

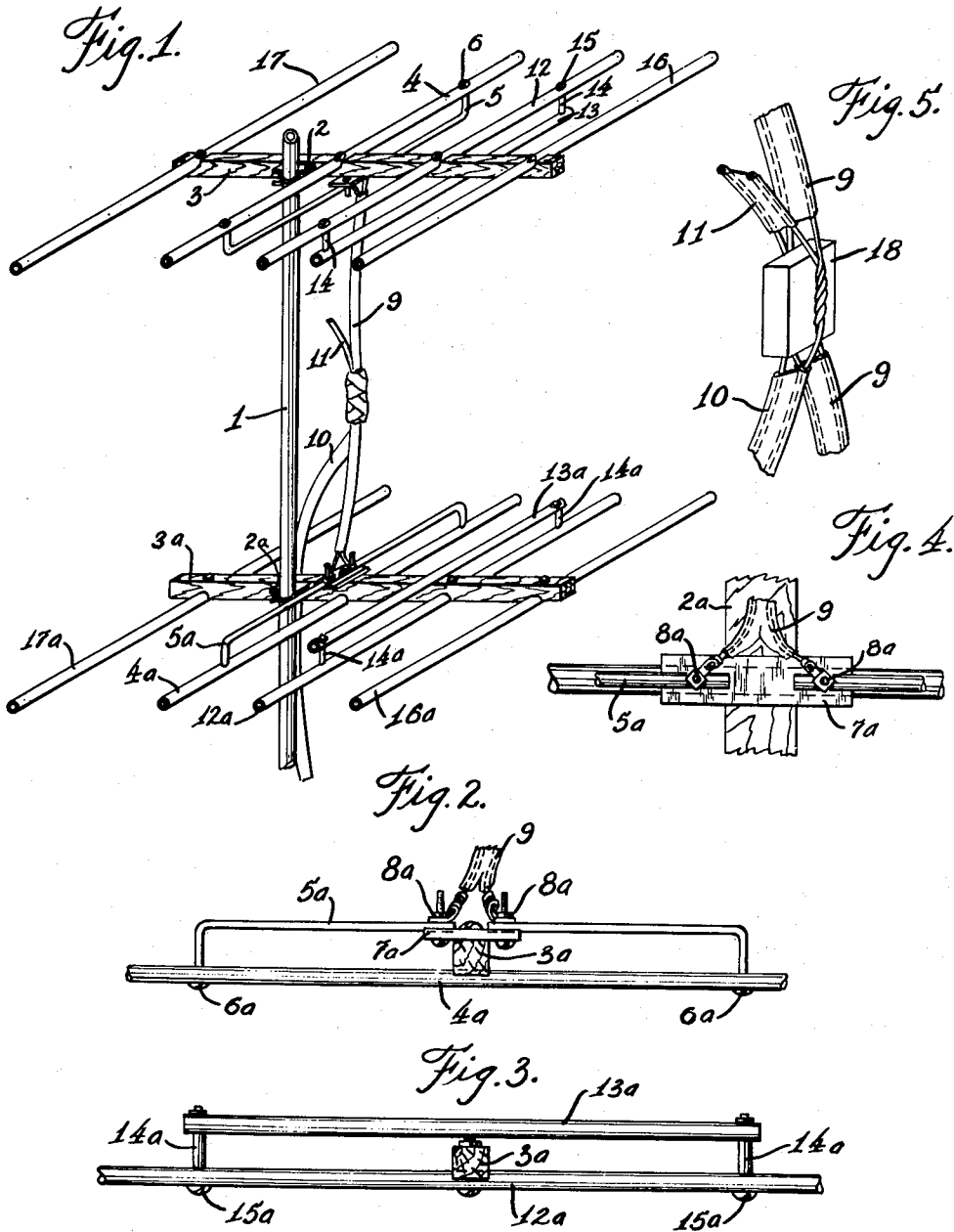
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S. P. CUPEC

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TELEVISION ANTENNA

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INVENTOR.
SYLVESTER P. CUPEC

BY

William J. Ruano
ATTORNEY

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TELEVISION ANTENNA

Sylvester P. Cupec, Bentleyville, Pa.

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The present invention relates to a television antenna and, more particularly, to a television antenna of the stacked type, including units having a plurality of parasitic elements to obtain high gain and clear reception from distant television stations.

It is well known in the television art that a half wave dipole antenna, either of the straight or folded type, may have added to it parallel disposed elements, in the same horizontal plane, known as parasitic elements, for improving the gain of the antenna as well as for eliminating interference by giving greater sensitivity or directional effect to a particular desired station. For instance, a reflector in the form of a straight parallel metal tube having no electrical connection to the antenna, is disposed behind the antenna, that is, away from the station to which the antenna is tuned or from which maximum signal strength is desired. The effect of the reflector is to increase the sensitivity in the forward direction and to decrease it in the opposite direction, also to make the antenna system more directional so that there is maximum response to a narrower angle than is the case without the reflector. It is also known in the art to use one or more directors, in the form of straight rods or tubes, for example, disposed in the same horizontal plane parallel to and in front of the antenna or driven element so as to intercept signals from the desired station to which the antenna is cut or tuned before these signals reach the antenna and increase the response to this station, adding further to the increase obtained from the reflector and making the frequency response somewhat narrower. It is also known in the art to stack antenna driven elements as well as the above mentioned parasitic elements, that is, reflectors and directors, to obtain more gain of the antenna at the frequency for which the antenna is tuned or cut and to obtain broader frequency response. Certain antennas, including a reflector and one or more directors, with or without stacking, are generally known as "Yagi" antennas. This type of antenna is probably the highest gain antenna of simple form and construction known, and has a narrower band width than the more conventional television antennas, having peak gain over only one channel.

However, in the reception of distant television stations presenting weak signals in the face of strong signals presented by a local television station, a very serious and difficult problem arises which is not solved satisfactorily even by stacked Yagi antennas. Despite the use of a plurality of stacked parasitic elements, such as several groups of directors, and a reflector for each group, there is still noticeable interference from a local strong station or other sources of interference, making reception of a distant television station extremely difficult and attainment of a clear picture equally difficult or impossible.

An object of my invention is to provide a novel television antenna which is devoid of the above named disadvantages of conventional antennas and which is particularly adapted to receive distant television stations in spite of considerable interference and which will provide

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amazingly high gain and clear picture definition even from extremely weak signals obtained from such distant stations as well as better tone qualities.

A more specific object of my invention is to provide improvement in antennas of the stacked Yagi type to increase their sensitivity to distant stations for which they are tuned as well as to increase the gain and band width of response despite interference of a local and distant character.

Other objects and advantages of my invention will become apparent from a study of the following description, taken with the accompanying drawing wherein:

Figure 1 is a perspective view of a television antenna having stacked elements and embodying the principles of my invention;

Figure 2 is an enlarged front elevational view of one of the antenna or driven elements;

Figure 3 is an enlarged front elevational view of one of the directors shown in Figure 1;

Figure 4 is an enlarged fragmentary view showing the connection between the link 9 and gap in one of the looped elements of the driven element shown in Figures 1 and 2, and

Figure 5 is an enlarged fragmentary view showing the connection between the link, interconnecting the antenna or driven elements, the transmission line and quarter wave matching stub.

Referring more particularly to Figure 1 of the drawing, numeral 1 denotes a vertically extending piece of pipe or mast onto which is secured by means of a clamp 2 an insulating support 3 extending at right angles to the mast, which support may be made of wood, plastic or other suitable insulating material. Mounted on insulating support 3 is an antenna driven element 4 made, for example, from a length of $\frac{1}{2}$ inch diameter aluminum tubing of slightly less than one-half wave length in length from end to end, preferably 46% of the wave length of the station to which the antenna is cut or tuned. Fastened to one side of driven element 4 is a looped piece of tubing of substantially U-shape, preferably of copper and of smaller diameter, preferably about $\frac{3}{16}$ " diameter, which has an over-all length of roughly two-thirds of the half wave length of the desired station. Preferably, the distance between the extreme ends of tubing 5 is 30.7% of the wave length and the length of each L-shaped half of tubing 5 is 16.8% of the wave length of the desired station, and the distance between centers of copper tubing 5 and driven element 4 is preferably about 2.6% of the wave length. Tubing 5 is secured to the driven element 4 by means of screws 6 which extend into the bent end portions of the tubing. As shown more clearly in Figure 2 illustrating a lower, duplicate, stacked driven element, there is a central gap in the tubing 5a across which is secured an insulating spacer element 7a onto which is fastened terminals 8a so as to secure the two wire terminals of the link 9 to the respective sections of tubing 5a. Link 9 may be made of flat, ribbon-like insulating material with parallel conductors or may be made of two separate, parallel spaced pieces of tubing, such as 4.

Also mounted on the insulating support 3 is a director 12 in the form of a straight piece of tubing, preferably of the same diameter and material as driven element 4 and of the same total length of the driven element, that is, about 46% of the wave length, and which has secured to one side thereof a shorter length or segment of tubing of the same diameter or of smaller diameter 13 which is fastened to tubing 12 by means of short lengths of tubing 14 and bolts 15 extending from the top of the director tubing 12 to the bottom of the shorter length of tubing 13. The distance between centers of tubing 12 and 13 is about 2.76% of the wave length of the station desired and the length of tubing 13 is preferably 30.5% of the wave

length. And immediately in front of director 12 is an additional director 16 of the same length and diameter as the longest length of tubing of director 12 to provide additional interception of the signals before reaching the driven element 4. Behind the driven element 4, there is disposed in parallel relationship just as the remaining parasitic elements, a reflector 17 in the form of a straight piece of tubing of the same diameter of driven element 4, also preferably of aluminum, but which is slightly longer as is the case of reflectors in general, preferably of a length equalling about 48.4% of the desired wave length.

The antenna structure described so far is a complete unit in itself and can be used very effectively for receiving weak signals from distant stations at relatively high gain, particularly in view of the construction of the antenna driven element 4—5 and the use of the specific shape of director elements 12—13—14 and 16 as well as the use of the conventional reflector element 17. The directors, particularly because of the looped segments 5 and 5a, increase the response to the designed signal adding further to the increase obtained from the reflector, whereas the reflector has the conventional function of very considerably increasing the sensitivity in a forward direction, that is, in a direction towards the transmitting station as well as decreasing the sensitivity in an opposite direction to make the antenna more directional. Stated differently, the reflector is used to bring up signal strength from one direction or in one channel, to reduce or eliminate interference from the opposite direction, or for both purposes.

The reflector 17 is preferably spaced 15.4% of the desired wave length behind the antenna proper, whereas the directors 12 and 16 are preferably spaced 10.2% of the desired wave length from each other and director 12 has the same spacing from antenna driven element 4. In order to increase the effectiveness of the antenna in receiving an extremely weak signal, the various elements are cut to receive the carrier frequency of a desired station and in addition similar elements of a second antenna are stacked in the same vertical plane and in parallel relationship with the above described elements so as to greatly increase the reception of such weak signals as well as increase the band width of response. Thus under each of the antenna elements hereinbefore described, there is disposed a correspondingly shaped duplicate element but arranged in an inverted manner and denoted by the addition of reference letter "a" to the corresponding numeral. For example, underneath and parallel to driven element 4 is stacked a corresponding driven element 4a having a shorter length of tubing of smaller diameter 5a in the same vertical plane and of the same dimensions as tubing 5. Likewise, immediately underneath the director 12, 13, 14 is an identical director 12a, 13a, 14a, but inverted; underneath and in the same vertical plane as director 16, there is a duplicate director 16a, and underneath the reflector 17 there is a corresponding shaped reflector 17a, all of the same dimensions as the corresponding elements and in spaced parallel relationship thereto. The distance between the upper array and lower array of antenna elements may be as much as $\frac{1}{2}$ wave length, preferably slightly less. The central gaps of tubing 5 and 5a are interconnected by a twin lead or link 9. Connected to a central point of link 9 is a transmission line 10 which leads to the television set. And as shown more clearly in Figure 5, there is connected to the same central point of the two wires of the link 9 about an insulating block 18, in addition to transmission line 10, a matching stub 11 which may be about $\frac{1}{4}$ wave length in length for matching the impedance of the antenna and whose extreme ends may be shorted (or left open if the stub is of longer length).

It should be noted that even the upper array of elements when used alone, that is, without stacking of the lower elements therewith, will provide highly improved results in reception of a weak signal and that director 16 may be omitted and possibly also reflector 17 without seriously affecting the reception of weak signals. However, best results are obtained by using all elements of the unit and by stacking the lower array of elements therewith.

Thus it will be seen that I have provided an efficient antenna for television, substantially of the stacked Yagi type, but with considerable and amazing improvement in gain as well as picture definition of a distant station from which only a weak signal is received and despite considerable interference by local stations or other interference such as from electrical apparatus, diathermy apparatus, etc.

While I have illustrated and described a specific embodiment of my invention, it will be understood that this is by way of illustration only, and that various changes and modifications may be made within the contemplation of my invention and within the scope of the following claims.

I claim:

1. A television antenna of the stacked Yagi type, comprising a pair of driven elements in spaced parallel relationship in a vertical plane, each of said driven elements comprising a straight piece of tubing of substantially half wave length at the frequency of the station to which the antenna is tuned and a U-shaped looped piece of tubing of smaller diameter than, and attached to said straight piece and having an over-all distance between legs of substantially 31% of the said wave length and a height of substantially 2.6% of the said wave length, and having central gaps in the base of said U-shaped pieces of tubing, the lowermost U-shaped pieces of tubing being inverted, said gaps being interconnected by a link to which a transmission line and matching stub are connected at a central portion of said link, and a pair of stacked director elements in spaced parallel relationship to said driven elements and of substantially the same length as the over-all length of said driven elements and having similarly U-shaped looped pieces extending in the same vertical plane, the U-shaped piece of the lower director element being inverted in relation to that of the upper piece.

2. A television aerial as recited in claim 1 having, in addition, a second pair of directors in the form of straight pieces of tubing in vertically stacked relationship in the direction toward the station to which the antenna is tuned, and a pair of vertically stacked reflectors disposed behind the stacked driven elements, said reflectors being of a length equal to substantially 48% of the wave length of the station to which the antenna is tuned, which stacked array of elements provides relatively high gain as well as a wide band frequency response and sensitivity to a given station as well as rejection of substantially all interfering signals, and clear picture reception.

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