## Description

The invention relates to an optically readable storage disc comprising an optical quality transparent substrate, a recording layer on the substrate, which layer can be modified locally by means of a radiation beam focussed on the layer through the substrate, and a cover disc which is secured to the substrate in a substantially gas-tight manner at some distance from at least that part of the recording layer which is intended for recording, so that a sealed space is enclosed between the substrate and the cover disc, which cover disc is formed as a shallow tray comprising first portions for connection to the substrate, which first portions are disposed in a first plane, and second portions, for covering the sealed space, which second portions are disposed substantially in a second plane at some distance from and parallel to the first plane.

A sealed storage disc is known, for example from US—A—4,074,282, in which the storage disc comprises a plurality of first discs which are spaced from each other by concentric annular spacers glued between them near a central aperture and near the circumference of the storage disc. In practice a storage disc which comprises two glass substrates between which two concentric annular spacers are glued has been used most frequently until now. Each of the glass substrates is provided with a recording layer on the side which faces the sealed space. Thus, a double-sided disc is obtained and the one substrate serves as a cover disc for the other substrate.

The gas-tight sealing of the enclosed space of this known storage disc is necessary for two reasons. First, the recording layer is formed by vacuum-deposition of a tellurium alloy on the glass substrate. During recording a laser beam forms pits in the tellurium layer by local melting. Environmentally less desirable gaseous by-products are then released. The sealed space then functions as a space in which these gaseous by-products are trapped. Second, it is desirable to protect the tellurium layer against atmospheric influences, in particular against moisture in combination with oxygen, because oxydization of the tellurium layer would occur, which would impair the readability of the recorded information. The presence of a gas-tight sealed space is therefore essential. However, this sealed space is also a source of problems. In particular, the deformation of the storage disc under the influence of changes in the barometric pressure. Said known storage discs have a diameter of approximately 30 cm and although they comprise glass substrates of some millimetres thickness they may be deformed to an undesired extent. Such deformations may impair the recording and reading process and they may also load the critical layers of glue between the substrates and the annular spacers.

A storage disc of the kind mentioned in the opening paragraph is known from NL—A—7 900 205. This known disc is similar to the disc known from the previously cited US—A—4,074,282 except that, instead of using separate spacer rings, the spacer rings are now integrated with the cover disc, resulting in the shallow tray shape of the cover disc.

It is an object of the invention to provide an optically readable storage disc of the type mentioned in the opening paragraph which has improved properties in respect of deformations resulting from ambient pressure variations and which in principle is suitable for use up to altitudes of a few thousands of metres above sea level. The invention is characterized in that, the substrate comprises a flat disc without a central aperture and the cover disc is connected to the substrate only near the circumference, in comparison with the substrate, the cover disc has a substantially lower resistance to deformations caused by differences between the gas pressure in the sealed space and the barometric pressure, so that the substrate deforms to a substantially smaller extent than the cover disc under influence of said pressure differences and the shallow tray comprises central third portions disposed in a plane between the first two planes and above a centre part of the substrate which is not intended for recording.

The storage disc in accordance with the invention employs a cover disc which differs from the substrate so that generally the storage disc can be used on one side only. The lower resistance of the cover disc to deformations caused by differences between the gas pressure in the sealed space and the barometric pressure ensures that the substrate deforms to a substantially smaller extent than the known storage disc. For many uses the one-side storage capability of the disc is no problem, whilst it is of importance that the substrate remains flat under all conditions of barometric pressure.

The problems associated with the gas-tight connection of the cover disc to the substrate are mitigated by the use of a cover disc which is connected to the substrate only near the circumference. In comparison with the afore-mentioned known optical storage discs such an embodiment of the invention has the advantage that only one connection is required between the substrate and the cover disc. Since the substrate and the cover disc are not interconnected near the centre, this has the additional advantage that both the substrate and the cover disc have a lower resistance to flexure under the influence of differences between the pressure in the sealed space and the barometric pressure. However, the ratio of the two rigidities increases even further, so that the situation as regards the deformation of the substrate remains more favourable. However, since the cover disc now has a greater span and is even more flexible, it is not unlikely that under certain conditions, for example due to mishandling or in the case of an extremely high ambient pressure, the cover disc would be pressed against parts of the recording layer which are intended for recording, so that these parts could be damaged, thereby rendering the storage disc unserviceable.

It is therefore advantageous that the shallow tray comprises central third portions disposed in a plane between the first two planes and above a part of the substrate which is not intended for recording.

In accordance with an advantageous characteristic further feature the cover disc also comprises fourth portions which adjoin the first portions and which comprise the circumference of the substrate and in that sealing means are present between the substrate and the cover disc at the location of the said first portions as well as at the location of the said fourth portions. It is envisaged that the substrate will generally be glued to the cover disc. Some glues which are suitable for the purpose, such as epoxy resins, require heating of the product to a temperature of 80 to 90°C for correct and fast curing. The last-mentioned embodiment has the advantage that the cover disc and the substrate are centred relative to each other before the layer of glue has cured, which is of importance for efficient production. A second advantage is that the layer of glue may have a greater radial width than when the third portion does not comprise the cirumference of the substrate. The gas-tight sealing of the sealed space improves as the path-length through the layer of glue from the atmospheric air to the sealed space is increased.

Preferably, the cover disc is made of thin metal sheet. Such a cover disc is gas-tight, easy to manufacture and depending on the thickness, which in principle can be very small, it is also sufficiently flexible in relation to the deformability of the substrate.

A further interesting embodiment, suitable for use with metal sheet cover discs, is characterized in that the cover disc is formed with radial reinforcements. This embodiment has the advantage that very thin and flexible materials may be used without the risk that the cover disc can be pressed against the recording layer in the part between the third and fourth portions, i.e. in the part facing the part of the recording layer intended for recording. In the case of a metal cover disc, the reinforcements may be obtained by local deformation of a flat cover disc.

A further embodiment which can be used in combination with metallic cover discs is characterized in that the said fourth portions are folded around the circumference of the substrate. If glue is used as the sealing medium, this leads to a further increase of the earlier said path-length. The principal advantage of this embodiment, however, is that before the layer of glue is subjected to thermal treatment the substrate and cover disc already form a structural unit and can therefore be handled without problems. This embodiment has additional advantages for storage discs in which the cover disc is not glued to the substrate and in which a permanently elastic sealing layer is present between the cover disc and the substrate. The folded-over edge loads the elastic sealing layer permanently in compression, which is of importance for the quality of the gas-tight seal. Such storage discs may have a shorter life expectancy than storage discs in which the cover disc is glued to the substrate. However, for some uses this may not be an objection. Rapid and cheap manufacture and consequently low price may be of greater importance to the consumer in certain applications than the life expectancy of the disc.

It is noted that in EP—A—0,010,017 an optically readable storage disc is disclosed from which it is known per se to provide a substrate bearing a recording layer under a cover, which may be of sheet metal. However, in this storage disc the cover is more rigid than the substrate. Deformation of the substrate is what the present invention tries to prevent.

EP—A—0,089,874, which was not published prior to the priority date of the present invention, relates to a similar storage disc in which, however, the recording layer is not situated on the substrate but on the inside of the cover instead.

Part of the subject matter described hereafter is made subject of divisional application No. 88202996, which especially relates to a separate axially projecting central centring member.

The invention will now be described in more detail, by way of example, with reference to the drawing which is a perspective view of an optically readable storage disc in accordance with the invention, a part of the storage disc and some parts belonging to an apparatus for driving the storage disc being cut away.

The storage disc comprises a transparent glass or plastics substrate 1. A reflecting recording layer 2 which can be modified locally by means of a radiation beam, is deposited on the substrate. In the present embodiment this recording layer is present only on the substrate area which is actually intended for recording. However, it is possible to deposit the recording layer over a larger part of the substrate, if desired over the entire substrate area. Information is recorded and read through the transparent substrate by means of a laser beam, not shown. A cover disc 3 is fixed to the substrate in a substantially gas-tight manner at some distance from the recording layer 2, so that a sealed space 4 is enclosed between the substrate and the cover disc. The cover disc is substantially thinner than the substrate and has a substantially lower resistance to deformations as may be caused by differences between the gas pressure in the sealed space 4 and the baromctric pressure.

The cover disc is made of thin metal sheet, for example aluminium sheet, which is formed into a shallow tray comprising first portions 3A in the form of an annularflange for the connection to the substrate, which flange is disposed in a first plane. Second portions 3B, which constitute the bottom of the shallow tray and which cover the sealed space 4 are disposed in a second plane parallel to the first plane. Adjacent the flange 3A third portions are present in the form of a folded-over rim 3C which comprises the circumference of the substrate. These third portions are folded

around the circumference of the substrate. The substrate 1 comprises an entirely flat disc and is not provided with the usual central aperture for centring and placing the disc on a drive apparatus. The cover disc is therefore connected to the substrate only near the circumference. The cover disc also comprises fourth portions 3D in the form of a round embossment whose bottom is disposed in a plane between the afore-mentioned two planes and above a part of the substrate which is not used for recording. This part is disposed at some distance from the substrate but is situated closer to said substrate than the portion 3B. If the cover disc is depressed this portion, *inter alia* because it is the most central portion, will first come into contact with the substrate but in an area where this has no undesired consequences. In this respect it is important, especially when a very thin metal sheet is used, that the cover disc is provided with radial reinforcements 3E formed by local deformation. These reinforcements ensure that the portion 3B has the required rigidity.

The storage disc can be rotated about a central axis of rotation 5. On the side facing the recording layer 2 the substrate carries an axially projecting central centring member 6. This member is adapted to cooperate with centring means in the form of a spindle 7 of an apparatus, not shown, for inscribing and/or reading optically readable storage discs. A suitable apparatus, apart from the centring means which are of a slightly different construction and which are intended for cooperation with discs having a central aperture, is described in the EP—A—1,140,082, published 25.07.84. The entire centring member 6 is made of steel sheet and is connected to the substrate by a layer of glue 8. It comprises a flat flanged rim 6B which is connected to the substrate by the layer of glue 8. The bottom 6A of the centring member 6 is formed with a central centring aperture 6C through which the spindle 7 extends with a slight clearance. This spindle may be the motor spindle of a drive motor, allowing a very simple yet sufficiently accurate centring of the storage disc on the drive apparatus.

The spindle 7 carries a turntable 9 which supports the substrate 1. The turntable carries an annular permanent magnet 10 which draws the sheet-steel centring means 6 axially onto the turntable 9. Furthermore, the turntable comprises a ring 11 of a suitable elastic material which is subject to a slight elastic deformation as a result of the force of attraction of the permanent magnet 10. In the present embodiment the ring 11 cooperates directly with the substrate 1. Alternatively, the flange 6B of the centring means 6 may be given a greater diameter, so that the ring 11 does not cooperate directly with the substrate 1 but with the flange 6B. The free end of the motor spindle 7 bears against the underside of the substrate and thus constitutes a stop which defines the axial position of the information disc on the turntable 9.

The substrate 1 may have a central aperture, so that the cover disc 3 and the substrate are also interconnected nearer the centre of the substrate. The cover disc may be of a material other than metal, for example, a suitable plastics. Generally, a plastics material is not absolutely moisture-proof, but this need not be an objection for discs which only need to have a limited lifetime.

The provision of a substrate without a center aperture has additional advantages as disclosed and explained in EP—A—117576.

**Claims**

1. An optically readable storage disc comprising:

an optical quality transparent substrate (1),

a recording layer (2) on the substrate, which layer can be modified locally by means of a radiation beam focussed on the layer through the substrate, and

a cover disc (3) which is secured to the substrate in a substantially gas-tight manner at some distance from at least that part of the recording layer which is intended for recording, so that a sealed space (4) is enclosed between the substrate and the cover disc, which cover disc (3) is formed as a shallow tray comprising first portions (3A) for connection to the substrate (1), which first portions are disposed in a first plane, and second portions (3), for covering the sealed space (4), which second portions are disposed substantially in a second plane at some distance from and parallel to the first plane, characterized in that,

the substrate (1) comprises a flat disc without a central aperture and the cover disc (3) is connected to the substrate only near the circumference,

in comparison with the substrate (1), the cover disc (3) has a substantially lower resistance to deformations caused by differences between the gas pressure in the sealed space (4) and the barometric pressure, so that the substrate deforms to a substantially smaller extent than the cover disc under influence of said pressure differences and

the shallow tray comprises central third portions (3D) disposed in a plane between the first two planes and above a centre part of the substrate (1) which is not intended for recording.

2. An optical storage disc as claimed in claim 1, characterized in that

the cover disc (3) also comprises fourth portions (3C) which adjoin the first portions and which comprise the circumference of the substrate (1) and in that

sealing means are present between the substrate and the cover disc at the location of the said first portions as well as at the location of the said fourth portions.

3. An optically readable storage disc as claimed in Claim 2, characterized in that the cover disc (3) is made of a thin metal sheet.

4. An optical storage disc as claimed in Claim 3, characterized in that the cover disc is formed with radial reinforcements.

around the circumference of the substrate. The substrate 1 comprises an entirely flat disc and is not provided with the usual central aperture for centring and placing the disc on a drive apparatus. The cover disc is therefore connected to the substrate only near the circumference. The cover disc also comprises fourth portions 3D in the form of a round embossment whose bottom is disposed in a plane between the afore-mentioned two planes and above a part of the substrate which is not used for recording. This part is disposed at some distance from the substrate but is situated closer to said substrate than the portion 3B. If the cover disc is depressed this portion, *inter alia* because it is the most central portion, will first come into contact with the substrate but in an area where this has no undesired consequences. In this respect it is important, especially when a very thin metal sheet is used, that the cover disc is provided with radial reinforcements 3E formed by local deformation. These reinforcements ensure that the portion 3B has the required rigidity.

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The substrate 1 may have a central aperture, so that the cover disc 3 and the substrate are also interconnected nearer the centre of the substrate. The cover disc may be of a material other than metal, for example, a suitable plastics. Generally, a plastics material is not absolutely moisture-proof, but this need not be an objection for discs which only need to have a limited lifetime.

The provision of a substrate without a center aperture has additional advantages as disclosed and explained in EP—A—117576.

**Claims**

1. An optically readable storage disc comprising:

an optical quality transparent substrate (1),

a recording layer (2) on the substrate, which layer can be modified locally by means of a radiation beam focussed on the layer through the substrate, and

a cover disc (3) which is secured to the substrate in a substantially gas-tight manner at some distance from at least that part of the recording layer which is intended for recording, so that a sealed space (4) is enclosed between the substrate and the cover disc, which cover disc (3) is formed as a shallow tray comprising first portions (3A) for connection to the substrate (1), which first portions are disposed in a first plane, and second portions (3), for covering the sealed space (4), which second portions are disposed substantially in a second plane at some distance from and parallel to the first plane, characterized in that,

the substrate (1) comprises a flat disc without a central aperture and the cover disc (3) is connected to the substrate only near the circumference,

in comparison with the substrate (1), the cover disc (3) has a substantially lower resistance to deformations caused by differences between the gas pressure in the sealed space (4) and the barometric pressure, so that the substrate deforms to a substantially smaller extent than the cover disc under influence of said pressure differences and

the shallow tray comprises central third portions (3D) disposed in a plane between the first two planes and above a centre part of the substrate (1) which is not intended for recording.

2. An optical storage disc as claimed in claim 1, characterized in that

the cover disc (3) also comprises fourth portions (3C) which adjoin the first portions and which comprise the circumference of the substrate (1) and in that

sealing means are present between the substrate and the cover disc at the location of the said first portions as well as at the location of the said fourth portions.

3. An optically readable storage disc as claimed in Claim 2, characterized in that the cover disc (3) is made of a thin metal sheet.

4. An optical storage disc as claimed in Claim 3, characterized in that the cover disc is formed with radial reinforcements.



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5. An optically readable storage disc as claimed in Claim 2 and 3, characterized in that the said fourth portions (3C) are folded around the circumference of the substrate (1).

**Patentansprüche**

1. Optisch auslesbare Speicherscheibe mit:
einem transparenten Substrat (1) optischer Qualität,
einer Aufzeichnungsschicht (2), die mit Hilfe eines durch das Substrat hindurch auf die Schicht fokussierten Strahlungsbündels örtlich modifiziert werden kann und
einer Abdeckplatte (3), die auf im wesentlichen gasdichte Art und Weise in einem Abstand von wenigstens demjenigen Teil der Aufzeichnungsschicht auf dem Substrat befestigt ist, der zur Aufzeichnung bestimmt ist, so dass zwischen dem Substrat und der Abdeckplatte ein abgedichteter Raum (4) eingeschlossen ist, wobei die Abdeckplatte (3) als untiefe Schale mit ersten, in einer ersten Ebene liegenden Teilen (3A) zur Verbindung mit dem Substrat (1) ausgebildet ist, sowie mit zweiten, im wesentlichen in einer zweiten Ebene in einem bestimmten Abstand von und parallel zu der ersten Ebene liegenden Teilen (3) zur Abschirmung des abgedichteten Raums (4), dadurch gekennzeichnet, dass
das Substrat (1) eine flache Scheibe ohne ein Zentralloch aufweist und die Abdeckplatte (3) nur in der Nähe des Umfangs mit dem Substrat verbunden ist,
im Vergleich zu dem Substrat (1) die Abdeckplatte (3) eine wesentlich niedrigere Formfestigkeit hat, und zwar durch Unterschiede im Gasdruck in dem abgedichteten Raum (4) und dem barometrischen Druck, so dass unter dem Einfluss der genannten Druckunterschiede das Substrat wesentlich weniger verformt als die Abdeckplatte und die untiefe Schale zentrale dritte Teile (3D) in einer Ebene zwischen der ersten und zweiten Ebene und über einem zentralen, nicht für Aufzeichnung bestimmten Teil des Substrats (1) aufweist.

2. Optische Speicherscheibe nach Anspruch 1, dadurch gekennzeichnet, dass
die Abdeckplatte (3) ebenfalls vierte, an die ersten Teile grenzende und den Umfang des Substrats (1) aufweisende Teile (3C) aufweist und dass
zwischen dem Substrat und der Abdeckplatte an der Stelle der ersten Teile sowie an der Stelle der vierten Teile Abdichtungsmittel vorhanden sind.

3. Optisch auslesbare Speicherscheibe nach Anspruch 2, dadurch gekennzeichnet, dass die Abdeckscheibe (3) aus einer dünnen Metallplatte hergestellt ist.

4. Optische Speicherscheibe nach Anspruch 3, dadurch gekennzeichnet, dass die Abdeckplatte mit radialen Verstärkungen ausgebildet ist.

5. Optisch auslesbare Speicherscheibe nach Anspruch 2 und 3, dadurch gekennzeichnet, dass die vierten Teile (3C) um den Umfang des Substrats (1) gefaltet sind.

**Revendications**

1. Disque de stockage à lecture par voie optique comprenant:
un substrat transparent de qualité optique (1);
une couche d'enregistrement (2) sur le substrat, couche qui peut être modifiée localement au moyen d'un faisceau de rayonnement focalisé sur la couche à travers le substrat, et
un disque de coiffage (3) qui est fixé au substrat d'une manière en substance étanche aux gaz à une certaine distance d'au moins la partie de la couche d'enregistrement qui est destinée à l'enregistrement, de sorte qu'un espace scellé (4) est enfermé entre le substrat et le disque de coiffage, ce disque de coiffage (3) ayant la forme d'un plateau peu profond comprenant des premières portions (3A) à relier au substrat (1), ces premières portions étant disposées dans un premier plan, et des deuxièmes portions (3B), pour couvrir l'espace scellé (4), ces deuxièmes portions étant disposées en substance dans un second plan à une certaine distance du premier et parallèlement à celui-ci; caractérisé en ce que:
le substrat (1) comprend un disque plat dépourvu d'ouverture centrale et le disque de coiffage (3) est relié au substrat uniquement au voisinage de sa circonférence;
par rapport au substrat (1), le disque de coiffage (3) a une résistance nettement moins élevée aux déformations causées par des différences entre la pression de gaz dans l'espace scellé (4) et la pression barométrique, de sorte que le substrat se déforme dans une mesure nettement plus faible que le disque de coiffage sous l'influence des différences de pression, et
le plateau peu profond comprend des quatrièmes portions centrales (3D) disposées dans un plan situé entre les deux premiers plans et au-dessus d'une partie centrale du substrat (1) qui n'est pas destinée à l'enregistrement.

2. Disque de stockage à lecture par voie optique suivant la revendication 1, caractérisé en ce que:
le disque de coiffage (3) comprend également des troisièmes porions (3C) qui sont adjacentes aux premières portions et qui enserrent la circonférence du substrat (1) et en ce que:
des moyens de scellement étanche sont présents entre le substrat et le disque de coiffage à l'emplacement des premières portions ainsi qu'à celui des quatrièmes portions.

3. Disque de stockage à lecture par voie optique suivant la revendication 2, caractérisé en ce que le disque de coiffage (3) est fait d'une mince tôle.

4. Disque de stockage optique suivant la revendication 3, caractérisé en ce que le disque de coiffage présente des renforcements radiaux.

5. Disque de stockage à lecture par voie optique suivant les revendications 2 et 3, caractérisé en ce que les troisièmes portions (3C) sont repliées autour de la circonférence du substrat (1).



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