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ANTENNA TUNED BY BENDING END PORTIONS

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Fig.1

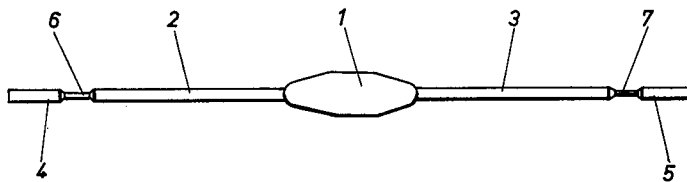


Fig.2

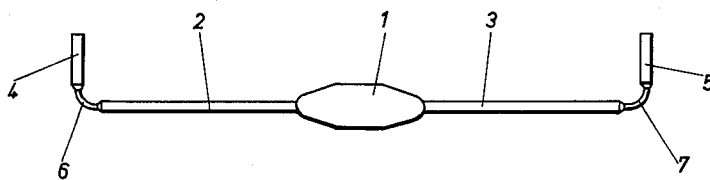


Fig.3

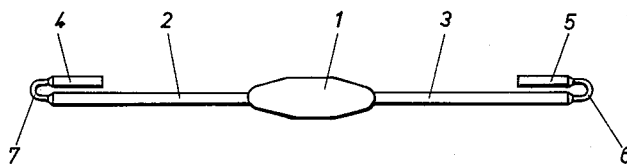
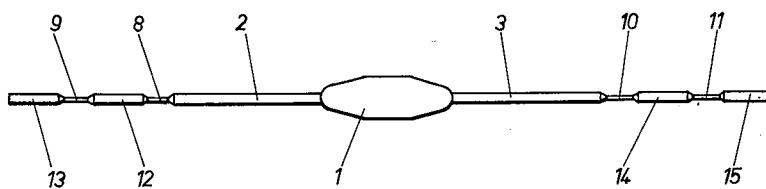


Fig.4



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The invention relates to a new aerial system for the reception of very high frequency signals, particularly television signals, which is also suitable for the propagation of high frequency energy from a transmitter.

It is an object of this invention to provide an aerial system for outdoor use which is easily tunable within predetermined limits of frequency or to predetermined channels, even after the aerial has been completely installed.

A further object of the invention is to provide means for tuning an aerial, which are mechanically simple and inexpensive, but at the same time completely resistant to weather and strong enough for outdoor use.

Another and very important object of the invention is to provide means which do not only allow to increase the resonance frequency, but also to return to a lower resonance frequency, i.e. according to this invention reversible tuning of the aerial system in both directions within predetermined limits of frequency is possible.

A further object of the invention is to provide an aerial system having the above mentioned objects in which the frequencies or channels, to which the aerial can be tuned, are indicated preferably by engraving or punching in the tuning means.

It is common practice to provide tunable aeralis, for example, indoor aeralis, wherein the aerial elements can be pulled out and pushed back in the manner of a telescope. However, this type of aerial is expensive, not sufficiently resistant to weather, and not strong enough for outdoor use.

Moreover, it is known to make extensible dipole antennas from two rods wherein the ends of the rods contain a plurality of notches for the purpose of tuning the dipole to a higher frequency by electrically cutting off the ends. However, it is considered a serious drawback with these antennas that the resonance frequency can only be shifted to higher frequencies and the change cannot be made retrogressive.

With the aerial of the present invention, on the contrary, it is possible to effect such reversible tuning, within certain limits, in both directions. In addition, the aerial is very simple, inexpensive and completely weather resistant.

The length of the aerial elements, according to the present invention, is also changed for tuning purposes. This is made possible by providing close to the dipole ends one or more elements capable of being bent, which are more resilient than the antenna elements themselves, due to a suitable deviation either in the form and/or in the material employed, and which may be bent repeatedly back and forth, without breaking off. Such elements capable of bending are known per se. They are used, for example, in connection with aeralis used on vehicles and are mounted close to the base of the aerial so as to permit adapting the inclination of the aerial, in a simple way, to the contours of the vehicle body. Moreover, it has been proposed to use a device consisting of two metal bands lying in the same plane and having comb-like slits, for connecting a source of high frequency with a mismatched receiving set. In order to improve the adaptation of the device it was proposed to bend the flaps formed by the slits inwardly about 90° so that their surfaces extend parallel and at a relatively short

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distance from each other, thus forming a transverse capacity which, when applied at a suitable point, produces a reduction of the stationary waves upon said device.

Such prior use of bending elements was not suggestive of the aeralis of the present invention which were based upon an entirely different concept.

The aerial system according to the present invention comprises at least one, but in most cases of practical use several stretched or rod-like elements, which may be approximately as long as half of the operating wave length or as long as the whole operating wave length. For purpose of tuning the length of the said aerial-elements is changed. This is made possible by providing close to the extreme free ends of the said elements at least one section capable of being bent, which is more yielding with respect to nonresilient deformation than the said aerial elements themselves, so that the said extreme ends can be bent easily forward and back several times without breaking off and will remain in any bent position.

The said bending sections can be made of a metal having a lower yield point (flow limit) than the material of the said aerial elements themselves, and/or they may be shaped in such a way that they have a smaller section modulus (resistance moment) than the said aerial element themselves. For this purpose they can have a different form or size of cross-section.

The aerial elements inclusive the bending sections may consist of a relatively hard material, only said bending sections being annealed. Alternatively, the aerial elements may be originally soft and subsequently hardened all over with exception of the said bending sections.

The invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

A typical example of an element of the aerial according to the present invention is shown in FIG. 1 in the original shape.

FIG. 2 and FIG. 3 shows the same aerial element, the bending sections being bent by 90° and 180° respectively.

FIG. 4 shows a further embodiment of an element of the aerial according to the present invention which has however several bending sections on the free ends.

An element of the aerial according to the present invention is shown, by way of example, in FIG. 1. It consists of an insulated carrier 1, adapted to receive a feed cable or other type of transmission line, and which may be associated laterally with two metal rods or pipes (2 and 3) which together form an extended open dipole. This dipole can be approximately as long as one-half or one whole wave length of its operational frequency. At the transition point leading to the extreme ends 4 and 5 of the metal rods or pipes, there are provided bending sections 6 and 7 which, due to either their form and/or the metal of which they are made, are more yielding with respect to non-resilient deformation than the aerial rods or pipes themselves. Thus, it is possible to even subsequently bend the ends of the mounted aerial, with the greatest ease, for example, to the extent of 90° as shown in FIG. 2, or to the extent of 180° as shown in FIG. 3. In this way the electrically useful length of the aerial element can be constantly varied between two limits.

The bending sections can be made of a metal having a lower flow limit than the material of the aerial element itself, and/or they may be shaped in such a way that their resistance moment is smaller than the aerial element itself. The bending sections may be pieces obtained by soft annealing of an otherwise rigid rod or pipe. The aerial rods or pipes may, on the other hand, be soft to

begin with and then hardened with the exception of the bending points.

FIG. 4 shows a further embodiment of an element of the aerial according to the invention. It consists, like the element according to FIG. 1, of the insulated portion 1 with two associated rods or pipes 2 and 3. However, at the ends of the latter there are provided in this case a plurality of bending sections 8 to 11 alternating with more rigid rod or pipe sections 12 to 15. It is, of course, possible to increase this number as desired. An aerial, consisting of such elements, can be selectively tuned to several definite frequencies or, for example, television channels, by bending over one or more segments 12, 13, 14, 15 at the points defined by the bending sections, to the position illustrated in FIG. 3. The frequencies and the channel numbers are suitably indicated on each of the segments, preferably by engraving or punching.

It is possible to assemble multiple element aerals from such elements in any desired order. In this connection, the elements of a multiple element aerial may all or only in part be tunable.

In the case of parasitic elements (reflectors and directors), the insulating portion 1 can be left out, if it is not needed. The scope of the invention is to include all aerals constructed according to the invention, regardless of their use for receiving or transmitting purposes of all kinds. The illustrated form of a symmetrical dipole is only given by way of example. Other types of aerals, for example unsymmetrical rod aerial (Marconi aerial) which can be tuned in the manner of the present invention, are also within the contemplated scope.

It is, of course, immaterial for the purpose of the present invention, whether or not ends 4 and 5 extending from bending sections 6 and 7 (FIG. 1) be made of the same material and possess the same cross-sectional form, i.e. the same diameter, as the aerial rods 2 and 3. They may, on the contrary, consist of any conducting material and have any desired cross-sectional form. They may consist, for example, of the same material and have the same diameter as the bending elements.

I claim:

1. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said bendable sections at least at their portions in the neighborhood of the said non-elastic intermediate portion offering less resistance to bending than the said non-elastic intermediate portion, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

2. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said bendable sections at least at their portions in the neighborhood of the said non-elastic intermediate portion consisting of a more flexible material than the said non-elastic intermediate portion, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

3. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said in-

termediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said bendable sections at least at their portions in the neighborhood of the said non-elastic intermediate portion being more flexible due to the different form of cross-section than the non-elastic intermediate portion, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

4. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said bendable sections at least at their portions in the neighborhood of the said non-elastic intermediate portion being more flexible due to the different size of cross-section than the non-elastic intermediate portion, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

5. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said aerial elements including said bending sections being made of a relatively hard metal and only said bending sections being annealed, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

6. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and bendable sections at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said aerial elements including said bending sections being made of a soft metal and hardened with exception of the bendable sections, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

7. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and a plurality of bendable sections at certain intervals at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, said bendable sections at least at their portions in the neighborhood of the said non-elastic intermediate portion, respectively in the neighborhood of the outer ends of the other bendable sections, offering less resistance to bending than the said non-elastic intermediate portion, so that said bendable sections can be bent easily backward and forward through an angle up to 180° several times without breaking off and will remain in any bent position.

8. A tunable aerial for outdoor use, comprising at least one rod-like element consisting of a non-elastic intermediate portion and a plurality of bendable sections at certain intervals at the extreme free ends of said intermediate portion, having a length which is only a small fraction of the length of said intermediate portion and serving as means for reversible tuning of the aerial within predetermined limits of frequency, these frequencies or number of channels being indicated on the said

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bendable sections, preferably by engraving or punching, said bendable section being of more flexible material than the said intermediate portion.

References Cited in the file of this patent

UNITED STATES PATENTS

1,716,144 Morrison ----- June 4, 1929
2,094,475 Schwarzhaupt ----- Jan. 26, 1935

5

2,192,187
2,379,577
2,419,311
2,533,529
2,565,661
2,642,528
2,647,211
2,657,311

6

Gordon ----- Mar. 5, 1940
Harsted ----- July 3, 1945
Bigue ----- Apr. 22, 1947
Spindler ----- Dec. 27, 1949
Lidz ----- Aug. 28, 1951
Albright ----- June 16, 1953
Smeby ----- July 28, 1953
Kleis ----- Oct. 27, 1953