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INDOOR TELEVISION ANTENNA

2,881,429

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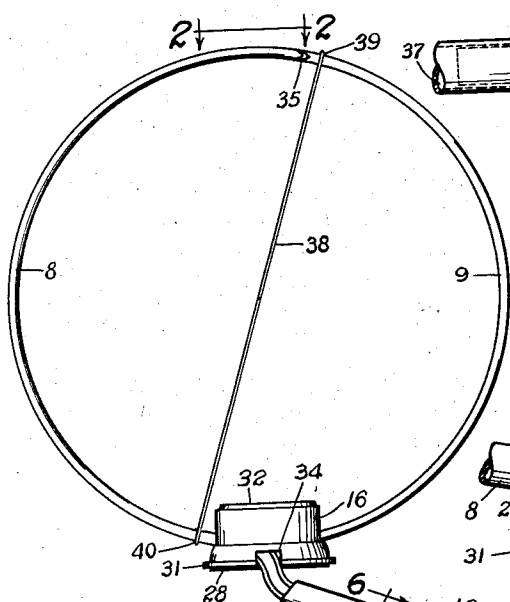


Fig. 1.

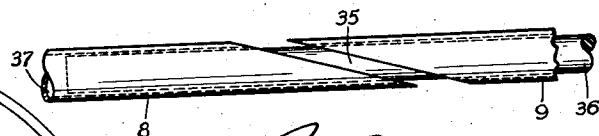


Fig. 2.

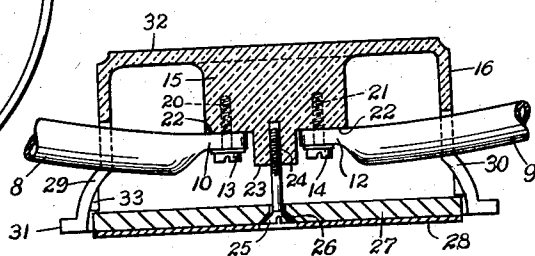


Fig. 3.

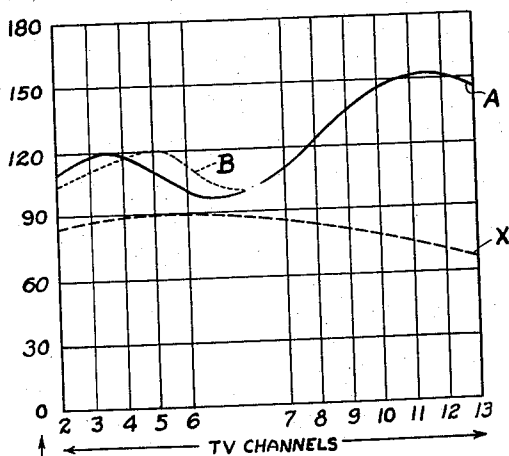


Fig. 5.

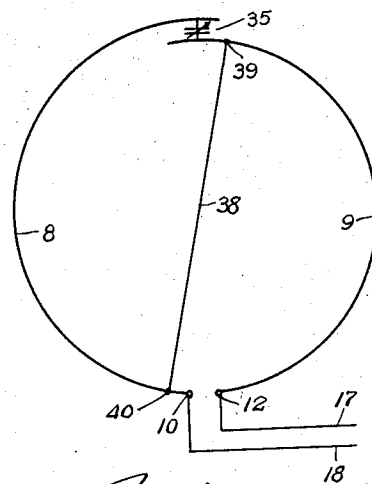


Fig. 4.

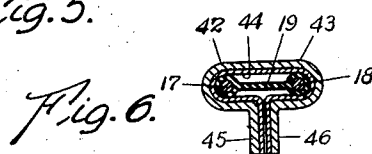


Fig. 6.

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INDOOR TELEVISION ANTENNA

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5 Claims. (Cl. 343-744)

The present invention relates to improvements in an indoor antenna adapted particularly for reception of television broadcast signals.

An object of the invention is to provide an improved antenna having certain structural features which result in reception performance far superior to that which is obtainable from the use of the ordinary so-called dipole or divergent rabbit-ear type of antenna.

Another object is to provide an antenna for television reception, which requires no extensive manipulation and adjustments in order to effectively receive signals of different frequencies in the broadcast band or range for which it is designed.

Another object is to provide an improved type of antenna having simple yet effective tuning means, inexpensively incorporated therein, to enhance the performance of the receiver thereto connected.

A further object of the invention is to provide an improved antenna of the character stated, which is so constructed that its use will not interfere with curtains, ornaments, or other objects located near the antenna or the receiver upon which it may be placed when in use.

In general, it is an object of the invention to improve the reception of television broadcasts, while at the same time eliminating or minimizing annoyances and undesirable features that characterize other types of antennae.

The foregoing and other objects to be hereinafter set forth, are attained by the means described herein and illustrated upon the accompanying drawing, in which:

Fig. 1 is an elevational view of the improved antenna, including part of the lead-in wire and showing also a coupling tuner applied to said wire.

Fig. 2 is an enlarged fragmental view taken on line 2-2 of Fig. 1.

Fig. 3 is a vertical section taken through the antenna base in the plane of the antenna ring.

Fig. 4 is a schematic view of the antenna circuit.

Fig. 5 represents a chart or graph showing comparative gain acquired with the use of the present antenna and one of the dipole type.

Fig. 6 is an enlarged cross-sectional view taken on line 6-6 of Fig. 1, showing details of a coupling tuner applied to the lead-in wire.

The device of the present invention is designed to perform the functions of the common dipole antenna, with a marked increase of efficiency and convenience. From the standpoint of convenience of usage, the present device is superior in that it is relatively small in size, has no projecting parts to become entangled in curtains, drapes or the like, and requires only a limited amount of clear space for rotational adjustment when required. Due to its symmetrical design, the improved antenna also possesses the desirable characteristics of pleasing appearance and balanced construction. As to the increase of efficiency resulting from the new construction, that will be treated in detail as the description proceeds.

In the most acceptable form presently known to me, the antenna comprises a two-piece loop or ring, the parts of which are marked 8 and 9, and are curved on a radius such that the overall diameter of the ring or loop approximates the order of about one-half the wave-

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length at the mean frequency of the broadcast band to be received, or about nineteen and one-half inches. The parts 8 and 9 necessarily are constructed of metal so as to be conductive of electric signal current, and I have found that an appropriate metal for the parts in aluminum or copper tubing tempered sufficiently to avoid likelihood of accidental bending under normal conditions of use, from the original true circular formation. The tubing accordingly may be hard or half-hard tempered, and should have a wall thickness approximating one thirty-second inch, with an outside diameter of about three-eighths inch. The above specifications are for an antenna designed to receive television signals on channels 2 through 13, but may be altered to perform on P.M. (frequency modulated), V.H.F. (very high frequency), and the U.H.F. (ultra high frequency) bands, if desired.

As illustrated upon Fig. 3, the ring parts 8 and 9 have terminal ends 10 and 12 which may be flattened and pierced to accommodate screws 13 and 14. The screws are threadedly anchored in a central boss 15 of the antenna base 16, to fix the terminal ends of parts 10 and 12 within the base. The screws serve also as binding posts for the inner ends of the lead-in wires 17 and 18 (Fig. 1), which wires preferably are arranged in parallelism within a substantially flat insulating cover 19 sometimes referred to as a ribbon cable. The boss 15 and the base 16 are of dielectric material, such as molded phenolic plastic, for example. The boss may be drilled at the locations 20 and 21 to receive the threaded shanks of the screws, and should be provided with seats 22 for the flattened ends of the ring parts 8 and 9.

A central extension of the boss, indicated at 23, may be drilled and threaded to receive the threaded shank 24 of a cover attaching screw 25, which passes through a central aperture 26 formed in a cover or base plate 27 which closes the open bottom of the antenna base. The cover or plate 27, if desired, may be weighted in any appropriate manner, as by making it of a heavy material such as metal, plaster, or the like. The character 28 indicates a layer or sheet of felt or other soft material applied to the bottom surface of the plate, so that the base may be moved over or upon any polished or finished surface without scratching or injuring the surface. The sheet 28 may be centrally apertured as shown, giving access to the head of the screw 25.

Where the ring parts 8 and 9 enter the sides of the antenna base, the sides may be vertically slotted as indicated at 29 and 30. If preferred, round holes in the sides may be substituted for the slots 29 and 30, as will readily be understood. The base may have a circumferential lower rim or flange 31, and a solid top 32 which preferably, though not necessarily, is made substantially flat so that a small ornament might be supported thereon if desired. Interiorly of the base may be formed a series of stops or abutments 33 against which the margin of the plate 27 may impinge as the screw 25 is tightened against the center of the plate. At a suitable location in the side of the base may be provided an aperture 34 (Fig. 1), through which the lead-in cable or wire may enter the base, wherein inner ends of the conductors 17 and 18 may be electrically connected to the ring terminals 10 and 12, as by means of the screws or fasteners 13 and 14. The connection mentioned may be effected otherwise than by means of the screws 13 and 14, if desired.

Referring now to Figs. 1 and 2, it will be noted that the ring or loop constituted of the parts 8 and 9, is separated or split at a location directly above the antenna base 16. The split or separation may be effected by means of a saw cut or the like, extending at an angle relative to the plane of the loop or ring. The angularity of the

saw cut should be such as to provide an overlap when the gap is closed, amounting to about three-fourths inch, or between limits one inch and one-fourth inch, approximately. The angular or diagonal cut, indicated plainly upon Fig. 2, results in the formation of the gap 35 which may be increased or decreased in width by springing the loop or ring parts 8 and 9 away from or toward one another. To ensure retention of the gap adjustment, it is desirable to provide at the gap, some form of frictional guide or retainer, which in the example illustrated, consists of a rod or bar 36 snugly but slidably fitted into the bore 37 of the tubing constituting the ring or loop. This rod or bar 36 may be of rubber-like material preferably, and must be non-conductive of electric current. Dielectric materials of various types are suitable for constructing the rod or bar 36. For example, semi-hard rubber or plastic compounds capable of keeping the tube parts 8 and 9 in substantial alignment, while at the same time affording a frictional grip inside the tubing parts, have been found highly satisfactory as materials for the rod or bar 36. As will be noted by reference to Fig. 2, the rod or bar 36 is of sufficient length to extend well within the tubes at opposite sides of the gap. The rod or bar, as will be understood, maintains any given adjustment of the gap 35 obtained by shifting the ring parts 8 and 9 toward and away from one another at the location of the gap.

As was previously stated herein, the disclosed antenna having a loop or ring diameter approximating nineteen and one-half inches, has been designed primarily to perform on television channels 2 through 13. In effect, it is a loop antenna with a circumference that peaks on the frequency at approximately the middle of the high frequency TV band, that is, between channels 7 and 13. This has been modified by splitting the upper portion of the loop or ring at an angle to provide capacity coupling and also inductive coupling. Splitting the top of the loop, which is normally a null point with the sides of the loop in opposite phase, results in a modified wave pattern and tends to cause the highest voltage node to move toward the ring ends at the gap. However, such action is resisted by the angular gap, which nevertheless permits the coupling of the two ring ends by capacity and also coupling inductively by the magnetic field due to the overlapping of the ring ends at the gap. Both the capacity and the inductive coupling are rendered variable at the adjustable gap.

The gap adjustment serves to tune or change the effective wavelength of the antenna, particularly with respect to the frequencies which characterize channels 2 through 6 of the TV band. At the higher frequencies of channels 7 through 13, the gap adjustment is not critical.

For the frequencies of TV channels 2 through 6, an automatic tuning effect is obtained by electrically connecting, by means of a high impedance wire or conductor 38, a point such as 39 with a point 40, these points being located on opposite halves of the loop or ring. More specifically, it is pointed out that one of the loop parts has electrical connection with the wire or conductor 38 at a point near the gap 35, while the other loop part has electrical connection with the opposite end of the wire or conductor 38 at a point at or near the antenna base, close to the lead-in conductor of said other loop part. The points of electrical connection for the diametral wire or conductor 38 are indicated upon Fig. 1 of the drawing at the locations 39 and 40. The effect of the diametral conductor 38 is to permit an additional tuned circuit to exist, providing a bypass for a portion of the loop current. The overall effect of the loop or ring, the angular gap, and the diametral conductor, is to provide a multiple range of peak frequencies which can be tuned by varying the width of the gap. It may here be noted that only the circular part of the ring or loop provides the highest gain in the high band frequencies of channels 7 through 13, whereas in the lower band frequencies of channels

2 through 6, the highest gain is obtained through the circuit which includes the ring part 9 and the diametral conductor 38. As stations are selected in the low and high band frequencies, the alternative circuits of the antenna come into play automatically for obtaining the highest possible gain at the different frequencies of the high and low bands.

The diametral conductor 38 may be conveniently applied to the loop or ring parts, by simply providing the ends thereof at 39 and 40 with half-circular hooks to snugly embrace the tubular parts 8 and 9. By making the conductor 38 of a proper length, it may thereby be maintained under tension to ensure satisfactory electrical contact at the locations 39 and 40.

The representation of Fig. 4 is a diagram showing the capacity and inductive coupling effect of the variable gap at 35, and the dual circuits of the antenna resulting from the use of the diametral wire or conductor 38 joining the gap portion of one loop part with the lead-in terminal portion of the other loop part. The lead-in wire for the antenna disclosed herein should have an impedance value of about 300 ohms.

Fig. 5 is illustrative of a comparison chart resulting from tests made upon a standard TV receiver equipped first with a standard dipole type antenna with adjustable legs, and secondly, with an antenna of the type herein disclosed. The full line A indicates the gain obtained on the various TV channels with the use of the antenna of the present invention, while the broken line X indicates the gain on the same channels under similar circumstances of test, using a standard dipole type of antenna. The chart indicates that at all frequencies, in both the high and the low bands, the gain obtained with the use of the improved antenna was at all times greater, and sometimes exceeded by 100 percent, the signal strength obtained with the use of a standard dipole antenna. The broken line B upon the chart indicates changes of gain that were obtained with relation to the several lower frequency channels, by adjusting the gap 35 of the improved antenna. It should be understood that the gain reading indicated by the full line A, representing the improved antenna test, was obtained without any adjustment of the gap 35 in the course of the test, whereas, on the other hand, the standard dipole antenna was adjusted for each channel signal in both the high and the low frequency bands, as the test for the standard dipole antenna progressed. It will be apparent, therefore, that the test of the standard dipole antenna as indicated by the broken line X was taken under circumstances most favorable to that type of antenna.

To increase the gain, when necessary, in the antenna circuit on the high frequency channels, a coupling tuner indicated by the character 42 may be applied to the lead-in wire or cable 19 as illustrated by Figs. 1 and 6. The coupling tuner 42 may be in the form of a sleeve approximating four inches in length, wrapped about the lead-in wire and adapted to be shifted lengthwise thereof toward and from the antenna base. The sleeve may comprise a rectangular sheet of fabric indicated at 43, provided with a lining or lamination 44 of metal or metallic foil in face contact therewith. At opposite edges of the fabric sheet may be formed a pair of tabs 45 and 46 turned at an angle to the lead-in wire and serving as finger grips whereby the sleeve may be shifted along the length of the lead-in wire. As the sleeve 42 is moved toward and from the base of the antenna, a tuning effect is observed on the high frequency channels 7 through 13, which in many instances may sharpen and brighten the picture received. It should be understood that the coupling tuner 42 may be found useful only under extremely poor reception conditions, and that same is not an element necessary to the proper performance of the improved antenna of this invention under ordinary conditions.

In conclusion, it may be noted that the device of the

present invention possesses many advantages over the common dipole type of antenna. For example, the extent of adjustment necessary for satisfactory reception is reduced to a minimum, and does not interfere with objects such as draperies and ornaments located near the antenna. Its use involves no lightning hazards or unsightly outdoor antenna installations. The improved antenna is highly directional, requiring only slight rotation of the base to obtain clear, sharp pictures without objectionable noise pick-up. The low impedance circular design reduces body capacity effect to a minimum, and is highly effective in tuning out interference. In brief, the new antenna of this invention improves to a material extent the reception of television broadcasts, while eliminating or minimizing inconveniences and annoyances commonly experienced with the use of other forms of antennae heretofore available upon the market.

The invention herein disclosed is made applicable to antennae for the reception of U.H.F. (ultra high frequency) broadcasts, by simply reducing the diameter of the ring or loop to approximately eight inches, and such changes of dimensions are to be considered within the scope of the invention. It is to be understood further, that various other modifications and changes in structural details may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim is:

1. In a device of the class described, the combination of a metallic substantially circular ring formed of a pair of arcuate members each having an upper end and a lower end, a base, and means connecting the lower ends of the arcuate members to the base in electrically insulated relation, with the arcuate members disposed in a common plane, means at the upper ends of the arcuate members providing between them an adjustable gap, a lead-in conductor electrically connected to each arcuate ring member near the lower end thereof, and a substantially diametral conductor of higher impedance than the arcuate ring members, electrically connecting the upper end portion of one arcuate ring member with the lower end portion of the other arcuate ring member.

2. In a device of the class described, the combination of a metallic substantially circular ring formed of a pair of flexible arcuate members each having an upper end and a lower end, a base, and means connecting the lower ends of the arcuate members to the base in electrically insulated relation, with the arcuate members disposed in a common plane, the upper ends of the arcuate members being overlapped and tapered relatively to each other without physical contact to provide a gap, and flexing of the arcuate members at the upper ends thereof toward and from each other varies the gap for tuning purposes, friction means insulated from the arcuate members to maintain the gap in adjusted positions, a lead-in conductor electrically connected to each arcuate ring member near the lower end thereof, and a conductor of higher impedance than the arcuate ring members, electrically connecting the upper end portion of one arcuate ring member near the gap, with the lower end portion of the other arcuate ring member.

3. In a device of the class described, the combination of a metallic substantially circular ring formed of a pair of arcuate tubular members at least one of which is flexible, said members each having an upper and a lower end, a base, and means connecting the lower ends of said members to the base in electrically insulated relation, with the arcuate members disposed in a common plane, the upper ends of the members being cut diagonally on a common angle so as to overlap one another when the upper ends are in contact and in substantial alignment, said upper ends being separable by flexation of one of the arcuate members to form an adjustable gap at the diagonal cut, a rod of dielectric material spanning the gap and extending into the open ends of the tubular arcuate members at the gap, said rod being snugly

but slidably fitted into said open ends to frictionally resist flexation of the arcuate members relatively, and to thereby oppose variance of the gap from adjusted positions, a lead-in conductor electrically connected to each arcuate ring member near the lower end thereof, and a conductor in the form of a wire of higher impedance than the arcuate ring members, electrically connecting the upper end portion of one arcuate ring member near the gap, with the lower end portion of the other arcuate ring member.

4. In a device of the class described, the combination of a metallic substantially circular ring formed of a pair of flexible arcuate tubular members each having an upper end and a lower end, a base, and means connecting the lower ends of the arcuate members to the base in electrically insulated relation, with the arcuate members disposed in a common plane, the upper ends of the arcuate members being cut diagonally on a common angle so as to overlap one another when the upper ends are in contact and in substantial alignment, said ends being separable by flexation of the arcuate members to form an adjustable gap at the diagonal cut, a semi-rigid rod insulated electrically from the arcuate ring members and extended into the open ends of the latter at the gap, said rod being snugly but slidably fitted into said open ends to frictionally resist flexation of the arcuate members and variance of the gap from adjusted positions, a conductor of higher impedance than the arcuate ring members, electrically connecting the upper end portion of one arcuate ring member near the gap, with the lower end portion of the other arcuate ring member, and a lead-in conductor electrically connected to each arcuate ring member near the lower end thereof.

5. In a device of the class described, the combination of a metallic substantially circular ring formed of a pair of arcuate tubular members at least one of which is flexible, said members each having an upper and a lower end, a base, and means connecting the lower ends of said members to the base in electrically insulated relation, with the arcuate members disposed in a common plane, the upper ends of the members being cut diagonally on a common angle so as to overlap one another when the upper ends are in contact and in substantial alignment, said upper ends being separable by flexation of one of the arcuate members to form an adjustable gap at the diagonal cut, a rod of dielectric material spanning the gap and extending into the open ends of the tubular arcuate members at the gap, said rod being snugly but slidably fitted into said open ends to frictionally resist flexation of the arcuate members relatively, and to thereby oppose variance of the gap from adjusted positions, a lead-in conductor having terminal ends concealed within the base and connected electrically to each arcuate ring member near the lower end thereof, and a conductor in the form of a wire of higher impedance than the arcuate ring members, electrically connecting the upper end portion of one arcuate ring member near the gap, with the lower end portion of the other arcuate ring member, said higher impedance conductor being located entirely outside the limits of the base.

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