

REMARKS

In the Office Action, the Examiner (1) objected to the drawings; (2) rejected claims 21-24, 30, and 32-35 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,189,434 issued to Bell (“Bell”); (3) rejected claims 1-6, 9, 10, 17, 18, 20, 25-27, and 36-38 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of U.S. Patent Application Publication No. 2006/0050009 to Ho (“Ho”); (4) rejected claims 31, 41, 42, and 47 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of U.S. Patent No. 6,573,869 issued to Moore (“Moore”); (5) rejected claims 7 and 8 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Ho and further in view of U.S. Patent Application Publication No. 2007/0060089 to Owen et al. (“Owen”); (6) rejected claims 28, 29, 39, and 40 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of U.S. Patent Application Publication No. 2005/0200535 to Elkobi et al. (“Elkobi”); (7) rejected claims 11-16 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Ho and further in view of Elkobi; (8) rejected claims 43, 44, and 48 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Moore and further in view of Ho; and (9) rejected claims 45 and 46 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Moore in view of Ho and further in view of Elkobi. Reconsideration and allowance of the application are requested.

I. Objections to the Drawings

Figures 1A-1G have been revised to include the legend “Prior Art” as requested by the Examiner. Replacement sheets for these figures are attached. The objections to the drawings should accordingly be withdrawn.

II. Prior Art Rejections

The Examiner rejected claims 21-24, 30, and 32-35 under 35 U.S.C. § 102(b) as being anticipated by Bell. These rejections should be withdrawn because Bell fails to disclose or suggest each and every element of the claims.

Bell discloses a hybrid circuit network for feeding multiple antenna arms. The hybrid circuit network includes a plurality of output terminals A, B, C, and D, to which four antenna

arms ARM 1, ARM 2, ARM 3, and ARM 4 are coupled. See, e.g., Bell, FIG. 2A and Col. 6, lines 50-58. The hybrid circuit module couples the feed points of the antenna arms to isolate inputs in the network from one another and outputs from one another. See, e.g., Bell, Col. 4, lines 25-30.

Independent claim 21 is directed to a multimode antenna structure that includes a plurality of antenna ports and a plurality of antenna elements, each operatively coupled to a different one of the antenna ports. The multimode antenna structure also includes one or more connecting elements electrically connecting the antenna elements at a location on each antenna element that is spaced apart from an antenna port coupled thereto to form a single radiating structure such that electrical currents on one antenna element flow to a connected neighboring antenna element and generally bypass the antenna port coupled to the neighboring antenna element. Bell fails to disclose or suggest a multimode antenna structure including “one or more connecting elements electrically connecting the antenna elements at a location on each antenna element that is spaced apart from an antenna port coupled thereto to form a single radiating structure” as recited in claim 21. Bell instead couples its antenna arms together through the hybrid circuit network, which is on the opposite side of the antenna ports from the antenna elements. Bell does not disclose or suggest connecting elements electrically connecting the antenna elements at a location on each antenna element that is spaced apart from an antenna port. Therefore, Bell does not anticipate claim 21, and the rejection should be withdrawn.

Claims 22-24 and 30 are allowable over Bell by virtue of their dependence on claim 21. The rejections of these claims should also be withdrawn.

Independent claim 32 is directed to a method for controlling antenna patterns of a multimode antenna structure that includes a plurality of antenna ports and a plurality of antenna elements, each operatively coupled to a different one of the antenna ports. The antenna structure includes one or more connecting elements electrically connecting the antenna elements at a location on each antenna element that is spaced apart from an antenna port coupled thereto to form a single radiating structure such that electrical currents on one antenna element flow to a connected neighboring antenna element and generally bypass the antenna port coupled to the

neighboring antenna element. As with independent claim 21, Bell fails to disclose or suggest a multimode antenna structure including “one or more connecting elements electrically connecting the antenna elements at a location on each antenna element that is spaced apart from an antenna port coupled thereto to form a single radiating structure” as recited in claim 32. Bell instead couples its antenna arms together through the hybrid circuit network. Therefore, Bell does not anticipate claim 32, and the rejection should be withdrawn.

Claims 33-35 are allowable over Bell by virtue of their dependence on claim 32. The rejections of these claims should also be withdrawn.

The Examiner rejected claims 1-6, 9, 10, 17, 18, 20, 25-27, and 36-38 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Ho.

Independent claim 1 is directed to a multimode antenna structure that includes a plurality of antenna ports and a plurality of antenna elements, each operatively coupled to a different one of the antenna ports. The multimode antenna structure also includes one or more connecting elements electrically connecting the antenna elements such that electrical currents on one antenna element flow to a connected neighboring antenna element and generally bypass the antenna port coupled to the neighboring antenna element, the electrical currents flowing through the one antenna element and the neighboring antenna element being generally equal in magnitude, such that an antenna mode excited by one antenna port is generally electrically isolated from a mode excited by another antenna port at a given desired signal frequency range without the use of a decoupling network connected to said antenna ports. Bell fails to disclose or suggest electrical isolation of an antenna mode excited by one antenna port from a mode excited by another antenna port without the use of a decoupling network connected to the antenna ports. As explained above, Bell discloses a hybrid circuit network including a plurality of output terminals A, B, C, and D, to which four antenna arms ARM 1, ARM 2, ARM 3, and ARM 4 are coupled. See, e.g., Bell, FIG. 2A and Col. 6, lines 50-58. The hybrid circuit module couples the feed points of the antenna arms to isolate inputs in the network from one another and outputs from one another. See, e.g., Bell, Col. 4, lines 25-30. Therefore, the hybrid circuit module of Bell functions as a decoupling network connected to the antenna ports. Claim 1, by contrast,

recites an antenna mode excited by one antenna port is generally electrically isolated from a mode excited by another antenna port at a given desired signal frequency range without the use of a decoupling network connected to said antenna ports.

Ho is cited by the Examiner for purportedly disclosing different types of communications devices and an antenna structure fabricated on a printed circuit board substrate. Office Action, page 5. Ho fails to cure the deficiencies of Bell with respect to independent claim 1, as noted above. Accordingly, the combination of Bell and Ho does not teach each and every limitation of claim 1. The rejection of claim 1 should therefore be withdrawn.

Claims 2-6, 9, 10, 17, 18, and 20 are allowable over the combination of Bell and Ho by virtue of their dependency on claim 1.

The Examiner rejected claims 31, 41, 42, and 47 under 35 U.S.C. § 103(a) as being unpatentable over Bell in view of Moore.

Independent claim 41 is directed to a multimode antenna structure that includes a plurality of antenna ports and a plurality of antenna elements, each operatively coupled to a different one of the antenna ports. One of said plurality of antenna elements includes a slot therein defining two branch resonators. The presence of the slot results in a mismatch between said one of the plurality of antenna elements and another antenna element of said multimode antenna structure at the given signal frequency range to further isolate the antenna ports.

The Examiner concedes that Bell does not disclose antenna elements including a slot therein defining two branch resonators, and wherein the presence of the slot results in a mismatch between said one of the plurality of antenna elements and another antenna element of said multimode antenna structure at the given signal frequency range to further isolate the antenna ports. The Examiner however contends that Moore discloses this structure in column 2, lines 34-37 of the reference. Applicants respectfully disagree.

Moore discloses an antenna having a single feed point 19. See, e.g., Moore, Col. 2, lines 37-40, FIG. 1. The portion of the reference cited by the Examiner states: “the spiral slot 14 is formed in the single element patch radiator 12 to create nulls in the modal distribution at the

antenna's high frequencies and a single but larger null at the antenna's low frequencies." Moore, column 2, lines 34-37. The cited passage refers to nulls over frequency of the antenna radiation performance. Because Moore discloses only a single feed point antenna, it does not relate to and says nothing about port to port isolation on a multi-port antenna. Moore, therefore, does not disclose or suggest an antenna structure in which one of said plurality of antenna elements includes a slot therein defining two branch resonators, and wherein the presence of the slot results in a mismatch between said one of the plurality of antenna elements and another antenna element of said multimode antenna structure at the given signal frequency range to further isolate the antenna ports. Therefore, even if combined, Bell and Moore do not disclose or suggest all the elements of independent claim 41.

Furthermore, Bell and Moore are not properly combinable under 35 U.S.C. § 103(a) because of the fundamental differences between the references. Moore, as discussed above, discloses an antenna having a single feed point. Bell, on the other hand, discloses a hybrid circuit module including a plurality of output terminals A, B, C, and D, to which four antenna arms ARM 1, ARM 2, ARM 3, and ARM 4 are coupled. See, e.g., Bell, FIG. 2A and Col. 6, lines 50-58. The hybrid circuit module couples the feed points of the antenna arms to isolate inputs in the network from one another and outputs from one another. See, e.g., Bell, Col. 4, lines 25-30. One skilled in the art would not consider using Moore's single feed point antenna with Bell's multiple output hybrid circuit module for multiple antenna arms. Accordingly, the combination of the references is improper, and this is an additional reason that the rejection of claim 41 over the combination of Bell and Moore should be withdrawn.

Claims 42 and 47 are also allowable over the combination of Bell and Moore, by virtue of their dependency on independent claim 41.

As to the remaining claims in the application, the Examiner has cited the Owens and Elkobi references as purportedly teaching the various additional features recited in these remaining claims. However, even assuming that Owens and Elkobi teach the additional features as asserted by the Examiner, the references still fail to cure the defects of Bell, Ho, and Moore as applied to claims 1, 21, 32, and 41 as discussed above. Thus, claims 7, 8, 11-16, and 19 (which

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depend on claim 1), claims 28 and 29 (which depend on claim 21), claims 39 and 40 (which depend on claim 32), and claims 43-46 and 48 (which depend on claim 41) are patentably distinguishable over the suggested combination of references for at least the same reasons as those discussed above with respect to independent claims 1, 21, 32, and 41.

CONCLUSION

Any changes to the claims in this amendment that have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

The Commissioner is hereby authorized to charge any fee deficiency associated with this submission, or credit any overpayment to Deposit Account No. 06-1448.

In the event that an extension of time is required, or that may be required in addition to that requested in any petition for an extension of time, a petition for extension is hereby made to make this response timely, and the Commissioner is hereby authorized to charge any fee for such, to deposit account number 06-1448.

If a telephone conversation with Applicants' Attorney would expedite the prosecution of the above-identified application, the Examiner is urged to call the undersigned at (617) 832-1268.

Respectfully submitted,

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Attachment: Replacement Sheets for FIGS. 1A to 1G