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ANTENNA SYSTEM

Filed April 21, 1967

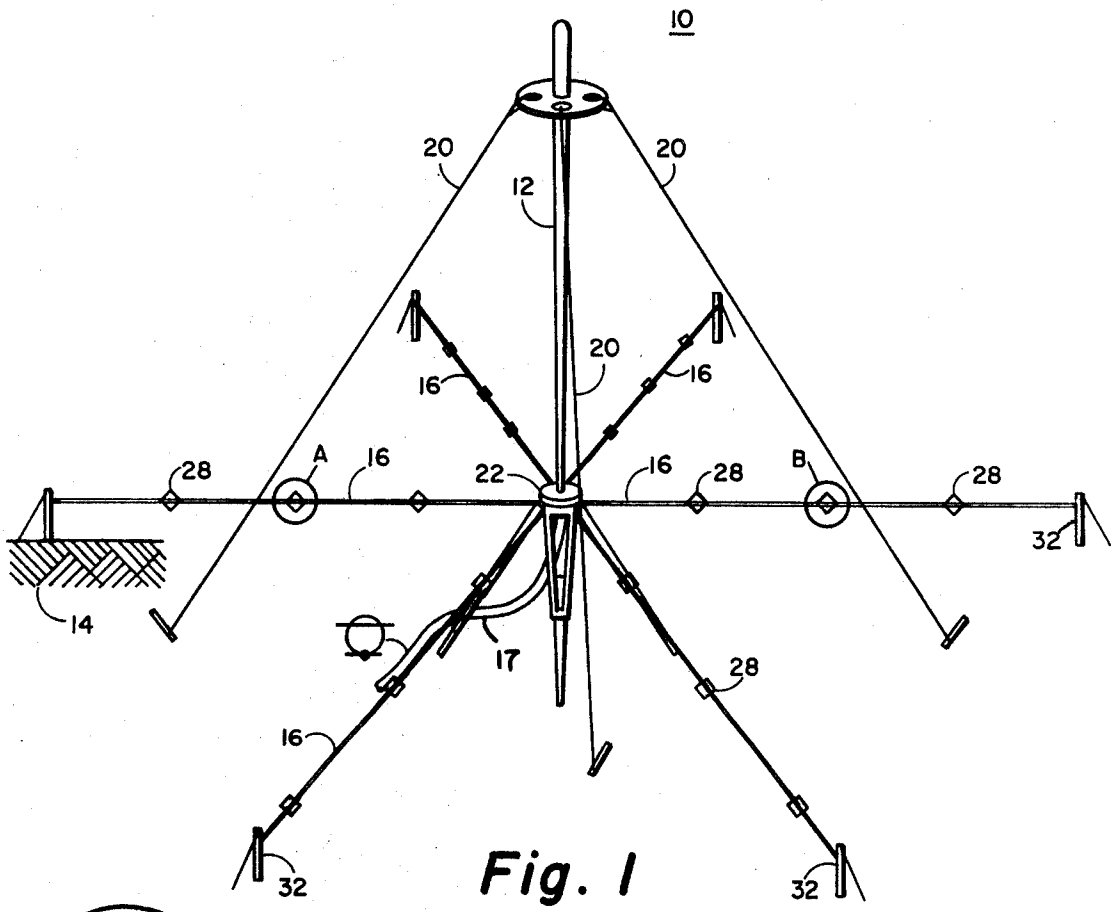


Fig. 1

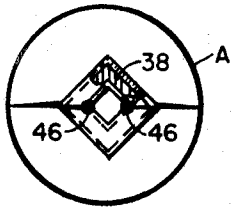


Fig. 2

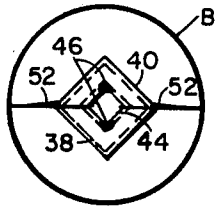


Fig. 3

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ANTENNA SYSTEM

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ABSTRACT OF THE DISCLOSURE

An antenna system having a vertical radiating element and a plurality of ground plane arms forming a ground plane. The conductive length of each of the arms is adjustable so as to steer or adjust the radiation pattern of the vertical radiating element to a desired shape.

The present invention relates to antenna systems which are adapted to have their radiating pattern varied.

Often a requirement is placed upon an antenna system that its radiation pattern be made adjustable to make it suitable for either short range or long range communications. Moreover, other usual requirements are that the antenna system be not only easily installed but also quickly tuned. Unfortunately, these requirements for most existing antenna systems are at cross purposes. That is to say, an antenna system may be easily installed but difficult to tune.

Accordingly, an object of the present invention is to provide an improved readily installable antenna system which has an adjustable radiating pattern and which is quickly installed and tuned.

Briefly described, an antenna system embodying the invention has a vertical radiator and a plurality of conductive ground plane arms. The conductive length of the ground plane arms are independently adjustable. Thus, the radiation pattern of the vertical antenna may actually be contoured to a desired shape.

An important feature of the invention is the provision of improved means for adjusting or varying the conductive length of radial arms comprising the ground plane.

The invention itself, both as to its organization and method of operation, as well as additional objects and advantages thereof, will become more readily apparent from a reading of the following description in connection with the accompanying drawings in which:

FIG. 1 is a perspective view diagrammatically illustrating an antenna system in accordance with the invention showing a vertical whip antenna and a plurality of radial arms forming the ground plane for the vertical whip. Portions of the arms at A and B in FIG. 1 are exploded as shown in FIGS. 2 and 3, and in different operational positions, showing how to change the conductive length of a radial arm.

Referring more particularly to the drawing a representative antenna system **10** is shown which may operate in the high frequency band. A vertical monopole radiator **12** and a plurality of radial arm elements **16** which comprise a ground plane, comprise the antenna.

The arms **16** are spaced from the earth **14**. The antenna **10** is fed via a coaxial feed line **17**, which in turn is coupled to a transmitter, not shown. At the feeding junction between the coaxial cable **17** and the antenna system **10**, the outer coaxial conductor engages the ground plane arms **16** whereas the inner conductor feeds the vertical monopole radiator **12**.

Also included within the antenna system **10** are a plurality of guide wires **20** and a supporting structure **22** which secures the monopole **12**. Both these members are formed of an insulating material so as not to significantly effect the radiating pattern of the monopole **12**.

A whip (unsupported, except at its base) monopole may also be used.

Each arm **16** includes a plurality of light weight coupling devices **28** (see FIGS. 2 and 3) which are movable between conducting and non-conduncting positions to thereby change the conductive length of each of the arms **16**. The free end of each arm **16** is fastened to the earth **14** by means of an anchor. Just before the anchor is a stake element **32** which functions to hold its associated arm in a spaced relation from the ground **14**.

By reducing the conductive length of the arms **16**, the radiation pattern of the antenna system **10** elevates. When the conductive length of the arms **16** is extended, the radiation pattern (viz. the angle of the launch pattern) lowers.

By way of illustration of the utility of the above principle but without limitation, when broadcasting over long distance, say for example 900 miles, the current practice has it that the monopole **12** should be dimensioned to be about $\frac{1}{2}\lambda$ (λ being the wave length of the operation frequency) and the ground plane should have at least about eight conductive arms **16**. To reduce the broadcasting range without reducing the length of the whip **12**, all that need be done is to reduce the conductive length of the arms **16**, and to extend the broadcasting range the arms **16** should be extended.

For shorter range broadcasting, it has been found that when the whip **12** is below $\lambda/4$, an effective way to match the impedance of the antenna system **10** to the coaxial line **17** (viz. to tune the antenna) is to vary the conductive length of the arms **16**.

Referring now to FIGS. 2 and 3, the light weight coupling devices **28** are comprised of a ring shaped conductive center core member **38** surrounded by insulating material such as laminated plastic **40**. Each coupler **28** is formed with a hollow interior **44** in such a manner so that two opposite disposed portions **46** of the conductive core **38** are exposed and may be engaged by loops **52** formed in the radial arms **16** in the manner shown in FIG. 2, thereby providing a conductive path by way of the core **38** up to the next coupler **28**. To terminate the conduction of a radial arm **16** at a coupler **28**, all that need be done is to rotate the coupler **28** to its position shown in FIG. 3, whereby each of the loops will only engage the insulating material **40** surrounding the conductive core.

From the foregoing description it will be apparent that there has been provided an improved ground plane antenna system. Variations and modifications of the illustrated antenna system will undoubtedly become apparent to those skilled in the art. For example, the ground plane could be somewhat distorted to form an apex-down cone which would raise the position of the main lobe of the radiation pattern. Moreover, the guide wires **20** could be made of conductive material to change the radiation resistance of the antenna system. Accordingly, the foregoing description should be taken as illustrative and not in any limiting sense.

What is claimed is:

1. An antenna system comprising:
   (a) a vertical radiating element,
   (b) a ground plane having a plurality of arms extending outwardly with respect to said vertical element, and said arms having conductive portions separated by couplers, said couplers having insulative and conductive parts, and
   (c) means for varying the conductive length of said arms by alternatively presenting said insulative and conductive portions to adjacent arm portions separated thereby to adjust the radiation to adjust the radiation pattern of said antenna system.

2. The invention as set forth in claim 1 wherein said radiator is a monopole and said arms extend radially therefrom.

3. The invention as set forth in claim 1 wherein said ground plane is spaced from the earth.

4. The invention as set forth in claim 1 wherein a plurality of said couplers are interposed in each arm with, each said coupler having a first position in which said insulative portion thereof is presented and a second position in which said conductive portion is presented, each of said couplers being adapted to be moved between said positions to change the conductive length of its arm.

5. The invention as set forth in claim 4 and wherein each said coupler is comprised of a conductive core element surrounded by an insulating material but leaving two exposed portions which are engageable by said radial elements in said second position.

6. The invention as set forth in claim 5 wherein said couplers are rings having a square hole said exposed portions being disposed at opposite corners of said hole.

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