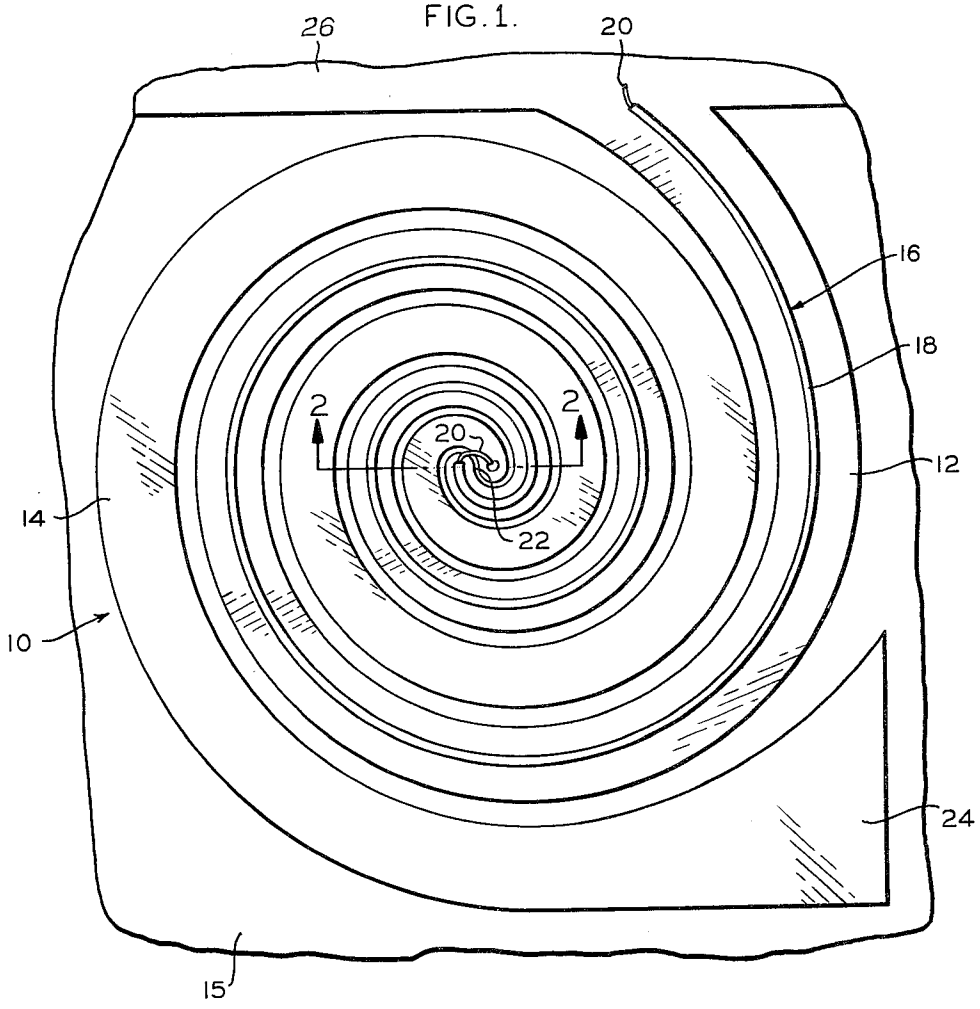
March 15, 1966 L. W. LECHTRECK 3,241,148

END LOADED PLANAR SPIRAL ANTENNA

Filed April 4, 1960

FIG. 1.



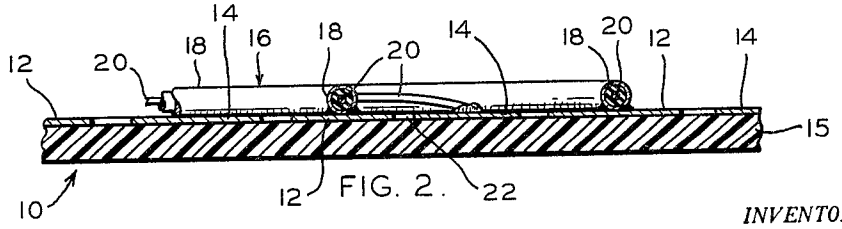


FIG. 2.

INVENTOR.

LAWRENCE W. LECHTRECK

BY

Gravely, Lieder & Woodruff

ATTORNEYS

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END LOADED PLANAR SPIRAL ANTENNA

Lawrence W. Lechtreck, St. Louis County, Mo., assignor to McDonnell Aircraft Corporation, St. Louis, Mo., a corporation of Maryland

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3 Claims. (Cl. 343—895)

The present invention relates to antennas in general and more particularly to broad band antennas.

It is well known to construct broad band antennas by interwinding the elements thereof. It is also well known that broad band characteristics can be achieved by interwinding the elements of an antenna in a spiral, however, the known constructions are relatively large and bulky requiring considerable space for mounting, and the known constructions are also relatively inefficient to operate and require separate means apart from the antenna itself for matching the antenna to an associated unit of equipment such as a radar set or the like. Furthermore, the known devices are relatively complicated to construct and are relatively vulnerable to damage caused by jarring and vibration. These and other disadvantages of the known devices are overcome by the present invention.

Briefly, the present antenna comprises a pair of spirally interwound, spaced and coplanar elements one of which has a portion integral therewith for loading the antenna and the other of which has a connection to ground and also a coaxial cable mounted thereon, said cable having one conductor which makes connection with said associated element and another conductor which makes connection with the other element at a central location on the antenna.

It is a principal object of the present invention to provide an antenna having broad band characteristics and small electrical size achieved through end loading.

Another object is to provide simple means for loading antennas.

Another object is to provide an inexpensive, compact, and efficient broad band antenna construction.

Another object is to reduce the size and weight of antenna devices.

Another object is to reduce the number of antennas required to cover a frequency range.

Still another object is to reduce the size and weight of air and space borne equipment.

These and other objects and advantages of the present invention will become apparent after reading the following detailed specification in conjunction with the accompanying drawing, wherein:

FIG. 1 is a plan view of an antenna device constructed according to the teaching of the present invention, and said view being in the plane of the antenna, and

FIG. 2 is a cross sectional view taken on line 2—2 of FIG. 1.

In the drawing, the number **10** refers generally to an antenna constructed according to the present invention. The antenna **10** is constructed of two spaced and mutually insulated interwound elements **12** and **14**. The elements **12** and **14** may be formed of flat relatively thin metal, such as copper, and mounted on an insulator, such as the insulator **15**; they may be formed by etching a copper surface applied to a dielectric element, such as the insulator **15**; they may be suspended in air; or they may be formed in any other suitable way.

The most important characteristics of the elements **12** and **14** are that they be formed of electrical conductive material, that they be positioned substantially in one plane, that they be spaced and mutually insulated from each other, that they have approximately, although not necessarily, the same overall length, that the element **12** be connected to a conducting ground plane, and that the element **14** be end loaded by a portion **24**.

A coaxial cable **16** is shown mounted centrally on the element **12** and extends substantially the full length thereof. It is contemplated, however, that the cable **16** could be positioned in other locations on the associated element **12**. In the embodiment shown in the drawing, the cable **16** has an outer conductor **18** which is soldered on the surface of the element **12** and an inner conductor **20** (insulated from the outer conductor **18**) which extends across the gap **22** between the innermost ends of the elements **12** and **14**, said inner conductor being connected to the element **14**. The opposite end of the conductor **20** is connected to a suitable device such as a radar set, a radio receiver, a transmitter, or other similar type of device, not shown.

In the particular embodiment of the antenna shown, the outer conductor **18** of the coaxial cable **16** and the associated element **12** are grounded electrically and the outer end of the element **14** is formed integral with a portion **24**. The size and shape of the portion **24** is varied depending upon the characteristics of the antenna and its connection to the ground plane **26**. The portion **24** is provided to load the antenna and to provide proper match for efficient operation particularly at the lower part of its frequency band where ordinary spirals cannot perform.

The size and shape of portion **24** are determined empirically since it depends on the desired lower cutoff frequency and the structure adjacent to the antenna. The existence of end loading **24** and grounding at **26** allow the use of antennas whose largest dimension are less than of ⅛ the longest radiated wave length. Frequency band widths as large as 30:1 have been obtained through end loading and grounding.

The impedance of the antenna **10** is determined by the metal to gap ratio of the spiral and also by the size of the portion **24**. The metal to gap ratio also effects the size of the portion **24**.

The shapes and spacing of the antenna arms and the shape and size of the end-loading portion **24** also have an effect on the operating characteristics and, of course, can be varied as aforesaid to produce a particular operating condition.

In actual practice it has been found that the antenna **10** can have overall dimensions that are substantially smaller than other known antennas having similar broad band characteristics. This is an important feature of the present device especially when used on air borne and space borne vehicles where weight and space requirements are very restricted.

Thus, it is apparent that there has been provided a novel antenna device which fulfills all of the objects and advantages sought therefor. Obviously, many of the specific characteristics of the present antenna, as shown, could be changed, altered or modified by those skilled in the art without departing from the spirit and scope of the invention. All such changes, alterations and modifications which do not depart from the spirit and scope of the invention are deemed to be covered by the present invention which is limited only by the claims which follow.

What is claimed is:

1. An antenna comprising a pair of spirally interwound, spaced and coplanar elements, one of which has a portion formed integral therewith at one end for end loading and matching the antenna, means connecting the other of said elements to ground, and a coaxial cable mounted on said other element, said cable having two conductors, each of which are connected to a different one of said elements.

2. An antenna comprising a pair of mutually insulated spiral shaped elements interwound in spaced and coplanar relation about a central location, said elements being relatively flat and thin in the plane of the antenna, means grounding one end of one of said elements, the other of said elements having an enlarged coplanar portion formed integral with one end thereof for loading the antenna, said enlarged portion being of a size to provide a proper match for efficient operation at relatively low frequencies, and a transmission line connected to the antenna, said transmission line including a pair of spaced conductors each of which is connected to a different one of said elements.

3. An antenna comprising two mutually insulated, metallic, spiral shaped strips interwound with each other and supported in the same plane, the width of said strips and the spacing therebetween varying along the lengths thereof, one of said strips having an enlarged coplanar end portion integral therewith and of determinable area size for loading the antenna, and means connecting the other of said strips to a ground plane.

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ELI LIEBERMAN, *Acting Primary Examiner.*

GEORGE N. WESTBY, HERMAN KARL SAALBACH, *Examiners.*