

Method for printing on disc-shaped information carriers

The invention relates to a method and a corresponding apparatus for printing label information in the form of graphics and/or characters on disc-shaped information carriers, which information is provided on the information carrier on at least one side thereof in at least one area, as is known from DE-B-2 304 723.

5 Disc-shaped information carriers are generally provided with so-called label information, for example relating to the information content of the information carrier. Generally, the label information comprises both characters and graphics. In the case of optically readable disc-shaped information carriers, for example so-called Compact Discs, the label information is provided on one side of the information carrier
10 in a broad annular area which is concentric with the centre hole. In prior-art methods this label information is applied by a screen-printing or a tampon printing process. For both processes it is necessary to produce a film and subsequently a printing block, which takes time and is expensive. Moreover, the known printing methods are not flexible, *i.e.* in the case of a high production rate a rapid change-over to print different
15 label information on different information carriers is not possible. It is substantially impossible to provide each information carrier with an individual identification.

As individual desk-top printers in data processing it is known to use printers of the kind which generate the printing format again for each printing cycle, for example matrix printers or ink-jet printers. Printers of this type are used in many
20 printing processes. For this reference is made to, for example, GB-A-2,120,821, which discloses a label printer specially adapted to print labels. Another construction which is likewise suitable for continually changing labels is known from, for example, US-A-4,393,386. This concerns, for example, address printing on envelopes by means of an ink-jet printer. These known constructions, in which printers are coupled to data
25 processing systems, have the advantage that the data to be printed can be changed at all times.

For making up layouts of newspapers and magazines graphic programs are known by means of which the label information can first be made up in the desired

format purely electronically in a data processing system. At this stage the label information can be changed simply. Subsequently, this still purely electronic label information generated in the data processing system is prepared for and transferred to a printer. The preparation of the label information consists, for example, in the
5 breakdown into rows in the desired structure to enable it to be processed in the appropriate manner by a printer. Such programs are known in a wide variety for printers, for example for matrix or ink-jet printers in data processing systems.

DE-B-2,219,520 describes a method of forming an readable identification in the surface of an audio or video disc provided with a spiral groove for the storage of
10 scannable signals. For this purpose the surface of a disc stamper is engraved by means of a cutting stylus or a high-energy radiation beam with a line or dot pattern in the form of a spiral or separate concentric turns. To form a readable identification the cutting stylus is lifted or the beam is interrupted at given locations. Subsequently, the stamper is used for replication in an embossing or pressing process in a manner known *per se*.

15 Finally, DE-B-2,304,723 describes an arrangement for printing a readable identification on the label area of a plastics disc-shaped record carrier with one or two playing sides, particularly an audio disc. This arrangement should be constructed in such a way that the substrate can be reversed without manual contact and without damaging and soiling of the recording area. This is achieved in that there have been
20 provided at least a first printing device associated with one side of the record carrier and at least one further printing device associated with the other side of the record carrier, the first printing device being arranged in the path of the lower section and the further printing device being arranged in the path of the upper section of an endless conveyor belt which is movable in steps and which has openings for receiving, holding
25 and conveying record carriers. The information carriers are successively transferred to the individual work stations. The information carrier, which is mounted in a pallet, is advanced by one station at the operating frequency of the conveyor belt, so that it is situated underneath a first printing unit in the next cycle and underneath a second printing unit in the subsequent cycle. In both printing units the information carrier is
30 inked with a background colour in the flat label area of the upper side. In the next two operating cycles the background is allowed to dry. In the next operating cycle the information carrier is moved to a further printing area, where it is provided with the

label information. Subsequently, the information carrier is reversed and the reverse side is processed in the same way and sequence.

It is an object of the invention to provide a method of the type defined in the opening paragraph, for printing on disc-shaped information carriers, enabling high-
5 quality printing on information carriers to be produced in a reliable manner using simple means.

According to the invention this object is achieved, in a manner as defined in Claim 1, in that

- a) the label information is generated and prepared for a laser printer by means of a
10 data-processing system,
- b) for each printing cycle a laser-sensitive exposure cylinder is illuminated by a laser in conformity with a computer graphics program,
- c) the exposed areas are wetted *via* an ink container and transferred to a printing cylinder, and
- 15 d) said printing information is transferred to one information carrier at a time..

This provides high-quality printing because a laser printer enables a high resolution to be obtained, so that finer and consequently better structures are obtained.

The label information thus prepared and applied to the laser printer now drives the laser printer in order to print the label information on the information
20 carriers. Thus, by means of the invention label information can be prepared rapidly and, moreover, alterations can be made very rapidly both during processing and subsequently. The data-processing system can generate different label information in the form of a file, which can be fetched when required and printed on the information carrier by means of the laser printer. Thus, the arrangement enables a rapid change-
25 over between different label information during printing on the information carriers. In comparison with the prior art shorter preparation times are obtained, so that new label information can be produced and printed on a new series of disc-shaped information carriers in a substantially shorter time. Proofs, for example, can also be made in a short time. Consequently, when a new series is started no time is lost in the production of the
30 new label information, for example as required for the production of the printing blocks in the prior art. As a result of the very flexible method of printing different kinds of label information time and costs can be saved, in particular in the case of small series, so that the production of very small series with a separate label now becomes

economically feasible. Programs for processing the label information in the data - processing system, such as for example graphic programs or programs for preparing the information for the printer are commercially available and most data-processing systems use such programs anyway.

- 5 In many cases, to protect the printed information, an embodiment of the method of the invention is of advantage, in which after printing the information carrier is provided with a transparent protective coating.

- In another advantageous embodiment of the invention other printing methods can be used. This makes it possible to print the basic information (trade mark,
10 manufacturer, etc.) using a customary tampon-printing or screen-printing method, whereas the additional, variable information (title, composer, tracks, individual characterization, etc.) is printed with the above-mentioned method in accordance with the invention. The method can be combined without too many problems with the prior-art screen-printing or tampon-printing methods. By means of these prior-art methods it
15 is for example easy to produce a coloured background on which further detailed information, which may differ for different series, can be printed by means of the method in accordance with the invention.

- In a further embodiment of the invention the label information of each individual information carrier method includes an individual marking. This method
20 offers the important possibility of marking individual disc-shaped information carriers of one series having the same information content. This is for example of interest in the case of so-called CD-ROM discs. Individual marking enables a specific copy to be identified, *i.e.* to ascertain whether the user of said copy is the legitimate owner. This possibility is of special importance in view of copyright protection. Such an individual
25 marking may also be important for information carriers provided with music, because it enables so-called bootleg discs to be traced, *i.e.* discs having the same information content which have been manufactured illegally by third parties.

- The invention further relates to an apparatus for carrying out the laser-printing method in accordance with the invention. This apparatus is characterized by
30 a) a data-processing system for generating and preparing label information for a laser printer,
b) an exposure cylinder which can be illuminated by a laser and which has an associated ink container, and

- c) a printing cylinder which cooperates with the exposure cylinder and which is arranged in the direct proximity of a transport device for the information carriers to be printed, for example Compact Discs.

In the drawing Figures 1 to 3 show diagrammatically an exemplary
5 embodiment of the invention.

Fig. 1 shows diagrammatically an apparatus comprising a laser printer for printing on disc-shaped information carriers,

Figs. 2 and 3 show parts of the apparatus shown in Figure 1.

Figure 1 shows diagrammatically a printing apparatus for disc-shaped
10 information carriers 51, which apparatus comprises a laser printer 524. This printer comprises a laser 525 which illuminates an exposure cylinder 526 provided with an electrically chargeable layer 527 (for example selenium). The exposure cylinder 526, which has an associated ink container 528, cooperates with a printing cylinder 529. A transport device 530 provides the transport of the information carrier 51 to be processed
15 in the direction 531. A data-processing system 523 supplies the label information and drives the laser 525. For each information carrier 51, for example a Compact Disc, to be provided with print a separate printing cycle is carried out. In Fig. 1 printing has been completed for the disc 51a (see Fig. 2), printing is in progress for the disc 51b, and the printing has not yet started for the disc 51c.

20 The cylinder 526 is illuminated in conformity with the computer graphics (label information). The ink from the container 528 is applied to the printing cylinder 529 and hence to the Compact Disc 51 to be provided with print. After printing the Compact Disc 51a is provided with a transparent scratch-resistant coating.

Fig. 2 shows the exposure cylinder viewed in the direction 532. Here, the
25 exposure range of the laser 525 is referenced 533 and the exposed area bears the numeral 534.

Fig. 3 shows a finished Compact Disc 51a. The actual information on the Compact Disc is situated between the polycarbonate layer 535 and the metallization 536. The numeral 537 indicates a protective coating, the numeral 538 is the printed layer
30 applied in accordance with the invention, and the numeral 539 indicates a transparent scratch-resistant coating, for example a UV lacquer.

The use of a laser printer is not expensive and provides a high printing quality.

Claims:

1. A method of printing label information in the form of graphics and/or characters on disc-shaped information carriers (51), which information is provided on the information carrier (51) on at least one side thereof in at least one area,
characterised in that
- 5 a) the label information is generated and prepared for a laser printer (524) by means of a data-processing system (523),
b) for each printing cycle a laser-sensitive exposure cylinder (526) is illuminated by a laser (525) in conformity with a computer graphics program,
c) the exposed areas are wetted *via* an ink container (528) and transferred to a
10 printing cylinder (529), and
d) said printing information is transferred to one information carrier (51) at a time.
2. A method as claimed in Claim 1, characterised in that after printing the information carrier (51a) is provided with a transparent protective coating (539).
3. A method as claimed in Claim 1 or 2, characterised in that the label
15 information (538) of each individual information carrier (51) includes an individual marking.
4. A method as claimed in any one of the Claims 1 to 3, characterised in that in addition other printing methods are used.
5. An apparatus for carrying out a method as claimed in any one of the
20 Claims 1 to 4, characterised by
 - a) a data-processing system (523) for generating and preparing label information for a laser printer (524),
b) an exposure cylinder (526) which can be illuminated by a laser and which has an associated ink container (528), and
25 c) a printing cylinder (529) which cooperates with the exposure cylinder (526) and which is arranged in the direct proximity of a transport device (530) for the information carriers (51c) to be printed, for example Compact Discs.