such that the desired minute separation between the surfaces of the substrate and the inner surfaces 36 and 38 is automatically provided.

The cover has been determined to be particularly desirable as the added strength and rigidity of the two bonded cover halves results in an appreciably stiffer cover, thereby improving the total indicated runout (TIR), i.e., the extent of vertical deflection of the cover and disk assembly when rotated about its axis, such as would occur during record and playback operations. This reduction in TIR further makes possible the use of cheaper polymeric substrates, rather than more expensive substrates of metals such as

aluminum. The cover also protects the enclosed recordable medium against accumulated dust and debris which may interfere with subsequent reading and writing operations and also offers environmental protection to enable archivable lifetimes of the disk assembly in excess of approximately ten years, while not resulting in any appreciable loss of sensitivity. Rather, the raised air gap in the portions of the cover overlying the recordable area on the substrate provides thermal isolation over the optical recording medium, resulting in a more effective concentration of a laser beam utilized during writing operations into the recordable information site. Furthermore, the remoteness of the cover from the surface of the recordable layer eliminates any possible mechanical inhibition which would effect the formation of the pit or bubble of recorded information.

In the region of the first annulus 29 and 30, each cover half is desirably constructed to have chemical and physical properties similar to those of an accompanying substrate, thereby enabling the covers to be directly bonded to the substrate near the inner diameters of each respective member. As the covers are preferably bonded to each other at their outer periphery, in that region compatibility between the cover halves themselves is only necessary.

As noted above, the amount of adhesive at the interface of the outer periphery of each cover half may be utilized to control the dimension of the minute separation between the inner surfaces of each respective cover half and the outer periphery of the substrate. Such a separation thus relieves strain due to inequalities of thermal expansion and warping due to other stress factors which are more pronounced near the respective perimeters while the radial clearance of each respective cover half outside the outer periphery of the substrate allows room for expansion or contraction of the substrate relative to the cover. These controlled gaps also assist in preventing the introduction of high frequency ripple onto the surface of the recording media, thereby making tracking by a focus servo system utilized during playback operations much more readily achieved.

In order to maximize the bond strength between the respective members, it is desirable to provide a cohesive bond of polymer to polymer rather than with an intervening substrate. Therefore, the peripheral bond between the respective cover halves is further preferred to be made beyond the perimeter of the substrate. This also eliminates process steps common in prior art assemblies, which require masking off of the outside edge of the substrate to enable bonding of the outer perimeters of the cover halves and substrates together.

In forming the overall assembly, each respective cover half is typically injection molded or cast from PMMA or a similar moldable, low birefringence material. A suitable adhesive is then applied in the region at the outer periphery of each respective cover half. One cover half is then placed with the adhesive side up on a concentric locating fixture. A pretested substrate with a recordable layer on one or both sides thereof is then placed atop the lower cover half using the same fixture, and the second cover half is then keyed with the concentric locating fixture to the substrate and the lower cover half. The members are then clamped until a bond is appropriately formed. During subsequent read and write operations, it has been found desirable to provide for the locating hub of the drive assembly to clamp either to the raised inner peripheries of the assembled cover or onto the substrate itself.

A number of variations in the types of adhesives used to bond the respective cover halves together have been identified. Thus for example, depending on the material utilized for each respective cover half, solvents such as methylene chloride or monomers such as methylmethacrylate or acrylic acid may desirably be utilized to provide a high strength chemical bond. The latter monomers have been found to provide the best bond strength and weather resistance. Similarly, monomer and polymer blends together with appropriate catalysts as well as conventional epoxies have been found to be quite suitable. Similarly, where subsequent disassembly of the respective cover halves is desired, thermoplastic adhesives are also desirably utilized, such that subsequent heating operations may be utilized to free the respective cover halves. Pressure sensitive acrylic adhesives are also desirably utilized. As is well known to those skilled in the art, the various adhesives selected for use in the bonding operation may be applied by a variety of techniques including the application via a syringe, and transfer or screen printing via the use of tape preforms and via spray coatings.

The benefits obtained with the cover of the present invention in improving the total vertical run out of the resultant assembly is particularly evident in measurements of the vertical displacement of the assembly, utilizing a conventional capacitive probe technique. Thus, for example, it has been determined that a total indicated run out in the vertical direction with a typical assembly turning at a rotational rate of 1800 rpm, is in the range of 165 micrometers at the outer radius of the disk. In contrast, prior art optical recording disks having protective covers as taught in the prior art have been observed to typically exhibit a total vertical indicated runout when measured under the same conditions several times higher. For example, when a number of such competitive disks were measured, nearly forty percent exceeded an arbitrarily allowable limit of total indicated runout of 400 micrometers, while 75 percent of such disks exceeded the 165 micrometer TIR typically obtained with the assembly of the present invention.

Claims

1. A cover (10) and optical recording medium assembly (12) said optical recording medium (12)

aluminum. The cover also protects the enclosed recordable medium against accumulated dust and debris which may interfere with subsequent reading and writing operations and also offers environmental protection to enable archivable lifetimes of the disk assembly in excess of approximately ten years, while not resulting in any appreciable loss of sensitivity. Rather, the raised air gap in the portions of the cover overlying the recordable area on the substrate provides thermal isolation over the optical recording medium, resulting in a more effective concentration of a laser beam utilized during writing operations into the recordable information site. Furthermore, the remoteness of the cover from the surface of the recordable layer eliminates any possible mechanical inhibition which would effect the formation of the pit or bubble of recorded information.

In the region of the first annulus 29 and 30, each cover half is desirably constructed to have chemical and physical properties similar to those of an accompanying substrate, thereby enabling the covers to be directly bonded to the substrate near the inner diameters of each respective member. As the covers are preferably bonded to each other at their outer periphery, in that region compatibility between the cover halves themselves is only necessary.

As noted above, the amount of adhesive at the interface of the outer periphery of each cover half may be utilized to control the dimension of the minute separation between the inner surfaces of each respective cover half and the outer periphery of the substrate. Such a separation thus relieves strain due to inequalities of thermal expansion and warping due to other stress factors which are more pronounced near the respective perimeters while the radial clearance of each respective cover half outside the outer periphery of the substrate allows room for expansion or contraction of the substrate relative to the cover. These controlled gaps also assist in preventing the introduction of high frequency ripple onto the surface of the recording media, thereby making tracking by a focus servo system utilized during playback operations much more readily achieved.

In order to maximize the bond strength between the respective members, it is desirable to provide a cohesive bond of polymer to polymer rather than with an intervening substrate. Therefore, the peripheral bond between the respective cover halves is further preferred to be made beyond the perimeter of the substrate. This also eliminates process steps common in prior art assemblies, which require masking off of the outside edge of the substrate to enable bonding of the outer perimeters of the cover halves and substrates together.

In forming the overall assembly, each respective cover half is typically injection molded or cast from PMMA or a similar moldable, low birefringence material. A suitable adhesive is then applied in the region at the outer periphery of each respective cover half. One cover half is then placed with the adhesive side up on a concentric locating fixture. A pretested substrate with a recordable layer on one or both sides thereof is then placed atop the lower cover half using the same fixture, and the second cover half is then keyed with the concentric locating fixture to the substrate and the lower cover half. The members are then clamped until a bond is appropriately formed. During subsequent read and write operations, it has been found desirable to provide for the locating hub of the drive assembly to clamp either to the raised inner peripheries of the assembled cover or onto the substrate itself.

A number of variations in the types of adhesives used to bond the respective cover halves together have been identified. Thus for example, depending on the material utilized for each respective cover half, solvents such as methylene chloride or monomers such as methylmethacrylate or acrylic acid may desirably be utilized to provide a high strength chemical bond. The latter monomers have been found to provide the best bond strength and weather resistance. Similarly, monomer and polymer blends together with appropriate catalysts as well as conventional epoxies have been found to be quite suitable. Similarly, where subsequent disassembly of the respective cover halves is desired, thermoplastic adhesives are also desirably utilized, such that subsequent heating operations may be utilized to free the respective cover halves. Pressure sensitive acrylic adhesives are also desirably utilized. As is well known to those skilled in the art, the various adhesives selected for use in the bonding operation may be applied by a variety of techniques including the application via a syringe, and transfer or screen printing via the use of tape preforms and via spray coatings.

The benefits obtained with the cover of the present invention in improving the total vertical run out of the resultant assembly is particularly evident in measurements of the vertical displacement of the assembly, utilizing a conventional capacitive probe technique. Thus, for example, it has been determined that a total indicated run out in the vertical direction with a typical assembly turning at a rotational rate of 1800 rpm, is in the range of 165 micrometers at the outer radius of the disk. In contrast, prior art optical recording disks having protective covers as taught in the prior art have been observed to typically exhibit a total vertical indicated runout when measured under the same conditions several times higher. For example, when a number of such competitive disks were measured, nearly forty percent exceeded an arbitrarily allowable limit of total indicated runout of 400 micrometers, while 75 percent of such disks exceeded the 165 micrometer TIR typically obtained with the assembly of the present invention.

Claims

1. A cover (10) and optical recording medium assembly (12) said optical recording medium (12)

* C L M S *

(15)

having a disk-shaped substrate (14) including a central aperture (16) and outer periphery (18) and having an optically recordable coating on at least one major surface thereof extending at least between the central aperture and outer periphery, characterised by said cover comprising two substantially identical disk-like halves (20 and 22) each of which is a single, integrally molded construction having a central aperture (24 and 26) and outer periphery (27 and 28).

(a) the inner surface of each half including

(i) a first substantially planar annulus (29 and 30) adjacent to the central aperture (24 or 26) thereof bonded to a like planar annulus on said substrate,

(ii) a second substantially planar annulus (32 and 34) extending radially outward from said first annulus and off-set relative thereto, slightly spaced from a said substrate surface over an annular region on which a said optically recordable coating extends, said cover half in the region of said second annulus (32 or 34) being formed of a material which is substantially transparent and has substantially no birefringent characteristics at the wavelength of the light to be used for subsequent recording and playback, thereby allowing a light beam having said wavelength to pass substantially unimpeded therethrough,

(iii) a third substantially planar annulus (36 and 38) adjacent to said outer periphery for partially supporting said substrate upon assembly therewith, and

(iv) a portion (40) on the outer periphery bonded to a corresponding member of an opposing half to thereby enclose the space between said substrate and said second annulus, and

(b) the outer surface of each half including a raised, substantially planar annulus (46 and 48) adjacent to the central aperture thereof for supporting the assembly, thereby minimising contact with the portion of the halves overlying the recordable coating to prevent scratches and the like which would otherwise interfere with subsequent optical recording and playback.

2. An assembly according to claim 1, wherein each cover half (20, 22) in the region of said second annulus (32, 34) is formed of polymethylmethacrylate or polycarbonate.

3. An assembly according to claim 1 or 2, wherein said halves of the cover (20, 22) and said substrate (14) of the optical recording medium enclosed therein are formed of materials having substantially the same coefficients of expansion and wherein the inner surface of each half of the cover in the region of the third planar annulus (36, 38) is bonded to a matching outer peripheral surface of the substrate.

4. An assembly according to any preceding claim, wherein the inner surface of each half of the cover (20, 22) in the region of the third planar annulus (36, 38) is adapted to provide a minute gap between and to partially support said substrate upon assembly therewith, while allowing independent movement of the respective peripheral regions, and wherein the inner surface of each outer peripheral portion of each half of the cover is dimensioned to provide upon assembly a circumferential gap (44) between the outer periphery of the enclosed substrate and the inside surface of the mated halves to allow radial expansion of the substrate relative to the cover assembly.

5. An assembly according to any preceding claim, further comprising means for bonding the inner surface of each disk half (20, 22) in the region of said first annulus (29, 30) to said substrate and for bonding the inner surfaces in the region of said outer peripheral portions (40) to each other.

6. An assembly according to claim 5, when appended to claim 4, wherein said outer peripheral portions (40) include a substantially planar section parallel to said third annulus and off-set relative thereto an amount approximately one-half the thickness of said substrate enclosed therein, and wherein the means for bonding said outer peripheral portions together comprises a layer of organic adhesive on said planar sections, the thickness of which is sufficient to slightly separate said outer peripheral portions, thereby defining the minute gap between the third annulus and substrate.

7. A cover (10) for use with an optical recording medium (12) having a disk-shaped substrate (14) including a central aperture (16) and outer periphery (18) and having an optically recordable coating on at least one major surface thereof extending at least between the central aperture and outer periphery, characterised by said cover (10) comprising two substantially identical disk-like halves (20 and 22) each of which is a single, integrally molded construction having a central aperture (24 and 26) and outer periphery (27 and 28),

(a) the inner surface of each half including

(i) a first substantially planar annulus (29 and 30) adjacent to the central aperture (24 or 26) thereof for bonding to a like planar annulus on the substrate,

(ii) a second substantially planar annulus (32 and 34) extending radially outward from said first annulus and off-set relative thereto, adapted to be slightly spaced from a said substrate surface over an annular region on which a said optically recordable coating extends, said cover half in the region of said second annulus (32 or 34) being formed of a material which is substantially transparent and has substantially no birefringent characteristics at the wavelength of the light to be used for subsequent recording and playback, thereby allowing a light beam having said wavelength to pass substantially unimpeded therethrough,

(iii) a third substantially planar annulus (36 and 38) adjacent to said outer periphery for partially supporting said substrate upon assembly therewith, and

(iv) a portion (40) on the outer periphery adapted to be bonded to a corresponding

* C L M S *

member of an opposing half to thereby enclose the space between said substrate and said second annulus, and

(b) the outer surface of each half including a raised, substantially planar annulus (46 and 48) adjacent to the central aperture thereof for supporting the cover halves when assembled with the recording medium, thereby minimising contact with the portion of the halves overlying the recordable coating to prevent scratches and the like which would otherwise interfere with subsequent optical recording and playback.

8. A cover according to claim 7, wherein each cover half (20, 22) in the region of said second annulus (32, 34) is formed of polymethylmethacrylate or polycarbonate.

9. A cover according to claim 7 or 8, further comprising means for bonding the inner surface of each half (20, 22) in the region of said first annulus (29, 30) to the substrate and for bonding the inner surfaces in the region of said outer peripheral portions (40) to each other.

Patentansprüche

1. Anordnung mit einer Hülle (10) und einem optischen Aufzeichnungsträger (12), der ein scheibenförmiges Substrat (14) mit einer zentralen Ausnehmung (16) und einem Außenumfang (18) besitzt, sowie auf mindestens einer Hauptfläche des Substrats einen für optische Aufzeichnungen geeigneten Überzug, der sich mindestens zwischen der zentralen Ausnehmung und dem Außenumfang erstreckt, dadurch gekennzeichnet, daß die Hülle zwei im wesentlichen identische scheibenförmige Hälften (20 und 22) besitzt, von denen jede aus einem einzigen, einstückig formgepreßten Gebilde mit einer zentralen Ausnehmung (24 und 26) und einem Außenumfang (27 und 28) besteht,

(a) wobei die Innenfläche jeder Hälfte umfaßt:

(i) eine im Bereich der zentralen Ausnehmung (24 oder 26) angeordnete, erste im wesentlichen ebene Ringfläche (29 und 30), die stoffschlüssig mit einer ähnlichen ebenen Ringfläche auf dem Substrat verbunden ist,

(ii) eine radial auswärts von der ersten Ringfläche angeordnete und ihr gegenüber versetzte zweite im wesentlichen ebene Ringfläche (32 und 24), die in einem ringförmigen Bereich, auf dem sich der für optische Aufzeichnungen geeignete Überzug erstreckt, in geringem Abstand von einer Fläche des Substrats angeordnet ist, und die Hüllenhälfte im Bereich der zweiten Ringfläche (32 oder 34) aus einem im wesentlichen durchsichtigen Werkstoff besteht, der bei der Wellenlänge des für die spätere Aufzeichnung und Wiedergabe verwendeten Lichtes im wesentlichen keine Doppelbrecheigenschaften besitzt, so daß ein Lichtstrahl mit der genannten Wellenlänge im wesentlichen ungeschwächt hindurchtreten kann,

(iii) eine im bereich des Außenumfangs angeordnete, dritte im wesentlichen ebene Ringfläche (36 und 38) zum teilweisen Abstützen des Substrats nach dem Zusammensetzen damit und

(iv) einen an Außenumfang vorgesehenen Teil, der zum Einschließen des Zwischenraums zwischen dem Substrat und der zweiten Ringfläche mit einem entsprechenden Teil einer gegenüberliegenden Hälfte verbunden ist, und

(b) die Außenfläche jeder Hälfte im Bereich der zentralen Ausnehmung eine im wesentlichen ebene, erhabene Ringfläche Ringfläche (46 und 48) zum Abstützen der Anordnung besitzt, so daß die Berührung mit dem über der für Aufzeichnungen geeigneten Überzug liegenden Teil der Hälften auf ein Minimum herabgesetzt wird und Kratzer und dergleichen verhindert werden, die sonst beim späteren Aufzeichnen und Wiedergabe stören würden.

2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß jede Hüllenhälfte (20, 22) im Bereich der zweiten Ringfläche (32, 34) aus Polymethylmethacrylat oder Polycarbonat besteht.

3. Anordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Hüllenhälften (20, 22) und das darin eingeschlossene Substrat (14) des optischen Aufzeichnungsträgers aus Werkstoffen bestehen, die im wesentlichen gleiche Wärmeausdehnungskoeffizienten haben, und daß die Innenfläche jeder Hüllenhälfte im Bereich der dritten ebenen Ringfläche (36, 38) stoffschlüssig mit einer dazu komplementären Außenumfangsfläche des Substrats verbunden ist.

4. Anordnung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Innenfläche jeder Hüllenhälfte (20, 22) im Bereich der dritten ebenen Ringfläche (36, 38) geeignet ist, nach dem Zusammensetzen mit dem Substrat mit diesem einen winzigen Spalt zu bilden und das Substrat teilweise abzustützen, aber voneinander unabhängige Bewegungen der entsprechenden Umfangsbereiche zu gestatten, und daß die Innenfläche jedes Außenumfangsteils der Hüllenhälfte so bemessen ist, daß nach dem Zusammensetzen der Anordnung zwischen dem Außenumfang des umschlossenen Substrats und der Innenfläche der passend zusammengefügten Hälften ein Umfangsspalt (44) vorhanden ist, der eine radiale Ausdehnung des Substrats gegenüber der Hüllenanordnung gestattet.

5. Anordnung nach einem der vorhergehenden Ansprüche mit Mitteln zum stoffschlüssigen Verbinden der Innenfläche jeder Scheibenhälfte (20, 22) im Bereich der ersten Ringfläche (29, 30) mit dem Substrat und zum stoffschlüssigen Verbinden der Innenflächen im Bereich der Außenumfangsteile (40) miteinander.

6. Anordnung nach Anspruch 5, soweit er auf Anspruch 4 rückbezogen ist, dadurch gekennzeichnet, daß die Außenumfangsteile (40) einen im wesentlichen ebenen Bereich besitzen, der zu der dritten Ringfläche parallel und ihr gegenüber um etwa die Hälfte der Dicke des darin eingeschlossenen Substrats versetzt ist, und daß die Mittel zum stoffschlüssigen Verbinden der Außenumfangsteile miteinander mindestens teilweise aus einer auf den genannten ebenen Bereichen befindlichen, aus einem organischen Lebstoff bestehenden Schicht bestehen, die so dick ist, daß

* C L M S *

sie zur Bildung des winzigen Spaltes zwischen der dritten Ringfläche und dem Substrat die Außenumfangsteile in einem geringen Abstand voneinander hält.

7. Hülle (10) für einen optischen Aufzeichnungsträger (12), der ein scheibenförmiges Substrat (14) mit einer zentralen Ausnehmung (16) und einem Außenumfang (18) besitzt, sowie auf mindestens einer Hauptfläche des Substrats einen für optische Aufzeichnungen geeigneten Überzug, der sich mindestens zwischen der zentralen Ausnehmung und dem Außenumfang erstreckt, dadurch gekennzeichnet, daß die Hülle zwei im wesentlichen identische scheibenförmige Hälften (20 und 22) besitzt, von denen jede aus einem einzigen, einstückig formgepreßten Gebilde mit einer zentralen Ausnehmung (24 und 26) und einem Außenumfang (27 und 28) besteht,

(a) wobei die Innenfläche jeder Hälfte umfaßt:

(i) eine im Bereich der zentralen Ausnehmung (24 oder 26) angeordnete erste im wesentlichen ebene Ringfläche (29 und 30), die stoffschlüssig mit einer ähnlichen ebenen Ringfläche auf dem Substrat,

(ii) eine radial auswärts von der ersten Ringfläche angeordnete und ihr gegenüber versetzte zweite im wesentlichen ebene Ringfläche (32 und 34), die in einem ringförmigen Bereich, auf dem sich der für optische Aufzeichnungen geeignete Überzug erstreckt, in geringem Abstand von einer Fläche des Substats anbeordnet werden kann und die Hüllenhälfte im Bereich der zweiten Ringfläche (32 oder 34) aus einem im wesentlichen durchsichtigen Werkstoff besteht, der bei der Wellenlänge des für die spätere Aufzeichnung und Wiedergabe verwendeten Lichtes im wesentlichen keine Doppelbrecheigenschaften besitzt, so daß ein Lichtstrahl mit der genannten Wellenlänge im wesentlichen ungeschwächt hindurchtreten kann,

(iii) eine im Bereich des Außenumfangs angeordnete, dritte im wesentlichen ebene Ringfläche (36 und 38) zum teilweisen Abstützen des Substrats nach dem Zusammensetzen damit und

(iv) einen am Außenumfang vorgesehenen Teil, der zum Einschließen des Zwischenraums zwischen dem Substrat und der zweiten Ringfläche, mit einem entsprechenden Teil einer gegenüberliegenden Hälfte verbunden ist, und

(b) die Außenfläche jeder Hälfte im Bereich der zentralen Ausnehmung eine im wesentlichen ebene, erhabene Ringfläche (46 und 48) zum Abstützen der Anordnung besitzt, so daß die Berührung mit dem über dem für Aufzeichnungen geeigneten Überzug liegenden Teil der Hälften auf ein Minimum herabgesetzt wird und Kratzer und dergleichen verhindert werden, die sonst beim späteren Aufzeichnen und Wiedergabe stören würden.

8. Hülle nach Anspruch 7, dadurch gekennzeichnet, daß jede Hüllenhälfte (20, 22) im Bereich der zweiten Ringfläche (32, 34) aus Polymethylmethacrylat oder Polycarbonat besteht.

9. Hülle nach Anspruch 7 oder 8, mit Mitteln zum stoffschlüssigen Verbinden der Innenfläche jeder Scheibenhälfte (20, 22) im Bereich der ersten Ringfläche (29, 30) mit dem Substrat und zum stoffschlüssigen Verbinden der Innenflächen im Bereich der Außenumfangsteile (40) miteinander.

Revendications

1. Assemblage de housse ou gaine (10) et de support d'enregistrement optique (12), ledit support d'enregistrement optique (12) comprenant un substrat en forme de disque (14) qui présente un trou central (16) et une périphérie extérieure (18) et qui comporte un revêtement optiquement enregistrable sur au moins une de ses surfaces principales s'étendant au moins entre le trou central et la périphérie extérieure, caractérisé en ce que ladite gaine comprend deux moities sensiblement identiques en forme de disque (20 et 22) dont chacune est une structure moulée monobloc unique comportant un trou central (24 et 26) et une périphérie extérieure (27 et 28),

(a) la surface intérieure de chaque moitié comprenant:

(i) un premier anneau sensiblement plan (29 et 30), adjacent à son trou central (24 et 26) et lié à un anneau plan semblable sur ledit substrat,

(ii) un deuxième anneau sensiblement plan (32 et 34), s'étendant radialement vers l'extérieur à partir du dit premier anneau et décale par rapport à ce dernier, légèrement espacé d'une dite surface de substrat au-dessus d'une région annulaire sur laquelle s'étend un dit revêtement optiquement enregistrable, ladite moitié de gaine dans la région dudit deuxième anneau (32 ou 34) étant fabriquée en une matière qui est sensiblement transparente et ne possède sensiblement pas de caractéristiques de biréfringence à la longueur d'onde de la lumière à utiliser pour l'enregistrement et la lecture ultérieure, ce qui permet à un faisceau de lumière ayant ladite longueur d'onde de la traverser sensiblement librement,

(iii) un troisième anneau sensiblement plan (36 et 38), adjacent à ladite périphérie extérieure, pour supporter partiellement ledit substrat lors de l'assemblage avec celui-ci, et,

(iv) une partie (40) sur la périphérie extérieure, liée à une partie correspondante d'une moitié opposée de manière à entourer l'espace compris entre ledit substrat et ledit deuxième anneau, et

b) la surface extérieure de chaque moitié comprenant un anneau surélevé sensiblement plan (46 et 48), adjacent à son trou central, pour supporter l'assemblage de façon à minimiser le contact avec la partie des demi-gaines située au-desus du revêtement enregistrable afin d'éviter les égratignures et autres qui gêneraient sans cela l'enregistrement et la lecture optiques subséquents.

2. Assemblage suivant la revendication 1, dans lequel chaque demi-gaine (20, 22) dans la région dudit deuxième anneau (32, 34) est réalisée en polyméthylméthacrylate ou en polycarbonate.

3. Assemblage suivant la revendication 1 ou 2, dans lequel lesdites demi-gaines (20, 22) et ledit

* C L M S *

substrat (14) du dupport d'enregistrement optique contenu à l'intérieur sont fabriqués en matières ayant sensiblement les mêmes coefficients de dilatation, et dans lequel la surface intérieure de chaque demi-gaine dans la région du troisième anneau plan (36, 38) est liée à une surface périphérique extérieure correspondante du substrat.

4. Assemblage suivant l'une quelconque des revendications précédentes, dans lequel la surface intérieure de chaque moitié de la gaine (20, 22) dans la région du troisième anneau plan (36, 38) est prévue pour définir un petit intervalle et pour supporter partiellement ledit substrat après assemblage avec celui-ci, tout en permettant un mouvement indépendant des régions périphériques respectives, et dans lequel la surface intérieure de chaque partie périphérique extérieure de chaque moitié de la gaine est dimensionnée pour définir, lors de l'assemblage, un intervalle circonférentiel (44) entre la périphérie extérieure du substrat contenu dans la gaine et la surface intérieure des demi-gaines accouplées, de manière à permettre une dilatation radiale du substrat par rapport à l'assemblage de la gaine.

5. Assemblage suivant l'une quelconque des revendications précédentes, comprenant en outre des moyens de liaison de la surface intérieure de chaque demi-disque (20, 22), dans la région dudit premier anneau (29, 30), audit substrat et de liaison des surfaces intérieures l'une à l'autre dans la région des dites parties périphériques extérieures (40).

6. Assemblage suivant la revendication 5, lorsqu'elle dépend de la revendication 4, dans lequel lesdites parties périphériques extérieures (40) comprennent une région sensiblement plane, parallèle audit troisième anneau et décalée par rapport à celui-ci d'une valeur correspondant sensiblement à la moitié de l'épaisseur dudit substrat contenu à l'intérieur, et dans lequel les moyens de liaison desdites parties périphériques extérieures l'une à l'autre comprennent une couche d'adhésif organique sur lesdites régions planes, l'épaisseur de cette couche étant suffisante pour séparer légèrement lesdites parties périphériques extérieures de manière à définir le petit intervalle entre le troisième anneau et le substrat.

7. Gaine (10) utilisable avec un support d'enregistrement optique (12) comprenant un substrat en forme de disque (14) qui présente un trou central (16) et une périphérie extérieure (18) et qui comporte un revêtement optiquement enregistrable sur au moins une de ses surfaces principales s'étendant au moins entre le trou central et la périphérie extérieure, caractérisée en ce que ladite gaine (10) comprend deux moitiés sensiblement identiques en forme de disque (20 et 22) dont chacune est une structure moulée monobloc unique présentant un trou central (24 et 26) et une périphérie extérieure (27 et 28),

(a) la surface intérieure de chaque moitié comprenant:

(i) un premier anneau sensiblement plan (29 et 30); adjacent à son trou central (24 et 26), pour la liaison à un anneau plan semblable sur le substrat,

(ii) un deuxième anneau sensiblement plan (32 et 34), s'étendant radialement vers l'extérieur à partir dudit premier anneau et décale par rapport à celui-ci, prévu pour être légèrement espacé d'une dite surface de substrat au-dessus d'une région annulaire sur laquelle s'étend un dit revêtement optiquement enregistrable, ladite demi-gaine dans la région dudit deuxième anneau (32 ou 34) étant en une matière qui est sensiblement transparente et n'a sensiblement pas de caractéristiques de biréfringence à la longueur d'onde de la lumière à utiliser pour l'enregistrement et la lecture subséquents, ce qui permet à un faisceau de lumière ayant ladite longueur d'onde de la traverser sensiblement librement,

(iii) un troisième anneau sensiblement plan (36 et 38) adjacent à la dite périphérie extérieure pour supporter partiellement ledit substrat lors de l'assemblage avec celui-ci,

(iv) une partie (40) sur la périphérie extérieure, prévue pour être liée à une partie correspondante d'une moitié opposée, de manière à entourer l'espace compris entre ledit substrat et ledit deuxième anneau, et

(b) la surface extéterieure de chaque moitié comprenant un anneau surélevé sensiblement plan (46 et 48), adjacent à son trou central, pour supporter les demi-gaines lorsq'elles sont assemblées avec le support d'enregistrement, de manière à minimiser le contact avec la partie des demi-gaines située au-dessus du revêtement, afin d'éviter les égratignures et autres défauts qui gêneraient sans cela l'enregistrement et la lecture optiques subséquents.

8. Gaine suivant la revendication 7, dans laquelle chaque moitié de gaine (20, 22) dans la région dudit deuxième anneau (32, 34) est réalisée en polyméthylméthacrylate ou en polycarbonate.

9. Gaine suivant la revendication 7 ou 8, comprenant en outre des moyens pour lier la surface intérieure de chaque demi-gaine (20, 22) dans la région dudit premier anneau (29, 30) au substrat et pour lier les surfaces intérieures dans la région desdites parties périphériques extérieures (40) l'une à l'autre.

* C L M S *