

受験番号 : 18IPE011

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問1

1. A reference voltage generating circuit comprising:  
a first resistor (10) including an end to which a first electric potential is supplied, and another end connected to an output terminal from which a reference voltage is output;  
a second resistor (11) including an end to which a second electric potential is supplied, and another end connected to the output terminal;  
a first bipolar transistor (15) having a first polarity, the first bipolar transistor (15) including a collector to which the first electric potential is supplied, and an emitter connected to the output terminal;  
a second bipolar transistor (16) having a second polarity that is different from the first polarity, the second bipolar transistor (16) including a collector to which the second electric potential is supplied, and an emitter connected to the output terminal;  
a first bias generating circuit (17, 18) configured to generate and supply a first direct-current bias voltage to a base of the first bipolar transistor; and  
a second bias generating circuit (19, 20) configured to generate and supply a second direct-current bias voltage to a base of the second bipolar transistor.
2. The reference voltage generating circuit according to claim 1, wherein  
a value of the first direct-current bias voltage is lower than a value of the reference voltage and is equal to or higher than a value of a voltage obtained by subtracting a value of a base-emitter forward voltage of the first bipolar transistor from the value of the reference voltage, and  
a value of the second direct-current bias voltage is higher than the value of the reference voltage and is lower than a value of a voltage obtained by adding the value of the reference voltage to a value of a base-emitter forward voltage of the second bipolar transistor.

問2

Recently, attention has been focused on an OCT (Optical Coherence Tomography) that forms the image of a cross section of a measuring object using an interference phenomenon of a light beam such as a laser beam. The OCT does not have an invasive procedure on a human body and thus has been expected to be widely applied in the medical field and the field of biochemistry. As an example, in the field of ophthalmology, apparatuses to form the images of cross sections of, for example, eyeground and cornea have already been put into practical use.

Patent document 1 discloses an apparatus to which the OCT is applied. This apparatus includes a measurement arm to scan on object using a rotary scanning mirror (galvanometer mirror), a reference arm provided with a reference mirror, and an exit at which an interference device is provided to analyze the intensities of the interference light of light fluxes from the measurement arm and the reference arm using a spectroscope. In addition, the reference arm is configured to change the phase of reference light into discontinuous values in stages.

The apparatus disclosed in patent document 1 uses what is called "Fourier domain OCT" technique. The apparatus irradiates an measuring object with a beam of low coherence light, generates interference light by superimposing reference light and reflected light from the measuring object, obtains the spectrum intensity distribution of the interference light for performing Fourier conversion to obtain an image of the shape of the measuring object with reference to a direction of depth thereof (z direction).

問3

A remote communication apparatus is connected to a monitoring unit using an arbitrary proper network such as a cellular network or the Internet. Needless to say, the network includes, for example, public switched telephone networks, radio links, cable connections, short message services as alternatives.

A remote monitoring apparatus makes a request for an object person to identify herself/himself and then gives that person an instruction to perform a particular monitoring or measuring procedure. The object person is notified of how to perform a measurement and how to report the result of the measurement to the monitoring apparatus.

A typical monitoring unit is a remote monitoring unit, which may be disposed on the hospital side of a network connection. However, this is simply an example, and procedures based on the monitoring unit may be performed at a position convenient for a patient and a medical professional. When the patient establishes connection using a digital apparatus, the user may typically perform various procedures using the remote unit. In another embodiment, the user manually establishes connection using a telephone, and, in this case, procedures are performed at a location distant from the patient.