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CIRCULAR CAVITY SLOT ANTENNA

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FIG. 1

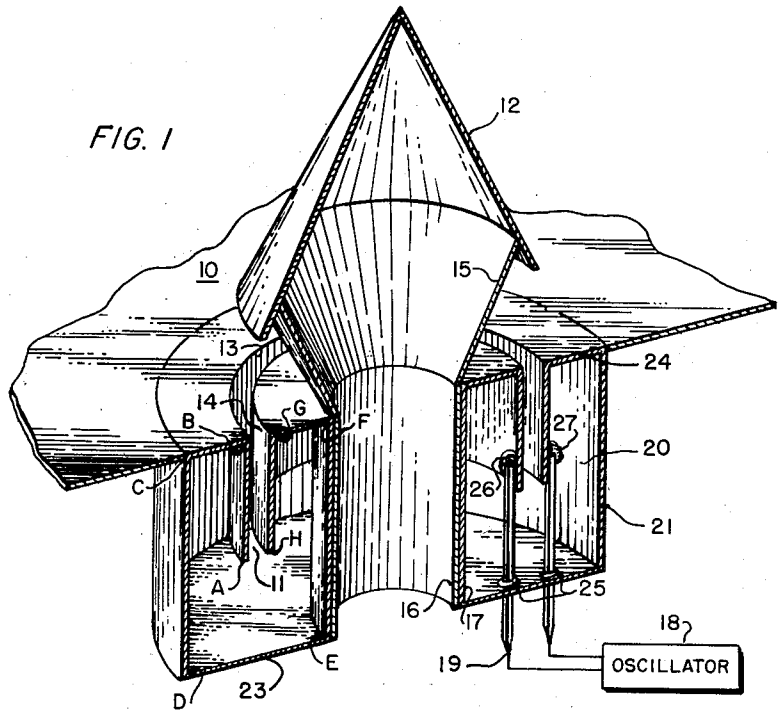
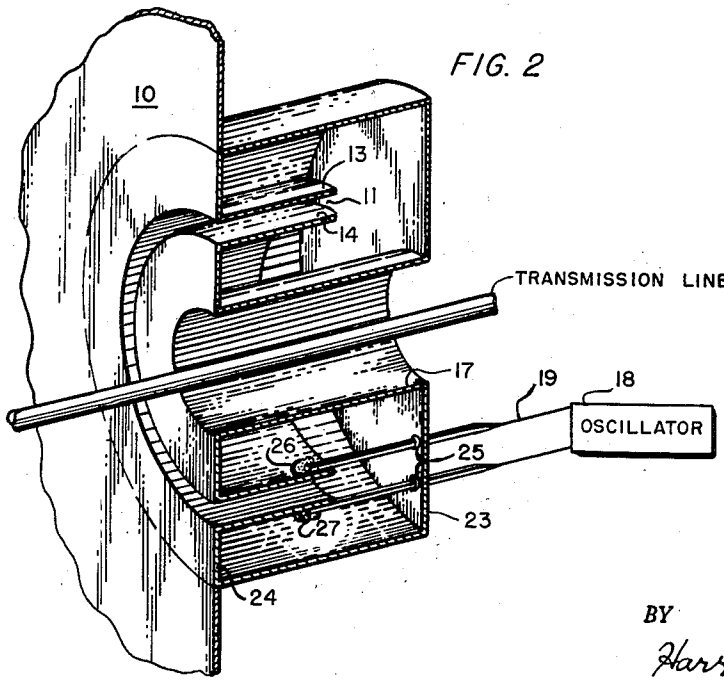


FIG. 2



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CIRCULAR CAVITY SLOT ANTENNA

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5 Claims. (Cl. 343—769)

The present invention relates to antennas and more specifically to a type of antenna known as a slot antenna which has incorporated therein a resonant cavity.

The increase in the utilization of radio waves in aircraft for the purposes of communication, direction and distance determination and the like has caused a corresponding increase in the number and types of antennas carried by modern aircraft. The reduction of the number of antennas by utilization of one to perform more than one function and the suitable design of antennas to withstand the forces involved in high flight speed of aircraft and to avoid wind drag and other undesirable effects on the aircraft due to the antenna has therefore become of increasing concern.

A very effective approach to the problem has been the use of slot antennas, in which a slot-like aperture in the outer conductive surface of the aircraft is coupled to a radio frequency generator or receiver, the slot in this way being effective to radiate or receive desired radio signals. In addition, the slot has been utilized as the frequency control for the transmitting oscillator, thus eliminating the need for an anode tuned impedance or "tank" circuit as a distinct element. In this connection a cavity resonator can be used adjacent to the slot as an additional or alternate tuning device.

An object of the invention is to provide an antenna of small size and with a field pattern suitable for use in airborne equipment.

Another object of the invention is to provide a novel antenna having a doughnut shaped field pattern and which can act both as an antenna and a resonant circuit.

The exact nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing in which:

Figure 1 shows one embodiment of the invention with an adjustable center element.

Figure 2 shows an embodiment of the invention adapted to transmit over a transmission line.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts, there is shown in Figure 1 one embodiment of the antenna excited by an oscillator **18**, as shown. Energy from oscillator **18** is supplied by means of a suitable transmission line **19** to a cylindrical cavity **20** which is shown in longitudinal section as bounded by ABCDEFGH, which includes inner and outer cylindrical walls **17** and **21**, respectively and lower and upper walls **23** and **24** respectively. The lower wall contains suitable opening and insulating means as at **25** to allow the transmission line to enter the cavity. It is understood, of course, that any other desired entrance means may be used.

The upper wall contains a circular slot **11** which extends into the cavity **20** by means of cylinders **13** and **14** as shown. The transmission line is connected to cylinders **13** and **14** at **26** and **27**. In operation, cylindrical cavity **20** will resonate at a particular frequency when suitably excited by oscillator **18** and circular slot **11** allows radiation of the electro-magnetic wave in a direction outward from ground plane **10** in a doughnut-shaped field pattern, the exact shape of which is determined by the shape of center element **12**.

The loading of the antenna is controlled by moving center element **12** in and out perpendicularly to ground plane **10**. Conical center element **12** and elements **15** and **16** are contiguous and mechanically rigid so that movement of element **12** will occasion relative sliding motion between surfaces **16** and **17**.

The antenna may be utilized as either an additional or an alternate tuning device for the oscillator. When it serves as the primary tuning device or resonant tank circuit of the oscillator, the areas of cylinders **13** and **14** are made proportional to the desired capacity of the tank circuit and the length of path ABCDEFGH is made proportional to the inductance. The transmission line **19** will then be connected from **26** to **27** to the other elements of the oscillator directly. This manner of connection does not form a part of this invention but is given as one illustration of possible use.

The embodiment in Figure 2 shows another use of the antenna. As can be seen from this figure, the center element **12** and elements **15** and **16** have been eliminated and the antenna is made concentric with, but not touching, a single wire transmission line. In all other respects, the structure of Fig. 2 is identical with that of Fig. 1. In this way the radio frequency signal can be propagated down a line carrying another current, for example. A specific application could be in power line telemetering systems, where one wire carries both sixty-cycle power and a high-frequency signaling circuit.

It may be noted that the antenna will not work efficiently without some sort of a center conductor, such as the center element **12** of Figure 1 or the transmission line of Figure 2. This is due to the fact that the radiated signal has a radial electric field which tends to cancel itself unless the center conductor is present to act as a shield between diametrically opposite portions of the field.

It is thus seen that the antenna disclosed having incorporated therein a resonant cavity has a suitable field pattern and can be fabricated in a size suitable for airborne applications.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced other-wise than as specifically described.

What is claimed is:

1. A cavity slot antenna comprising first and second conducting coaxial cylinders, two conducting plates, said cylinders being joined at one end by one of said conducting plates, the other plate having a circular slot therein forming inner and outer portions, said slot being concentric with said cylinders, the other ends of said cylinders being joined respectively to said inner and outer portions conducting flanges extending from said slot toward but not touching said one of the plates, and a cylindrical conductor placed coaxially within said cylinders and extending outwardly from said plates.

2. A cavity slot antenna comprising first and second conducting coaxial cylinders, the space between said cylinders being bounded on two ends by conducting plates, the plate on one end being formed with a circular slot therein, said slot being concentric with said cylinders, flanges extending from said slot toward the plate on the other end, and a conductor placed coaxially within said

first and second cylinders and extending outwardly past said conducting plates.

3. A conducting circular cavity slot antenna comprising a cylindrical resonant cavity bounded by: a first cylinder, a second cylinder coaxial with and smaller in cross-sectional area than the first cylinder, a first plate normal to the first and second cylinders and joining one end of each of said cylinders, a second plate parallel to the first plate and extending inwardly from the other end of the first cylinder, a third plate parallel to the first plate and coplanar with the second plate extending outwardly from the other end of the second cylinder, and two concentric cylinders each extending from the second and third plates partly toward the first plate; said two concentric cylinders together defining a slot in communication with the cylindrical resonant cavity on one end of the slot, and a cylindrical conductor coaxially placed within said second cylinder and extending outward past the first, second, and third plates.

4. A conducting circular cavity slot antenna comprising a first cylinder, a second cylinder coaxially within the first, a plate connecting said first and second cylinders at one end thereof, an outwardly projecting flange on the other end of the second cylinder, an inwardly projecting flange on the other end of the first cylinder, said inwardly and outwardly projecting flanges being coplanar but

spaced from each other, a third cylinder attached at one end to the inwardly projecting flange coaxially within the first cylinder and projecting toward but not touching the connecting plate, a fourth cylinder attached at one end to the outwardly projecting flange and coaxially within the third cylinder and projecting toward but not touching the connecting plate, and a conductor placed coaxially within the second cylinder and extending outward past the projecting flanges.

5. A coupler for coupling high frequency currents from an oscillator to a transmission line comprising a cylindrical resonant cavity coaxial with and surrounding a transmission line, said cylindrical cavity having first and second cylindrical walls, a cylindrical slot contained within said walls, said slot being formed by flanges extending from one end of said walls inwardly from the outer wall and outwardly from the inner all and then coaxially with the transmission line and said walls, and an oscillator connected to said resonant cavity at the flange-formed slot, whereby electromagnetic radiation radiated through said slot will coact with and be transmitted by said transmission line.

References Cited in the file of this patent

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