Description

The invention relates to an optically readable disc comprising a round transparent substrate which is to be driven about a central axis of rotation which is provided with an information layer.

Such discs are known in various types and versions. For example, GB—A—1,446,009 describes an optically readable video disc comprising a transparent substrate which is provided on one side with a structure which can be read through the substrate by means of a laser beam and which is coated with a reflective vacuum-deposited metal layer which is in turn coated with a protective layer of lacquer. Frequently, two such discs are glued to each other back-to-back, yielding a double disc which is optically readable on both sides. For centring and positioning the video disc on a video-disc player the video disc is provided with a central aperture which cooperates with a centring member arranged on a drive spindle in the video-disc player. Optically readable audio discs generally have small dimensions and a differently coded information structure but for the rest they are in principle identical to said known video discs.

Another type of optically readable disc is known from US—A—4,074,282. These known discs comprise a number of parts among which one or more transparent substrates — sometimes in combination with a non-transparent disc — which are glued to each other by means of coaxial annular spacers. By means of the annular spacers at least one gas-tight space is formed between the various parts of the disc. This type of optically readable disc is intended as a storage disc. By means of a laser beam a recording layer adjoining a sealed space can be provided with information through a transparent substrate. The recording layer comprises, for example, a thin layer of a tellurium alloy formed on the substrate by vacuum deposition.

Still other known optically readable discs are used as an intermediate product in the manufacture of optically readable video discs and audio discs. These optically readable discs, generally referred to as "masters", comprise a glass substrate on one side of which a photosensitive layer is deposited. In a highly dust-free and very well ventilated room the video information and/or audio information is written on the recording layer by means of a laser beam using special precision equipment. After the information has been recorded the photosensitive layer is developed. The photosensitive layer then contains a pattern of pits which can be duplicated by means of duplicating techniques of the type as described in, for example, US—A—4,312,823 (herewith incorporated by reference). The masters are provided with a central aperture for the accurate centring on the drive spindle of the machine used for recording the information.

The optical storage discs generally used until now comprise two glass substrates which are glued to each other with interposed concentric annular spacers. However, when depositing the tellurium layer on these glass substrates, and when depositing the photosensitive layer on the glass substrates of masters, some problems occur. These problems are mainly associated with the method of depositing said layers on the substrates. By way of example a brief description will be given of the method used for depositing the photosensitive layer on the masters and the further processing of the exposed disc.

A ground-glass substrate is employed whose surface which is to be provided with the photosensitive layer is first thoroughly cleaned and washed with demineralised water. These operations and all further operations to which the masters are subjected must be carried out in an air-conditioned highly dust-free room. For cleaning and washing, the substrate is placed on a rotating spindle which projects through the central hole in the substrate. The disc is dried by rotating it with a higher speed, so that the water particles are spun off the surface. The next steps in the method are also effected with a rotating disc, repeated drying being effected by rotation at a higher speed. After having been washed and dried the substrate is degreased by means of a suitable liquid, after which an adhesive liquid is applied to the disc. Then degreasing is repeated and finally the photo-resist layer is applied. The photo-resist layer is distributed evenly over the surface by fast rotation of the disc. After the exposure of the photo-resist layer on the aforementioned special machine, developing takes place, again with rotating disc, after which in a final operation the surface is rinsed again and subsequently a silver layer is applied by vacuum-deposition. It has been found difficult to prevent residual liquids used in previous steps of the method from settling in the central aperture of the disc. This may give rise to contamination and consequent rejection of the product. Without describing the entire method of manufacturing optical storage discs it will be evident from the foregoing that, since the substrates of such discs also came several times into contact with liquids, similar problems will occur during manufacture.

Even with video discs and audio discs the central hole in the disc may give rise to problems. As already stated, the discs are provided with an extremely thin metal layer, in general vacuum-deposited silver, which is covered with a lacquer coating of 5 to 10 µm (microns) thickness. The silver layer must be coated very thoroughly because in the long run it may be affected by sulphur from the atmosphere, thereby rendering the disc unserviceable. The lacquer coating extends from the circumference of the disc to the central hole. At these locations there is an increased risk of the silver layer being attacked. Near the centre hole this risk even increases because the disc is clamped in positioned near the central hole, so that at this location forces are exerted on the disc which may give rise to shear stresses between the lacquer coating and the silver layer.

It is the object of the invention to provide

optically readable discs of the type mentioned in the opening paragraph which do not present the aforementioned problems and the invention is characterized in that the substrate comprises an imperforate disc which is flat at least on the side where the information layer is located, and on the other side the substrate carries an axially projecting central centring member for cooperation with centring means of an apparatus for writing and/or reading information on optically readable discs.

All the aforementioned problems which result from the presence of the centre hole are solved by the invention. However, depending on the embodiment, the invention also has some further advantages. When injection-moulding plastics audio and video discs a moving part in the injection-moulding machine for the formation of the centre hole may be dispensed with. Instead of this the plastics disc may be provided with an integrally moulded plastics central centring member. This is also expected to have the advantage of reducing stresses in and consequent deformations of the disc.

An advantageous embodiment of the invention is characterized in that the centring member is made at least partly of a ferromagnetic material. In this respect it is advantageous, in particular when the substrate is made of glass but also in other cases, if the centring member is made entirely of a ferromagnetic material and is connected to the substrate by a layer of adhesive. The advantage of these embodiments is that the disc can be clamped magnetically on a drive spindle. It is then no longer necessary to urge the disc in position from the other side or to clamp it in position by other mechanical means. Moreover, in the manufacture of the masters this yields the additional advantage that the aforementioned method can be automated, the rotating spindles used in the various stage of manufacture being provided with an electrically controlled electromagnetic clutch which releases or attracts the centring member, as desired. As a result of this the substrate can be transferred automatically from one spindle to another by mechanical means, so that it need not be handled by an operator. This leads not only to an increase in productivity but also to a cleaner process, resulting in a further reduction of the percentage of rejects.

If the centring member comprises a separate component which is affixed to the disc, optical means may be used for the accurate alignment of the centring member relative to the tracks recorded on the disc or relative to the outer circumference of the disc.

An advantageous embodiment which is particularly suitable for consumer products such as small storage discs is characterized in that the centring member comprises a part which is made of a sheet material and which has a flat circular wall joined to a flat flange-shaped rim, and the flanged-shaped rim is connected to the substrate by the layer of adhesive. Such a centring member can be manufactured simply and cheaply and is found to perform satisfactorily in practice. The apparatus on which the disc is used may be provided with a drive spindle having permanent-magnetic means which cooperate with a sheet-steel centring member. For accurately and simply centring the disc on a drive spindle it is advantageous to use another embodiment, which is characterized in that the flat circular wall of the centring member is formed with a central centring aperture for the passage, with a slight clearance, of a centring means of an apparatus for writing and/or reading information on optically readable discs. In the sheet steel component a central aperture can be formed with high precision and with a smaller tolerance of its diameter. Moreover, a central aperture is very useful in glueing the centring member to the substrate at the correct location with the aid of optical means.

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 of an apparatus for driving the storage disc being cut away.

The storage disc comprises a transparent glass or plastics substrate 1. A reflective 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 extends over only that area of the substrate which will actually carry the recording. However, it is alternatively 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 a 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 deformation which may be caused by differences between the gas pressure in the sealed space 4 and the external atmospheric pressure.

The cover disc is made of thin metal sheet, for example aluminium sheet, which is formed into a shallow tray comprising a first part 3A in the form of an annular flange for attachment to the substrate, which flange is disposed in a first plane. A second part 3B constituting the bottom of the shallow tray and covering the sealed space 4 is disposed in a second plane parallel to the plane in which the flange 3A is disposed. Adjacent the flange 3A is a third part in the form of a turned-over rim 3C which untraces the edge of the substrate. This third part is sprung over the edge of the substrate. The substrate 1 comprises a perfectly flat round disc and is not formed with a central aperture for centring and fixing the disc on a drive means. The cover disc is connected to the substrate only at the circumference of the substrate. The cover disc comprises a fourth part 3B

in the form of a flat circular boss, whose flat wall is disposed in a plane situated between the aforesaid first and second planes and above a part of the substrate which is not used for recording. This part is therefore situated as a distance from the substrate but is situated closer to the substrate than the part 3B. In the event of deflection of the cover disc this part, *inter alia* because it is the most central part, will come into contact first with the substrate in an area where this has no undesirable consequences. In this respect it is important, especially if the metal sheet used is thin, that the cover disc is provided with radial reinforcements 3E obtained by local deformation of the part 3B of the cover disc. These reinforcements ensure that the part 3B has the required rigidity.

The storage disc can be rotated about a central axis of rotation 5. On the side remote from the recording layer 2 the substrate carries a central centring member 6 which projects in the axial direction from the substrate. This member is adapted to cooperate with centring means in the form of a spindle 7 of an apparatus, not shown, for writing and/or reading information on optically readable storage discs. A suitable apparatus, apart from the centring means which have a slightly different shape and which are intended for discs having a central aperture, is described in the Applicant's previous NL—A—8300133 which has not been published in due time. The centring member 6 is made entirely of sheet steel and is connected to the substrate by a layer of adhesive 8. It has a flat circular wall 6A and a flat flange-like rim 6B which is connected to the substrate by the layer of adhesive 8. The wall 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 means.

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 member 6 axially onto the turntable 9. Moreover, the turntable is provided with 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. In the present embodiment the ring 11 cooperates directly with the substrate 1. Alternatively, the flange 6B of the centring member 6 may be given a larger diameter, so that the ring 6 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 1 and thereby constitutes a stop which defines the axial position of the information disc on the turntable 9.

Many different embodiments are possible. For example, a centring member may be used which comprises a plurality of parts, which may be made of different materials. A part of the centring member may then be integral with the substrate.

Claims

1. An optically readable disc comprising a round transparent substrate (1) which is to be driven about a central axis of rotation (5) and which is provided with an information layer, characterized in that the substrate consists of at least an imperforate disc which is flat at least on the side where the information layer is located, and that the substrate carries an axially projecting central centring member (6) for co-operation with centring means (7) of an apparatus for writing and/or reading information on optically readable discs on the side opposite to the side provided with the information layer.

2. An optically readable disc as claimed in Claim 1, characterized in that the centring member is made at least partly of a feromagnetic material.

3. An optically readable disc as claimed in Claim 2, characterized in that the centring member (6) is made entirely of a ferromagnetic material and is connected to the substrate by a layer of adhesive (8).

4. An optically readable disc as claimed in Claim 3, characterized in that the centring member (6) comprises a part which is made of a sheet material and which has a flat circular wall joined to a flat flange-shaped rim (6B), and the flange-shaped rim is connected to the substrate by the layer of adhesive.

5. An optically readable disc as claimed in Claim 4, characterized in that the flat circular wall (6A) of the centring member (6) is formed with a central centring aperture (6C) for the passage, with slight clearance, of a centring means (7) of an apparatus for writing and/or reading information on optically readable discs.

Patentansprüche

1. Optisch lesbare Platte mit einem kreisrunden transparenten um eine zentrale Antriebsachse (5) anzutreibenden mit einer Informationsschicht versehenen Träger (1), dadurch gekennzeichnet, dass der Träger aus wenigstens einer dichten Scheibe besteht, die wenigstens an derjenigen Seite, an der sich die Informationsschicht befindet, flach ist und dass der Träger auf der mit einer Informationsschicht versehenen gegenüberliegenden Seite ein in axialer Richtung herausragendes zentrales Zentrierelement (6) aufweist zum Zusammenarbeiten mit Zentriermitteln (7) einer Anordnung zum Einschreiben und/oder Auslesen von Information auf optisch lesbaren Platten.

2. Optisch lesbare Platte nach Anspruch 1, dadurch gekennzeichnet, dass das Zentrierelement wenigstens teilweise aus ferromagnetischem Material besteht.

3. Optisch lesbare Platte nach Anspruch 2, dadurch gekennzeichnet, dass das Zentrierelement (6) völlig aus einem ferromagnetischen Material besteht und mittels einer Klebschicht (8) mit dem Träger verbunden ist.

4. Optisch lesbare Platte nach Anspruch 3, dadurch gekennzeichnet, dass das Zentrierele-

in the form of a flat circular boss, whose flat wall is disposed in a plane situated between the aforesaid first and second planes and above a part of the substrate which is not used for recording. This part is therefore situated as a distance from the substrate but is situated closer to the substrate than the part 3B. In the event of deflection of the cover disc this part, *inter alia* because it is the most central part, will come into contact first with the substrate in an area where this has no undesirable consequences. In this respect it is important, especially if the metal sheet used is thin, that the cover disc is provided with radial reinforcements 3E obtained by local deformation of the part 3B of the cover disc. These reinforcements ensure that the part 3B has the required rigidity.

The storage disc can be rotated about a central axis of rotation 5. On the side remote from the recording layer 2 the substrate carries a central centring member 6 which projects in the axial direction from the substrate. This member is adapted to cooperate with centring means in the form of a spindle 7 of an apparatus, not shown, for writing and/or reading information on optically readable storage discs. A suitable apparatus, apart from the centring means which have a slightly different shape and which are intended for discs having a central aperture, is described in the Applicant's previous NL—A—8300133 which has not been published in due time. The centring member 6 is made entirely of sheet steel and is connected to the substrate by a layer of adhesive 8. It has a flat circular wall 6A and a flat flange-like rim 6B which is connected to the substrate by the layer of adhesive 8. The wall 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 means.

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 member 6 axially onto the turntable 9. Moreover, the turntable is provided with 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. In the present embodiment the ring 11 cooperates directly with the substrate 1. Alternatively, the flange 6B of the centring member 6 may be given a larger diameter, so that the ring 6 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 1 and thereby constitutes a stop which defines the axial position of the information disc on the turntable 9.

Many different embodiments are possible. For example, a centring member may be used which comprises a plurality of parts, which may be made of different materials. A part of the centring member may then be integral with the substrate.

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1. An optically readable disc comprising a round transparent substrate (1) which is to be driven about a central axis of rotation (5) and which is provided with an information layer, characterized in that the substrate consists of at least an imperforate disc which is flat at least on the side where the information layer is located, and that the substrate carries an axially projecting central centring member (6) for co-operation with centring means (7) of an apparatus for writing and/or reading information on optically readable discs on the side opposite to the side provided with the information layer.

2. An optically readable disc as claimed in Claim 1, characterized in that the centring member is made at least partly of a feromagnetic material.

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5. An optically readable disc as claimed in Claim 4, characterized in that the flat circular wall (6A) of the centring member (6) is formed with a central centring aperture (6C) for the passage, with slight clearance, of a centring means (7) of an apparatus for writing and/or reading information on optically readable discs.

Patentansprüche

1. Optisch lesbare Platte mit einem kreisrunden transparenten um eine zentrale Antriebsachse (5) anzutreibenden mit einer Informationsschicht versehenen Träger (1), dadurch gekennzeichnet, dass der Träger aus wenigstens einer dichten Scheibe besteht, die wenigstens an derjenigen Seite, an der sich die Informationsschicht befindet, flach ist und dass der Träger auf der mit einer Informationsschicht versehenen gegenüberliegenden Seite ein in axialer Richtung herausragendes zentrales Zentrierelement (6) aufweist zum Zusammenarbeiten mit Zentriermitteln (7) einer Anordnung zum Einschreiben und/oder Auslesen von Information auf optisch lesbaren Platten.

2. Optisch lesbare Platte nach Anspruch 1, dadurch gekennzeichnet, dass das Zentrierelement wenigstens teilweise aus ferromagnetischem Material besteht.

3. Optisch lesbare Platte nach Anspruch 2, dadurch gekennzeichnet, dass das Zentrierelement (6) völlig aus einem ferromagnetischen Material besteht und mittels einer Klebschicht (8) mit dem Träger verbunden ist.

4. Optisch lesbare Platte nach Anspruch 3, dadurch gekennzeichnet, dass das Zentrierele-

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ment (6) einen Teil aufweist, der aus Blechmaterial hergestellt ist und eine flache kreisförmige Wand aufweist, die an einem flachen flanschförmigen Rand (6B) befestigt ist, wobei der flanschförmige Rand mittels der Klebschicht mit dem Träger verbunden ist.

5. Optisch lesbare Platte nach Anspruch 4, dadurch gekennzeichnet, dass die flache kreisförmige Wand (6A) des Zentrierelementes (6) mit einer zentralen Zentrieröffnung (6C) versehen ist zum mit geringem Spielraum Hindurchlassen eines Zentriermittels (7) einer Anordnung zum Einschreiben und/oder Auslesen von Information auf optisch lesbaren Platten.

Revendications

1. Disque à lecture par voie optique comprenant un substrat transparent rond (1) qui doit être entraîné autour d'un axe de rotation central (5) et qui est pourvu d'une couche d'information, caractérisé en ce que le substrat est formé, au moins d'un disque imperforé qui est plat au moins du côté de la couche d'information, et le substrat porte un organe de centrage central (6) en saillie axialement pour coopérer avec le moyen de centrage (7) d'un appareil pour écrire et/ou lire de l'information sur des disques à lecture par voie optique du côté opposé au côté pourvu de la couche d'information.

2. Disque à lecture par voie optique suivant la revendication 1, caractérisé en ce que l'organe de centrage est fait au moins partiellement d'une matière ferromagnétique.

3. Disque à lecture par voie optique suivant la revendication 2, caractérisé en ce que l'organe de centrage (6) est fait entièrement d'une matière ferromagnétique et est relié au substrat par une couche d'adhésif (8).

4. Disque à lecture par voie optique suivant la revendication 3, caractérisé en ce que l'organe de centrage (6) comprend une pièce qui est faite d'une matière en feuille et qui comporte une paroi circulaire plane reliée à un rebord en forme de bride plane (6B) et le rebord en forme de bride est relié au substrat par la couche d'adhésif.

5. Disque à lecture par voie optique suivant la revendication 4, caractérisé en ce que la paroi circulaire plane (6A) de l'organe de centrage (6) est pourvue d'une ouverture de centrage centrale (6C) pour le passage, avec un léger jeu, d'un moyen de centrage (7) d'un appareil destiné à écrire et/ou à lire de l'information sur des disques à lecture par voie optique.