

April 20, 1965

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3,179,211

PORTABLE ANTENNA SUPPORT RING

Filed May 25, 1960

2 Sheets-Sheet 1

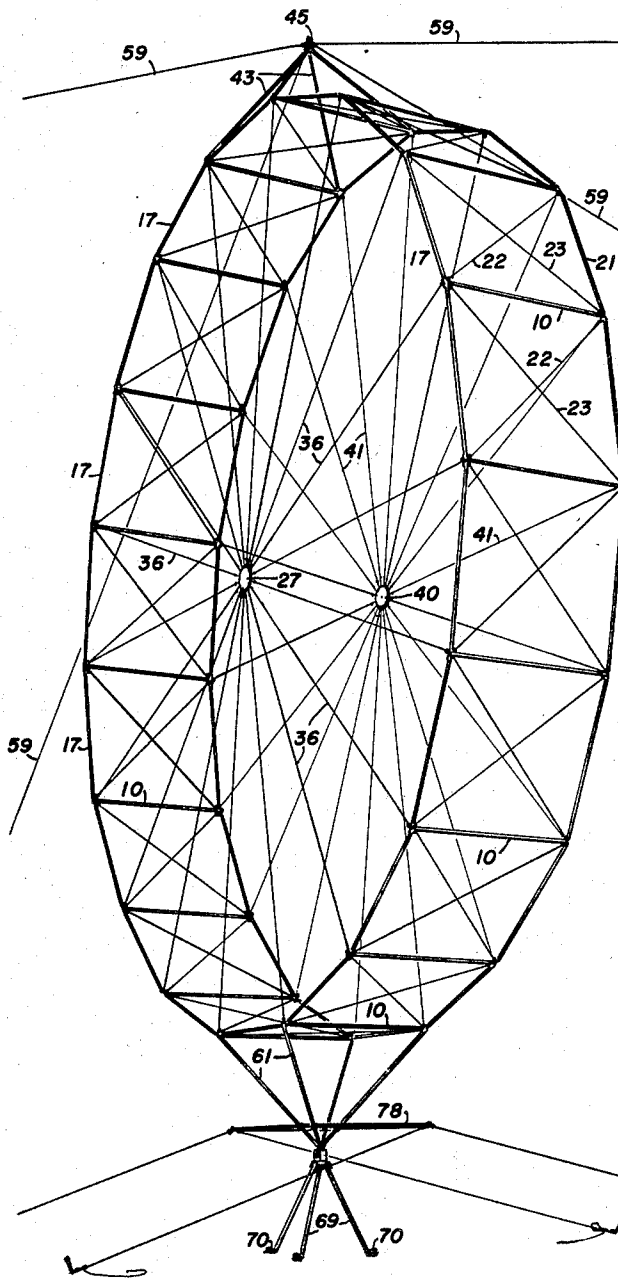


FIG. 1.

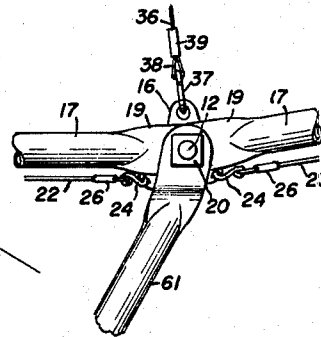


FIG. 2.

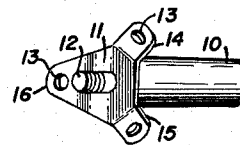


FIG. 3.

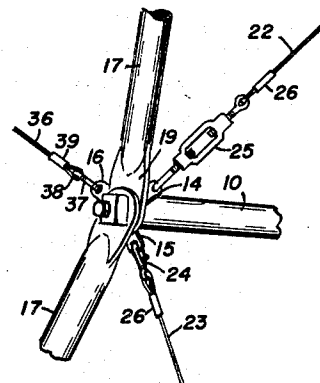


FIG. 4.

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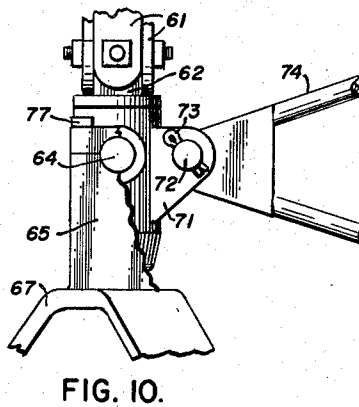
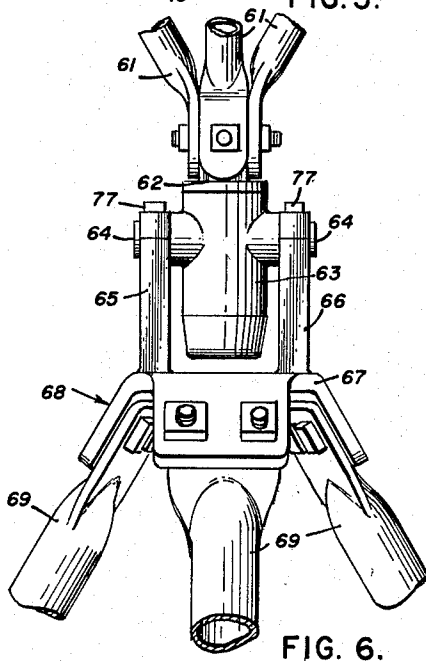
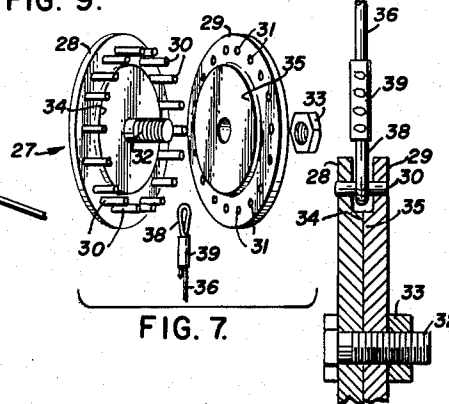
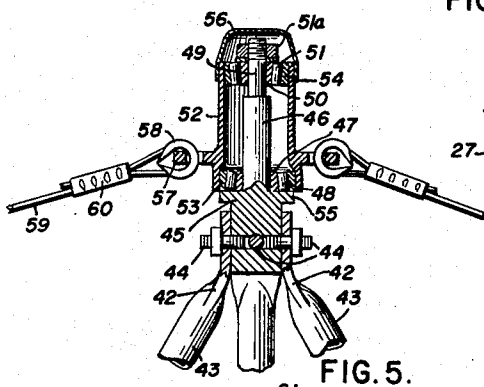
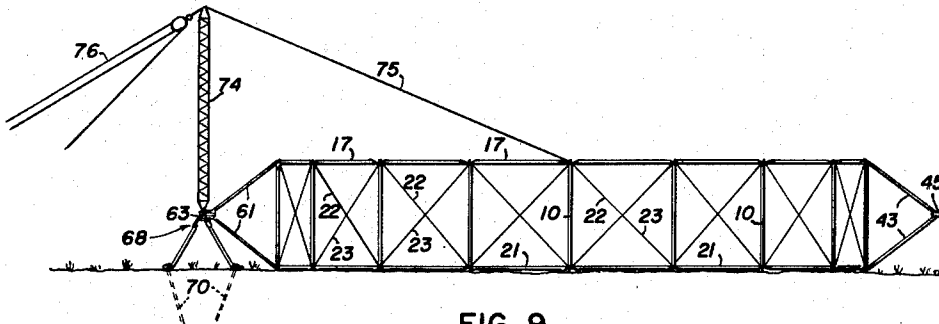
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PORTABLE ANTENNA SUPPORT RING

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2 Sheets-Sheet 2



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PORTABLE ANTENNA SUPPORT RING
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Filed May 25, 1960, Ser. No. 31,589
5 Claims. (Cl. 189-13)

This invention relates to antenna supports and has reference to a pivotally mounted structure adapted for quick on site assembly and orientation.

The use of antenna configurations and types other than dipoles and rhombics is advantageous and desirable in many military, commercial and scientific applications having special requirements for gain, polarization or directional characteristics.

Where elements of a large directional antenna are to be mounted in one plane and reflector components are to be mounted in a second plane parallel therewith, the fabrication of large yet portable supporting structures has heretofore presented a number of difficulties. In such structures, weight and strength are of prime importance and are interdependent in many respects. For conventional forms of construction a small increase in the area of a supported surface leads generally to a large increase in the strength requirements of some supporting members or results in structural complexity; either effect tends to restrict the portability of the structure. Combat conditions may require that the parts of an antenna structure for military use be transported by foot over rough terrain and then be assembled and erected by hand under adverse working conditions. The same stringent limitations may obtain in the construction of interim or emergency commercial systems, and the logistic circumstances of some scientific endeavors also attest to the importance of portability. Generally, directional antennas can be used to the greatest advantage when their physical orientation is subject to adjustment. Where selective communication is the purpose of the adjustment, a pivotally mounted supporting structure greatly increases the utility of an antenna; under extreme weather conditions a pivotal mounting also provides an added safety factor in that it allows a supporting structure to be oriented for minimum wind resistance. In a large and rigid antenna supporting structure, the combined features of portability and pivotal mounting would do much to advance the utility of field operations and provide improved means for the establishment of emergency communication facilities.

Accordingly, an object of the present invention is to provide a portable structure capable of supporting planar elements of a large antenna.

Another object of the present invention is to provide an antenna structure capable of supporting antenna elements and reflector components in separate and parallel planes.

A particular object of the present invention is to provide means whereby a large antenna supporting structure of the type described may be constructed of component parts each of which is light enough to be transported on foot.

A further object of the invention is to provide a construction for an antenna structure whereby component parts may be assembled by unskilled labor and wherein the assembled structure may be erected and manipulated by hand.

Another object of the present invention is to provide means rotatably supporting an antenna structure of the type described.

It is also an object of the present invention to provide means whereby an antenna supporting structure may be assembled on the ground and erected in rigid form by hand.

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An additional object of the present invention is to provide a portable and rotatable planar antenna supporting structure which offers relatively low broadside resistance to wind.

These and other objects will become apparent from the following description and the accompanying drawing, wherein:

FIGURE 1 is a perspective view of the invention shown assembled and erected.

FIGURE 2 is an enlarged and broken perspective view of perimeter bars and attached tubular legs at the base of the invention.

FIGURE 3 is an enlarged and broken perspective view of a spacer bar and anchor plate of the invention.

FIGURE 4 is an enlarged and broken perspective view of a spacer bar in its assembled relationship to perimeter bars and strut assemblies of the invention.

FIGURE 5 is a sectional view of the upper bearing of the invention.

FIGURE 6 is a rear elevational view of the base bearing member of the invention and of a supporting tripod assembly.

FIGURE 7 is an exploded perspective view of a hub of the invention.

FIGURE 8 is a fragmentary transverse sectional view of the hub illustrated in FIGURE 7.

FIGURE 9 is a side elevational view of the invention shown assembled but not erected.

FIGURE 10 is a side elevational view of the base bearing member of the invention and showing the pivotal connection of a gin pole thereto.

Generally, the invention is comprised of a plurality of elongate tubular members of equal length joined end to end into two substantially circular frames which are held in spaced relationship by additional tubular members. Tubular members of each circular frame are held in longitudinal compression against adjacent tubular members by cables extending radially in tension from a central hub to the perimeter of the frame. The radially extending cables on at least one side of the frame are made of a non-conducting material and the hub to which each cable is attached within that frame is likewise made of an insulating material so that an antenna attached thereto is not electrically united with its supporting surface. In many applications the radial cables of the other circular frame will serve as part of a reflector and hence may be made of metal. The spaced circular frames are mounted between upper and lower bearings so that they may be pivotally rotated as a unit, and the lower bearing is pivotally supported upon a supporting tripod so that the frames may be assembled on the ground and then be pivotally erected through use of a gin pole with block and tackle.

With specific reference to the drawings, a plurality of spacer bars 10 are spaced from one another in parallel relationship and are disposed horizontally with respect to the ground. Each of the spacer bars 10 is formed as an elongate tubular member and all are of equal length. Triangular anchor plates 11 are respectively attached to each end of each tubular member 10 and are disposed perpendicularly to the axes thereof. A threaded rod 12 is centrally attached to each anchor plate 11 and projects coaxially with and exteriorly of a spacer bar 10. Circular openings 13 are formed in the corners 14, 15 and 16 of each anchor plate and two of the corners 14 and 15 are folded inwardly toward the spacer bar; the remaining or unbent corner 16 of each pair of anchor plates 11 at opposite ends of a spacer bar 10 extend in the same direction away from the axis of the spacer bar. A plurality of forward perimeter bars 17, each constructed as an elongate tubular member, are disposed with their axes in a common vertical plane and are arranged ad-

jacently in end to end relationship to define a circular frame 18 which is perpendicular to the spacer bars 10. All of the perimeter bars 17 are of equal length and each is constructed with its opposite ends 19 pressed together into flat surfaces parallel with the plane of the circular frame 18. Corresponding openings in adjacent and overlapping ends 19 of two successive perimeter bars 17 receive the threaded rod 12 projecting from an anchor plate 11 on a spacer bar 10 and are secured thereto by a nut 20; one of the perimeter bars 17 then extends to connection at its opposite end with a threaded rod on the corresponding end of another spacer bar, and in like manner successive perimeter bars are each connected at their ends to the threaded rods projecting from anchor plates at corresponding ends of the plurality of spacer bars. At the opposite or rearward ends of the plurality of spacer bars 10 rear perimeter bars 21 are secured by nuts 20 to threaded rods 12 projecting outwardly of anchor plates 11. The spacer bars 10, forward perimeter bars 17 and rearward perimeter bars 21 are all of substantially equal length and corresponding forward and rear perimeter bars extending between a pair of spacer bars constitute a series of structural squares with successive squares sharing a common side. Within each square, a pair of diagonal struts 22 and 23 extend in tension between openings 13 in bent corners of diagonally opposed anchor plates 11. Each diagonal strut 22 and 23 is provided with a hook 24 at one of its ends and a turnbuckle 25 at its other end; the body of the strut consists of a length of cable having its ends respectively looped through appropriate openings in the hook 24 and turnbuckle 25 and folded back upon itself within a collet 26. In the closed structure formed by the continuous series of squares there is an even number forward perimeter bars 17 and a like number of rearward perimeter bars 21 and spacer bars 10.

A forward hub 27 is constructed of two non-conducting discs 28 and 29 identical in diameter with one another. One of the discs 28 is provided with a plurality of pegs 30 projecting perpendicularly from one face of the disc and regularly arranged near the circumference thereof. The other disc is provided with a plurality of openings 31 positioned near its circumference and adapted to receive the projecting ends of the pegs 30. Openings in the centers of the discs 28 and 29 are adapted to receive a non-metallic bolt 32 projecting through and from the first disc 28 in the same direction as the pegs 30. A non-metallic nut 33 engages so much of the bolt 32 as projects beyond the second disc 29 when the pegs 30 of the first disc 29 are received by the openings 31 of the second disc. Circular spacer plates 34 and 35 integrally and centrally formed with the respective first and second discs 28 and 29 of the forward hub 27 keep the perimeters of opposed faces of the first and second disc in spaced relationship when the pegs 30 are received by the openings 31. The number of pegs 30 of the hub 27 corresponds to the number of spacer bars 10 of the supporting structure and a non-conducting forward flexible line 36 extends from each peg to a hook 37 engaging the opening in the unbent corner 16 of a corresponding anchor plate 11 on the forward end of a spacer bar 10. Each end of each flexible line 36 is formed as a loop 38 held by a collet 39.

A rear hub 40 identical in construction to the forward hub 27, except that it may be fabricated of metal, is centrally positioned in the plane of the rearward perimeter bars 21, and a rearward flexible line 41, formed from a length of metal cable, extends from each peg of the rearward hub to an opening 13 in the unbent corner 16 of a corresponding anchor plate 11 on the rearward end of a spacer bar 10. In the manner previously described for the ends of the forward flexible lines 36, the rearward flexible lines 41 are each looped about a peg of the hub 40 and are secured by a collet 39 at one of their ends and are likewise looped and secured to a hook 37 at their

opposite ends; the various hooks are received by the openings 13 in the unbent corners 16 of the several anchor plates 11.

A generally cylindrical and skeletal structure equal in length to the length of a spacer bar 11 and equal in radius to the length of a flexible line 36 is thus formed by the previously described components and is made rigid by tension of the flexible lines which, in turn, exerts a force of longitudinal compression upon each of the perimeter bars 17 and 21.

On the top of the cylindrical structure flattened ends 42 of four tubular legs 43 are respectively received by the four threaded rods 12 projecting from the ends of two next adjacent bars 11 and are secured thereto by the nuts 20. The four tubular legs 43 extend upwardly and convergently and each is received and engaged at its upper end by one of four studs 44 projecting laterally from the lower end of a cylindrical bearing block 45. A shaft 46 projecting vertically from the bearing block 45 is received by the inner race 47 of a thrust bearing 48 of the tapered roller type. The upper portion 49 of the shaft 46 is of reduced diameter and receives the inner race 50 of a second thrust bearing 51. A nut 51a engages threads on the upper end of the shaft 46 and bears downwardly upon the inner race 50 of the second thrust bearing 51. A sleeve 52 enlarged at its lower end to accommodate the outer race 53 of the first thrust bearing 48, is circumjacently attached at its upper end to the outer race 54 of the second thrust bearing 51 and surrounds the shaft 46. A circular flange 55, integrally constructed with the bearing block 45, covers the lower end of the sleeve 52 whereas a cap 56 engages the outer surface of the sleeve and encloses the upper end of the same. Bosses 57 project laterally from the sleeve 52, and each boss is provided with an opening through which a stirrup 58 is positioned. One end of a guy line 59 is positioned about each stirrup and is there secured by a collet 60; the opposite end of each guy line is tied to a stake (not shown) driven into the ground at a suitable distance from the antenna structure.

On the base of the cylindrical structure four tubular legs 61 are secured to threaded rods 12 and extend convergently downward and are attached to a lower bearing member 62. The construction of the lower tubular legs 61 and the bearing member 62 which includes a shaft and two thrust bearings within a sleeve 63 is identical to the construction described for its upper counterpart except that the bosses 57 of the upper sleeve 52 are omitted in the lower sleeve and, in their place, trunnions 64 project laterally from the lower sleeve. Split bearings 65 and 66 receive the trunnions 64 and are supported by the table 67 of a tripod 68 which includes three tubular legs 69 bolted to the table and held to the ground by stakes 70. The height of the tripod 68 as measured from the ground to the journal boxes of the split bearings 65 and 66 is equal to one half the length of a spacer bar 11.

Ears 71 are attached to and project forwardly from the lower sleeve 63, and a horizontally disposed pin 72 projects through aligned openings in the ears where it is secured by cotter keys 73. One end of a gin pole 74 is received by the pin 72 and an erection line 75 is strung from the projecting end of the gin pole to the forward hub 27. A block and tackle 76 are rigged from the projecting end of the gin pole 74 to a stake (not shown) driven into the ground forwardly of the tripod.

Because the spacer bars 10, perimeter bars 17 and 21 and tubular legs 43 and 61 are of substantially identical length, packaging of the dismantled structure is greatly simplified and all parts can be placed in a few boxes amenable to hand portage when necessary. For assembly, a sufficient number of perimeter bars 21 to form the rearward frame are laid out in a circle upon the ground, and spacer bars 11 are attached thereto. The remaining perimeter bars 17 are then attached to the projecting ends of the spacer bars 11 and the diagonal struts 22 and 23

are attached to the structure and tightened by their turnbuckles 25. The tubular legs 43 and 61 are then attached to diametrically opposed portions of the structure. The rearward hub 40 with all of its flexible lines 41 preassembled and attached thereto is then placed on the ground in the center of the assembled structure and the flexible lines are successively attached to the unbent corners 16 of the anchor plates 11. All of the rear flexible lines 41 except one are fixed in length by the collets 39 at their opposite ends, and all except that one are attached to the rearward frame. Likewise, all of the flexible lines 36 except one of the forward frame are of fixed length and these are attached to the forward frame 18, having been preassembled with the forward hub. The various flexible lines are attached to the structure in a manner and order such that the last remaining flexible lines to be attached are positioned one above the other within the assembled but un-erected structure; these last two flexible lines are provided with turnbuckles (not shown). If all the spacer bars except one are positioned to form a circle on the ground, and that one with its perimeter bars is pivoted outwardly of the circle, it will be seen that the effective diameter of the structure so disposed is less than the diameter of the completely assembled structure by an approximate factor of the length of a perimeter bar divided by $\frac{1}{2} \pi$. By so positioning the peripheral members of the structure during attachment of the flexible lines 36 and 41 sufficient slack is provided for each flexible line to permit attachment to the several anchor plates. When all other flexible lines have been so attached, the last two flexible lines are secured to the anchor plates 11 of the outwardly pivoted spacer bar and the turnbuckles of these two lines are used to urge the radially extended spacer bar toward the hubs and to expand the structure into its ultimate diameter. Proper tension can be imparted to the last flexible lines by use of a torque wrench on their turnbuckles.

Once the rigid cylindrical structure has been assembled, the split bearings 65 and 66 are assembled about the trunnions 64 of the lower sleeve 63 and opposite members of each split bearing are fastened together by bolts 77. The tripod 68 is then staked to the ground, guy lines 59 are attached to the upper sleeve 52, and the gin pole 74 is attached to the ears 71 on the lower sleeve 63 by the pin 72. By block and tackle 76 the structure is then erected upon the tripod 68 and the guy lines 59 are staked to the ground at a suitable distance from the structure. After erection, the gin pole 74 may be removed from the sleeve 63 and an azimuth bar 78 may be attached to the structure to facilitate its rotation about the upper and lower bearings.

A reticular antenna may be attached to and preassembled with the forward flexible lines so that the previously described assembly of the rigid structure results in the incorporation of an antenna into the forward frame. Likewise, a reticular reflector may be preassembled and incorporated in the rearward frame. Means for constructing such antennas are disclosed and claimed in my copending application, Serial No. 31,717, filed May 25, 1960, now Patent No. 3,129,427.

The invention is not limited to the exemplary construction herein shown and described, but may be made in various ways within the scope of the appended claims.

What is claimed is:

1. A supporting structure for antennas or the like, said structure comprising: a plurality of forward perimeter bars having their principal axes in a common plane and being pivotally connected end to end in continuous and substantially circular arrangement, an electrically non-conducting forward hub centrally positioned with respect to said arrangement of said forward perimeter bars, electrically non-conducting forward flexible lines extend-

ing in tension between said forward hub and said pivotal connections of said forward perimeter bars, a plurality of rearward perimeter bars having their principal axes in a common plane parallel with but spaced from said plane of said forward perimeter bar and being pivotally connected end to end in continuous and substantially circular arrangement, a rearward hub centrally positioned with respect to said arrangement of said rearward perimeter bars, rearward flexible lines extending in tension between said rearward hub and said pivotal connections of said rearward perimeter bars, rigid spacing means connecting said forward perimeter bars to said rearward perimeter bars, a base stand, a bearing, means supporting said bearing on said base stand, a vertical shaft in said bearing, and means supporting said plurality of forward perimeter bars and said plurality of rearward perimeter bars on said shaft.

2. The invention as defined in claim 1 and including: a second bearing positioned diametrically opposite said first bearing, a vertical shaft in said second bearing, means connecting said plurality of forward perimeter bars and said plurality of rearward perimeter bars to said shaft in said second bearing, and means fixing the position of said second bearing with respect to the ground.

3. The invention as defined in claim 1 and wherein said means supporting said bearing on said base stand includes a pivot on said bearing, and means on said base stand rotatably receiving said pivot.

4. The invention as defined in claim 3 and including: a gin pole demountably connected to said bearing and disposed perpendicularly to said pivot, an erection line connecting said gin pole to one of said hubs, and a block and tackle connecting said gin pole to the ground.

5. A supporting structure for antennas or the like, such structure comprising: a plurality of perimeter bars having their principal axes in a common plane and being pivotally connected end to end in continuous and substantially circular arrangement, an electrically non-conducting forward hub centrally positioned with respect to said arrangement of forward ones of said perimeter bars, electrically non-conducting forward flexible lines extending in tension between and connected to said forward hub and said pivotal connections of said forward perimeter bars, a plurality of rearward perimeter bars having their principal axes in a common plane parallel with but spaced from said plane of said forward perimeter bar and being pivotally connected end to end in continuous and substantially circular arrangement, a rearward hub centrally positioned with respect to said arrangement of said rearward perimeter bars, rearward flexible lines extending in tension between and connected to said rearward hub and said pivotal connections of said rearward perimeter bars, and rigid spacing means connecting said forward perimeter bars with said rearward perimeter bars.

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