March 19, 1968 R. C. FENWICK 3,374,483

TUNABLE ELECTRICALLY SMALL ANTENNA

Filed May 6, 1965

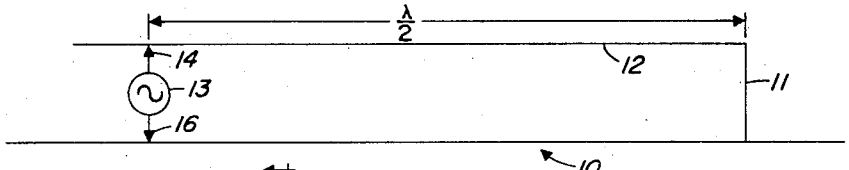


FIG 1

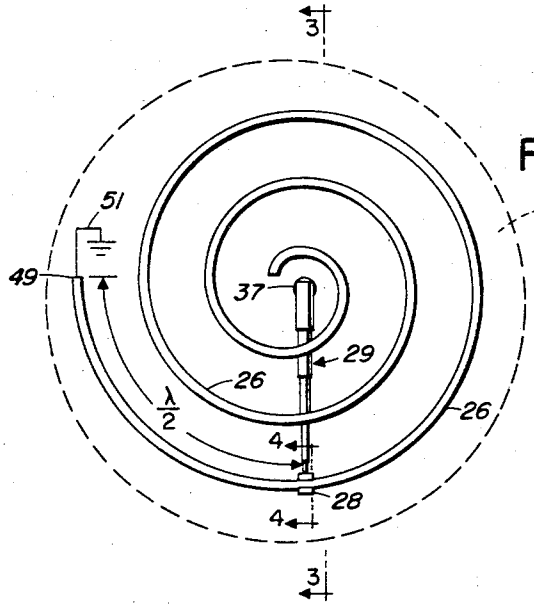


FIG 2

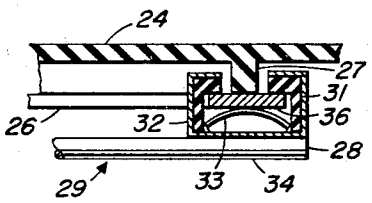
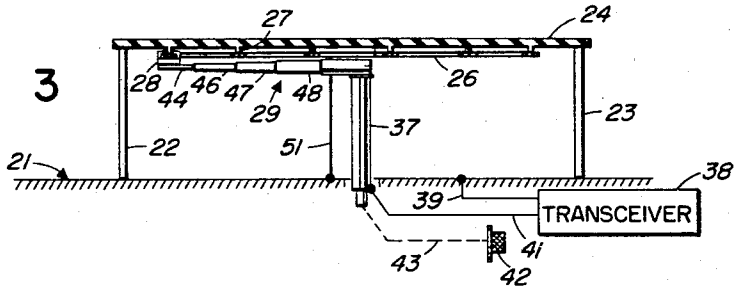


FIG 4

FIG 3



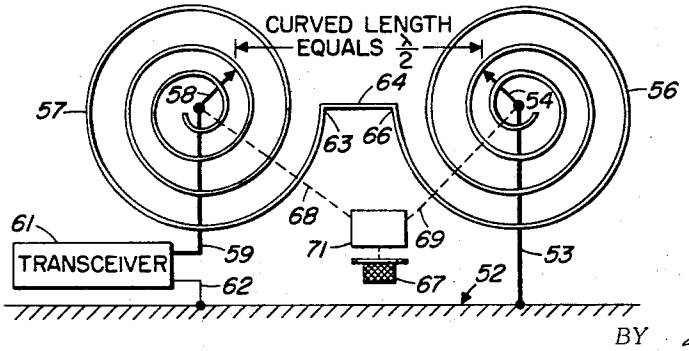


FIG 5

INVENTOR.
RICHARD C. FENWICK

BY Marvin Moody

ATTORNEY

United States Patent Office 3,374,483 Patented Mar. 19, 1968

3,374,483

TUNABLE ELECTRICALLY SMALL ANTENNA

Richard C. Fenwick, Richardson, Tex., assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

Filed May 6, 1965, Ser. No. 453,801
6 Claims. (Cl. 343—895)

ABSTRACT OF THE DISCLOSURE

A space saving implementation of an electrically small antenna of the type comprising a conductor arranged parallel to a ground plane with one end of the conductor shorted to the ground plane through a vertical conductor and with a feed point connected between a selected point at or near the other end of the conductor and the ground point. The half wavelength conductor is formed into a spiral arrangement permitting a space saving arrangement with which a novel slidable feed point contact may be incorporated for tuning purposes.

This invention relates in general to antennas and in particular to a spiral wound antenna.

It is desirable at times to construct an antenna which is as small as possible so as to eliminate large structures which might be subject to adverse icing and wind resistance. The present invention relates to a half-wave conductor formed into a spiral and which has a movable contact that allows the half-wave length of the antenna to be varied.

It is an object of this invention to provide an improved compact antenna.

Another object is to provide a simple construction which allows an antenna to be cheaply and easily manufactured.

Further objects, features, and advantages of this invention will become apparent from the following description and claims when read in view of the accompanying drawings, in which:

FIGURE 1 is a schematic illustration of a pair of short monopoles separated by a half-wave length antenna;

FIGURE 2 is a top view of a spiral-shaped antenna according to this invention;

FIGURE 3 is a side view of the antenna shown in FIGURE 2;

FIGURE 4 is an enlarged detailed sectional view of the slide contact of this invention; and,

FIGURE 5 is a modification of the invention illustrating a pair of spirals connected together to form a composite antenna.

FIGURE 1 illustrates a ground plane designated generally as **10**. A conductor **11** has one end connected to the ground plane and the other end connected to a conductor **12** which is parallel to the ground plane **10**. An energizing source **13** has a pair of slide contacts **14** and **16** which are engageable with the conductor **12** and the ground plane **10**. The distance between the contact **14** and the monopole **11** is a half-wave length at the resonant frequency of the antenna thus formed. By moving the energizing means **13** along the conductor **12**, the frequency of the antenna may be increased or decreased as desired. Thus by moving the energizing means **13** toward the monopole **11**, the frequency will become higher and, alternatively, by moving the energizing means **13** and cnotact **14** away from the monopole **11**, the frequency will be lowered.

Monopoles separated by half-wave length conductors

as shown in FIGURE 1 comprise antennas which are very efficient.

FIGURES 2, 3 and 4 illustrate a practical embodiment of the antenna in FIGURE 1.

A ground plane **21** has standoffs **22** and **23** attached to it for supporting an insulating plate **24**. A spirally wound conductor **26** is attached to the plate **24** by spiral support **27**. This is best shown in FIGURE 4. Conductor **26** engages the end **28** of a telescoping slide contact **29**. The end **28** is formed with an outer U-shaped member **31** which is lined with Teflon material **32**. A wiper spring **33** is mounted in member **31** and is electrically connected to the end **34** of wiper contact **29**. The spring contact **33** makes electrical contact with the face **36** of the spiral conductor **26**.

As best shown in FIGURE 3, the telescoping contact **29** is rotatably connected to a support **37**. A transceiver **38** has one output lead **38** connected to the ground plane **21** and the other output lead **41** connected to the support member **37** and to the telescoping arm **29**. A knob **42** is connected to a shaft **43** which extends through the support **37** and is connected to the telescoping arm **29** to rotate it. Telescoping arm **29** is formed of a number of telescoping sections **44**, **46**, **47** and **48**. Electrical continuity is maintained between lead **41** and contact **33**.

In operation, the outer end **49** of the spiral conductor **26** is connected to the ground plane by a lead **51**. The lead **51** corresponds to the monopole **11** in FIGURE 1. The point of engagement of the spring contact **33** of the telescoping wiper contact **29** determines the length between the monopole **11** and the wiper contact **14**. In other words, the half-wave length distance is indicated in FIGURE 2 between the ground point **51** and the wiper contact **29**. Thus, a simple and compact antenna is formed which may by tuned by the knob **42** which rotates contact arm **29** to vary the half-wave length distance between ground point **51** and the position of the contact **33**.

A modification of the invention is illustrated in top view FIGURE 5, wherein a ground plane **52** is electrically connected by lead **53** to a telescoping contact **54** which engages a spiral conductor **56**. The wiper contact **54** is similar to contact **29** shown in FIGURES 2, 3 and 4 and the conductor **56** is similar to the conductor **26** shown in FIGURES 2, 3 and 4. A second spiral conductor **57** is mounted adjacent conductor **56** and has a telescoping wiper contact **58** which is electrically connected by lead **59** to the output of a transceiver **61**. The other output lead **62** of the transceiver is connected to the ground plane **52**. The end **63** of conductor **57** is connected by a conductor **64** to the end **66** of the spiral conductor **56**.

Shafts **68** and **69** are connected to wiper contacts **54** and **58**, respectively, to rotate them. The shafts **68** and **69** are connected into a suitable gear box **71** and a knob **67** is attached to box **71**. As knob **67** is turned, the electrical distance between the wiper contacts **54** and **58** will be lengthened or shortened depending on the direction of the rotation of the knob **67**. To increase the length between contact **58** and point **63** of the spiral **67**, the contact **58** must be rotated clockwise. To increase the length from point **66** to wiper contact **54**, the contact **54** must be rotated counterclockwise to shaft **68**. Thus, gear box **71** causes shaft **68** to turn clockwise when shaft **69** turns counterclockwise. Alternatively, when the shaft **69** is rotated clockwise, shaft **68** rotates counterclockwise.

The active lengths of the spirals **56** and **57** comprise quarter-wave lengths at the resonant frequency of the antenna and the distance between the contacts **54** and **58** will therefore be a half-wave length. This allows an antenna to be formed in a relatively small space.

It is seen that this invention provides a compact and efficient antenna. Although it has been described with respect to particular embodiments thereof, it is not to be so limited, as changes and modifications may be made therein which are within the spirit and scope of the invention as defined by the appended claims.

I claim:

1. An antenna comprising a ground plane, support means attached to said ground plane, a spiral conductor supported by said support means, one end of the spiral conductor connected to said ground plane and the other end of said conductor being free, a wiper conductor engageable with the spiral conductor and movable thereto, feed points for the antenna connected to the wiper contact and said ground plane, said wiper contact being formed of a guide member engageable with said spiral conductor and a telescoping arm attached to said guide member, and a shaft attached to one end of said telescoping arm with the shaft supported for rotary motion at the center of said spiral conductor.

2. An antenna comprising a ground plane, support means attached to said ground plane, an insulated plate attached to said support means, a spiral conductor attached to the insulated plate, one end of said spiral conductor electrically connected to said ground plane, a wiper contact engageable with said spiral conductor and movable relative thereto, said wiper contact comprising an engaging end for mechanically and electrically contacting said spiral conductor, a telescoping arm attached to said engaging end, and the other end of said telescoping arm rotatably supported adjacent of said spiral conductor.

3. In apparatus according to claim 2 means for rotating the telescoping arm to vary the contact point on the spiral conductor.

4. An antenna comprising a pair of coplanar spiral conductors arranged at equal distance from a ground plane with the outer ends of said spiral conductors connected together, a pair of wiper contacts each engageable with one of said spiral conductors, means for moving the wiper contacts relative to the spiral conductors, one of said wiper contacts being connected to said ground plane and the other of said wiper contacts and said ground plane comprising respectively feed points for said antenna.

5. In apparatus according to claim 4 wherein said wiper arms are caused to move with respect to their associated spiral conductors so as to simultaneously effect a length of each spiral conductor between its associated wiper arm and the common connection between the outer ends of said spiral conductors equal to approximately one-quarter wavelength as defined by the operating frequency of said antenna.

6. In apparatus according to claim 5 wherein said spiral conductors are wound with respective opposite senses.

References Cited

UNITED STATES PATENTS

1,530,684	3/1925	Mauborgne et al.	343—895
1,553,315	9/1925	Gould	343—870 XR
2,431,124	11/1947	Kees et al.	343—845 XR
2,758,300	8/1956	Dylewski	343—845
3,151,328	9/1964	Boyer	343—748 XR
3,152,330	10/1964	Chatelain	343—895 XR

ELI LIEBERMAN, *Primary Examiner.*

HERMAN KARL SAALBACH, *Examiner.*

M. NUSSBAUM, *Assistant Examiner.*