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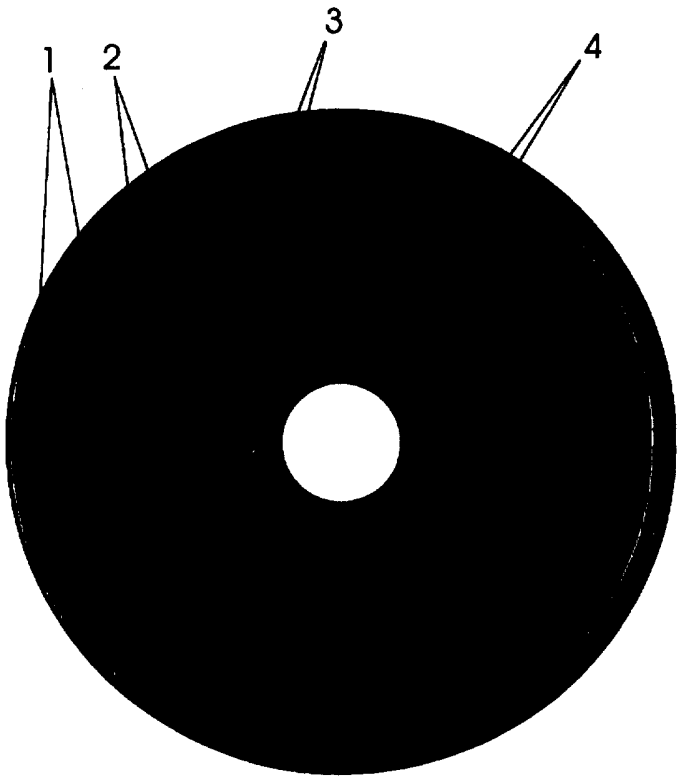
With amended claims.

(54) Title: A CD-ROM SOFTWARE PROTECTION SYSTEM

(57) Abstract

This Protection System, for PC Software stored in CD-ROM, prevents the illegal copying (hacking) with negligible cost increase of the protected Application. The same CD-ROM that contains the Application Software serves as a "protection key". The CD-ROM disk undergoes a special treatment during its production phase that results in the generation of the Inspection Ring. This system uses a special method for the verification of the authenticity of the Inspection Ring. The existence of the Inspection Ring along with the use of the authenticity verification procedure make impossible the copying of the CD-ROM disk even with the most advanced recording equipment. This system has many advantages over other protection methods like: excellent protection, transparency to the end-user and very low cost since the "protection-key" is the same CD-ROM disk that contains the Application. This system can be used for the protection of every Application Software for PC compatibles that is stored in a CD-ROM and runs under DOS or Windows environments.



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TECHNICAL DESCRIPTION

A CD-ROM Software Protection System

1. Introduction

This system is used for the protection of CD-ROM software (for PC compatible computers) from illegal copying. This method can be used for CD disks of any size and any CD-ROM format. This system prevents the illegal copying of the PC software using as a "protection key" a specially processed CD-ROM. A very high degree of software protection is provided due to the fact that this specific CD-ROM can not be copied and due to the existence of an advanced method for the verification of the CD-ROM authenticity.

This system consists of two parts:

a)The specially manufactured CD-ROM

b)The System Software that verifies the CD-ROM authenticity

2. Development of the Software Protection System

2.1 Modification of the Protected Application Software

The protected Application Software (hereafter referred as Application Code) combines with the special Protection Software (hereafter referred as Protection Code) to form a new Composite Application Code. The Protection Code is placed before the Application Code in order to carry out the initial checks for the verification of the CD-ROM authenticity prior to the execution of the Application Code.

The integration of the Protection Code into the Application Code can be carried out in either the form of objective code or in the form of executable code.

2.2 Glass Master production

The Composite Application Code that resulted from the procedure defined in paragraph 2.1 together with the rest of the Application files are copied on the Glass Master with the

use of special CAD/CAM tools that control this process. Special attention is given to the spatial distribution of the software on the Glass Master. As seen in figure 1 that shows this special Glass Master, a specific ring (3) with width of a few mm is reserved, so that the central region (4) is mechanically processed during a following step, while the adjacent areas on either sides contain the Protection Code and special Encrypted Data that are checked by the Protection Code. This area will be referred hereafter as Protection Ring (3). The Application Code and the Data are stored in the areas (1) & (2) of the Glass Master.

2.3 Mechanical Processing of the Glass Master

During this phase, the Glass Master undergoes a special mechanical treatment with the use of special equipment that is used for the Glass Master manufacturing. Thus, a homocentric ring (4) of 10 μm width is produced within the central part of the Protection Ring. This ring marks the specific region and is checked by the Protection Code for the verification of the authenticity of the CD-ROM disk and will be referred hereafter as Inspection Ring (4). The polar coordinates of the Inspection Ring are very critical for the verification of the authenticity of the CD-ROM. These parameters are included in the Data of the Protection Code since the polar coordinates of the Inspection Ring are predetermined.

This very special treatment can only be carried out with the use of special CAD/CAM package that controls the Glass Master production machine. The Inspection Ring (4) is seen in Figure 1 that shows the special Glass Master that contains the Software Protection System. The Composite Application Code with the Data are stored in adjacent areas (1) & (2) to the Protection Ring (3) on both sides. The Inspection Ring (4) is located in the middle of the Protection Ring (3). The Glass Master (Figure 1) is used subsequently for the production of the CD-ROM disks with special machines (stampers). Although this special processing refers to the CD-ROM Glass Master, it can be applied to any type of Optical Disk regardless of size and format.

3. The Operation of the Software Protection System

3.1 The Protection Code

The Protection Code is written in Assembly language for Intel 80x86 microprocessors and was developed with the use of the Borland Turbo Assembler. The Microsoft Linker was also used for the linking process. The Protection Code is combined with the Application Code in either objective or executable form.

3.2 The Functional Operation of the Protection System

The Software Protection System requires the presence of the original CD-ROM disk in the CD player independent of whether the Application was copied on the hard disk or is executed from the CD disk. During the execution of the Application, initially the Protection Code is executed, inspects the CD-ROM Protection Ring and decodes the polar coordinates of the Inspection Ring. Then it checks that the Inspection Ring is at the predefined position thus verifying the authenticity of the CD-ROM. If the CD-ROM is not the original one, then the execution is terminated and the user receives a relative message. Special attention is given during the Software development phase, so that the verification process does not conflict with the operation of the CD-ROM device driver.

Only after the authenticity of the CD-ROM is verified, the execution of the application is allowed in either a DOS or Windows environment. In a case that the original CD-ROM is absent, the Application execution does not commence, while at the same time a relative message on the user screen appears.

This system can achieve a very high degree of protection because it is impossible to copy the original CD-ROM. This is due to the existence of the Inspection Ring on the CD-ROM disk. The most common ways of illegal copying of CD-ROMs are:

a) CD-ROM copying with CDR (CD Recordable) equipment
b)Glass Master copying & reproduction
c)Application copying on the hard disk
d)Protection Code "cracking" with the use of Software or Hardware Debugger

Cases (a), (b) & (c) are prevented with the help of the Inspection Ring that as a destroyed area makes every possible recording procedure to fail. Case (d) is prevented thanks to the unique integration of the authenticity verification procedure into the Application software in a way that can not be cracked by experienced programmers and hackers. In particular, the Protection Code prevents the introduction of Breakpoints with the use of Software & hardware Debugger, thus making it impossible to crack the protected software.

CLAIMS

I) System for the protection of DOS & Windows Applications from illegal copying that is based on the use of a specially processed CD-ROM disk that can not be copied due to special treatment on a small area of its surface with the use of Glass Mastering equipment. This treatment results in permanent destruction of the optical properties in this specific area.

II) Software protection system, according to claim I, that is characterised by the fact that the treatment is carried out at a predefined position, in a homocentric ring of a specific width (Inspection Ring).

III) Software protection system, according to claims I & II, that the special reserved region on the CD-ROM disk (Inspection Ring) has predefined polar co-ordinates which are stored as encrypted data information on the disk in an adjacent reserved area (Protection Ring).

IV) Software protection system, according to claims I & III, that during its operation, the position of the Inspection Ring is detected and its co-ordinates are compared to the predefined co-ordinates that were stored on the disk during the production phase. If these co-ordinates are found the same, the authenticity of the disk is verified, while in the opposite case the disk is regarded an illegal copy and the Installation & Execution operations are cancelled.

V) Software protection system, according to claims I & IV, that is characterised by the fact that the authenticity verification is carried out prior to the Protected Application execution, thus no further requiring the presence of the original CD-ROM disk in the drive for verification purposes.

AMENDED CLAIMS

[received by the International Bureau on 28 January 1997 (28.01.97); original claims 1-5 replaced by amended claims 1-17 (3 pages)]

1) A method for the protection of DOS & Windows Applications from illegal copying that is based on the use of a specially processed CD-ROM or DVD-ROM disk that can not be copied successfully by any CD-ROM recording equipment due to special treatment on a small area of its surface with the use of Glass Mastering equipment.

2) A CD-ROM disk according to claim 1; wherein one or more areas (Protection Rings) that are homocentric rings are reserved for special treatment with Glass Mastering equipment and storage of encrypted data.

3) A CD-ROM disk according to claim 2; wherein permanent destruction of the optical properties of one or more specific ring areas in the middle of the reserved areas (Inspection Rings) of the Glass Master is achieved with the use of Mastering Equipment that creates a continuous spiral track that has the form of a continuous pit.

4) A mark according to claim 3 that is a ring of non-standard format (Inspection Ring) that can be accessed only by special software methods.

5) A mark according to claim 4; wherein any attempt to access this ring (Inspection Ring) with special software will result in the issue of a specific error code message by the operating system.

6) A CD-ROM disk according to claim 3; wherein the reserved areas of the Protection Ring that are adjacent to the Inspection Ring contain encoded data that include the precise polar coordinates of the Inspection Ring and encrypted information about the protected Application software.

7) A method according to claim 3; wherein the specially processed ring (or rings) is reproduced through the CD fabrication process in a successive order from the original Glass Master to the Father Stamper CD, to the Mother Stamper CD, to the

Production Stamper CD and to the finally produced CDs that are distributed in the market.

8) A CD-ROM disk according to claim 2; wherein the area of the CD that does not undergo any specific treatment (Application Rings) has the standard CD-ROM or DVD-ROM format and can be used for Information storage. It contains the Application Code & Data.

9) A CD-ROM disk according to claim 3 that is characterised by the fact that the treatment is carried out at a predefined position, in a homocentric ring of a specific width (Inspection Ring).

10)A CD-ROM disk according to claim 8; wherein the CD, following the radial direction towards the circumference, contains an area with Application Code & Data (Application Ring) followed by one or several Protection Rings in alternative succession with Application Rings. Each Protection Ring has a specific location on the CD-ROM and precise width size. According to this pattern, the inner & outer rings are always Application Rings containing Application Code & Data.

11)A software protection system according to claims 1; wherein the Protection Algorithm (Protection Code) is placed in the beginning of the Application Code thus forming a Composite Application code that is distributed into the Application Ring areas.

12)A software protection system according to claim 11; wherein the encrypted data that are stored in the Protection Ring indicating the precise polar coordinates of the Inpsection Ring are also contained in the Protection Code that is part of the Composite Application code.

13)A software protection system according to claims 1 & 10; wherein its operation comprises of the following steps:

verify the position of the Inspection Ring (or Rings if more than one are used) and measure its polar co-ordinates

compare the measured with the predefined polar co-ordinates that were stored on the disk during the production phase in the Protection Ring (or Rings)

compare the measured with the predefined polar co-ordinates that were placed in the Protection Code

If both comparisons agree, the authenticity of the disk is verified, while in the opposite case the disk is regarded an illegal copy and the Installation and/or Execution operations are cancelled.

14)A software protection system according to claim 13; wherein the Protection Code accesses the Inspection Ring area and verifies that a predefined error code message is obtained.

15)A software protection system according to claim 13; wherein its operation comprises of the following steps:

verify the position of the Protection Ring (or Rings if more than one are used) and measure its polar co-ordinates and width

compare the measured with the predefined polar co-ordinates & width that were placed in the Protection Code

If the comparison agrees, the authenticity of the disk is verified, while in the opposite case the disk is regarded an illegal copy and the Installation and/or Execution operations are cancelled.

16)A software protection system according to claim 13 that is characterised by the fact that the authenticity verification is carried out prior to the Protected Application execution, thus no further requiring the presence of the original CD-ROM disk in the drive for verification purposes.

17)A software protection system according to claims 1 & 13; wherein the Protection Code is transparent to the end-user and has an autonomous operation that does not need any provision of special key-codes to be provided by authorised dealers of the protected Application software.

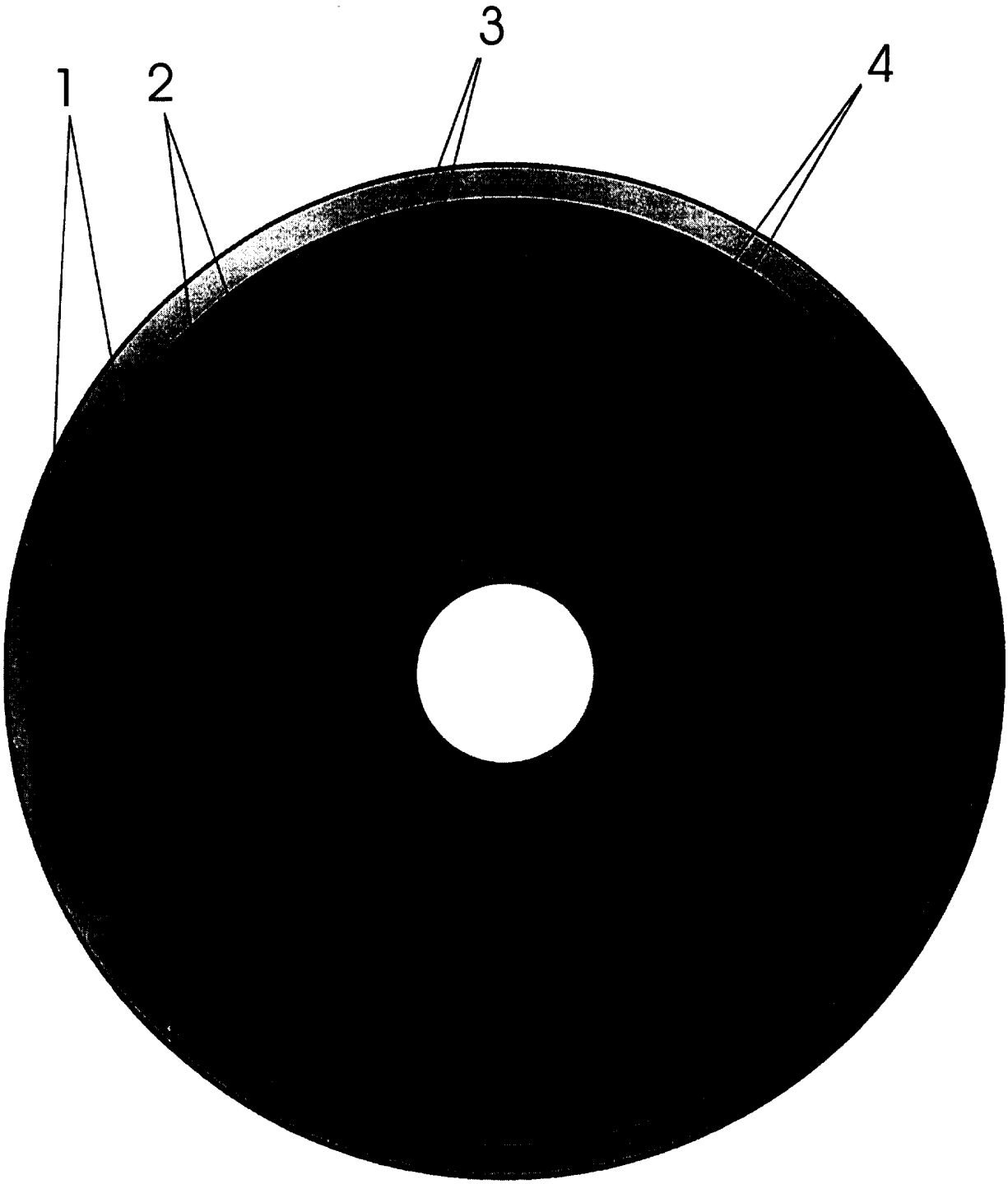

FIGURE 1

INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/GR 96/00013

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G11B20/00 G06F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 400 319 (FITE BARRY A ET AL) 21 March 1995 see column 12, line 7 - column 16, line 13; figures 1-7 see column 3, line 54 - column 5, line 46	1,2,5
A	see column 2, line 9 - column 3, line 16	3,4

X	WO,A,95 03655 (OAKLEIGH SYSTEMS INC) 2 February 1995	1,5
A	see page 9, paragraph 1 see page 10, last paragraph - page 11, paragraph 3; figures 3,6	2-4

A	DE,A,37 20 233 (KEESE THOMAS) 22 December 1988 see column 7, line 44 - column 8, line 62; claims 10-13,16; figures 4-6	1-5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-5400319	21-03-95	US-A- 5513169	30-04-96
WO-A-9503655	02-02-95	EP-A- 0711479	15-05-96
DE-A-3720233	22-12-88	NONE	