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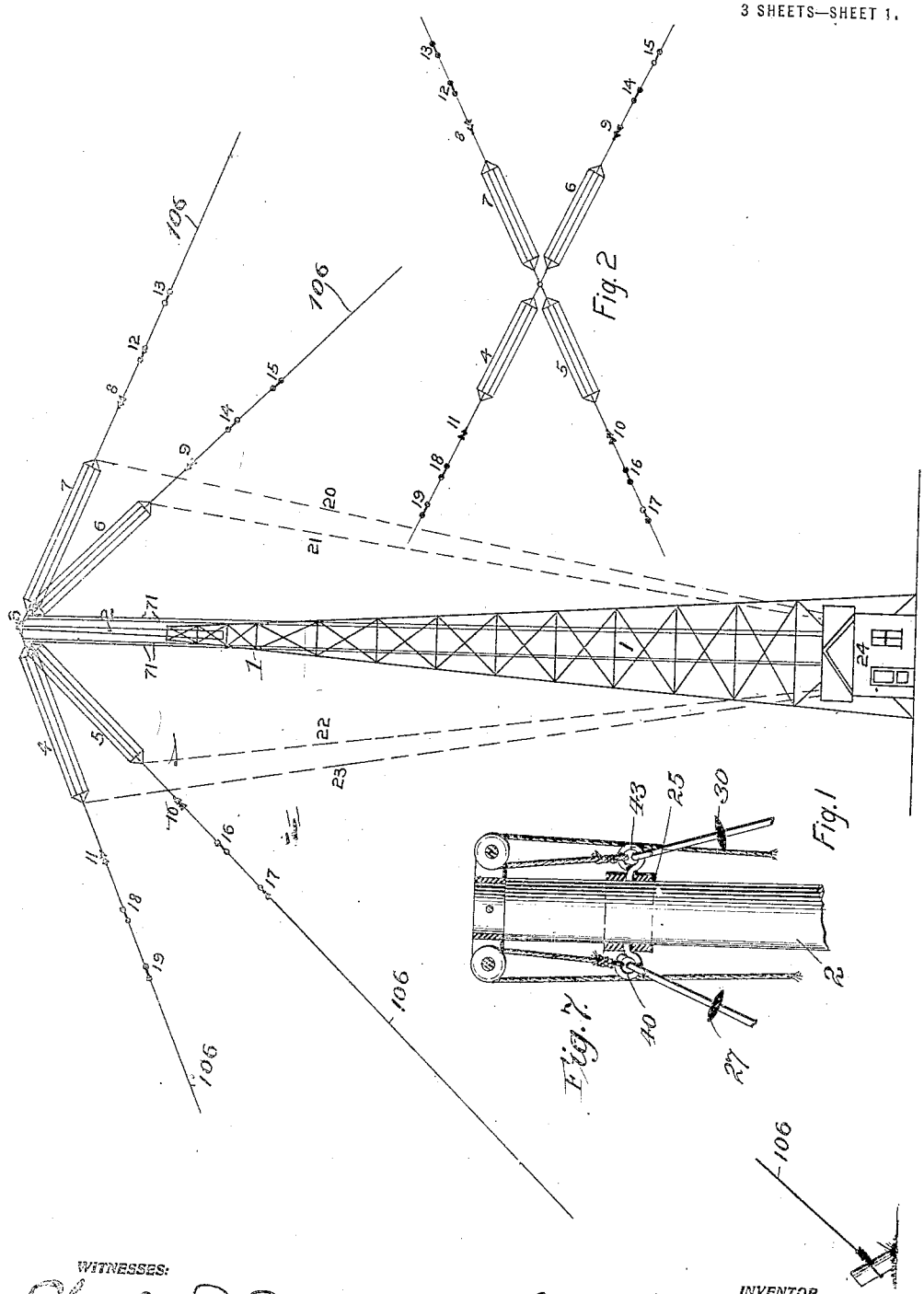
ANTENNA AND SUPPORT THEREFOR FOR USE IN WIRELESS TELEGRAPH OR TELEPHONE SYSTEMS.

APPLICATION FILED JAN. 19, 1912.

1,206,353.

Patented Nov. 28, 1916

3 SHEETS—SHEET 1.




WITNESSES:

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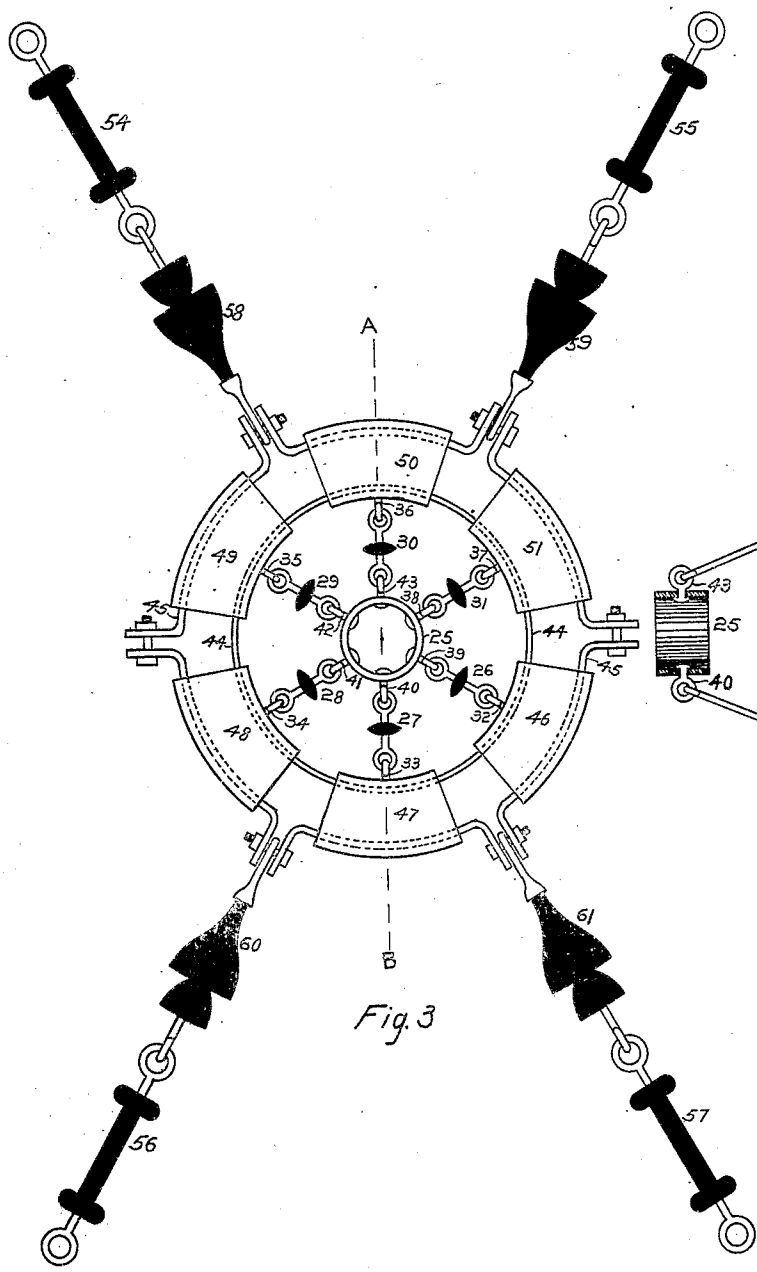



Fig. 3

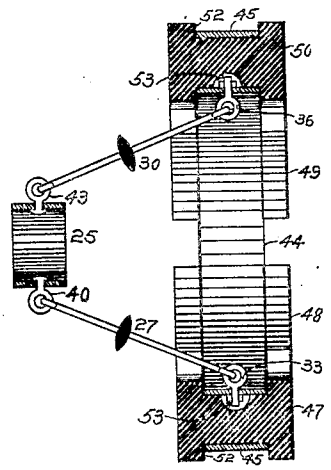



Fig. 4

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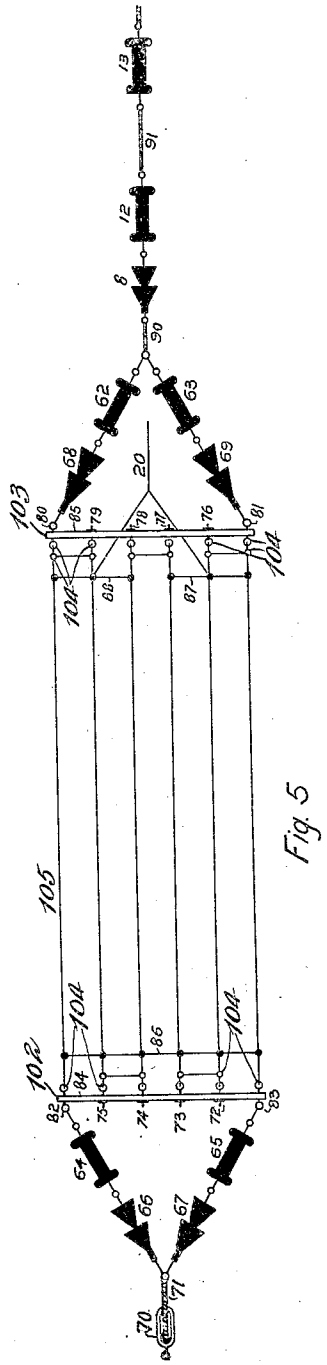



Fig. 5

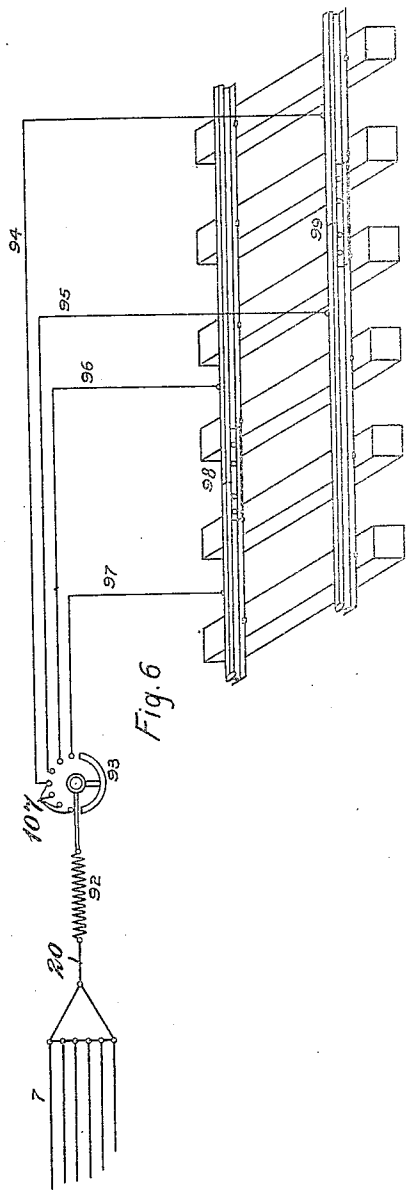



Fig. 6

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# UNITED STATES PATENT OFFICE.

FREDERICK HOYER MILLENER, OF OMAHA, NEBRASKA.

## ANTENNA AND SUPPORT THEREFOR FOR USE IN WIRELESS TELEGRAPH OR TELEPHONE SYSTEMS.

1,206,353. Specification of Letters Patent. Patented Nov. 28, 1916.

Application filed January 19, 1912. Serial No. 672,168.

*To all whom it may concern:*

Be it known that I, FREDERICK HOYER MILLENER, a citizen of the United States of America, residing in Omaha, in the county of Douglas, State of Nebraska, have invented new and useful Improvements in Antennæ and Supports Therefor for Use in Wireless Telegraph or Telephone Systems, of which the following is a specification.

The invention hereinafter set forth is designed for use with any system of telegraphy or telephony involving etheric transmission, and requiring an antenna and a ground or so-called counterpoise, or with any system that employs energy in the form of electric waves etherically transmitted. It is more especially intended for use in connection with railway systems, or for land use.

Considerable difficulty has heretofore been experienced in the transmission of energy, signals, sound or speech by electric or electromagnetic waves, in providing a suitable antenna and proper ground for the system. Especial difficulty has been met with in providing an antenna of small area combined with proper capacity, and using a single mast or tower of adequate height. The so-called "umbrella antenna," while possessing certain desirable qualities, covers so great an area that it can be used in open fields only. In stormy weather such antenna is liable to breakage or injury, and in cold weather it is apt to become clogged with ice, and broken or rendered wholly inoperative, or unsatisfactory in operation. The difficulties of repairing such antenna are also considerable. In the erection of wireless apparatus for transmitting or receiving electric energy, in whatever form, and especially in locations where high winds and sleet storms occur, it is desirable to guard against the injurious effects thereof.

Accordingly the invention herein described has for its object a construction of antennæ or aerials and ground connections embodying the desirable features of the so-called "umbrella antennæ," yet capable of use in crowded freight yards and like places. The construction is such, also, that I am enabled to increase considerably the amount of energy radiated, to give proper direction thereto, and to eliminate to a certain extent, interference by waves transmitted through or by said apparatus, with waves from other sources.

My invention may be better understood by reference to the accompanying drawings, wherein:

Figure 1 is an elevation of the supporting tower, showing diagrammatically the antennæ which it carries; Fig. 2, a plan view showing the directional positions of the antennæ; Fig. 3, a top plan view of the device to which the upper ends of the antennæ are attached; Fig. 4, a sectional view on the line *a*—*b* of Fig. 3; Fig. 5, a plan view of one of the antenna units; Fig. 6, a diagrammatic perspective of the ground connections; and Fig. 7, a detail view of the apparatus for raising and lowering the device shown in Figs. 3 and 4, and the parts carried thereby.

In these drawings the numeral 1 indicates a tower of any suitable form or construction, here shown as a steel tower with suitble transverse and diagonal bracing. Extending above the main body 1 of the tower, but suitably joined thereto or supported therein, is a mast or post 2 of wood or other suitable material, which should be well protected from the effects of the weather, rain, snow, or moisture, by a coating of paraffin, waterproof varnish, or other insulating material or preparation. Encircling the mast or post 2 is a device or structure 3, designed to serve at once as a support and an insulator for the antenna units 4, 5, 6 and 7, presently to be described. This structure 3 comprises an inner hoop or band 25, provided with eyes 38, 39, 40, 41, 42 and 43, to receive similarly formed upper ends of links or hangers 26, 27, 28, 29, 30 and 31, the lower ends of which engage with eyes 32, 33, 34, 35, 36 and 37 carried by an annular band 44. Each of said links is provided at a suitable point in its length with an insulator, as shown in Figs. 3 and 4. The eyes both of the band 25 and of the band 44 are preferably swiveled as seen in Fig. 4, to give a freedom and flexibility of movement to the parts so that there may be no cramping or binding in use.

Concentric with the bands 25 and 44 is a third hoop or band 45, which may be in one continuous piece, but which is preferably constructed in sections as shown in Fig. 3,

each section having outwardly turned ends or ears perforated to receive bolts 45ª, which serve the double purpose of drawing together the sections of the band 45 and of holding between the ears of said band the perforate upper ends of strain insulators 58, 59, 60 and 61 of petticoat type, which are introduced between the device 3 and the antenna units 4, 5, 6 and 7, to maintain a dry strip or section of insulated antenna-supporter between the antenna and mast in stormy weather, or when the air is heavily charged with moisture. For more effective insulation, additional strain insulators 54, 55, 56 and 57 may be connected with the lower or outer extremities of the strain insulators 58, 59, 60 and 61, these strain insulators each being provided at their ends with eyes for interconnection, and for connection with the device 3 and with tension or straining-ropes, or with pulley-blocks through which the tension or straining-ropes pass, to enable the ropes and the connected parts to be put under proper stress or tension and kept taut. Physical connection is made between the concentric hoops or bands 44 and 45 by blocks 46, 47, 48, 49, 50 and 51 of suitable insulating material. These blocks are of segmental form, and have in their outer and inner faces, respectively, grooves or channels 52 and 53, as indicated in Figs. 3 and 4, to receive the said bands 45 and 44, which fit snugly within said grooves or recesses in said blocks. These insulating blocks are equidistantly spaced apart, and arranged concentrically with the several hoops or bands.

It will be seen that under this construction, a tightening of the bolts 45ª will cause the band 45 as a whole to be contracted, and not only to seat the sections of said band snugly within the grooved outer faces of the insulating blocks, but also to press said blocks inward against or upon the inner hoop or band 44, causing the blocks to bear firmly and snugly thereon, holding said blocks in position, and preventing distortion or buckling of the inner hoop or band 44, which is, of course, subject to the compressive stress incident to contraction of band 45. The blocks 46, 47, 48, 49, 50 and 51 provide effective insulation between the hoops or bands 44 and 45.

The innermost hoop or band 25 is large enough to slide freely up and down upon or about the post 2, and may be raised or lowered thereon by any convenient means. In Fig. 7 pulleys 100 and ropes 101 are shown, the ropes passing from the ring 25 over the pulleys, and thence downward to a suitable point from which to manipulate them when necessary. They may extend to the foot of the tower, or to the platform at the top thereof, as desired, and are normally made fast in any convenient way. The rise and fall of the device 3 is, of course, merely through the height of the post 2.

In Fig. 5 is illustrated an antenna unit. This comprises two stretchers 102 and 103, which may conveniently be made of iron pipe, and which are provided with eyes or eye-bolts as 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82 and 83, the eye-bolts or eyes 72, 73, 74, 75, 76, 77, 78, 79, 80 and 81 carrying each a loose or swiveled eye-member 104. The eyes or eye-bolts 80, 81, 82 and 83 have eyes on both sides of the stretchers 102 and 103. Beginning at one corner of the rectangle of which the stretchers 102 and 103 form the ends, as for instance at 82 in Fig. 5, a wire 105 is made fast to the eye at that point, and is carried thence to the loose eye 104 at the opposite end of the rectangle, being threaded through the same and carried thence to and through the loose eye associated with the eye-bolt 79, thence again to the left and threaded through the eye-bolt 104 connected with the eye-bolt 75, and so on in succession back and forth from one stretcher toward the other, until the eye-bolt 83 is reached, when the end of the wire 105 is made fast thereto. In this way the continuous wire 105, which may be of copper, stranded or plain, but which is preferably made of phosphor bronze because of its greater strength coupled with good conducting capacity, is caused to connect the two stretchers, and to make up a flexible rectangular structure consisting of the stretchers and the series of parallel stretches of wire. Being threaded or run loosely through the loose eyes, the wire 105 is free to play, and the whole structure may weave and play to such an extent as will break loose ice or sleet forming on or adhering to said wire, or the parts with which it is connected. Cross connections may be made between the stretches of the wire 105 by means of suitable wires or conductors 86, 87 and 88, soldered or otherwise connected to said wire 105. The metal stretchers 102 and 103 give adequate strength and stiffness, and also contribute to the capacity of the antennæ, as do the cross connections 86, 87 and 88.

Extending from the eyes 82 and 83 to a common ring or clevis connected with a tension or straining-rope 71, are draft devices comprising strain insulators 66 and 67 of the petticoat type, and other strain insulators 64 and 65 of the spool type, arranged in alinement and interconnected, as indicated in Fig. 5. 70 in said figure indicates a sheave or pulley block through which the tension or straining-rope 71 is carried to the base of the tower, or other convenient point. This sheave or block 70 is in practice attached to the eye at the lower or outer end of one or another of the strain insulators 54, 55, 56 or 57 of the sustaining-device 3, there being one such

pulley block for each tension or straining-rope or cable. These ropes serve as means of giving to each guy-rope or cable 106, of which there is one secured to the lower or opposite end of each antenna unit, the desired tension, and they also permit any unit to be lowered independently of the others, or quickly raised and lowered to break up or loosen and shake off any adhering ice, sleet or snow, and this without ascending the tower or leaving the ground.

At the opposite end of the antenna unit, and connected with the eyes 80 and 81, are similar petticoat insulators 68 and 69 and spool insulators 62 and 63, connected with each other through interlocking eyes, and with a clevis or coupling 90, which in turn connects with an insulator 8 of the petticoat form, the petticoat insulators serving to protect the eyes or connections beneath them from moisture. Other insulators as 12 and 13, with intermediate connections as 91, may be interposed between the antenna unit and the guy-rope 106, which as before mentioned, is carried and secured to a suitable anchorage at the ground.

The angular relation of the several guy-ropes or cables 106 is such as to give a bracing or staying effect to the tower and mast, but is not necessarily so great as to necessitate any wide area between the anchorages of either pair of guy-ropes or cables. The arrangement of the four guy-ropes or cables, and consequently of the four antenna units in approximately one general plane, as illustrated in Fig. 2, tends to give direction to the electric waves proceeding from the antennæ. Each antenna unit is provided with a conducting wire 20, 21, 22 or 23, of Fig. 1, which as shown in Fig. 5, is divided into two branches, electrically connected to the cross connecting wires 87 and 88, preferably at the midlength of each. These wires 20, 21, 22 and 23 are carried to the capacity or counterpoise, as indicated in Fig. 1 and in greater detail in Fig. 6. Such connection may be made from each antenna unit directly and by its own wire, to the capacity or counterpoise, or from each unit to the next in series, and by a single wire thence to the capacity or ground.

In Fig. 6 there is illustrated a means of securing suitable ground connection for the antennæ, this being particularly designed for use in connection with railway systems where the rails are available as capacity or counterpoise. In dry climates it is often difficult to secure a good ground connection, and in such sections it is common to use coils of wire as a counterpoise, or iron wire is staked to the ground. In freight yards, and in many other places, this would obviously be inconvenient or impracticable, but the track rails afford a convenient and satisfactory substitute, capable of being increased or diminished at will by a suitable capacity adjuster such as is indicated in Fig. 6.

Railway rails laid upon ties and connected by fish-plates in the usual way, in a short time become practically insulated from each other and from the ground, by reason of oxidation and lack of perfect contact. Rails thus connected, despite the fish-plates and the bolts, are not in fact in good electrical connection, and hence where the rails are used as a means of electrical transmission, as for instance in connection with block signal systems, it is found necessary to bond the rails by means of wires, usually of copper, and so electrically connected with the rails as to be unaffected by the oxidation of the outer surfaces of said rails, fish-plates, bolts, etc. It is hence found practicable to make direct electrical connection of each of the wires or conductors 20, 21, 22 and 23 with one or more rail lengths 98 and 99, or with one or more groups of rails suitably bonded, without adding to the capacity or counterpoise other rails mechanically connected therewith but not similarly bonded or in like electrical connection therewith. I therefore avail of these facts to vary the extent of the capacity or counterpoise by carrying separate conductors as 94, 95, 96 and 97 to separate rails, and making good electric bond or connection therewith, as illustrated in Fig. 6, the other ends of said conductors being carried to contact-stud 107, with any one or more of which contact may be made by an arc-shaped contact-member 93, free to swing about a supporting stud or post, and adapted, as indicated, to rest simultaneously upon all of the contact studs 107, or upon any lesser number thereof. Electrical connection is made from the supporting or pivot post of the contact-member 93 to the wire or conductor 20, 21, 22 or 23 of the respective antenna units, preferably through an inductance 92.

It will be readily understood upon reference to Fig. 6 that as the contact-member 93 is made to bear upon more or fewer of the studs 107, greater or less capacity or counterpoise will be brought into use, and in this way the apparatus may be adjusted or adapted to varying atmospheric or meteorological conditions. The capacity regulator or controller is, as indicated in Fig. 6, thus introduced between the antenna units and the counterpoise or capacity, and may conveniently be located in an operator's house 24 at the base of the tower, or in other convenient position, where sending and receiving instruments will also be placed.

From the foregoing description it will be seen that there is afforded by my plan a quite simple structure, the antenna units of which can be readily positioned, stretched taut and so maintained, without necessity,

after first installation and adjustment, of ascending the tower, the tension or straining-ropes 71 affording means whereby each antenna unit may be stressed to any required degree, or loosened to swing and play in the wind, or be raised and lowered by manipulation of the tension or straining-ropes so as to break up and shake off, ice or sleet, or to remove snow or accumulated moisture. It will also be seen that by raising or lowering the supporting-device 3, the several units may be simultaneously stressed or slackened, for the purpose of clearing them, or to vary the tension of all alike. The flexible or jointed connections also permit considerable deflection of the guy-ropes in one or another direction, to clear tracks, buildings or other objects in or about a railway yard, or like place. The structure is hence peculiarly adapted for use in connection with railway service, for which, as before stated, it is primarily designed.

It is obvious that without departing from the spirit or scope of my invention, details of the structure, such as the connections between the antenna-support 3 and the antenna units, or between said units and their anchorages, the devices for raising and lowering said support, and those for stressing the guy-ropes, may be varied. Any form of tower, mast or upright may be employed, likewise. The guys 106 are intended primarily to maintain the antenna-sections in proper position and under suitable tension, but they may be made to contribute also in any desired degree toward staying or steadying the tower, mast or upright, the elements of the antenna units being made of appropriate strength to enable them to perform this function.

It is of course understood that the aerials or antennæ here described are to be used for the reception as well as for the transmission or sending of waves.

It should be observed in this connection that in order to be available as capacity for the wireless or etheric transmission apparatus, the railway rails should have the same general direction as the antenna units, and that said units should have the general direction of a straight line connecting the two stations between which tranmission is primarily to be made. It is not essential that they be in perfect alinement or absolutely parallel, but the nearer the approximation to alinement or parallelism, the greater is the efficiency of transmission.

Having thus described my invention, what I claim is:—

1. An aerial for etheric transmission systems, comprising in combination a suitable upright; a plurality of antenna units, each comprising a pair of stretchers and a plurality of stretches of wire extending from one stretcher to the other in common plane; means for mechanically connecting the upper end of each unit with, but electrically insulating it from, the upright; guys mechanically connected with but electrically insulated from the lower ends of the antenna units; and suitable anchorages to which said guys are secured, substantially as described.

2. In an aerial for wireless or etheric transmission systems, an antenna unit comprising two stretchers suitably separated one from the other, and each provided with eyes; and a wire or conductor connected at one end to one of said stretchers, and extending thence back and forth from one stretcher toward the other and passing freely through eyes of said stretchers, and finally connected at its second end with one of said stretchers; whereby there is produced a unitary structure comprising a series of stretches of wire in common plane, suitably spaced apart and flexibly connected with the stretchers.

3. An antenna unit comprising two separated stretchers each provided with eyes; a wire or electric conductor extending back and forth from each stretcher toward the other and laced or threaded through the eyes thereof alternately, and having ends secured to one or other of said stretchers; cross conductors electrically connecting the several stretches of wire; converging strain insulators for the upper end of said unit, connected with the stretcher at said end near its extremities; a straining or tension rope connected with said insulators at the point of convergence; similar converging strain insulators connected in like manner with the lower stretcher of the unit; and a guy connected with the latter strain insulators at the point of convergence; whereby the wires of the antenna unit may be suitably stressed and held in common plane and at proper distances one from another.

4. In combination with a suitable mast or upright, an antenna-support or carrier, comprising an inner hoop or band adapted to encircle the mast and to move freely thereon; a second hoop or band concentric with the first; links or hangers flexibly connected at their upper ends with the inner hoop or band, and at their lower ends with the second hoop or band; a third hoop or band concentric with the second one, divided at one or more points, and there provided with ears; a series of insulating blocks having their inner and outer faces grooved to receive the two lower hoops or bands; and means for contracting the outer hoop and thereby binding together the two hoops and the interposed insulating blocks, substantially as described.

5. In combination with a suitable mast or upright, an antenna-supporting device comprising an upper hoop or band 25,

adapted to encircle the mast and to move freely up and down thereon; hangers loosely jointed to said band; a lower hoop or band 44 to which the lower ends of said hangers are likewise loosely jointed; segmental insulating blocks as 46, having their inner and outer faces circumferentially grooved, and having the band 44 seated in their inner grooves; a sectional band 45 encircling the insulating blocks, seated in the outer grooves thereof, and provided at the ends of each section with ears; strain insulators having their perforated ends introduced between proximate ears of the sectional band; and bolts passing through said ears, and serving both to contract the sectional band and to connect the strain insulators therewith.

6. In combination with a suitable mast or upright, an antenna-support bodily adjustable up and down thereon, and provided with sheaves or pulleys; a plurality of antenna units, each provided with a straining or tension rope, each of said ropes passing about one or another pulley of the supporting device and thence to a convenient point at or near the ground, for manipulation; guys connected each to one or another of the antenna units and suitably anchored; and means for bodily raising and lowering the antenna support; whereby the several antenna units may be simultaneously raised and lowered to stress or to slacken them, and each such unit may be independently stressed or slackened.

7. In combination with an antenna for etheric transmission systems, a capacity or counterpoise consisting of separate rail sections; independent conductors passing from separate rail sections to independent electric contact studs; and a contact-member electrically connected with the antenna, and adapted to make contact at will with any one or more of the contact-studs, and thereby to place said antenna in electrical connection with any or all of the rail sections.

8. In an etheric transmission apparatus, the combination of an antenna; a railway track; and means for connecting a length or section of said track with the antenna as a counterpoise or capacity, the antenna and the connected track section both extending in the general direction of a line connecting the points between which transmission is to be effected.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."