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(54) **Low-profile omni-antenna.**

(57) A base plate (11) supports a non-conductive substrate (24) on which a conductive substrate (25) is mounted. A connector (19) conducts a signal to or from the conductive substrate. Inductive posts (28) such as screws are electrically connected to the conductive substrate and the base at selected locations for inductively tuning the antenna. A radome (26) is supported by the base and covers the conductive and non-conductive substrates so that the antenna may be mounted in a low profile or near-flush configurations. The non-conductive substrate may be teflon glass or air. The conductive substrate may be a copper-clad disc located on the teflon glass.

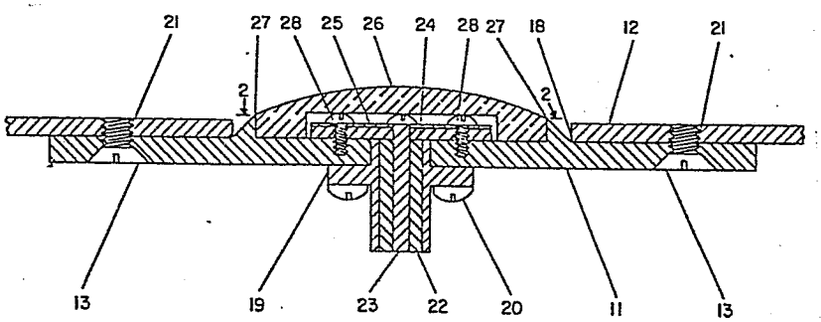



FIG. 1

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# LOW PROFILE OMNI-ANTENNA

The invention relates generally to low cost antennas and, in particular, to tuneable, low profile antennas.

Disc radiators are well known in the prior art. However, the tuning of such radiators is usually accomplished by a matching network or a parasitic radiating element. These tuning methods usually result in a high cost antenna.

It is an object of this invention to provide a low cost, low profile omnidirectional antenna (omni-antenna) for use on aircraft with a microwave landing system (MLS) receiver.

It is another object of this invention to provide a low cost antenna having a simple construction, including an element in the form of a disc which may be tuned.

The antenna according to the invention comprises a base plate supporting a non-conductive substrate on which a conductive substrate is mounted. First means provides signals received by said conductive substrate to a receiver. Second means inductively tunes a capacitive discontinuity in said conductive substrate which occurs when the signal is received.

For a better understanding of the present invention, together with other and further objects, reference is made to the following description, taken in conjunction with the accompanying drawings, and its scope will be pointed out in the appended claims.

Figure 1 is a cross-sectional view of one embodiment of an antenna according to the invention mounted in a low profile configuration.

Figure 2 is a sectional view taken along line 2-2 of figure 1.

Figure 3 is a cross-sectional view of another embodiment of an antenna according to the invention mounted in a near-flush configuration.

The low profile omni-antenna according to the invention is particularly suited for aircraft applications. Preferably, the antenna is mounted on the aircraft skin and is used with a microwave landing system receiver in the aircraft.

As illustrated in figures 1 and 2, antenna 10 includes base plate 11 mounted in a low profile configuration to aircraft skin 12 by bolts 13 which engage aircraft skin 12.

Antenna 10 is mounted through opening 18 in aircraft skin 12 and is connected to its associated system, such as an MLS receiver, by TNC connector 19. Base plate 11 has an opening which is engaged by TNC connector 19. Screws 20 have threads (not shown) which engage corresponding threads in base plate 11 and retain TNC connector 19 in place. Connector 19

supports insulator 22 having conductor 23 located in its center. Non-conductive substrate 24 is adjacent base plate 11 and supports conductive substrate 25 which is connected to conductor 23. This structure is enclosed by radome 26 mounted on base plate 11 and engaged by projections 27. Base plate 11, substrate 24 and substrate 25 are preferably located in parallel planes, as illustrated.

As illustrated in figure 2, a preferred embodiment of antenna 10 is a circular configuration with conductive substrate 25 being a metallic disc. However, the antenna according to the invention may be configured in any appropriate shape which provides the desired radiation pattern.

Due to reciprocity, antenna 10 may be used in either a transmitting or receiving mode. In the receiving mode, TNC connector 19 is connected by coaxial cable to a signal receiver (not shown). Conductive substrate 25 functions as the receiving element and provides received signals to conductor 23. The signals are transmitted through the coaxial cable to the receiver. In the transmitting mode, TNC connector 19 is connected via coaxial cable to a transmitter (not shown) which provides a signal to be

radiated. The signal is conducted by the coaxial cable through conductor 23 to conductive substrate 25 which radiates the signal.

Tuning of antenna 10 is accomplished in the following manner. Conductive substrate 25, preferably a copper disc, has its primary signal reflection region at or near its edge. This primary reflection region occurs at the discontinuity between the captured wave and the radiated wave i.e. from the region inward disc 25 functions as a radial waveguide whereas from the region outward disc 25 functions as a radiator. From this primary reflection region or discontinuity outward, the conductive substrate 25 appears to be a capacitive device. Tuning is accomplished by selectively inserting screws 28 through conductive substrate 25 and in electrical contact therewith, through the non-conductive substrate 24 and threading into base plate 11. Screws 28 function as inductive posts which inductively tune the capacitive discontinuity of antenna 10.

In a preferred embodiment, the base plate 11 is a circular metallic plate electrically contacting aircraft skin 12. Non-conductive substrate 24 is a teflon glass substrate 0.16 cms. thick having

copper cladding to form the conductive substrate 25. Radome 26 is a clear plastic radome such as polycarbonate having tapered shoulder 26a which results in a configuration which has a very low profile and can be fabricated at low cost. Futhermore, such a structure provides performance with respect to impedance matching which is more than adequate for MLS applications. This is due, in part, to the fact that the thickness of the non-conductive substrate 24 provides the impedance transformation necessary to match the antenna so that its VSWR is less than 2:1.

Figure 3 illustrates antenna 10 mounted in a near-flush configuration wherein base plate 11 engages the upperside of aircraft skin 12. In the embodiment shown in figure 3, air gap 30 functions as the non-conductive substrate between base plate 11 and conductive substrate 25. Tuning screws 28 support substrate 25 in place. Figure 1 is a lower profile configuration because radome 26 is located within opening 18 and maintains a low profile with respect to aircraft skin 12 so that skin 12 and the top of radome 26 are in substantially the same plane.

CLAIMS:

Claim 1. An antenna having a conductive base (11), said antenna characterized by:

(1) a non-conductive substrate (24) adjacent said base (11);

(2) a conductive substrate (25) adjacent said non-conductive substrate (24);

(3) a first circuit (19, 22, 23) for conducting a signal to or from said conductive substrate (25); and

(4) a second circuit (28) coupled between said conductive substrate (25) and said base (6) at selected locations for inductively tuning said antenna.

Claim 2. The antenna of claim 1 wherein said base, said non-conductive substrate, and said conductive substrate are located in parallel planes.

Claim 3. The antenna of claim 1 wherein said second circuit (28) comprises inductive posts electrically connected to said conductive substrate, and said base.

Claim 4. The antenna of claim 3 further comprising a radome (26) supported by said base and covering said conductive substrate and said non-conductive substrate.

Claim 5. The antenna of claim 4 wherein said conductive substrate (25) comprises a metallic disc and said inductive posts comprise metallic members electrically connected between said base and said disc at selected regions.

Claim 6. The antenna of claim 5 wherein said non-conductive substrate (24) comprises teflon glass.

Claim 7. The antenna of claim 6 wherein said metallic disc is a copper cladding located on said teflon glass.

Claim 8. The antenna of claim 7 wherein said metallic members are screws and said radome is polycarbonate.

Claim 9. The antenna of claim 5 wherein said non-conductive substrate comprises air (30).

Claim 10. The antenna of claim 6 wherein said first circuit comprises a connector grounded to said base and coupled to said disc.

Claim 11. The antenna of claim 9 wherein said first circuit comprises a connector grounded to said base and coupled to said disc.

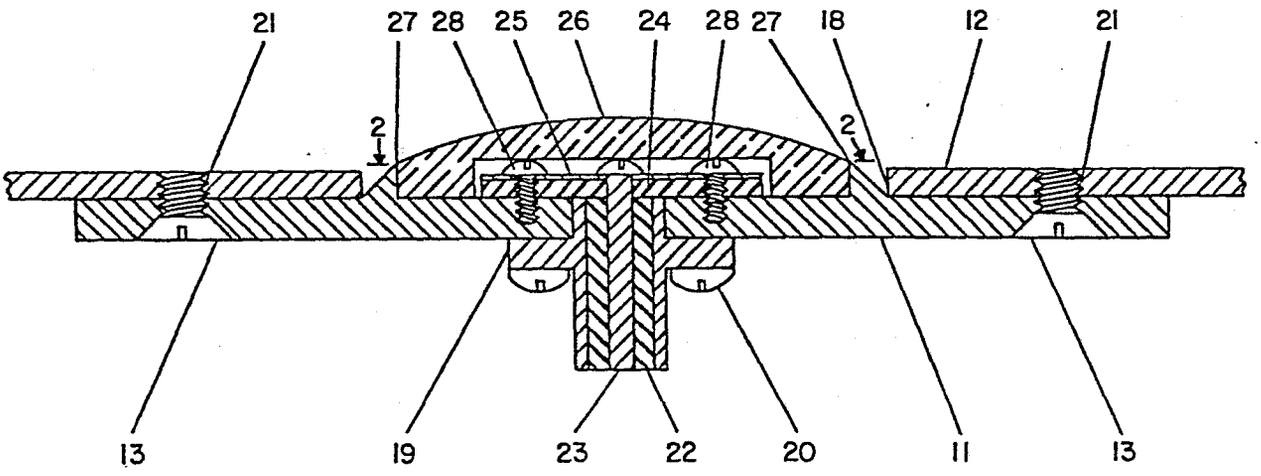



FIG. 1

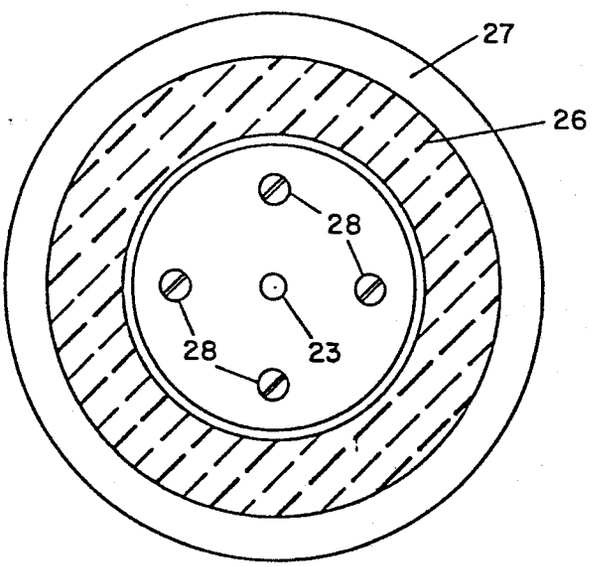



FIG. 2

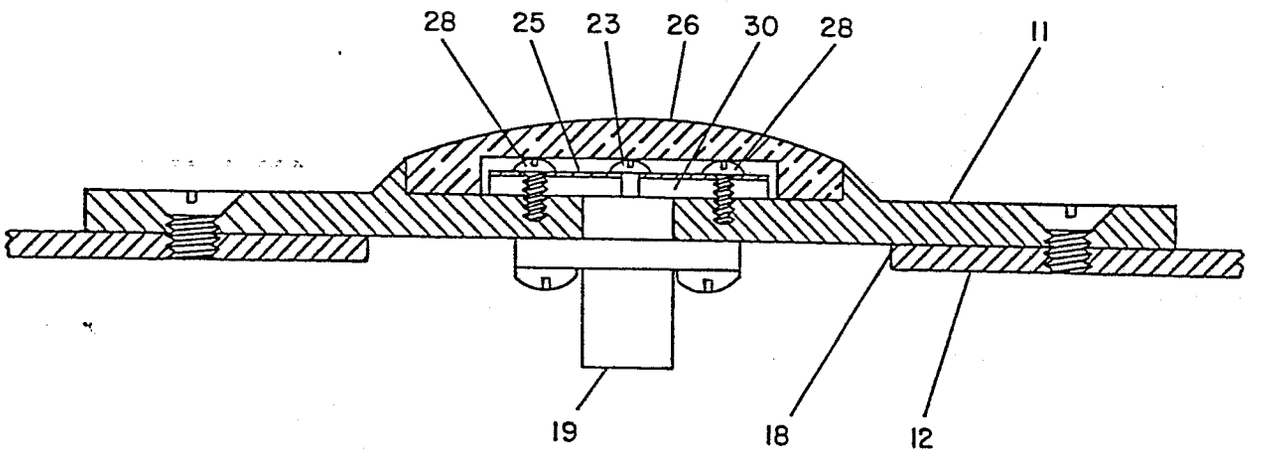



FIG. 3

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# EUROPEAN SEARCH REPORT

0117017
Application number

EP 84 30 0023

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. ³) |
|---|---|---|---|
| Y,A | US-A-4 051 480 (F. REGGIA et al.) * Figure 1; column 2, lines 33-57 * | 1-3,5,6 | H 01 Q 1/28 |
| Y | IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION, vol. AP-27, no. 5, September 1979 D.H. SCHAUBERT et al. "Conformal dielectric-filled edge-slot antennas with inductive-post tuning", pages 713-716 * Page 714, figure 1; column 1, paragraph II * | 1-3 | |
| A | US-A-2 368 663 (A.G. KANDOIAN) * Figure 2, references 12, 14, 64 * | 4,10 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl. ³) |
| A | US-A-2 689 302 (J.A. ALBANO) * Figure 2 * | | H 01 Q 1/28 |
| A | DE-A-2 408 578 (LICENTIA PATENT-VERWALTUNGS-GMBH) * Figure 1 * | | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| BERLIN | 11-04-1984 | BREUSING J |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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