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Khalil et al.

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(54) **METHOD FOR MODULATING LIGHT PENETRATION DEPTH IN TISSUE AND DIAGNOSTIC APPLICATIONS USING SAME**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 09/302,207, filed on Apr. 29, 1999, now Pat. No. 6,241,663, which is a continuation-in-part of application No. 09/080,470, filed on May 18, 1998, now Pat. No. 6,662,030.

(51) **Int. Cl.**
A61B 5/00 (2006.01)

(52) **U.S. Cl.** **600/310; 600/316**

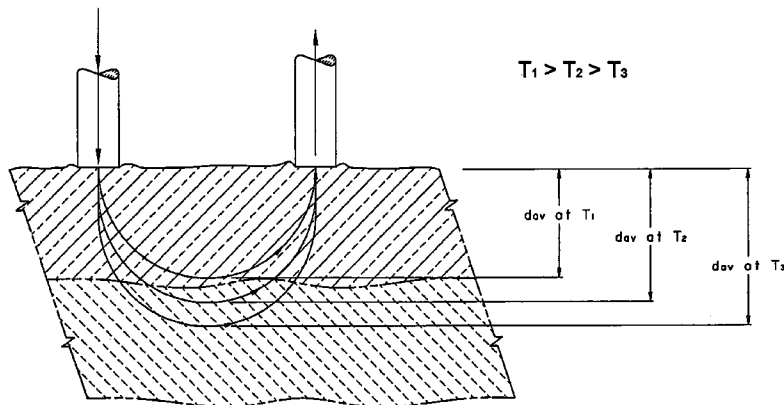
(58) **Field of Classification Search** **600/310-311, 600/316, 322-324, 326, 328, 334, 339; 356/39-41**
See application file for complete search history.

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(57)

ABSTRACT

Devices and methods for non-invasively measuring at least one parameter of a sample, such as the presence of a disease condition, progression of a disease state, presence of an analyte, or concentration of an analyte, in a biological sample, such as, for example, a body part. In these devices and methods, temperature is controlled and is varied between preset boundaries. The methods and devices measure light that is reflected, scattered, absorbed, or emitted by the sample from an average sampling depth, d_{av} , that is confined within a region in the sample wherein temperature is controlled. According to the method of this invention, the sampling depth d_{av} , in human tissue is modified by changing the temperature of the tissue. The sampling depth increases as the temperature is lowered below the body core temperature and decreases when the temperature is raised within or above the body core temperature. Changing the temperature at the measurement site changes the light penetration depth

presence of a disease condition, progression of a disease state, presence of an analyte, or concentration of an analyte in a biological sample. According to the method of this invention, an optical measurement is performed on a biological sample at a first temperature. Then, when the optical measurement is repeated at a second temperature, light will

penetrate into the biological sample to a depth that is different from the depth to which light penetrates at the first temperature by from about 5% to about 20%.

30 Claims, 14 Drawing Sheets

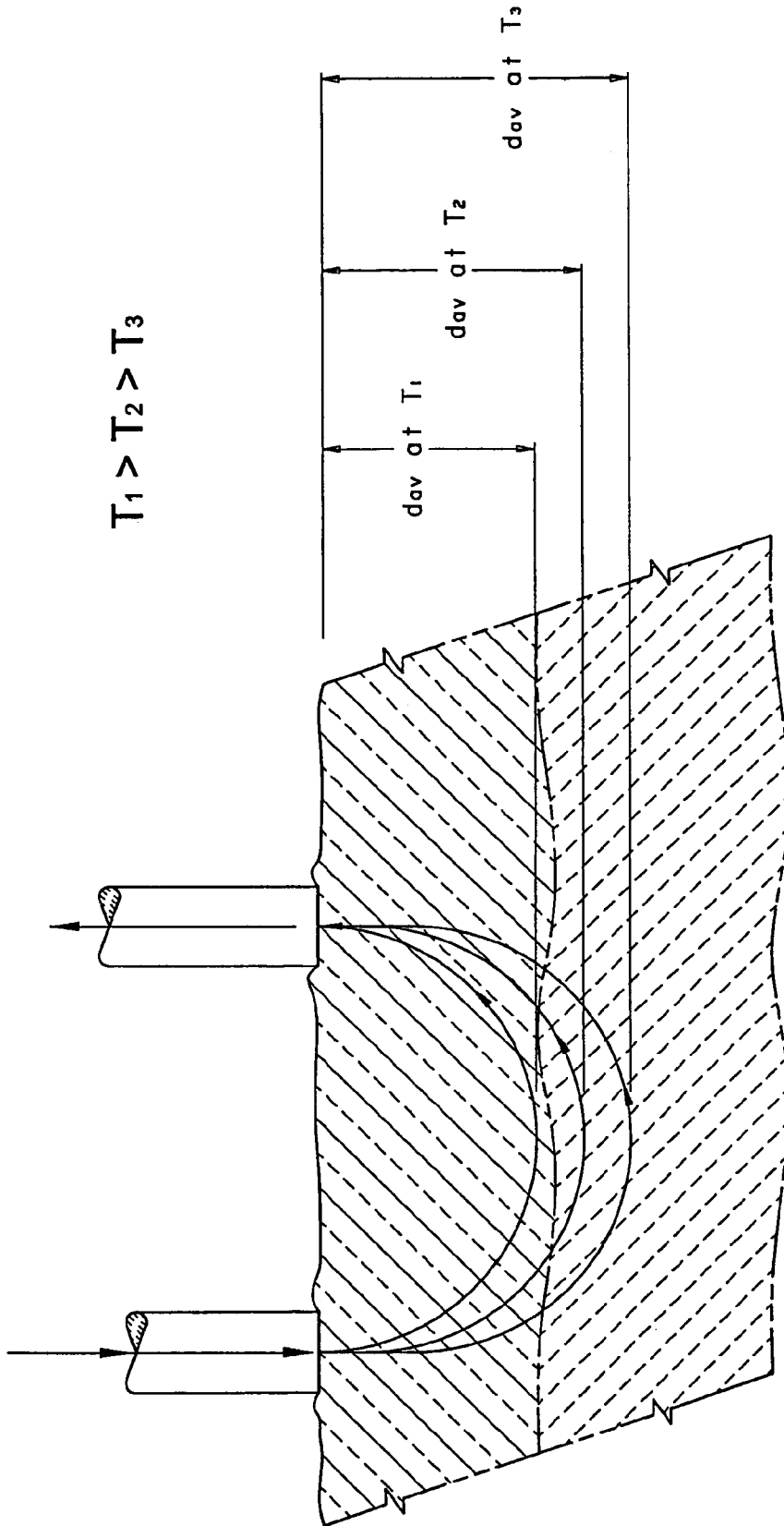


FIG. 1

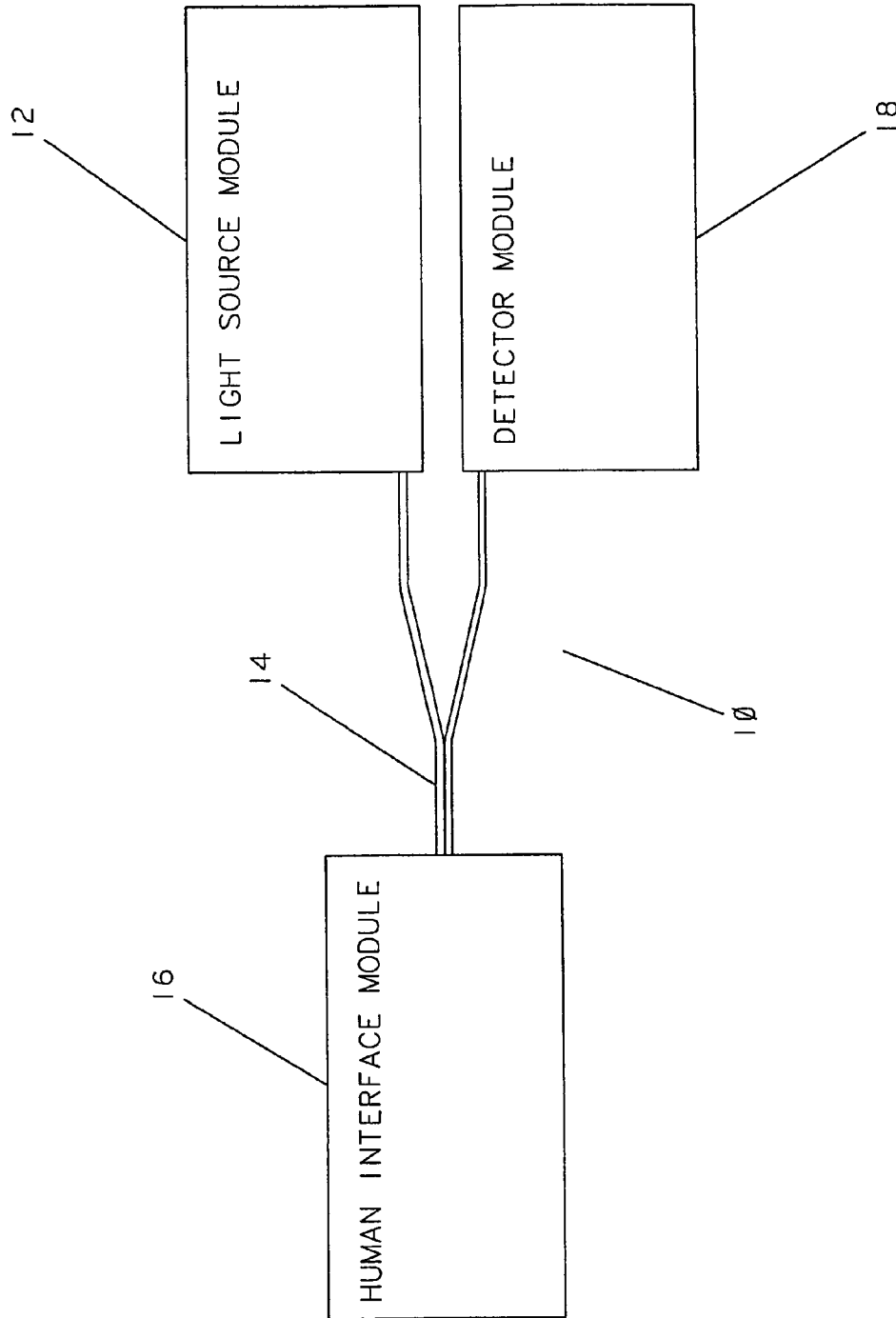


FIG. 2

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