United States Patent

Gregory

[15] **3,701,161**

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[54] **FOUR BAND SLOT ANTENNA**

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[52] **U.S. Cl.** **343/770,** 343/767, 343/789

[51] **Int. Cl.** **H01q 13/10**

[58] **Field of Search**...............343/767, 769, 770, 789

[56] **References Cited**

UNITED STATES PATENTS

3,296,616	1/1967	Kuecken	343/767
3,312,976	4/1967	Gregory	343/767

Primary Examiner—Eli Lieberman

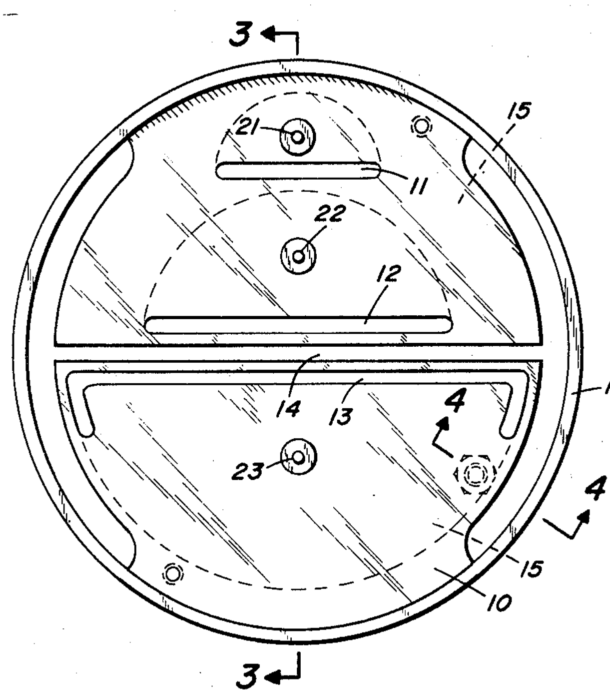
Attorney—R. S. Sciascia and Roy Miller

This application goes under Rule 47(b).

[57] **ABSTRACT**

A multiple radiator microwave antenna comprising four separate discretely tuned cavity-backed slot antennas for providing a unidirectional radiated RF energy field in a narrow beam along a common axis at four discrete frequencies.

6 Claims, 4 Drawing Figures



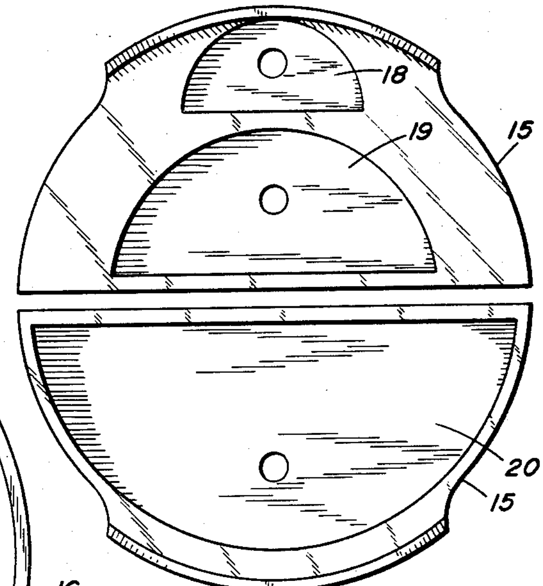


FIG. 2

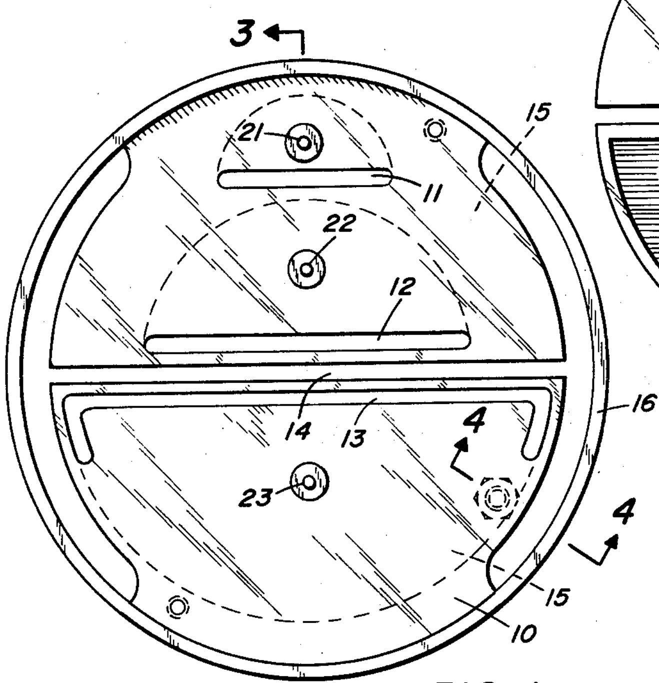


FIG. 1

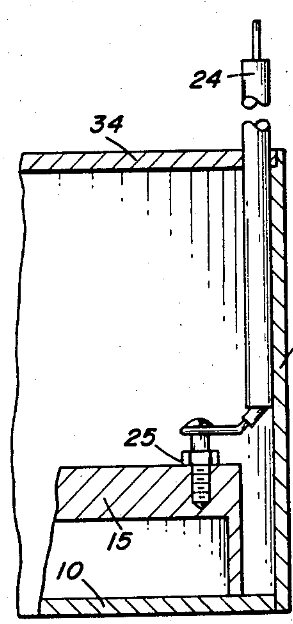


FIG. 4

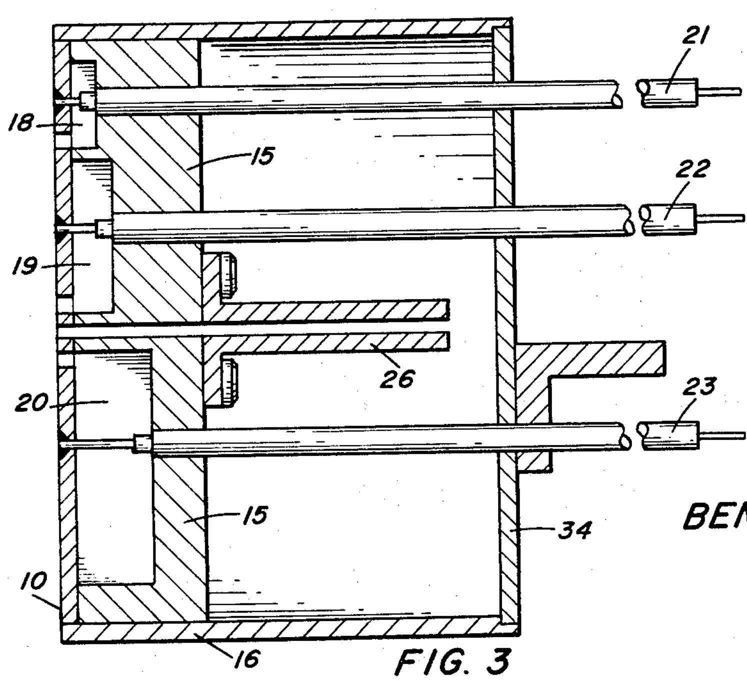


FIG. 3

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FOUR BAND SLOT ANTENNA

BACKGROUND OF THE INVENTION

The present invention is directed to the problem of providing a small, lightweight, flashlight type of microwave radiator capable of being handheld and projecting beams of microwave energy in the same manner as the dual frequency cavity back slot antenna set forth in U.S. Pat. No. 3,312,976.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of the antenna with the protective cover removed;

FIG. 2 is a planned view of the antenna inner body;

FIG. 3 is a cross section of the antenna structure with the protective cover removed taken along line **3 — 3** of FIG. 1; and

FIG. 4 is a section taken on lines **4 — 4** of FIG. 1 illustrating the connection used to drive the cavity for the fourth band.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The antenna structure comprises a circular front plate **10** of electrically conductive material having narrow radiating slots **11, 12, 13** and **14**, therethrough. The radiating length of the individual slots is made to be approximately ½λ at the radiated frequency.

In the case of the band **3** antenna, slot **13**, the physical length of the slot is insufficient to tune to ½ wavelength at the frequency of interest. Therefore the curved slots at opposite ends of the horizontal slot add the required reactants to tune the slot.

In the case of the band **4** antenna, slot **14**, the curved slots, formed by inner body **15** and an adjacent cylindrical wall **16** of the antenna housing, add additional reactance in combination with the horizontal slot **14** to tune the slot to the frequency of interest.

The front plate **10** is mounted on and supported by a cylindrical metal inner body **15, FIG. 3**, having cut into the front face thereof three substantially semicylindrical cavities **18, 19** and **20**. A plan view of the inner body **15** is shown in FIG. 2. Slot **11** overlies and opens into cavity **18** along the diameter thereof; slot **12** overlies and opens into cavity **19** along the diameter thereof and slot **13** overlies and opens into the cavity **20** along its diameter. The individual cavities are separated from each other by conductive wall portions of the inner body **15**. Slot **14** divides the inner body **15** into two sections.

Coaxial conductors **21, 22** and **23** having the inner conductor soldered to front plate **10** are used to drive the respective cavities **18, 19** and **20**. The coaxial cables are introduced through apertures in the rear wall **34** of the antenna body.

The back cavity for the band **4** antenna is formed by the volume within the inner housing to the rear of the antenna inner body **15** and the rear member **34**. Microwave energy is introduced into the band **4** cavity by means of coaxial conductor **24** having an inner and outer portion, the inner portion of which is attached to the rear surface of the antenna inner body **15** as at **25** (FIG. **4**). Impedance matching of the antenna to the 50 ohm coaxial transmission line **24** is accomplished by selecting a point of feed which provides the required impedance transformation from the high impedance of the horizontal slot **14**. The coaxial cables **21, 22** and **23** which span the band **4** cavity, add reactance to the back cavity which is compensated for by a slight change in the point of feed.

The band **4** antenna, as previously stated, requires additional tuning to approximate ½ wavelength at the radiated frequency. This is further aided by means of the capacitor **26** attached to the rear wall of the inner body portion **15** wherein the parallel flanges of the capacitor brackets **26** and the parallel faces of the horizontal slot in the inner body constitute the capacitor. This assists in tuning the slot to a lower resonant frequency than otherwise possible for the existing physical length of the slot.

Impedance matching of the high impedance antenna **13**, band **3**, is accomplished by selecting a point of feed for the required transformation to the 50 ohm coaxial transmission line. The depth of the cavity **20** contributes to the location of the proper point of feed.

The band **1** and **2** antennas, i.e., slots **11** and **12** are equal in length to ½ wavelength at the frequency of interest without the aid of curved slots. The coaxial transmission lines **21** and **22** are terminated at a point of feed in the front plate **10** matching the antenna to the 50 ohm impedance of the respective lines.

As was the case with the dual frequency cavity back slot antenna of the U.S. Pat No. 3,312,976, the slots **11, 12, 13** and **14** opening into their respective cavities are protected from the intrusion of moisture or other foreign matter which could affect the tuning of the antenna by dielectric cover plate (not shown) which is adhered to the face of the conductive plate **10** by any suitable means, such as a resin cement.

The design criteria relative to the location of the slots, depth of cavities, length of slots, bill of materials, etc., are not gone into detail in that essentially the same criteria as applied to the design of U.S. Pat. No. 3,312,976 apply herein.

What is claimed is:

1. A multiple radiator microwave antenna comprising;

- a cylindrical body portion having front and rear members terminating said body portion;
- an electrically conductive member mounted within said body portion abutting said front member and spaced from said rear member;
- at least one substantially semicylindrical cavity formed within said conductive member;
- a radiating slot in said front member opening into said at least one cavity along the diameter of the cavity;
- a substantially cylindrical microwave cavity formed by the volume between said rear member and said electrically conductive member;
- another radiating slot in said front member opening into said cylindrical microwave cavity such that a portion of the electrically conductive body is removed in width equal to the width of said another radiating slot; and
- means for introducing RF electromagnetic energy into said cavities such that said cavities are resonant at particular frequencies and radiate energy from said slots in narrow beams normal to said front member.

2. A multiple radiator microwave antenna as set forth in claim 1 and further including;

a second substantially semicylindrical cavity formed within said conductive member;

a second radiating slot in said front member opening into the second cavity along the diameter of the second cavity; and

additional means for introducing electromagnetic energy into the second cavity such that the second cavity is resonant at a particular frequency and radiates energy from the second slot in a narrow beam normal to said front member.

3. A multiple radiator microwave antenna as set forth in claim 2 and further including;

a third substantially semicylindrical cavity formed within said conductive member;

a third radiating slot in said front member opening into the third cavity along the diameter of the third cavity; and

further means for introducing RF electromagnetic energy into the third cavity such that the third cavity is resonant at a particular frequency and radiates energy from the third slot in a narrow beam normal to said front member.

4. A multiple radiator microwave antenna as set forth in claim 1 wherein;

said another radiating slot in said front member opening into said cylindrical microwave cavity divides said electrically conductive member into two physically separate portions.

5. A multiple radiator microwave antenna as set forth in claim 1 wherein;

said another radiating slot in said front member opening into said cylindrical microwave cavity is equal in length to the diameter of said front member and wherein said another radiating slot continues around a portion of said front member at either end of the diameter of the front member.

6. A multiple radiator microwave antenna as set forth in claim 5 wherein;

each of the radiating slots is of the length substantially equal to one half wavelength at the frequency to be radiated and further including;

adjustable loading means in said cylindrical cavity for loading said cavity.

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