

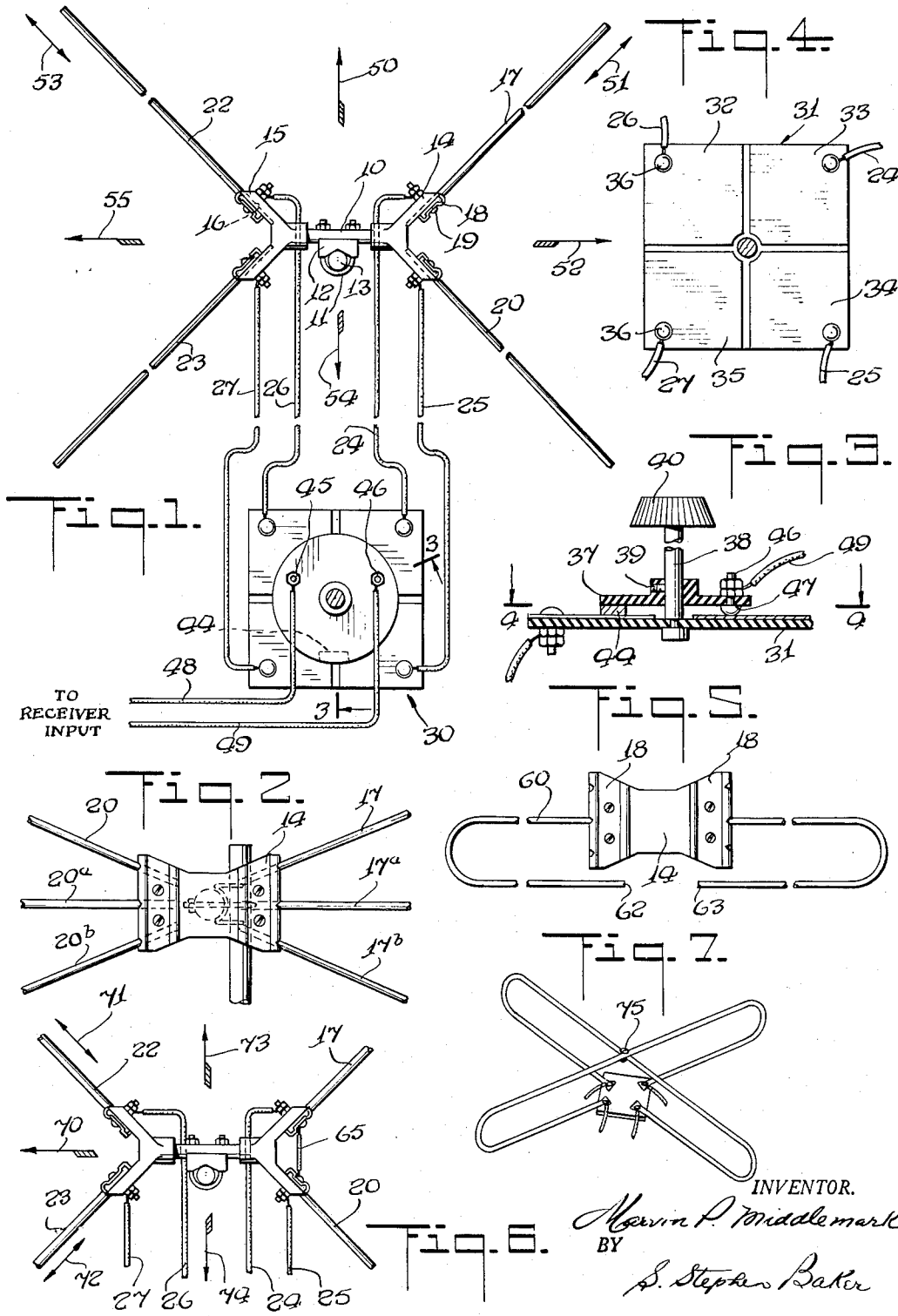
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DIRECTIONAL ANTENNA SYSTEMS

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DIRECTIONAL ANTENNA SYSTEMS

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This invention relates to high frequency antennas for use with television receivers.

It is well understood that proper television reception, as presently practiced, generally requires a directive antenna oriented toward the particular station which is selected. In many areas, the number of stations or channels which serve the receiver are dispersed in various directions so that for best results the antenna should be either physically or electrically oriented. The instant invention discloses a structure having dipole elements specifically arranged in combination with a novel selector switch which combines various dipole elements to accomplish directivity as required. Thus, in the principal embodiment, the four dipole rods of a crossed dipole arrangement are brought into various combinations whereby any of eight directions is effectively selected by turning of a switch. In some directions the dipoles employed are conical or substantially unidirectional while in others they are aligned or bi-directional. The invention also discloses the automatic shorting of non-selected elements to serve as a reflector.

In an alternate embodiment of the invention, some dipole elements are permanently shorted to serve as a reflector when certain elements are selected for directivity.

The invention will be further understood from the following description and drawings in which:

Figure 1 is a top view of an antenna system constructed according to the instant invention;

Figure 2 is a front, fragmentary view thereof;

Figure 3 is a cross-sectional view taken along the lines 3—3 of Figure 1;

Figure 4 is a view of the switch mechanism as taken along the lines 4—4 of Figure 3;

Figure 5 is a front fragmentary view similar to Figure 2 but illustrating a first modified embodiment;

Figure 6 is a fragmentary top view similar to that of Figure 1 but illustrating a second modified embodiment; and

Figure 7 is a perspective view illustrating a third modified embodiment.

Referring to Figure 1, the antenna elements are shown as being disposed in a horizontal plane as is customary. The supporting member includes a rod 10 through which extends a U-shaped holder 11. Holder 11 in cooperation with clamp 12 grips the vertical mast 13 as will be evident. Such structure serves to support the antenna elements and insulators on a roof or other site.

To the ends of rod 10 are connected a pair of insulator brackets 14 and 15. These are of electrically insulating material such as Bakelite or the like. Insulator 14 is angular in form, having two arms, each of which support the antenna elements in a predetermined angular relationship. Thus, each arm is formed with one or more grooves 16 into which the antenna elements, in this case dipole rods, fit. Referring to Figure 1, the dipole rod 17 fits into a groove 16 wherein it is retained by a metal clamp 18 which is tightened by a bolt 19. This arrange-

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ment is more or less conventional and it serves to maintain the dipole rod 17 firmly in the groove.

It will be understood that whereas a complete antenna system, as will be hereinafter described, includes only four dipole rods such as might be deduced from the view of Figure 1, actually each insulator bracket 14 may have three diverging grooves as illustrated in Figure 2, these grooves holding the dipole rods 17, 17a and 17b. Inasmuch as the bracket 18 clamps all three of these dipole rods simultaneously, it will be evident that they function as a unit so that the same principles of operation apply to either a three element dipole rod arrangement or a single one, as the case may be.

Dipole rod 20 is similarly disposed in the opposing insulator arm as illustrated in Figure 2, while the other dipole rods 20a and 20b are also included in the arrangement.

The other end of the antenna employs an insulator 15 and the dipole rods 22 and 23 each of which is one of the group of three as above described. Viewing the antenna from above as in Figure 1, the structure may be described as comprising two crossed or perpendicularly related dipoles, each consisting of two dipole rods and all the rods being disposed in stellate form relative to each other.

Wires 24, 25, 26 and 27 are respectively connected to each of the inner terminal ends of the dipole rods 17, 20, 22 and 23. A suggested manner of connection is to connect the wires to the bolts 19 of the clamps 18 as illustrated in Figure 1, such connection being transmitted to the dipole rods themselves by the metal clamps. Wires 24 to 27 will be of the transmission line type. Thus, for example, wires 24 and 25 may be of the two conductors of twin transmission line having the usual 300 ohm impedance. In the same way wires 26 and 27 may be the conductors of another twin transmission line. Of course, other conventional transmission lines may be employed.

In achieving the directivity accomplished by the apparatus of the instant invention, a switch 30 is employed. Switch 30 may be disposed within or adjacent to the television receiver cabinet, probably depending upon whether it constitutes original equipment or is subsequently secured. As will be hereinafter described, switch 30 is manually operated by the user of the television receiver in order to select the proper effective direction and thus secure the best reception.

Switch 30 includes a plate 31 having four angularly arranged conducting sections 32, 33, 34 and 35. The plate 31 is itself of insulating material while the sections 32 and 35 may comprise metallic inserts secured or coated thereon. Switch sections 32 and 35 are insulated from each other by the perpendicularly related lines of spacing between them as illustrated in Figure 4. Wires 24 to 27 are connected to the respective switch sections 32 to 35 as by the bolts 36 which contact the respective switch sections so as to effect electrical connection therewith.

Switch plate 31 is the stationary member of switch 30 and a rotatable selector dial member 37 is provided. Dial 37 is secured to the shaft 38 as by a set screw 39. An operating knob 40 is secured to shaft 38. Loosely mounted on a reduced portion of shaft 38 is the plate 31 which will further be restrained against any rotation as by connection thereof to a frame or body or the like. Accordingly, manual rotation of knob 40 rotates dial 37 relative to plate 31 over which it is superimposed.

The construction of selector dial 37 is most important. It includes a pair of output terminal members 45 and 46 which are offset from the center of the dial as represented by the shaft 38. Terminals 45 and 46 are not in alignment so that they actually form an obtuse angle with the shaft 38. Terminals 45 and 46 may take the form of

metallic bolts 47, the dial 37 being itself of insulating material. Wires 48 and 49 are connected to the respective terminals 45 and 46 as partially illustrated in Figure 3. Wires 48 and 49 are connected to the input of the television receiver so as to feed the antenna signal thereto.

The construction of switch 30 is such as to effectively select any two of the four quadrant switch sections 32 to 35 for application to the input of the television receiver. Thus, if the dial 37 is turned in the position illustrated in Figure 1, the switch terminals 45 and 46, by virtue of their offset and angular disposition, reach past the lines of insulation and effect electrical contact by wiping action over switch sections 32 and 33 so as to feed the energy collected by dipole rods 17 and 22 to the television receiver. These dipole rods, being driven elements as distinguished from reflectors, may be considered as radiator elements. The directivity of such an arrangement will be in the direction of the arrow 50. It will be understood by those skilled in the art that the dipole rods 17 and 22 may be considered as the elements of a conical dipole which are forwardly tilted in the direction of reception. Accordingly, the arrow 50 represents the direction of such reception. It will be recognized that when dipole rods 17 and 22 are thus connected to the input terminals of the television receiver, the wires 24 and 26 are effectively terminated by a load which substantially matches their characteristic impedance of 300 ohms. Accordingly, the energy collected by the dipole rods is effectively transferred to the receiver. However, the wires 25 and 27 may be simply shorted as hereinafter described. Whether or not they are shorted, they are not terminated in a load of their characteristic impedance and are therefore terminated in a reflective termination which increases the effectiveness of the non-selected dipole rods as a reflector element.

Now, if dial 37 is turned approximately 30° to the right from the position illustrated in Figure 1, the terminal 45 will still be in electrical contact with switch section 32 but terminal 46 will then be in contact with switch section 34. In this way, dipole rods 20 and 22 will be selected as the operating dipole and the output therefrom will be fed to the television receiver through the wires 48 and 49. The direction of reception will then be as indicated by the arrow 51. It will be noted that arrow 51 is two-headed indicating that the reception is bi-directional. This results because of the aligned disposition of the dipole rods 20 and 22.

By further turning the selector dial 37, terminal 45 will be brought into contact with switch section 33 while terminal 46 will remain in contact with switch section 34, the resulting position being a rotation of 90° from the position illustrated in Figure 1. This will bring dipole rods 17 and 20 into operation so as to achieve directivity in the direction of the arrow 52. If the dial member 37 is further rotated, terminals 45 and 46 may effect contact with switch sections 33 and 35 so as to bring dipole rods 17 and 23 into operation and effect directivity in the direction of the arrow 53. Further rotation will effect contact with switch sections 34 and 35 so as to employ dipoles 20 and 23 and achieve directivity in the direction of arrow 54.

Continued rotation of the dipole member 37 so as to effect electrical contact with switch sections 32 and 34 actually duplicates a previous position so that this need not be explained. However, further continued rotation, as will be evident, will cause contact with switch sections 32 and 35 so as to achieve directivity in the direction of arrow 55.

It will be understood from the foregoing that directivity may thus be accomplished in substantially any direction indicated by the arrows 50—55, all through the simplified rotation of switch dial 37 and without requiring elaborate moving parts or involving unduly expensive or energy loss producing equipment. The disposition of the

output terminal members is such as to enable any combination of two dipole rods or sets thereof to be applied to the receiver input.

Switch 30 also includes means for shorting or bridging certain non-selected dipole rods so that they may serve as a reflector. To this end, a conducting or shorting member 44 is formed on the underside of dial 37. It will be observed in Figure 1, that switch sections 34 and 35 are shorted while sections 32 and 33 are selected for directivity. This means that dipole rods 20 and 23 are connected so as to serve as a reflector for rods 17 and 22. Of course, the horizontal spacing is not the optimum but the connected rods do provide advantages which would not otherwise be present.

When rods 20 and 22 or the other aligned pair of rods are connected, the conducting member 44 will have no effect because it will be confined to only one switch section. In this event, the aligned dipole will have no reflector, such reflector addition being present only with the conically disposed or tilted dipole rod combinations.

Figure 5 illustrates a slightly modified embodiment respecting the disposition of the dipole rods. Thus, instead of the straight dipole rods illustrated in Figure 1, each dipole may actually comprise two folded sections 60 and 61, one end of each being maintained in one groove of the insulator bracket 14 through the clamps 18. The outer ends 62 and 63 are free. This arrangement will be duplicated on the opposite side of the antenna so that four such folded dipole rods will be employed. The switch employed will be the same as above described.

In Figure 6 a modification is shown wherein the dipole rods 17 and 20 are connected together or bridged by the wire 65. In such a system, selected directivity is limited but the results are improved in many directions which can be selected and the shorting member 44 of the switch 30 need not be used. This arrangement may be preferable where it is desired to exclude the effect of interfering stations or when there are no stations located in certain directions.

The wires 24 to 27 are connected to the switch sections 32 to 35 respectively as in the first embodiment. When the selector dial 37 effects contact with switch sections 32 and 35 the wires 26 and 27 will connect the dipole rods 22 and 23 to the receiver input. This will give directivity in the direction of the arrow 70. The signal will be appreciably increased because the bridged dipole rods 17 and 20 will function as a reflector and without requiring such action by the selector dial as illustrated in Figure 1.

When the selector dial is turned so as to contact switch sections 35 and 33 then dipoles 23 and 17 will be applied to the receiver so as to give directivity in the direction of the arrow 71. Actually, the effect will be bi-directional because the dipole rods 23 and 17 are in alignment. At the same time, directionality will be accomplished in the direction of arrow 72 because the dipole rods 20 and 23 function as a conical dipole. In either of the last two instances, there will be an additional dipole rod which does not contribute toward the strength of the signal as will be evident.

If the switch output terminals are rotated so as to contact switch sections 32 and 33, directivity is achieved in the direction of arrow 73 although there will also be directivity in the direction of arrow 72 because of the dipole rods 20 and 22. If the selector dial is further rotated to contact sections 32 and 34, the result is the same because sections 33 and 34 are effectively connected by the bridging element 65.

If the selector dial is still further rotated to contact sections 33 and 34, the antenna is inoperative because it only includes the reflector. However, further rotation so as to connect sections 34 and 35 gives directivity in the direction of arrows 71 and 74. Contact with sections 32 and 34 accomplishes the same orientation as the con-

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tact of sections 32 and 33 which were above described.

It will be recognized from the above description of Figure 6 that substantially all directions can be selected with the exception of that in which the reflector is disposed. This disadvantage is somewhat compensated for by the increased pick up where the reflector is effective while it simplifies the functions of the selector switch.

It will be further understood that the dipole rods of Figure 1 may assume various forms such as are conventional in the art. For example, Figure 7 shows crossed folded dipoles, the dipoles being connected at the center point 75 which is electrically neutral. The four wires shown are connected to the said switch sections in the same way as in the first embodiment and the operation and results are similar.

What is claimed is:

1. A television antenna system comprising a pair of dipoles crossed perpendicularly and each comprising two dipole rods so that four inner terminal ends are provided, wires extending from the four inner terminal ends, a switch to which said wires are connected, said switch comprising four flat, metallic sections insulated from each other and angularly spaced 90° apart, a manually rotatable selector dial on said switch, a single pair of centrally offset, spaced output terminals on said selector dial, said output terminals being disposed so as to effect wiping contact with any two of said flat sections as said selector dial is rotated whereby the remaining two flat sections are electrically isolated from the output terminals of the selector dial.

2. A television antenna system according to claim 1 and wherein each of said flat switch sections is separated to provide the insulation between them, said switch output terminals being out of alignment with the center of said selector dial so as to define an angle with said center as the apex.

3. A television antenna system comprising a pair of crossed dipoles each having two inner terminal ends and

each comprising two dipole rods so as to form four dipole rods arranged in stellate form, two adjacent dipole rods having their inner terminal ends bridged, wires extending from the other terminal ends and from the bridged ends, a switch to which said wires are connected, a manually operated selector dial on said switch, said switch including four elements to which said wires are respectively connected, a pair of output terminals on said dial, said output terminals effecting selective wiping contact with any two of said switch sections.

4. A television antenna system comprising four dipole elements, each having inner and outer ends, said inner ends being terminal ends and all of said dipole elements radiating outwardly from a common central location, two adjacent dipole elements having their inner terminal ends bridged, wires extending from the inner ends of said two bridged dipole elements and from the inner ends of the remaining dipole elements, a switch to which all of said wires are connected, said switch including four sections to which said wires are respectively connected, manually operated selector means on said switch, and a pair of output terminals on said switch, said output terminals effecting selective wiping contact with at least two of said switch sections through said selector means.

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