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Hyun

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(54) **METHOD AND APPARATUS FOR DISPLAYING A COLOR FLOW IMAGE IN AN ULTRASOUND DIAGNOSTIC SYSTEM**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
A61B 8/00 (2006.01)

(52) **U.S. Cl.** **600/443**; 382/182

(58) **Field of Classification Search** 600/437, 600/443, 453, 463, 468; 604/19, 20, 606, 604/601

See application file for complete search history.

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U.S. Appl. No. 11/627,200, filed Jan. 25, 2007, Hyun.
U.S. Appl. No. 11/739,431, filed Apr. 24, 2007, Shin.
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(57) **ABSTRACT**

The present invention relates to a method and an ultrasound diagnostic system for displaying a 3-dimensional color flow image performing a transparency treatment for a predetermined region. The method of displaying a color flow image, comprises: a) forming a plurality of 2-dimensional color flow images based on ultrasound echo signals; b) sequentially superposing the plurality of 2-dimensional color flow images to form a 3-dimensional color flow image including a plurality of image regions; c) receiving selection information for selecting a desirable image region from the 3-dimensional color flow image; and d) performing a transparency treatment upon the selected region in the 3-dimensional color flow to have a predetermined transparency.

2 Claims, 4 Drawing Sheets

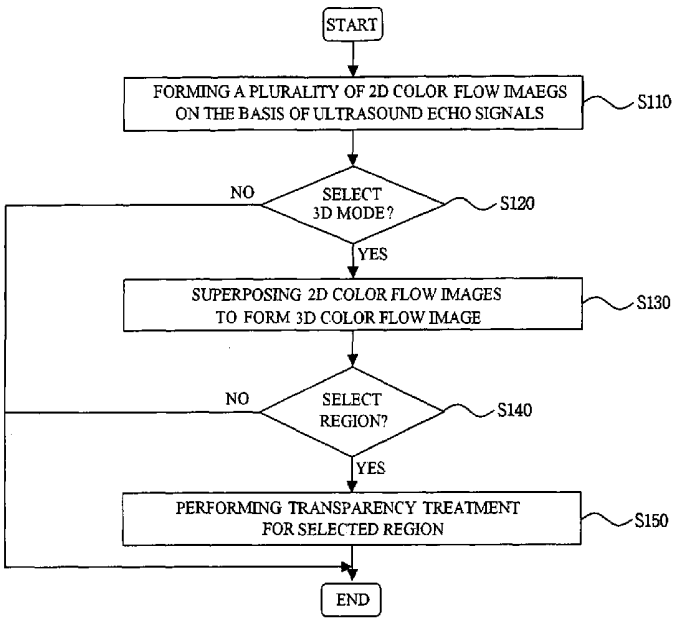


FIG. 1

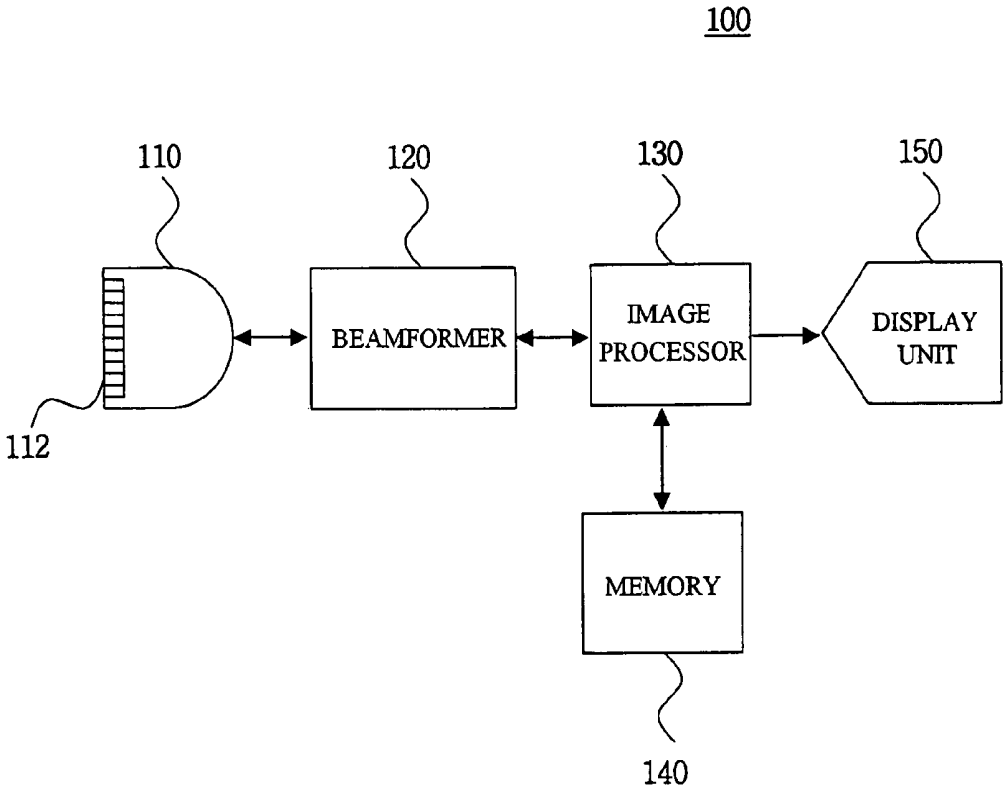
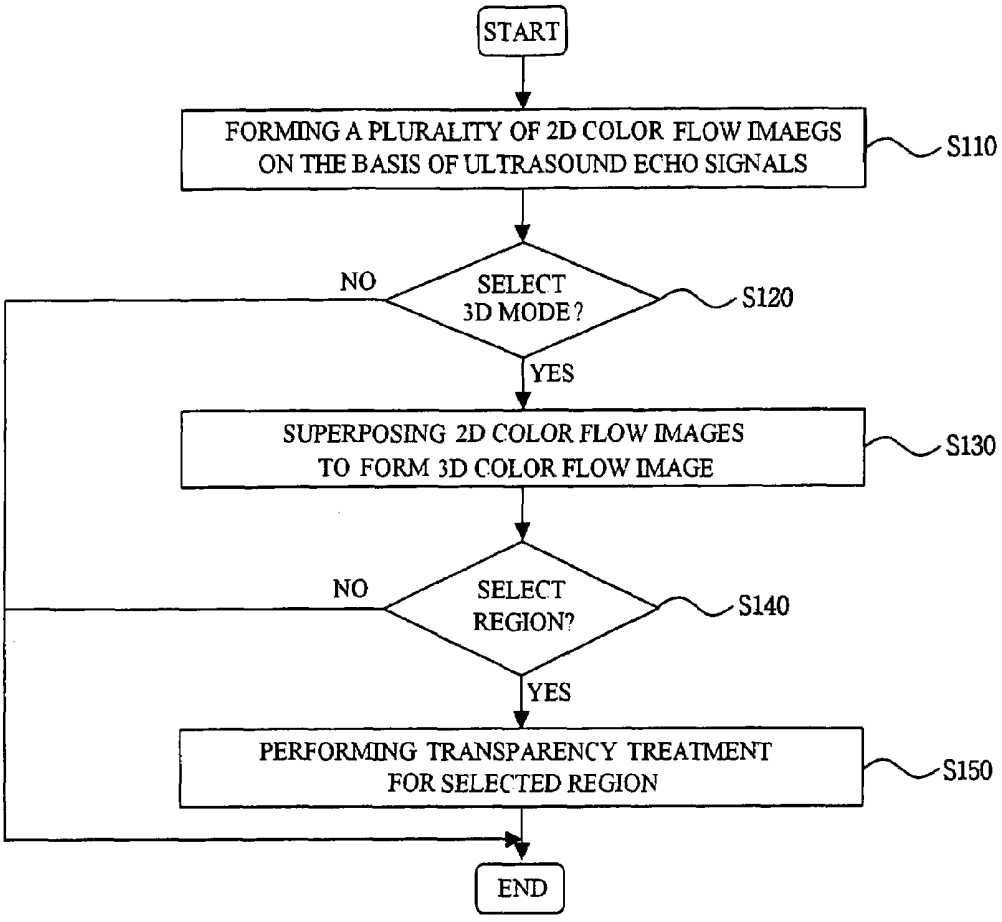
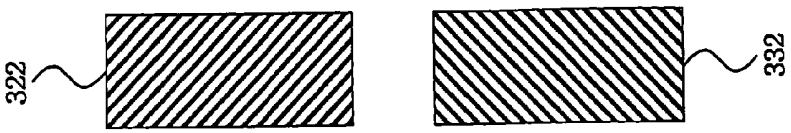

100
110
120
130
150
BEAMFORMER
IMAGE PROCESSOR
DISPLAY UNIT
112
MEMORY
140

FIG. 2


START
FORMING A PLURALITY OF 2D COLOR FLOW IMAEGS ON THE BASIS OF ULTRASOUND ECHO SIGNALS
S110
SELECT 3D MODE?
NO
S120
YES
SUPERPOSING 2D COLOR FLOW IMAGES TO FORM 3D COLOR FLOW IMAGE
S130
SELECT REGION?
NO
S140
YES
PERFORMING TRANSPARENCY TREATMENT FOR SELECTED REGION
S150
END



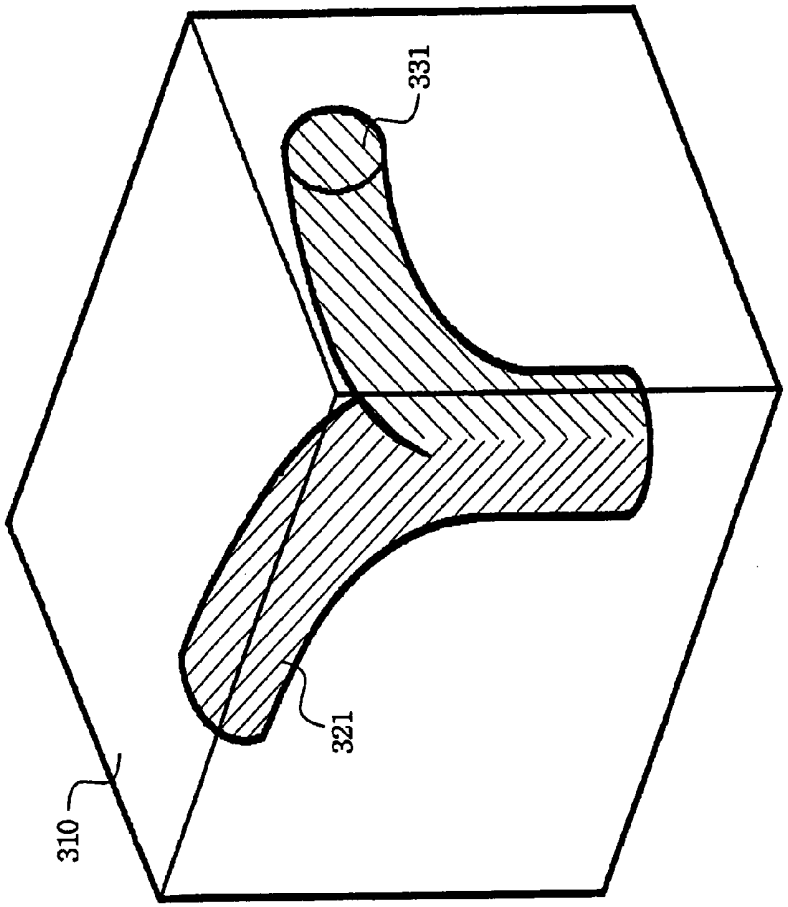
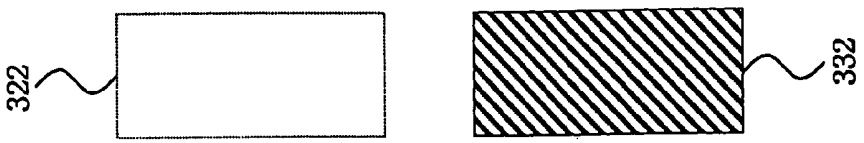


FIG. 3



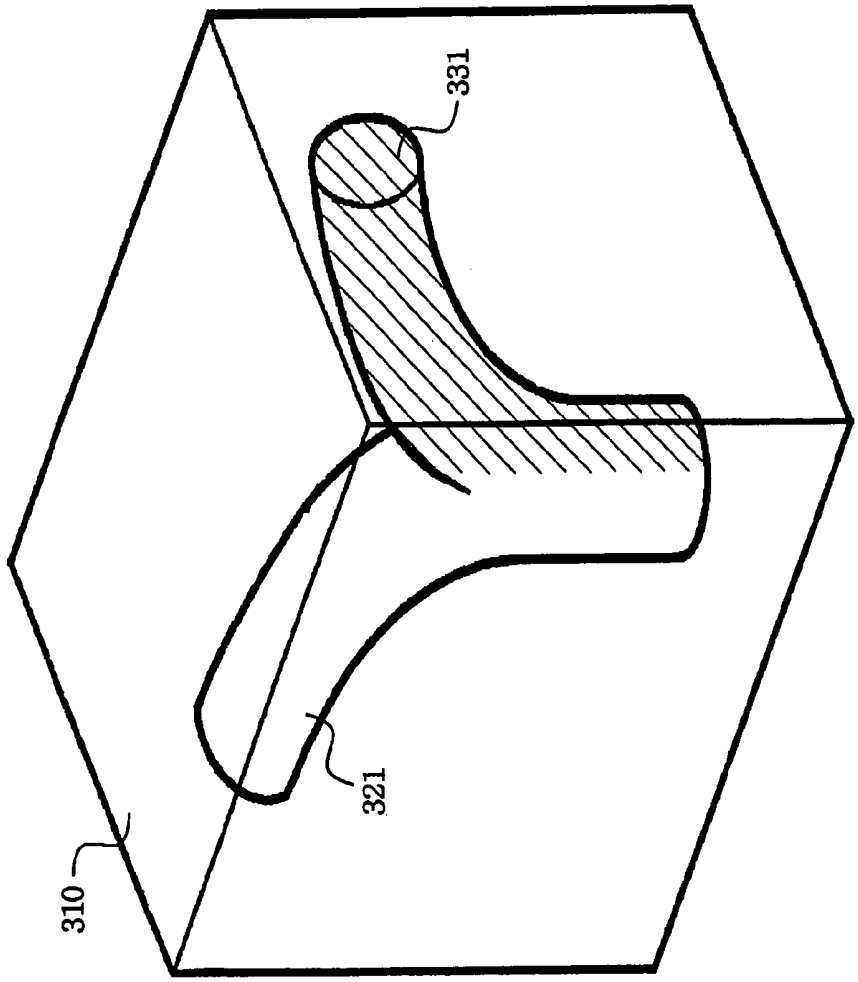


FIG. 4

METHOD AND APPARATUS FOR DISPLAYING A COLOR FLOW IMAGE IN AN ULTRASOUND DIAGNOSTIC SYSTEM

FIELD OF THE INVENTION

The present invention generally relates to ultrasound diagnostic systems, and more particularly to an apparatus and method for displaying a color flow image in an ultrasound diagnostic system.

BACKGROUND OF THE INVENTION

Generally, an ultrasound diagnostic system projects ultrasound signals from a surface of a target object toward a desired part within the target object. This is to obtain an ultrasound image of a soft tissue or blood flow by non-invasive means through using information of ultrasound echo signals from the target object. Compared to other medical imaging systems (e.g., X-ray diagnostic system, X-ray CT scanner, MRI and nuclear medicine diagnostic system), the ultrasound diagnostic system is advantageous since it is small in size and fairly inexpensive. Further, the ultrasound diagnostic system is capable of providing real-time display and is highly safe without any dangerous side effects such as exposure to X-rays, etc. Thus, it is extensively utilized for diagnosing the heart, abdomen and urinary organs, as well as being widely applied in the fields of obstetrics, gynecology, etc.

The ultrasound diagnostic system forms ultrasound images of various modes (e.g., B-mode, M-mode, etc.) based on the ultrasound echo signals reflected from the target object. Also, the ultrasound diagnostic system can provide a color flow image, which indicates the velocities of a moving target object and scatters. The ultrasound diagnostic system displays the velocity and direction of blood flowing within a moving object (e.g., heart, blood vessel or the like) with various colors based on the Doppler shift of an ultrasound signal. For example, the conventional ultrasound diagnostic system indicates the blood flowing toward the transducer of the probe with a red color, while indicating the blood flowing backward from the transducer of the probe with a blue color. Furthermore, the conventional diagnostic system indicates a rapidly flowing blood with a light color, while indicating a slowly flowing blood with a dark color.

Since the conventional diagnostic system displays the color Doppler image, which indicates the velocities of the moving target object and the scatters, on a 2-dimensional level, there is a problem in that a person unskilled in the conventional diagnostic system cannot accurately analyze the 2-dimensional color Doppler image.

In order to overcome the above problem, the conventional ultrasound diagnostic system superposes a plurality of 2-dimensional ultrasound images to provide a 3-dimensional color Doppler image. This is so that the above unskilled person can easily examine the target object through the displayed 3-dimensional color Doppler image. However, if the 2-dimensional color Doppler images indicating different blood flows are superposed, then the colors indicating the blood flows are displayed while the images are superposed. Therefore, there is a problem in that the conventional ultrasound diagnostic system cannot provide accurate information of the blood flows.

SUMMARY OF THE INVENTION

The present invention provides an apparatus and a method for performing a transparency treatment for blood flow images with predetermined transparency in the 3-dimensional color flow image to accurately display a target blood flow in an ultrasound diagnostic system.

In accordance with one aspect of the present invention, there is provided a method of displaying a color flow image, comprising: a) forming a plurality of 2-dimensional color flow images based on ultrasound echo signals; b) sequentially superposing the plurality of 2-dimensional color flow images to form a 3-dimensional color flow image including a plurality of image regions; c) receiving selection information for selecting a desirable image region from the 3-dimensional color flow image; and d) performing a transparency treatment upon the selected region in the 3-dimensional color flow image to have a predetermined transparency.

In accordance with another aspect of the present invention, there is provided an apparatus for displaying a color flow image in an ultrasound diagnostic system, comprising: an image forming unit for forming a plurality of 2-dimensional color flow images based on ultrasound echo signals and sequentially superposing the plurality of 2-dimensional color flow images to form a 3-dimensional color flow image including a plurality of image regions; a receiving unit for receiving selection information to select a desirable image region from the 3-dimensional color flow image; and a transparentizing unit for performing a transparency treatment upon the selected region in the 3-dimensional color flow image.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram showing an ultrasound diagnostic system constructed in accordance with the preferred embodiment of the present invention;

FIG. **2** is a flow chart showing an operation of the image processor constructed in accordance with the present invention;

FIG. **3** is a diagram showing a 3-dimensional color flow image formed in accordance with the present invention; and

FIG. **4** is a diagram showing a 3-dimensional color flow image in which a selected blood flow image is transparentized.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

FIG. **1** is a block diagram showing an ultrasound diagnostic system **100**, which is constructed in accordance with the preferred embodiment of the present invention. As shown in FIG. **1**, the ultrasound diagnostic system **100** includes a probe **110**, a beam former **120**, an image processor **130**, a memory **140** and a display unit **150**.

The probe **110** includes a 1-dimensional or 2-dimensional array transducer **112**. The transmit signals, which are appropriately delayed to form a focused ultrasound beam in the beam former **120**, are transmitted to the array transducer **112** and the focused ultrasound beam is transmitted along a scan line of a target object (not shown). The probe **110** receives ultrasound echo signals reflected from the target object and converts the ultrasound echo signals into electric signals (hereinafter referred to as reception signals). The reception signals are transmitted into the beam former **120**.

The beam former **120** controls the delay of transmit signals to be transmitted to the array transducer **112** in the probe **110** such that the ultrasound signals outputted from the array

transducer **112** are focused on a focal point. Further, the beam former **120** focuses the reception signals received at the array transducer **112** included in the probe **110** in consideration of the delays with which the ultrasound echo signals arrived at each transducer.

The image processor **130** sequentially superposes a plurality of 2-dimensional color flow images, which are formed based on the reception signals outputted from the beam former **120**, to form a 3-dimensional color flow image containing blood flow images. The 3-dimensional color flow image includes a plurality of image regions and each region is differently colored. The image processor **130** performs a transparency treatment for a blood flow image region selected by a user to have a predetermined transparency. The 3-dimensional color flow image, which is processed in the image processor **130**, may be stored in the memory **140** or displayed on the display unit **150** according to the selection of the user.

Hereinafter, the operation of the image processor will be described in detail in view of FIGS. **2** to **4**. FIG. **2** is a flow chart showing the operation of the image processor, which is constructed in accordance with the present invention. As shown in FIG. **2**, the image processor **130** forms the plurality of 2-dimensional color Doppler image based on the focused reception signals outputted from the beam former **120** at step S**110**. The reception signals include color information of the target object.

The image processor **130** checks whether a 3D mode is selected at step S**120**. If it is determined that the 3D mode is selected at step S**120**, then the image processor **130** sequentially superposes the plurality of 2-dimensional color flow images so as to form the 3-dimensioanl color flow image at step S**130**. The 3-dimensional color ultrasound image **310** includes a plurality of image regions and each region is differently colored. The 3-dimensional color ultrasound image **310** and color maps **322** and **332** corresponding to blood flow images **321** and **331**, which are examples formed in the image processor **130**, are shown in FIG. **3**.

Subsequently, the image processor **130** checks whether a region, which is processed with transparency, is selected based on selection information inputted from the user at step S**140**. The selected region may correspond to a region, which the user does not wish to observe. In such a case, the selection of the region is carried out by selecting one of the color maps **322** and **332** or one of the colors within the color maps **322** and **332**.

If it is determined that the region to be processed with the transparency is selected at step S**150**, then the image processor **130** performs the transparency treatment for a color of a blood flow in the selected region so as to have a predetermined transparency at step S**150**. For example, if the color map **322** corresponding to the blood flow image **130** is selected as a region to be transparentized, then the image processor **130** assigns a transparent color having the predetermined transparency to the color indicating the blood flow image **321** and color map **322**. Consequently, the color indicating the blood flow image **321** and color map **322** are transparentized, as shown in FIG. **4**.

According to the preferred embodiment of the present invention, the region selected by the user is transparentized as a region that is not to be observed. However, the regions, which are not selected by the user, may be set as regions that are not to be observed. This is so that the transparency treatment may be performed to the regions with the exception of the selected regions in accordance with another embodiment of the present invention.

As the transparency treatment is selectively carried out for colors corresponding to the blood flow images that are superposed, the blood flow image to be observed can be separately displayed. This is so that the user can accurately examine the blood flow image that the user wishes to observe.

While the present invention has been described and illustrated with respect to a preferred embodiment of the invention, it will be apparent to those skilled in the art that variations and modifications are possible without deviating from the broad principles and teachings of the present invention which should be limited solely by the scope of the claims appended hereto.

What is claimed is:

1. A method of displaying a color flow image in an ultrasound diagnostic system, comprising the steps of:

a) forming a plurality of 2-dimensional color flow images based on ultrasound echo signals;

b) sequentially superposing the plurality of 2-dimensional color flow images to form a 3-dimensional color flow image including a plurality of image regions, and forming a plurality of color maps corresponding to the 3-dimensional color flow image, each of the said plurality of color maps having colors associated therewith;

c) receiving selection information from a user for selecting one of the color maps or one of colors in the color maps; and

d) performing a transparency treatment upon an image region corresponding to the selected color map or color in the 3-dimensional color flow image to have a predetermined transparency.

2. An apparatus for displaying a color flow image in an ultrasound diagnostic system, comprising:

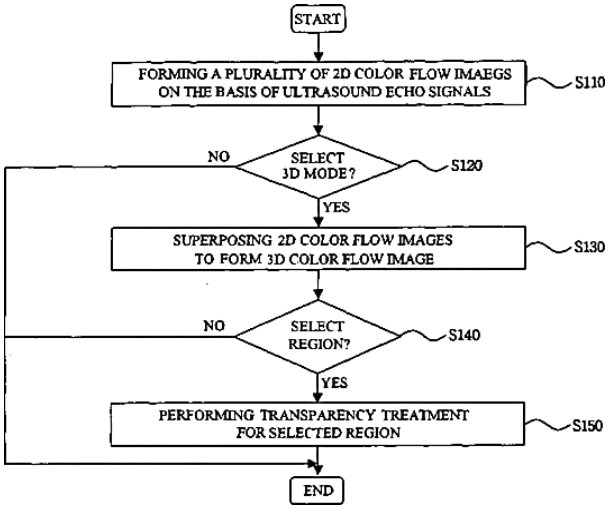
an image forming unit for forming a plurality of 2-dimensional color flow images based on ultrasound echo signals and sequentially superposing the plurality of 2-dimensional color flow images to form a 3-dimensional color flow image including a plurality of image regions, the image forming unit further forming color maps corresponding to the 3-dimensional color flow image, each of the said plurality of color maps having colors associated therewith;

a receiving unit for receiving selection information from a user to select one of the color maps or one of colors in the color maps; and

a transparentizing unit for performing a transparency treatment upon an image region corresponding to the selected color map or color in the 3-dimensional color flow image.

* * * * *

专利名称(译)	用于在超声诊断系统中显示彩色血流图像的方法和装置		
公开(公告)号	US7621872	公开(公告)日	2009-11-24
申请号	US11/473181	申请日	2006-06-23
申请(专利权)人(译)	MEDISON CO.，LTD.		
当前申请(专利权)人(译)	MEDISON CO.，LTD.		
[标]发明人	HYUN DONG GYU		
发明人	HYUN, DONG GYU		
IPC分类号	A61B8/00		
CPC分类号	A61B8/06 A61B8/483 G06T15/503 G06T19/20 G06T2219/2012 G06T2210/24 G06T2210/62		
优先权	1020050056011 2005-06-28 KR		
其他公开文献	US20070038104A1		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及一种用于显示对预定区域执行透明处理的三维彩色血流图像的方法和超声诊断系统。显示彩色流图像的方法包括：a）基于超声回波信号形成多个二维彩色流图像; b）顺序地叠加多个二维彩色血流图像，以形成包括多个图像区域的三维彩色血流图像; c）接收用于从三维彩色血流图像中选择所需图像区域的选择信息; d）对三维彩色流中的所选区域进行透明处理，以具有预定的透明度。