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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 05-091311-00004-0000

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Señores

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

DIVISION DE NUEVAS CREACIONES

E. S. D.

REF: Expediente No. 05 091.311 - Solicitud de Patente FASE NACIONAL

Corresp. a la Solicitud Internacional PCT/US2004/005669

a favor de: **LUMINETX CORPORATION.**

Titulada: SISTEMA DE IMÁGENES USANDO LUZ INFRARROJA DIFUSA.

JUAN PABLO CADENA SARMIENTO, vecino de Bogotá, portador de la tarjeta profesional No. 57492 del Consejo Superior de la Judicatura, obrando como apoderado de la Sociedad **LUMINETX CORPORATION.**, según lo acredita el documento de poder presentado en esa División, de acuerdo con el Artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina, me permito solicitar que se examine si la invención contenida en la solicitud en referencia es patentable.

De acuerdo con lo anterior, me permito anexar el recibo oficial de caja No. 07-41,257 por valor de \$202.000.

De la Señora Jefe atentamente,

JUAN PABLO CADENA SARMIENTO

C.C. No. 80.410.337 de Usaquén

T.P. No. 57492 del C.S.J.

Cra 7 No. 71-21 Torre B, Piso 4

Bogotá, 15 de agosto de 2007

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BRIGADA & CASIERO LTDA	COMERCIALIZACION	PAISADO POPULAR	000-00010-0	34000110	17/05/2007	10.550.000.00

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CONCEPTO	TOTAL CONCEPTO
1 55505 01-01 SUCESOR	792,000.00
114 PID CAP 11 EXAMEN DE PATENTABILIDAD	200,000.00
TOTAL :	\$ 992,000.00

4. **התאמה** – התאמה בין המידע המוצג לבין המידע המצוי.

RECIBO DE CASH APPLICADO AL EFICIENTE No.

DIVISION DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No 05-091311

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCION**

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **574** DE

FECHA **30 DE MARZO DE 2007** EL TERMINO HABIL EÑALADO POR LA LEY

EXPIRA EL **03 DE JULIO DEL 2007**

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI ☐ _ _ _ _ _

NO ☒ _ _ _ _ _

United States Patent [19] Pennypacker et al.

[11] Patent Number: 4,817,622
[45] Date of Patent: Apr. 4, 1989

[54] INFRARED IMAGER FOR VIEWING
SUBCUTANEOUS LOCATION OF
VASCULAR STRUCTURES AND METHOD
OF USE

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80302

[21] Appl. No.: 888,916

[22] Filed: Jul. 22, 1986

[51] Int. Cl. A61B 5/00

[52] U.S. Cl. 128/664; 250/330;
358/113; 358/169

[58] Field of Search 128/653, 664; 250/330,
250/342; 358/166, 167, 164, 169, 113

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11-15, 1979, pp. 266-267.

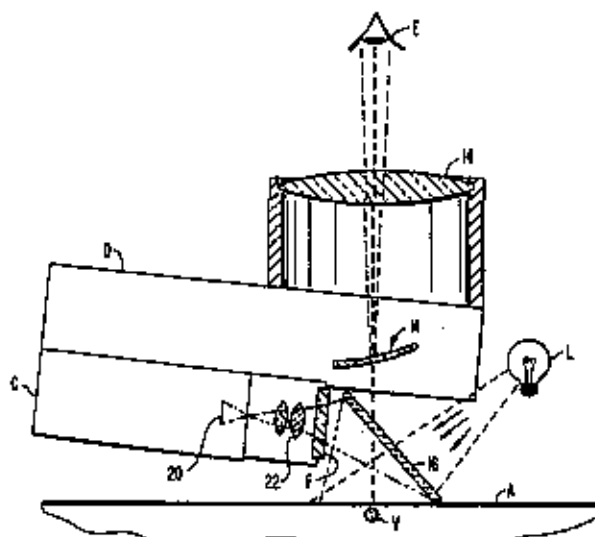
Primary Examiner—Ruth S. Smith

Attorney, Agent, or Firm—Townsend and Townsend

[57] ABSTRACT

A human appendage, typically the inside of the elbow, is illuminated with an infrared source, for example, at least one incandescent light bulb. A video camera for producing a video image and immediately overlying monitor for displaying the video image is utilized to look at the flesh. The camera is sensitive to infrared radiation. A video display results in which infrared absorbing or scattering contrasting portions of the flesh are highlighted, for example, hard to find veins for insertions of needles. A contrast enhancing circuit is included which discloses amplifying the video information with high contrast enhancement of the video. Adaptation of the disclosed circuit to conventional TV charge coupled device cameras and monitors is illustrated with compensation of horizontal sweep to even image background, intensity averaging line to line for vertical image uniformity and display of image contrasts on a log amplification format.

11 Claims, 3 Drawing Sheets



U.S. Patent

Apr. 4, 1989

Sheet 1 of 3

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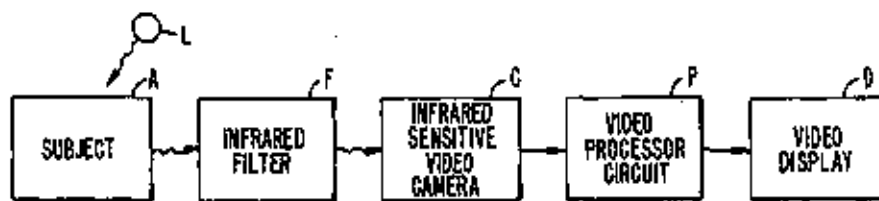


FIG. 2.

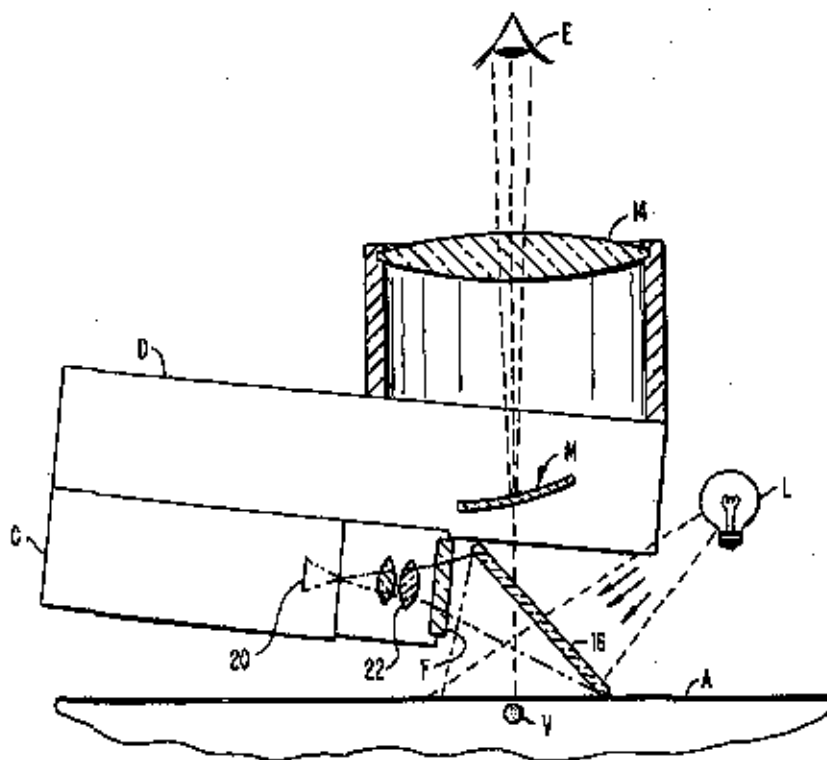


FIG. 1A.

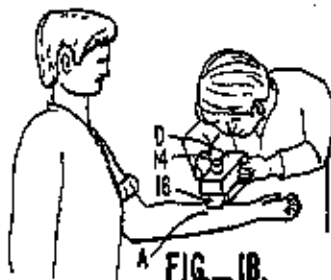


FIG. 1B.

INFRARED IMAGER FOR VIEWING SUBCUTANEOUS LOCATION OF VASCULAR STRUCTURES AND METHOD OF USE

BACKGROUND OF THE INVENTION

This invention relates to a simple, medical electronic device for viewing infrared absorption contrast under the skin. Simply stated, a TV camera and monitor is disclosed for viewing hard to find vascular structure for insertion of needles.

STATEMENT OF THE PROBLEM

Veins and arteries in many patients are hard to find. When dehydrated patients, dark-skin patients, and young patients are treated, finding the veins and arteries is a classic medical problem involving pain, stress and distress. Further, unskilled technicians have grave difficulty in locating many subcutaneous structures in even normal patients. Thus, an aid in locating such structures is needed.

STATEMENT OF THE RELEVANT ART

The use of infrared photography for visualizing subcutaneous veins, arteries and structures has been known for many years. These systems make use of the penetration of the near infrared rays into the skin, and the preferential absorption of the near infrared rays by the molecules in the vascular system. Consequently, a low contrast infrared image can be produced.

Heretofore, this technique has only been used with photography.

SUMMARY OF THE INVENTION

Part of the human body or appendage, for example the inside of the elbow, is illuminated with an infrared source, for example, at least one incandescent light bulb. A video camera for producing a video image and immediately overlying monitor for repeating the video image is utilized to look at the flesh. The video camera is sensitive to infrared radiation. If the camera is also sensitive to visible light, an infrared passing filter which stops visible light may be interposed. A video display results in which infrared contrasts in portions of the flesh are highlighted, for example, hard to find veins for insertions of needles. A contrast enhancing circuit is included which discloses amplifying the video information with high contrast enhancement of the video signal. Adaptation of the disclosed circuit to conventional CCD cameras and monitors is illustrated with compensation of horizontal sweep to even out image background, intensity averaging line to line for vertical image uniformity and display of image contrasts on a non-linear scale.

OTHER OBJECTS AND ADVANTAGES

An object of this invention is to disclose a process for finding infrared contrast differentiated structure in the flesh, for example veins in human appendages such as the inside elbow of the arm. A source of infrared illumination is provided, which for example can be a regular incandescent bulb, or an infrared light emitting diode or laser. An infrared sensitive video camera and immediately overlying video monitor for displaying the image from the camera is used. The video signal is enhanced as to contrast to display the underlying infrared absorption or scattering differentiated structure.

An advantage of the disclosed process and apparatus is that it is specifically suited for finding veins and arteries. Moreover, relative movement of a needle tip to a vein or artery is easily observed.

A further object of this invention is to disclose a process of video signal enhancement of an infrared image showing vascular structure. Simply, the video portion of the signal is amplified with an enhanced contrast output. Thereafter, the sync signal is added and played at a monitor to disclose the infrared absorption differentiated area. For example, veins in appendages can be clearly shown.

Yet another object of this invention is to disclose adjustments that can adapt conventional silicon CCD cameras and monitors to portray enhanced contrast images. According to this aspect of the invention the sync pulses are stripped. Amplification occurs and the sync pulses are restored. The signal level along each horizontal scan line is compensated for variations in the background, typically near the beginning and the end of the scan line. Vertical intensity averaging is utilized with each line being intensity averaged and being utilized to control the intensity of at least the following line. Enhanced contrast is displayed within a limited linear range, outside of which range the log of the amplified high contrast image is displayed. Moreover, the total brightness excursion provided is clamped to prevent "false" sync pulses. A coherent signal capable of displaying an enhanced infrared image results.

Over photography, the disclosed infrared video technique can be used in real time to study subjects at the infrared wavelengths. More importantly, the contrast enhancing technique possible with video signal processing includes a dynamic range and signal to noise ratio far superior to infrared photography. Coupled with the real time aspect of this invention, a superior apparatus and process is disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of this invention can become more apparent after referring to the following specification and attached drawings in which:

FIG. 1A is a side elevation section of the camera and monitor utilized to amplify a vein in an arm for manipulation of a needle to the vein;

FIG. 1B is a perspective illustrating a technician utilizing the apparatus in FIG. 1A to locate a vein.

FIG. 2 is a block diagram of the invention;

FIG. 3 is a block diagram of the video processor circuit; and,

FIG. 4 is a diagram of an actual circuit utilized to practice the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1A and 1B, a conventional video display D having a monitor screen M is illustrated. The screen is observed by an observer at eye E through a lens system 14. A mirror 16 deflects an image through an infrared bandpass filter F to a video camera C. It will be understood that the video camera C is conventional. Video camera C includes a charged coupled device 20 with a lens system 22. As an alternative to the lens 22, a coherent optical fiber bundle can be used for imaging into the plane of the charged-coupled-device. An appendage A having a vein V is illustrated. Illumination occurs from a light source L, schematically shown.

It will be seen that monitor screen M of display D immediately overlies the real-world location of the vein V. The lens 14 projects the screen and its image of the vein, as seen by the observer at position E, into the same plane in space as the actual vein and appendage. This enables a technician manipulating a needle to see in real spatial alignment a two-dimensional picture of the needle and vein without parallax error. The size of the image on M can be chosen such that the projected image as seen from E will be full size, after magnification by lens 14. Substantial assistance of manipulating the needle with respect to the vein results.

The reader will understand that here we show a video display D. The image could likewise be recorded and stored for record purposes.

Referring to FIG. 2 a block diagram is shown. Typically light L (preferably a regular incandescent bulb) illuminates the appendage A of the subject. The light passes through an infrared filter F to an infrared sensitive video camera C. The signal thereafter is passed through a processing circuit P to a video display D. It is the video display D which shows the site.

Having set forth this much, the circuit of FIG. 3 can be easily understood. A sync separator 30 strips out a sync signal. It passes the stripped signal to a timing generator 32. The generator outputs through video gate 34 and sync gate 36 signals. These respective signals are utilized to switch on and off amplification and processing to the video signal only with amplification of the sync and frame pulse being omitted. Respective video gates are located at 40, 44, and 46. When either a video gate signal at 34 is detected or a sync gate signal at 36 is detected, operation of the amplifiers is switched out of the circuit output. However, when the absence of the video gate and sync gate signals is present, amplification as disclosed occurs.

A so-called "crisper" amplifier 50 is utilized. This amplifier supplies amplification in the range of five times. Moreover, it is operative to increase relative gain for the high frequency portion of the signal. Thus, when the scanning raster undergoes rapid high frequency excursion—as in coming across a relatively low contrast vein B in an appendage A—amplifier 50 enhances or renders sharper the signal.

Variable gain at amplifier 60 is provided for optimizing the gain to the particular patient.

Stopping here, and with conventional TV cameras and monitors, it has been found that the enhanced contrast produces an extremely unsuitable contrasted image (nearly black at some areas and nearly white at others) across the totality of the video picture because of variations in illumination or reflectance of the skin or optical system efficiency across the image. Accordingly, it is necessary to average the signal from top scan to bottom scan, to adjust the video background relative to the horizontal sweep and additionally to display contrasts beyond a limited range as the log of the resultant contrast signal.

Referring to circuit 70, the average intensity of a preceding horizontal scan line is remembered. This average intensity is fed back to the following video line. This intensity is used to modulate the intensity of the following line so that the average is maintained. Thus, the signal is prevented from having undesirable vertical contrasts.

Additionally, it has been found that the signal varies as the raster sweeps horizontally. The variation produced is typically at the edges or shoulders of the pic-

ture. Accordingly, the width of the shoulder adjustment is adjusted at left center adjustment 83 and right center adjustment 84. The amount of adjustment provided is adjusted at left adjustment 81 and at right adjustment 82. Thus, the background is adjusted to a level where the contrasted image can be seen.

A divided by three attenuator 90 provides two functions. First, divide by three attenuator 90 includes a soft clamp of the resultant video signal to give brightness proportional to the logarithm of the enhanced contrast produced by amplifiers 50 and 60 when it exceeds the linear range for display by the monitors. Secondly, the resultant signal is reduced in intensity so that the video signal having the right contrast range for display at the monitor is provided.

Additionally, a divide by two attenuator 100 is utilized. This attenuator also includes a hard clamp which clamps the excursion of the video signal sufficiently below an excursion which would be recognized as either an end of frame or sync signal. By such clamping, a video signal is produced which can be played to a monitor.

Finally, and after signal processing, a sync restorer gate 110 is utilized. Gate 110 puts back into the amplified and processed signal the video and sync gating required for monitor display.

Those having skill in the video arts will recognize that the video processor circuit here is shown connecting a conventional camera to a conventional monitor. If the camera and monitor here disclosed is to be integrally designed, the video portion of the camera signal would not have the sync pulses added to the video portion, until full image processing had occurred or the sync signal would be fed by a separate wire to the monitor sync circuit. Here, however, because a camera that adds sync pulses is utilized; it is necessary to strip the signal during amplification. Likewise, and because a conventional monitor is used, it is required to add the sync signal back immediately before the signal is played at the monitor.

Turning to FIG. 4, the actual fabrication of the enhancement circuit can now be easily understood.

Referring to FIG. 4 the video gate 40 is illustrated having an analog switch 141. Crisper amplifier 50 is shown having a high frequency bandpass capacitor at 151 with an amplifier at 152. Amplification connections illustrated are conventional. Video gate 44 has an analog switch 142.

Variable gain amplifier 60 includes a variable gain control 161.

Divide by three circuit 90 includes variable potentiometer 191 for setting the soft clamp level and 192 for adjustment of the clamp rate about the desired logarithmic function.

Divide by two attenuator 100 includes a variable pot 101 for setting the level of the hard clamp for prevention of an amplified pulse from being confused with a sync pulse.

Sync restorer gate 110 is again an analog switch. The switching here is phased to allow the sync pulse to pass out of the circuit.

The video compensator 80 includes potentiometer 81, 82 for adjustment of the intensity of the edge correction. The edge width itself is adjusted by the respective potentiometers 83, 84.

Circuit 70 is a conventional circuit for comparison of the average intensity of an overlying horizontal scan to

a current horizontal scan. Output to the divide by three attenuator at 90 occurs.

It will be understood that the disclosed signal processing technique is exemplary. For example, the enhancement of the contrast herein provided could be over a limited brightness range. By the expedient of adjusting the brightness to a uniform level, areas of contrast can be enhanced.

Similarly, image enhancement can be provided by a crisper circuit or differentiator circuit which could be tuned to enhance areas differing in brightness. Thus, tuning of the image produced can result in resolution displaying the desired vascular structure.

Likewise, illumination of the subject by infrared light of differing wavelengths with subtraction of the brightness signal resulting from illumination at one wavelength from the signal produced by illumination at the other wavelength can occur. Alternately, and by using by light of differing wavelengths, the ratios of brightness between the two wavelengths at each point in the picture can be compared and displayed on the monitor.

Moreover, illumination may be moved to deeper region in the body. For example, a fiber optic bundle placed in contact with the skin (or in a body cavity or orifice) can be utilized to guide the illuminating infrared energy. This fiber optic bundle will illuminate relatively deep vascular structures, which surface illumination would not reach. This would reduce surface scattering of IR which occurs when a bulb is used to illuminate the surface, and can improve image contrast.

Furthermore, pressure on the skin will collapse veins and empty them of blood, thus applying and removing pressure and subtracting the two images taken with and without pressure can enhance visibility of the veins in the image.

This device is well adapted for diverse uses in medical examinations, such as examination of the middle ear behind the ear drum, which is transparent to near infrared of appropriate wavelength. Other applications include examination of the subsurface structure of the mucous membrane surfaces such as nose, mouth, throat, trachea, esophagus, stomach, etc., and vagina and rectum. This device can be adapted for use as a real time infrared ophthalmoscope for examining behind the retina and for viewing the eye interior through cataracts.

We have illustrated the particular circuit here shown as a preferred embodiment. However, the enhancement of the infrared image to which we refer includes any of the above apparatus, the present method being preferred because of reduction of practice.

What is claimed is:

1. Apparatus for producing an enhanced contrast infrared image of the flesh for viewing subcutaneous structures such as veins in flesh illuminated with light which includes infrared light, said apparatus comprising: light source means including means for providing infrared light and adapted to illuminate a portion of flesh so as to produce an image of said flesh from differential absorption of said infrared light on said flesh;
- video camera means adapted to receive an image of said differentially absorbed infrared light on said illuminated flesh and output a video signal;

monitor means for playing back from said outputted video signal the image of said illuminated flesh; and,

circuit means connecting said video camera means and said monitor means for producing an enhanced contrast image of said flesh in real time whereby said image from said differential absorption of infrared light has the contrast enhanced to view subcutaneous structure such as veins.

2. The apparatus of claim 1 and wherein said monitor means is located immediately overlying said camera means and oriented to display said image away from said camera means whereby said image in said monitor means overlies said flesh in space.

3. The apparatus of claim 1 wherein said circuit means includes means for generating successive horizontal scans and further includes means for vertically averaging the intensity of each horizontal scan to the intensity of at least one horizontal scan.

4. The apparatus of claim 3 and wherein said circuit means includes means for adjusting the background of said horizontal scans with respect to a corresponding scan of said camera means and monitor means.

5. The apparatus of claim 1 and wherein said circuit means includes means for amplifying the video signal of said camera profiled to a log output.

6. The invention of claim 5 and wherein said circuit means includes means for passing to high amplification, high frequency contrast signals in said video signal.

7. A process for viewing infrared absorbing or scattering structures in flesh, such as veins, comprising illuminating said flesh with an infrared light source to produce differential infrared absorption of infrared light;

taking an infrared video image, using a video camera, of said infrared illuminated flesh to produce a differential infrared absorption image of said illuminated flesh on a monitor;

outputting a video signal of said differential infrared absorption image of said illuminated flesh;

providing enhanced contrast amplification to the video signal derived from the infrared image of said flesh; and,

playing back the video image of said flesh on a monitor to produce a high contrast visible image of infrared absorbing or scattering structures in said flesh in real time.

8. The process of claim 7 and including the step of positioning said monitor immediately overlying said camera and orienting said monitor to display said image away from said camera and the flesh whereby said image in said monitor overlies said flesh in space.

9. The process of claim 7 and including amplifying said video signal by preferably amplifying high frequency portions of said video signal to enhance said infrared absorbing or scattering structures.

10. The process of claim 7 and including in said amplification step vertically averaging each line of said video signal with respect to a previous line of said video signal.

11. The process of claim 7 and including in said amplification step adjustment of the horizontal background of said scan.

* * * * *



US006178340B1

(12) **United States Patent**
Svetliza

(10) Patent No.: **US 6,178,340 B1**

(45) Date of Patent: **Jan. 23, 2001**

(54) **THREE-DIMENSIONAL INFRARED IMAGER FOR SUBCUTANEOUS PUNCTURE AND STUDY OF VASCULAR NETWORK**

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(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **09/138,542**

(22) Filed: **Aug. 24, 1998**

(51) Int. Cl.⁷ **A61B 1/00**

(52) U.S. Cl. **600/310; 600/321; 600/407; 600/473; 600/476; 250/226; 250/341.8**

(58) Field of Search **250/226; 128/664; 128/920; 348/65; 359/464; 600/310, 473, 476, 311, 312**

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5,751,479 • 5/1998 Homagishi et al. 359/464
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* cited by examiner

Primary Examiner—Marvin M. Lateef

Assistant Examiner—Jee-Yuh Lin

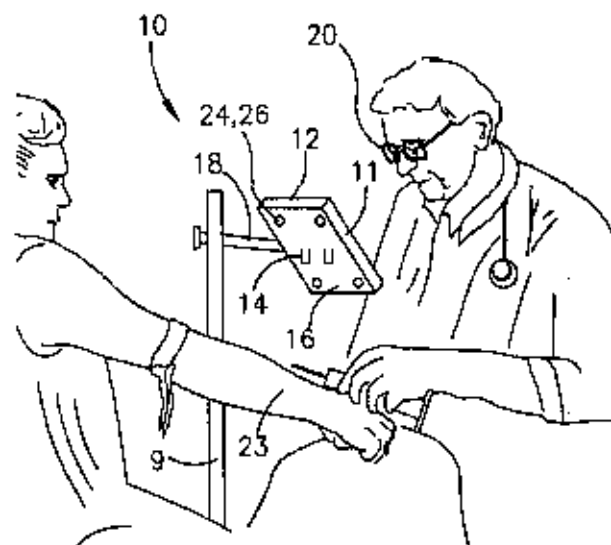
(74) Attorney, Agent, or Firm—Edward Langer, Pat. Atty.

(57) **ABSTRACT**

A novel three-dimensional infrared imager for study of the

vascular network so as to cause blood vessels to be visualized for accurate subcutaneous puncture during insertion of a hypodermic needle. The invention uses the properties of near infrared light as it is absorbed and reflected by the human body, allowing the user to visualize the tissues a few millimeters in depth from the skin's surface. The use of infrared light permits the manipulation of the acquired information to a grade of sensed visualization, which is impossible to reach with visible light. The invention imitates the human three-dimensional perception by use of a stereoscopic infrared viewer, and is designed to be user friendly, allowing the health care professional to work in his usual manner. A double image is superimposed on the viewer and the user wears blue-red eyeglasses to create the three-dimensional image from the double image on the viewer. With the depth perception provided by the three-dimensional image, the user can accurately penetrate the vein on the initial attempt, thereby lowering the fear of venous puncture and causing the patient to be at ease, while lowering the incidence of medical complications associated with inaccurate puncture. In a preferred embodiment of the invention, a liquid crystal display (LCD) mounted in a frame is provided on the upper surface of the apparatus. Sensitive, charge-coupled devices are provided which develop images and deliver them to a microprocessor which synchronizes the images and allows the user to manipulate the images as desired, controlling effects such as brightness, contrast, sharpness and edge enhancement. In another embodiment, the inventive imaging system incorporates the use of a contrast agent to enhance the image and allow for study of the vascular system. In yet another embodiment, the imaging system incorporates the use of a coherent source of light, such as an infrared laser.

19 Claims, 5 Drawing Sheets



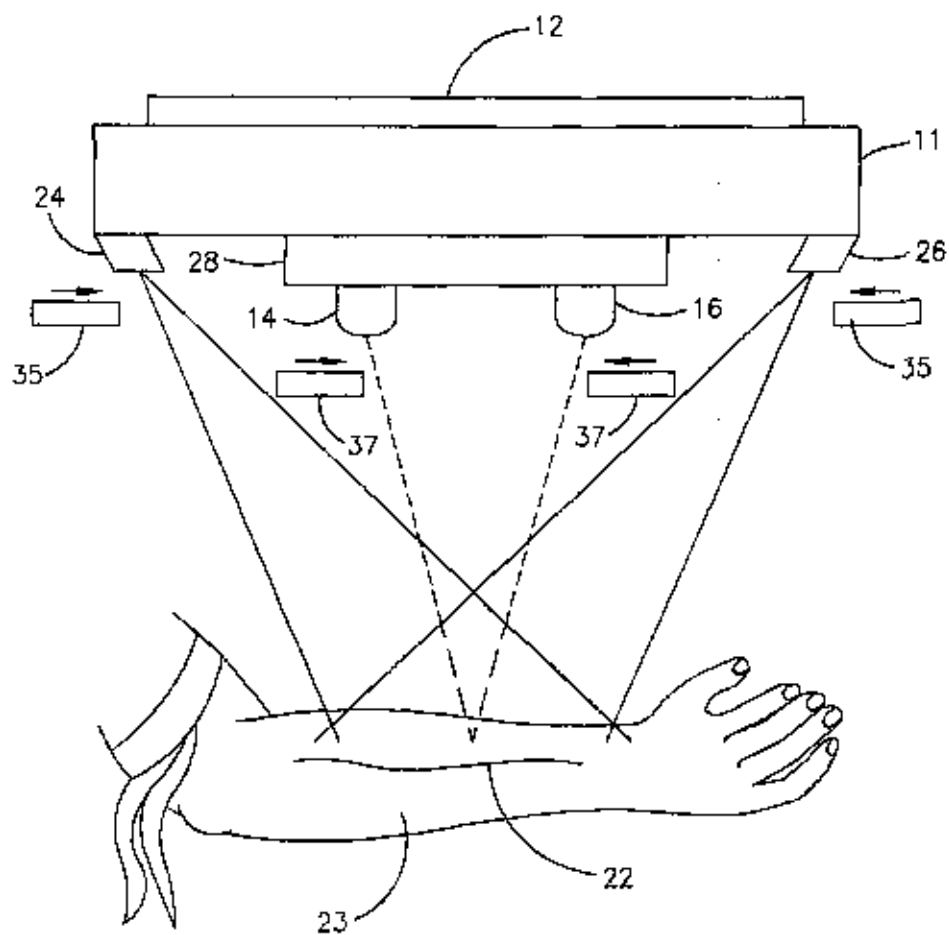


FIG.2

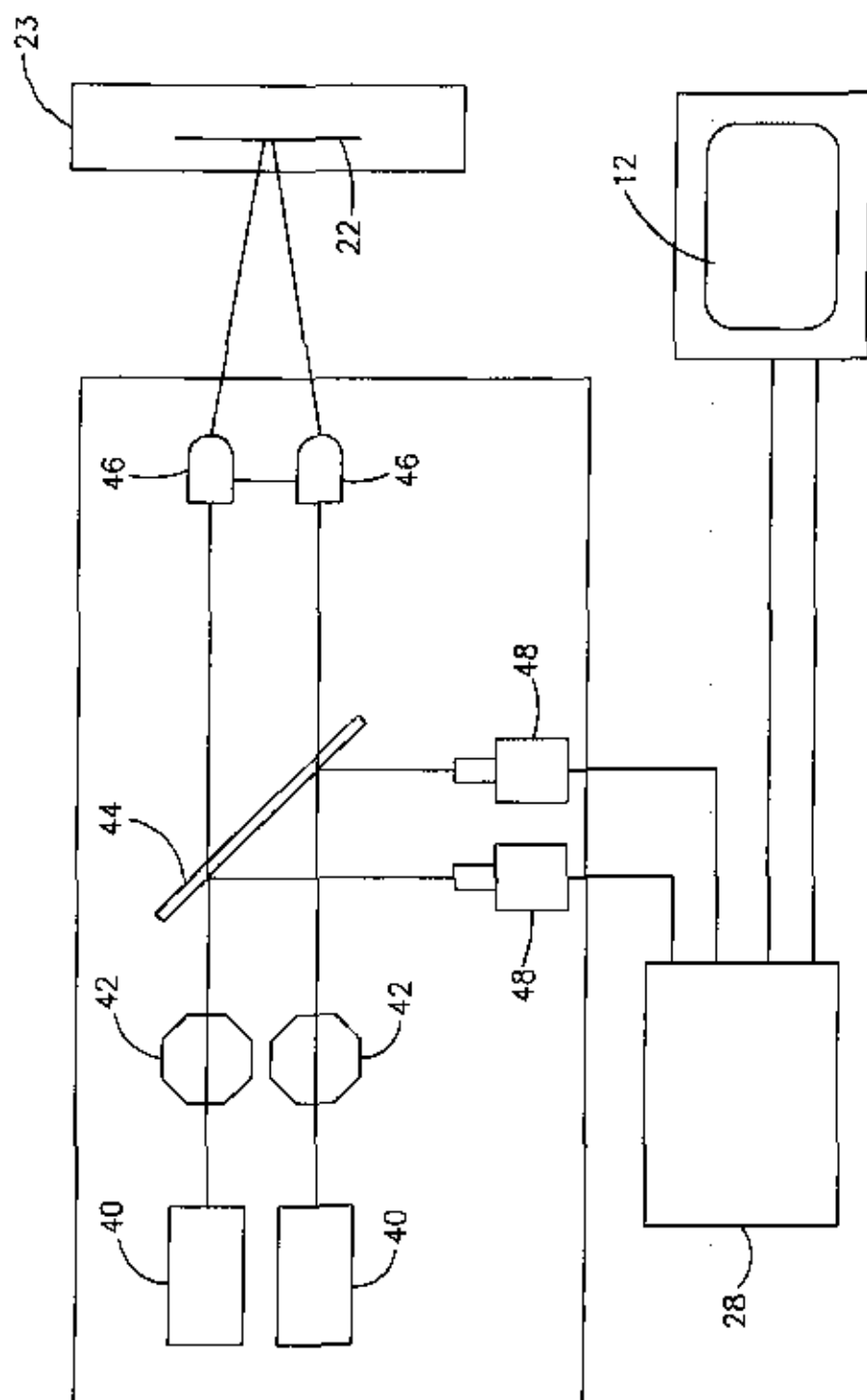


FIG. 6

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a visible image improves the human vision capability beyond its normal limitations.

The present invention uses the properties of near infrared light as it is absorbed and reflected by the human body allowing the user to visualize the tissues a few millimeters in depth from the skin's surface. The use of infrared light permits the manipulation of the acquired information to a grade of sensed visualization, which is impossible to reach with visible light.

The present invention is designed to be user friendly, allowing the health care professional to work in his usual manner. The invention imitates the human three-dimensional perception by use of a stereoscopic infrared viewer. A double image is superimposed on the viewer and the user wears blue-red glasses to create the three-dimensional image from the double image on the viewer. With the depth perception provided by the three-dimensional image, the user can accurately penetrate the vein on the initial attempt, causing the patient to be at ease.

In a preferred embodiment of the invention, a liquid crystal display (LCD) mounted in a frame is provided on the upper surface of the apparatus. Sensitive, charge-coupled devices are provided which develop images and deliver them to a microprocessor which synchronizes the images and allows the user to manipulate the images as desired, controlling effects such as brightness, contrast, sharpness and edge enhancement. Two sensors are provided fixed to the LCD. The support of the apparatus is flexible allowing free movement, or is provided as an articulated arm. The user moves the sensors together with the LCD to find the proper distance and angle of work. Alternatively, the sensors may be movable and provided independent of the LCD, while the LCD remains in a fixed position. LED lamps provide infrared radiation. A diffuser lens is provided for better diffusion of the light on the subject. The angle of radiation ranges between 45° and 90° depending on the diffuser lens. The homogeneous dispersion of the light increases the definition of the fine details of simulated veins. The apparatus may be attached to a table or be standing on the floor.

In another preferred embodiment, the LCD screen is separated from the frame and held on the wall or placed on a table or supported by an arm. The frame includes the infrared video sensors and the infrared illumination which is projected on the subject. In this way the user is able to work more comfortably.

In yet another embodiment, one illumination source and one diffuser lens are used for uniform scattering of radiation. Another aspect of the required radiation is provided as fiber optics, allowing the light reaching the subject to be soft and uniform.

In still a further embodiment, the inventive imaging system incorporates the use of a contrast agent which may be administered intravenously to obtain an angiogram in a three-dimensional image to allow for study of the vascular system.

In yet another embodiment, the imaging system incorporates the use of a coherent source of light, such as an infrared laser, provided in a double beam configuration for scanning and illumination, with a beam splitter optical arrangement.

Other features and advantages of the invention will become apparent from the following drawings and description.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention with regard to the embodiments thereof, reference is made, by way of

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example only, to the accompanying drawings in which like numerals designate corresponding elements throughout, and in which:

FIGS. 1a-b show, respectively, a health care provider attempting venous puncture without and with the apparatus of the present invention;

FIG. 2 shows a side view of the apparatus operated in accordance with the principles of the invention;

FIG. 3 is an electronic block diagram of a color converter circuit for use with the apparatus of FIG. 2;

FIG. 4 is a schematic layout diagram of a three-dimensional infrared imager, constructed in accordance with the principles of the present invention;

FIG. 5 illustrates an alternate embodiment of the present invention in which the sensors move independently of the main body of the apparatus; and

FIG. 6 illustrates another alternative embodiment of the invention using a double beam configuration for scanning and illumination of the area of interest.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1a, there is shown a health care provider attempting venous puncture using the conventional method. In FIG. 1b the health care provider is using the apparatus 10 of the present invention to aid in location of the veins. Note that the position of the user is consistent with that used in the conventional method and the present invention allows the user to work in the manner to which he is accustomed. LCD screen 12 on apparatus 10 provides two superimposed images due to two infrared video sensors 14, 16 mounted on the back of screen 12 which obtain the images from different angles. Screen 12 is mounted within a frame 11 and its position can be conveniently adjusted with the use of articulated arm 18, mounted on stand 9. The user wears blue-red or other two color filter viewing eyeglasses 20 to perceive a three-dimensional infrared real time image of the veins 22 (FIG. 2), in an area of examination 23 on the skin.

FIG. 2 shows a side view diagram of the apparatus operated in accordance with the principles of the invention. Infrared LED light sources 24 and 26 project light onto veins 22. Light which is reflected by the skin is sensed by sensors 14 and 16. Mounted below the lower side of LCD screen 12 is a microprocessor 28 which is programmed in accordance with skill of the art electronic imaging techniques to synchronize images delivered from sensors 14 and 16. Sensors 14 and 16 may be either black and white types, or color infrared sensors.

Microprocessor 28 also allows manipulation of the image to control the level of brightness, contrast, sharpness, edge enhancement, and subtraction. This is accomplished by means of knobs or pushbuttons on image control panel 30 visible in FIG. 4. The image can be converted to a negative image allowing the user to visualize the veins in white on a black background for further clarity. If sensors 14 and 16 are provided as color sensors, the color images are obtained by adjusting the color parameters of each sensor to the respective color desired. The color parameter of one sensor is adjusted to obtain a red image from a value of the red color zone, and the color parameter of the second sensor is adjusted to a green or blue color zone value.

If a third color sensor is added to the system, this will improve the color appearance of the image, and microprocessor 28 synchronizes the third color sensor, which may use

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**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISIÓN DE NUEVAS CREACIONES**

2020
Bogotá, D.C.,

Abogado
JUAN PABLO CADENA SARMIENTO

ASUNTO	Radicación	05-91311
	Trámite	002
	Evento	001
	Actuación	430
	Oficio	15390
	Folios	004

Patente de Invención ☐ Patente de Modelo de Utilidad ☐

Vía Nacional ☐

Vía PCT (fase nacional) ☒ Cap. I ☐ Cap. II ☒

No. Sol. Internacional PCT/US2004/005669
Fecha de Presentación Internal. 25 febrero 2004

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. Documentos estudiados

- 1.1. Descripción: Folios 38 a 62 como se radicó inicialmente
- 1.2. Reivindicaciones: Folios 63 a 68 como se radicó inicialmente
Folios 90 a 92 del pliego modificado
- 1.3. Dibujos: Folios 70 a 81 como se radicó inicialmente
- 1.4. Prioridad: Folio: 1
(11 marzo 2003, US, N° 10/386,249).

2. Objeto de la invención

La presente solicitud se titula "SISTEMA DE IMÁGENES USANDO LUZ INFRARROJA DIFUSA", Folio N° 1.

El objeto de la presente solicitud de patente consiste en un sistema para iluminar un objeto con luz infrarroja difusa y producir una imagen de video de objeto en base a la luz infrarroja reflejada.

De otra parte, el pliego reclama un aparato para enriquecer la visibilidad de una estructura enterrada debajo de la superficie de un objeto, relacionado en las reivindicaciones 1 a 12.

El objeto de la solicitud definido anteriormente se clasificó en la IPC A61B 6/00

3. Claridad de la solicitud

3.1. Reivindicaciones (artículo 30 D 486)

Las reivindicaciones calificadas no definen la materia que se desea proteger ni son suficientemente claras debido a que no es posible determinar cual es la mejora aportada por el solicitante al estado del arte. En ellas se relacionan unos componentes de un sistema de imagen, pero no se establece la relación funcional entre estos componentes.

La reivindicación 1, se limita a enumerar los componentes de un sistema de imagen, pero no establece la relación estructural o funcional entre los mismos. En lugar de esto, se desvía presentando el uso de estos elementos: "una fuente de iluminación para iluminar... una estructura difusora... suministra niveles de difusión... un dispositivo de imagen... para producir imagen... etc.". El uso o los resultados producto de la utilización de un dispositivo NO son características esenciales de la invención. Sin perjuicio de ello, la inclusión de elementos no técnicos pueden afectar la claridad de la reivindicación.

La inclusión de términos imprecisos tales como "espaciada separadamente" en la reivindicación 6, afecta la claridad de la reivindicación, puesto que no es posible establecer el alcance y ámbito de la protección solicitada.

La reivindicación 9 no aclara ni delimita ninguna característica técnica incluida en la reivindicación principal, en lugar de esto crea confusión porque no queda claro si el objeto de la invención es un sistema de imágenes o un polarizador.

En la reivindicación 12 no queda claro que es el "plano del LED", debido a que este plano no se encuentra definido anteriormente.

Por los motivos anteriores, el pliego reivindicatorio calificado NO cumple con los requisitos de claridad exigidos en el citado artículo.

4. Determinación del Estado de la Técnica

Considerando que la fecha de presentación de la primera solicitud de patente de la cual se reivindica prioridad es el 11 de marzo de 2003, se buscaron documentos del estado de la técnica relacionados, con fecha de publicación anterior a esta. Se realizó búsqueda de documentos relevantes dentro del estado de la técnica, entendiendo como estado de la técnica la definición provista en el Art. 16 D 486, y las excepciones fijadas en el Art. 17 de la misma.

No obstante, la solicitud presenta problemas de concisión, se realizó una búsqueda parcial la cual se complementará una vez se realicen los ajustes a la solicitud.

Se encontró como anterioridades los documentos relacionados a continuación que pueden afectar la patentabilidad del objeto de la presente solicitud

Nº	Documento*	Título	Fecha de publicación
D1	US4817622	INFRARED IMAGER FOR VIEWING SUBCUTANEOUS LOCATIONS OF VASCULAR STRUCTURES AND	1989-04-04

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		METHOD OF USE	
D2	US6178340	THREE-DIMENSIONAL INFRARED IMAGER FOR SUBCUTANEOUS PUNCTURE AND STUDY OF VASCULAR NETWORK	2001-01-23

*los documentos mencionados se anexan al expediente

5. Análisis de patentabilidad (artículo 14 D486)

En cumplimiento del Art. 14 D486 se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicabilidad industrial, con el fin de establecer la patentabilidad de la invención reivindicada de la solicitud en estudio.

5.1. Nivel Inventivo (artículo 18 D486)

La presente invención está contenida en un capítulo reivindicatorio que incluye 1 reivindicación independiente y 11 que dependen de ella. De acuerdo al estado de la técnica establecido en el numeral 4, los documentos más cercanos a la solicitud son los siguientes: **US5953225 (D1)** y **US1683676 (D2)**.

Las reivindicaciones 1 a 12, se ven afectadas por los documentos anteriores de la siguiente manera:

La anterioridad **D1** se refiere a un aparato electrónico para ver el contraste que se produce bajo la piel, al exponer esta a radiación infrarroja. La imagen de la estructura vascular revelada de esta manera, se captura en una cámara de video **C** y luego es presentada en un monitor de video **D**. El aparato descrito en este documento contiene los siguientes elementos comunes a la presente solicitud:

Una fuente de iluminación infrarroja **L** (Figs. 1 y 2, resumen, col. 2 líneas 67 a 68, col. 3 líneas 16 a 22, reivindicaciones 1 y 7) que al tratarse de una bombilla incandescente, presenta múltiples trayectorias de iluminación (Fig. 1A), un monitor de video para proyectar imágenes **D**, que cuenta con una pantalla **M** (Figs. 1 y 2, resumen, col. 1 líneas 64 a 68, col. 2 línea 57 a col. 3 línea 22, reivindicaciones 1, 2, 7 y 8), una cámara de video para recibir la imagen producida por la luz infrarroja reflejada **C** (Figs 1 y 2, resumen, col. Línea 60 a col. 3 línea 22, reivindicaciones 1 a 11).

De lo anterior es evidente que la anterioridad **D1** abarca todas las características esenciales de la invención a excepción de la estructura difusora. El documento **D1**, aunque trata una fuente de luz difusa tal como una bombilla incandescente, no se refiere a una estructura para aumentar los niveles de difusión. Sin embargo la anterioridad **D2**, que se refiere a un sistema de imagen infrarroja tridimensional, para el estudio de redes vasculares tales como el sistema de vasos sanguíneos, presenta un sistema de fuentes múltiples en una estructura de lentes que permite proporcionar una radiación difusa al objeto (Fig. 2 y 4 a 6, col.3 líneas 34 a 40, col.4 líneas 54 a 63). El uso de otras estructuras difusoras esta incluido en las modalidades alternativas que conllevan al mismo resultado de proporcionar luz difusa para mejorar la calidad de la imagen.

De acuerdo a lo expuesto arriba, una persona del oficio normalmente versada en la materia podría derivar de manera obvia el objeto la solicitud del estado de la técnica, por lo cual el objeto de la presente solicitud carece de nivel inventivo.

6. Conclusión:

Los requisitos de patentabilidad de la presente solicitud se encuentran afectados así:

N°	Documento N°	Reivindicaciones afectadas	Requisito que afecta
D1	US4817622	1 a 12	Nivel Inventivo
D2	US6178340	1 a 12	Nivel Inventivo

Se recomienda, que tenga en cuenta que el replanteamiento de esos apartes NO podrá implicar una ampliación de la protección que correspondería a la divulgación contenida en la solicitud inicial, de acuerdo a lo que establece el artículo 34 de la Decisión 486.

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta días *contados a partir de la fecha de notificación de la presente comunicación*. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2 Literal e) del capítulo quinto del título primero de la Circular Única No. 10 de 2001.


ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe de División de Nuevas Creaciones

El anterior requerimiento fue notificado por fijación en lista, de fecha
30 NOV. 2007

CONCEPTO TECNICO No. 2359	EXAMINADOR TÉCNICO Código No. 202082
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