Sept. 8, 1964 D. R. HOVERMAN 3,148,371

BROADBAND UNIDIRECTIONAL UHF TELEVISION ANTENNA

Filed May 31, 1962 2 Sheets-Sheet 1

Fig. 1.

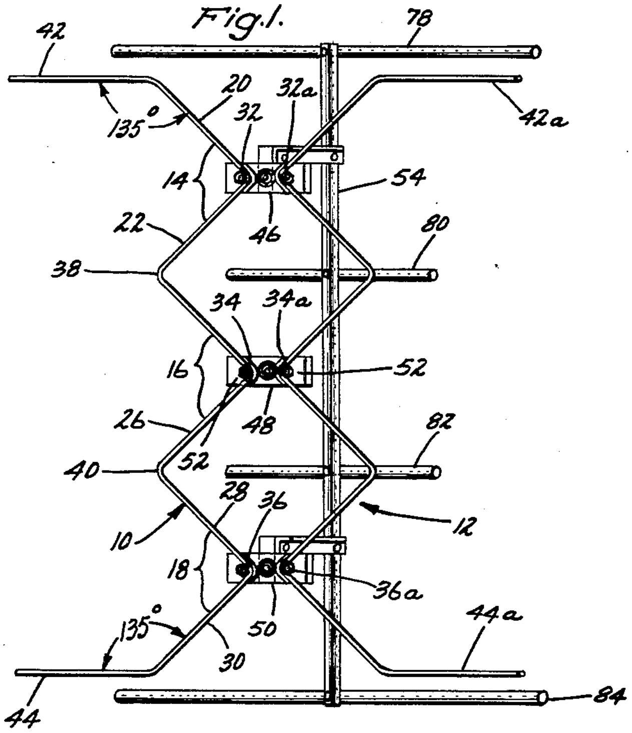
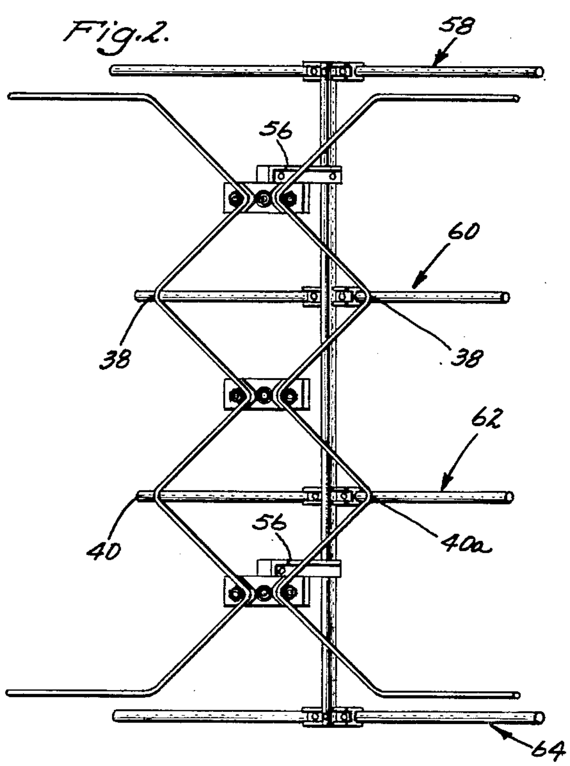


Fig. 2.



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BROADBAND UNIDIRECTIONAL UHF TELEVISION ANTENNA

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Fig.3.

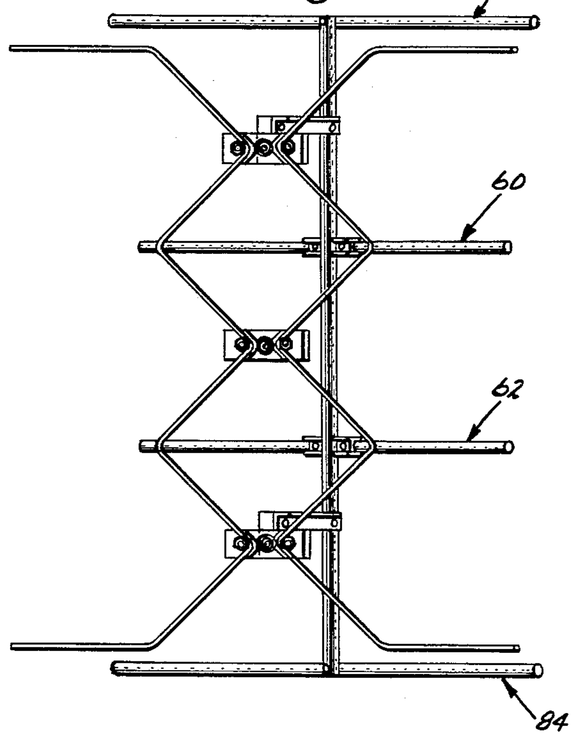


Fig.4.

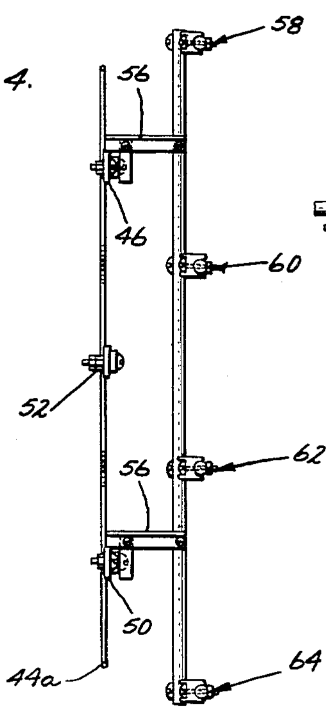
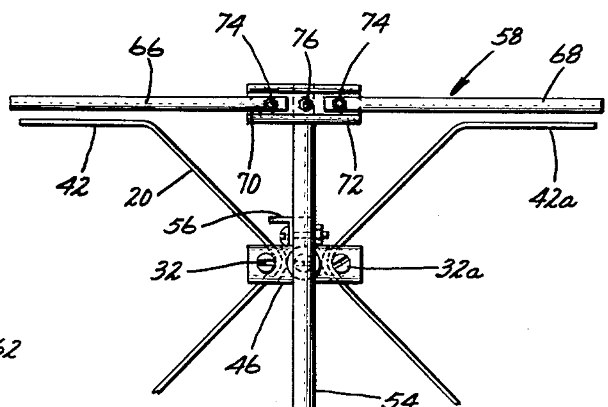


Fig.5.



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United States Patent Office

3,148,371
Patented Sept. 8, 1964

3,148,371
BROADBAND UNIDIRECTIONAL UHF TELEVISION ANTENNA

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Filed May 31, 1962, Ser. No. 198,855
9 Claims. (Cl. 343—806)

The present invention relates to a television-receiving antenna, and more particularly to a unitary antenna construction having broad frequency and unidirectional response in the UHF television spectrum.

Commercial television signals are telecast in the frequency spectrum normally characterized as "ultra High Frequency." This spectrum is commonly referred to in an abbreviated form as "UHF." The UHF spectrum extends from 470 to 890 megacycles.

The present invention is particularly useful in this UHF spectrum and constitutes an improvement in the antenna covered by my Patent No. 2,918,672, issued Dec. 22, 1959. Experimentation and use of the antenna of my aforementioned patent has revealed that it possesses considerable gain both bidirectionally and omnidirectionally, depending upon the specific construction used. However, the present invention is an improvement over the antenna of my prior patent in the respect that it is unidirectional and provides a substantial increase in gain over a relatively broad section of the UHF band.

It is therefore an object of this invention to provide a broadband, unidirectional antenna for use in the UHF spectrum, which exhibits substantial gain characteristics and can therefore be used in fringe, television areas.

It is another object of this invention to provide, in a single construction, an antenna of simple and lightweight design which utilizes a coplanar driven array and a coplanar, resonant reflective array, these two arrays being spaced apart and arranged in parallel planes.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIGS. 1, 2 and 3 are perspective illustrations of three different embodiments of this invention;

FIG. 4 is a side elevation of the antenna of FIG. 2; and

FIG. 5 is a fragmentary rear elevation of the antenna of FIG. 2.

Referring to the drawings, the driven element of the antenna shown therein may be constructed identically to that disclosed in FIG. 1 of my prior Patent No. 2,918,672 and described in the specification. More particularly, and referring to FIG. 1, the driven element comprises two elongated, metallic rod or wire-like elements **10** and **12**. These two members or antenna sections **10** and **12** are substantially identical, therefore the description of one will suffice for both.

Each antenna section or wire-like member **10**, **12** is bent into a series of V-shaped elements, as indicated respectively by the reference numerals **14**, **16** and **18**. Each of these V-shaped elements **14**, **16**, **18** have outwardly extending legs **20**, **22**, **24**, **26**, **28** and **30**, which are joined together, end-to-end, to provide three apices **32**, **34** and **36** along one side and two apices **38** and **40** along the other side. The apices **32**, **34** and **36** are disposed along a substantially straight imaginary line, as are the two apices **38** and **40** along another substantially straight imaginary line, these two imaginary lines being substantially parallel. On the extremities of the two endmost legs **20** and **30** are formed or integrally connected two substantially straight extensions **42** and **44**, these extensions being at substantially right angles to the

two imaginary lines just described and, further, extending at obtuse angles with respect to the respective legs **20** and **30**.

As shown in FIG. 1, the two antenna sections **10** and **12** are assembled in substantial parallelism and in a common plane. Further, the end extensions **42**, **44** are disposed to project oppositely to the end extensions **42***a* and **44***a*, respectively, the letter suffixes on the reference numerals indicating the same element on the antenna section **12** as appears on the antenna section **10** which bears the same numeral. Further, these sections **10** and **12** are positioned with the respective apices **32**, **34** and **36** juxtaposed and spaced from the respective apices **32***a*, **34***a* and **36***a*.

Three bar-like insulators formed of Plexiglas or polystyrene, **46**, **48** and **50**, are fastened to the respective pairs of apices **32**, **32***a* through **36**, **36***a*. Any suitable fastening means may be used, suitable bolts, nuts and washers, as indicated by the reference numeral **52**, being illustrated. Each individual apex **32** through **36** is clamped into a conformed groove in the insulator under the head of the bolt **52**, the bolt passing through the insulator and receiving on the other side a nut and washer. By means of this fastening, the two antenna sections **10** and **12** are secured in assembled relation, but are electrically insulated from each other.

Experimentation has revealed that broadband operating characteristics for the reception of UHF television stations are achieved when the angles of all the apices **32** through **40** are substantially 90° while the lengths of the legs **20** through **30** and the extensions **42** and **44** are substantially seven inches. When constructed according to these dimensions, the antenna exhibits good performance even in Class B fringe areas for channels 14 through 35 in the UHF spectrum. The antenna is installed in an upright position as shown in FIGS. 1–3 inclusive; that is, with the extensions **42**, **42***a*, **44** and **44***a* extending horizontally.

While the angle of the individual apices **32** through **40** may be something other than 90°, experiments have shown that either enlarging or reducing the size of the angle affects the frequency response, causing the antenna to resonate at other points in the frequency spectra. If these angles are made too large or too small, the antenna becomes inoperative.

A conventional two-conductor 300-ohm transmission line may be connected to the driven element by fastening the ends of the two conductors to the two terminals **52** which are attached to the insulator **48**.

A coplanar, resonant reflector screen is disposed to one side, or in other words the rear, of the driven element **10**, **12** in parallelism therewith. This reflector screen comprises an elongated supporting bar **54** which may be fabricated of aluminum tubing or angle stock. Two transverse supporting bars **56** are secured rigidly at one end thereof to spaced-apart points on the supporting bar **54** and at the other ends to the two insulators **46** and **50**, this connection thereby electrically insulating the driven element **10**, **12** from the reflector screen.

Mounted on the supporting bar **54** in spaced-apart relation are four resonant reflector elements indicated generally by the reference numerals **58**, **60**, **62** and **64**. Since the construction of these four reflector elements is identical except for specific dimensioning which will be explained in more detail hereinafter, a description of one will suffice for all. Referring more particularly to FIG. 5, the reflector element **58** is shown as comprising two colinear, elongated sections **66** and **68** which may be fabricated of suitable aluminum tubing or bar stock. The adjacent ends of these two sections **66** and **68** are fitted into a groove **70** formed in a plastic insulating block **72**, suitable screws **74** being used to secure the sections **66** and **68** to the block **72**. It should be noted that the adjacent ends of the two sections **66** and **68** are spaced apart such that they will be electrically insulated from each other and also from the supporting bar **54**. A suitable screw **76** passing through the central portion of the insulator **72** anchors the reflector element to the supporting bar **54**.

As clearly shown in FIGS. 4 and 5, the reflector element **58** is mounted on a supporting bar **54** at right angles thereto and substantially directly behind and in parallelism with the extensions 42 and 42*a* of the driven element. In other words, the colinear reflector sections **66** and **68** as well as the extensions **42** and **42***a* may be said to lie in a plane which is perpendicular to the parallel planes of the driven element **10**, **12** and the reflector screen respectively.

Similarly, the reflector element **64**, which preferably is identical in construction and size to the reflector element **58**, is positioned directly behind and in parallelism with the lower driven element extensions **44** and **44***a*.

The reflector element **60** is located immediately behind the two apices **38** and **38***a* of the driven element, or in other words is located in a plane passing through the two apices **38** and **38***a* and which is perpendicular to the plane of the driven element. The reflector element **62** is similarly positioned with respect to the two apices **40** and **40***a*.

As already stated, the two reflector elements **58** and **64** are preferably of the same construction and size. With respect to the two elements **60** and **62**, these are also identical to each other but, in the preferred embodiment of this invention, are somewhat shorter than the two elements **58** and **60**. For example, the reflector sections **66** and **68** of the two reflector elements **58** and **60** are of equal length to each other, this length being equal to a half-wavelength in the lower portion of the UHF spectrum. A typical dimension for each of the elements **66** and **68** is fourteen (14) inches. With respect to the individual sections for the reflector elements **60** and **62**, these are selected as having a length equal to a half-wavelength in the upper region of the UHF spectrum, a dimension of ten (10) inches being an example.

By locating the particular reflector elements as just described with respect to the particular structural features of the driven element **10**, **12** the complete antenna exhibits a broadband frequency response in the UHF spectrum as well as unidirectional response. Also, the antenna exhibits an appreciable front-to-back gain ratio.

The antenna of FIG. 1 differs from the embodiment just described and illustrated in FIGS. 2, 4 and 5 in the respect that instead of using colinear resonant reflector elements **58**, **60**, **62** and **64**, reflector bars **78**, **80**, **82** and **84** are used. These particular reflector bars are of unitary construction and preferably are fabricated of aluminum tubing, each bar being rigidly and electrically connected at its center to the supporting bar **54** by means of suitable screw assemblies or the like. These reflector bars are positioned with respect to the driven element the same as the reflector elements **58**, **60**, **62** and **64** just described.

In the embodiment shown in FIG. 1, the two bars **78** and **84** are of the same length, being equal to one or more odd numbers of wavelengths in the lower portion of the UHF spectrum. Similarly, the two reflector bars **80** and **82** have wavelengths equal to one or more odd numbers of wavelengths in the upper regions of the UHF spectrum.

With respect to FIG. 3, the antenna there illustrated is shown as having a reflector screen which is a composite of the screens shown in FIGS. 1 and 2. With the same driven element **10**, **12** as before, in this embodiment the reflector screen is composed of two reflector bars **78** and **84** and two intermediate reflector elements **60** and **62**. In all other respects, this antenna is the same as that already shown and described in connection with FIGS. 1 and 2.

Experience has shown that the antenna of FIG. 2 is more efficient over a broader frequency spectrum than the antenna of FIG. 1. Also, the dimensions as to the specific operating embodiments of this invention with respect to use in the lower portion of the UHF spectrum, that is channels 14 to 35, may be appropriately scaled down if the antenna is to be used in the upper regions of the UHF spectrum, that is above channel 35, if it is desired to obtain maximum gain and efficiency in these upper regions. In fact, experimentation has proven that in designing an antenna of this invention, the lengths of the various legs, such as **20**, **22**, **24**, **26**, **28** and **30**, may be calculated to be seventeen percent (17%) longer than a quarter wavelength of the frequency of the lowest channel on which operation is desired. With respect to the reflector screen, in the embodiment of FIG. 1, the upper and lower elements **78** and **84** are calculated to have a length of twenty percent (20%) longer than a wavelength at the frequency of the lowest channel of operation and the middle two elements **80** and **82** are calculated to have a length twenty percent (20%) longer than a wavelength at the frequency of the uppermost channel of operation, such that if the antenna is designed to operate in the range of channels 14 to 35, the elements **78** and **84** will have a length of about twenty-nine (29) inches and the elements **80** and **82** will have a length of about twenty-four (24) inches. For the design of FIG. 2, the element halves **66** and **68** are calculated to have a length each which is seventeen percent (17%) longer than a half wavelength at the frequency of the lowest channel of operation, and the halves of the middle two elements **60** and **62** are calculated to have a length each which is equal to one-half wavelength of the frequency of the uppermost channel of desired operation. Thus, for a frequency spread from channels 14 to 35, the halves **66** and **68** have a length of fourteen (14) inches and the halves of the elements **60** and **62** have a length of ten (10) inches, respectively.

An antenna design to cover the frequency spread between channels 35 and 58 will have dimensions correspondingly shorter than the specific ones just given as will a third antenna design for the spread between channels 58 and 83 have still correspondingly shorter dimensions.

In a typical operating embodiment of this invention, the separation between the planes of the driven element **10**, **12** and the reflector screen is in the order of three and one-half (3½) inches, this particular spacing providing relatively high gain over a relatively broad portion of the UHF spectrum. Also, in a typical working embodiment of this invention, the following materials and dimensions may be used in the driven element **10**, **12** it being understood that by giving this example the scope of the invention is not to be limited thereto but is to be determined by the coverage of the claims appended hereto.

Antenna sections **10**, **12**—No. 9 hardened aluminum wire
Insulators **46**, **48**, **50** and **72**—Plexiglas or polystyrene, 2¾ inches by 1 to 1¼ inches with the two holes for the bolts **52** being spaced about 1¾ inches apart

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

1. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising three series-connected V-shaped elements arranged in end-to-end relation thereby providing three, spaced-apart apices along one side and two spaced apart apices along the other side, said three apices being disposed on a first imaginary substantially straight line, said two apices being disposed on a second imaginary substantially straight line which is substantially parallel to said first straight line, two parallel straight extensions integrally connected to the extremities of the two endmost V-shaped elements,

respectively, and extending away from both of said imaginary lines, the angles separating the V-shaped elements and the angles in the V-shaped elements themselves being substantially ninety degrees, the angle between said extensions and said second imaginary line being substantially ninety degrees; said two antenna sections being spaced apart in parallelism with the three apices thereof being respectively juxtaposed and lying on respective lines at right angles with respect to said imaginary lines, thereby providing three pairs of adjacent but spaced apart apices, three spaced apart bar-like insulators, said three pairs of apices being secured to said three insulators respectively; the legs of said V-shaped elements and said extensions being approximately seven inches long, two terminals connected to the intermediate pair of apices for attaching a dual conductor transmission line thereto, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a line parallel to and midway between said first imaginary lines, said bar being parallel to the plane of said antenna sections, two supporting elements having opposite ends, one end of each supporting element being rigidly connected to the outermost ones respectively of said insulators and the other end of each element being rigidly connected to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, each reflector element comprising two equal length sections having adjacent ends which are insulated from each other, four supporting insulators, one supporting insulator each mounting each pair of adjacent reflector section ends onto said supporting bar, the reflector sections of the first-mentioned two reflector elements being about fourteen inches long, and the reflector sections of the second-mentioned two reflector elements being about ten inches long, the reflector screen being about three and one-half inches from the plane of said antenna sections.

2. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising three series-connected V-shaped elements arranged in end-to-end relation thereby providing three, spaced-apart apices along one side and two spaced apart apices along the other side, said three apices being disposed on a first imaginary substantially straight line, said two apices being disposed on a second imaginary substantially straight line which is substantially parallel to said first straight line, two parallel straight extensions integrally connected to the extremities of the two endmost V-shaped elements, respectively, and extending away from both of said imaginary lines, said two antenna sections being spaced apart in parallelism with the three apices thereof being respectively juxtaposed and lying on respective lines at right angles with respect to said imaginary lines, thereby providing three pairs of adjacent but spaced apart apices, three spaced apart bar-like insulators, said three pairs of apices being secured to said three insulators respectively; two terminals connected to the intermediate pair of apices for attaching a dual conductor transmission line thereto, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a line parallel to and midway between said first imaginary lines, said bar being parallel to the plane of said antenna sections, two supporting elements having opposite ends, one end of each supporting element being rigidly connected to the outermost ones respectively of said insulators and the other end of each element being rigidly connected to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, each reflector element comprising two equal length sections having adjacent ends which are insulated from each other, four supporting insulators, one supporting insulator each mounting each pair of adjacent reflector section ends onto said supporting bar, the reflector sections of the first-mentioned two reflector elements having a length about twenty percent longer than a half-wave in the lower frequency portion of the UHF spectrum, and the reflector sections of the second-mentioned two reflector elements having a length about twenty percent longer than a half-wave in the upper frequency portion of the UHF spectrum.

3. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising three series-connected V-shaped elements arranged in end-to-end relation thereby providing three, spaced-apart apices along one side and two spaced apart apices, along the other side, said three apices being disposed on a first imaginary substantially straight line, said two apices being disposed on a second imaginary substantially straight line which is substantially parallel to said first straight line, two parallel straight extensions integrally connected to the extremities of the two endmost V-shaped elements, respectively, and extending away from both of said imaginary lines, said two antenna sections being spaced apart in parallelism with the three apices thereof being respectively juxtaposed and lying on respective lines at right angles with respect to said imaginary lines, thereby providing three pairs of adjacent but spaced apart apices, three spaced apart bar-like insulators, said three pairs of apices being secured to said three insulators respectively; two terminals connected to the intermediate pair of apices for attaching a dual conductor transmission line thereto, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a line parallel to and midway between said first imaginary lines, said bar being parallel to the plane of said antenna sections, two supporting elements having opposite ends, one end of each supporting element being rigidly connected to the outermost ones respectively of said insulators and the other end of each element being rigidly connected to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, said supporting bar being conductive and said reflector elements being connected thereto midway between the ends thereof, the first-mentioned two reflector elements each having a length about twenty percent longer than a full-wave length in the lower portion of the UHF spectrum, and the second-mentioned two reflector elements each having a length about twenty percent longer than a full-wave length in the upper portion of the UHF spectrum.

4. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections

formed of rod-like material, said two sections being of substantially identical configuration; each section comprising three series-connected V-shaped elements arranged in end-to-end relation thereby providing three, spaced-apart apices along one side and two spaced apart apices along the other side, said three apices being disposed on a first imaginary substantially straight line, said two apices being disposed on a second imaginary substantially straight line which is substantially parallel to said first straight line, two parallel straight extensions integrally connected to the extremities of the two endmost V-shaped elements, respectively, and extending away from both of said imaginary lines, said two antenna sections being spaced apart in parallelism with the three apices thereof being respectively juxtaposed and lying on respective lines at right angles with respect to said imaginary lines, thereby providing three pairs of adjacent but spaced apart apices, three spaced apart bar-like insulators, said three pairs of apices being secured to said three insulators respectively; two terminals connected to the intermediate pair of apices for attaching a dual conductor transmission line thereto, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a line parallel to and midway between said first imaginary lines, said bar being parallel to the plane of said antenna sections, two supporting elements having opposite ends, one end of each supporting element being rigidly connected to the outermost ones respectively of said insulators and the other end of each element being rigidly connected to said supportng bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, said supporting bar being conductive, the first-mentioned two reflector elements comprising two equal length sections having adjacent ends which are insulated from each other, two supporting insulators, one supporting insulator each mounting each pair of said adjacent reflector section ends onto said supporting bar, the reflector sections having a length about twenty percent longer than a half-wave in the lower portion of the UHF spectrum, the second-mentioned two reflector elements being connected midway between the ends thereof to said supporting bar, said second-mentioned reflector elements each having a length about twenty percent longer than a half-wave length in the upper portion of the UHF spectrum.

5. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising an odd plurality of series-connected V-shaped elements arranged in end-to-end relation thereby providing a first series of spaced apart apices along one side and a second series of spaced apart apices along the other side, each V-shaped element including two leg portions, two parallel straight extensions connected to the extremities of the two endmost V-shaped elements respectively, said extensions forming obtuse angles with said extremities, respectively; said two antenna sections being spaced apart in parallelism with the first series apices being respectively juxtaposed thereby providing plural pairs of adjacent but spaced apart apices, and means fixedly securing said antenna sections into assembled relation, the lengths of the leg portions of the V-shaped elements being substantially equal and corresponding to a length about seventeen percent greater than a quarter of a wavelength at a selected frequency in the UHF spectrum, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a straight line passing between said antenna sections, means securing said antenna sections to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, each reflector element comprising two equal length sections having adjacent ends which are insulated from each other, four supporting insulators, one supporting insulator each mounting each pair of adjacent reflector section ends onto said supporting bar, the reflector sections of the first-mentioned two reflector elements having a length about twenty percent longer than a half-wave in the lower frequency portion of the UHF spectrum, and the reflector sections of the second-mentioned two reflector elements having a length about twenty percent longer than a half-wave in the upper frequency portion of the UHF spectrum.

6. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising an odd plurality of series-connected V-shaped elements arranged in end-to-end relation thereby providing a first series of spaced apart apices along one side and a second series of spaced apart apices along the other side, each V-shaped element having two leg portions, two parallel straight extensions connected to the extremities of the two endmost V-shaped elements respectively, said extensions forming obtuse angles with said extremities, respectively; said two antenna sections being spaced apart in parallelism with the first series apices being respectively juxtaposed thereby providing plural pairs of adjacent but spaced apart apices, and means fixedly securing said antenna sections into assembled relation, the lengths of the leg portions of the V-shaped elements being substantially equal and corresponding to a length about seventeen percent greater than a quarter of a wavelength at a selected frequency in the UHF spectrum, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a straight line passing between said antenna sections, means securing said antenna sections to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, said supporting bar being conductive and said reflector elements being connected thereto midway between the ends thereof, the first-mentioned two reflector elements each having a length about twenty percent longer than a full wave length in the lower portion of the UHF spectrum, and the second-mentioned two reflector elements each having a length about twenty percent longer than a full wave length in the upper portion of the UHF spectrum.

7. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising an odd plurality of series-connected V-shaped elements arranged in end-to-end relation thereby providing a first series of spaced apart apices along one side

and a second series of spaced apart apices along the other side, each V-shaped element including two legs portions, two parallel straight extensions connected to the extremities of the two endmost V-shaped elements respectively, said extensions forming at obtuse angles with said extremities, respectively; said two antenna sections being spaced apart in parallelism with the first series apices being respectively juxtaposed thereby providing plural pairs of adjacent but spaced apart apices, and means fixedly securing said antenna sections into assembled relation, the lengths of the leg portions of the V-shaped elements being substantially equal and corresponding to a length about seventeeen percent greater than a quarter of a wavelength at a selected frequency in the UHF spectrum, an elongated supporting bar lying in a plane which is normal to the plane of said antenna sections and which intersects the latter plane in a straight line passing between said antenna sections, means securing said antenna sections to said supporting bar; a resonant planar reflector screen mounted on said supporting bar and lying in a plane parallel to said antenna sections, said screen comprising four rod-like reflector elements which are parallel to each other and extending at right angles to said supporting bar, two of said reflector elements being disposed directly behind the opposite end extensions of said antenna sections, respectively, the other two of said reflector elements being spaced apart and directly behind two pairs of outermost apices of said antenna sections, respectively, two of said reflector elements having lengths equal to an odd number of wave lengths in the lower portion of the UHF spectrum, and two of said reflector elements having lengths equal to an odd number of wave lengths in the upper portion of the UHF spectrum.

8. The antenna of claim 7 wherein the spacing between the reflector screen and the plane of the antenna sections is equal to about one-sixth of a wavelength in the upper portion of the UHF spectrum.

9. A broadband UHF unidirectional antenna comprising two side-by-side, coplanar, metallic antenna sections formed of rod-like material, said two sections being of substantially identical configuration; each section comprising an odd plurality of series-connected V-shaped elements arranged in end-to-end relation thereby providing a first series of spaced apart apices along one side and a second series of spaced apart apices along the other side, each V-shaped element including two leg portions, two parallel straight extensions connected to the extremities of the two endmost V-shaped elements respectively, said extensions forming obtuse angles with said extremities, respectively; said two antenna sections being spaced apart in parallelism with the first series apices being respectively juxtaposed thereby providing plural pairs of adjacent but spaced apart apices, and means fixedly securing said antenna sections into assembled relation, the lengths of the leg portions of the V-shaped elements being substantially equal and corresponding to a length about seventeen percent greater than a quarter of a wave length at a selected frequency in the UHF spectrum, a resonant planar reflector screen, means for mounting said screen in a plane parallel to said antenna sections, said screen comprising a plurality of rod-like reflector elements which are spaced apart and parallel to each other and also transverse to an imaginary line drawn between said first and second series of apices, at least one of said reflector elements having a length about twenty percent longer than a wave length at a selected frequency in the lower portion of the UHF spectrum and at least one of said reflector elements having a length about twenty percent longer than a wave length at a selected frequency in a higher portion of the UHF spectrum.

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2,290,800	Brown	July 21, 1942
2,586,276	Umstead	Feb. 19, 1952
2,918,672	Hoverman	Dec. 22, 1959