March 13, 1962 C. H. THIES 3,025,524

CALIBRATED THIN METAL LAMINA ANTENNA

Filed May 6, 1959

FIG. 1

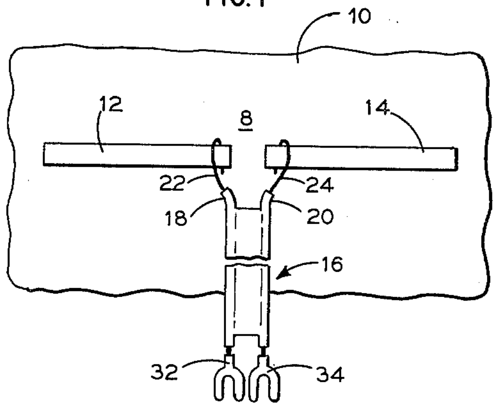


FIG. 2A

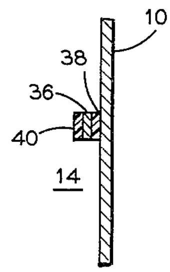


FIG. 2B

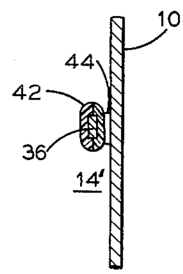


FIG. 3

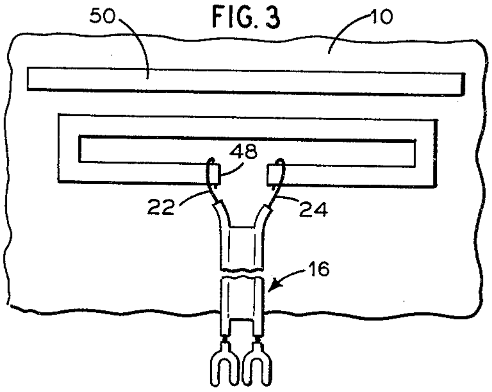


FIG. 4

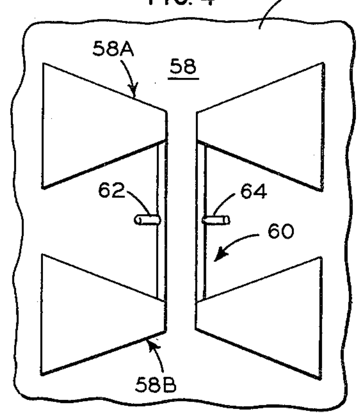
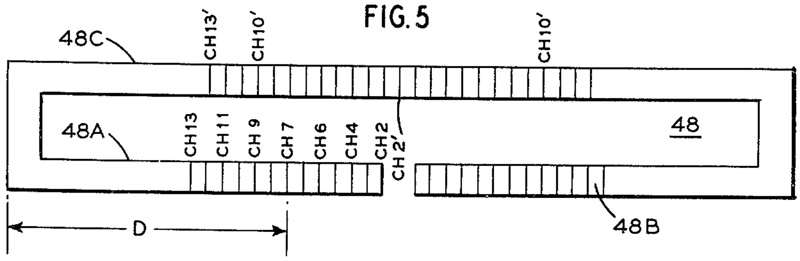


FIG. 5



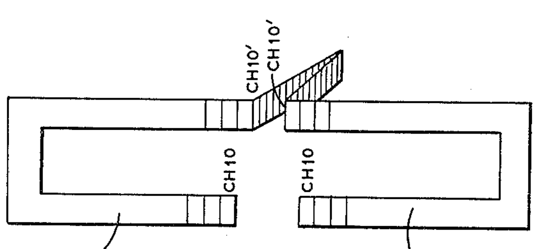


FIG. 6

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CALIBRATED THIN METAL LAMINA ANTENNA

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This invention pertains to antennas and more particularly to antennas for receiving or transmitting electromagnetic radiation.

Many receivers of electro-magnetic radiation such as FM and television receivers, require antennas. At present, these receivers often are manufactured with antennas permanently enclosed in the housing of the receiver. These built-in antennas permit the users to install the receivers indoors without resorting to any other antennas. Such antennas perform adequately as long as the receiver is in an area of high signal levels. However, many of the receivers are in weak signal areas and poor reception is obtained. In general, the poor reception results from causes such as low signal strength due to the distance between the receiving antenna and the sending antenna, the local electrical shielding of the building, the orientation of the receiver cabinet in a direction unfavorable to good reception or to high local noise generation.

In addition to these causes, many of the antennas built into receiver cabinets are compromise designs since it is necessary to limit the overall dimensions of the antenna to the dimensions of the cabinet that houses the receiver. Such compromises decrease the aperture or receiving ability of the antenna. The problem becomes more acute in the portable type receivers because of their small overall dimensions.

At present, in those areas where the signal-to-noise ratio is of such a value that there is unsatisfactory reception or where the signal strength is too low, it is necessary to employ outdoor antennas or indoor antennas such as "rabbit ears." In many instances, it is impossible or extremely expensive to install and maintain the required outdoor antennas. On the other hand, conventional indoor antennas are often objectionable because of their unsightly appearance.

It is accordingly an object of the invention to provide an improved antenna having dimensions approaching the optimum values for good signal reception.

It is another object of the invention to provide an antenna for indoor reception which is optimally positioned with respect to the transmitting antenna and is at the same time inconspicuous.

It is a further object of the invention to provide an improved receiving antenna which is extremely simple and inexpensive to fabricate and at the same time easy to install and maintain.

Briefly, in accordance with the invention, an antenna is provided to be affixed on a plane surface. The antenna comprises a lamina of conductive material. The surface dimensions of the lamina are functionally related to the operating wave length of the signals being received by the antenna. Means are further provided for adhering one of the surfaces of the lamina to the plane surface.

It should be noted that such an antenna is easily applied to the walls, floor or ceiling of a room. Once the antenna is placed in position, its location being chosen for optimum reception with respect to the transmitting antenna, it may be completely covered by wallpaper, plasterboard or similar building materials and remains totally inconspicuous.

It should further be noted that such an antenna may easily be applied or incorporated in the windshield of a vehicle to provide optimum reception for mobile receivers.

Other objects, features and advantages of the invention will be apparent from the following detailed specification when read with the accompanying drawings wherein:

FIGURE 1 shows a half wave dipole antenna in accordance with one embodiment of the invention;

FIGURES 2A and 2B show a cross-section of the antenna taken along the lines 2—2 of FIGURE 1;

FIGURE 3 shows an antenna system comprising a folded dipole antenna and reflector in accordance with another embodiment of the invention;

FIGURE 4 shows a stacked array of "bow tie" antennas in accordance with a further embodiment of the invention; and

FIGURES 5 and 6 show the means for controlling the dimensions of a folded dipole antenna in accordance with a feature of the invention.

Referring to FIGURE 1, an antenna **8** is shown affixed to a plane surface **10** such as a wall, ceiling or floor, in accordance with the invention. The antenna **8** is a half wave dipole antenna having elements **12** and **14**. Each of the elements **12** and **14** has a length equal to one quarter of the operating wave length of the signal being received by the antenna **8**. The leads **18** and **20** of a conventional two-wire transmission line **16** are respectively coupled to the elements **12** and **14** by clips **22** and **24**. The other ends of the leads **18** and **20** are respectively provided with lugs **32** and **34** for connection to the receiver.

FIGURE 2A shows one embodiment of the element **14**. In particular, the element **14** comprises a lamina **36** of a conductive material. The conductive material may be, for example, aluminum foil, but it may also be a nonmetallic substance which is electrically conductive at the wave lengths of the received signals. An adhesive medium **38** is disposed on one surface of the lamina **36**. The adhesive material may be directly applied to the conductive lamina **36** or may be applied to a nonconductive material such as paper which is in turn fixed to the lamina **36**. A protective layer **40** may be affixed to the other surface of lamina **36**. The protective layer **40** may be of any suitable material such as paper or well known plastics. In some instances, the protective layer **40** can be conventional wallpaper. In other words, the antenna **8** is affixed to the plane surface **10** which may be a wall and then the wall is covered with wallpaper, thus hiding the antenna from view.

In FIGURE 2B, is an alternate embodiment of the element **14'**. In particular, the lamina **36** of conductive material is completely enveloped in an insulative protective sheath **42**. The protective sheath **42** may be of a well known plastic such as polyethylene. Disposed on one surface of the sheath **42** is an adhesive medium **44** to permit the affixing of the antenna **8** to the plane surface **10**. It should be noted that the element **14'** is a sandwich of a pair of layers of insulative protective material with the conductive lamina **36** disposed between the layers. It should further be noted that FIGURES 2A and 2B show the elements **14** and **14'** having an exaggerated thickness for the sake of clarity. In general the thickness of the element **14** and the similar element **12** will be in the order of thousandths of an inch. It should be noted that although there is the provision for an adhesive layer, in some instances, an adhesive layer is not necessary. For example, the lamina **36** may be sandwiched between two sheets of glass in a window or a windshield.

FIGURE 3 shows an antenna system embodying the principles of the invention. In particular, the antenna system comprises a folded-dipole antenna **48** and a reflector **50**. Folded-dipole antenna **48** and reflector **50** have the same construction as the element **14** of FIGURE 1, the only difference being in surface geometry. The clips **22** and **24** extending from the leads of transmission line **16** are connected to the folded-dipole antenna **48** to permit the coupling of the antenna system to a receiver. The folded-dipole antenna 48 has a length equal to one-half the operating wave length of the signal being received, while the reflector 50 has a length which is five percent greater.

FIGURE 4 shows an antenna system 58 affixed to the plane surface 10. The antenna system 58 comprises a pair of "bow tie" antennas 58*a* and 58*b*, connected by the transmission line 60. The bow tie antennas 58*a* and 58*b* and the transmission line 60 are of similar construction as shown in FIGURES 2A and 2B. Terminals 62 and 64 may be incorporated in the transmission line 60 to couple the antenna system 58 to a receiver.

Since the length of an antenna determines the optimum operating wave length for reception, it is necessary to fix the length of the antenna to the length required for optimum reception of a signal having a particular operating wavelength. Accordingly, FIGURE 5 shows folded-dipole antenna 48 having a plurality of indicators CH2 to CH13 along its length. These indicators are at pre-determined positions D as indicated in the following table:

Table I

Channel	Channel Limits, mc.	D in feet
2	54- 60	4.3
3	60- 66	3.9
4	66- 72	3.6
5	76- 82	3.1
6	87- 88	2.9
FM Band	88-108	2.5
7	174-180	1.4
8	180-186	1.35
9	186-192	1.30
10	192-198	1.25
11	198-204	1.21
12	204-210	1.18
13	210-216	1.15

As is shown in FIGURE 5, the overall dimensions for the folded-dipole antenna 48 are for television channel 2. To tune the antenna to a higher channel such as television channel 10, it is only necessary to shorten the arms 48*a* and 48*b* by deleting the portion between the indicators CH10 and CH2. As shown in FIGURE 6, this deletion may be accomplished by a simple cutting operation or by folding the arms 48*a* and 48*b* back along the line CH10. The excess portion of the arm 48*c* may be folded as is shown in FIGURE 6 and hidden behind the exposed portion of the arm 48*c*. Of course, it should be noted that the antenna 48 may comprise two sections separated at the indicator CH2′ on arm 48*c*. The trimming operation then would be required for both the arms 48*a* and 48*b* and the arm 48*c*. There would further be required an overlapping electrical connection between the two portions of the arm 48*c*.

It should be noted that, in general, antennas may be used interchangeably for transmitting and receiving. Therefore, although the discussion has been directed toward receiving antennas, the antennas are equally applicable to transmission systems and there is no intent to restrict them to receiver.

There has thus been shown an improved receiving antenna which may have the required dimensions for optimum reception of signals, that may be used indoors without being conspicuous. The antenna besides being highly efficient, is extremely simple and inexpensive to fabricate.

There will now be obvious to those skilled in the art many modifications and variations which accomplish the objects and satisfy many or all of the advantages but which do not depart from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. An antenna, for use in the very high frequency range for TV or FM operation, such antenna comprising a folded-dipole of a thin metal lamina consisting of two dipole elements and a back connecting element, each of the dipole elements having calibration lines marked thereon, transverse to the length of the element and identified by a corresponding broadcasting channel number, to locate and define fold lines at which the dipole elements may be folded with the adjacent ends folded back upon the dipole elements so the remaining effective lengths of said dipole elements will constitute quarter wave length sections for the frequency of the selected broadcasting channel, whereupon said two shortened dipole elements may be placed in closer aligned end-spaced juxtaposition to establish an overall length including such spacing that will be approximately a half-wave length, and the back connecting element having similar marking lines in mirror-spaced pairs, relative to a virtual center line, identifying a broadcasting channel number and serving to define fold lines at which said back connecting element may be folded, to form an intermediate folded section that may be folded back against either of the adjacent side sections of said back connecting element, to bring the two fold lines of said back connecting element into coincidence to establish a linear dimension in said back connecting element at a value corresponding to slightly more than a half wave length, to accommodate the spacing between the adjacent facing ends of the folded-dipole elements.

2. An antenna, as in claim 1, in which one side surface of the dipole and of the back connecting elements is provided with a layer of adhesive material, whereby the antenna may be affixed to a supporting surface in the relationship established by said folding operations.

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