Apparatus and Method for Coating an Optically Readable Data Carrier

The present invention relates to an apparatus and a method for coating an optically readable data carrier, as well as to an optically readable data carrier.

Optical data carriers, such as CDs, as well as methods and apparatus for producing the same, are known. Such data carriers generally have a data-carrying surface that must be protected from environmental conditions. To protect the surface, a hardening lacquer was used in the past that was applied to a central region of the rapidly rotating data carrier so that it would flow outwardly due to centrifugal force and would form an essentially uniform layer upon the CD. However, in this connection the data carrier must be rotated at a high speed in order to produce adequate centrifugal forces for a uniform distribution of the lacquer upon the surface that is to be protected. This process has the inherent danger of damaging the data carrier. Furthermore, with this method excess lacquer is flung out from the data carrier, and must subsequently be removed in a complicated and expensive process.

EP-A-0 855 703 furthermore discloses a method for gluing together two disk-like substrates of a data carrier using an adhesive film that has adhesive on both sides. With this known method, the substrates are glued together in such a way that the information-carrying surfaces of the substrates are directed outwardly, and are thus exposed to environmental influences.

Starting with this method, it is an object of the present invention to provide a simplified and economical method for coating an optically readable data carrier as well as a data carrier produced in this manner.

This object is inventively realized for a method for coating an optically readable data carrier in that a transparent adhesive film is applied to a data carrier surface that is to be protected, and subsequently a covering film is applied to the adhesive film. The use of an adhesive film in combination with an adhesive film has the advantage that the aforementioned centrifuging process for coating the data carrier with a lacquer is eliminated, and no flung-off residual lacquer, which must be removed in an expensive and complicated manner, results. The combination of adhesive film and cover film furthermore provides a good protection of the data-carrying surface of the data carrier. The adhesive film and the covering film can have specific optical characteristics in order to permit reading of the data found on the data carrier. The application of the films furthermore provides a particularly simple and economical solution for the coating of a data carrier.

The transparent adhesive film is preferably a layer of an adhesive without a carrier material in order not to affect the reading of the data on the data carrier. The transparent covering film is preferably a so-called PC tape, which has good optical characteristics for a reader of the data carrier.

In accordance with one preferred embodiment of the present invention, during or after application to the data carrier the adhesive film and/or the covering film is withdrawn from a carrier film. The carrier film has the advantage that the respective film is protected prior to its application to the data carrier, and the adhesive film has an adequate stability for transport. In addition, a protective film is preferably withdrawn prior to applying the adhesive film and/or the covering film, the protective film protecting the respective film surface that faces away from the carrier film from contamination and damage.

In order to completely cover the data carrier, the shape and size of the adhesive film and/or of the covering film advantageously correspond to the surface of the data carrier surface that is to be protected. Sections of the adhesive film and/or of the covering film that correspond to the shape and size of the data carrier are advantageously punched onto the carrier film.

The adhesive film and/or the covering film is preferably applied centered on the data carrier surface that is to be protected in order to ensure a uniform coating of the surface of the data carrier. For this purpose the adhesive film and/or the covering film and the data carrier are preferably aligned with one another prior to application.

Pursuant to a further specific embodiment of the present invention, the adhesive film and/or the covering film is pressed onto the data carrier via a rotating pressure roller, to ensure a reliable contact between the respective film and the data carrier. In this connection,

the pressure of the pressure roller is preferably controlled in order to achieve an optimum adhesive effect of the respective films.

Prior to pressing by the pressure roller, the adhesive film and/or the covering film is preferably held at a pre-specified angle relative to the surface of the data carrier in order to hold the adhesive film at a distance from the data carrier, and to ensure a controlled pressing only in the region of the pressure roller. This prevents air from being trapped between the adhesive film and the surface of the data carrier and/or between the adhesive film and the covering film.

Pursuant to a preferred specific embodiment of the present invention, the data carrier and the pressure roller are moved relative to one another in order to enable a continuing application of the adhesive film upon the surface of the data carrier. In this connection, the data carrier is advantageously moved past the pressure roller linearly, and the pressure roller is advantageously rotated synchronously with the movement of the data carrier in order to continuously press the adhesive film onto the data carrier.

The object of the present invention is also realized by an apparatus for coating an optically readable data carrier, and includes a first laminating station for applying a transparent adhesive film to a data carrier surface that is to be protected, and a second laminating station to apply a transparent covering film.. With such an apparatus, the advantages mentioned above with regard to the method are achieved. In particular, with such an apparatus there is eliminated the danger of

damage to the data carrier due to the centrifuging process, and in addition there is eliminated the complicated and expensive preparation and removal of residual lacquer that is flung off.

The object is furthermore realized by an optically readable data carrier having a transparent adhesive film and a covering film on a data-carrying surface. The combination of adhesive film and covering film leads to the advantages already described above. Pursuant to a presently preferred specific embodiment of the present invention, the data carrier is disposed in a protective housing that surrounds the data carrier. By using a protective housing, the mechanical requirements placed upon the combination of adhesive film and covering film are significantly reduced, since this layer does not have to restrain strong stresses, but rather serves chiefly as a protective layer against contamination and chemical influences.

The present invention is explained in greater detail in the following using preferred exemplary embodiments with reference to the figures, in which:

Fig. 1 is a schematic representation of an apparatus for producing optical data carriers in accordance with the present invention;

Fig. 2 is a schematic view of parts of a laminating station in accordance with the present invention;

Fig. 3 is a side view of an alternative embodiment of a laminating station in accordance with the present invention;

Figs. 4 is a schematic side view of an optical data carrier of the present invention.

Figure 1 illustrates an apparatus 1 for producing an optical data carrier having at least one surface that is to be protected

The apparatus has a feed unit 3 for feeding an optical data carrier 6, such as a CD or a DVR. The data carrier 6 from the first feed station 3 is conveyed to a laminating station 7 that is described in greater detail with reference to Figures 2 and 3. In the laminating station, a pressure-sensitive adhesive tape or film which has adhesive on one side and is known as PSA tape, is applied to the surface of the optical data carrier 6 that is to be protected. The terms adhesive tape and adhesive film are to be understood as a layer of an adhesive without a carrier material. The optical properties of such a layer of adhesive can generally be controlled more precisely and better than those of a coated carrier material. The adhesive film has varying adhesion properties as a function of the pressure applied to it.

The data carrier 6 is subsequently conveyed via a handling apparatus 8 into a second laminating station 9. In the second laminating station 9, a protective or covering film is placed upon the adhesive film. The second laminating station 9 is essentially identical to the first laminating station 7, with the main difference being in the

laminating film that is utilized. The covering film that is applied in the second laminating station is, for example, a so-called PC tape that has the optical characteristics required for a data carrier of the DVR type.

After the laminating-on of the covering film, the data carrier is conveyed via a handling apparatus 10 into a quality checking unit 11. After checking of the quality, the data carrier is deposited either upon a collection station 12 for good data carriers or upon a collection station 13 for defective data carriers.

The apparatus 1 is arranged in a clean room in which each of the work steps can be performed under clean room conditions.

Figures 2 and 3 are schematic representations of a laminating station 7 in accordance with the present invention, whereby the respective components of the laminating stations illustrated in Figures 2 and 3 are arranged somewhat differently. However, the same reference numbers are used for identical/similar components in the following description of the laminating station in accordance with Figures 2 and 3.

The laminating station 7 has a feed roller 22 on which a tape-like laminating film 23 is rolled. The laminating film 23 comprises a total of three films, namely, a protective film 24, an adhesive film 25 that is a layer of an adhesive without carrier material, and a carrier film 26, as can be best seen in the enlarged circular detail in Figure 2. The adhesive film 25 has sections 27 that are punched corresponding to

the size and shape of a surface of the data carrier 6 that is to be coated.

The laminating station furthermore has a take-up roller 28 on which the remainder of the laminating film 23 is taken up after a laminating process. The laminating film 23 is conducted between the feed roller 22 and the take-up roller 28 around a plurality of guide rollers 30 through 38 in order to provide a defined path for the tape-like laminating film 23 between the rollers 22 and 28. Each of the rollers 30 through 38 is rotatable about its axis of rotation, and the rollers 31 and 37 are designed as so-called compensating rollers that are borne movable in the horizontal direction in order to make it possible to compensate for the length of the laminating film 23 between the rollers 22 and 28. This makes it possible for the rollers 22 and 28 to be rotated at a constant speed despite discontinuous laminating cycles, as will be described in the following. The parts of the adhesive film 25 that are not needed can be removed in advance, that is, prior to introducing the laminating film into the laminating station, for instance during production of the laminating film, or they can remain on the film in order to ensure a uniform thickness of the film 23 across the entire width and length thereof, at least prior to a laminating process.

The laminating film 23 is conducted around a wedge-shaped blade 40, where the laminating film 23 turns sharply in order to make it possible to remove the protective film 24 from the laminating film 23 so that one side of the adhesive film 25 is exposed for adhering with the

optical data carrier 6. The removal of the protective film 24 is best seen in Figure 3. Once removed, the protective film 24 is rolled onto a roller (not shown in greater detail). An alternative type of film removal device could also be used instead of the wedge-shaped blade 40.

Once the laminating film 23 has been conducted around the blade 40, it is conducted around the roller 33 that is lower with respect to a horizontal and that is embodied as a pressure roller. After the roller 33, the laminating film 23 is conducted about the shaft 34, which is driven via a motor 42.

Rotation of the driven roller 34 causes corresponding rotation of the pressure roller 33 and a downstream roller 35 that is embodied purely as a guide roller.

The laminating station 7 has a first sensor 45 that is associated with the driven roller 34 and that is able to detect contours in the punched sections 27 of the adhesive film 25. The laminating film 23 is moved back and forth in the longitudinal direction via the driven roller 34 until the sensor 45 detects a certain contour of the punched sections 27, such as for instance a punched center hole. When the sensor 45 detects the center hole, it is positioned directly over one edge of the center hole by the movement of the film, this resulting in precise alignment of the section 27 with respect to the roller 34 and in particular the pressure roller 33 in the longitudinal direction of the laminating film 23.

The laminating station 7 furthermore has a support and transport unit 47 for the data carrier 6 to be laminated. The support and transport unit 47 forms a horizontal support for the data carrier 6 and can be moved in any direction via suitable moving apparatus (not shown in greater detail). A lowerable centering pin 48 ensures precise alignment of the data carrier 6 on the support and transport unit 47. The pin 48 can be lowered during the laminating process so that it is not impaired. This is achieved in that it is pressed upward into the position shown in Figure 3 by a spring with relatively limited spring force. When pressure is exerted on the pin from above, it is pressed downward against the spring force. Alternatively, the pin can be moved via a cylinder or motor.

Prior to the lamination of the data carrier 6, the transport and support unit 47 is moved in the X direction, which corresponds to the longitudinal direction of the laminating film 23, against a stop. This ensures that the substrate 6 and the section 27 of the adhesive film 25 previously aligned in the longitudinal direction are aligned to one another. Then the transport and support unit 47 is moved back and forth in the Z direction, which runs transverse to the longitudinal direction of the laminating film 23. A sensor pair 50 allocated to the transport and support unit 47 detects a contour, such as for instance the contour of a center hole, of the punched section 27 of the adhesive film 25, which makes it possible to laterally align the data carrier 6 with respect to the section 27.

Once the data carrier 6 has been aligned in the above manner both in the X direction and in the Z direction with respect to the section 27 of the adhesive film 25, the transport and support unit 47 is raised in the Y direction. Now the motor 42 drives the roller 34, which causes the laminating film 23 to move in the X direction. At the same time and synchronized with the rotation, the transport and support unit 47 is moved in the X direction. The section 27 comes into contact with the surface of the data carrier 6 to be protected and is pressed thereagainst by the pressure roller 33 such that it adheres to the data carrier 6 and detaches from the carrier film 26. The synchronized movement of the drive roller 34 with the transport and support unit 47 applies a section 27 of the adhesive film 25 centered on the data carrier 6 so that the section 27 of the film 25 completely covers the side of the data carrier 6 to be protected and does not project over the edge. The pressure of the pressure roller in the Y direction is controlled via the position of the transport and support unit 47 in order to control the adhesion properties of the pressure sensitive adhesive film 25. Alternatively, of course, the pressure roller 33 can move in the direction of the transport and support unit. A spring-type suspension system can be provided for good control or compensation of the pressure. The suspension can be provided via a spring or compressed air cylinder.

Then the data carrier thus provided with the section 27 of adhesive film 25 is conveyed via the handling apparatus 8, which has,

for example, an interior hole gripper, removed from the transport and support unit 47, and conveyed to the second laminating station 9.

A new data carrier 6 is loaded onto the transport and support unit 47 of the laminating station 7, and the process is repeated. As was mentioned in the foregoing, the rollers 22 and 28 rotate continuously during the entire process, although the adhering process is discontinuous. The longitudinal compensation of the laminating film 23 that is therefore necessary is achieved via a horizontal movement of the compensating rollers 31 and 37, as already mentioned in the foregoing.

The second laminating station 9 has the same construction as does the first laminating station 7, and the second laminating station 9 will therefore not be described in any detail. The laminating film utilized in the second laminating station essentially has the same arrangement as does the laminating film 23, with the exception that instead of the adhesive film 25 a protective or covering film, in particular a PC tape, is provided.

Although the laminating film has three layers in accordance with the description in the foregoing, namely a protective film 24, an adhesive/covering film 25, and a carrier film 26, it should be noted that it is not absolutely necessary for there to be a protective film 24. However, if no protective film 24 is used, at least the rollers 30 and 32 should be specially coated in order to prevent the then exposed

adhesive-covering film 25 from adhering to or being damaged by these rollers.

Alternatively, the guide rollers up to the roller 33 can be omitted, whereby in this case the rollers 22 and 28 must be controlled such that the sections 27 are aligned and a movement of the laminating film 23 is achieved synchronized with the transport and support unit 47.

In addition, a single sensor, such as for instance a camera, can be used for the above alignment processes instead of the sensors 45 and 50.

Figure 4 shows a schematic side view of an inventive data carrier 6 that was manufactured in the previously described manner. The data carrier has a PC disk having a thickness of approximately 1.1 mm. The PC disk has a data-carrying surface 62 upon which is applied the adhesive film 25, as described previously. The adhesive film 25 is formed by an adhesive layer having a thickness approximately 25 µm. Provided on the adhesive film is the PC tape 64, which was laminated on in the previously described manner. The PC tape 64 has a thickness of approximately 75 µm. As a result of the PC tape 64, the data carrier obtains the required optical characteristics for a DVR. The data carrier can, for example, be disposed, in the manner of a diskette, within a housing that surrounds it, thereby significantly reducing the mechanical requirements placed upon the coating.

The present invention was previously described with the aid of preferred exemplary embodiments of the invention, without, however,

being limited to these special embodiments. In particular, the invention is not limited to the previously mentioned materials and dimensions.

* C L M S *

## Patent claims

1. Method of coating an optically readable data carrier (6), according to which a transparent adhesive film (25) is applied to a surface of the data carrier (6) that is to be protected, and subsequently a transparent covering film is applied to the adhesive film.

2. Method in accordance with claim 1, characterized in that the adhesive film (25) comprises a layer of adhesive without carrier material.

3. Method in accordance with claim 1 or 2, characterized in that the covering film is a PC tape.

4. Method in accordance with any of the preceding claims, characterized in that said adhesive film (25) and/or said covering film is withdrawn from a carrier film (26) during or after application to said data carrier (6).

5. Method in accordance with any of the preceding claims, characterized in that a protective film is withdrawn from said adhesive film (25) and/or said covering film prior to the application.

6. Method in accordance with any of the preceding claims, characterized in that the shape and size of said adhesive film (25) and/or of said covering film corresponds to the surface of said data carrier (6) to be protected.

7. Method in accordance with claim 6, characterized in that sections (27) of said adhesive film (25) and/or of said covering film that correspond to the shape and size of said data carrier (6) are punched onto said carrier film (26).

8. Method in accordance with any of the preceding claims, characterized in that said adhesive film (25) and/or said covering film is applied centered on the surface of said data carrier (6) to be protected.

9. Method in accordance with claim 8, characterized in that said adhesive film (25) and said data carrier (6) are aligned with one another prior to application.

10. Method in accordance with any of the preceding claims, characterized in that said adhesive film (25) and/or said covering film is pressed onto said data carrier (6) during the application via a rotating pressure roller (33).

11. Method in accordance with claim 10, characterized in that the pressure of said pressure roller (33) is controlled.

12. Method in accordance with any of the preceding claims, characterized in that prior to pressing by said pressure roller (33) said adhesive film (25) and/or said covering film is held at a pre-specified angle relative to the surface of said data carrier (6).




13. Method in accordance with any of the preceding claims, characterized in that the data carrier (6) and the pressure roller (33) are moved relative to one another.

14. Method in accordance with claim 13, characterized in that said data carrier (6) is moved past said pressure roller (33) linearly.

15. Method in accordance with claim 13 or 14, characterized in that said pressure roller (33) is rotated synchronously with the relative movement of said data carrier (6).

16. Method in accordance with any of the preceding claims, characterized in that the adhesive film (25) is an adhesive film that responds to pressure, the adhesion characteristics of which vary as a function of the pressure.

17. Apparatus for coating an optically readable data carrier (6), with a first laminating station (7) for applying a transparent adhesive film (25) onto a surface of the data carrier (6) that is to be protected, and a second laminating station for applying a transparent covering film to the adhesive film (25).

18. Apparatus in accordance with claim 17, characterized in that the shape and size of said adhesive film (25) and/or of said covering film correspond to the surface of said data carrier (6) that is to be protected.

19. Apparatus in accordance with either of claims 17 or 18, characterized in that sections (27) of said adhesive film (25) and/or of said covering film that correspond to the shape and

size of said surface of the data carrier (6) that is to be protected are punched onto a carrier film (26).

20. Apparatus in accordance with any of claims 17 to 19, characterized in that at least one of said laminating stations (7) has an aligning unit for aligning said adhesive film (25) with the surface of said data carrier (6) to be protected.

21. Apparatus in accordance with any of claims 17 to 20, characterized in that at least one of the laminating stations (7) has a rotatable pressure roller (33).

22. Apparatus in accordance with any of claims 17 to 21, characterized in that at least one of the laminating stations (7) has a device for moving the data carrier (6) and/or the pressure roller (33).

23. Apparatus in accordance with claim 22, characterized in that the device has at least one linear movement unit (27) for the data carrier (6).

24. Apparatus in accordance with any of claims 17 to 23, characterized by a device for withdrawing a protective film (24) from the adhesive film (25) and/or the covering film.

25. Apparatus in accordance with any of claims 17 to 24, characterized in that the adhesive film (25) is a layer of an adhesive without carrier material.

26. Apparatus in accordance with any of claims 17 to 25, characterized in that the covering film is a PC tape.

27. Optically readable data carrier (6), the data-carrying surface of which is covered with a transparent adhesive film (25) and a transparent covering film.

28. Data carrier in accordance with claim 27, characterized in that the adhesive film (25) is a layer of an adhesive material without carrier material.

29. Data carrier in accordance with claim 27 or 28, characterized in that the covering film is a PC tape.

30. Data carrier in accordance with any of claims 27 to 29, characterized in that the data carrier (6) is disposed in a protective housing.