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[54] ANTENNA MOUNTING STRUCTURE

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[52] **U.S. Cl.** **343/757,** 343/763, 343/837, 343/880, 343/882, 343/883

[51] **Int. Cl.**.....**H01q 1/10,** H01q 1/12, H01q 3/08

[58] **Field of Search**.....343/757, 758, 763, 765, 882–883, 343/880, 881

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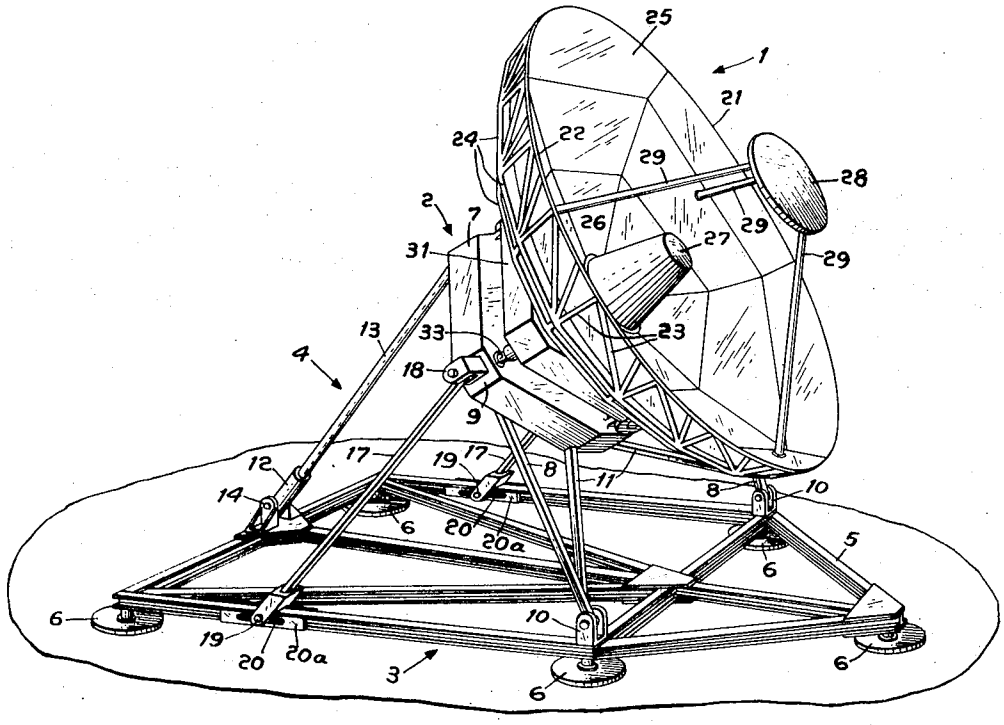
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[57] **ABSTRACT**

A limited motion antenna mounting structure for use with synchronous satellites. The structure is a modified polar mount constructed of aluminum and steel having the advantage of being rigid, light-weight, of low cost, highly transportable, of simple design, self erecting and aligned without use of special tools, equipment or techniques. The structure includes a base assembly, an antenna supporting assembly pivotably secured to the base assembly and adjustably secured to the antenna assembly to enable hour angle fine adjustment of the antenna assembly and a hydraulic jack or electric motor driven worm gear to perform the combined functions of self-erection and elevation angle adjustment pivotably secured to the base assembly and the supporting assembly.

14 Claims, 3 Drawing Figures



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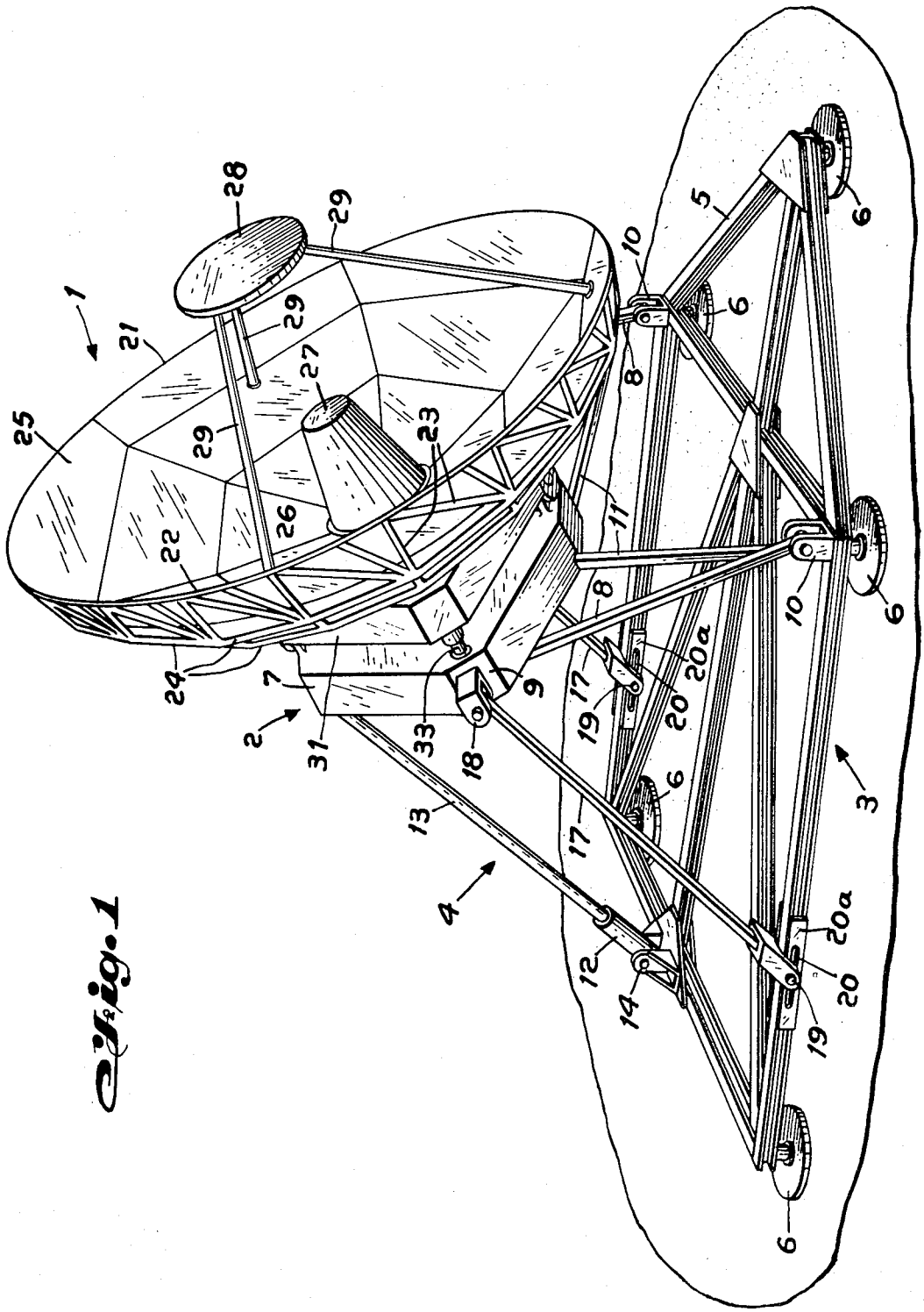


Fig. 1

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Fig. 2

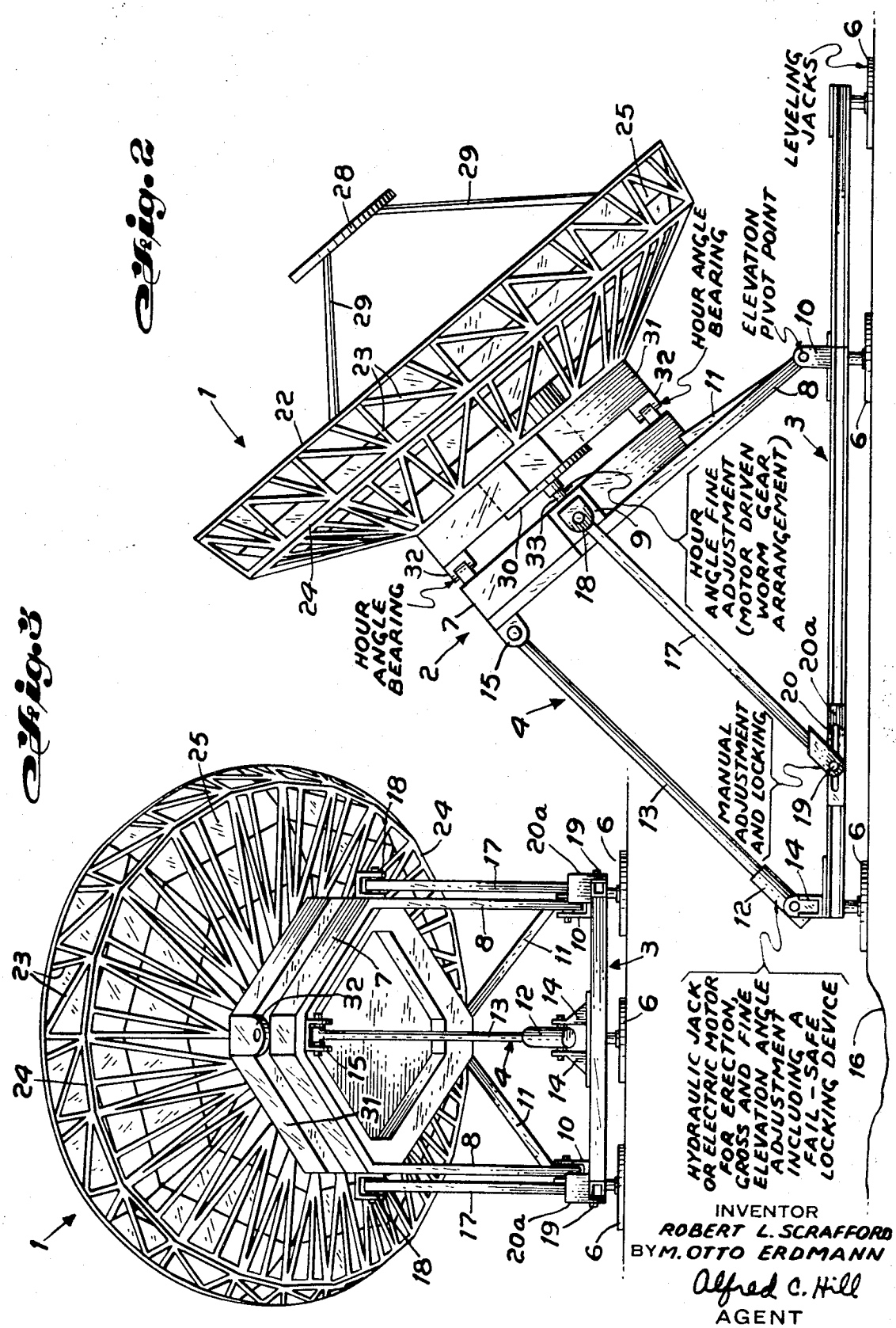


Fig. 3

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ANTENNA MOUNTING STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates to antenna assemblies and more particularly to a mounting structure for an antenna assembly employed with synchronous satellites.

In the past, antenna systems employed at a ground station for communication with synchronous or near synchronous satellites are heavy, complicated in design and have required large complicated equipment for elevation and azimuth motion of the antenna assembly, on-site heavy equipment for erection and special optical alignment tools and procedures. These factors, among others, require excessive time, personnel effort and cost.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an antenna mounting structure which overcomes the aforementioned difficulties of prior art antenna mounting structures.

Another object of the present invention is to provide a rigid, lightweight, and highly transportable antenna and an antenna mounting structure of simple design.

A further object of this invention is to provide an antenna mounting structure that results in low cost when compared to the prior art arrangement.

Still a further feature of this invention the provision of an antenna mounting structure which is self-erecting and thereby does not require on-site heavy equipment for erection.

Still another feature of this invention is the provision of an antenna mounting structure that is easily erected, aligned, and rendered operational within a short period of time without the use of any special tools, equipment or techniques.

A feature of the present invention is the provision of an antenna mounting structure comprising a base assembly; an antenna assembly; an antenna supporting assembly adjustably secured to the antenna assembly and pivotably secured to the base assembly; and a combined erection and elevation angle adjustment assembly pivotably secured to the base assembly and the supporting assembly.

BRIEF DESCRIPTION OF THE DRAWING

The above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of an antenna assembly supported upon the antenna mounting structure in accordance with the principles of this invention;

FIG. 2 is a side elevational view of FIG. 1; and

FIG. 3 is a rear elevational view of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1, 2 and 3, there is illustrated an antenna assembly 1 supported on an antenna mounting structure in accordance with the principles of this invention. The antenna mounting structure includes antenna supporting assembly 2 adjustably secured to antenna assembly 1 and pivotably secured to base assembly 3 and a combined erection and elevation angle adjustment assembly in the form of hydraulic jack or electric motor driven worm gear 4 pivotably secured to base assembly 3 and supporting assembly 2.

Base assembly 3 includes a horizontal frame work 5 having secured thereto leveling jacks 6 to enable leveling of base assembly 3 with respect to the terrain upon which the antenna mounting structure stands.

Antenna supporting assembly 2 includes an antenna support member 7 having a rectangular configuration as illustrated with the orientation thereof illustrated most clearly in FIG. 3. A pair of legs 8 each have one end thereof secured permanently to member 7 adjacent diagonally opposed angles 9 and the other end thereof pivotably secured to base 3 by pivot bearing 10. The lower angle of member 7 is supported by a pair of struts 11 extending from legs 8 to member 7 as illustrated and permanently fastened at both ends thereof to their associated structural elements.

Hydraulic jack or electric motor driven worm gear 4 includes a hydraulic cylinder or electric motor 12 and an extendable rod or worm gear 13. Item 12 is pivotably secured to base assembly 3 by pivot bearing member 14 and item 13 is pivotably secured to member 7 at its upper end by pivot bearing member 15. When item 4 includes the single solid extendable rod 13 as illustrated, provision must be made at the site to receive rod 13, such as depression 16 in the terrain, when member 7 is lowered, or prior to erection, since rod 13 extends from the rear of item 12 when the mounting structure is in a lowered position. Alternatively, rod 13 can be formed of telescoping sections, and in this case, these sections would be self-contained within item 12. A further alternative arrangement would be to employ different length rods for rod 13 and a short stroke hydraulic jack. The stroke of jack 4 would be sufficient to increase the elevation a given number of degrees, for instance, in the order of 10°. At the end of the strokes of the hydraulic jack a longer rod would be substituted for the shorter rod after the supporting assembly 2 has been shored up and the hydraulic jack returned to its lower position. This process would be continued until the antenna mounting structure has been elevated to approximately the desired elevational angle.

Once assembly 2 has been raised to the desired elevational angle out riggers 17 are placed in position, one end thereof being pivotably secured to member 7 by pivot bearing member 18 and the other end thereof being locked in position by bolt 19 engaging adjustment slot 20 in member 20a carried by base assembly 3 include therein an adjustment slot 20. In addition, the fail-safe locking device of item 4 is engaged. This fail-safe device may including a hydraulic circuit including a hydraulic check valve or a rotor brake in the case of an electric motor drive system, and a mechanical pinning.

In accordance with the illustration antenna assembly 1 includes a main reflector 21 formed from ring 22 and hub 26 between which is secured a rigid, light-weight lattice framework composed of radial components 23 and circumferential components 24. To this framework is added reflector panels 25 of proper shape to form a Cassegrain shaped reflective surface. Hub 26 also supports the conical antenna feed 27 extending from the front surface of the main reflector toward the sub-reflector 28 support by a tripod structure including legs

29. Extending from the rear of hub 26 is a water-tight enclosure 30 (FIG. 2) which includes support members for both the antenna feed transmission lines and the low noise receiver assembly. The main and sub-reflector assemblies due to the rigid, light-weight lattice framework ensures operation of the reflector within specification tolerances during operational wind conditions. In addition, antenna assembly 1 has secured to the back of the hub 26 a backing member 31 which is pivotably secured to support member 7 by means of pivot bearing members 32 disposed on a line between diagonally disposed angles of members 7 and 31 and a reversible motor driven worm gear arrangement 33 which is spaced from the diagonally disposed bearings 32 such as at a point on member 7 adjacent angle 9 intermediate the two pivot bearings members 32. This arrangement of bearings 32 and reversible motor driven worm gear arrangement 33 provides an hour angle adjustment arrangement interconnecting backing member 31 and supporting member 7 to permitting hour angle adjustment of antenna assembly 1. The hour angle adjustment enables the scanning of antenna assembly 1 at a fixed elevational angle and is in contrast to an azimuth angle adjustment which requires also a variable elevational angle.

As should be apparent from the foregoing, the antenna assembly and the antenna mounting structure is composed of four separate main assemblies formed from separable components and, as a result, renders the antenna assembly and the antenna mounting structure readily disassembled for transportation from one location to another location by either an aircraft, such as a cargo DC8 or 707, or tractor-trailer.

The maximum weight of any one piece will not exceed 400 pounds thereby permitting easy moving and positioning by erection personnel without the use of special or heavy equipment.

The erection of the antenna assembly 1 and the antenna mounting structure is accomplished as follows.

All the components and parts of each assembly is match-marked and dowled for simplicity and repeatability of assembly. Base assembly 3 is assembled and coarse leveled on the terrain by leveling jacks 6. Antenna supporting assembly 2 is then assembled, mounted in pivot bearing members 10 and secured to hydraulic jack or electric motor driven worm gear 4 near the 0° elevational position. Member 31 is secured to member 7 by bearing members 32 and worm gear arrangement 33 prior to assembling the main and sub-reflector sub-assemblies. The supporting assembly 2 and the antenna assembly 1 is then raised by item 4 to approximately the desired elevational angle. The out riggers 17 are then secured in position and locked in place and at the same time the fail-safe locking device of item 4 is engaged. Additional guying, if required during dynamic wind loading, of supporting assembly 2 from member 7 to ground anchors completes the erection procedure.

No critical optical alignment or any heavy equipment is required to erect the antenna assembly and align the antenna for operational use. Fine hour angle adjustment is accomplished by the reversible motor driving worm gear arrangement 33 with coarse hour angle adjustment being accomplished prior to assembly and erection by appropriate positioning base assembly 3. Item 4 is sensitive enough in its motion to provide for both coarse and fine elevation angle adjustment. Both of the fine adjustments would be required to compensate for the synchronous satellite drift.

In accordance with the antenna mounting structure of the present invention, the mounting structure and the antenna assembly can be assembled and oriented to position with a minimum of three men and without the aid of additional mechanical equipment, such as a crane or hoist. The same elevation-axis drive is used for erection and for elevation adjustment. Both adjustable axes, elevation and hour angle axes, are orthogonal to each other and in a plane perpendicular to the nominal line of sight to the satellite. Initial azimuth positioning of the antenna mount at the normal operating angle is not critical and can be coarse set to within a few degrees using simple alignment devices, as the fine adjustment range in hour-angle has sufficient lattitude to compensate for this initial misalignment. The resulting antenna mounting structure due to the foregoing has a substantially reduced cost with respect to the prior art arrangements mentioned above under the heading "-Background of the Invention."

The antenna mounting structure of this invention may be employed in permanent installations as well as non-permanent installations. In a permanent installation, all horizontal structural members of base assembly 3 can be eliminated and the mounting structure set on three concrete piers resulting in a further lowering of cost without sacrificing performance.

The components of the antenna mounting structure and antenna assembly above the pivot point in member 10 are made of aluminum and the members of base assembly 3 are made of steel.

While we have described above the principles of our invention in connection with specific apparatus, it is to be more clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the objects thereof and in the accompanying claims.

We claim:

1. An antenna mounting structure comprising:
a base assembly;
an antenna assembly;
an antenna supporting assembly adjustably secured to said antenna assembly and pivotably secured to said base assembly at at least a pair of given pivot points; and
a combined erection and elevation angle adjustment assembly pivotably secured to said base assembly and said supporting assembly to pivotably raise said antenna assembly and said supporting assembly from said base assembly about said pair of given pivot points to a desired operating elevational angle for said antenna assembly and to enable adjustment of said elevation angle after said antenna assembly is raised to said desired operating elevational angle.

2. A structure according to claim 1, wherein
said combined assembly includes
a hydraulic jack pivotably secured to said base assembly.

3. A structure according to claim 2, wherein
said hydraulic jack includes therein
a fail-safe locking device.

4. A structure according to claim 1, wherein
said combined assembly includes

an electric motor driver worm gear pivotably secured to said base assembly.

5. A structure according to claim 4, wherein said electric motor driven worm gear includes therein
a fail-safe locking device.

6. A structure according to claim 1, wherein said supporting assembly includes
at least a pair of legs each have one end thereof pivotably secured to said base assembly,
an antenna support member secured to the other end of said legs, and
an hour angle adjustment arrangement disposed between and interconnecting said antenna assembly and said support member.

7. A structure according to claim 6, wherein said antenna assembly includes
a backing member; and
said hour angle adjustment arrangement includes
a pair of pivoting devices interconnecting said backing member and said support member at two spaced points, along a given line, and
a motor driven worm gear arrangement interconnecting said backing member and said support member at a third point spaced from said given line and disposed intermediate said two spaced points.

8. A structure according to claim 1, further including
a pair of outriggers each pivotably secured at one end thereof to said supporting assembly and adjustably secured at the other end thereof to said base assembly.

9. A structure according to claim 8, wherein said combined assembly includes
a hydraulic jack having a fail-safe locking device pivotably secured to said base assembly.

10. A structure according to claim 8, wherein said combined assembly includes
an electric motor driven worm gear having a fail-safe locking device pivotably secured to said base assembly.

11. A structure according to claim 8, wherein said supporting assembly includes
at least a pair of legs each having one end thereof pivotably secured to said base assembly,
an antenna support member secured to the other end of said legs, and
an hour angle adjustment arrangement disposed between and interconnecting said antenna assembly and said support member.

12. A structure according to claim 8, wherein said antenna assembly includes
a backing member; and
said hour angle adjustment arrangement includes
a pair of pivoting devices interconnecting said backing member and said support member at two spaced points along a given line, and
a motor driven worm gear arrangement interconnecting said backing member and said support member at a third point spaced from said given line and disposed intermediate said two spaced points.

13. A structure according to claim 8, wherein said supporting assembly includes
at least a pair of legs each having one end thereof pivotably secured to said base assembly,
an antenna support member secured to the other end of said legs, and
an hour angle adjustment arrangement interconnecting said antenna assembly and said support member;
said antenna assembly includes
a backing member;
said hour angle adjustment arrangement including
a pair of pivoting devices interconnecting said backing member and said support member at two spaced points along a given line; and
a motor driven worm gear arrangement interconnecting said backing member and said support member at a third point spaced from said given line and disposed intermediate said two spaced points; and
said combined assembly includes
a hydraulic jack having a fail-safe locking device, one end of said jack being pivotably secured to said base assembly and the other end of said jack being pivotably secured to said support member.

14. A structure according to claim 8, wherein said supporting assembly includes
at least a pair of legs each having one end thereof pivotably secured to said base assembly,
an antenna support member secured to the other end of said legs, and
an hour angle adjustment arrangement interconnecting said antenna assembly and said support member;
said antenna assembly includes
a backing member;
said hour angle adjustment arrangement including
a pair of pivoting devices interconnecting said backing member and said support member at two spaced points along a given line; and
a motor driven worm gear arrangement interconnecting said backing member and said support member at a third point spaced from said given line and disposed intermediate said two spaced points; and
said combined assembly includes
an electric motor driven worm gear arrangement having a fail-safe locking device, one end of said worm gear arrangement being pivotably secured to said base assembly and the other end of said worm gear arrangement being pivotably secured to said support member.

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