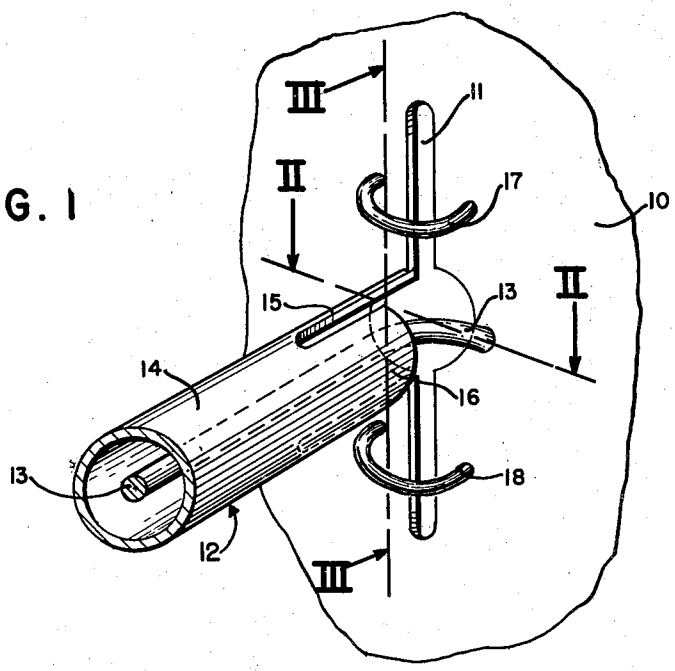
July 29, 1952 H. J. RIBLET 2,605,411

DIRECTIONAL SLOT ANTENNA

Filed April 11, 1946

FIG. 1



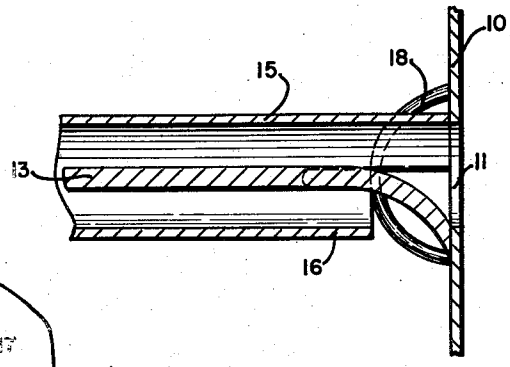


FIG. 2

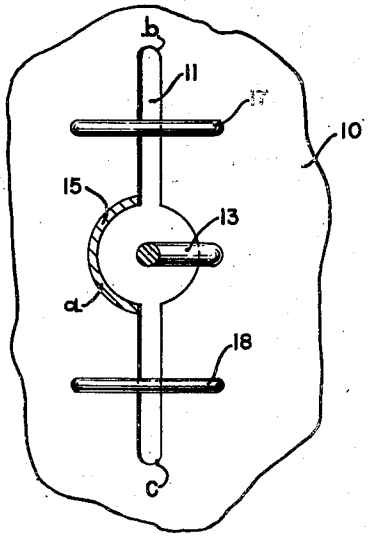


FIG. 3

INVENTOR
HENRY J. RIBLET

BY

ATTORNEY

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DIRECTIONAL SLOT ANTENNA

Henry J. Riblet, Erie, Pa., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

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8 Claims. (Cl. 250—33)

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This invention relates to antenna systems and more particularly to such systems using lumped reactances to suppress radiation in a given direction.

To reduce the resistance to air flow of the outer surface of an aircraft it has been desirable to replace rod antennas with slotted antennas. The slotted antenna consists of a narrow slot cut in the outer metallic "skin" of an aircraft. The slot is fed in such a manner (as will be made clear below) that the distribution of energy along the slot approximates that of a half wave antenna. Thus conditions for efficient radiation are satisfied, and effectively the slot becomes a dipole. There are normally radiations in two directions; both directions being perpendicular to the surface of the aircraft. The radiation out from the surface of the plane is desirable but the radiation into the interior of the plane is undesirable in that it diverts one half of the total radiated energy. It is also undesirable to have uncontrolled radiation in the interior of the aircraft. Heretofore radiation into the interior of the aircraft has been suppressed by enclosing the inner surface of the skin immediately adjacent to the radiating slot in a metal box, thus making radiation into the interior an impossibility. There were two outstanding difficulties encountered in the practical application of this method. The first was that in an aircraft containing a multiplicity of slotted antennas, the space and weight contributed by the metal boxes was appreciable. The second and more serious difficulty lay in the nature of the metal box itself. The inner surface of the box acted as a cavity. Unless the resonant frequency of the cavity was the same as the radiating frequency of the slot, the cavity would absorb energy from the radiating slot and much of the advantage gained from suppressing radiation into the interior would be lost. It was possible with careful design to prepare a metal box whose resonant frequency was the same as that of the radiating slot; but in the case of an antenna called upon to perform on a number of different frequencies, it was then necessary to have a different box for each frequency.

The general object of the present invention is to suppress effectively the radiation on one side of a radiating slot.

Another object of the present invention is to provide a backing on one side of the slot to suppress radiation on that side of the slot.

Still another object is to provide a lumped reactance to be used as a backing for the slot.

A further object is to provide a tuned or untuned means as the required lumped reactance.

A still further object is to provide a metal loop

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or multiplicity of metal loops to provide the lumped reactance.

These and other objects will become apparent from the following specification when taken in connection with the accompanying drawing in which:

Fig. 1 is a perspective view of one form of the invention;

Fig. 2 is a top axial sectional view of the representation in Fig. 1 taken along the line II—II of Fig. 1;

Fig. 3 is a front sectional view of the representation in Fig. 1 taken along the line III—III of Fig. 1.

The present invention uses a lumped reactance to suppress undesired radiation. If a lumped reactance with proper constants is placed behind the slot, then the slotted antenna will radiate back into a circuit at its resonant frequency and the same set of conditions will exist as though there were a metal box backing the slotted antenna. The lumped reactance may take many forms and, dependent upon the use of the antenna, may be either fixed or variable. For the purpose of illustration only, a fixed reactance is shown.

Referring now to Fig. 1, a metallic sheet 10, which may the outer covering of an aircraft, has a slot 11 cut therein. A coaxial line 12, comprising a center conductor 13 and an outer conductor 14, is split into sections 15 and 16 at one end, and is used to feed slot 11. Metallic loops 17 and 18 are fixedly attached to the inside of sheet 10 in such a manner that the center of each of loops 17 and 18 is directly over slot 11. Metallic loops 17 and 18 contain capacitance and inductance and thus act as lumped reactances.

Referring to Fig. 2 there is shown the method of energizing slot 11. Section 15 of outer conductor 14 is connected directly to wall 10 on one side of slot 11. Inner conductor 13 is connected to wall 10 on the opposite side of slot 11. A potential difference equal to that between the inner conductor 13 and outer conductor 14 is thus set up across the opposite walls of slot 11.

Referring to Fig. 3, the structure of slot 11 is shown in greater detail. Signal voltage is applied across the center of slot 11 at point (a), and therefore the greatest difference of potential appears at the center. There is no potential difference across the slot at points (b) and (c). It is thus seen that the distribution of voltage along slot 11 will resemble that of a half wave antenna with the maximum potential at the center and a minimum potential at the ends.

In operation center conductor 13 and outer conductor 15 (Fig. 2) supply energy to point (a)

of slot 11 (Fig. 3). Slot 11 becomes an effective half wave antenna and radiates energy in the direction perpendicular to and on the outside of metallic sheet 10. Radiation in the direction perpendicular to and on the inside of sheet 10 is reduced to a negligible value due to the effect of loops 17 and 18 (Fig. 1).

While a particular embodiment of the present invention has been disclosed and described it is to be understood that various changes and modifications may be made therein without departing from the scope thereof as set forth in the appended claims.

What is claimed is:

1. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy whereby energy may be radiated from said slot on either side of said sheet, and means including a plurality of conductive loops connected to said conductive sheet in a transverse bridging relationship to said slot, said loops being disposed on one side of said conductive sheet whereby radiation from said slot on said last mentioned side of said sheet is suppressed.

2. Antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy whereby energy may be radiated from said slot on either side of said sheet, and means including a first and second conductive loop connected to said conductive sheet at one side thereof, said first loop being disposed across and at right angles to said slot at a point intermediate the center of said slot and a first end of said slot, said second loop being disposed across and at right angles to said slot at a point intermediate said center of said slot and a second end of said slot whereby radiation of energy from said slot on the side of said sheet including said loops is suppressed.

3. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy comprising a coaxial line having the outer conductor thereof connected to said sheet at one side of said slot and the inner conductor thereof connected to said sheet at the other side of said slot, first and second U-shaped conductive members, said first conductive member being disposed at right angles to said slot at a position intermediate a first end of said slot and the point of connection of said transmission line, the ends of said U-shaped member being connected to said sheet on opposite sides of said slot, said second U-shaped member being similarly disposed and connected at a point intermediate a second end of said slot and the point of connection of said transmission line.

4. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy comprising a coaxial line having the outer conductor thereof connected to said sheet at one side of said slot and the inner conductor thereof connected to said sheet at the other side of said slot, first and second U-shaped conductive members, said first conductive member being disposed at right angles to said slot and perpendicular to said sheet at a position intermediate a first end of said slot and the point of connection of said coaxial line, the ends of said U-shaped member being conductively connected to said sheet on opposite sides of said slot, said second U-shaped member being similarly disposed and connected at a point intermediate a second end of said slot and the point of connection of said coaxial line.

5. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy comprising a two-conductor transmission line having the one conductor thereof connected to said sheet at one side of said slot and the other conductor thereof connected to said sheet at the other side of said slot, first and second U-shaped conductive members, said first conductive member being disposed at right angles to said slot at a position intermediate a first end of said slot and the point of connection of said transmission line, the ends of said U-shaped member being conductively connected to said sheet on opposite sides of said slot, said second U-shaped member being similarly disposed and connected at a point intermediate a second end of said slot and the point of connection of said transmission line.

6. An antenna system comprising a conductive sheet having a slot formed therein, a transmission line coupled to said slot midway between the ends thereof, and means including a first and second conductive loop connected to said conductive sheet at one side thereof, said first loop being disposed across said slot and at right angles thereto at a point intermediate said transmission line and a first end of said slot, said second loop being disposed across said slot and at right angles thereto at a point intermediate said transmission line and a second end of said slot whereby radiation of energy from said slot on the side of said sheet including said loops is suppressed.

7. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy, said means being such that energy may be radiated from said slot on either side of said sheet, and a plurality of spaced conductive loops disposed across said slot on one side of said sheet, said loops being conductively connected to said sheet whereby radiation from said slot on the side of said sheet including said loops is suppressed.

8. An antenna system comprising a conductive sheet having a slot formed therein, means for energizing said slot with radio frequency energy substantially at the midpoint thereof, and a plurality of conductive loops conductively connected across said slot on one side of said sheet and spaced from each other and from said energizing means, whereby radiation from said antenna system on the side of said sheet including said loops is suppressed.

HENRY J. RIBLET.

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