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**United States Patent** [19]

Johnston et al.

[11] **Patent Number:** 5,784,032[45] **Date of Patent:** Jul. 21, 1998[54] **COMPACT DIVERSITY ANTENNA WITH WEAK BACK NEAR FIELDS**[75] Inventors: **Ronald H. Johnston**, Calgary; **Laurent Joseph Levesque**, Winnipeg, both of Canada[73] Assignee: **Telecommunications Research Laboratories**, Edmonton, Canada

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[22] Filed: Nov. 1, 1995

[51] Int. Cl.<sup>6</sup> ..... H01Q 1/24

[52] U.S. Cl. .... 343/702; 343/742; 343/846

[58] Field of Search ..... 343/702, 700 MS, 343/741, 742, 846, 848, 841, 725, 727, 729, 789, 797, 866

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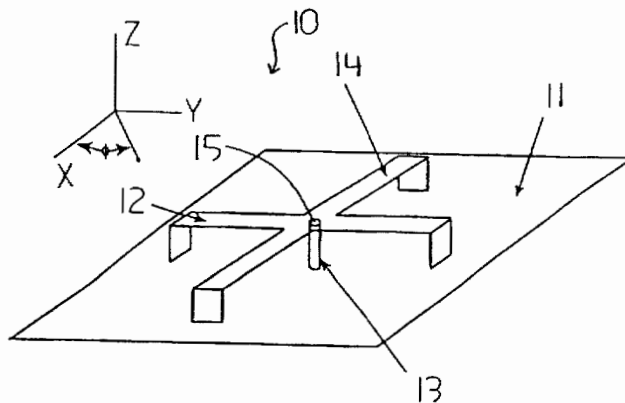
Primary Examiner—Donald T. Hajec

Assistant Examiner—Tan Ho

Attorney, Agent, or Firm—Anthony R. Lambert

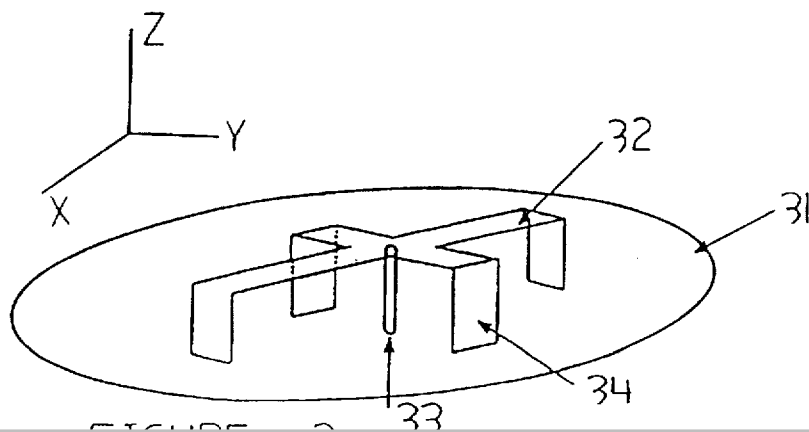
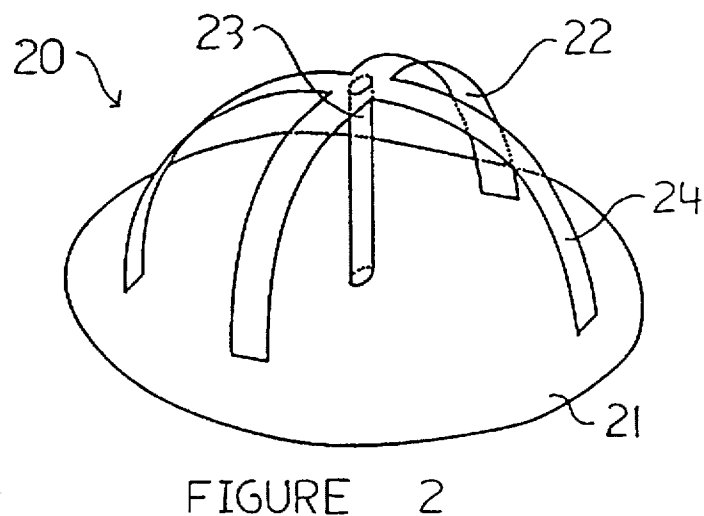
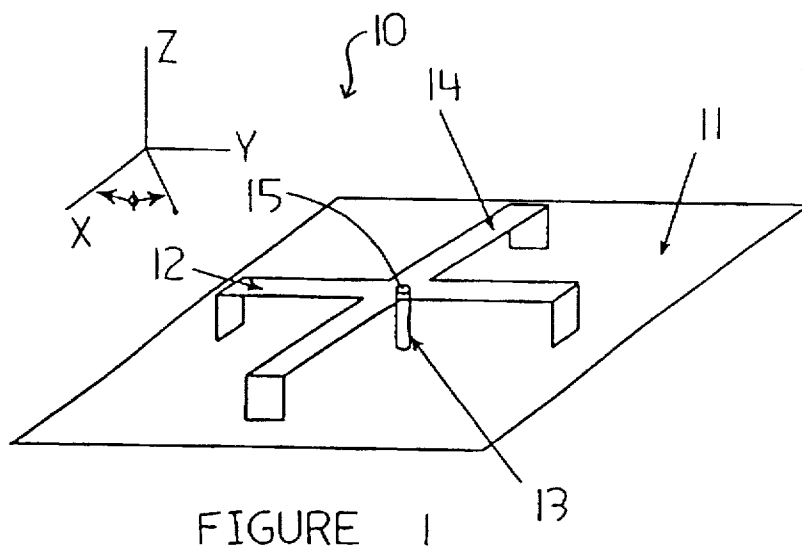
[57] **ABSTRACT**

A compact diversity antenna is presented consisting of two electrically isolated orthogonal loop conductors joined at a midpoint. This midpoint is also electrically attached to a vertical conductor which produces a third mode of operation electrically isolated from the first modes. The two horizontal conductors and the vertical conductor may be constructed to have various relationships with a ground plane of various shapes and sizes. Some of the possible feed arrangements for each of the antennas is presented as well as matching and tuning circuits. All three antenna elements are found to have relatively weak near electric and magnetic fields on the ground plane side of the antenna where the ground plane is small in extent. This feature provides for reduced radiation into the head and neck of the cellular phone user.

**65 Claims, 13 Drawing Sheets**

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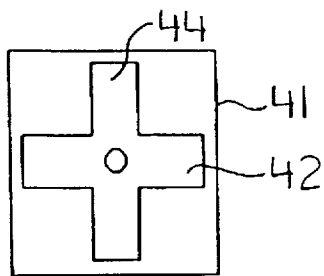


FIGURE 4

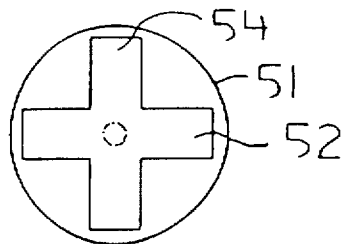


FIGURE 5

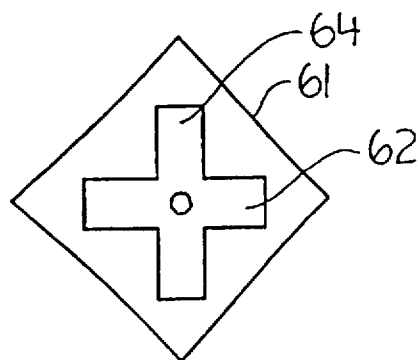


FIGURE 6

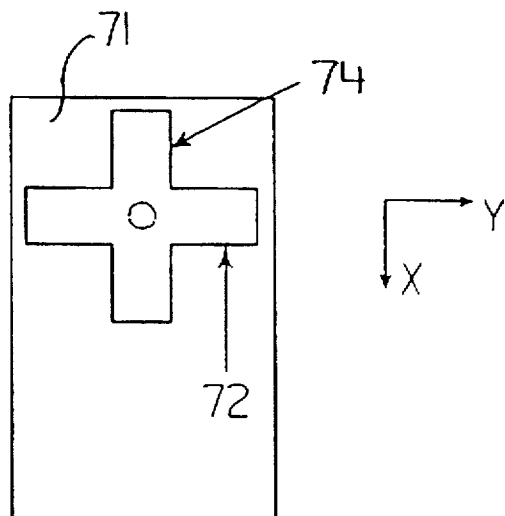
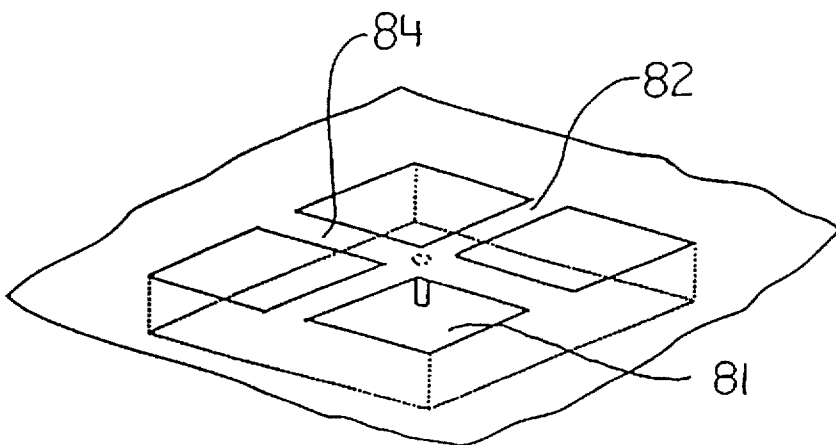


FIGURE 7



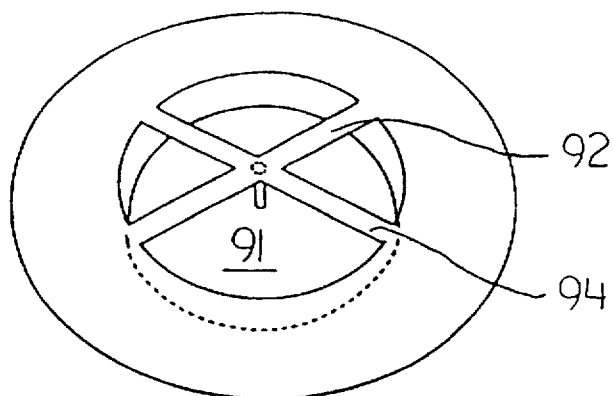


FIGURE 9

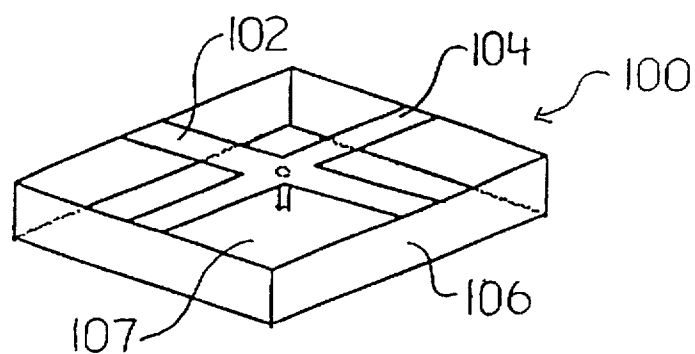
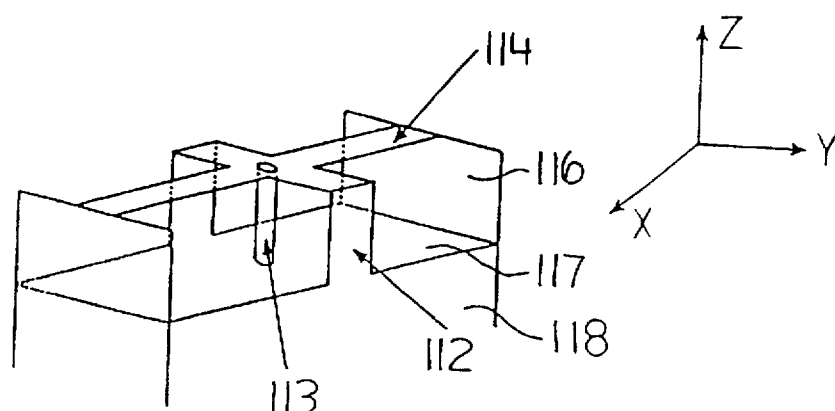


FIGURE 10



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