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TELEVISION ANTENNA

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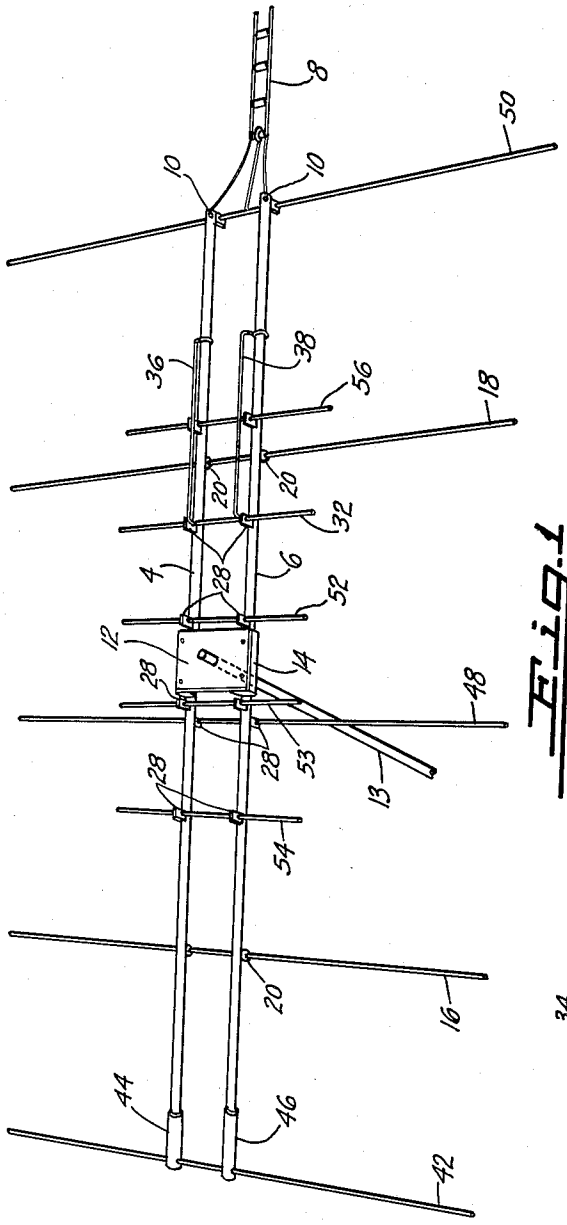


Fig. 1

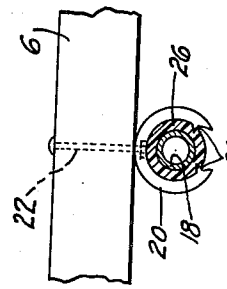


Fig. 2

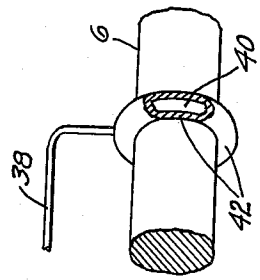


Fig. 3

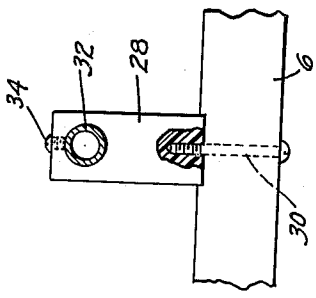


Fig. 4

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TELEVISION ANTENNA

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1 Claim. (Cl. 250—33.51)

This invention relates to a parasitic array of the Yagi type. More particularly, it relates to an antenna which is suitable for use in fringe area television reception of a number of channels.

It is one object of the present invention to provide a multiple band antenna which gives a high gain and high signal strength making it suitable for use in television fringe areas.

Another object of this invention is to provide an antenna which is suitable for multiple band reception wherein the elements for the different bands are supported only by the transmission line and wherein the transmission line is of such length that it provides a matching stub for the various bands resulting in a low standing wave ratio.

Another object of this invention is the arrangement of a multiple band antenna in such a manner that the elements for one band do not interfere with the reception from another band.

Still another object of this invention is to provide a highly directional antenna which will pick up a minimum of stray noise which might interfere with television reception.

Another object of this invention is to provide a television antenna which is strong, relatively light in weight and simple to manufacture.

A further object of this invention is to provide a highly directional antenna with high gain with broad frequency response, so that it will pass a complete television channel even in fringe areas.

Still another object of this invention is to provide an antenna having loose coupling between the driven elements and the transmission line said loose coupling tending to minimize stray pick-up and aid in the impedance match between the driven elements and the transmission line.

In the drawings forming a part of this application there is illustrated a preferred specific embodiment of my invention wherein the antenna is designed for use on channels 4, 5 and 7 as they are now designated by the Federal Communications Commission. It will be obvious to those skilled in the art that the same principles may be embodied in antennas suitable for reception of any desired channels and that more than three channels may be combined in a single antenna. In the description of the invention frequent reference will be made to the receiving properties of the antenna but it is obvious that the same principles may be embodied in a transmitting antenna.

Turning now to the drawings which form a part of this application there is shown in Figure 1 a perspective view of my improved television antenna.

In Figures 2 there is shown a detailed view of the method of coupling the driven element on channels 4 and 5 to the transmission line.

In Figure 3 is shown a detailed view of the method of coupling the driven element for channel 4 to the transmission line.

Figure 4 is a detailed view of the method of supporting

all the parasitic elements and the driven element for channel 7 on the transmission line.

Referring now to the drawings by reference characters, there is shown in Figure 1 a television antenna having two parallel spaced bars designated 4 and 6 which serve both as a transmission line and as a support for the elements of the antenna. Bars 4 and 6 may be suitably made of thin walled aluminum tubing having an outside diameter of 1 inch and spaced 12 inches. Other suitable dimensions may be used, such as 1.25 inch tubing spaced 7.75 inches on centers. With these particular dimensions, the bars 4 and 6 constitute a transmission line having an impedance of slightly over 400 ohms. Thus, the transmission line consisting of bars 4 and 6 provides a good impedance match to conventional open wire transmission line 8 which has size 18 copper wires spaced 1 inch between center. Fastening means 10 are provided at one end of the transmission line for coupling to the open wire line 8. The impedance match is sufficiently close to permit ordinary plastic insulated line ("Twin Lead") to be used instead of the air insulated line illustrated.

The bars 4 and 6 are supported and held in their spaced relationship by a center section 12 which is preferably placed at the center of balance of the completed antenna and which provides a convenient way of fastening the antenna to a mast 13. Center section 12 may be made of plastic or metal but is suitably made with the center section of metal with plastic, or other insulating material 14 at each end thereof. The plastic ends 14 are provided with suitable means for fastening bars 4 and 6 to the center section 12 and for insulating the bars from the center section 12.

Both the driven and parasitic elements are supported at right angles to the bars 4 and 6 as is shown in the drawings.

In the embodiment shown, the antenna has three driven elements. The driven element for channel 5 is designated 16 and the driven element for channel 4 is designated 18. The element 16 is 70 inches long while the element 18 is 80 inches long. Thus these elements resonate in approximately the center of channels 5 and 4 respectively. These elements as well as the other elements to be described are suitably made from ½ inch O. D. aluminum tubing, although other suitable metals may be used.

The method of fastening these two driven elements to the bars 4 and 6 is shown in detail in Figure 2. The method consists of a U-shaped clamp 20 of spring metal which is attached to one of the transmission line elements 6 by means of a screw 22 or other suitable device. The clamp 20 has tangs 24 at the outer edges of the U which tend to lock the element into place. The element 18 is surrounded by a suitable insulator such as polyethylene 26. Thus the driven elements 16 and 18 are not directly connected to the transmission line but are insulated therefrom; the clamp 20 together with the insulation 26 and the element 18 constitutes a capacitor giving capacity coupling between the driven element and the transmission line. The capacitance of such a coupling is about 10 mmfd.

A different method is used for fastening the driven element for channel 7 and also the parasitic elements for all channels to the transmission line. This method is illustrated in Figure 4 and consists of an insulating block of plastic 28 connected by means of a screw 30 to the transmission line 6 and having a hole therein to accommodate the element 32. The element 32 may be held in place by means of a screw 34.

The driven element 32 is insulated from the transmission line by the insulator 28 and is connected to the transmission line through matching sections designated 36 and 38. The method of coupling the matching sections 36 and 38 to the transmission line is shown in Figure 3 and

consists of a metallic ring 40 covered with a plastic material 42. Preferably the ring is made from flattened tubing. The dimensions of this connection are so selected that a connector has a capacity of about 10 mmfd; the element 32 is connected to the transmission line capacitatively only.

Having now described the driven elements of the array, the parasitic elements will be described. Located at the front of the antenna is the director 42 for channel 5. The director is 67 inches long and is spaced 29 inches (0.2 wave-length) from the channel 5 driven element 16. It will be noted that the director 42 is mounted on the transmission line by means of wooden rods 44 and 46. These wooden rods serve as insulators for the element 42 and are 8 inches in length. This leaves 21 inches of the transmission lines 4 and 6 ahead of the driven element 16, said lengths acting as matching stubs to match the driven element 16 to the transmission line. The wooden rods 44 and 46 may be painted with aluminum paint, thereby constituting a resistance element. Such a resistance tends to "swamp" any currents traveling from the back to the front of the antenna. Without such a terminating resistance, any reflected waves picked up from the opposite direction would be reflected back into the transmission line and cause a ghost image. In extreme fringe areas, the resistance may be omitted. Instead of painting the rods, a resistor may be fastened across the front of bars 4 and 6. A valve of 200 to 400 ohms is suitable.

The element 48 is 77 inches long and is mounted 33 inches (0.2 wavelength) from the elements 16 and 18. The element 48 serves as a director for driven element 18 and as a reflector for driven element 16. The element 16 also serves as a director for driven element 18. Mounted at the rear of the antenna is element 50 which is 84 inches long and spaced 33 inches from the element 18. The element 50 acts as a reflector for driven element 18.

Thus, the channel 5 driven element 16 has a director 42 and a reflector 48 and is provided with a matching open stub which is 21 inches long to match it to the transmission line. The channel 4 driven element 18 has two director elements 16 and 48 and one reflector 50. That portion of the transmission lines 4 and 6 lying in front of the driven element 18 constitutes about ½ wave length at the channel 4 frequency and assists in matching the channel 4 driven element to the line.

The channel 7 elements are preferably mounted on the opposite side of the bars 4 and 6 from the elements for channels 4 and 5, as shown. The channel 7 driven element 32 is 31.2 inches long and is insulated from the transmission line as shown; it has three director elements 52, 53 and 54 each of which is 30 inches long. The director element 52 is mounted 13 inches (0.2 wavelength) from the element 32 and in turn the element 53 is mounted 13 inches in front of element 52 and element 54 is mounted 13 inches in front of element 53. The reflector for channel 7 is the element 56 which is 33 inches long and mounted 13 inches behind the driven element 32.

As has been previously mentioned, the driven element 32 is insulated from the transmission lines 4 and 6 at its point of support and is coupled to the transmission line by the matching lines 36 and 38 which in turn are capacitatively coupled to the transmission lines. The elements 36 and 38 are about 28 inches long. The length of the electrical path from the channel 7 driven element 32 through the connecting lines 36 and 38 to the channel 4 driven element 18 is about 45 inches. This constitutes about ¼ wave length for channel 4 and an odd multiple of a ¼ wave length, i. e. ¾ wave length, for channel 7. This prevents there being interaction between the two elements which would result in one driven element shorting out the other.

By capacitatively coupling the driven elements to the transmission lines there is a minimum interference between the various driven elements which are coupled to the transmission lines. Further, the capacity coupling is such that it offers little resistance to the passage of the high frequency television signal but offers a high resistance to the passage of lower frequencies, such as ignition noise. Thus, by capacitatively coupling the elements to the line one secures a high signal strength together with a high attenuation of lower frequency noise.

It will be noted that the spacing between any driven element and its parasitic elements is about 0.2 wavelength. By using this separation the Q of the antenna is kept low, giving a broad response to pass on entire television channel.

The antenna of the present invention is a system or method whereby multiple complete antennas may be coupled through capacitances to a common transmission line.

I claim:

An antenna for high frequency use having in combination a spaced rigid transmission line, said transmission line having at right angles thereto more than one driven element, each of said driven elements being loosely coupled to the transmission line, and parasitic elements insulated from said transmission line, said rigid transmission line furnishing the sole support for the driven and parasitic elements, and wherein the spacing of one of said driven elements on the transmission line acts as a shorted matching stub for another of said driven elements on said transmission line.

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