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(54) **METHODS AND APPARATUS FOR FORWARD-DIRECTED OPTICAL SCANNING INSTRUMENTS**

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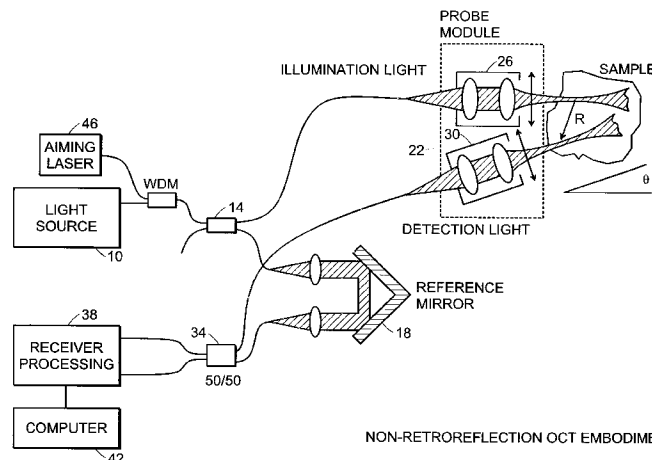
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(57) **ABSTRACT**

An imaging system for performing forward scanning imaging for application to therapeutic and diagnostic devices used in medical procedures. The imaging system includes forward directed optical coherence tomography (OCT), and non-retroreflected forward scanning OCT. Also interferometric imaging and ranging techniques and fluorescent, Raman, two-photon, and diffuse wave imaging can be used. The forward scanning mechanisms include a cam attached to a motor, pneumatic devices, a pivoting device, piezoelectric transducers, electrostatic driven slides for substantially transverse scanning; counter-rotating prisms, and offset lenses are used for arbitrary scanning. The imaging system of the invention is applied to hand held probes including probes integrated with surgical probes, scalpels, scissors, forceps and biopsy instruments. Hand held probes include forward scanning lasers. The imaging system is also applicable to laparoscopes and endoscopes for diagnostic and therapeutic intervention in body orifices, canals, tubes, ducts, vessels and cavities of the body. The imaging system includes application to surgical and high numerical aperture microscopes. An important application of the invention is implantation of the optical probe for periodic or continuous extraction of information from the tissue site where implanted.

9 Claims, 33 Drawing Sheets



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