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Dreyer et al.

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(54) **HOLLOW WAVEGUIDE CAVITY RINGDOWN SPECTROSCOPY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 783 days.

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(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**
G01N 21/00 (2006.01)

(52) **U.S. Cl.** **356/437**; 356/432; 356/436

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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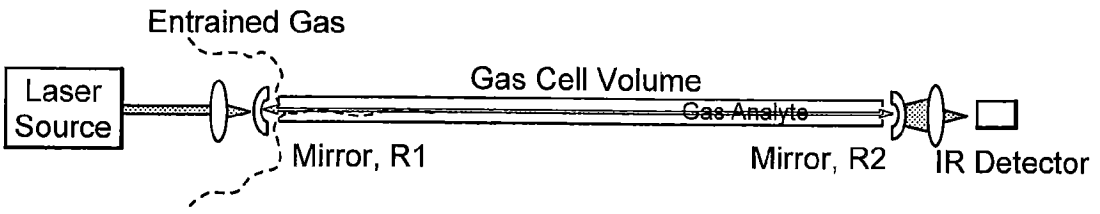
(57) **ABSTRACT**

Laser light is confined in a hollow waveguide between two highly reflective mirrors. This waveguide cavity is used to conduct Cavity Ringdown Absorption Spectroscopy of loss mechanisms in the cavity including absorption or scattering by gases, liquid, solids, and/or optical elements.

23 Claims, 8 Drawing Sheets



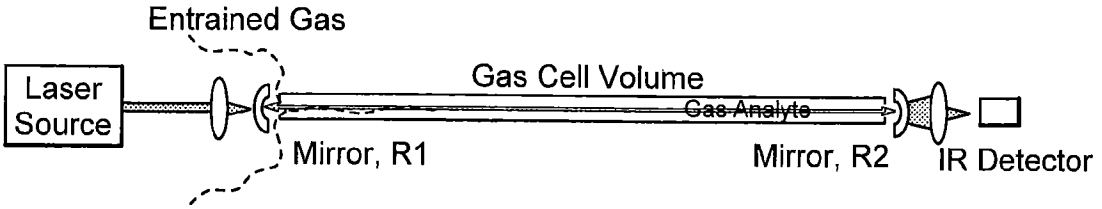

Entrained Gas
Laser Source
Gas Cell Volume
Gas Analyte
Mirror, R1
Mirror, R2
IR Detector

Fig. 1

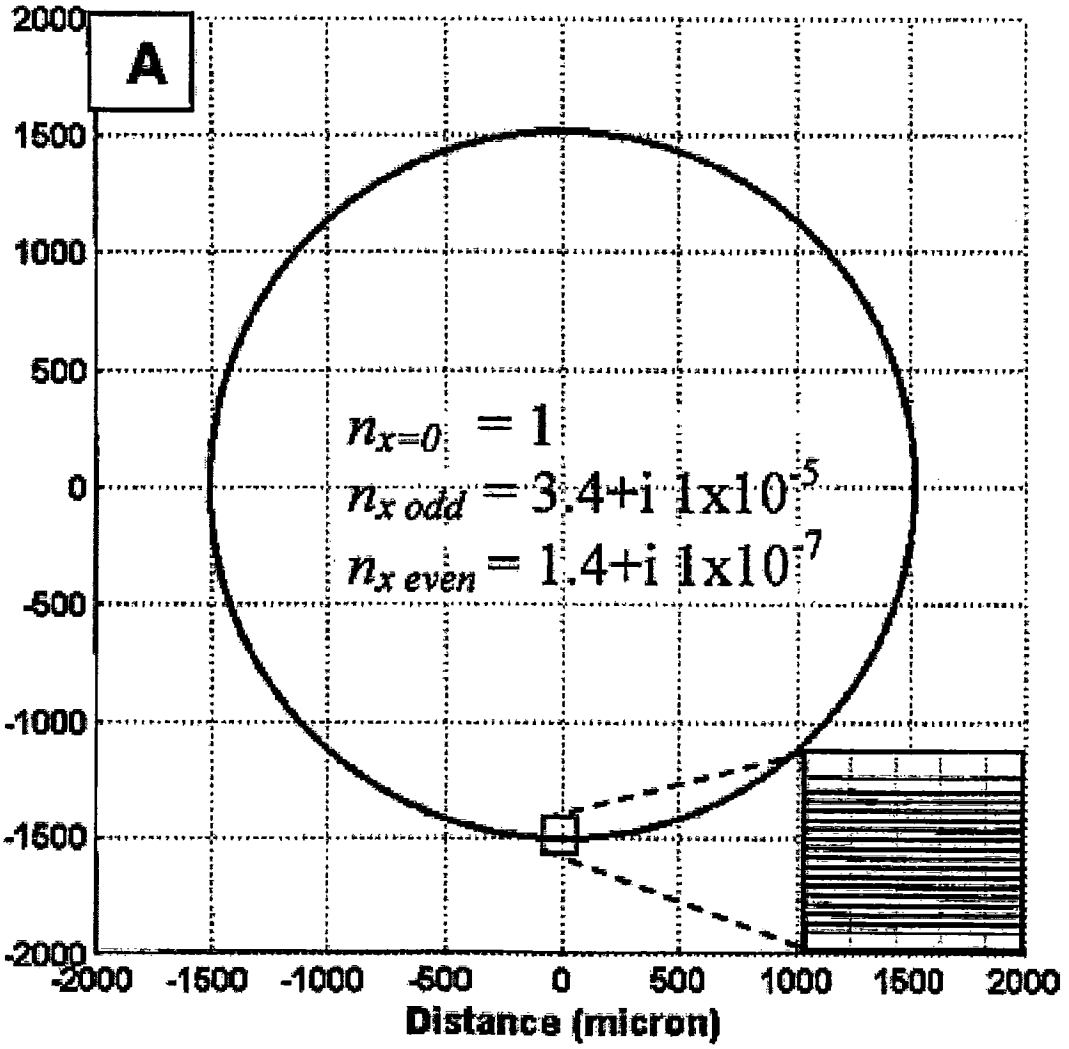

A
$n_{x=0} = 1$
$n_{x\,odd} = 3.4+i\,1x10^{-5}$
$n_{x\,even} = 1.4+i\,1x10^{-7}$
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2000 -1500 -1000 -500 0 500 1000 1500 2000
Distance (micron)

Fig. 2

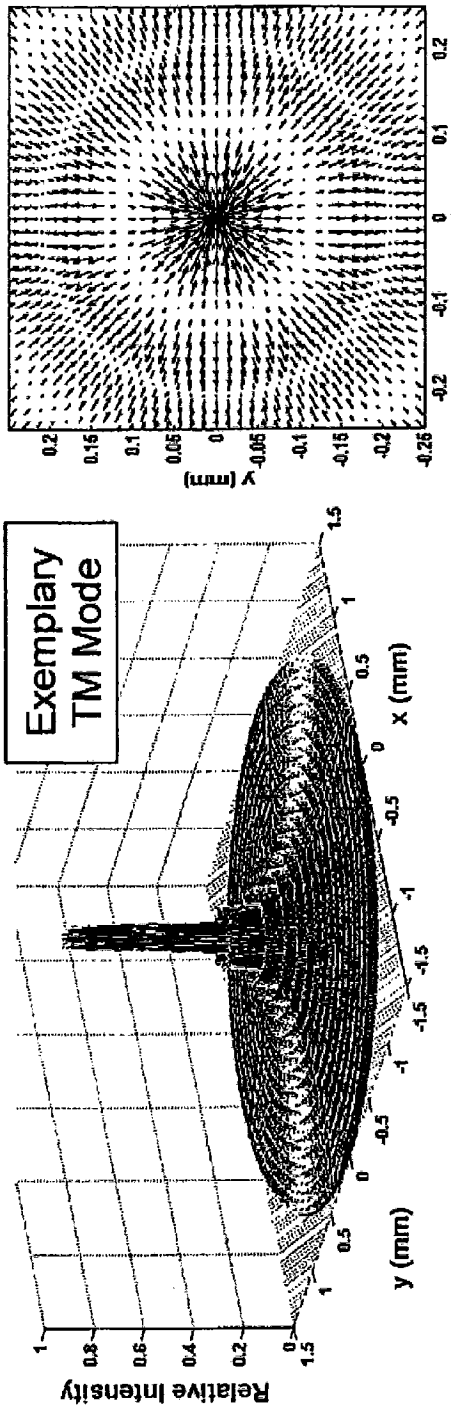

Exemplary TM Mode
Relative Intensity
y (mm)
x (mm)
y (mm)
x (mm)

Fig. 3A

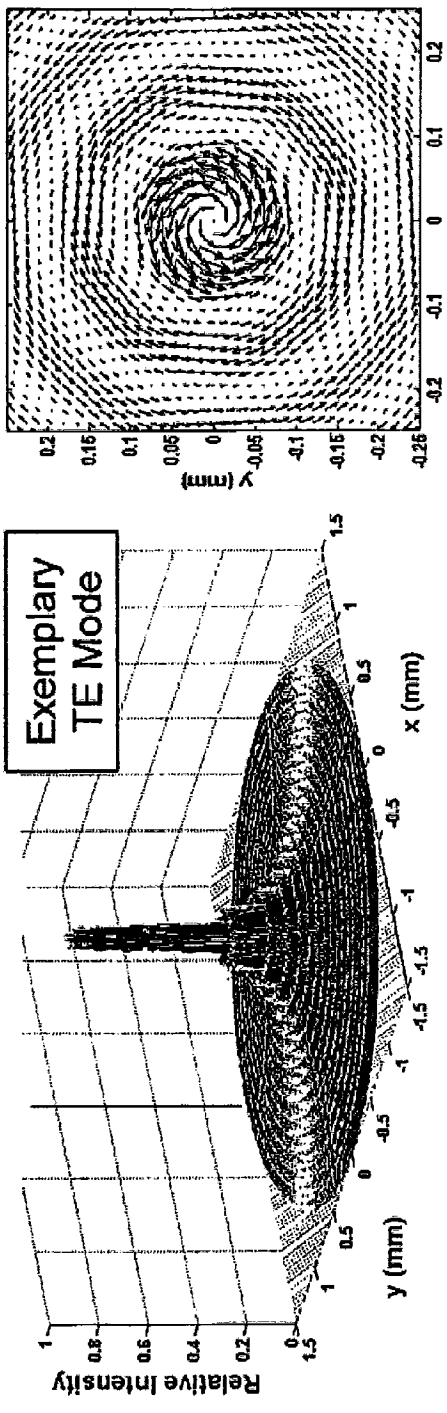
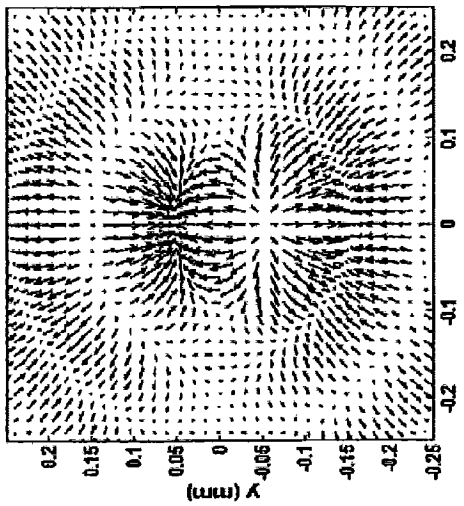

Exemplary TE Mode
Relative Intensity
y (mm)
x (mm)
y (mm)
x (mm)

Fig. 3B


y (mm)
x (mm)

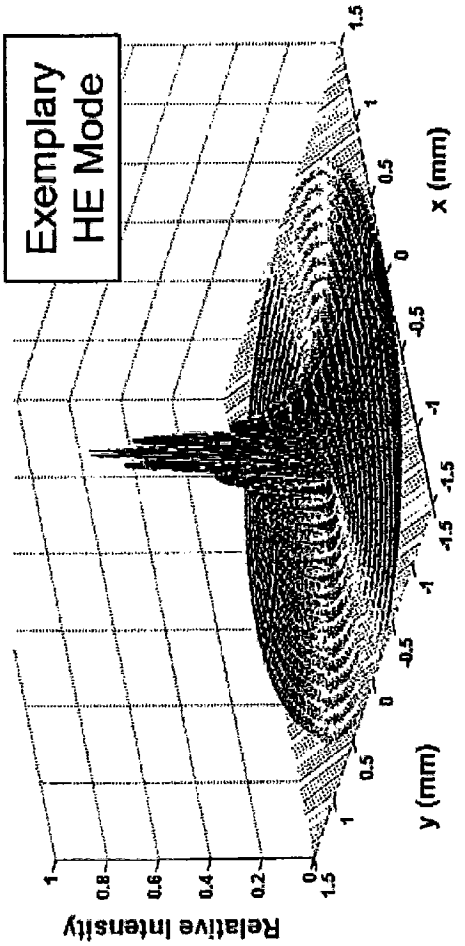
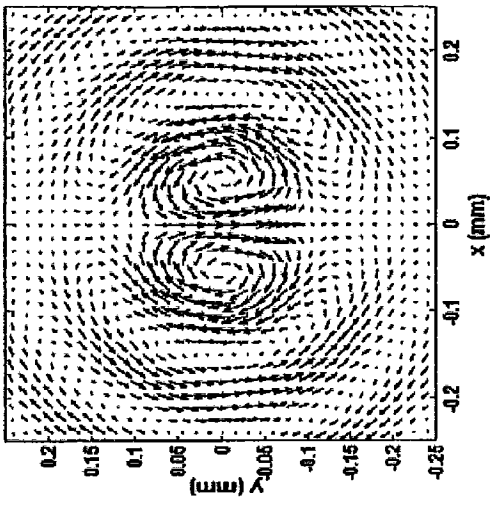

Exemplary
HE Mode
Relative Intensity
x (mm)
y (mm)

Fig. 3C


y (mm)
x (mm)

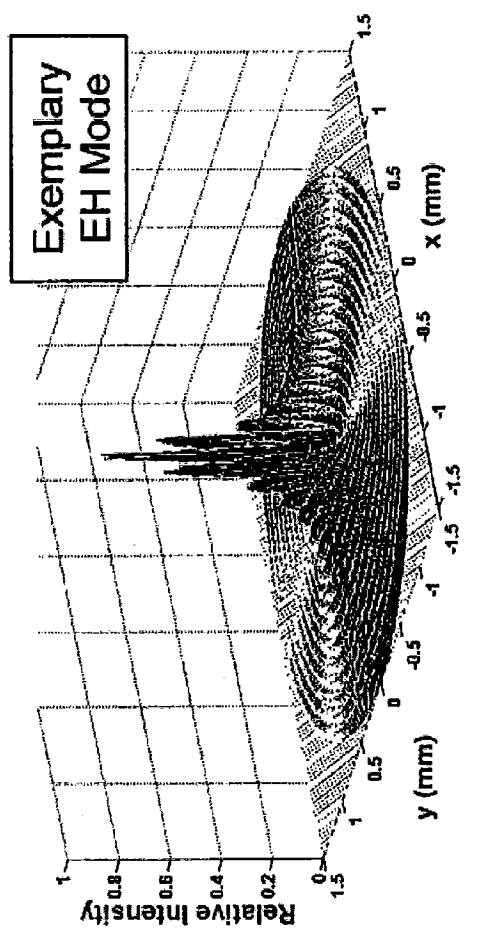

Exemplary
EH Mode
Relative Intensity
x (mm)
y (mm)

Fig. 3D