"An optical disc cartridge and a mechanism for preventing an incorrect insertion of a cartridge"

The present invention relates to an optical disc cartridge and a mechanism for preventing an incorrect insertion of a cartridge, especially to an optical disc cartridge of the size of 90 mm and the preventing mechanism therefor. There are three kinds of write-once type of optical discs on the market. The sizes of them are 350, 203 and 133 mm. Recently, an erasable type of optical disc of the size of 90 mm is under development. In order to obtain a cartridge of the 90 mm erasable optical disc, a 90 mm magnetic floppy disc cartridge based on U.S. proposal of "ANSI X 3B8/86-57" can be used to design the cartridge for the 90 mm erasable optical disc. The actual diameter of this standard magnetic floppy disc is in fact 86 mm. The size of the cartridge for it is 90 mm in width, 94 mm in length, 3.3 mm in thickness. The diameter of the erasable optical disc is 86 mm. The size of the cartridge for the erasable optical disc is 90 mm in width, 94 mm in length, 6 mm or 8 mm in thickness.

In a reproducing apparatus for a standard 90 mm floppy disc the incorrect insertion of a 90 mm, erasable optical disc cartridge can be prevented because the height of the aperture of the reproducing apparatus for the floppy disc cartridge is less than the thickness of the 90 mm erasable optical disc cartridge. Conversely, in a

reproducing apparatus for a 90 mm erasable optical disc, it will be possible to insert the 90 mm floppy disc into the aperture of the reproducing apparatus for the optical disc cartridge by mistake. In the case of an incorrect insertion, it is possible to damage either the optical head for retrieving information in the reproducing apparatus, or the disc rotating portion. The structure of the 90 mm magnetic floppy disc is shown in detail in United States Patent Specification No. 4,546,397.

It is an object of the present invention to provide a 90 mm erasable optical disc cartridge for use with an information reproducing apparatus, the insertion of which cartridge the wrong way around in the apparatus is prevented.

It is another object of the present invention to provide in combination an optical disc cartridge and an information reproducing apparatus, wherein the insertion of the cartridge the wrong way round in the apparatus is prevented.

According to one aspect of the present invention there is provided an optical disc cartridge for use with an information reproducing apparatus, said cartridge including:

(a) a case for housing an optical disc;

(b) a shutter slidably mounted on said case for opening and closing an aperture provided in said case, said shutter being engageable and moveable by shutter moving means between a position in which the aperture is normally closed and a position where the aperture is open when the case has been fully inserted into a cartridge receiving

portion of the information reproducing apparatus; and

(c) a notch provided on a side of said case opposite to the side thereof from which said shutter moving means engages said shutter, said notch being engageable with said shutter moving means as said optical disc cartridge is inserted incorrectly into said cartridge receiving portion, so as to prevent further movement of said optical disc cartridge into said cartridge receiving portion of the information reproducing apparatus.

A cut-out portion may be provided at the side of the case opposite to the side thereof from which the shutter moving means engages the shutter and a stop is provided in correspondence therewith on the cartridge receiving portion, whereby only the correct cartridge can be completely inserted into the cartridge receiving portion of the information reproducing apparatus.

The shutter moving means may comprise a pivotable lever for engaging said shutter in order to open it as the cartridge is inserted into the cartridge receiving portion of the information reproducing apparatus.

In addition, the optical disc cartridge may include a second lever actuatable by the cartridge to energize a motor to effect the rotation of the optical disc within the case of the cartridge.

Furthermore, the optical disc cartridge may include means to prevent the actuation of said second lever by the cartridge in the event that the first lever does not open the shutter upon insertion of the cartridge into the

cartridge receiving portion of the information reproducing apparatus.

The present invention will now be described in greater detail by way of example with reference to the accompanying drawings, wherein:-

Figure 1 (for background reference only) is a perspective side view of a cartridge having a cut-out portion in correspondence with a stop on the cartridge receiving portion of an information reproducing apparatus for preventing complete insertion of an incorrect cartridge into the apparatus;

Figure 2 is a perspective bottom end view of the cartridge shown in Figure 1;

Figure 3 illustrates a bottom end view of the cartridge as seen from the back side of Figure 1;

Figures 4 and 5 (for background reference only) are plan views of another cartridge, illustrating one form of shutter moving means;

Figures 6 and 7 are explanatory views of an embodiment of the cartridge according to the present invention;

Figure 8 is an explanatory view of the present invention;

Figure 9 is an expanded perspective view of the notch 311 shown in Figure 8;

Figures 10A, 10B, 10C, 10D, 10E and 10F illustrate variations of the notch shown in Figures 8 and 9; and

Figures 11A, 11B and 11C illustrate a further embodiment of the cartridge of the invention; Figure 11A is

a plan view, Figure 11B is a front view of the cartridge shown in Figure 11A, and Figure 11C is a cross sectional view taken along line E-E in Figure 11B.

Referring to Figures 1 and 2, a cartridge 100 is provided for receiving and protecting an optical disc 104 therein. A cartridge inserting portion 200 is provided in

an information reproducing apparatus which is not shown in full in the drawings. A shutter 101 on the cartridge is arranged to slidably open at the time of insertion into the information reproducing apparatus. The shutter 101 is provided with an aperture 102 therein. An aperture 103 is also provided on the cartridge 100. An aperture 106 is provided in the cartridge for inserting a motor driven shaft for rotating the optical disc 104, which shaft is not shown in the drawings. Location holes 107 and 108 are provided in the cartridge and are used to align the cartridge 100 in the cartridge inserting portion 200 accurately. At the insertion side of the cartridge 100, a cut-off portion 105 is provided at a head and side portion of the cartridge 100, the location of which is just at the opposite side of the 90 mm magnetic floppy disc cartridge based on the above referred to U.S. proposal of "ANSI X 3B8/86-57". A stop 201 for preventing the incorrect insertion of a different type of cartridge is provided in the cartridge inserting portion 200 against the cut-off portion 105.

The optical disc 104 which can be used in the cartridge can include: an optical disc of a reproducing-only type comprising uneven pits; an optical disc of a write-once type using a hole-melting, a phase change, and an organic dye; and an optical disc of erasable (re-writable) type using a magneto-opto, and a phase change.

As shown in Figure 3, the cut-off portion 105 is located just at the opposite side of the 90 mm magnetic floppy disc cartridge. There is no cut-off portion at the

opposite side portion 109 where normally there is provided a cut-off portion in the 90 mm magnetic floppy disc cartridge. Furthermore, a stop 201 is provided in the cartridge inserting portion 200 adjacent the cut-off portion 105. When a cartridge 100 having the cut-off portion 105 is inserted into the portion 200, it can be set into the right position without touching the stop 201. On the other hand, in case of inserting a different type of cartridge, for example, a standard 90 mm magnetic floppy disc cartridge, a side edge portion of the cartridge abuts against the stop 201, and the cartridge cannot be fully inserted into the information reproducing apparatus. Since an insertion of an incorrect cartridge can be prevented, damage to either an optical head for retrieving information in the reproducing apparatus, or a disc rotating portion can be prevented.

If the following dimensions for the positioning of the reference holes 107 and 108 and the cut-off portion 105 are selected, the designs of the cartridge, optical disc and the magnetic floppy disc are substantially the same, so that the production and the design of the cartridge inserting portion can be simplified. As shown in Figure 3 these dimensions for the holes 107, 108 and the cut out portion 105 are as follows:-

L1=80 mm

L2=85 mm

θ1=45 deg

The distance between the inclined edge of the cut-off portion 105 and the corresponding inclined edge of the stop

201 is set to be more than 0.5 mm.

The above described dimensions are only examples, and other suitable dimensions can also be used. It is only necessary to provide the cut-off portion at the opposite side against the 90mm magnetic floppy disc, in order to prevent insertion of an incorrect 90 mm magnetic floppy disc into the information reproducing apparatus.

Referring now to Figures 4 and 5, the cartridge insertion portion 200 is provided with a first lever 202 for opening the shutter at the time of insertion of the cartridge 100, and a second lever 203 for operating the motor rotating portion. The first lever 202 and the second lever 203 are biased by means of springs 204 and 205. A stop 206 is provided for preventing the operation of the second lever 203 when the cartridge 100 is inserted into the reproducing apparatus when the shutter 101 is closed.

Figures 4 and 5 show motions in the case where the cartridge 100 is inserted in the correct way. After inserting the cartridge 100 into the cartridge inserting portion 200 in a direction indicated by an arrow A, the first lever 202 abuts against the side edge of the shutter 101, rotates in the direction indicated by an arrow B, and slides the shutter 101 in a direction indicated by an arrow C in response to the insertion of the cartridge 100. Upon further insertion of the cartridge 100, the edge of the cartridge 100 touches the second lever 203, and pushes it to operate a motor rotating portion. The central area of the

optical disc 104 is known as the hub, and is made of metal for the purpose of magnetic clamping. The motor rotating portion comprises a motor and a turn table made of a magnetizable magnet material. The turn table is coupled to the hub by means of magnetic force through an aperture 106 of the cartridge, and transmits the rotational power of the motor to the optical disc 104. Under these conditions, the aperture 102 of the shutter 101 coincides with the aperture 103 of the cartridge 100, so that the information reproducing apparatus is in a fully operative condition.

In the case where the first lever 202 can not catch the edge of the shutter 101, the first lever 202 rotates in the direction of the arrow B and slides on the front edge of the shutter 101. The first lever 202 is moved forwards into the reproducing apparatus in an advanced position as compared with the normal position, and then abuts against the second stop 206 in order to arrest the movement of the first lever of the cartridge as well as the rotational movement of the second lever 203. By stopping the movement of the second lever 203, damage to the optical head for retrieving information in the reproducing apparatus, or a disc rotating portion can be prevented.

Referring now to the embodiment of the present invention shown in Figures 6 and 7, an optical disc cartridge 300 is shown movable into and out of the inserting portion 400 of an information retrieving apparatus. The optical disc cartridge 300 houses an optical disc 304. A shutter 301 is provided on the cartridge, the shutter having a front edge which has an

antisymmetrical sharp edge in the direction of insertion as indicated by the arrow A. An aperture 302 is provided on the shutter 301. An aperture 303 is provided on the cartridge 300. A lever 402 is provided for opening the shutter 301 and is biased by means of a spring 404. A stop 401 is provided against which a cut-off portion 305 of the cartridge 300 will abut.

The dimensions of the cartridge 300 shown in Figures 6 and 7 are selected as follows.

L0=90 mm, L3= 5 mm, L4=34 mm, L5=22 mm,
L6=32 mm, L7=30 mm, L8= 5 mm.

Figures 6 and 7 also show the movements in the case where the cartridge 300 is inserted in the correct way. Upon inserting the cartridge 300 into the cartridge inserting portion 400 in the direction indicated by the arrow A, the lever 402 contacts an inclined portion 309 of the front edge of the cartridge 300 and a side edge of the shutter 301. It is rotated in the direction shown by the arrow B. The head of the lever 402 slides along the front edge 310 of the cartridge and slides the shutter 301 in a direction shown by the arrow C in response to the insertion of the cartridge 300. At the end of this movement, the aperture 302 of the shutter 301 coincides with the aperture 303 of the cartridge 300, so that the information reproducing apparatus is brought into the operative condition.

Figure 8 represents an explanatory view and indicates that the cartridge is being inserted into the reproducing

apparatus the wrong way around. The underneath side of the cartridge is shown in Figure 8. In order to prevent incorrect insertion a notch 311 is used as a stop. The distance of the side edge of the shutter 301 from the right side of the cartridge 300 is indicated as L3 in Figure 6. The distance of the beginning of the notch 311 from the left side of the cartridge 300 is indicated as L8 in Figure 6. In this example, the distances L3 and L8 are both equal to 5 mm. Accordingly, the location of the side edge of the shutter 301 from the right side of the cartridge 300 in Figure 6 and the location of the beginning of the notch 311 from the left side of the cartridge 300 in Figure 8 are the same.

When the cartridge 300 is inserted into the reproducing apparatus incorrectly as shown in Figure 8, the edge of the lever 402 is caught in the notch 311, and the rotational movement of the lever 402 is stopped and further insertion of the cartridge is prevented.

If the notch 311 is not provided in front of the cartridge 300 and the cartridge 300 is inserted into the reproducing apparatus the wrong way round, the top edge of the lever 402 is not caught at the beginning by anything and slides on the front edge 312 until the top edge of the lever 402 engages with the right edge of the shutter 301 shown in Figure 8. When the lever 402 engages with the shutter 301, almost all the cartridge has been inserted into the reproducing apparatus,there remaining only the last few mm projecting outside. In this case, the user may try to push

the cartridge fully home into the reproducing apparatus by force. This results in either the shutter 301 or the lever 402 being broken, and may result in the cartridge 300 becoming totally jammed within the reproducing apparatus.

An aperture 306 is provided for inserting a motor rotating portion for rotating the optical disc 304, which is not shown in the drawing. The aperture 306 is covered by the shutter 301 in order to prevent the ingress of dust. Location holes 307 and 308 may also be provided for the purpose disclosed with reference to the first embodiment. The location holes 307 and 308 are also used to accurately align the cartridge 300 in the cartridge inserting portion 400 of the reproducing apparatus.

An expanded perspective view of the notch 311 shown in Figure 8 is shown in greater detail with reference to Figure 9.

Figures 10A, 10B, 10C, 10D, 10E, 10F show variations in the shape of the notch or depression shown in Figures 8 and 9. As will be evident,large varieties of shapes and sizes are available. In Figures 10A and 10D the notches are square. In Figures 10B and 10E the notches are semi-circular, whilst in Figures 10C and 10F they are triangular. In Figures 10D, 10E and 10F, the notches 311 are located slightly to the left as compared with examples shown in Figures 10A, 10B and 10C.

Referring now to Figures 11A, 11B and 11C which illustrate a further embodiment of the present invention. It should be noted that in normal operation, when the

cartridge 300 is in the state of being taken out from the reproducing apparatus, the shutter 301 must be closed. In order to close the shutter normally, a twisted coil spring is used. The cartridge 300 normally comprises two parts of a case. In this embodiment, the twisted spring 315 is fitted so as to widen the distance between the cartridge 300 and the shutter 301, and closes the shutter 301. The disc cartridge comprises a two part case, consisting of an upper part 300a and a lower part 300b. The twisted coil spring 315 is fitted to the cartridge 300 as follows. After fitting one of the ends of the coil spring 315 to the shutter 301, the other end of the coil spring 315 is put into the cartridge 300. The notches 311 which act as the stop are provided in both cases 300a and 300b, and one of the notches 316 is deeper than the other in order to facilitate the fitting of the coil spring 315 into the cartridge 300. The coil spring 315 can be put into the cartridge by pushing the spring 315 against the case 300b, because there is a difference of depth as shown by La and Lb between the notch 311 and the notch 316 as shown in Figure 11C.

As described in detail above, a cut-off portion may be provided at the head and side portion and at an inserting side of the 90 mm erasable optical disc cartridge, and is opposite to a cut-off portion used in the standard (86 mm) floppy disc cartridge. A stop in a cartridge insertion portion of the reproducing apparatus is located in correspondence with the cut-off portion of the cartridge. Accordingly, this ensures that an incorrect type of

cartridge cannot be inserted into the reproducing apparatus.

Furthermore, as described in detail above, in accordance with the invention, a stop in the form of a notch is provided at a front end of the cartridge and at a portion along the axis adjacent to an edge of the shutter where the shutter opening lever abuts. This ensures that it is impossible to insert a cartridge the wrong way round.

CLAIMS

1. In combination, an optical disc cartridge and an information reproducing apparatus, wherein incorrect insertion of the optical disc cartiridge into a cartridge receiving portion of the information reproducing apparatus is prevented, said cartridge including:

(a) a case for housing an optical disc; and

(b) a shutter slidably mounted on said case for opening and closing an aperture provided in said case; said apparatus including:

(c) means for engaging and moving said shutter between a position in which the aperture is normally closed and a position where the aperture is open when the case has been fully inserted into said cartridge receiving portion of the information reproducing apparatus;

wherein a notch is provided on a side of said case opposite to the side thereof from which said shutter moving means engages said shutter, said notch being engageable with said shutter moving means as an optical disc cartridge is inserted incorrectly into said cartridge receiving portion, so as to prevent further movement of said optical disc cartridge into said cartridge receiving portion of the information reproducing apparatus.

* C L M S *

2. The combination according to claim 1, wherein a stop is provided on the cartridge receiving portion in correspondence with a cut-out portion located at the side of said case opposite to the side thereof from which said shutter moving means engages said shutter, whereby complete insertion of an incorrect cartridge into the cartridge receiving portion of the information reproducing apparatus is prevented.

3. The combination according to claim 1 or claim 2, wherein said shutter moving means comprises a pivotable lever for engaging said shutter in order to open it as the optical disc cartridge is inserted correctly into the cartridge receiving portion of the information reproducing apparatus.

4. The combination according to claim 3, including a second lever actuatable by the cartridge to energise a motor to effect rotation of the optical disc within the case of the cartridge.

5. The combination according to claim 4, including means to prevent actuation of said second lever by the cartridge in the event that the first lever does not open the shutter upon insertion of the optical disc cartridge into the cartridge receiving portion of the information reproducing apparatus.

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* C L M S *

6. The combination according to claim 5, wherein said second lever actuation prevention means is a stop engageable by the first lever.

7. In combination, an optical disc cartridge and an information reproducing apparatus, constructed substantially as herein described with reference to and as illustrated in Figures 6 and 7; Figures 8 and 9; and Figure 8 as modified by any one of Figures 10A to 10F and/or Figure 11 of the accompanying drawings.

8. An optical disc cartridge for use with an information reproducing apparatus, said cartridge including:

(a) a case for housing an optical disc;

(b) a shutter slidably mounted on said case for opening and closing an aperture provided in said case, said shutter being engageable and moveable by shutter moving means between a position in which the aperture is normally closed and a position where the aperture is open when the case has been fully inserted into a cartridge receiving portion of the information reproducing apparatus; and

(c) a notch provided on a side of said case opposite to the side thereof from which said shutter moving means engages said shutter, said notch being engageable with said shutter moving means as said

optical disc cartridge is inserted incorrectly into said cartridge receiving portion, so as to prevent further movement of said optical disc cartridge into said cartridge receiving portion of the information reproducing apparatus.

9. An optical disc cartridge according to claim 8, wherein a cut-out portion is provided at said side of said case opposite to the side thereof from which said shutter moving means engages said shutter, said cut-out portion being for correspondence with a stop provided on the cartridge receiving portion of the information reproducing apparatus, whereby the complete insertion of an incorrect cartridge into the cartridge receiving portion is prevented.

10. An optical disc cartridge according to claim 8 or claim 9, wherein said notch is rectangular, semi-circular or triangular.

11. An optical disc cartridge according to any one of claims 8 to 10, wherein said shutter is slidable at right angles to the direction of insertion of said case into the cartridge receiving portion of the information reproducing apparatus, in order to open and close the aperture in the case.

12. An optical disc cartridge according to claim 11, wherein spring means are provided in said case to bias the shutter to a position where it closes the aperture.

13. An optical disc cartridge according to any one of claims 8 to 12, wherein at least one hole is provided in said case for aligning the case in the cartridge receiving portion of the information reproducing apparatus.

14. An optical disc cartridge constructed substantially as herein described with reference to and as illustrated in Figures 6 and 7; Figures 8 and 9; and Figure 8 as modified by any one of Figures 10A to 10F and/or Figure 11 of the accompanying drawings.

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