(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 September 2010 (02.09.2010)

PCT

(10) International Publication Number
WO 2010/097572 A2

(51) International Patent Classification:
G03B 35/00 (2006.01)

(21) International Application Number:
PCT/GB2010/000312

(22) International Filing Date:
24 February 2010 (24.02.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0903239.2 25 February 2009 (25.02.2009) GB

(71) Applicant *(for all designated States except US)*: **UGCS (UNIVERSITY OF GLAMORGAN COMMERCIAL SERVICES) LIMITED** [GB/GB]; University of Glamorgan, Pontypridd, Mid Glamorgan CF37 1DL (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **PLASSMANN, Peter** [DE/GB]; 15 Lon-y-Rhyd, Rhiwbina, Cardiff CF14 6JS (GB). **JONES, Carl** [GB/GB]; 15 Weldon Close, Croesyceiliog, Cwmbran, Gwent NP44 2PB (GB).

(74) Agents: **HASLAM, Simon, David** et al.; Abel & Imray, 20 Red Lion Street, London WC1R 4PQ (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: METHOD AND APPARATUS FOR STEREOSCOPIC IMAGING, AND ADAPTOR THEREFOR

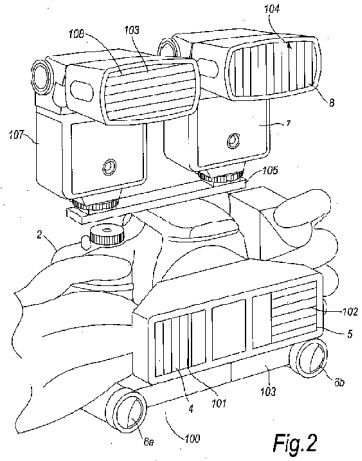

Fig.2

(57) **Abstract**: An apparatus (100) is provided for the production of stereoscopic images, the apparatus comprising: first and second imaging surfaces for the receipt of light one or more light sources (7, 107) for illuminating a subject with first characteristic radiation being polarised in a first orientation and second characteristic radiation being polarised in a second orientation: a first polarising element (101) for inhibiting passage of first characteristic radiation to the first imaging surface but facilitating the passage of second characteristic radiation to the first imaging surface, and a second polarising element (102) for inhibiting passage of second characteristic radiation to the second imaging surface but facilitating the passage of first characteristic radiation to the second imaging surface.

WO 2010/097572 A2

Method and apparatus for stereoscopic imaging, and adaptor therefor

The present invention relates to an apparatus and method for stereoscopic imaging, and an adaptor for an apparatus for stereoscopic imaging.

Stereoscopic imaging has been known for many years. Typically, two images are taken, for example, using two mutually-spaced lenses. The images may be viewed using a crossed-eyed technique or in a stereoscopic viewer to produce an image with an illusion of depth. More recently, images have been analysed using computer models to produce three-dimensional representations of objects from which measurements may be taken. For example, such techniques have been used to measure the shape of wounds and the like which are otherwise difficult to measure by conventional techniques. When one is imaging such subjects, flash photography is typically used to illuminate the subject. In one known method, the illuminating flash light is not polarised. This results in satisfactory illumination of the subject, but often results in a bright region in each of the two images which make up the stereoscopic image due to specular reflection of flash light by the subject. The position of the bright region in each of the two images tends to be mutually different, and if this is the case, then if the bright region in either of the two images overlaps with the region whose shape is to be measured, then measurement of shape may be difficult. One way of mitigating against this problem is to polarise the illuminating light and to use a second polariser (an analyser) to remove any specular reflected light. The resulting images are, however, generally very dark and surface texture is reduced, therefore making it difficult to measure shape. The present invention seeks to mitigate one or both of these known problems.

In accordance with a first aspect of the present invention, there is provided an apparatus for the production of stereoscopic images, the apparatus comprising:

first and second imaging surfaces for the receipt of light

one or more light sources for illuminating a subject with first characteristic radiation being polarised in a first orientation and second characteristic radiation being polarised in a second orientation:

a first polarising element for inhibiting passage of first characteristic radiation to the first imaging surface but facilitating the passage of second characteristic radiation to the first imaging surface, and

a second polarising element for inhibiting passage of second characteristic radiation to the second imaging surface but facilitating the passage of first characteristic radiation to the second imaging surface.

The apparatus in accordance with the first aspect of the present invention has proved particularly effective in producing stereoscopic images from which measurements of shape may be taken or computed.

While the apparatus may comprise a single light source (for example, in the form of a flash unit having an elongated light-emitting part), it is preferred that the apparatus comprises a first light source and a second light source. It is further preferred that the first light source illuminates the subject with first characteristic radiation and the second light source illuminates the subject with second characteristic radiation. It is preferred that the apparatus comprises a third polarising element for polarising light so as to produce first characteristic radiation and a fourth polarising element for polarising light so as to produce

second characteristic radiation. It is preferred that the third polarising element polarises light emitted from the first light source and the fourth polarising element polarises light emitted from the second light source (if the apparatus comprises first and second light sources).

The first and second imaging surfaces may be provided, for example, by one or more image-forming arrays of photosensitive elements (for example, by one or more charge coupled devices). Alternatively, the first and second imaging surfaces may be provided by one or more backing plates against which a frame of film may be located for forming an image on said frame of film. The first and second imaging surfaces are typically flat, planar surfaces, but may be curved.

The apparatus may comprise a first aperture for collecting light for the first imaging surface and a second aperture for collecting light for the second imaging surface.

The first and second imaging surfaces may be co-planar and may be contiguous with one another. For example, the first and second imaging surfaces may be provided by a single charge coupled device in a digital camera. The apparatus may comprise a light controller which forms a first optical path for directing light to the first imaging surface and a second optical path for directing light to the second imaging surface. This is of particular use when the first and second imaging surfaces are co-planar and contiguous. The light controller may, for example, be as simple as a mirror. The light controller may comprise a first plurality of optical elements for directing light to the first imaging surface and a second plurality of optical elements for directing light to the second imaging surface. One or both of the first and second plurality of optical elements may comprise one or both of a lens and a mirror. The light controller may comprise (if present) the first aperture for collecting light for the first

imaging surface and the second aperture for collecting light for the second imaging surface. The first and second apertures may be mutually spaced. The centres of the first and second apertures may be mutually spaced by between 50 and 100mm. The first and second polarising elements may be located in the optical path between the subject and the light controller. For example, the first polarising element may be provided in the optical path between the subject and the first plurality of optical elements for directing light to the first imaging surface. The second polarising element may be provided in the optical path between the subject and the second plurality of optical elements for directing light to the second imaging surface.

If the apparatus comprises first and second light sources, it is preferred that the spacing of the centres of the light emitting parts of the first and second light sources is substantially the same as the spacing of the centres of the first and second apertures for collecting light.

If the apparatus comprises first and second light sources, it is preferred that, if the apparatus is in a normal orientation, the centre of the light emitting part of the first light source is substantially directly above the centre of the first aperture for collecting light for the first imaging surface. It is further preferred that, if the apparatus is in a normal orientation, the centre of the light emitting part of the second light source is substantially directly above the centre of the second aperture for collecting light for the second imaging surface. Such an arrangement has proven to be particularly effective in producing suitable stereoscopic images.

If the apparatus comprises first and second light sources, the first and second light sources may be symmetrically located. For example, if the apparatus has an optical plane of

symmetry, it is preferred that the first and second light sources are located symmetrically in relation to the plane of symmetry.

It is further preferred that, if the apparatus is in a normal orientation, a vertical plane which is substantially orthogonal to the light emitting part of the first light source and which passes through the centre of the light emitting part of the first light source is substantially coplanar with a vertical plane which is substantially orthogonal to the first aperture and which passes through the centre of the first aperture for collecting light for the first imaging surface. Such an arrangement has proven to be particularly effective in producing suitable stereoscopic images.

It is further preferred that, if the apparatus is in a normal orientation, a vertical plane which is substantially orthogonal to the light emitting part of the second light source and which passes through the centre of the light emitting part of the second light source is substantially coplanar with a vertical plane which is substantially orthogonal to the second aperture and which passes through the centre of the second aperture for collecting light for the second imaging surface. Such an arrangement has proven to be particularly effective in producing suitable stereoscopic images.

The apparatus may comprise a body and an adaptor, the adaptor being provided with an adapter mounting portion for mating with a corresponding body mounting portion provided on the body. The body of the apparatus may comprise a camera body such as is well-known to those skilled in the art. The body mounting portion may comprise a lens mount such as is well known to those skilled in the art. The adaptor may comprise the light controller (if present). The adaptor may further

comprise one or both of the first and second polarising elements.

The first imaging surface and second imaging surface may be mutually spaced i.e. the first and second imaging surfaces may be separated from one another (for example, by having the first imaging surface in one camera body and the second imaging surface in a second camera body). In this case, each of the two camera bodies may be provided with a source of light (e.g. a flash unit).

Each of the polarising elements may comprise one of more of an absorptive or a beam-splitting polariser. A dichroic polariser (such as Polaroid (R) film) is an example of an absorptive polariser. Beam-splitting polarisers include those using reflection polarisation (such as Brewster reflection) and birefringence.

Each light source may typically comprise a flash lamp, such as a xenon flash lamp as is well known to those skilled in the art. Such light sources are typically actuated to emit light for brief periods of time (typically 1/50 to 1/2000 second), hence the term "flash lamp". Alternative light sources could be used, such as light emitting diodes.

The transmission axis of the first polarising element may be oriented at an angle of from 80° to 90° (and preferably from 87° to 90°) to the plane of polarisation of the first characteristic radiation. In this case, if the apparatus comprises a third polarising element, the transmission axis of the first polarising element may be oriented at an angle of from 80° to 90° (and preferably from 87° to 90°) to the transmission axis of the third polarising element. The transmission axis of the first polarising element may be oriented at an angle of from 0 to 10° (and preferably from 0 to 3°) to the plane of polarisation of the second

characteristic radiation. In this case, if the apparatus comprises a fourth polarising element, the transmission axis of the first polarising element may be oriented at an angle of from 0 to 10° (and preferably from 0 to 3°) to the transmission axis of the fourth polarising element.

The transmission axis of the second polarising element may be oriented at an angle of from 80° to 90° (and preferably from 87° to 90°) to the plane of polarisation of the second characteristic radiation. In this case, if the apparatus comprises a fourth polarising element, the transmission axis of the second polarising element may be oriented at an angle of from 80° to 90° (and preferably from 87° to 90°) to transmission axis of the fourth polarising element. The transmission axis of the second polarising element may be oriented at an angle of from 0 to 10° (and preferably from 0 to 3°) to the plane of polarisation of the first characteristic radiation. In this case, if the apparatus comprises a third polarising element, the transmission axis of the second polarising element may be oriented at an angle of from 0 to 10°(and preferably from 0 to 3°) to the transmission axis of the third polarising element.

The transmission axis of the first polarising element may be at an angle of from 80° to 90° (and preferably from 87° to 90°) to the transmission axis of the second polarising element.

Those skilled in the art will realise that substantially all polarising elements attenuate radiation to some extent and therefore the term "facilitating passage of.....radiation" should be construed accordingly.

The term "inhibiting passage of....radiation" indicates that there is significant attenuation of the radiation. Whilst it is generally favourable to maximise the degree of inhibition,

the degree of attenuation which may be tolerated will vary according to each situation.

In accordance with a second aspect of the present invention, there is provided an adaptor for facilitating the capture of stereo images with a camera body having a single lens mount, the adaptor being suitable for use in the apparatus of the first aspect of the present invention.

In accordance with a third aspect of the present invention, there is provided an adaptor for facilitating the capture of stereo images with a camera body having a single lens mount, the adaptor comprising:

an adaptor mounting portion to enable the adaptor to be mounted on the single lens mount of the camera body and

a light controller which forms a first optical path for directing light to a first imaging surface in a camera and a second optical path for directing light to a second imaging surface in a camera.

The light controller may comprise a first plurality of optical elements for directing light to the first imaging surface and a second plurality of optical elements for directing light to the second imaging surface. The adaptor may further comprise first and second polarising elements which may be located in the optical path between a subject and the light controller. For example, the first polarising element may be provided in the optical path between the subject and the first plurality of optical elements for directing light to the first imaging surface. The second polarising element may be provided in the optical path between a subject and the second plurality of optical elements for directing light to the second imaging surface.

The transmission axis of the second polarising element may be at an angle of from 80° to 90° (and preferably from 87° to 90°) to the transmission axis of the first polarising element.

The adaptor may comprise those features described above in relation to the apparatus of the first aspect of the present invention.

In accordance with a fourth aspect of the present invention, there is provided a kit for facilitating the taking of stereo images, the kit comprising an adaptor in accordance with the second or third aspects of the present invention and at least two polarising elements.

The kit may be provided with four polarising elements.

The kit of the fourth aspect of the present invention may further comprise one or more (and preferably two) light sources (such as flash guns). In the event that the adaptor does not comprise first or second polarising elements, two of the polarising elements provided with the kit may be for mounting in the optical path between a subject and the light controller of the adaptor. The kit may comprise two polarising elements for mounting so that light emitted from the light sources through the polarising elements is polarised. It is preferred that each of two of the polarising elements may be mounted in relation to one of the light sources so that light emitted from the two light sources is substantially linearly polarised and the plane of polarisation of light emitted through one of the two polarising elements is at an angle of from 80° to 90° (and preferably from 87° to 90°) to the plane of polarisation of light emitted through the other of the two polarising elements. The kit may further comprise a light source mount for mounting two light sources in spaced relationship with one another.

The kit may comprise those features described above in relation to the apparatus of the first aspect of the present invention.

In accordance with a fifth aspect of the present invention, there is provided a method of taking two or more stereo images, said method comprising:

(i) exposing a subject to a first characteristic radiation which is polarised in a first plane and to a second characteristic radiation which is polarised in a second plane so that said first and second characteristic radiation is scattered by the subject

(ii) inhibiting passage of scattered first characteristic radiation to a first imaging surface and facilitating the passage of second characteristic radiation to the first imaging surface, thus forming a first image; and

(iii) inhibiting passage of scattered second characteristic radiation to a second imaging surface and facilitating the passage of first characteristic radiation to the second imaging surface, thus forming a second image.

Those skilled in the art will realise that steps (ii) and (iii) are typically performed contemporaneously.

The method may further comprise the step of processing the first and second images to produce a three dimensional representation of the subject.

The method of the fifth aspect of the present invention may comprise use of one or more of: the apparatus of the first aspect of the present invention, the adaptor of the second or third aspect of the present invention and the kit of the fourth aspect of the present invention.

The present invention will now be described by way of example only with reference to the following Figures of which:

Figure 1a is a perspective representation of a known apparatus for obtaining stereoscopic images;

Figure 1b is a plan view of a known adaptor used in the apparatus of Figure 1a;

Figure 2 is a schematic representation of an example of an apparatus in accordance with the first aspect of the present invention;

Figure 3a is a stereo photograph of a pot of hand cream taken using the apparatus of Figure 1a;

Figure 3b is a three-dimensional representation of a part of the pot of hand cream computed from the two images of Figure 3a;

Figure 4a is a stereo photograph of the pot of hand cream taken using a second known apparatus;

Figure 4b is a three-dimensional representation of a part of the pot of hand cream computed from the two images of Figure 4a;

Figure 5a is a stereo photograph of the pot of hand cream taken using the apparatus of Figure 2; and

Figure 5b is a three-dimensional representation of a part of the pot of hand cream computed from the two images of Figure 5a.

An example of a known apparatus is shown in Figure 1. Such a known apparatus is available from PhotoMetrix Limited, Pontypridd, Mid Glamorgan, United Kingdom, and is known as "MAVIS". The apparatus is generally denoted by reference numeral 1, and comprises a body 2 and adaptor 3. The body and

adaptor are provided with known interconnecting parts which facilitate the adaptor to be mounted on the body. The body is a Canon 400D body, although this is merely an example of a commercially-available single lens reflex (SLR) camera. The apparatus is provided with a conventional flash unit 7 which has light emitting part 8, the flash unit being mounted onto the body using a conventional hot shoe (not labelled).The apparatus is also provided with two low-powered light emitting diodes (LEDs) 6a, 6b, each provided with a focussing lens to produce a beam of light and being arranged so that the beams converge and meet at a point a fixed and desired distance from the apparatus, this distance corresponding to the distance at which the camera lens is focussed. The adaptor is shown in more detail in Figure 1b. The adaptor 3 is provided with two apertures 4, 5 for the collection of light. Light passing through aperture 5 hits mirror 11 and then mirror 13 before passing through lenses 15a, 15b. Lenses 15a, 15b focus the light so that, when the shutter of the camera is pressed, light is focussed onto part 17a of a charge coupled device 17 so as to form a first image. Similarly, light passing through aperture 4 hits mirror 12 and then mirror 14 before passing through lenses 16a, 16b. Lenses 16a, 16b focus the light so that, when the shutter of the camera is pressed, light is focussed onto part 17b of the charge coupled device 17 so as to form a second image. The first and second images are the two images needed to form a stereo image and data from the two images may be analysed using suitable software to produce a three-dimensional representation of the subject. Such software is available from PhotoMetrix Limited.

The apparatus of Figure 1a was used to take stereo images of a pot of hand cream. The pot of hand cream comprises a stylised figure "A" recessed into the surface of the pot. Images

obtained using the apparatus of Figure 1 are shown in Figure 3a. The two images were analysed using known computer software (PhotoMetrix Limited) to form a three-dimensional representation of the surface, in this case, of the shape of the recessed figure "A". As can be seen form Figure 3a, each of the two images shows a bright region which is produced when light from the flash is reflected in a specular manner by the pot. It should be noted that the bright region is in a different place for each of the two images. This makes it very difficult to analyse the two images in a satisfactory manner so as to reproduce the shape of the figure "A". The data were analysed and the results of this analysis are shown in Figure 3b. The data are very noisy and few points of the figure "A" are well-defined.

It is known to adapt the apparatus of Figure 1 by placing a polariser (typically a piece of Polaroid(R) film) over the light-producing part 8 of the flash unit 7, and a polariser over each of the light-collecting apertures 4, 5. The polarisers placed over the apertures 4, 5 are oriented so that the amount of specular reflected light transmitted to the CCD of the camera is minimised; this is typically achieved by orientating the transmission axis of each of the polarisers over light-collecting apertures 4, 5 at about 90 degrees to the transmission axis of the polariser placed over the light-producing part 8 of the flash unit 7.

Stereo images acquired using the adapted apparatus comprising the three polarisers are shown in Figure 4a. The bright regions which were present in Figure 3a are no longer present. However, the brightness of the two images is poor and it is very difficult to resolve surface texture in the images. Such images are difficult to analyse but an attempt was made to analyse the data to try to obtain a three-dimensional

representation of the shape of the figure "A", and the results of this analysis are shown in Figure 4b. Whilst the data are not as noisy as those in Figure 3b, few points of the figure "A" are well-defined.

An example of an apparatus in accordance with the present invention is shown in Figure 2. The apparatus is denoted generally by reference numeral 100. The apparatus comprises a body 2 and adaptor 103. The body 2 is essentially the same as described above in relation to Figure 1a. The adaptor 103 is essentially the same as the adaptor of Figures 1a and 1b apart from each of the apertures 4, 5 being provided with a polarising element 101, 102 (a piece of Polaroid(R) film). The relative orientations of the transmission axes of polarising elements 101, 102 are discussed shortly. The apparatus 101 comprises two flash units 7, 107, each of which is mounted on a bar 105. Each of the flash units is mounted using conventional hot shoe technology. The spacing of the centre points of the light emitting parts 8, 108 of flash units 7, 107 is the same as the spacing of the centre points of the light-collecting apertures 4, 5. The centre point of the light emitting part 8 of flash unit 7 is located directly above the centre point of light-collecting aperture 5. Likewise the centre point of the light emitting part 108 of flash unit 107 is located directly above the centre point of light-collecting aperture 4. Each of the light emitting parts 8, 108 is provided with a polarising element 104, 103. Polarising element 104 is "crossed" with polarising element 102 so that specularly reflected light from flash unit 7 will not pass through polarising element 102. The transmission axis of polarising element 104 is substantially orthogonal to the transmission axis of polarising element 102. Polarising element 103 is "crossed" with polarising element 101 so that specularly reflected light from flash unit 107 will not pass through polarising element 101. The transmission axis of

polarising element 103 is substantially orthogonal to the transmission axis of polarising element 101. The transmission axis of polarising element 104 is substantially parallel with the transmission axis of polarising element 101 and the transmission axis of polarising element 103 is substantially parallel with the transmission axis of polarising element 102. The effect of such an arrangement is that the specularly reflected light from flash unit 107 will be prevented from entering aperture 4 by polarising element 101, while specularly reflected light from flash unit 7 may enter aperture 4 through polarising element 101. Likewise, specularly reflected light from flash unit 7 will be prevented from entering aperture 5 by polarising element 102, while specularly reflected light from flash unit 107 may enter aperture 5 through polarising element 102. This symmetrical arrangement of light sources and collecting apertures ensures that the specular reflection occurs in essentially the same place in the images formed through apertures 4, 5.

This is clearly illustrated in Figure 5a. The apparatus of the present invention was used to take stereo images of the pot used previously. As can be seen from Figure 5a, the bright region associated with specular reflection is in essentially the same place in both the left hand and right hand images. The slight differences in the positions of the specular reflection were due to the imperfect nature of the prototype apparatus used to collect the images. Furthermore, both the left and right hand images are bright. The data of Figure 5a were analysed and produced the three-dimensional representation shown in Figure 5b. The three-dimensional representation is notably superior to those shown in Figures 3b and 4b.

The apparatus of Figure 2 uses two images to form a stereo image. Those skilled in the art will realise that it would be possible to adapt the apparatus to form more than two images from which to construct stereo images.

The example described above uses a digital camera to capture images. Those skilled in the art will realise that conventional film-based technology may also be used.

Those skilled in the art will realise that the two flash units could be replaced by a single, wide flash unit, one half of which is associated with one polarising element and the other half of which is associated with another polarising element.

Those skilled in the art will realise that the lasers 6a, 6b are not an essential part of the present invention, but merely a guide to show distance between the apparatus and subject.

The example of the apparatus in accordance with the present invention uses an adaptor to collect light for focussing onto one charge coupled device. Those skilled in the art will realise that the present invention may comprise an apparatus with two spaced lenses, each of which is used to collect light for the formation of one image and focus the light onto an imaging surface. Examples of stereo cameras which have two such lenses are known e.g. Belplasca, Kodak Stereo, Sputnik, Verascope f40. In this case the apparatus need not comprise an adaptor.

Claims

1. An apparatus for the production of stereoscopic images, the apparatus comprising:

first and second imaging surfaces for the receipt of light

one or more light sources for illuminating a subject with first characteristic radiation being polarised in a first orientation and second characteristic radiation being polarised in a second orientation:

a first polarising element for inhibiting passage of first characteristic radiation to the first imaging surface but facilitating the passage of second characteristic radiation to the first imaging surface, and

a second polarising element for inhibiting passage of second characteristic radiation to the second imaging surface but facilitating the passage of first characteristic radiation to the second imaging surface.

2. An apparatus according to claim 1 comprising a first light source and a second light source, wherein the first light source illuminates a subject with first characteristic radiation and the second light source illuminates the subject with second characteristic radiation.

3. An apparatus according to claim 1 or claim 2 comprising a third polarising element for polarising light so as to produce first characteristic radiation and a fourth polarising element for polarising light so as to produce second characteristic radiation.

4. An apparatus according to claim 3 when dependent on claim 2, wherein the third polarising element is for polarising light emitted from the first light source and the fourth polarising element is for polarising light emitted from the second light source.

5. An apparatus according to any one preceding claim wherein the first and second imaging surfaces are provided by one or more image-forming arrays of photosensitive elements.

6. An apparatus according to any one preceding claim wherein the first and second imaging surfaces are co-planar and contiguous with one another.

7. An apparatus according to any one preceding claim comprising a light controller which forms a first optical path for directing light to the first imaging surface and a second optical path for directing light to the second imaging surface.

8. An apparatus according to claim 7 wherein the light controller comprises a first aperture for collecting light for the first imaging surface and a second aperture for collecting light for the second imaging surface.

9. An apparatus according to claim 3 and any one of claims 4 to 8 when dependent on claim 3 wherein the transmission axis of the first polarising element is oriented at an angle of from 87° to 90° to the transmission axis of the third polarising element and the transmission axis of the first polarising element is oriented at an angle of from 0 to 10° to the transmission axis of the fourth polarising element.

10. An apparatus according to any one preceding claim wherein the transmission axis of the first polarising element is at an angle of from 87° to 90° to the transmission axis of the second polarising element.

11. An apparatus according to claim 2 or any one of claims 3 to 10 when dependent on claim 2, comprising a first aperture for collecting light for the first imaging surface and a second aperture for collecting light for the second imaging surface, wherein the spacing of the centres of the light emitting parts of the first and second light sources is substantially the same as the spacing of the centres of the first and second apertures for collecting light.

12. An apparatus according to claim 2 and any one of claims 3 to 11 when dependent on claim 2, comprising a first aperture for collecting light for the first imaging surface and a second aperture for collecting light for the second imaging surface, wherein when the apparatus is in a normal orientation, the centre of the light emitting part of the first light source is substantially directly above the centre of the first aperture for collecting light for the first imaging surface and when the apparatus is in a normal orientation, the centre of the light emitting part of the second light source is substantially directly above the centre of the second aperture for collecting light for the second imaging surface.

13. An apparatus according to any one preceding claim comprising a body and an adaptor, the adaptor being provided with an adapter mounting portion for mating with a corresponding body mounting portion provided on the body.

14. An apparatus according to claim 13 when dependent on claim 7, wherein the adaptor comprises the light controller.

15. An apparatus according to claim 13 wherein the adaptor comprises one or both of the first and second polarising elements.

16. An adaptor for facilitating the capture of stereo images with a camera body having a single lens mount, the adaptor being suitable for use in the apparatus of the claims 13 to 15.

17. An adaptor for facilitating the capture of stereo images with a camera body having a single lens mount, the adaptor comprising:

an adaptor mounting portion to enable the adaptor to be mounted on the single lens mount of the camera body and

a light controller which forms a first optical path for directing light to a first imaging surface in a camera and a second optical path for directing light to a second imaging surface in a camera.

18. An adaptor according to claim 17 comprising first and second polarising elements located in the optical path between a subject and the light controller.

19. An adaptor according to claim 18 wherein the transmission axis of the second polarising element is at an angle of from 87° to 90° to the transmission axis of the first polarising element.

20. A kit for facilitating the taking of stereo images, the kit comprising an adaptor in accordance with any one of claims 16 to 19 and at least two polarising elements.

21. A kit according to claim 20 comprising two light sources, the two polarising elements being for mounting so that light emitted from the light sources through the polarising elements is polarised.

22. A method of taking two or more stereo images, said method comprising:

(i) exposing a subject to a first characteristic radiation which is polarised in a first plane and to a second characteristic radiation which is polarised in a second plane so that said first and second characteristic radiation is scattered by the subject

(ii) inhibiting passage of scattered first characteristic radiation to a first imaging surface and facilitating the passage of second characteristic radiation to the first imaging surface, thus forming a first image; and

(iii) inhibiting passage of scattered second characteristic radiation to a second imaging surface and facilitating the passage of first characteristic radiation to the second imaging surface, thus forming a second image.

23. A method according to claim 22 further comprising the step of processing the first and second images to produce a three dimensional representation of the subject.

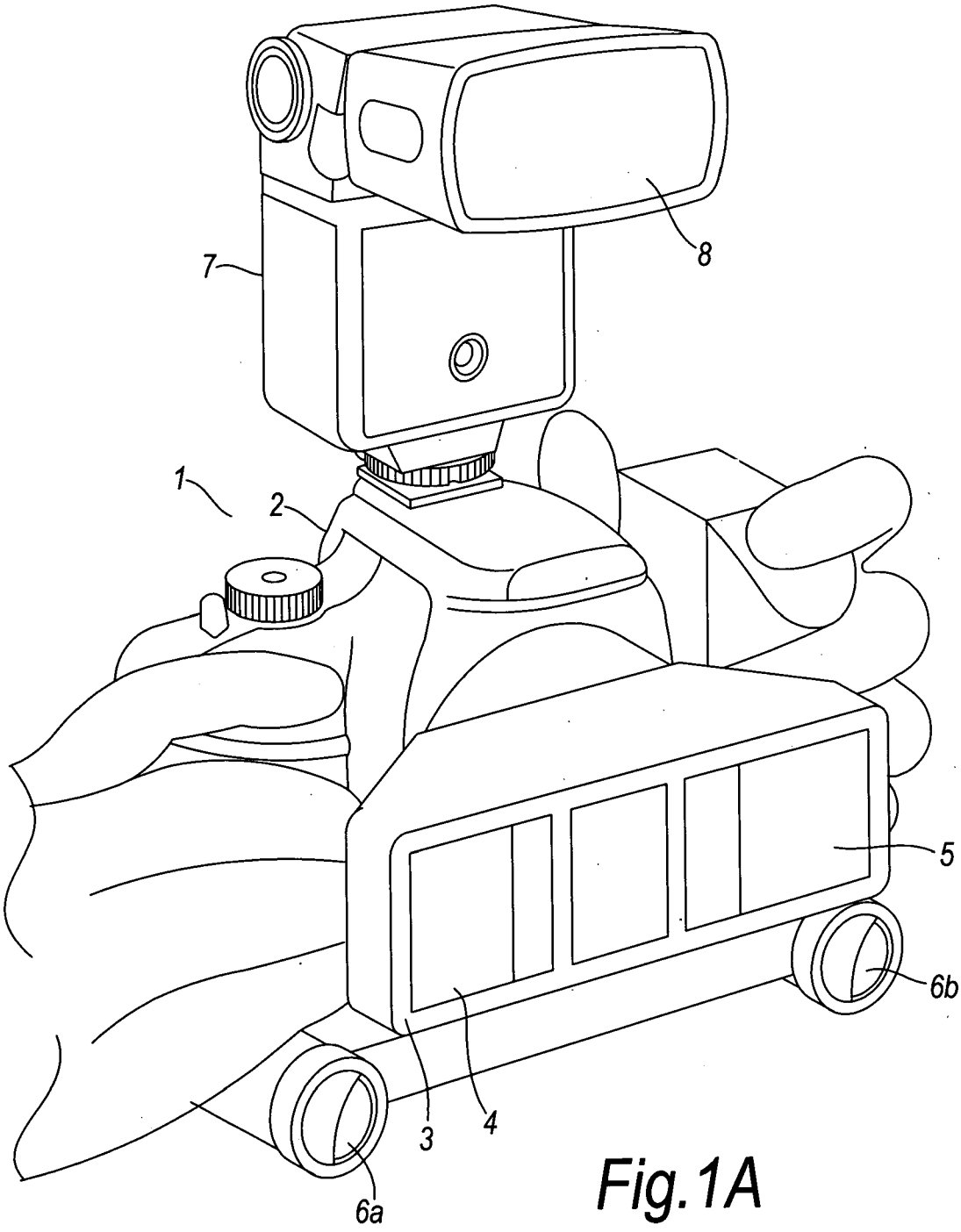

Fig.1A
PRIOR ART

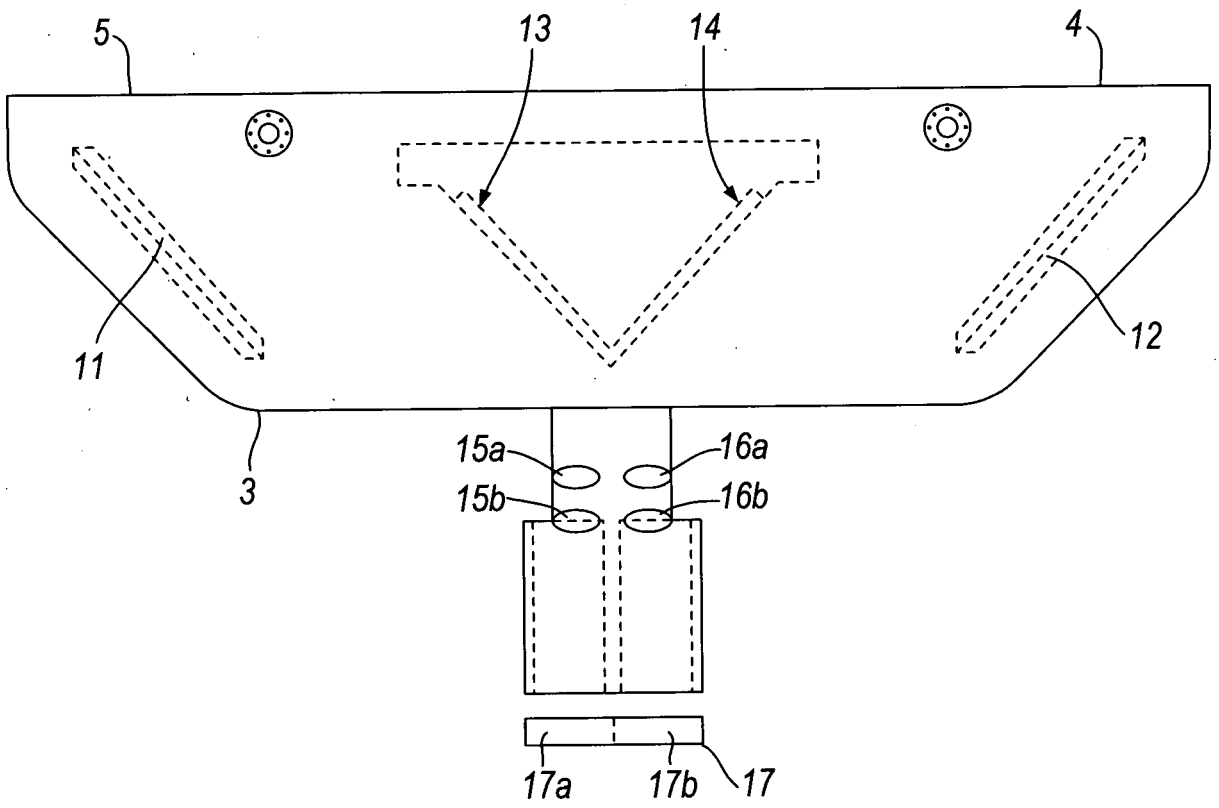

Fig.1B
PRIOR ART

3/6

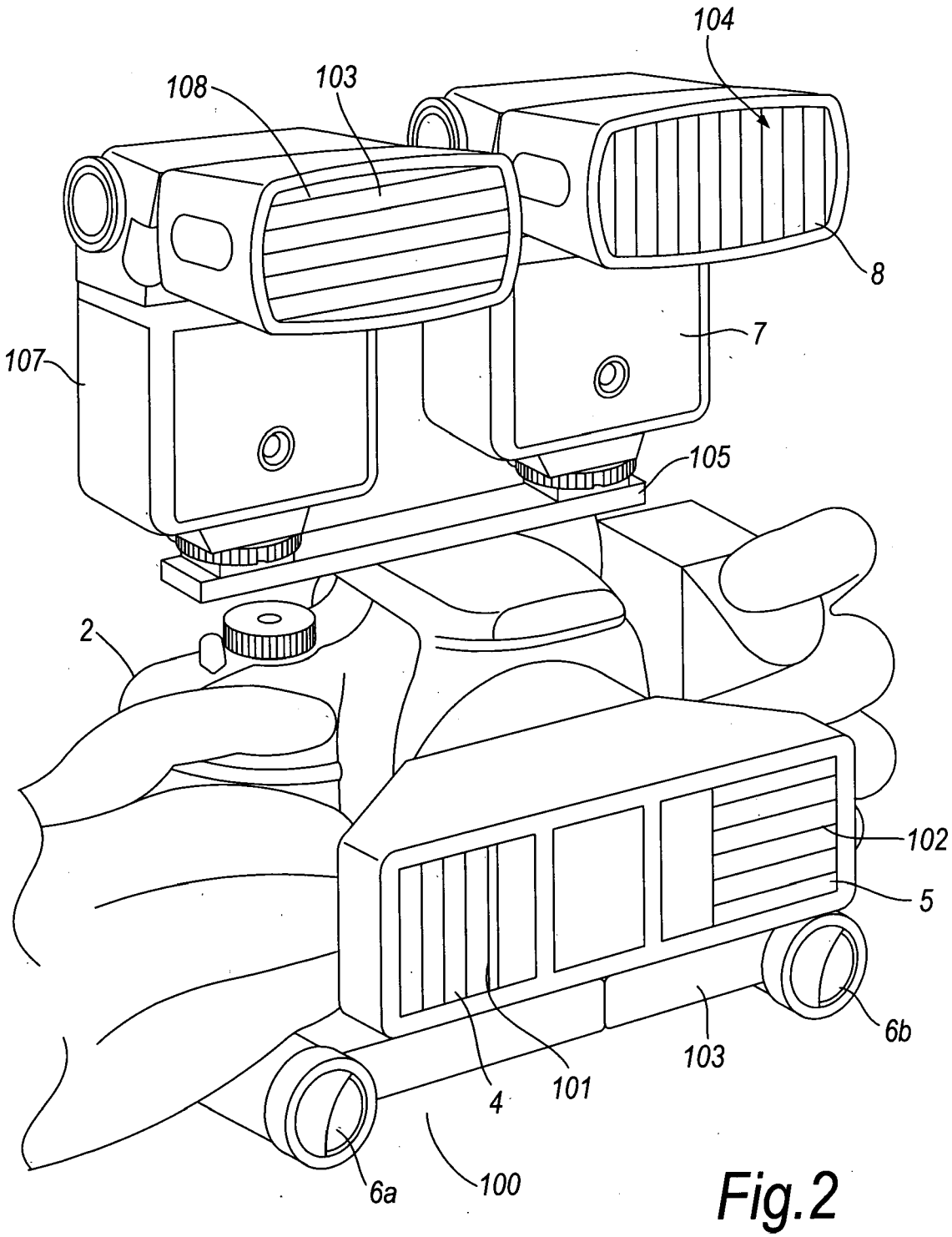

Fig.2

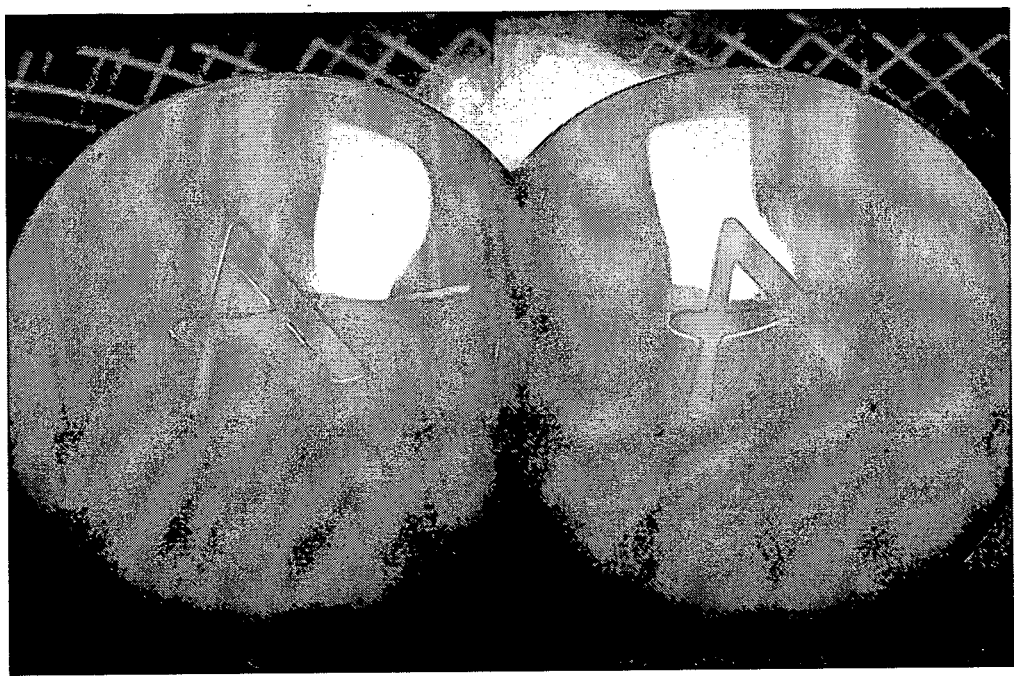

Fig.3A

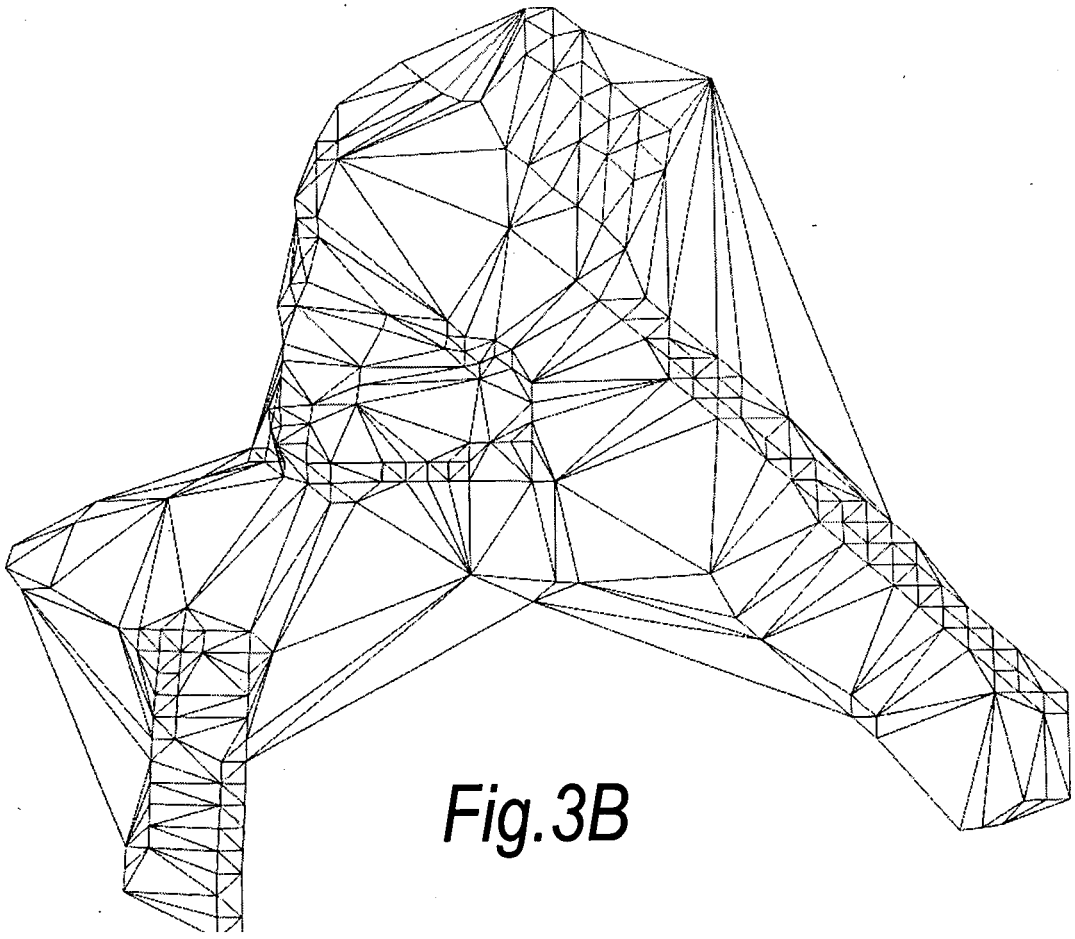

Fig.3B

5/6

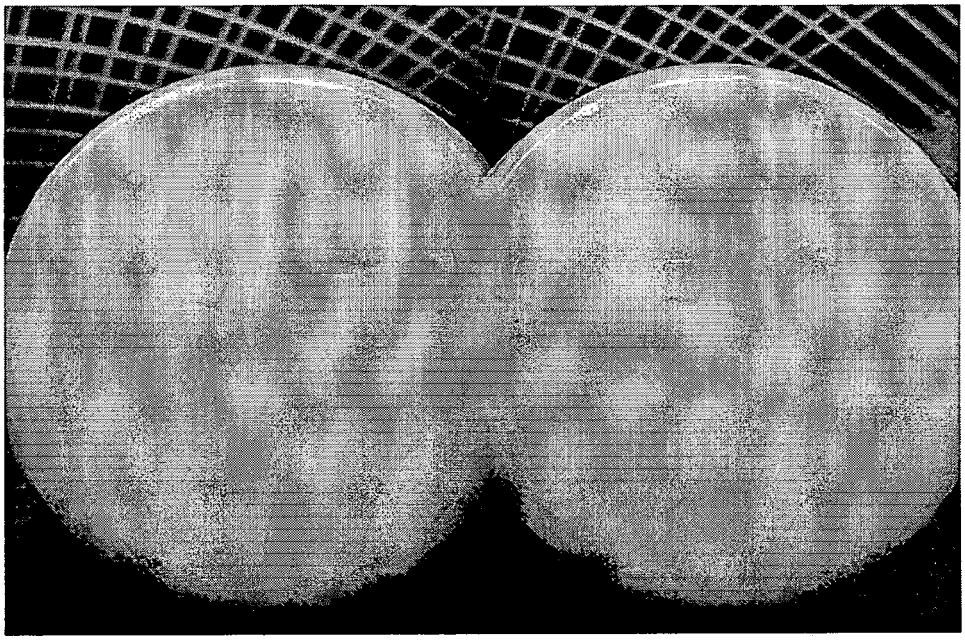

Fig.4A

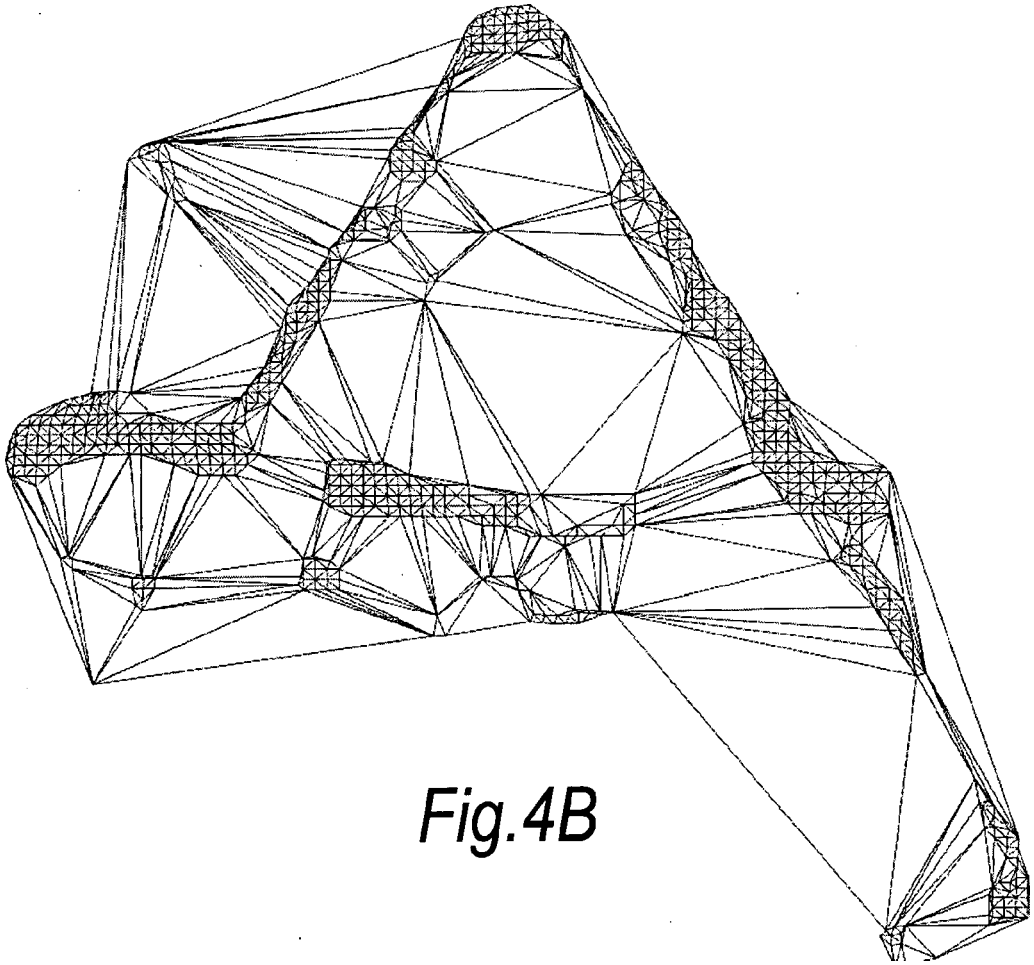

Fig.4B

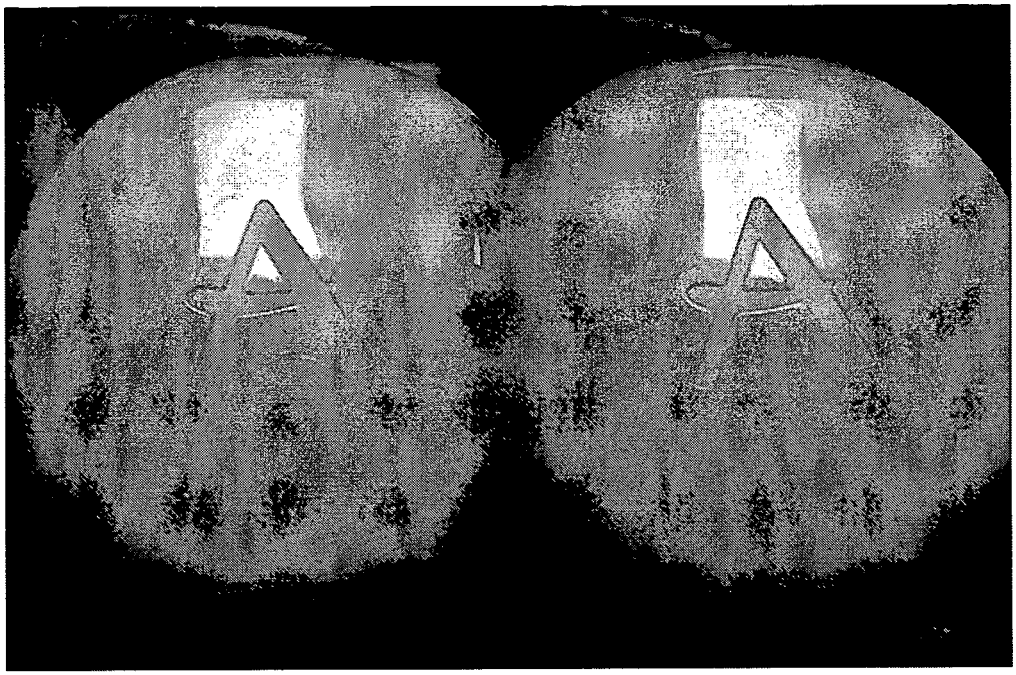

Fig.5A

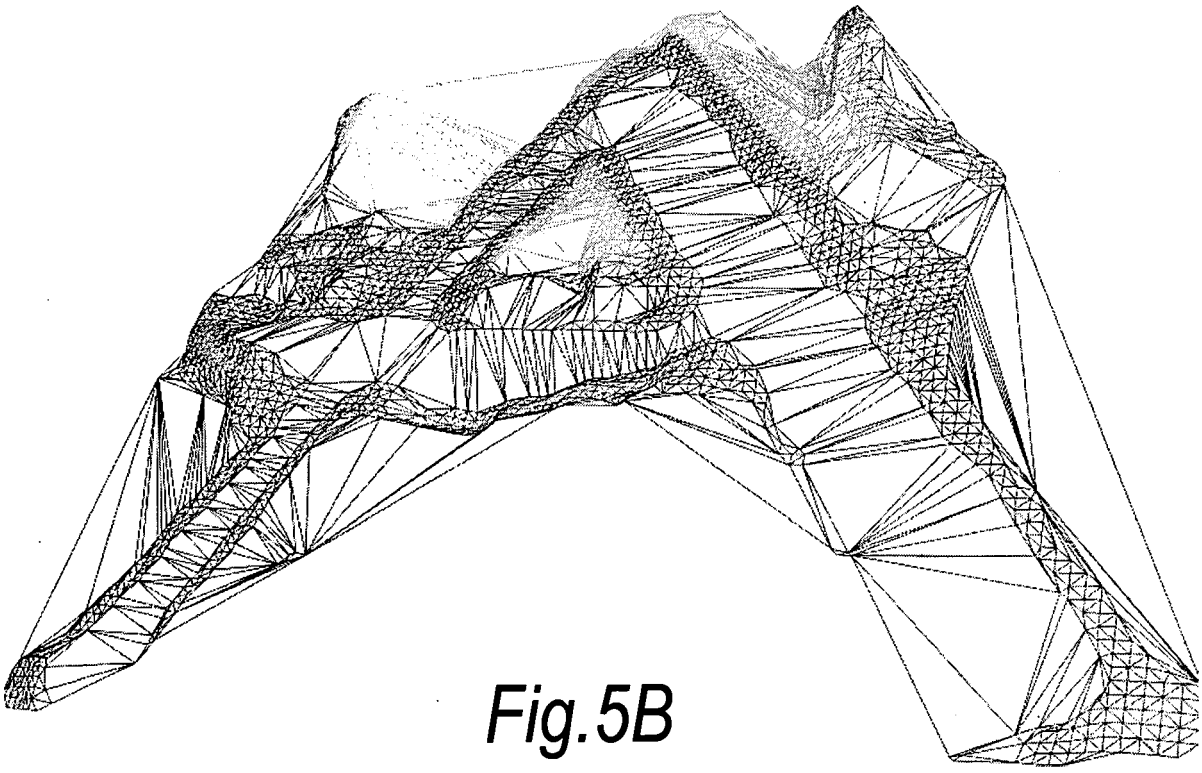

Fig.5B