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[54] PILLBOX ANTENNA AND ANTENNA ASSEMBLY

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[52] U.S. Cl. 343/780; 343/786; 343/754
[58] Field of Search 343/780, 786, 771, 761, 343/754

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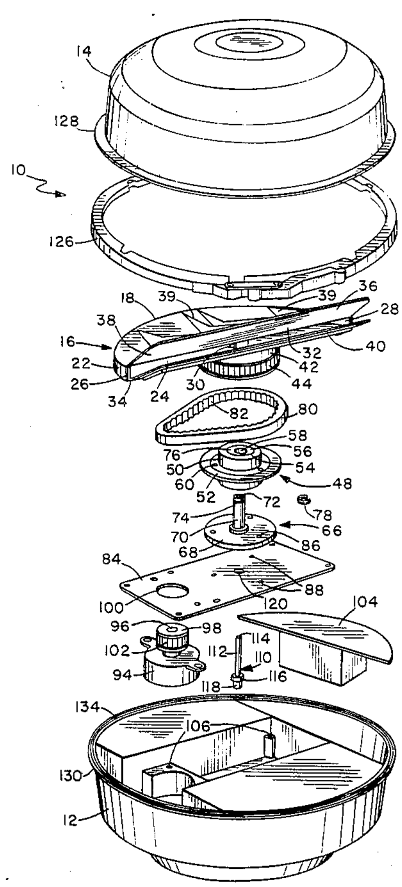
[57] ABSTRACT

A directive communications antenna comprising upper and lower plates, each having a leading edge, and a parabolic reflecting cylinder disposed between and axially intersecting the plates so as to form a cavity having a focus line. The cavity is open adjacent the plate leading edges. Upper and lower lip plates respectively extend along the leading edges of the upper and lower plates with both lip plates projecting upwardly therefrom. A feed assembly comprised of a feed probe and a sub-reflector is positioned within the cavity.

17 Claims, 3 Drawing Sheets



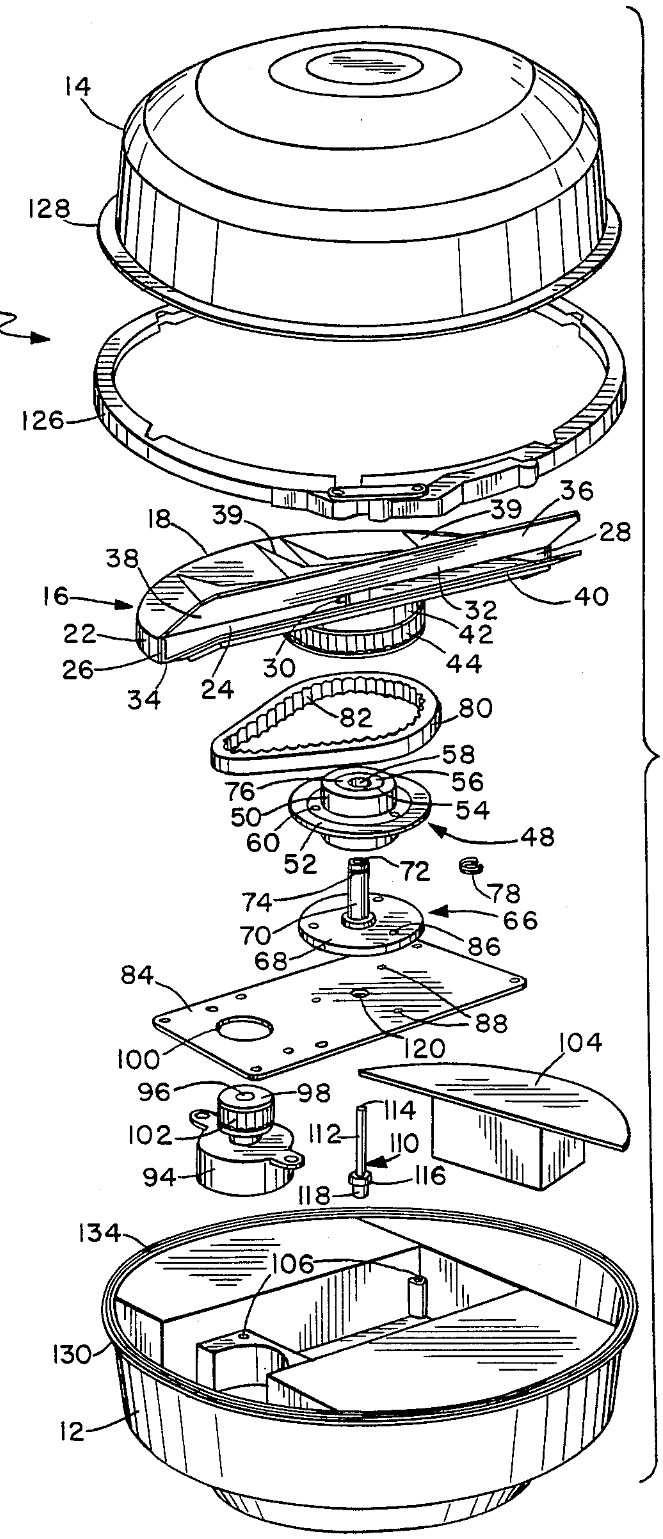

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FIG. 1

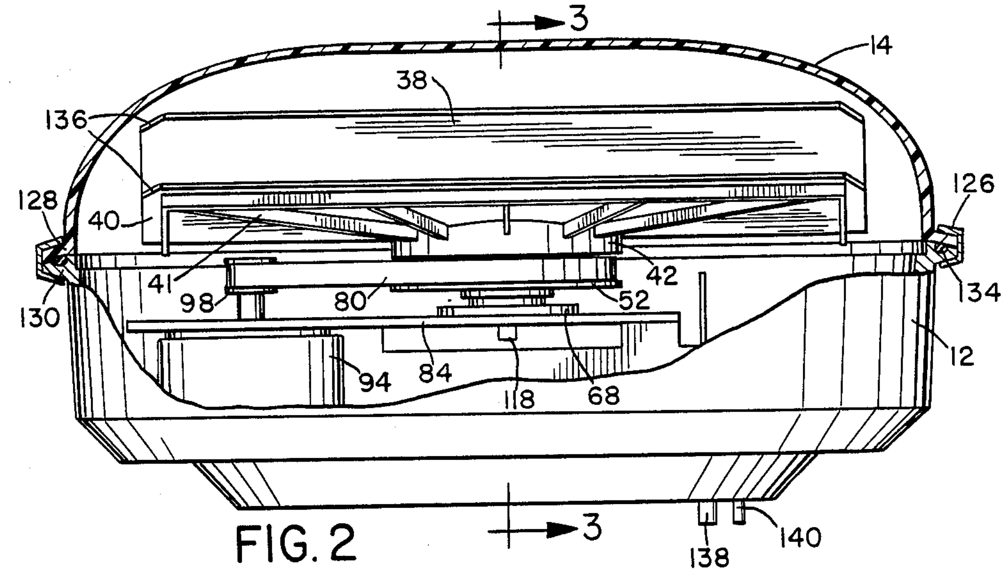

FIG. 2

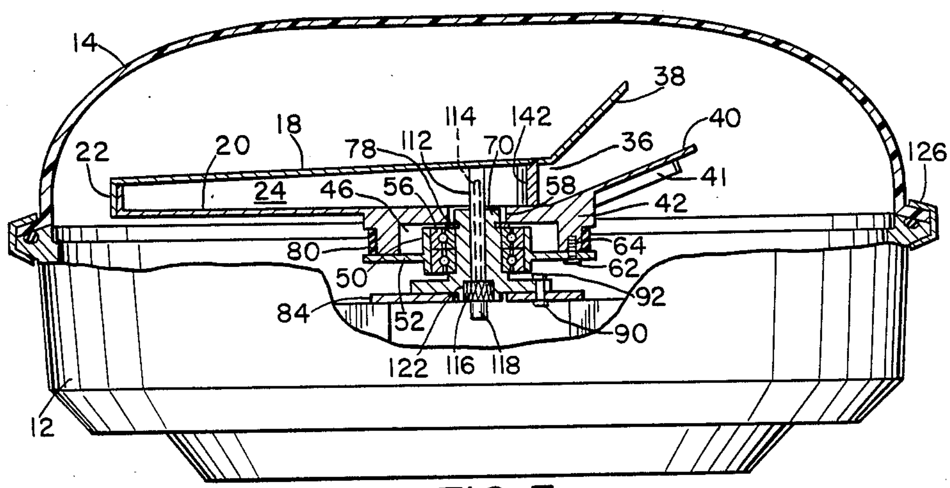

FIG. 3

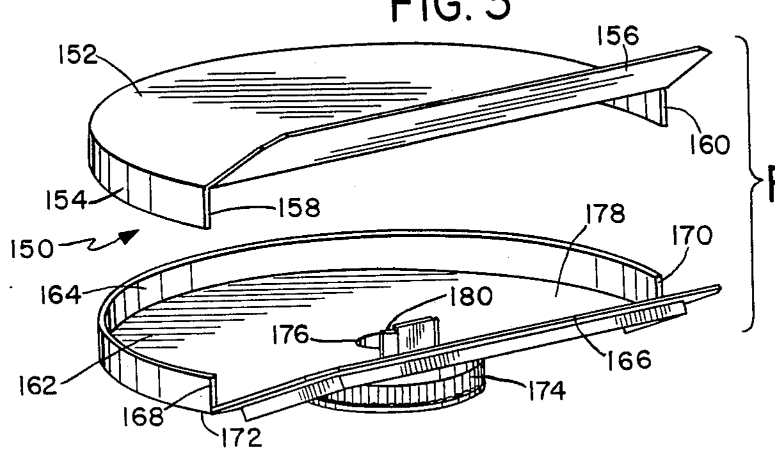

FIG. 4

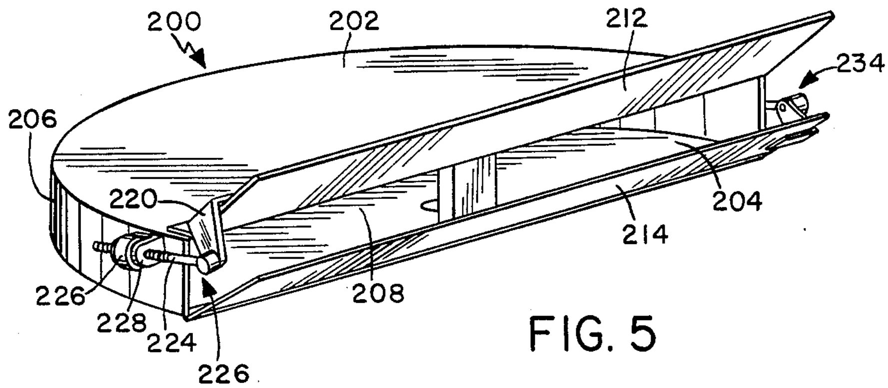

FIG. 5

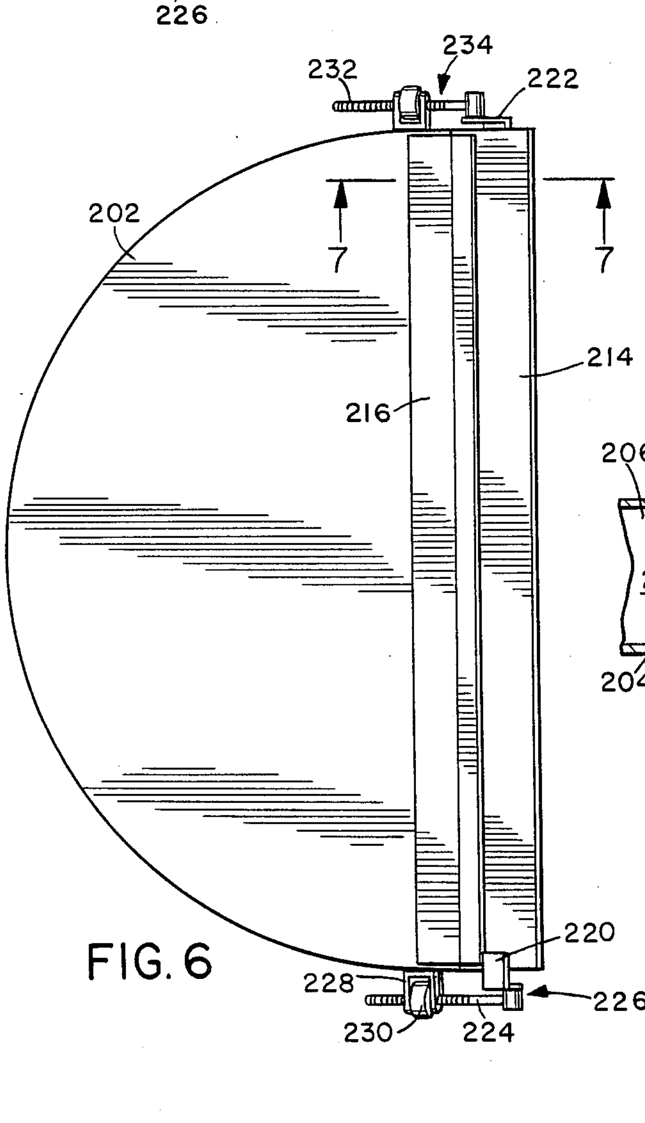

FIG. 6

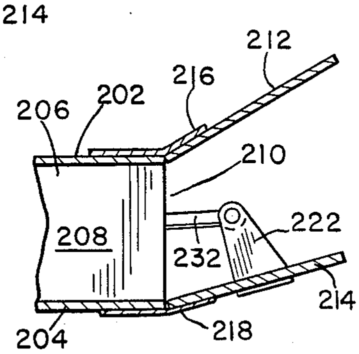

FIG. 7

PILLBOX ANTENNA AND ANTENNA ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an antenna. More specifically, the present invention is a novel and improved pillbox antenna having beam directive lips formed at the antenna aperture and constructed for rotation about a radiating feed probe positioned at the focus of the antenna parabolic reflecting cylinder.

2. Background Art

Pillbox antennas have been known for their use in applications where a directional antenna is required. Typically, the pillbox antenna has been used in radar systems and in particular marine radar systems. This type of antenna has generally not been used in communications systems due to the directivity limitations of the antenna. The pillbox antenna, when mounted in a horizontal plane, provides a beam shape that is substantially sharper in directivity in the horizontal plane than that of the vertical plane.

A pillbox antenna is generally defined as a radiating cavity formed by a parabolic reflecting cylinder axially terminated by parallel plates. The cavity structure includes an open mouth or aperture formed at a forward portion of the cavity. Typically, a horn or outwardly extending lips are formed at the aperture. The lips extend forward from the aperture and diverge symmetrically from a common plane defined by the parallel plates while diverging on opposite sides of the common plane. This configuration of lips dictates a beam pattern that spreads out in the vertical plane when the antenna is mounted in the horizontal plane.

It is, therefore, an object of the present invention to provide a new and improved highly directional rotatable pillbox antenna and antenna assembly for telecommunication applications.

SUMMARY OF THE INVENTION

The present invention encompasses a novel and improved antenna and assembly adapted for mounting upon a vehicle. The antenna assembly is specifically configured for use in a telecommunications system which involves the transmission and reception of data between a moving vehicle and one of a series of earth orbit geosynchronous communications satellites.

It is preferred in such a communications system that the vehicle mounted antenna be of the directive type. The pillbox antenna is, by its nature, a directive antenna. The use of a horizontal plane mounted pillbox antenna having upwardly oriented lips formed at the antenna aperture provide an enhanced beam directivity in communications with a satellite. Furthermore, mounting the antenna for rotation about a feed probe extending into the antenna cavity along the antenna focus line provides a simplification in construction of the antenna.

The present invention is a directive communications antenna comprising upper and lower plates, each having a leading edge, and a parabolic reflecting cylinder disposed between and axially intersecting the plates so as to form a cavity having a focus line. The cavity is open adjacent the plate leading edges. Upper and lower lip plates respectively extend along the leading edges of the upper and lower plates with both lip plates projecting upwardly therefrom. A feed assembly comprised of a feed probe and a sub-reflector are positioned within the antenna cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, objects, and advantages of the present invention will be more fully apparent from the detailed description set forth below, taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

FIG. **1** is an exploded perspective view of the antenna assembly components;

FIG. **2** is a front elevation view of the assembled antenna assembly, with portions cut away;

FIG. **3** is a sectional view taken on line **3—3** of FIG. **2**;

FIG. **4** is an exploded perspective view of an alternative construction for a pillbox antenna;

FIG. **5** is a perspective view of yet an alternative embodiment of the pillbox antenna adapted for varying the lip angles;

FIG. **6** is a top plan view of the structure of FIG. **5**; and

FIG. **7** is an enlarged sectional view taken on line **7—7** of FIG. **6**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIG. **1** illustrates the components of antenna assembly **10** in an exploded perspective view. The antenna and antenna drive system are mounted within a cavity formed by a protective housing comprised of lower casing **12** and upper casing or radome **14**.

Antenna **16** is a pillbox-type antenna formed by upper plate **18** and lower plate **20** having disposed between and axially intersecting therewith back wall or parabolic reflecting cylinder **22**. Cylinder **22** has upper and lower axial edges that are respectively affixed to upper and lower plates **18** and **20**. Cylinder **22** is generally perpendicular to lower plate **20** while extending upwardly therefrom to intersect with upper plate **18**. In the illustrated embodiment of the invention, plates **18** and **20** do not lie in parallel planes with one another. However, it is readily understood that plates **18** and **20** may lie in parallel planes. Plates **18** and **20**, along with cylinder **22**, form a radiating cavity **24**. Cylinder **22** is shaped in the form of a plane parabola having a focus line along the parabolic axis and a focus set back in cavity **24** from the intersection of the parabolic axis and a line connecting the opposite forward edges **26** and **28** of cylinder **22**. Axial throughbore **30** is formed in lower plate **18** on the focus line of cylinder **22**.

The forward edges of plates **18** and **20**, edges **32** and **34**, along with the forward edges **26** and **28** of cylinder **22** form an open mouth or aperture **36** for cavity **24**. Mounted respectively on plates **18** and **20** at forward edges **32** and **34**, are plates or lips **38** and **40**. Lips **38** and **40** respectively extend along edges **32** and **34** and project upwardly with respect to the plane of plates **18** and **20**. Lips **38** and **40** diverge asymmetrically from a common plane therebetween and on the same side of a plane defined by lower plate **20**. A set of spaced apart vertical support ribs **39** are formed along an upper surface of top plate **18** and intersect with lip **38**. Similarly, a set of spaced apart vertical support ribs **41** (FIGS. **2** and **3**) are formed on a lower surface of lower plate **20** and intersect with lip **40**.

Integrally formed upon the lower surface of plate **20** is a cylindrical pulley **42** having vertically oriented teeth **44** formed on the outer radial surface thereof. Pulley **42** is formed on lower plate **20** so as to be positioned centrally about the axis of throughbore **30**. The positioning of pulley **42** permits rotation of antenna **16** about the axis of throughbore **30**. Pulley **42** includes a centrally located cylindrical cavity **46** (FIG. 3) that shares a common axis with throughbore **30**.

Pulley **42** is mounted upon pulley hub assembly **48**. Pulley hub assembly **48** includes a cylindrical hub **50** with a radially extending flange **52**. Hub **50** includes an enlarged central axial bore **54** into which a set of bearings **56** are typically press fitted. Bearings **56** form a central axial opening **58** through hub **50**. Hub **50** includes in flange **52** a set of radially spaced apart axial holes **60**. Bolts **62** (FIG. 3) through holes **64** into aligned threaded holes (FIG. 3) in pulley **42**.

Pulley hub assembly **48** is rotably mounted upon spindle **66**. Spindle **66** includes a circular base **68** and a centrally located post **70** extending upwardly therefrom. Post **70** has a centrally located axially bore **72** which also extends through base **68**. Post **70** includes an outer radial groove **74** adjacent the end of post **70** opposite base **68**. Pulley hub assembly **48** is mounted upon spindle **66** with opening **58** receiving post **70** therethrough. Post **70** contacts beariangs **56** to enable rotation of hub **50** with respect to post **70**. Post **70** extends through opening **58** beyond top surface **76** of bearings **56** at the top end of hub **50** so that groove **74** is exposed. Retaining clip **78** is placed in groove **74** and contacts top surface **76** of bearings **56** so as to retain pulley hub assembly **48** upon spindle **66**.

Belt **80** having teeth **82** formed on an inner surface thereof is positioned over pulley **42** so that teeth **82** engage with teeth **44** of pulley **42**. The coupled pulley hub assembly **48** and spindle **66** are the coupled to pulley **42** by bolts **62**.

Spindle **66** is mounted upon the upper surface a rectangular mounting plate **84**. Spindle **66** includes radially spaced apart axial holes **86** formed in base **68**. Holes **86** are aligned with holes **88** formed in mounting plate **84**. Bolts **90** (FIG. 3) are positioned through holes **86** and **88** where nuts **92** (FIG. 3) retain bolts **92** in position.

Mounted adjacent one end of plate **84** is motor **94**. The housing of motor **94** is positioned adjacent the lower surface of plate **84**. Motor **94** has shaft **96** upon which pulley **98** is mounted. Shaft **96** and pulley **98** extend upwardly through hole **100** in plate **84**. Pully **98** includes vertical teeth **102** positioned on the outer radial surface thereof. The inner toothed surface of belt **80** fits over the outer toothed surface of pulley **96** where teeth **82** of belt **80** engage with teeth **102** of pulley **98**. Activation of motor **94** rotatably drives antenna **16** through the positive drive system of pulley **98**, belt **80** and pulley **42**.

Pulleys **42** and **98** along with belt **80** form a positive power transmission system for transferring rotational power from motor **94** to antenna **16**. One example of such a transmission system is disclosed in U.S. Pat. No. 3,756,091, the disclosure of which is incorporated by reference.

Motor control circutiry (not shown) is mounted within lower casing **12** with cover **104** mounted over the circuit. The motor control circuitry is conventional motor control circuitry well known in the art for controlling the rotation and position of motor shaft **96**. For accurate positional control of antenna **16**, motor **94** is typically a stepping motor with the motor control circuitry being conventional stepping motor controller.

Plate **84** is mounted upon standoffs **106** formed in lower casing **12**. Also mounted within lower casing **12** are the transceiver electronics (not shown).

Antenna assembly **10** further includes feed probe **110** which comprises a cylindrical outer insulator **112** which surrounds a center conductor **114**. Adjacent one end of probe **110** is a cylindrical shank **116** while at the same end is coupler **118**. Coupler **118** mates with a waveguide channel (not shown) or other suitable mating coupling in the transceiver electronics. Upon assembly of antenna assembly **10**, probe **110** extends through a series of aligned holes into cavity **24** of antenna **16**. Probe **110** extends through hole **120** in plate **84**, opening **72** and throughbore **30** into cavity **24**. Probe **110** when positioned in throughbore **30** is located on the antenna focus line rearward towards cylinder from lips **38** and **40**, and the antenna focus. Insulator **112** and conductor **114** extend into cavity **24** with the top end of insulator **112** contacting the inner surface of top plate **18**. Shank **116** is press-fit into an enlarged opening **122** in base **68** of spindle **66**, with opening **122** aligned with bore **72**. As antenna **16** rotates about spindle **66**, probe **110** remains fixed. When antenna assembly **10** is used in a transmit mode, probe **110** radiates omnidirectionally into cavity **24**.

When antenna assembly **10** is assembled, the antenna drive system and antenna **16** are encased within cavity **124** (FIG. 3) formed by casing **12** and radome **14**. Radome **14** is placed upon casing **12** where band **126** encircles mating lips **128** and **130** respectively formed about the periphery of casing **12** and radome **14**. Band **126** includes a clamping assembly **128** which tightens and secures band **126** to lips **128** and **130**. As assembled, antenna assembly **10** forms a low profile, compact antenna and transceiver system.

FIG. 2 illustrates antenna assembly **10** in assembled form. In FIG. 2, radome **14** is mounted upon casing **12** so as to form cavity **124** therein. Positioned between lips **128** and **130** is O-ring **134**. O-ring **134** serves as a mechanism which ensures a tight seal between lips **128** and **130** when band **126** secures radome **14** upon casing **12**.

In FIG. 2, pulley **98**, mounted upon the upper end of shaft **96** of motor **94**, is positioned in planer alignment with pulley **42** to insure proper alignment of belt **80**. Motor **94** drives pulley **98** which, via belt **80**, rotates pulley **42** and pulley hub assembly **48** about post **70** of spindle **66**. Direct coupling of pulley **42** to antenna lower plate **20** enables rotation of antenna **16** within cavity **124**. Edge notches **136** are formed on the outer corners of lips **38** and **40** to provide clearance for the lips during rotation of antenna **16** within cavity **124**. Notches **136** permit a dome-shaped contour of radome **14** to be utilized.

FIG. **3** illustrates a cross-sectional view of antenna assembly **10** taken along **3—3** of FIG. **2**. In FIG. **3**, casing **12** typically manufactured of a durable lightweight material such as aluminum. Radome **14** is typically constructed from the well-known type of material, such as thermal plastic materials or other organic materials, suitable for radome use.

The exterior dimensions of casing **12** is approximately 11 inches in diameter and 2.2 inches deep. The exterior dimensions of radome **14** is approximately 11 inches in diameter and 2.5 inches in height. Furthermore, casing **12** may include exterior mounting brackets (not shown) for mounting antenna assembly **10** to a vehicle. A pair of connectors **138** and **140** are mounted in the bottom wall of casing **12** for coupling power to antenna assembly **10** along with communication and control signals between antenna assembly **10** and the vehicle upon which the unit is mounted.

Bolts **62** extend through holes **60** in pulley hub assembly **48** where they are threadably engaged in threaded holes **64** in pulley **42**. Pulley hub assembly **48** is retained upon spindle by retaining clip **78** as positioned in groove **74**. Spindle **66** is affixed to mounting plate **84** by bolts **90** which extend through holes **88** and threadably engage with nuts **92**.

Antenna **16** is typically fabricated from a lightweight material such as aluminum or a plated composite material such as nickel-coated graphite fibers embedded in a polycarbonate material. In the construction of antenna **16**, upper and lower plate **18** and **20** may be substantially parallel. In a preferred embodiment, as illustrated in FIGS. **1–3**, the antenna is slightly greater in height at aperture **36** than at the vertex of curvature of cylinder **22**. For example, as illustrated in FIGS. **1–3**, there is a 4:3 ratio of height at aperture **36** to that at the vertex of curvature of cylinder **22**.

Mounted upon the upper inner surface of bottom plate **20**, adjacent to aperture **36** and within cavity **24**, is sub-reflector **142**. Sub-reflector **142** is a configured as a radial section of a parabolic reflecting cylinder. Sub-reflector **142** is concave facing cylinder **22**. Sub-reflector **142** is positioned along a line defined by the vertex of curvature of cylinder **22** and probe **110**, i.e. the parabolic reflecting cylinder focus line. Reflector **142** is generally axially positioned at the focus of cylinder **22** located on the focus line between probe **110** and lip **40**.

Lip **38** is generally positioned at an angle of approximately 45 degrees with respect to a horizontal plane defined by lower plate **20**. Lip **40** is typically at an angle approximately 18 degrees from the horizontal plane defined by lower plate **20**. Lips **38** and **40** provide enhanced directivity in beam shape for communications between the vehicle mounted antenna and a communications satellite.

FIG. **4** illustrates an alternate embodiment of a pillbox antenna. Antenna **150** is a typical pillbox-type antenna configured for minimal part count and adapted for injection molding processes in its construction. In this type of antenna construction, the preferred material is a conductive material such as nickel-coated graphite polycarbonate that is ultimately plated with a conductive material.

Antenna **150** is comprised of an upper portion which includes upper plate **152** intersected by downwardly directed parabolic reflecting cylinder **154**. Plate **152** has an integrally formed upwardly flared portion or lip **156** formed across plate **152** between the forward edges **158** and **160** of cylinder **154**.

The lower portion of antenna **150** includes lower plate **162** intersected by an upwardly directed parabolic reflecting cylinder **164**. Lower plate **162** has an integrally formed upwardly flared portion or lip **166**. Lip **166** is formed across plate **162** between forward edges **168** and **170** of cylinder **164**. Integrally formed upon lower surface **172** of lower plate **162** is pulley **174**. Pulley **174** is centrally positioned along the antenna focus line and slightly rearward towards cylinder **164** from the antenna focus. A throughbore **176** is formed at the center of pulley **174** which extends through lower plate **162**. Formed on upper surface **178** of lower plate **162** is a sub-reflector **180** which is shaped as a section of a parabolic cylinder and extends upwardly towards upper plate **152**. Sub-reflector **180** is formed on the antenna focus line between bore **176** and lip **166** at the antenna focus.

Antenna **150** is assembled by bonding overlapping cylinders **154** and **164** together. As discussed with reference to FIGS. **1–3**, upper and lower plates **152** and **162** may be either substantially parallel or slightly diverging at aperture **182** of antenna **150**. Furthermore, lips **156** and **166** are asymmetrically diverging from a common plane therebetween and on the same side of a plane defined by lower plate **162**. In the embodiment as illustrated in FIG. **4**, lips **156** and **166** are each fixed at a respective predetermined angle, typically 45 and 18 degrees, from a plane defined by lower plate **162**. A feed probe (not shown) extends into the antenna as discussed with reference to FIGS. **1–3**. Sub-reflector **180** is formed that in the assembled antenna, it contacts the lower surface of top plate **152**.

FIGS. **5–7** illustrate yet another feature of the pillbox antenna of the present invention. In FIGS. **5–7** a means for varying the directivity of the beam pattern is illustrated. Antenna **200** includes upper and lower plates **202** and **204** connected by parabolic reflecting cylinder so as to form radiating cavity **208** having an aperture **210**.

Lips **212** and **214** are respectively mounted on the forward edges of plates **202** and **204**. Lips **212** and **214** are respectively attached to plates **202** and **204** by means such as strips of adhesive backed conductive tape **216** and **218**. Lips **21** and **194** are, in essence, hinge mounted to a respective plate.

Respectively attached to lips **212** and **214** are brackets **220** and **222**. Bracket **220** is pivotally coupled to arm **224** which is connected to adjustment means **226**. Adjustment means **226** permits the angle of lip **212** to be adjusted. Adjustment means **226** is characterized by a bracket **228** mounted to cylinder **206**. A knob **230** having a threaded bore is held by bracket **228**. The portion of arm **224** opposite bracket **220** is threaded and engages with the threaded bore of knob **230**. Similarly, bracket **222** is associated with arm **232** and adjustment means **234** for adjusting the angle of lower lip **214**. The means by which the angle of lips **212** and **214** are adjusted can be accomplished in many different ways. The embodiment shown herein is only one such mehtod. It is further envisioned that the adjustment of lips **212** and **214** may be fully automated and under motor control.

It should be further noted that the pillbox antenna may require tuning. Therefore, tuning stubs may be added to the antenna as necessary to achieve optimal performance. In addition, a choke within may be necessary to optimize performance of the antenna. One type of choke is an angular groove within the radiating cavity formed in the lower plate and encircling the feed probe. The tuning of the antenna to particular performance characteristics is within the capability of one skilled in the art.

The previous description of the preferred embodiments are provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be really apparent to those skilled in the art and the generic principles defined herein may be applied to other embodiments without the use of the inventive faculty. The present invention is not intended to be limited to the embodiment shown herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

What is claimed is:

1. A directive communications antenna comprising:

a substantially parabolic upper plate having a leading edge;

a substantially parabolic lower plate having a leading edge;

a parabolic reflecting cylinder, having a pair of leading edges, disposed between and axially intersecting said plates so as to form an antenna cavity having a focus line and an antenna focus located on said focus line within said cavity, said upper and lower plate leading edges and said parabolic reflecting cylinder leading edges aligned along a common plane defining a cavity aperture thereat;

an upper lip plate extending along said upper plate leading edge and projecting upwardly therefrom at a first predetermined angle with respect to a plane defined by said lower plate;

a lower lip plate extending along said lower plate leading edge and projecting upwardly therefrom at a second predetermined angle with respect to said plane; and

electromagnetic feed means disposed along said focus line within said cavity, comprising;

a. a waveguide feed probe extending through a hole in said lower plate into said cavity at a point along said focus line; and

b. a reflector extending upwardly within said cavity from said lower plate, said reflector having a concave face facing said reflecting cylinder centered on said focus line between said probe and said lower plate leading edge at said antenna cavity focus.

2. The antenna of claim 1 wherein said first predetermined angle is greater than said second predetermined angle.

3. The antenna of claim 1 further comprising rotational means coupled to said lower plate for rotating said antenna about an axis defined by said probe.

4. The antenna of claim 1 further comprising:

a hollow, substantially cylindrical upper casing having an open lower end forming a radome;

a hollow, substantially cylindrical lower casing having an open lower end, said lower casing coupled at said lower casing open end to said upper casing at said upper casing open end so as to form a housing defining a housing cavity therein, said coupled upper plate, reflecting cylinder, lower plate and corresponding lip plates along with said electromagnetic feed means rotatably disposed within said housing cavity and wherein within said housing cavity said upper plate is positioned adjacent said upper casing and said lower plate is positioned adjacent said lower casing; and

retainer means for securely coupling said upper and lower casings.

5. A directive communications antenna comprising:

an upper plate having a leading edge;

a lower plate having a leading edge;

a parabolic reflecting cylinder disposed between and axially intersecting said plates so as to form a cavity having a focus line and said cavity open adjacent said leading edges;

an upper lip plate movably coupled to and extending along said upper plate leading edge and projecting upwardly therefrom;

a lower lip plate movably coupled to and extending along said lower plate leading edge and projecting upwardly therefrom;

means for adjusting said upper and lower lip plates at selected upward angles from a plane defined by said lower plate; and

electromagnetic feed means mounted along said focus line within said cavity.

6. The antenna of claim 5 wherein said electromagnetic feed means comprises:

a waveguide feed probe extending through a hole in said lower plate into said cavity at a point along said focal line; and

a reflector extending upwardly within said cavity from said lower plate, said reflector centered on said focus line between said probe and said lower plate leading edge.

7. The antenna of claim 5 further comprising rotational means coupled to said lower plate for rotating said antenna about an axis defined by said probe.

8. The antenna of claim 5 further comprising:

a radome; and

a lower casing coupled to said radome and forming a radome cavity therein, wherein within said radome cavity said upper plate is positioned adjacent said radome and said lower plate is positioned adjacent said lower casing.

9. A directive communications antenna comprising:

an upper plate having an upwardly flared edge portion;

a lower plate having an upwardly flared edge portion;

a parabolic reflecting cylinder disposed between and axially intersecting said plates so as to form a cavity having a focus line and said cavity open adjacent said upwardly flared portions;

means for adjusting said upper and lower plate flared edge portions at selected upward angles from a plane defined by said lower plate; and

electromagnetic feed means positioned along said focus line within said cavity.

10. The antenna of claim 9 wherein said electromagnetic feed means comprises:

a waveguide feed probe extending through a hole in said lower plate into said cavity at a point along said focus line; and

a reflector extending upwardly within said cavity from said lower plate, said reflector centered on said focus line between said probe and said lower plate leading edge.

11. The antenna of claim 9 further comprising rotational means coupled to said lower plate for rotating said antenna about an axis defined by said probe.

12. The antenna of claim 9 further comprising:

a radome; and

a lower casing coupled to said radome and forming a radome cavity therein, wherein within said radome cavity said upper plate is positioned adjacent said radome and said lower plate is positioned adjacent said lower casing.

13. A directive communications antenna comprising:

an upper member comprised of a first plate having an upwardly flared forward edge portion and a downwardly extending parabolic reflecting cylinder axially formed at a rearward edge portion thereof opposite said first plate upwardly flared forward edge portion;

a lower member comprised of a second plate having an upwardly flared forward edge portion and an upwardly extending parabolic reflecting cylinder axially formed at a rearward edge portion thereof, said second plates mounted together with said first and second plate cylinders, overlapping one another so as to form a cavity having a focus line with said cavity open adjacent said upwardly flared forward portions of said first and second plates;

means for adjusting said upper and lower plate flared edge portions at selected upward angles from a plate defined by said lower plate; and

electromagnetic feed means positioned along said focus line within said cavity.

14. A directive communications antenna assembly comprising:

a parabolic-shaped upper plate having an upwardly flared edge portion formed adjacent a line intersecting opposite side edges of said upper plate;

a parabolic-shaped lower plate having an upwardly flared edge portion formed adjacent a line intersecting opposite side edges of said lower plate;

a parabolic-shaped reflecting wall disposed between and axially intersecting said upper and lower plates, said reflecting wall increasing in height between said upper and lower plates from a vertex of curvature of said reflecting wall towards a pair of forward edges of said reflecting wall opposite said vertex, said reflecting wall having a concave face facing said upper and lower plate edge portions, said upper and lower plate edge portions respectively upwardly flared at first and second angles with respect to a plane formed by said bottom plate with said first angle greater than said second angle, said upper and lower plates with said reflecting wall defining an antenna cavity having an opening adjacent said upper and lower plate edge portions and said reflecting wall forward edges, said antenna cavity having a focus line with an antenna cavity focus on said focus line adjacent said opening;

a parabolic-shaped sub-reflecting wall disposed within said antenna cavity on said lower plate along said focal line at said focus, said sub-reflecting wall having a concave face facing said reflecting cylinder with a vertex of curvature at said focus, said sub-reflecting wall being of a shape corresponding to a radial section of said reflecting wall; and

a waveguide feed probe extending through a hole in said lower plate into said antenna cavity at a point along said focal line between said sub-reflecting wall and said reflecting wall.

15. The antenna assembly of claim **14** further comprising rotational means coupled to said lower plate for rotating said antenna assembly about an axis defined by said probe.

16. The antenna assembly of claim **15** wherein said rotational means comprises:

a pulley mounted to said lower plate having a central axial throughbore aligned with said hole in said lower plate;

a spindle having an axial throughbore;

hub assembly means for rotatably coupling said spindle to pulley means with said spindle throughbore axially aligned with said pulley throughbore; and

rotational driving means engaging said pulley means for rotatably driving said pulley.

17. The antenna assembly of claim **15** further comprising:

a hollow, substantially cylindrical upper casing having an open lower end and formed of a substantially electromagnetically transparent material;

a hollow, substantially cylindrical lower casing having an open upper end, said lower and upper casings engaging one another at its respective open ends so as to define an enclosure cavity for receiving said coupled upper and lower plates, said reflecting and sub-reflecting walls and said probe disposed within said enclosure cavity; and

retainer means for securing together said upper and lower casings.

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