THE JOINT EXAMINATION BOARD

PAPER P6

INFRINGEMENT AND VALIDITY OF UNITED KINGDOM PATENTS

25TH APRIL, 1996

10.00 A.M. - 2.00 P.M.

Please read the following instructions carefully. This is a **FOUR HOUR** Paper.

1. Write on one side of the paper only using **BLACK** ink. You must write your examination number and the designation of the Paper in the appropriate boxes at the top of the sheet. You must **NOT** state your name anywhere in the answer.

2. **NO** printed matter or other written material may be taken into the examination room.

3. Answers **MUST** be legible. If the examiners cannot read a candidate's answer no marks will be awarded.

4. Candidates are reminded that marks are awarded more for the points selected for discussion and the reasoning displayed than conclusions reached.

Documents supplied:-

Client's letter
Client's European Patent (UK) '007
Prior Art Patent
Part of Microsphere's Brochure

CLIENT'S LETTER

Your client writes the following letter to you:

Dear Sirs,

MICROSPHERES

As you know, my company, Spheroids Technology Limited, has been manufacturing what are called microspheres for many years.

The microspheres have been used in manufacturing liquid crystal devices for a number of years now but you will remember that six years ago you obtained for us a European patent covering inter alia the United Kingdom, for an application of these microspheres in the manufacture of *CD-ROM'S*. We refer to this patent as the '007 patent. In hindsight, the patented invention protected by '007 was ahead of its time and we have been working on ways of putting this technology into effect.

In January 1994, we were approached by a US company, Microballs Inc., for an exclusive licence under the '007 patent. As part of the negotiations, Microballs cited one prior patent which they say renders the validity of our '007 patent very suspect, I am enclosing copies of the '007 patent and of the cited patent. We negotiated with Microballs at length over this issue but negotiations broke down in August 1994 and Microballs told us that they were intending to manufacture CD-ROM's without a licence.

Since then they have set up a plant in Colorado and have begun to manufacture improved CD-ROM's without a licence and they are shipping their products to the United Kingdom, in large quantities. I am enclosing a copy of a part of their brochure which they are also distributing widely.

We really need your help. Please advise as to our position and what action we can take.

Yours faithfully,

You should advise your client on infringement and the validity of the European Patent (UK) **solely with regard to the United Kingdom**, providing very brief notes also on the action that your client can take, if any, making reference only to the copy of that patent and of the cited patent and to the brochure which your client sent you. You establish that the European Patent (UK) is in force.

CLIENT'S EUROPEAN PATENT '007

The present invention is concerned with improvements in or relating to optical storage media and with methods of recording and reading data on/from said media. More particularly, the invention is concerned with optical storage of information on data carriers such as CD-ROM's but may also be used with fiches, cards or recording tape.

In accordance with the present invention, the data carrier's surface is completely or partially covered by focusing microstructures adjacent to a layer, or "burn film", which has its optical properties changed when exposed to intense light, or changed by having holes burned therethrough where the light is focused. Each change or 'hole' would correspond to a binary '1' or a binary '0', depending on the manner in which the corresponding electronics were designed to read the surface.

During recording of data, such local changes are created in the layer by having the microstructures focusing the light, thus obtaining a high light intensity on the layer. During reading of data, the optical microstructures may operate as an active optical component assisting the reading equipment.

By using e.g. transparent microspheres (typical diameter: 1 to 100 μm (micron))as focusing elements disposed over an optically absorbing film, a tight focusing and high data storage capacity can be achieved without the complexity and the expense that otherwise would be required for a recording and reading system which focuses directly on the light absorbing layer. Using oblique illumination through the microspheres, possibilities arise for storage of a high number of data bits at each microsphere position as well as for data protection. Easy pre-recording on mass produced data carriers becomes possible. During reading of data, the microspheres can function as auxiliary optics, which enables the reading of large blocks of data without the use of a laser.

Storage of data by means of laser beams which produce local changes of the optical properties of a thin film on a planar substrate are well known.

The change in optical properties can be reversible, whereby the stored data can be deleted and replaced by new data.

Alternatively, the change in optical properties can be irreversible, whereby it becomes impossible to delete and/or re-record new data. Storage media of the latter type are often referred as WORM (Write Once Read Many Times) media.

A usual method of preparation of WORM media consists of depositing on the substrate, which is a plastic disc, a thin film of a low melting point metal such as Tellurium . During data storage, each data bit is represented by the physical status of the specific film area assigned for the storage of that one bit (one elementary data storage cell with its address), i.e. whether that area has been irreversibly changed due to exposure to light or whether it is unchanged.

In the prior art, a data storage medium of the optical type is known. This data carrier is however only adapted for the storage of visible data, i.e. images which are visually perceivable and which consist of spots that are to be interpreted together in order to create an image. "Tilt images" can be created due to the optical structures, i.e. a lens raster or array, because the lenses are able to direct light to define small areas underneath the lenses, depending on the direction of illumination. The variation range for the lens diameter is 150-500 μm. Thus, the technique described does not relate to a data storage medium for optimised "close packing" of e.g. digital independently interpretable data bits, but only to a spot-structured image storage of the directly visible type. Only irreversible recording of data is described in the prior art.

A main objective for the use of optical data storage media is the very high storage density which can be achieved.

A main objective of the present invention is to provide an optical data carrier and methods for recording and reading which, in spite of high data storage density, impose modest requirements upon the recording and reading equipment with respect to power and precision.

These objectives are achieved according to the invention by manufacturing an optical data storage medium of the type which is precisely defined in the accompanying claims, and by applying recording and reading processes for data on the medium.

The invention will now be further described by means of examples and will also be explained with the aid of the following figures:

Fig. 1 shows in more detail how a hole can be created in the burn-film in various positions underneath one single transparent sphere by varying the direction of the incident light beam.

Fig. 2 illustrates retro-reflection from the burn-film by means of a transparent sphere.

Figs 3 A and 3B illustrate how burn spots can be formed in the prior art and according to the present invention.

Figs. 4A and 4B illustrate the manner of recording through one single sphere from several directions by screenings or parallel displacement of the light beam at the entrance to the optical system and the effects of so doing.

The Figures show schematic drawings of a memory medium according to this invention: A carrier layer 5 of e.g. plastic is coated with a thin burn-film 4, which is covered with microlenses, e.g. small, transparent spheres which are spread on top of the film 4 or adjacent to it, preferably in a certain pattern. During recording of data a light beam 1 from a laser 7 is directed toward one sphere 10 at a time; the beam 1 only having to be sufficiently in focus to hit single spheres 10. The light is thereafter focused in the actual sphere 10 and illuminates a small spot of the burn-film 4 underneath the sphere 10, which causes a change of the optical properties in the burn-film 4 at this spot, e.g. a hole is created in the burn-film (a "burn-spot") through which light can pass. The presence or non-presence of a burn-spot represents one information bit (logical "0" or "1").

Fig. 3B shows how much "broader" a beam 9 can be to burn the same size spot when focused by a sphere 10 compared to the prior art system shown in Fig. 3A.

The problem still remains that large spheres 10, in analogy with large burn-spots, as mentioned above, give low data storage density as long as only one burn-spot relates to each sphere. However, by illuminating the spheres 10 from other directions, burn-spots will occur at many points 11 underneath one given sphere 10, see Fig 1. Writing of burn-spots 11 by illuminating at skew angles thus enables each sphere 10 to store several bits, depending on how many burn-positions can be assigned to each sphere.

Fig. 4B shows an example where light has been sent through a large number of spheres in the same way using 5 different angles in the same plane. The corresponding burn-holes in the film are formed in line, with good individual definition. This result shows that it is possible to produce under each sphere, for example, a group of well defined burn-holes.

The focusing microstructures can have many forms:

Such structures can include e.g.:

- Discrete optical elements, immobilised in relation to the data storage film (spheres, convex lenses, Fresnel structures).
- Stamped surface patterns in a transparent layer.

Two main alternatives exist for reading of data from the data storage medium, namely measuring the light that is reflected from the medium, or the light that is transmitted through it.

During recording and (in certain cases) reading, the laser beam has to be positioned and orientated at such an angle that each single sphere is struck correctly.

It is no trivial task to manufacture a data storage medium according to the invention, for example of the types with transparent spheres as optical structures. The spheres have to be placed as a monolayer onto the burn-film itself, they have thereafter to be fastened and protected. In practise the spheres must probably also be positioned with high precision in a predefined pattern.

After deposition of the spheres, the medium is encapsulated with a protective film of, e.g. transparent polycarbonate. A relevant total thickness of the memory medium is 0.8 mm, an ISO standard for credit cards.

CLAIMS

1 Optical data storage means (25) including a film (4) whose optical properties can be altered under the influence of strong localised radiation for recording data on the film and including optical elements (10) positioned in close proximity to the film (4) for refraction or reflection thereof on and/or control of the illumination towards the film (4), each optical element (10) focusing light in one group of localised areas (11) by illuminating the element (10) with light from different directions, the optical elements (10) forming an integral part of the data storage means (25), characterised in that each element (10) has dimensions less than 100 µm, preferably in the range 3 - 10 µm, parallel to the film (4), each group and each localised area (11) being readable and interpretable individually, and stored data formed by irradiation of the film being invisible.

2 Means according to claim 1, characterised in that the optical elements (10) comprise a plurality of separate, totally or partially transparent and optically refracting objects (10) placed on or above the film (4).

3 Means according to claim 2, characterised in that the optically refracting objects are spherical.

4 Means according to claim 3, characterised in that the spheres (10) have substantially the same diameter and physical properties.

5 Means according to claim 2 or 3, characterised in that the spheres (10) lie in contact with the film.

6 Means according to any one of claims 3-5, characterised in that the typical sphere (10) diameter is in the range 1 - 100 µm, preferably 3 - 10 µm.

7 A method of recording data on an optical data storage means (25) of the type described in any one of the previous claims, where intense illumination is directed toward the means from a plurality of different directions, each respective illuminated optical element (10) effecting change of optical properties of the film (4) in a number of localised areas (11) relating to each optical element, characterised in that the various directions of the illumination are achieved by parallel translation of a light beam (1) through various parts of the entrance side of one and the same optic focusing system (15), by selectively exciting permanently positioned, separate light sources or by selective partial blocking of a broad light beam (1) at the entrance side, causing the light to pass through different parts of the optical focusing system (15).

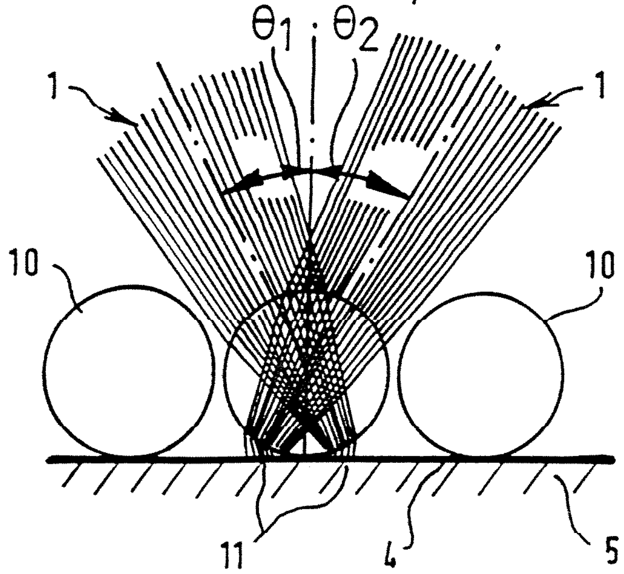


FIG.1

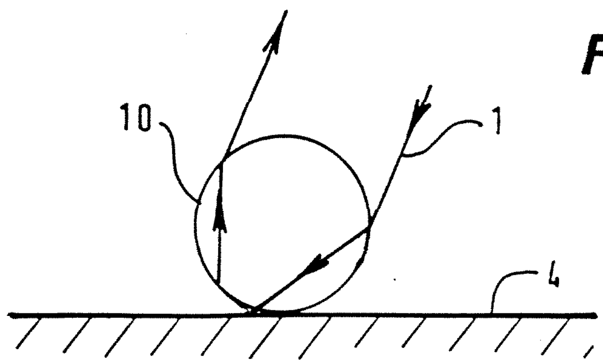
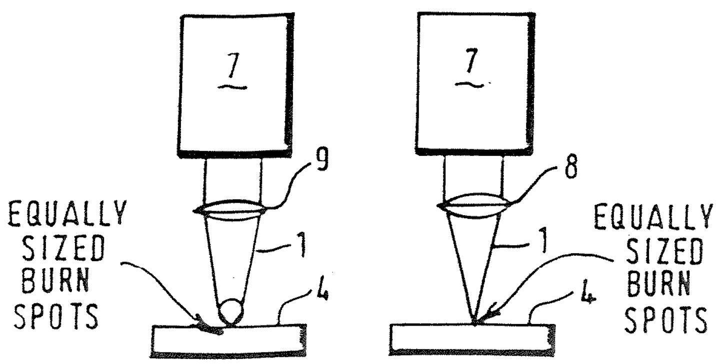


FIG.2

FIG.3B

FIG.3A



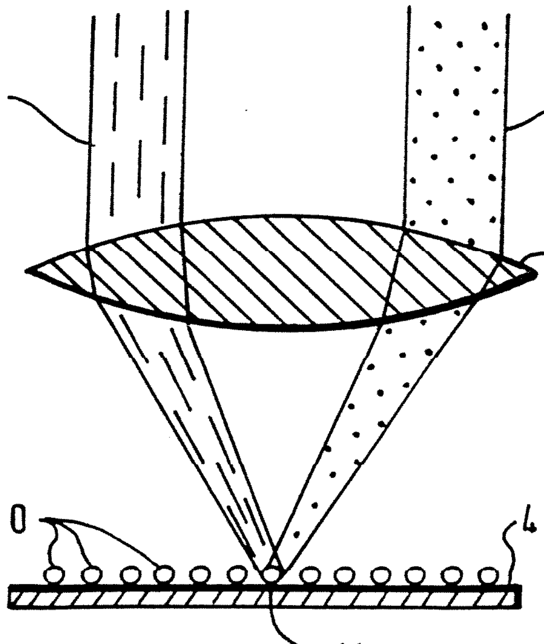
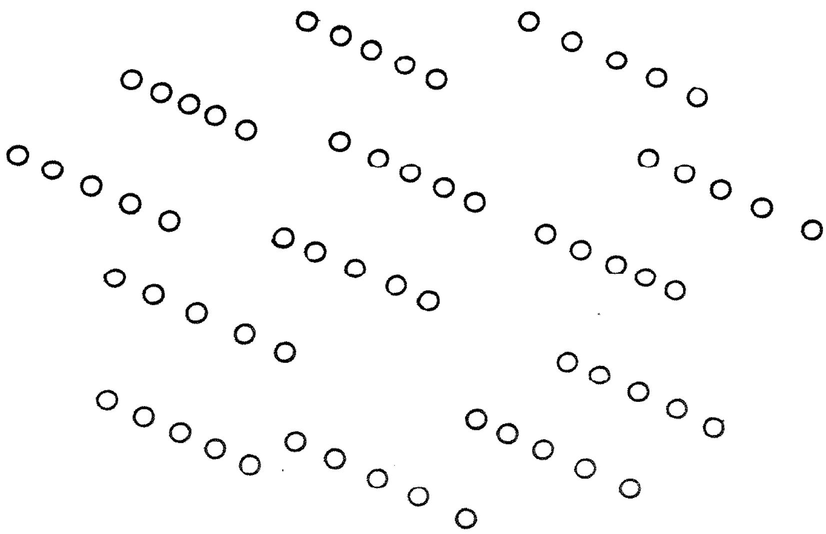


FIG.4A

FIG. 4B



PRIOR ART PATENT

The present invention relates to a data carrier in which information is provided in an inner volume area by means of a laser beam, said information being visible in the form of changes in the optical properties due to an irreversible change in the material caused by the laser beam, and to methods for producing and testing said data carrier.

Data carriers such as identification cards, credit cards, bank cards, cash payment cards and the like are used increasingly in a great variety of service sectors, for example in cashless transfers and within enterprises. Due to their widespread use they are, on the one hand, typical mass-produced articles; their manufacture, i.e. the production of the card structure and the addition of the card-individual user data, must be simple and inexpensive. On the other hand, the cards must be designed in such a way as to be protected as well as possible against forgery and falsification. The many kinds of identification cards already on the market or still in the development stage show the efforts of the relevant industry to optimise these two contrary conditions.

Thus, for example, it is known to provide light-diffractive elements such as holograms or diffraction grids in identification cards. This gives the cards optical effects which are at the same time protection against photographic or xerographic reproduction. Since the production of these holograms or diffraction grids is generally very expensive and very elaborate in terms of industrial processing, reasonable unit prices for these elements which allow for their use in identification cards are only obtained in the case of mass production with high piece numbers.

It is also a disadvantage of using holograms or diffraction grids in identification cards that good light conditions are required to test them visually. Even in normal room light, the desired optical effects up are only recognisable in a blur or not at all. Instead, the viewer, when testing a hologram, sees a surface which merely reflects metallically, or, when testing a diffraction grid, sees a slightly iridescent marking. Both effects can be imitated so well even using easily procurable so-called "decorating materials" that they cannot be distinguished by a layman from genuine holograms or diffraction grids under the above-mentioned unfavourable light conditions.

Furthermore, in the case of imprinted holograms or diffraction grids the feature is present in a relief structure of which a cast can be made using appropriate means which can then be used to forge genuine holograms.

In an advantageous embodiment of the invention, a lenticular screen in the form of a plurality of cylinder lenses disposed beside each other with straight or non-straight cylinder axes and/or spherical lenses is imprinted into a transparent film layer of a data carrier which forms the cover film. The focal lengths of the individual lenses may also vary, for example in accordance with a predetermined pattern, or else the cylinder lenses and/or spherical lenses may be disposed in a predetermined pattern. This cover film is preferably superimposed on a further transparent synthetic layer whose optical properties change under the effect of laser beams so that it blackens, for example.

Further advantages and advantageous embodiments are the object of the following description of the invention with reference to the figures, in which

FIG. 1 illustrates one embodiment of the invention.

FIGS. 2a to 2c show individual procedural steps for providing various pieces of information.

FIG. 3 shows an alternative method of making a credit card according to the invention.

FIG. 1 illustrates a credit card 1 or the like which is provided with the data such as the name of the user 2, an account number 3, a card number 4 and the information on the institution 5 issuing the card. User-related data 2, 3 are preferably burned by a laser into an inner volume area through a transparent cover film, while the general information such as that on the institution 5 is printed onto one of the card layers using printing techniques. In one area 8 of the card an optical authenticity feature in the form of a tilt image is provided whose structure and production shall be described in more detail below.

A card structure in a sample embodiment of such a card is shown in FIG. 2. The card comprises a core layer 6 made of paper or synthetic material, on the front and optionally the back of which information is provided using printing techniques or a laser writing method. The card core may be equipped with safety features such as watermarks, safety threads and/or fluorescent substances in order to increase its protection against forgery.

The core layer of the card is provided at least on one side, the front, with a transparent cover layer 7. A relief structure in the form of a plurality of cylinder lenses 15 disposed beside each other is imprinted into the surface of the cover layer in one area. These cylinder lenses confine the field of vision due to the focusing and thus only stripe-shaped areas of a data-carrying layer 12 located there below are visible on the plane of focus of the lenses when the card is viewed at a certain angle. Instead of cylinder lenses, other lens shapes such as spherical or a mixture of different lens shapes may also be used to achieve the same effect.

The lenticular screen itself, due to its specific relief structure, is already an authenticity feature which can be tested visually and/or mechanically.

Furthermore, this constitutes a further obstacle for the forger since he might now be forced to reconstruct the lenticular screen specially produced for a certain type of identification card or application.

Suitable materials for the transparent layer provided with the lenticular screen are, for example, synthetic materials which are permeable for the laser beam at least up to certain intensities, such as commercial PVC films. These films are advantageous in that they can be joined well to other synthetic films or paper layers of the card, for example by applying heat and pressure. The individual card layers are placed between two heated laminating plates and connected under pressure to form a unit.

The lenses (cylinder or spherical lenses) preferably have a width or a diameter of 400 µm, and an overall thickness of approx. 350 µm is preferably selected for the transparent imprinted layer.

Information is provided on the card by means of a pulse operated laser, the laser beam 9 being directed onto the lenticular screen at certain angles. A first piece of information is provided at a perpendicular angle as shown in Fig. 2a. When the laser beam is passed through the cylinder lenses, the beam is re-focused. Imaging is therefore restricted to linear stripe shaped areas 11 below the centres of the individual lenses 10a, 10b, 10c. By appropriately selecting the card structure and the laser parameters, the change in the card material caused by the laser radiation can be selectively influenced. In the embodiment shown in Figure 2, these parameters were limited to the surface area of the card core layer.

When the first piece of information has been provided the card may then be tilted so that the incident laser beam irradiates the card from other directions as shown in Figures 2b and 2c. Although the separate pieces of information form an array or group, they are observed separately by tilting the card in one direction or another.

In Figure 3, an alternative method of creating a credit card according to the invention is illustrated in which the card can be irradiated by laser light from separate sources 20 at different locations instead of being tilted.

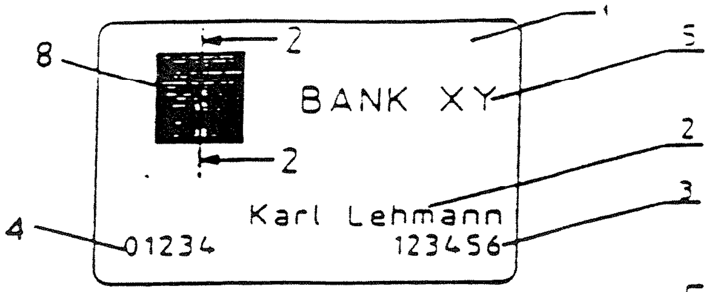


Fig. 1

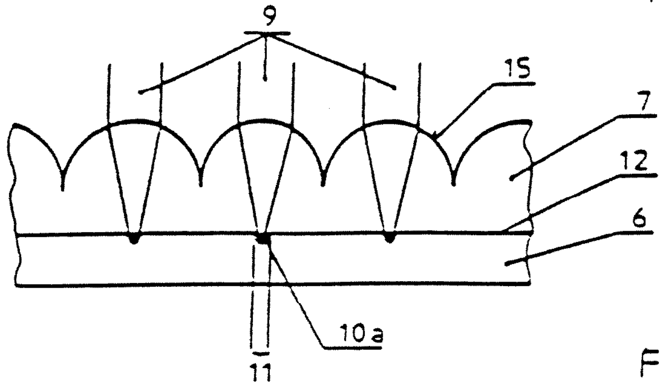


Fig. 2a

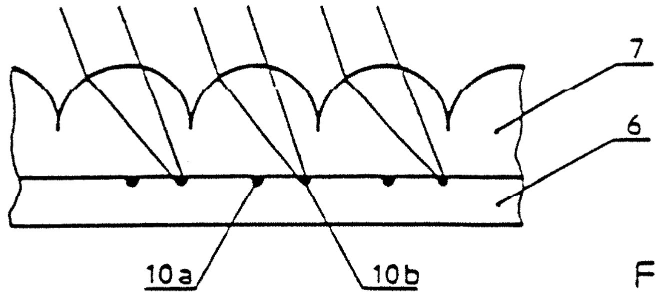


Fig. 2b

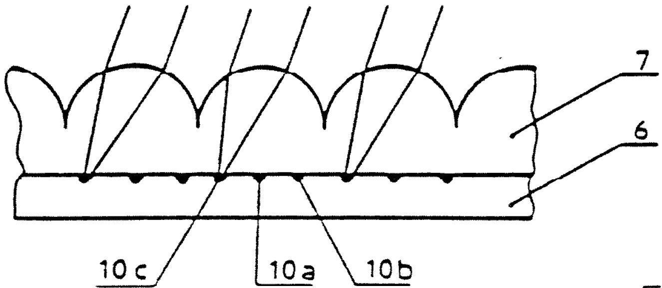


Fig. 2c

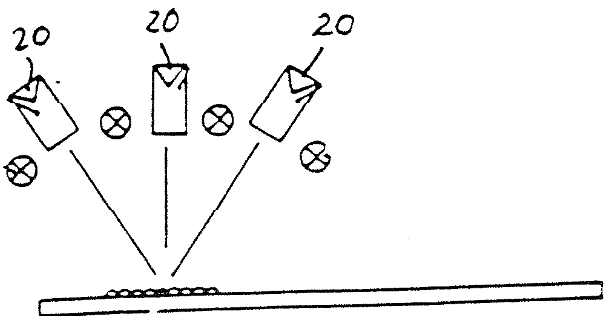


Fig.3

PART OF MICROSPHERE'S BROCHURE

NEW CD-ROM TECHNOLOGY

from

Microballs Incorporated

CD-ROM's supplied by Microballs Inc. have at least ten times the storage capacity of traditional CD-ROM's due to the use of improved technology provided by one of the world leaders in promoting new technologies.

How is it done?

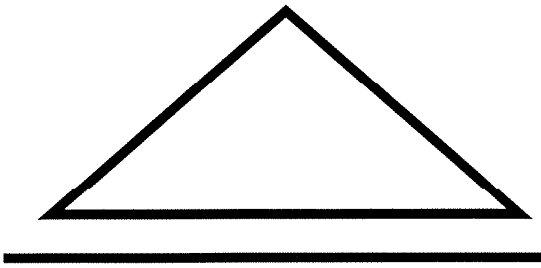
The recording of information on CD-ROM's is normally caused by exposing a storage or 'burn' film of the CD-ROM to laser light and controlling the laser so that it either affects the surface of the film at discrete spots and changes its reflective characteristics or literally burns holes in the film, so that, subsequently, when the disc is read, the presence of the changed surface spot or the presence of the hole will be read as a '0' or a '1' as the case may be.

In our laboratories, we have perfected a technology which includes covering the surface of the film with tiny lenses which are shown in the illustrations below; these tiny lenses are no more than a few tens of microns in diameter, and they focus laser light onto the underlying film more accurately than ever before so that the sharpest and smallest discrete part of the film is affected. This means that it is possible to create more storage capacity on a single disc than ever before because our processes ensure that more of the surface of the film is utilised.

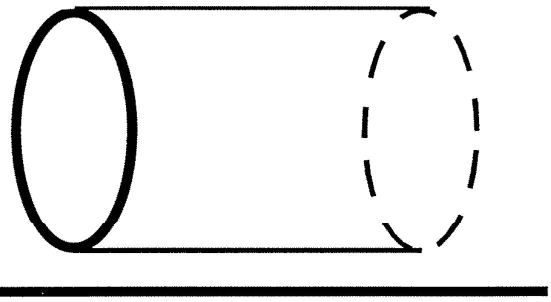
The lenses are in one of a number of forms as illustrated below, depending upon the storage density which is required of the CD-ROM; in some cases we use 'microrods' while in other systems we use ovoid or egg-shaped structures or prisms. These are coated onto the burn film using our own unique patented process and are then protected by an outer skin.

But Microballs has gone one step further. Using our unique technology, and by irradiating the lenses from different directions, we have been able to produce up to twenty five bits of information within the area of the burn film overlain which is overlain by each lens.

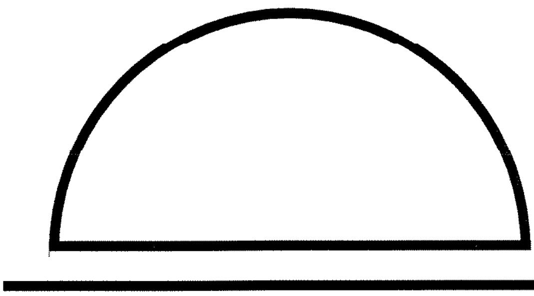
In comparison with CD-ROM's which are currently available, we have increased the storage capacity by a factor of ten which means that it is now possible to store ten times as much data and information on a single CD-ROM as before.



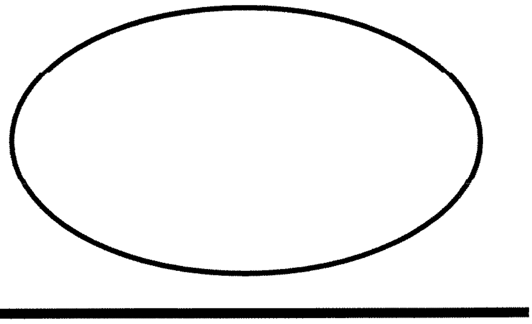
A



B



C



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