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Verma et al.

[11] **3,906,506**

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[54] **BUILT-IN TELEVISION CONSOLE ANTENNA**

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[21] Appl. No.: **454,175**

[52] **U.S. Cl.** **343/702;** 343/742; 343/876

[51] **Int. Cl.²** **H01Q 1/24**

[58] **Field of Search** 343/702, 742, 876

[56] **References Cited**

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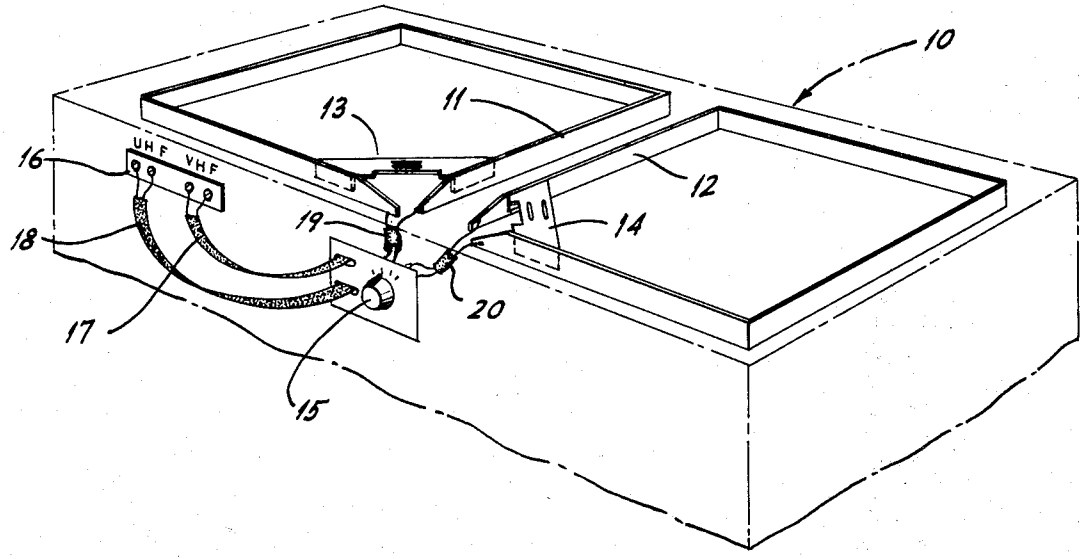
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Primary Examiner—Eli Lieberman
Attorney, Agent, or Firm—Robert D. Sanborn

[57] **ABSTRACT**

Two single turn horizontally oriented loops are located in a common plane inside a television receiver cabinet. A multi-position switch is used to connect the loops in various combinations to the receiver antenna terminals. In a typical receiver, employing separate VHF and UHF tuner inputs a four-position switch is employed. In one position one loop is connected to the VHF input and the other is connected to the UHF input. In the second position the loops are exchanged. In the third position both loops are connected to the VHF input and in the fourth position both loops are connected to the UHF input. Thus for either VHF or UHF reception the user has a selection of three switch positions for optimum signal pickup.

8 Claims, 8 Drawing Figures



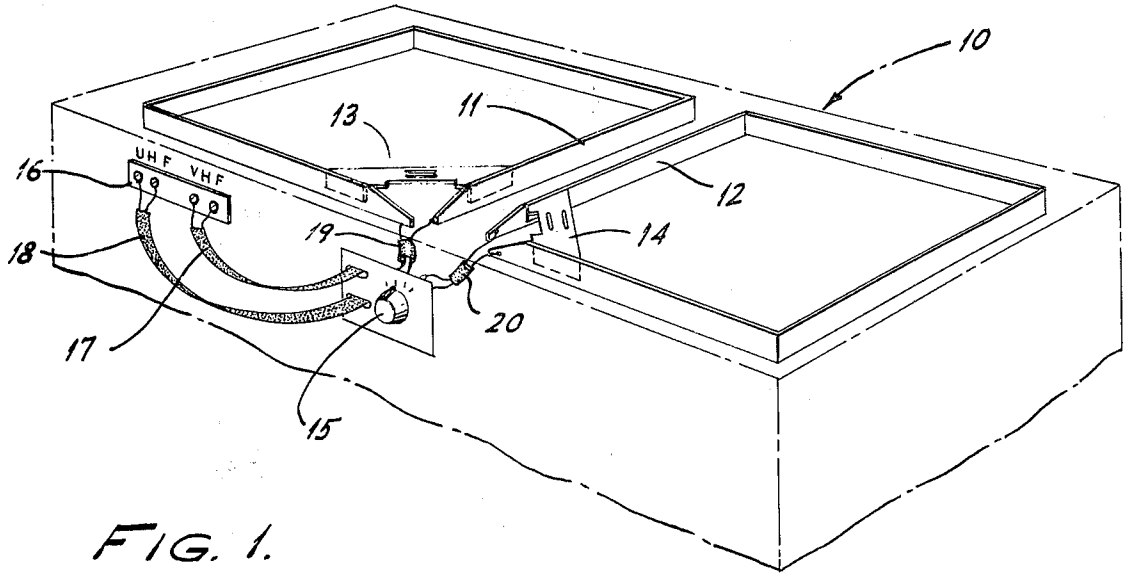

10
11
12
13
14
15
16
17
18
19
20
UHF VHF

FIG. 1.

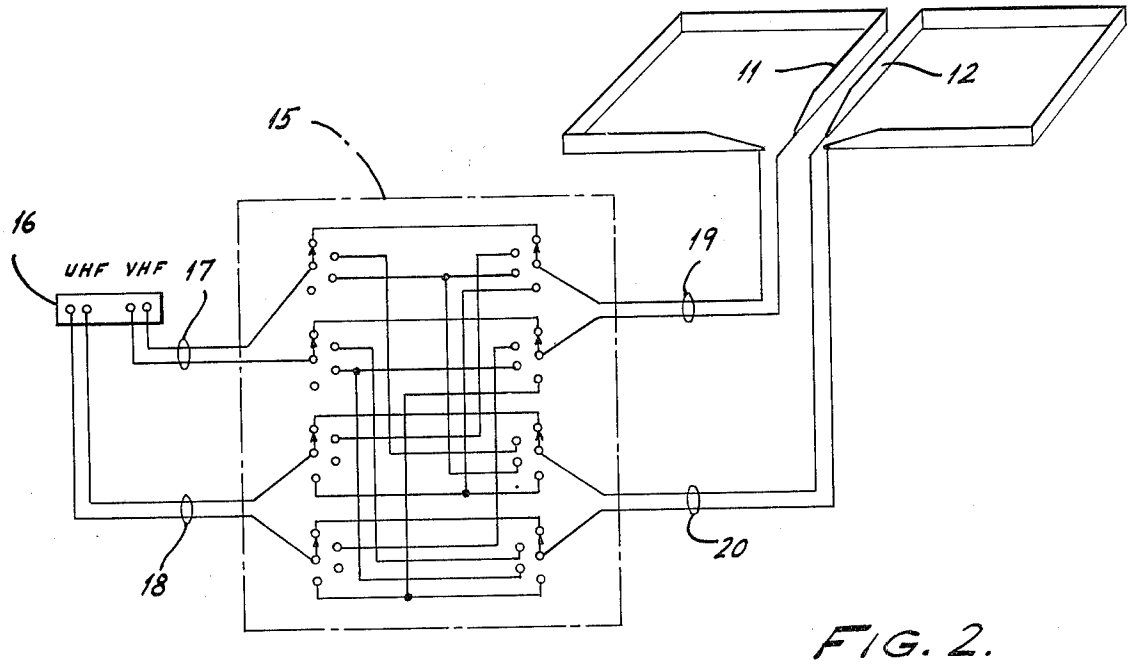

11
12
15
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UHF VHF
17
18
19
20

FIG. 2.

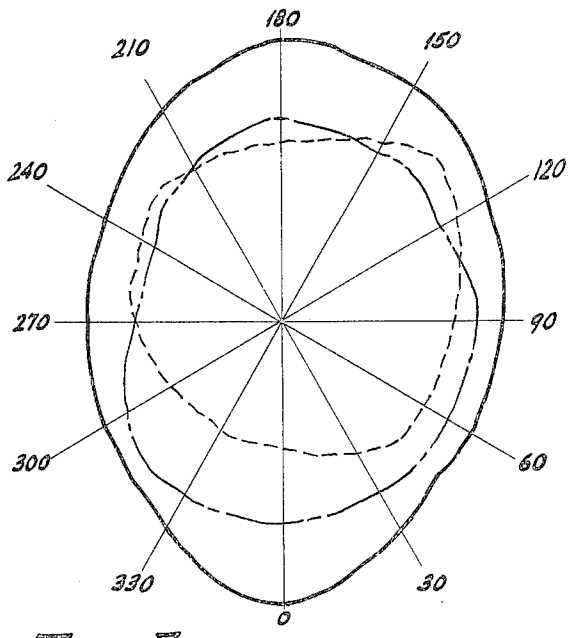


FIG. 3.

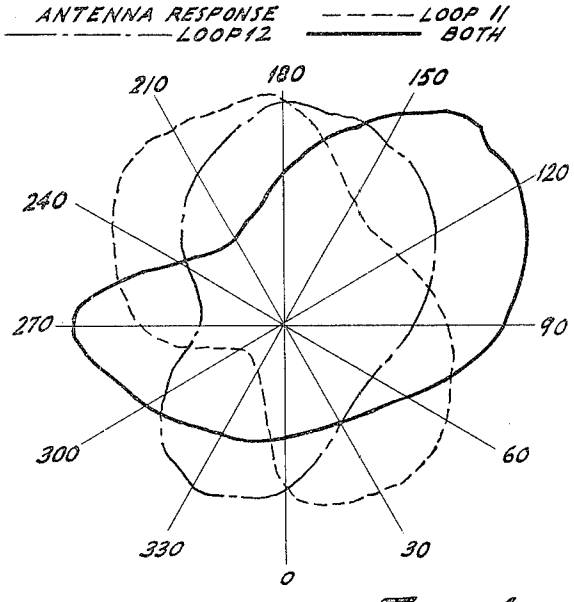


FIG. 4.

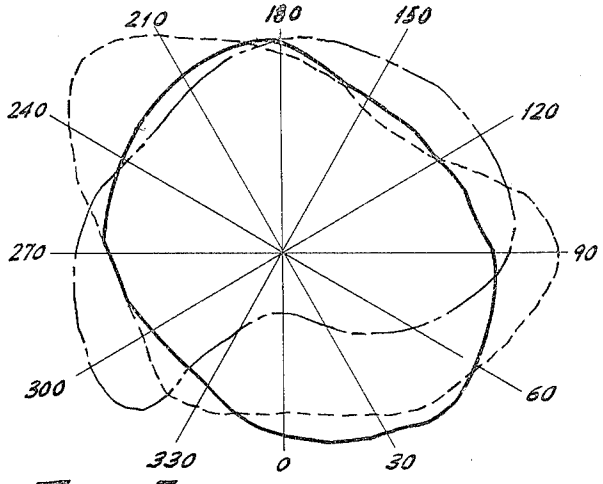


FIG. 5.

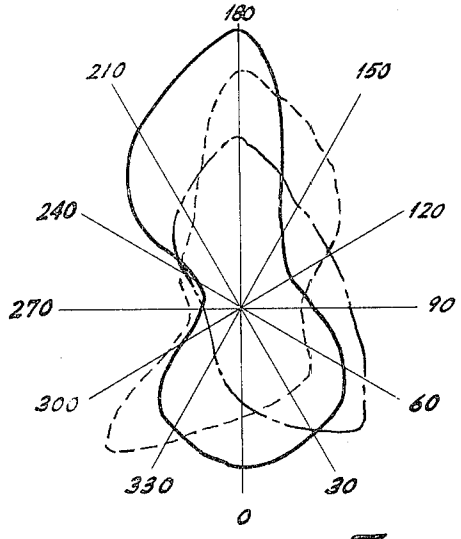


FIG. 6.

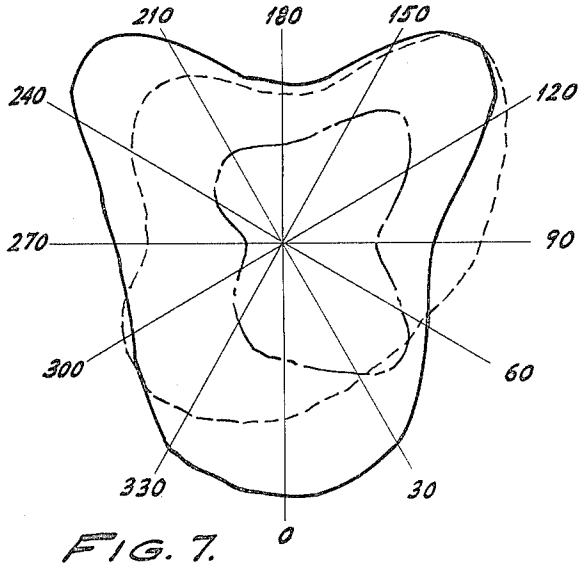


FIG. 7.

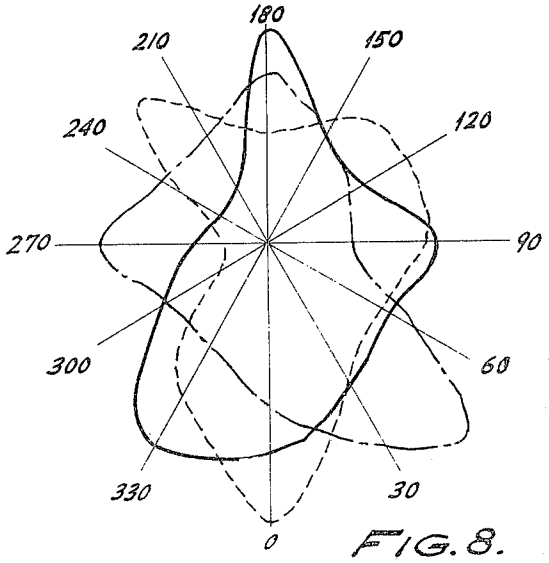


FIG. 8.

BUILT-IN TELEVISION CONSOLE ANTENNA

BACKGROUND OF THE INVENTION

A satisfactory built-in television receiver antenna has long been sought by the industry but complete success has not been achieved. One major problem is the broad range of signal frequencies that must be picked up. Currently in the United States three bands are involved. These are: low VHF-**54** to **88** MHz; high VHF-**174** to **216** MHz; and UHF-**470** to **890** MHz. A tuning range of over **16** to **1** is involved. This alone presents formidable problems in an antenna system and these problems are made much more difficult if the antenna is to be confined to the inside of the television receiver cabinet.

Optimum reception is achieved by using an outside antenna system, mounted above the building and adjusted for satisfactory operation. However, in strong signal areas, such as those normally found in metropolitan areas, indoor antennas can often provide satisfactory reception. The most popular indoor antennas are the telescoping dipole or monopole for VHF reception and a movable loop or a bowtie for UHF reception. Such antennas are unsightly and are cumbersome to adjust. They are susceptible to breakage and often develop poor electrical connections because of the sliding contacts involved.

The most desirable form of indoor antenna is one that is sufficiently compact to mount inside the conventional receiver cabinet. In the prior art dipoles of various configurations have been stapled or otherwise fastened inside the cabinet or fastened to the removable back cover. In some cases elaborate tuning devices were employed to make the antennas sufficiently responsive. Usually such antennas need orientation because of their directional response and this necessitates moving the receiver cabinet, often to a position that is quite unsuitable for viewing. Ordinarily the receiver cabinet is not large enough to accommodate an antenna that is rotatable.

To achieve the effect of rotation without actually moving the antenna it has been proposed to make the antenna in the form of four elements disposed at **90°** with respect to each other and having a common center. The four elements are connected to a switch that is arranged to connect the four elements in various configurations to the receiver antenna terminals. This effectively rotates the antenna pattern but at each position the antenna is resonant to a particular frequency. Thus such antennas are too narrow band to be of use over all of the television bands.

In short none of the prior art antennas associated directly with the television receivers, whether built in or attached to the cabinet, have proven to be very satisfactory.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a built-in television receiving antenna that is sufficiently broad band to cover both VHF and UHF bands and needs no physical orientation.

It is a further object to provide an antenna that can be secured unobtrusively inside a television receiver cabinet, and to provide electrical manipulation of performance in order to obtain most suitable operation.

These and other objects are achieved in the following manner. Two broadband single-turn loop antennas are

secured in close mutual proximity to the inside of the top of the receiver cabinet. The loops are horizontal and in the same plane. The loops are of a size that sets their fundamental reasonance to just above the high VHF band, which places their second harmonic just below the UHF band. Fundamental resonance occurs when the perimeter of the loop is one electrical wavelength. The loops are made square with flat sides adjacent. This configuration makes the pair conform easily to the conventional rectangular television console cabinet shape. The loops are connected, by means of conventional **300**-ohm ribbon leads, to a multi-position switch which in turn is connected, by means of similar ribbon leads, to the VHF and UHF antenna terminals on the receiver. The switch permits connecting the loops in various combinations to the two tuner inputs. In the preferred embodiment a four position switch provides the following loop connection permutations. In position number **1**, one loop is connected to the VHF tuner and the other loop is connected to the UHF tuner. In position number **2** the loops are exchanged. In position number **3**, both loops are connected together to the VHF tuner. In position **4**, both loops are connected together to the UHF tuner. Since the loops interact with each other and with the underlying, adjacent television receiver, their normally smooth omnidirectional pickup patterns will have lobes and nulls. By providing the user with three selections each for VHF and UHF operation, the patterns can be modified so the user can select the position of best performance.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** shows the antenna mounted in a television cabinet which is shown in phantom view;

FIG. **2** shows the essential elements of the antenna system; and

FIGS. **3—8** show the response, at six different frequencies; of the antenna mounted inside a convention console television receiver.

DESCRIPTION OF THE INVENTION

FIG. **1** shows a television receiver cabinet **10** in phantom outline. Square loops **11** and **12** are mounted, by means not shown, inside the top of the cabinet so as to be fully contained and concealed therein. Each loop is about **35** cm. across thereby making the perimeter about **1.4** meters. The loops are about **2** to **10** cm. apart. The fundamental loop resonance is about **230** MHz, or just above the high end of the high VHF band. The second harmonic is about **460** MHz, or just below the UHF band. The loop is made about **2.5** cm. wide and desirably can be made from sheet stock. Where thin metal stock is used, the edges can be rolled to make the structure more rigid. The ends of the loop are tapered, as shown, to reduce the terminal shunt capacitance. The open ends are held in position by insulators at **13** and **14.** The insulators can be cemented or riveted to the loop.

The loop as described appears capacitive at the VHF channels. At UHF it acts as a multiresonant loop, passing through one resonance, the third harmonic, at about television channel **50.** In the horizontal plane such a loop will be omnidirectional under free space conditions. Inside a television receiver cabinet, the loop will interact with the chassis, cathode ray tube components, wiring, and other outboard components. Accordingly, the omnidirectional pattern will be sub-

stantially modified, particularly at the higher frequencies. For example in a typical situation the antenna pattern will be largely omnidirectional at channel 2 but will show a triple lobed response having a substantial change in signal response as a function of angle, at channel 83.

In the dual loop configuration, as shown in FIG. 1, the loops are displaced with respect to each other in azimuth so that any lobing patterns will be relatively shifted by about 90°. If one were to switch from one antenna to the other it would be as if the first antenna were physically turned to a quadrature orientation.

Switch 15 is interposed between the loops and the receiver antenna terminal 16. The switch is connected to the receiver antenna terminals 16 by means of ribbon leads 17 and 18 to VHF and UHF inputs respectively. Ribbon leads 19 and 20 connect the two loops to switch 15.

FIG. 2 shows the details of the action of switch 15. The following list details the connection available by means of the four positions.

Position 1: Loop 11 is connected to the VHF terminals and Loop 12 is connected to the UHF terminals.

Position 2: Loop 11 is connected to the UHF terminals and Loop 12 is connected to the VHF terminals.

Position 3: Loops 11 and 12 are connected in parallel to the VHF terminals.

Position 4: Loops 11 and 12 are connected in parallel to the UHF terminals.

From the above it can be seen that for either VHF or UHF operation three conditions are available. These include either loop alone or the parallel combination or both. As described above, when switching from one loop to the other the antenna lobing pattern is shifted by about 90°. The third position or parallel connected loops provides still another lobe pattern which is a complex combination of the patterns of the separate loops. In the parallel connection the loops should be connected in the in-phase terminal relationship.

It will be noted that when the receiver is set for VHF the unused loop in Positions 1 and 2 will be connected to the UHF tuner which will act as a line termination. Thus not only do the loops interact with the television receiver components, they interact with each other because of their proximity and in accordance with the lead length and the nature of the lead termination. Thus while the leads connecting loops 11 and 12 to switch 15 should have the same length, this length can be selected or varied to modify the antenna patterns.

EXAMPLE

A television console receiver, using a 25V display, had loops installed, as described above and shown in FIG. 1. The receiver was operated in a variety of locations so as to produce a wide range of signal reception conditions. In addition, measurements of antenna performance were made and polar plots of signal response were developed.

FIG. 3 shows the separate and combined loop responses at Channel 2. It will be noted that the patterns are almost those of free space loops, thereby showing only moderate interaction with the chassis and other components.

FIGS. 4 and 5 show loop performance at VHF Channels 7 and 13 respectively. FIGS. 6, 7, and 8 show the UHF responses at Channels 14, 42, and 83. As the higher frequencies are approached, it will be noted that the departure from free-space loop performance increases. FIG. 8 clearly shows that the antenna has three well defined lobes and the lobes vary for each of the three loop configurations.

The bandwidth characteristics of the antenna were excellent thereby making it useful for color television reception. In areas of strong television signals the antenna performed as well as the conventional telescoping dipole and UHF loop combination. It was noted that the loops produced signals that were much less affected by adjacent environmental conditions such as people moving about and metal structures such as lamps and other appliances. On most channels, particularly the high-band VHF and UHF channels, the antenna could be switched to miminize ghost reception without moving the receiver. In general highly satisfactory reception was obtained in most cases with the fully built-in antenna.

The antenna of the invention and its performance have been described. Alternatives and equivalents will occur to persons skilled in the art. For example, the loops have been shown as square whereas they can be made round if adequate space is available inside the receiver cabinet. Rectangular or trapezoidal shapes could be used to conform the antenna with cabinet shape. Also ribbon lead connection cables have been shown, whereas each loop could be connected to a balun and a 75-ohm coaxial cable interconnection used. Accordingly, it is intended that the invention be limited only by the following claims:

We claim:

1. A built-in antenna for receiving signals in a television receiver having separate VHF and UHF tuners, said antenna comprising:

A pair of single turn loops adapted for mounting horizontally in spaced apart side by side relationship and in a common plane inside the cabinet of said receiver, and

means including a switch for connecting said loops to said receiver in combinations including either of said loops singly to either of said tuners and both of said loops connected together to either of said tuners, said switch being positionable for best signal reception.

2. The antenna of claim 1 wherein said switch has four positions, the first position arranged to connect the first loop of said pair to said VHF tuner and the second loop of said pair to said UHF tuner, the second position arranged to connect the first loop of said pair to said UHF tuner and the second loop of said pair to said VHF tuner, the third position arranged to connect said pair of loops to said VHF tuner, and the fourth position arranged to connect said pair of loops to said UHF tuner.

3. The antenna of claim 2 wherein said loops have a fundamental resonance at a frequency slightly higher than the highest VHF television channel.

4. An antenna built into a television receiver having separate VHF and UHF input terminals, said antenna comprising:

first and second loops disposed horizontally and in a common plane inside said receiver, said loops being oriented in azimuth at approximately right angles with respect to each other, and

means, including a multiposition switch, for connecting said loops to said input terminals, said switch having positions which provide for connections in-

cluding, said first loop connected to said VHF input and said second loop to said UHF input, said second loop connected to said VHF input and said first loop connected to said UHF input, said first and second loops connected in parallel to said VHF input, and said first and second loops connected in parallel to said UHF input.

5. The antenna of claim **4** wherein said loops are constructed of strips of sheet metal having substantial width to provide broadband performance.

6. The antenna of claim **5** wherein said parallel connections connect said loops in phase with each other.

7. The antenna of claim **6** wherein said loops have a fundamental resonance of a frequency in the spectral region between the VHF and UHF television bands.

8. The antenna of claim **7** wherein said switch has four positions for providing the recited connection combinations.

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