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[54] ANTENNA SLEW SYSTEM

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[52] **U.S. Cl.** **343/766**, 343/872, 343/881, 74/89, 74/96
[51] **Int. Cl.** **H01q 3/00**
[58] **Field of Search** 343/757, 762, 763, 765, 766, 343/760, 872, 881; 74/89, 96

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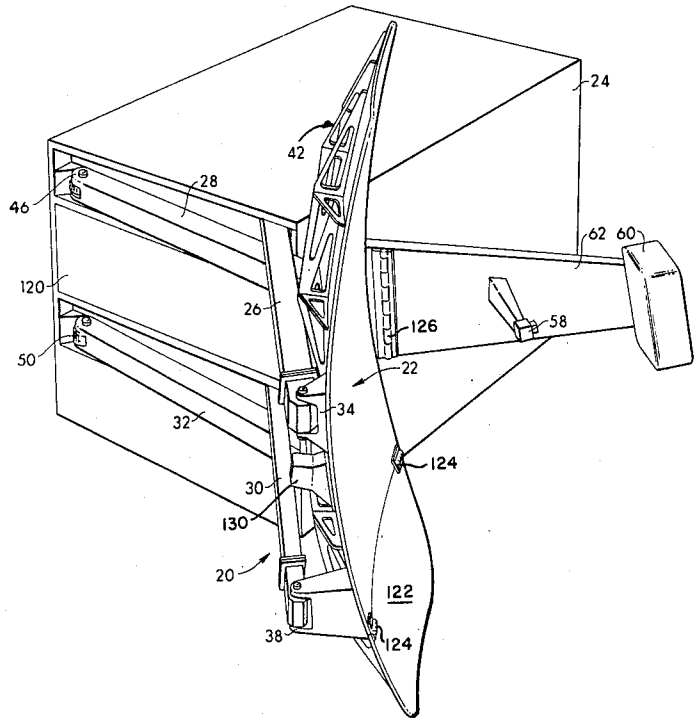
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[57] **ABSTRACT**

An antenna azimuthal positioning mechanism formed from pairs of elongated antenna supporting struts pivotally mounted on a fixed support structure and extending both outwardly and in crossed relationship therefrom to pivotally connect with an antenna whereby the antenna pivots with respect to the supporting struts as the supporting struts carry the antenna past an end of the fixed support structure to give a partial view to the rear of the support structure and thereby provide an azimuth sector scan subtending an arc which is greater than the pivoting arc of any one of the supporting struts. The supporting struts can be disconnected from the antenna to facilitate transfer of the antenna to a telescoping stowage support for antenna stowage.

10 Claims, 7 Drawing Figures



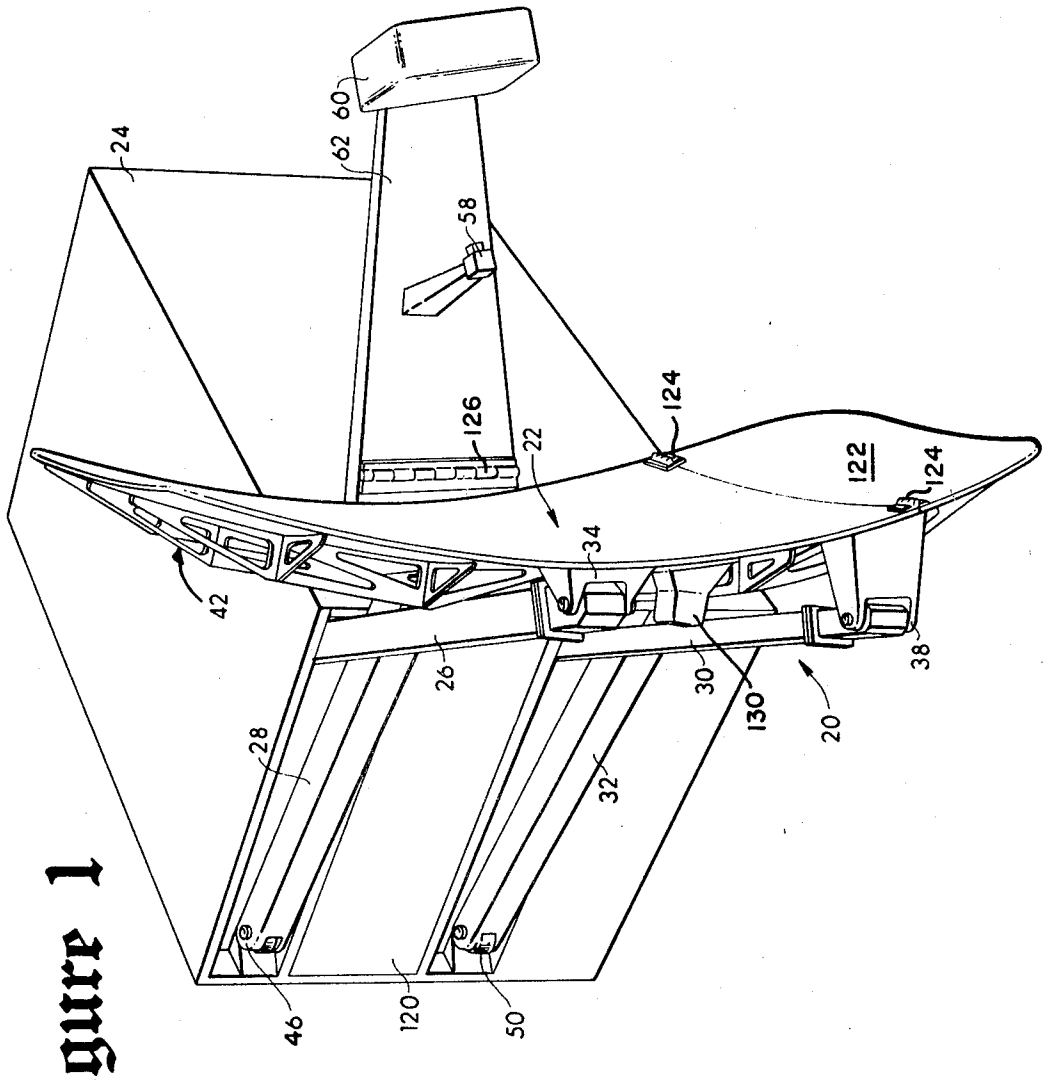


Figure 1

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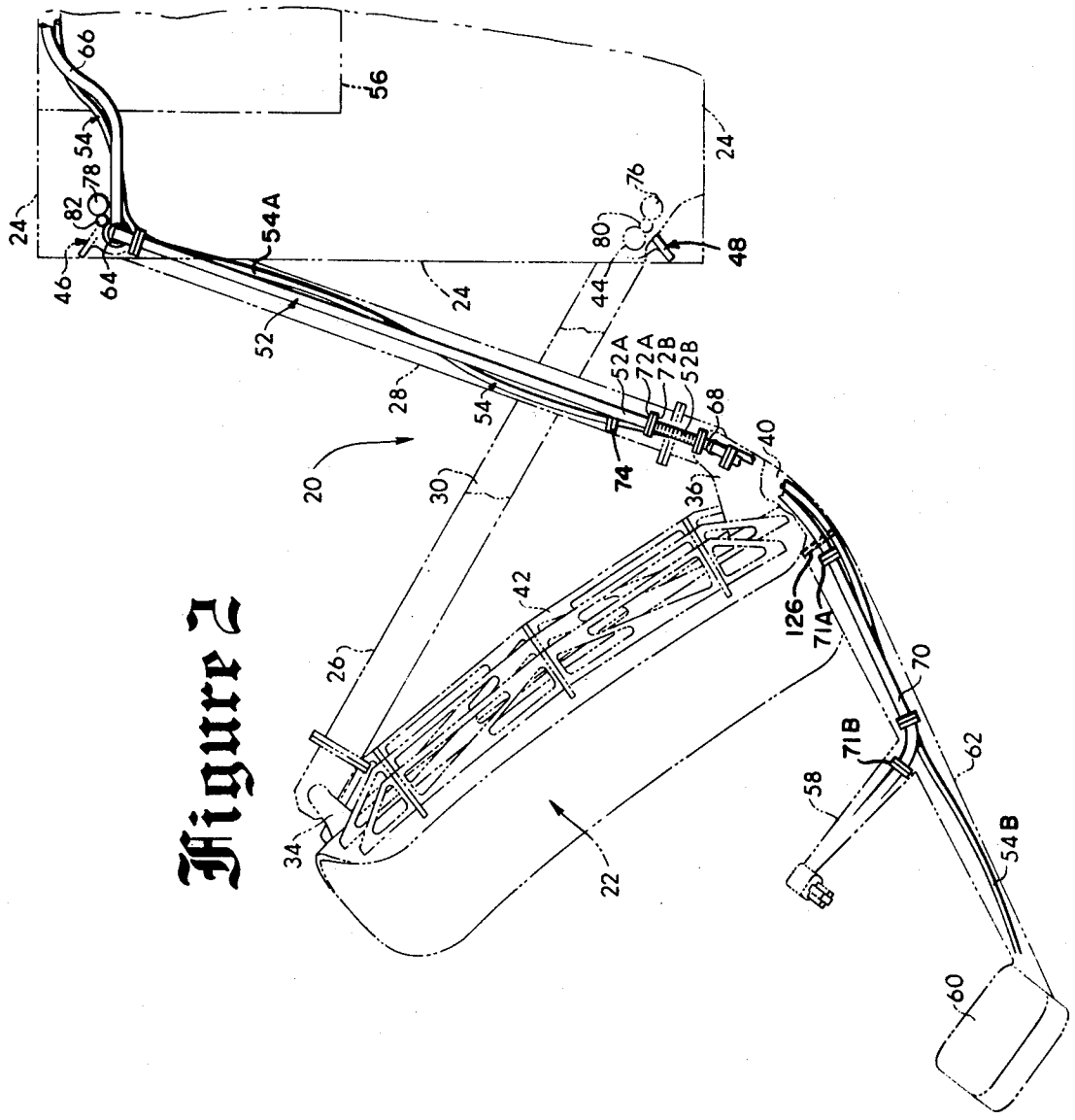


Figure 2

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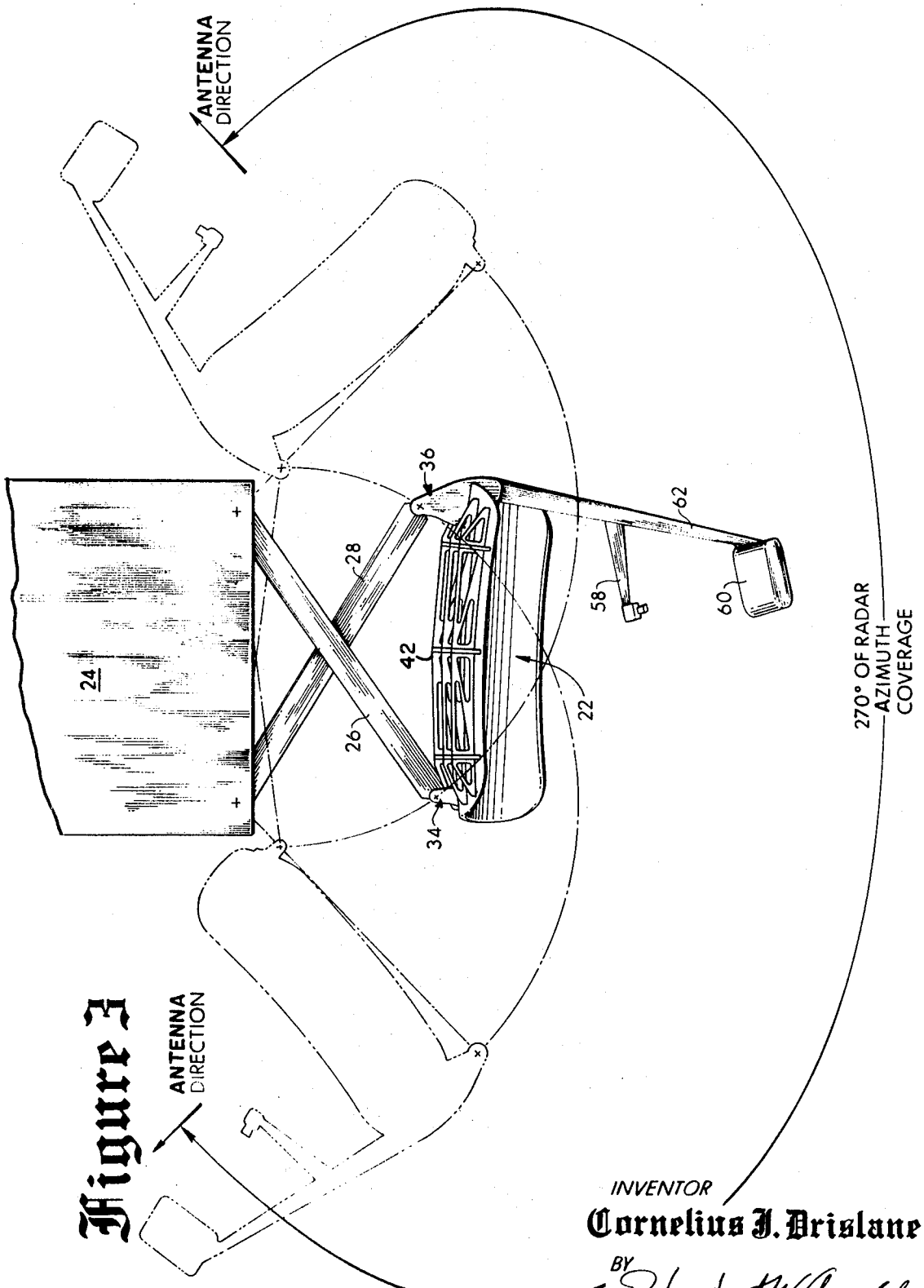


Figure 3

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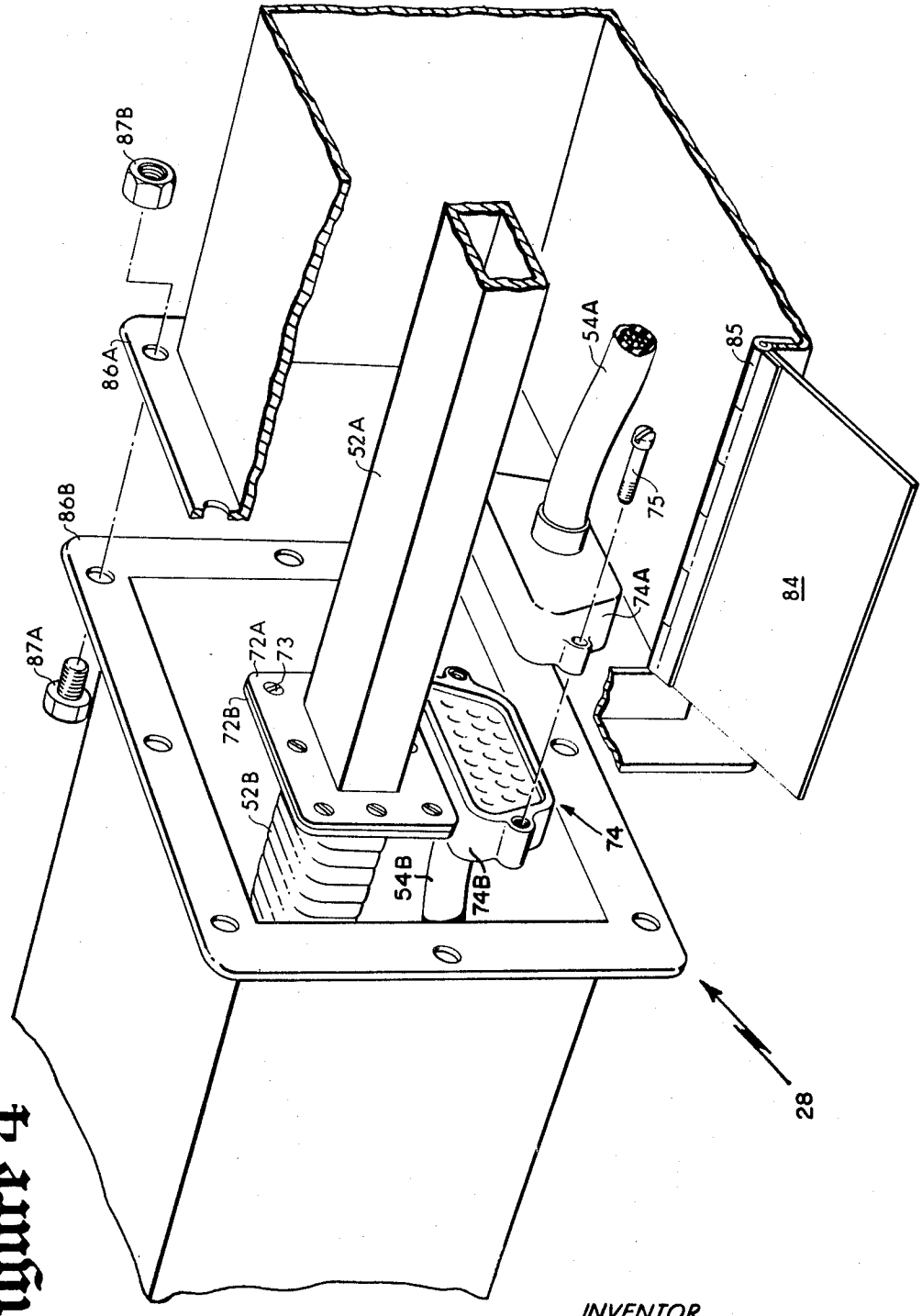


Figure 4

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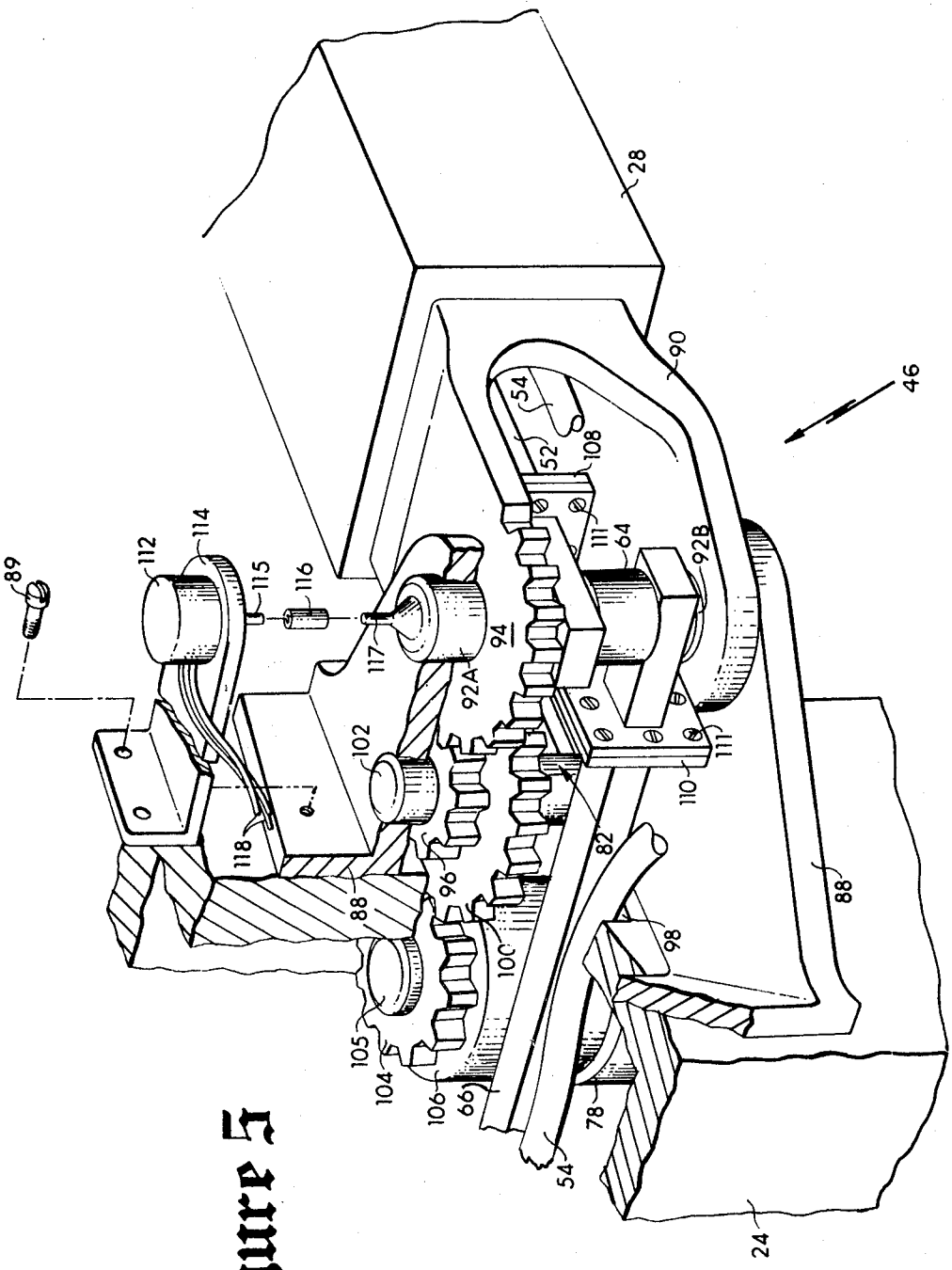


Figure 5

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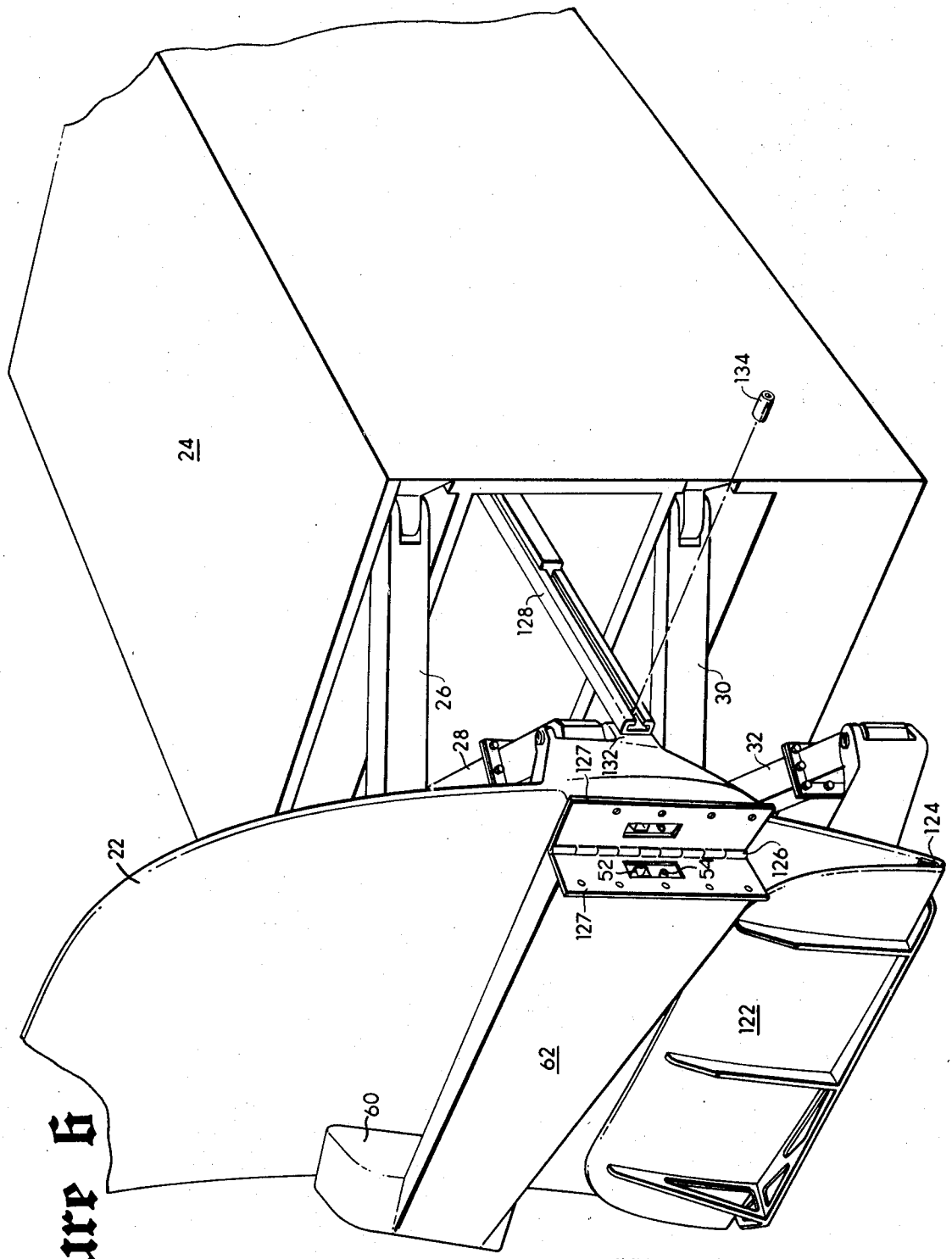


Figure 6

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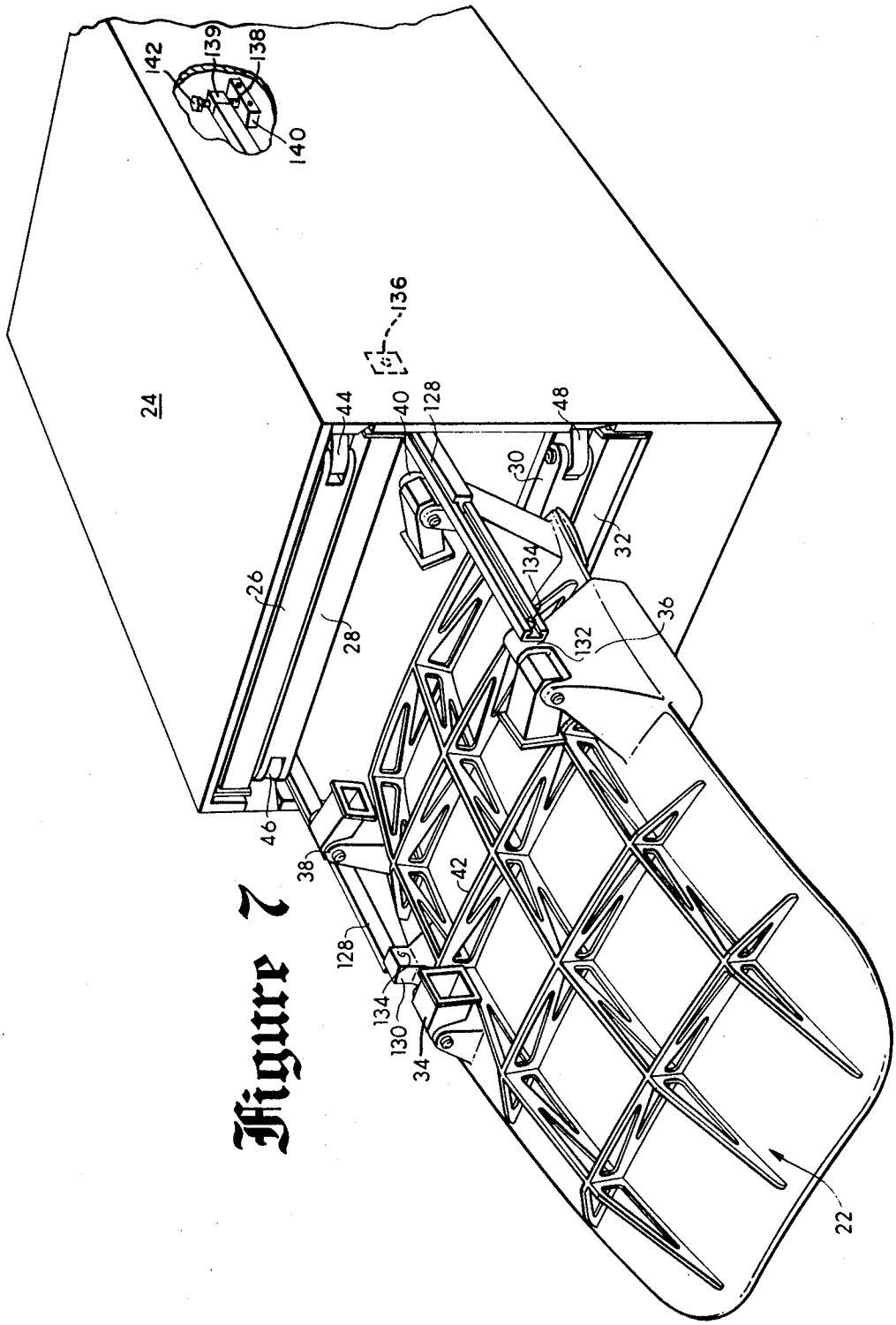


Figure 7

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ANTENNA SLEW SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to antenna positioning and support mechanisms and more particularly to an improved azimuthal positioning mechanism which is mounted on the side of a support structure or shelter and provides increased sector scan capability.

Conventional radar antennas are usually mounted either on top of a supporting structure such as a shelter for housing the electronics equipment or at some distance from the shelter in order to permit continuous azimuthal scanning through a 360° field of view which is unobstructed by the structure or shelter. In certain applications a continuous scanning of 360° in azimuth is not required, as in the surveillance of an airport runway, or may be impracticable to implement such as on a ship where the antenna may have to be mounted near a mast, or where space requirements preclude the mounting of the antenna on top of a structure. In each of these applications, it is frequently desirable to utilize a simpler form of antenna positioning mechanism which provides only a sector scan, and which can be mounted on the side of a structure such as the shelter. It is desirable to provide a side-mounted positioning mechanism that will provide a maximum sector scan angle in the range of 270° to 360° by swinging the antenna from one corner of the shelter to the other so that the antenna has at least a partial view towards the rear.

The side mounting of the antenna is advantageous for maintenance and checkout since the antenna is low enough to be within easy reach of service personnel. In the case of portable radar sets completely self-contained within a shelter, the side mounting of the antenna reduces the chance of a strong wind overturning the radar as might occur if a large antenna was mounted on top of the shelter, and also facilitates disconnection of the antenna for stowage.

It is therefore an object of the present invention to provide an azimuthal positioning mechanism side-mounted on a shelter for supporting and directing an antenna.

It is a further object of the invention to provide an improved side-mounted positioning mechanism for rigidly supporting an antenna and providing increased sector scan coverage.

It is also an object of the invention to provide a side-mounted antenna positioning mechanism having a compact form which facilitates stowage of the mechanism and the antenna.

SUMMARY OF THE INVENTION

An antenna positioning mechanism formed from at least one pair of elongated antenna supporting struts pivotally mounted at an end thereof to a fixed support structure and extending outwardly therefrom to pivotally connect with an antenna which pivots with respect to the supporting struts as the supporting struts carry the antenna around at least a portion of the fixed support structure, the supporting struts in said pair of supporting struts being crossed at an angle which varies with antenna position.

In a preferred embodiment the supporting struts are pivotally mounted to swing in horizontal planes so that the antenna scans an azimuthal sector subtending an arc which is larger than the pivoting arc of any of said supporting struts. The supporting struts can be disconnected from the antenna to facilitate transfer of the antenna to a telescoping stowage support for antenna stowage.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and other features of the invention are explained in the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a pictorial view of a portable radar system employing the antenna positioning mechanism of the invention;

FIG. 2 is a plan view exposing the drive mechanism and waveguide assembly in the antenna positioning mechanism of the invention;

FIG. 3 is a diagrammatic plan view of the positioning mechanism showing three positions of the antenna, one central position and two extreme positions, and the corresponding geometric configurations of the supporting struts of the antenna positioning mechanism;

FIG. 4 is an isometric view, partially cut away, of a portion of a supporting strut of the antenna positioning mechanism exposing the waveguide and cabling connections;

FIG. 5 is an isometric view, partially cut away and exploded, of a hinge assembly and power train of one of the supporting struts of the antenna positioning mechanism;

FIG. 6 is a pictorial view of the portable radar system showing the antenna in a folded configuration, and a telescoping stowage support extending from the interior of a shelter to the antenna; and

FIG. 7 is a perspective view, partially cut away, of a portable radar system with the antenna tilted in a horizontal position preparatory to stowage within the shelter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1**, **2**, and **3**, there is shown, respectively, a pictorial view, a plan view, and a diagrammatic plan view of a side-mounted antenna positioning mechanism in accordance with the invention utilized in conjunction with a portable electronically beam-steered radar for airport runway surveillance. The side-mounted antenna positioning mechanism is a four-arm mechanical linkage indicated generally by **20** for supporting radiating means such as a radar antenna **22** at an end of a portable shelter **24** which serves as a fixed support structure for the linkage **20**. The linkage **20**, composed of upper struts or arms **26** and **28**, and lower struts or arms **30** and **32**, each being of a common length, is connected to the antenna **22** at four points along its edge by hinges **34**, **36**, **38**, and **40** to which the aforementioned struts are respectively pivotally connected to provide stability in the presence of strong wind forces. The hinges **34**, **36**, **38** and **40** are carried by the struts in arcuate paths and protrude outwardly from the back side of antenna **22** to provide clearance of antenna frame **42** for the struts **26**, **28**, **30** and **32**. The other end of each of these struts is pivotally mounted to the shelter **24** respectively by means of hinges **44**, **46**, **48**, and **50**, so that, as shown in FIG. **3**, these struts carry the antenna **22** through a curved path in the horizontal plane. The upper struts **26** and **28** are in crossed relation to each other, and similarly, the lower struts **30** and **32** are in crossed relation to each other to provide a pivoting of the antenna **22** through a larger angle than the pivot angle of any one of the aforementioned struts with the result that, as shown in FIG. **3**, the antenna **22** has a partial view to the rear of shelter **24**.

Referring specifically to FIG. **2**, each of the struts has the form of a rigid beam having a hollow interior, one of which serves as a passage by which electrical conductors are brought out from the shelter to the antenna. Accordingly, one of the struts, namely strut **28** shown in phantom plan view in FIG. **2**, serves as a passage for waveguide **52** and cabling **54**. Electromagnetic energy and radar beam-steering signals are transferred from radar electronics equipment **56** having transmission, receiving, and beam-steering means, not shown, by means of waveguide **52** and cabling **54** respectively to antenna feed **58** and phased array subreflector **60** which are supported by boom **62**. A rotary joint **64** is provided within hinge **46**, as described in greater detail in FIG. **5**, in order to connect waveguide **52** to a stationary waveguide **66** which, in turn, is connected to the transmission and receiving portion of electronics equipment **56**. At the other end of strut **28**, a second rotary joint **68**, having the same form as rotary joint **64**, is provided within hinge **36** to connect waveguide **52** with boom waveguide **70** so that electromagnetic energy can be transferred via these waveguides irrespective of the antenna azimuth position. Waveguide **52** is formed from two sections, a long rigid section **52A** connected to a shorter flexible section **52B**, which permits alignment at the flanges **72A** and **72B** for

mating the two waveguide sections. Also, cabling **54** is formed from two sections, namely, a section **54A** within strut **28** and a second section **54B** in boom **62**, which are joined by a connector **74** to permit disconnection and reconnection of section **54A** from the antenna prior to stowage as will be described. Two electric drive motors **76** and **78** located near the upper corners of shelter **24** are mechanically connected respectively to struts **26** and **28** by means of gear trains **80** and **82**, partially shown in FIG. **2**, to impart pivotal motion about the hinges **44** and **46** to the struts **26** and **28** and thereby position the antenna **22** in azimuth.

Referring specifically to FIG. **3**, the antenna **22** is shown in two positions of maximum azimuthal extension and a third position in which the antenna **22** is centered along the end of shelter **24**. FIG. **3** shows three positions of the struts **26** and **28** corresponding to the aforementioned three antenna positions by means of solid and dashed lines, the solid lines being used to show the orientations of the struts **26** and **28** for the centered position of antenna **22**. The struts **30** and **32**, not shown, are positioned respectively beneath struts **26** and **28**. The hinges **34**, **36**, **38** and **40** protrude outwardly from the back side of antenna **22** to accommodate the struts in a position of maximum azimuthal extension so that, for example, the strut **28** passes beneath hinge **34** in a maximum clockwise azimuthal extension, and the strut **26** passes above hinge **36** in a maximum counterclockwise azimuth extension. The angular velocity or rotation rate of upper strut **26** and lower strut **30** are always equal and, in general, different from the rotation rate of struts **28** and **32**. It is readily apparent that a linear rotation rate of any strut is accompanied by a nonlinear rotation rate of the antenna **22**, and that the average rotation rate of the antenna **22** from one maximum azimuthal extension to the other maximum azimuthal extension is approximately double the average rotation rate of any of the struts **26**, **28**, **30** and **32** since antenna **22** rotates in azimuth approximately 270° while each strut rotates approximately 135°, as seen in FIG. **3**. The maximum sector scan of antenna **22** can be increased beyond 270° by a further extension of the hinges **34**, **36**, **38** and **40** outwardly from the back side of antenna **22**.

Referring now to FIG. **4**, there is shown a portion of upper strut **28**, partially cut away to expose waveguide **52** and cabling **54** as seen in FIG. **2**. The waveguide flanges **72A** and **72B** are held together by bolts **73**. Cabling connector **74** has connecting sections **74A** and **74B** which are held together by screws such as screw **75** located behind access cover **84** which is hinged about hinge **85** in a sidewall of the strut **28**. FIG. **4** also shows strut flanges **86A** and **86B** held together by bolts and nuts such as bolt **87A** and nut **87B**, by means of which strut **28** can be disassembled into two sections, as is done for antenna stowage to be described in connection with FIG. **6**.

Referring now to FIG. **5**, there is shown a detailed isometric view of hinge **46** attached to shelter **24** as seen in FIG. **2**, partially cut away, and showing hinge bracket **88** which pivotally supports strut end fitting **90** by means of two pins **92A** and **92B** about which strut **28** pivots. The upper portion of fitting **90** is provided with gear segment **94** which is driven by pinion **96** mounted on vertical shift **102** supported by bracket **88**. Pinion **96** is of smaller diameter than gear segment **94** to provide a torque multiplication for pivoting strut **28** about pins **92A** and **92B**. Pinion **96** is connected to drive gear **100** which extends through an aperture **98** in the vertical sidewall of bracket **88** into engagement with motor pinion **104** located within shelter **24**. Drive gear **100** rotates with pinion **96** about shaft **102** and is in turn driven by motor pinion **104** directly connected by motor shaft **105** to electric motor **78** and to a brake **106** for restraining the antenna **22** against wind loading. Electric motor **78** rotates pinion **104** to impart torque to drive gear **100**. The waveguides **52** and **66** are connected to a well-known rotary joint **64** respectively by means of pairs of mounting flanges **108** and **110**, secured together by bolts **111**. The axis of rotary joint **64** coincides with the axis of hinge **46**, so that electromagnetic energy can be transferred to and from the antenna for all angles of pivot of strut **28**.

An angle sensing device such as potentiometer **112** is mounted coaxially with the axis of hinge **46** by means of bracket **114** affixed to hinge bracket **88** by means of screws such as screw **89**. Potentiometer shaft **115** is connected by means of a well-known antibacklash shaft coupling **116** to extension **117** of pin **92A** which is connected rigidly to fitting **90** and rotates with strut **28** to provide a voltage signal in accordance with the angular disposition of strut **28** relative to stationary bracket **88**. The voltage signal of potentiometer **112** is transmitted along electrical conductors **118** to electronics equipment **56** shown in FIG. **2** and provides an indication of antenna azimuth position based on the geometric relationship of the azimuth angle of antenna **22** of FIG. **3** to the angle of strut **28** relative to shelter **24**.

Hinge **44**, shown in FIG. **2**, which is mechanically connected to its motor **76** through gear train **80**, operates in an analogous manner to hinge **46**.

In operation, therefore, the electric motors **76** and **78** are energized from a source of electric power, not shown, to impart rotation to the gears of gear trains **80** and **82**, as seen in FIG. **2**, the gear diameters being selected to provide a torque multiplication through the gear trains **80** and **82** whereby the motors **76** and **78** can impart sufficient torque to the upper struts **26** and **28** to redirect the antenna **22** even in the presence of opposition forces of wind blowing against the antenna **22**. The brake **106** connected to motor **78** and a similar brake, not shown, connected to motor **76** retain the antenna **22** in a fixed position when motors **76** and **78** are deenergized. Rotary joints **64** and **68** located respectively within hinges **46** and **36** at the ends of strut **28** provide for the coupling of electromagnetic power from electronics equipment **56** to antenna **22** through waveguides **66**, **52**, and **70** independently of the various relative positions of antenna **22** and strut **28** to shelter **24**.

In order to store antenna **22** within shelter **24**, each strut or arm of linkage **20** is readily adapted to become disconnected from antenna **22**. The stowage procedure, shown in FIGS. **6** and **7**, begins with the removal of access panel **120**, shown in FIG. **1** to provide an entrance into shelter **24** for the antenna. Panel **120** is preferably made from a lightweight material such as well-known aluminum-foam sandwich and is located between the upper and lower struts in the front end of shelter **24**. The panel is removed with the aid of handgrips, not shown. Antenna **22** is then positioned along the centerline of shelter **24** as shown in FIG. **3** and FIG. **6**. The bottom flap **122** of antenna **22** is folded up manually about hinges **124**, shown in FIG. **1** and FIG. **6**, to decrease the antenna length so that the antenna **22** can be fitted into the shelter **24**.

Also the boom **62** is folded inwardly toward the face of the antenna about hinge **126** after unbolting hinge flanges **127** and waveguide flanges **71A**, shown in FIG. **2**, by means of an access panel, now shown. In like manner, microwave feed **58** containing waveguide **70**, as shown in FIGS. **1** and **2**, if folded inwardly along boom **62** toward subreflector **60** by a hinge and flange structure similar to that of hinge **126**, although not shown, after unbolting waveguide flanges **71B** located behind an access panel, not shown. The folding of boom **62** and feed **58** is done preparatory to antenna stowage so that when the antenna **22** is moved into the shelter **24** as shown in FIG. **7**, the antenna clears the electronics equipment **56** in the shelter.

The antenna **22** is guided into the shelter **24** by guide arm means such as telescoping slides **128** which are attached to interior sidewalls of shelter **24**. Slides **128** are extended out manually in a well-known manner from shelter **24** to be pivotally attached to the antenna **22** at slide brackets **130** and **132** secured to antenna **22**, and located respectively beneath hinges **34** and **36**. The pivotal attachment is effected by means of pins **134**, one of which is passed through an aperture, not shown, in the end of each slide **128** and into a similar aperture in brackets **130** and **132**. In order to compensate for sag in the struts **26**, **28**, **30** and **32** due to the weight of antenna **22** each slide **128** is pivotally mounted near the front end of shelter **24** by means of slide pivot **136** located on the interior wall of

shelter 24, as shown in FIG. 7, so that the extended portion of each slide 128 carrying pin 134 can be raised or lowered to line up with brackets 130 and 132 on the antenna. This raising and lowering of the extended portion of a slide 128 is accomplished by means such as a rotatable bolt 138 threading vertically through a well-known threaded end fitting 139 on the back end of slide 128, as shown in the cutaway portion of FIG. 7, and journaled in a fixed bracket 140 which is attached, as by bolting, to the wall of shelter 24, thus permitting bolt 138 to rotate and move slide 128 relative to the fixed bracket 140. The rotatable bolt 138 terminates at its upper end in a hexagonal fitting 142 to mate with a wrench by which bolt 138 is manually rotated to urge the end of slide 128 vertically and thereby compensate for sag in the struts 26, 28, 30 and 32. This arrangement permits pins 134 to be inserted into brackets 130 and 132. The bolts 138 in each slide 128 are then further rotated to shift the antenna weight from the linkage 20 to the slides 128.

The waveguide 52 and cabling 54, shown in FIGS. 2 and 4, are then disconnected from the antenna as shown in FIG. 4, by opening the access cover 84 in strut 28 and then unbolting waveguide flanges 72A and 72B, and opening the cabling connector 74. The four struts 26, 28, 30, and 32 are then disassembled by unbolting the flanges adjacent to the antenna hinges in each strut, such as the pair of flanges 86A and 86B in strut 28 to free the antenna 22 from the struts.

The stowage procedure is completed by folding the four struts 26, 28, 30 and 32 inwardly towards the shelter 24 until they are aligned within the shelter as shown in FIG. 7. By tilting antenna 22 about the axis of the pins 134, it is brought into a horizontal position as shown in FIG. 7. The tilting operation can be accomplished manually since the slide brackets 130 and 132 are located approximately along an axis through the center of gravity of the antenna. The antenna 22 is then slid into the shelter 24 and the access panel 120 is replaced. To erect the antenna, the foregoing procedure is repeated in reverse order. In this manner, the entire radar system is rapidly converted into a form which is readily transportable to another site whereupon it can be manually set up for operation.

It is understood that the above-described embodiments of the invention are illustrative only and that modifications thereof will occur to those skilled in the art. Accordingly, it is desired that the invention is not to be limited to the embodiments disclosed herein but is to be limited only as defined by the appended claims.

What is claimed is:

1. An antenna positioning mechanism for carrying an antenna through a sector scan comprising:

a support structure, a plurality of first pivoting means mounted on said support structure in spaced-apart relationship, at least two pairs of antenna support struts, each strut in said pairs of struts being connected to a separate one of said first pivoting means for pivoting about said support structure, an antenna, a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pairs of struts extending outwardly from said support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, the two struts in each of said pairs of antenna support struts being disposed in crossed relation to each other during the central portion of said sector scan thereby permitting said antenna to rotate through an angle of sector scan which is larger than the angle of rotation of any one of said struts, waveguide means, one of said struts being adapted to carry said waveguide means between said support structure and said antenna, a first means for coupling energy from said waveguide means to a location within said support structure during pivoting of said one strut relative to said support structure, and a second means for coupling energy from said waveguide means to said antenna during pivoting of said one strut relative to said antenna.

2. The apparatus of claim 1 including stowage means, said stowage means having the form of an enclosed shelter means with an entrance adjacent to said antenna, said support struts having means for disconnection of said antenna from said struts, and means for guiding said antenna after said disconnection into said stowage means.

3. An antenna positioning mechanism for carrying an antenna through a sector scan comprising:

a fixed support structure, a plurality of first pivoting means mounted on said fixed support structure in spaced-apart relationship, at least two pairs of antenna support struts, each strut in said pairs of struts being connected to a separate one of said first pivoting means for pivoting about said fixed support structure, an antenna, a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pairs of struts extending outwardly from said fixed support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, the axes of said first and second pivoting means being parallel to each other, the two struts in each of said pairs of struts being angularly disposed in relation to said fixed support structure such that one strut in each of said pairs of struts is rotated about its first pivoting means in a further clockwise direction than the other strut in each of said pairs of struts, waveguide means, one of said struts being adapted to carry said waveguide means between said support structure and said antenna, a first means for coupling energy from said waveguide means to a location within said support structure during pivoting of said one strut relative to said support structure, and a second means for coupling energy from said waveguide means to said antenna during pivoting of said one strut relative to said antenna.

4. A positioning mechanism for scanning radiating means through a sector comprising:

a fixed support structure, a plurality of first pivoting means mounted on said fixed support structure in spaced-apart relationship, at least two pairs of support struts, each strut in said pairs of struts being connected to a separate one of said first pivoting means for pivoting about said fixed support structure, radiating means, plurality of second pivoting means mounted on said radiating means in spaced-apart relationship, each strut in said pairs of struts extending outwardly from said fixed support structure to connect with a separate one of said second pivoting means to pivot with respect to said radiating means, the two struts in each of said pairs of struts being disposed in crossed relation to each other at an angle which varies with the sector scanning position of said radiating means, waveguide means, one of said struts being adapted to carry said waveguide means between said support structure and said antenna, a first means for coupling energy from said waveguide means to a location within said support structure during pivoting of said one strut relative to said support structure, and a second means for coupling energy from said waveguide means to said antenna during pivoting of said one strut relative to said antenna.

5. An antenna positioning mechanism for carrying an antenna through a sector scan comprising:

a fixed support structure, a plurality of first pivoting means mounted on said fixed support structure in spaced-apart relationship, at least two pairs of antenna support struts, each strut in said pairs of struts being connected to a separate one of said first pivoting means to pivot about said fixed support structure, an antenna, a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pairs of struts extending outwardly from said fixed support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, said struts being angularly disposed with respect to said antenna in a manner in which the average angular velocity of said an-

tenna is substantially double the average angular velocity of any one of said struts as the antenna is carried by said struts through a full sector scan angle, waveguide means, one of said struts being adapted to carry said waveguide means between said support structure and said antenna, a first means for coupling energy from said waveguide means to a location within said support structure during pivoting of said one strut relative to said support structure, and a second means for coupling energy from said waveguide means to said antenna during pivoting of said one strut relative to said antenna.

6. An antenna positioning mechanism carrying an antenna through a sector scan comprising:

a fixed support structure;

a plurality of first pivoting means mounted on said fixed support structure in spaced-apart relationship;

an antenna;

at least one pair of antenna support struts, each strut in said pair of struts being connected to a separate one of said first pivoting means to pivot about said fixed support structure, one of said support struts being provided with waveguide means to feed electromagnetic energy to said antenna;

a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pair of struts extending outwardly from said fixed support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, said struts being angularly disposed with respect to said antenna in a manner in which the average angular velocity of said antenna is substantially double the average angular velocity of any one of said struts as the antenna is carried by said struts through a full sector scan angle;

stowage means, said support struts having means for disconnection of said antenna from said struts; and

retractable guide arm means for transporting said antenna after said disconnection into said stowage means.

7. A positioning mechanism for sector scanning a radiating device comprising radiating means, a fixed support structure enclosing a stowage means contained therein, retractable guide arm means mounted to said stowage means and telescopically extending from within said enclosed stowage means to said radiating means, positioning means including at least one rigid member pivotally interconnecting said radiating means to said fixed support structure and adapted to carry said radiating means in a path of sector scan towards an extended position of said guide arm means, and means for disconnecting said radiating means from said positioning means to transfer said radiating means from said positioning means to said guide arm means for antenna stowage.

8. An antenna positioning mechanism comprising:

radiating means;

a fixed support structure enclosing a stowage means contained therein;

retractable guiding means slidably mounted within said stowage means and adapted to extend from said stowage means to pivotally connect with said radiating means;

means for alternately connecting and disconnecting said retractable guiding means from said radiating means to permit scanning of said radiating means while said guiding means are retracted into said stowage means;

support means pivotally connected at one end to said fixed support structure and extending therefrom to said radiating means; and

means for alternately connecting and disconnecting said support means from said radiating means, said radiating means being pivotally connected to the other end of said support means to permit scanning of at least a portion of the space surrounding the fixed support structure when said retractable guiding means is disconnected from said radiating means, said retractable guiding means cooperating with said support means in disconnecting said radiating means from said support means and guiding said radiating means from a scanning position into said stowage means while said support means is separated from said radiating means.

9. An antenna positioning mechanism for carrying an antenna through a sector scan comprising:

a support structure, a plurality of first pivoting means mounted on said support structure in spaced-apart relationship, at least one pair of antenna support struts, each strut in said pair of struts being connected to a separate one of said first pivoting means for pivoting about said support structure, an antenna, a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pair of struts extending outwardly from said support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, the two struts in each of said pair of antenna support struts being disposed in crossed relation to each other during the central portion of said sector scan thereby permitting said antenna to rotate through an angle of sector scan which is larger than the angle of rotation of any one of said struts, stowage means, said stowage means having the form of an enclosed shelter means with an entrance adjacent to said antenna, said support struts having means for disconnection of said antenna from said struts, and means for guiding said antenna after said disconnection into said stowage means.

10. An antenna positioning mechanism for carrying an antenna through a sector scan comprising:

a support structure, a plurality of first pivoting means mounted on said support structure in spaced-apart relationship, at least one pair of antenna support struts, each strut in said pair of struts being connected to a separate one of said first pivoting means for pivoting about said support structure, an antenna, a plurality of second pivoting means mounted on said antenna in spaced-apart relationship, each strut in said pair of struts extending outwardly from said support structure to connect with a separate one of said second pivoting means to pivot with respect to said antenna, the two struts in each of said pair of antenna support struts being disposed in crossed relation to each other during the central portion of said sector scan thereby permitting said antenna to rotate through an angle of sector scan which is larger than the angle of rotation of any one of said struts, one of said support struts being provided with waveguide means to feed electromagnetic energy to said antenna, stowage means, said stowage means having the form of an enclosed shelter with an entrance adjacent to said antenna, said support struts having means for disconnection of said antenna from said struts, and means for guiding said antenna after said disconnection into said stowage means.

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