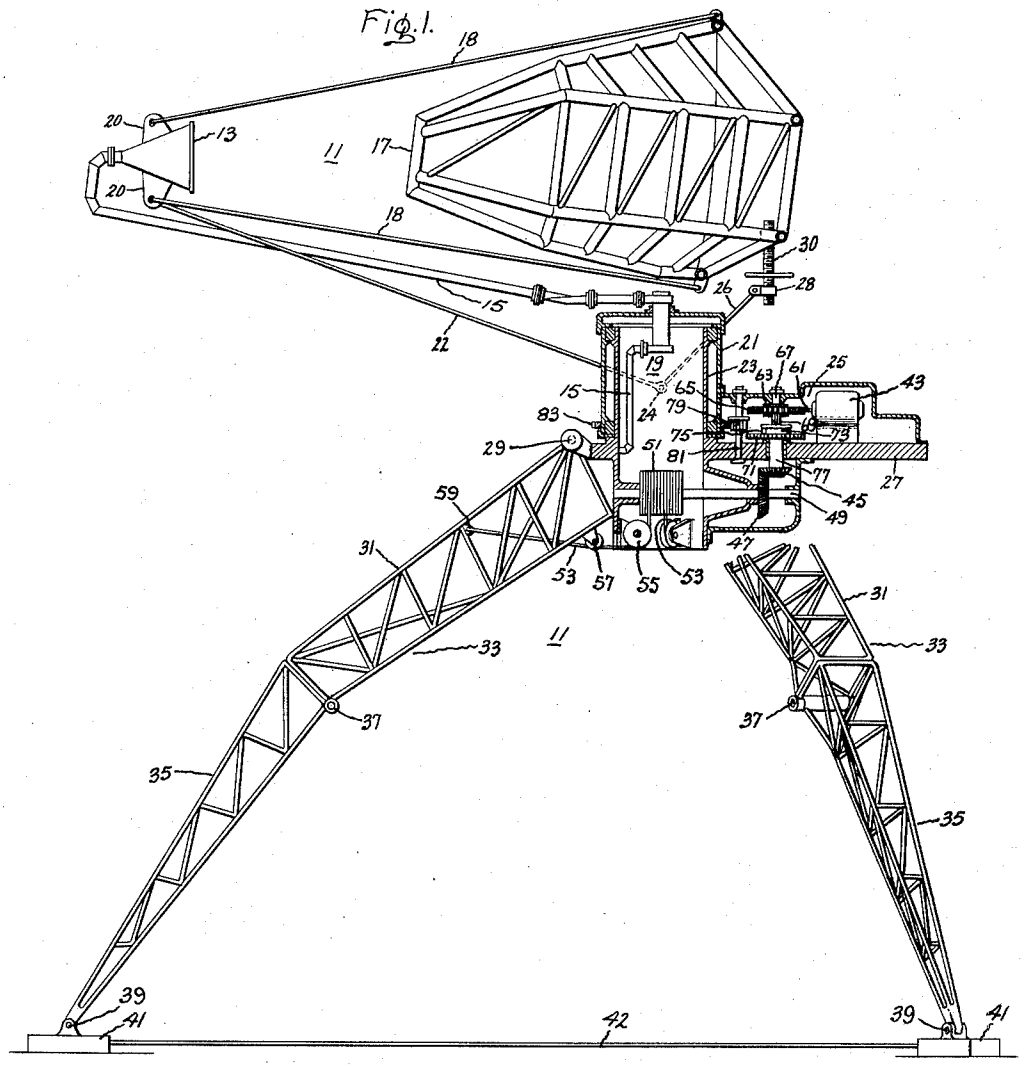
Nov. 11, 1958 E. P. WARNERY 2,860,342

SUPPORT STRUCTURE FOR RADAR ANTENNA SYSTEMS

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Fig. 1.



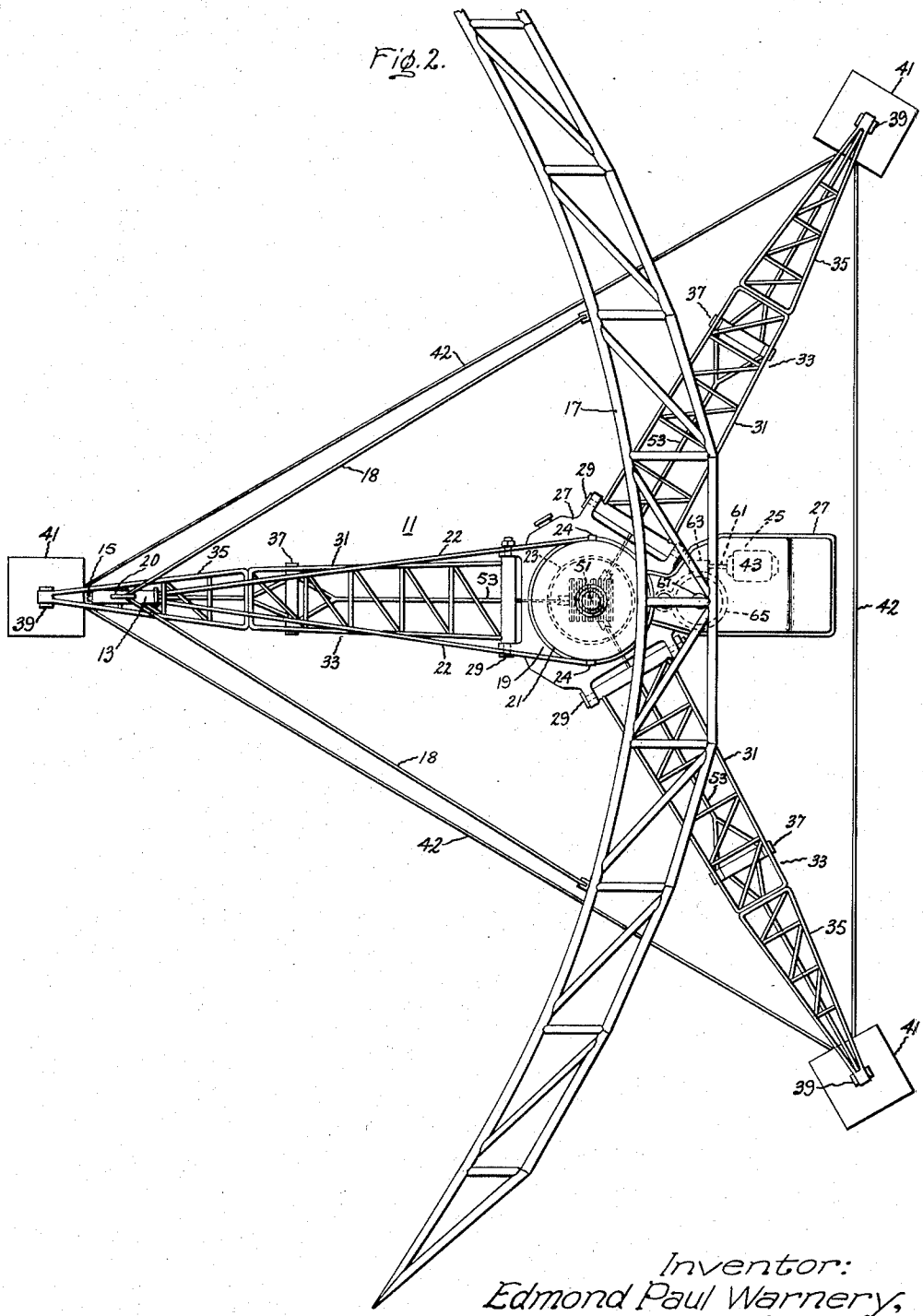
Inventor:
Edmond Paul Warnery,
by Charles M. Hutchins
His Attorney.

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SUPPORT STRUCTURE FOR RADAR ANTENNA SYSTEMS

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Fig. 2.



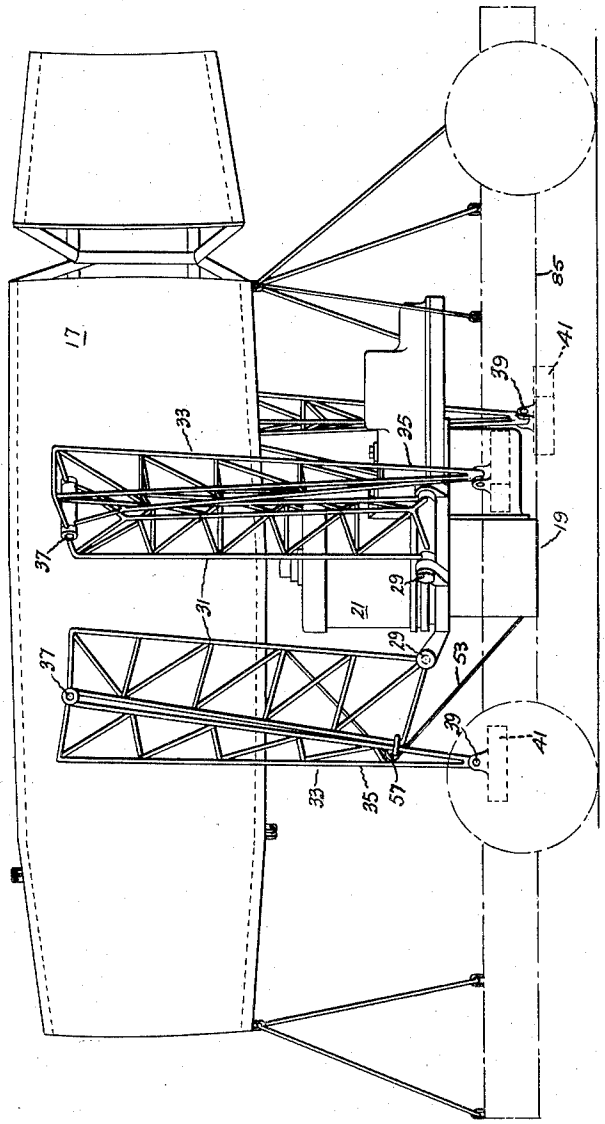
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SUPPORT STRUCTURE FOR RADAR ANTENNA SYSTEMS

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Fig. 3.



Inventor:
Edmond Paul Warnery,
by Charles M. Hutchins
His Attorney.

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SUPPORT STRUCTURE FOR RADAR ANTENNA SYSTEMS

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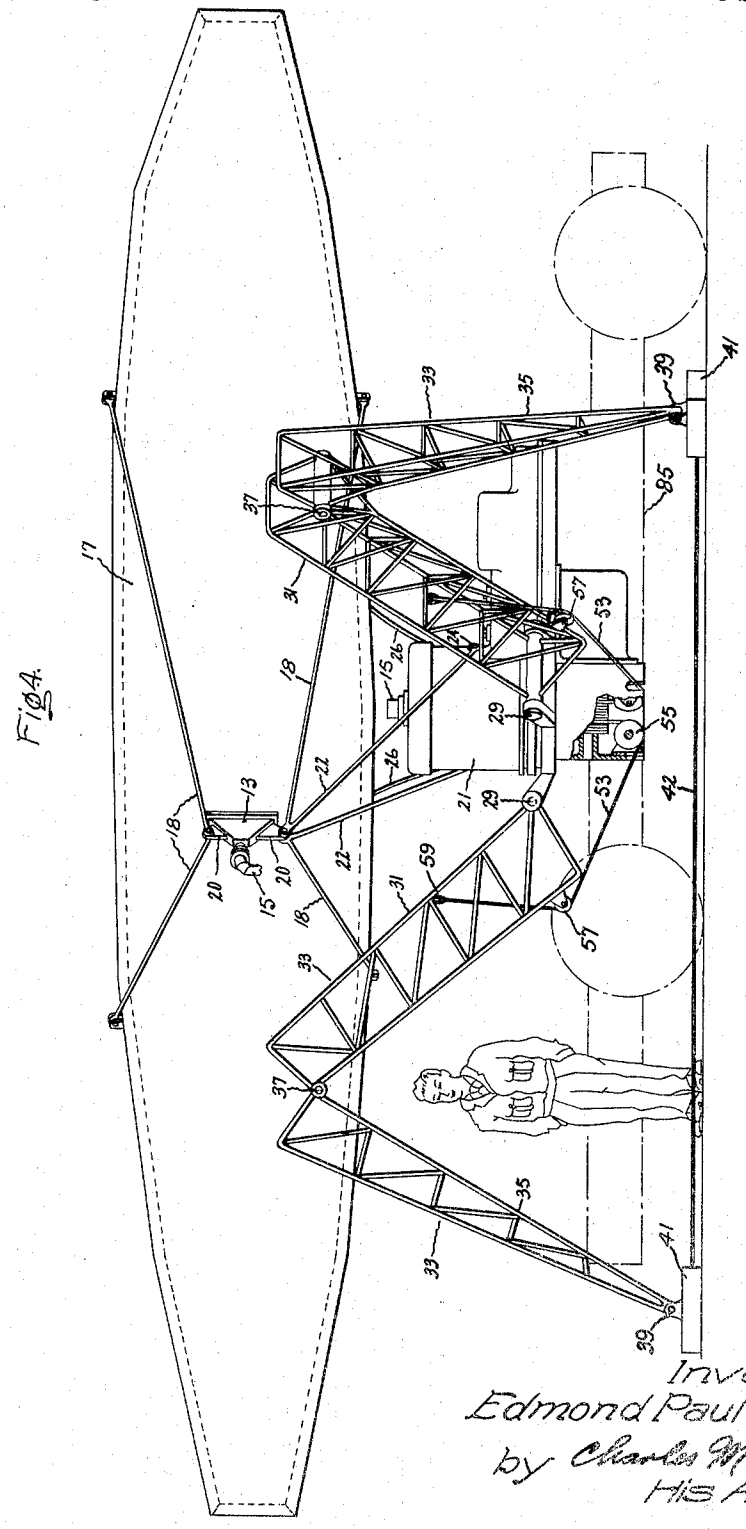


FIG 4.

Inventor:
Edmond Paul Warnery,
by Charles M. Hutchins
His Attorney.

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2,860,342

SUPPORT STRUCTURE FOR RADAR ANTENNA SYSTEMS

Edmond Paul Warnery, Boulogne, France, assignor to General Electric Company, Schenectady, N. Y.

Application April 3, 1953, Serial No. 346,642

Claims priority, application France May 19, 1952

6 Claims. (Cl. 343—881)

The present invention relates to radar antenna systems, and more particularly, to supporting structures therefor.

In present-day systems, the mounting and supporting of antennas meet with certain difficulties; in some cases the antenna and its supporting structure are manufactured separately and are assembled in place, but the loading and unloading of certain elements are delicate operations, especially the handling of the antenna itself which must have a perfect geometric shape. In other cases, the mounting of the antenna and its supporting structure requires the use of hoists which have to be installed first at the site at which the antenna is to be used.

The present invention eliminates such disadvantages and makes it possible to assemble completely the antenna and its supporting structure in the shop, to ship them on a truck or trailer in a minimum of space, and to install them in place without any special hoisting equipment.

An object of this invention is to provide a novel support structure for radar which incorporates, as an integral part thereof, the hoisting equipment required for setting up and supporting the antenna.

Another object is to provide an antenna support that may easily and quickly be collapsed and/or erected.

Still another object is to provide an antenna support of the type described, which comprises an adjustable frame capable of being folded into a minimum of space for transportation and of being quickly and easily erected to form a rigid support.

Another object of the invention is to provide an antenna support consisting of a platform which is supported on a plurality of legs each being foldable about an axis intermediate the ends thereof, the platform being arranged to support an antenna while the legs are in extended condition as well as in folded condition, the arrangement being such that the platform and the antenna supported thereon may be arranged in knockdown condition and transported to a site of operation at which point the platform may be raised by extending the tripod legs thus placing the antenna in position for operation.

Briefly stated, in accordance with one aspect of my invention, I provide a rotatable antenna structure that is provided with a platform supported by a plurality of hinged and foldable legs adapted to be folded up into a compact space for facilitating transportation of the antenna and in which power-operated means are provided for effecting the unfolding of the legs and the raising of a center platform from the lower, folded position is accomplished, and in which the same power means are also used for rotating or scanning of the reflector during normal operation thereof, thereby obviating the necessity for additional crane or derrick equipment for setting up the heavy antenna structure.

My invention will be better understood from the following description taken in connection with the drawing and its scope will be pointed out in the appended claims:

In the drawing:

Figs. 1 and 2 are elevation and top views, respectively,

of a radar antenna system and base supporting structure therefor constructed according to the invention and assembled in their final position;

Fig. 3 is a schematic elevation of the same elements loaded on a truck for shipment; and

Fig. 4 is a similar elevational showing of one stage of the assembly operation of the above elements.

Figs. 1 and 2 illustrate the elements of an ultra-high frequency antenna system 11 and a support structure therefor according to the invention. The antenna 11 may be any conventional horn-fed reflector type well-known to those skilled in the microwave art, and may include a horn radiator 13 adapted to be energized by high-frequency wave energy from a transceiver (not shown) to which the horn is connected by a conventional transmission line, here shown as a wave guide 15 of any suitable type. The radiation from the horn 13 irradiates a conventional reflector 17 which can be of any suitable shape and size and which for many purposes is quite large and of considerable weight. The horn 13 and reflector 17 may be maintained in proper spatial alignment by means of connecting rods 18, which as more clearly shown in Fig. 4, extend between a pair of brackets 20 fixed to the horn 13 and spaced points on the reflector 17.

The antenna system 11 is supported for rotation about a vertical axis by a turret 19 having relatively movable and stationary parts 21, 23, respectively, of which the movable part may be rotated as by a motor drive 25. Connecting rods 22 extending between the lower bracket 20 and a pair of diametrically opposed points 24 on the movable part 21 of the turret 19, provide forward support for the antenna 11, while connecting rods 26 extending between suitable anchor points on the movable part 21 and an adjustable collar 28 on a threaded member 30 that is fixed to the reflector 17 provide rearward support. Adjustment of the effective axis of irradiation of the reflector 17 by the horn 13 can be had by rotating the threaded member 30, thereby to tilt the reflector relative to the axis of the horn 13. To reduce the space requirements the reflector 17 is preferably made up of several parts that may be hinged together, the extremities of the reflector being foldable over on to the central parts thereof for shipment as illustrated in Fig. 3.

The stationary part 23 of the turret 19 is mounted on or, if desired, can be formed integrally with a platform 27, which, as more clearly shown in Fig. 2, is provided with axles 29, three such axles being shown, about which the upper ends or sections 31 of each of three supporting tripod legs 33 of the platform 27 can rotate freely.

Each of the legs 33 also consists of a lower part or section 35 that is hinged to the respective upper part 31 as at 37, and the respective upper and lower sections 31 and 33 of each leg can be provided with any suitable conventional automatic locking devices (not shown) at the hinged joint 37 to insure rigidity of the structure in extended condition. Similar locking devices can be provided in association with the axles 29 to rigidly secure the legs to the stationary part 23 of the turret 19 when the legs 33 are in extended condition. The lower ends of the sections 35 are pivoted as at 39 on base plates 41 which are adapted to be anchored in the ground. If desired, the base plates 41 can be accurately positioned at the apices of a triangle and secured in such position by means of tie rods 42.

The motor drive 25 consists of a motor 43 geared to two bevel gears 45 and 47 (Fig. 1). The gear 47 is keyed to a shaft 49 supported in bearings integral or fixed with the stationary part 23 of the turret 19. To this shaft is also keyed a cable drum 51 carrying one cable 53 for each leg 33, three cables being employed in the present invention.

As shown in Fig. 1, cable 53 associated with the leg

33 that extends downwardly and to the left passes over guiding rollers 55 and 57 and is fastened at one end to a bracket 59 affixed to the section 31 at a point intermediate the hinges 29 and 37. The two other cables 53 respectively associated with the two other legs 33 are arranged in the same way.

The motor drive 25 is also available to rotate the antenna 11 for the usual radar scanning operation, and is, accordingly, provided with a shiftable coupling for driving the rotating part 21 of the turret through a set of gears. In one form, the shiftable coupling can consist of a motor-driven shaft 61 (Fig. 2) carrying a worm 63 at its free end, the worm 63 engaging a wheel 65 which is rotatably mounted on a shaft 67. A portion of the shaft 67 is splined as at 69 (Fig. 1). A toothed wheel 71 having a reduced-diameter flanged hub 73 is keyed on the splined portion 69 so as to be rotatable therewith and axially slidable therealong when actuated by any suitable lever means (not shown) connected to a yoke 75. The yoke 75 fits snugly around the periphery of the hub 73 between the flange and the adjacent face of the wheel 71.

Attached to the opposite face of the wheel 71 and rotatable and slidable therewith is a tubular member 77 which carries, at the lower end thereof, the bevel gear 45. The assembly including the hub 73, wheel 71, tubular member 77 and bevel gear 45 are thus movable as a unit both for rotation and axial translation. In the position illustrated in Fig. 1, rotation of the motor is effective to produce rotation of the drum 51. Shifting the assembly upward results in the disengagement of the bevel gears 45 and 47 and the positive engagement of the teeth of wheel 71 with a toothed gear 79 which is rotatably mounted on a shaft 81 and in engagement with a ring gear 83 carried by the movable part 21 of the turret 19.

For shipment, as shown in Fig. 3, the lower part of the turret 19 is placed on the bottom of a truck or trailer 85, after the cables 53 have been sufficiently unwound to allow the legs 33 to be folded at the hinges 29, 37 and 39, so as to occupy a minimum of space. In the space between the three legs 33 is placed the central part of the antenna 11, and the extremities of the reflector 17 can also be folded if required.

The erection procedure in setting up the antenna in place is as follows. As shown in Fig. 4, truck 85 is placed exactly at the center of the three base plates 41, which may be anchored in the ground, the legs 33 having been somewhat straightened out to permit the base plates to be placed at the desired position. When the motor 43 is started, and with the shiftable coupling in the lower position so that the bevel gears 45 and 47 are in engagement, the cable drum 51 is driven and the cables 53 lift the platform 27, the turret 19 and the antenna 11 by gradually moving the legs 33 simultaneously from their position shown in Fig. 4 to that which they occupy in Fig. 1, whereupon the locks at the hinges 29 and 37 operate to insure automatically the rigidity of the supports. As soon as the turret begins to rise the truck or trailer may, if desired, be removed.

The motor system 25 can thereafter be uncoupled from the drum and coupled to drive the antenna by actuating the yoke 75 upwardly. Thereafter, rotation of the motor 43 produces any desired rotation of the antenna assembly.

When the antenna assembly is to be moved to a different location, it may be dismantled by the following reverse operation. Having placed the truck or trailer 85 under the platform 27 the structure is allowed to assume gradually the position shown in Fig. 4, under its own weight, the motion being slowed down, if desired, by any suitable brake mechanism (not shown) applied to the cable drum 51.

Once the turret 19 has been lowered on to the truck the sections 35 and 31 of the legs 33 are folded back until they occupy the positions shown in Fig. 3. The antenna then may be folded up and the entire unit is ready for shipment to the new location.

It will be understood, of course, that any modifications in the details of the mechanical accessories hereinabove described remain within the spirit of the present invention.

There has thus been described a radar antenna system and support structure therefor which can be very simply erected in place without any delicate operations or without the requirement of extraneous hoisting equipment. A special advantage flowing from the present invention resides in the fact that the same motive means that are used normally to rotate the antenna in its normal scanning operation is used in hoisting the apparatus from the knockdown transportation condition to the erected condition necessary for radar scanning operations.

While I have shown and described a preferred embodiment of my invention, it will be obvious to those skilled in the art that changes and modifications can be made without departing from the invention. I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A support structure for an antenna, comprising a platform for supporting said antenna, a plurality of legs supporting said platform, each of said legs comprising folding sections pivoted to each other, one section of each leg being pivoted to said platform, said legs being adapted, in folded condition, to be disposed with sections in adjacent substantially vertical side by side relation, the platform then being maintained in a lowered position below the points at which said sections of said legs are pivoted to each other, and motive means on said platform adapted to unfold the respective leg sections simultaneously, thereby to raise said platform to operating position.

2. A rotatable ultra-high frequency antenna system, comprising a reflector, a turret having relatively rotatable and stationary parts, means connecting said reflector to said rotatable part, a platform connected to said stationary part, a tripod having said platform mounted thereon and said tripod including a plurality of leg members each comprising folding sections pivoted to each other, one section of each member being pivoted to said platform, said leg members being adapted, in folded condition, to be disposed with sections in adjacent side by side relation when the platform is in a lowered position, motive means on said platform adapted to unfold the respective platform-pivoted sections simultaneously, thereby to raise said platform to operating position, and means for decoupling said motive means from said tripod sections and for coupling said motive means to drive said rotatable turret part.

3. In a rotatable high-frequency antenna system having a wave-energy reflector and a horn in energy-coupling relation therewith, a portable support structure for said antenna, comprising a turret having relatively rotatable and stationary parts, said reflector and said horn being adapted to be connected to and movable with said rotatable part, a platform supported by said stationary part, a tripod support for said platform, said tripod having a plurality of leg members each composed of folding sections pivoted to each other, one section of each member being pivoted to said platform, said leg members being adapted, in folded condition, to be disposed with respective sections in adjacent side by side relation when the platform is maintained in a lowered position, hoist means including a rotatable drum and a plurality of cables mounted on said platform, respective ones of said cables being connected to individual sections, whereby to produce relative rotation of said sections and to unfold said sections and to raise said platform to an elevated position, motive means on said platform connectable to actuate said drum, and selectively operable shift means for disconnecting said motive means

and said drum and for connecting said motive means to drive said relatively rotatable turret part.

4. A support structure for an antenna including a parabolic reflector, comprising a platform support for said reflector, said platform being supportable on a tripod having a plurality of leg members each composed of folding sections pivoted to each other, one section of each member being pivoted to said platform, said leg members being adapted, in folded condition, to be disposed with respective sections in adjacent substantially vertical side by side relation whereby the platform is maintained in a lowered position below the points at which said sections of said leg members are pivoted to each other, and motive means on said platform adapted to unfold the respective platform-pivoted sections simultaneously, thereby to raise said platform to operating position.

5. A rotatable ultra-high-frequency antenna system, comprising a reflector, a horn radiator disposed in energy-coupling relation with said reflector, a turret having relatively rotatable and stationary parts, means connecting said reflector and said horn to said rotatable part, a platform support, said platform being connected to said stationary part and supportable on a tripod having a plurality of leg members each composed of folding sections pivoted to each other, one section of each member being pivoted to said platform, said leg members being adapted to be disposed in folded condition when the platform is in a lowered position, motive means on said platform adapted to unfold the respective platform-pivoted sections simultaneously, thereby to raise said platform to operating position, and means for decoupling said motive means from said tripod sections and for coupling said motive means to drive said rotatable turret part.

6. A support structure for an ultra-high-frequency antenna, comprising a platform for supporting said antenna, a plurality of legs supporting said platform, each of said legs being composed of folding sections pivoted to each other, one section of each leg being pivoted to said platform, said legs being adapted to be in folded condition when the platform is in a lowered position below the points at which said folding sections of said legs are pivoted to each other; and motive means on said platform connected to unfold the respective leg sections simultaneously, thereby to raise said platform to elevated position.

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