

## 13 Documents

| Publication numbers            | Title                                                                    | Current assignees           |
|--------------------------------|--------------------------------------------------------------------------|-----------------------------|
| <a href="#">WO9641397 A1</a>   | Contrawound antenna                                                      | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">WO9707559 A1</a>   | Contrawound toroidal helical antenna                                     | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">US5442369 A</a>    | Toroidal antenna                                                         | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">US6593900 B1</a>   | Flexible printed circuit board antenna                                   | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">WO9909608 A1</a>   | Toroidal helical antenna                                                 | KURT L VANVOORHIES, ...     |
| <a href="#">WO9952179 A1</a>   | Contrawound helical antenna                                              | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">WO9641398 A1</a>   | Toroidal antenna                                                         | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">US6218998 B1</a>   | Toroidal helical antenna                                                 | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">WO9909609 A1</a>   | Method of manufacturing a contrawound toroidal helical antenna           | KURT L VANVOORHIES, ...     |
| <a href="#">WO200215329 A1</a> | Contrawound antenna                                                      | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">NL-279396D A</a>   | Directional antenna                                                      | HERMANN EHRENSPECK          |
| <a href="#">US6300920 B1</a>   | Electromagnetic antenna                                                  | UNIVERSITY OF WEST VIRGINIA |
| <a href="#">US4004179 A</a>    | Slow wave circuit having serially connected contrawound two-turn helices | LITTON SYSTEMS              |

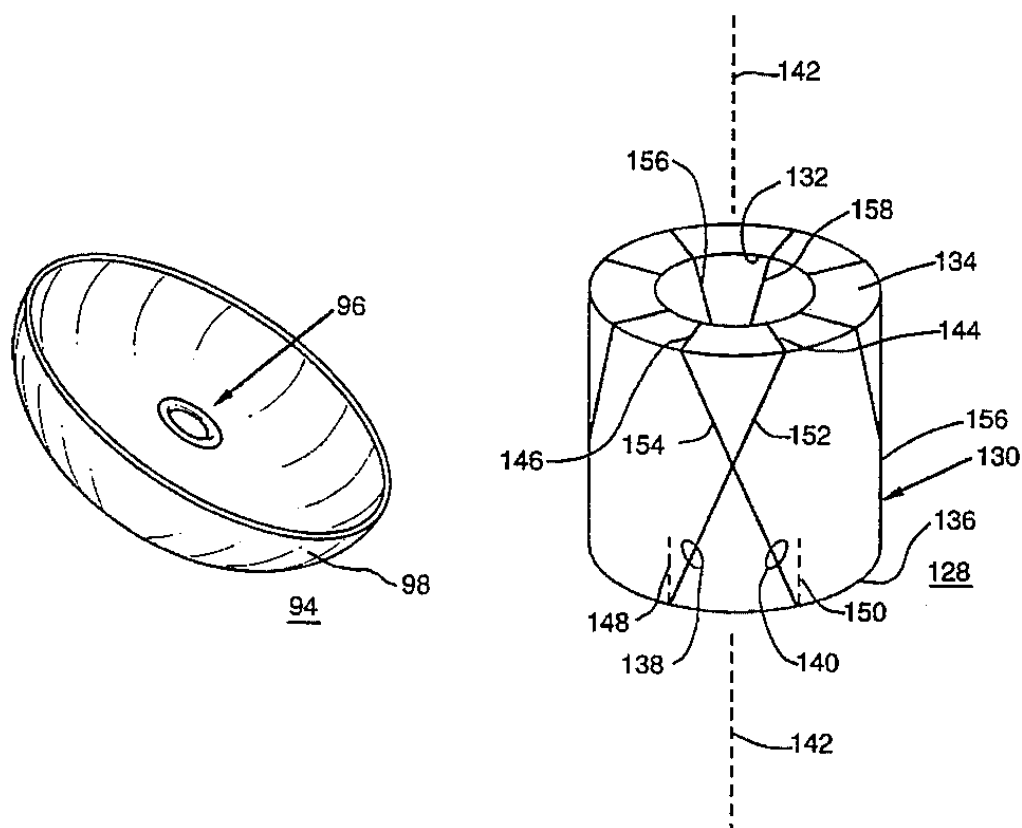
Family 1/13 - FAMPAT - ©Questel

## Title

(EP-830710)

### Contrawound antenna

## Images



### Publication data including kind & date

|               |    |            |               |
|---------------|----|------------|---------------|
| WO96/41397    | A1 | 1996-12-19 | WO9641397     |
| CA2223296     | A1 | 1996-12-19 | CA2223296     |
| AU6090396     | A  | 1996-12-30 | AU9660903     |
| US5654723     | A  | 1997-08-05 | US5654723     |
| EP0830710     | A1 | 1998-03-25 | EP-830710     |
| CZ392397      | A3 | 1998-04-15 | CZ9703923     |
| PL323920      | A1 | 1998-04-27 | PL96323920    |
| IL122469      | A  | 1998-06-15 | IL-122469     |
| CN1191042     | A  | 1998-08-19 | CN1191042     |
| MX9709707     | A  | 1998-10-31 | MX9709707     |
| NZ310165      | A  | 1999-02-25 | NZ-310165     |
| KR19990022702 | A  | 1999-03-25 | KR19990022702 |
| AU706459      | B2 | 1999-06-17 | AU-706459     |
| HU9900861     | A2 | 1999-07-28 | HU9900861     |
| HU9900861     | A3 | 1999-11-29 | HU9900861     |
| BR9608754     | A  | 1999-12-07 | BR9608754     |
| BRPI9608754   | A1 | 1999-12-07 | BRPI9608754   |
| JP2000503171  | A  | 2000-03-14 | JP2000503171  |
| IL122469      | B  | 2000-08-13 | IL-122469     |
| RU2159486     | C2 | 2000-11-20 | RU2159486     |
| PL180885      | B1 | 2001-04-30 | PL-180885     |



|                             |    |            |             |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|-----------------------------|----|------------|-------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <a href="#">CZ289897</a>    | B6 | 2002-04-17 | CZ-289897   |  |  |  |  |
| <a href="#">EP0830710</a>   | B1 | 2002-11-27 | EP-830710   |  |  |  |  |
| <a href="#">DE69625059</a>  | D1 | 2003-01-09 | DE69625059  |  |  |  |  |
| <a href="#">KR100416630</a> | B1 | 2004-07-01 | KR100416630 |  |  |  |  |
| <a href="#">CA2223296</a>   | C  | 2006-10-17 | CA2223296   |  |  |  |  |
| <a href="#">JP3913778</a>   | B2 | 2007-02-09 | JP3913778   |  |  |  |  |

**Abstract**

(EP-830710)

An antenna is disclosed that has windings that are contrawound in segments on a toroid form and that have opposed currents on selected segments. An antenna is disclosed that has one or more insulated conductor circuits with windings that are contrawound around and over a surface, such as a spherical surface, a generally spherical surface, a multiply connected surface, a toroidal surface, or a hemispherical surface. The insulated conductor circuits may form one or more endless conductive paths around and over the surface. The windings may have a helical pattern, a generally helical pattern, a partially helical pattern, a poloidal peripheral pattern or may be constructed from a slotted conductor on the toroid. Poloidal loop winds are disclosed with a toroid hub on a toroid that has two plates that provides a capacitive feed to the loops, which are selectively connected to one of the plates.

**Inventors**

CRAVEN ROBERT P M

PRINKEY MICHAEL T

SMITH JAMES E

**Latest standardized assignees - inventors removed**

UNIVERSITY OF WEST VIRGINIA

Family 2/13 - FAMPAT - ©Questel

**Title**

(EP-870344)

Contrawound toroidal helical antenna

**Images**

#### OTHER PUBLICATIONS

Van Voorhies, K.L. and Smith, J.E., "The Promises and Prospects of Worldwide Wireless Power Transfer: An Overview," 26th Intersociety Energy Conversion Engineering Conference, Aug. 4-9, 1991. 6 pp., Boston, Massachusetts, U.S.A.

Van Voorhies, K.L., *The Segmented Bifilar Counterwound Toroidal Helical Antenna*, vols. I-III, Ph.D. Dissertation, 1993 (Unpublished except for Abstract which was published by University Microfilms International, Ann Arbor, Michigan, U.S.A., on 15 Dec., 1994 in vol. 53, Issue 6B of Dissertation Abstracts).

PCT International Searching Authority, International Application No. PCT/US96/09119, International Search Report or the Declaration, 13 Sep. 1996.

PCT International Searching Authority, International Application No. PCT/US96/13125, International Search Report or the Declaration, 26 Nov. 1996.

PCT Preliminary Examining Authority, International Application No. PCT/US96/13125, International Preliminary Examination Report, 01 Aug., 1997.

Krahl, N.K. and Trivelpiece, A.W., *Principles of Plasma Physics*, San Francisco Press, Inc., San Francisco, California, U.S.A., 1986, pp. 267-286 no month.

Kandolan, A.G.; Siehak, W., "Wide-Frequency-Range Tuned Helical Antennas and Circuits," *Convention Record of the IRE, 1953 National Convention, Part 2—Antennas and Communications*, 42-47.

Birdsall, C.K.; Everhart, T.E., "Modified Contra-Wound Helix Circuits for High Power Traveling-Wave Tubes," *IRE Transactions on Electron Devices*, ED-3, (Oct. 1956), 190-204 no month.

Nevius, J.E., Jr., "An Investigation and Application of the Contraound Helix," *IRE Transactions on Electron Devices*, ED-6, 1959, 195-202 no month.

Ham, J.M.; Slemon, G.R., *Scientific Basis of Electrical Engineering*, John Wiley & Sons, N.Y., 1961, 1961, 303-305 no month.

Garnier, R.C., *Study of a radio frequency antenna with an edge-slot like structure*, Ph.D. Dissertation, Marquette University, Milwaukee, WI, 1987 no month.

Corum, J.F.; Corum, K.L., "Toroidal Helix Antenna," *Proceedings of the 1987 IEEE-Antennas no month*, and Propagation Society International Symposium, Blacksburg, Va., 1987, 832-835.

Pinzon, B.F.; Corum, J.F.; Corum, K.L., "A New Low Profile Anti-Skywave Antenna for AM Broadcasting," *Proceedings of the 1988 National Association of Broadcasters 42nd Engineering Conference*, Las Vegas, Nevada, Apr. 1988, 7-15.

Tiberio, C.A.; Ragarella, L.; Banci, G.; Franconi, C., "The RF Toroidal Transformer as a Heat Delivery System for Regional and Focused Hyperthermia," *IEEE Transactions on Biomedical Engineering*, 35, 12(Dec. 1988), 1077-1085.

*ARRL Antenna Handbook*, 1991, pp. 25-12 through 25-14 no month.

### Publication data including kind & date

|            |    |            |           |
|------------|----|------------|-----------|
| WO97/07559 | A1 | 1997-02-27 | WO9707559 |
| CA2229181  | A1 | 1997-02-27 | CA2229181 |
| AU6845696  | A  | 1997-03-12 | AU9668456 |
| US5734353  | A  | 1998-03-31 | US5734353 |
| EP0870344  | A1 | 1998-10-14 | EP-870344 |
| EP0870344  | A4 | 1998-10-14 | EP-870344 |
| US5952978  | A  | 1999-09-14 | US5952978 |
| CA2229181  | C  | 2000-11-14 | CA2229181 |
| US6239760  | B1 | 2001-05-29 | US6239760 |
| EP0870344  | B1 | 2002-04-03 | EP-870344 |



[DE69620453](#)

D1 2002-05-08 DE69620453

[DE69620453](#)

T2 2002-10-17 DE69620453

**Abstract**

(EP-870344)

An electrically small antenna is disclosed that is constructed from a generalized contrawound toroidal helix (1, 2) made from a single continuous conductor divided into two length portions each of which are substantially the same length and which have a generalized helical pattern. The helical pitch senses the two length portions are opposite to one another. The two length portions are insulated from one another and overlap one another on the surface of a generalized toroid. A signal is fed to the antenna at a port defined by the node locations (N1, N2) where the respective length portions join one another, or at a diametrically opposite point. A compact, broadband embodiment of the antenna is disclosed, as are other applications including a coaxial cavity resonator using the antenna as a feed element.

**Inventors**

VAN VOORHIES KURT L

**Latest standardized assignees - inventors removed**

UNIVERSITY OF WEST VIRGINIA

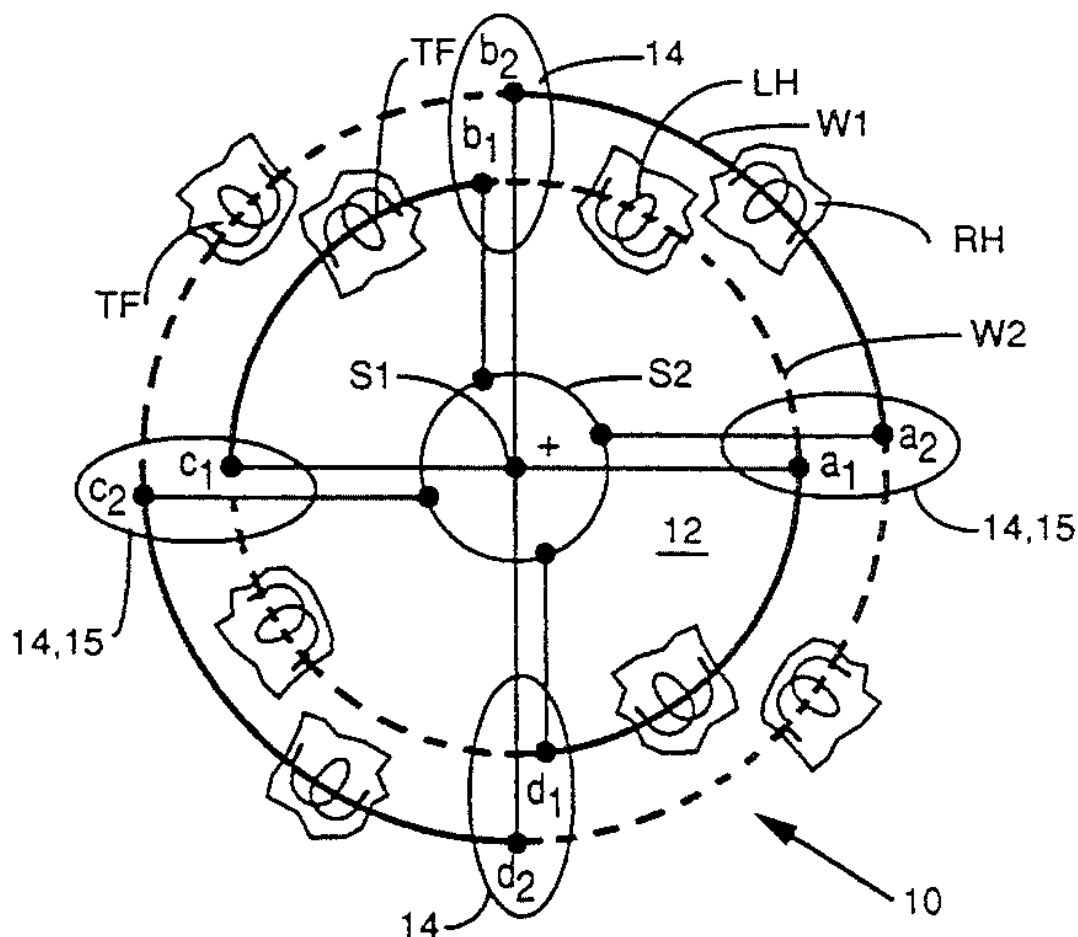
Family 3/13 - FAMPAT - ©Questel

**Title**

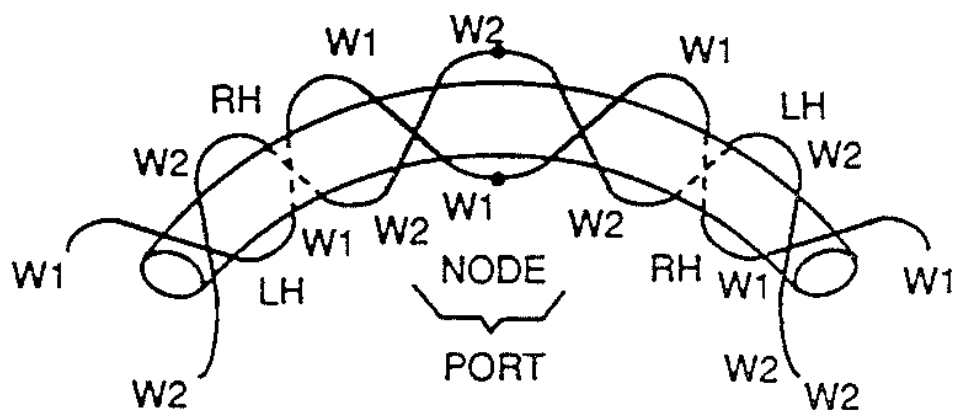
(US5442369)

Toroidal antenna

**Images**



### a) DIAMETRICALLY OPPOSED NODES NODE



### Publication data including kind & date

US5442369

A 1995-08-15 US5442369



### Abstract

(US5442369)

An antenna has windings that are contrawound in segments on a toroid form and that have opposed currents on selected segments. The windings may have a helical pattern, poloidal peripheral pattern or may be constructed from a slotted conductor on the toroid. Poloidal loop winds have a toroid hub on a toroid that has two plates that provides a capacitive feed to the loops, which are selectively connected to one of the plates.

### Inventors

VAN VOORHIES KURT L

SMITH JAMES E

**Latest standardized assignees - inventors removed**

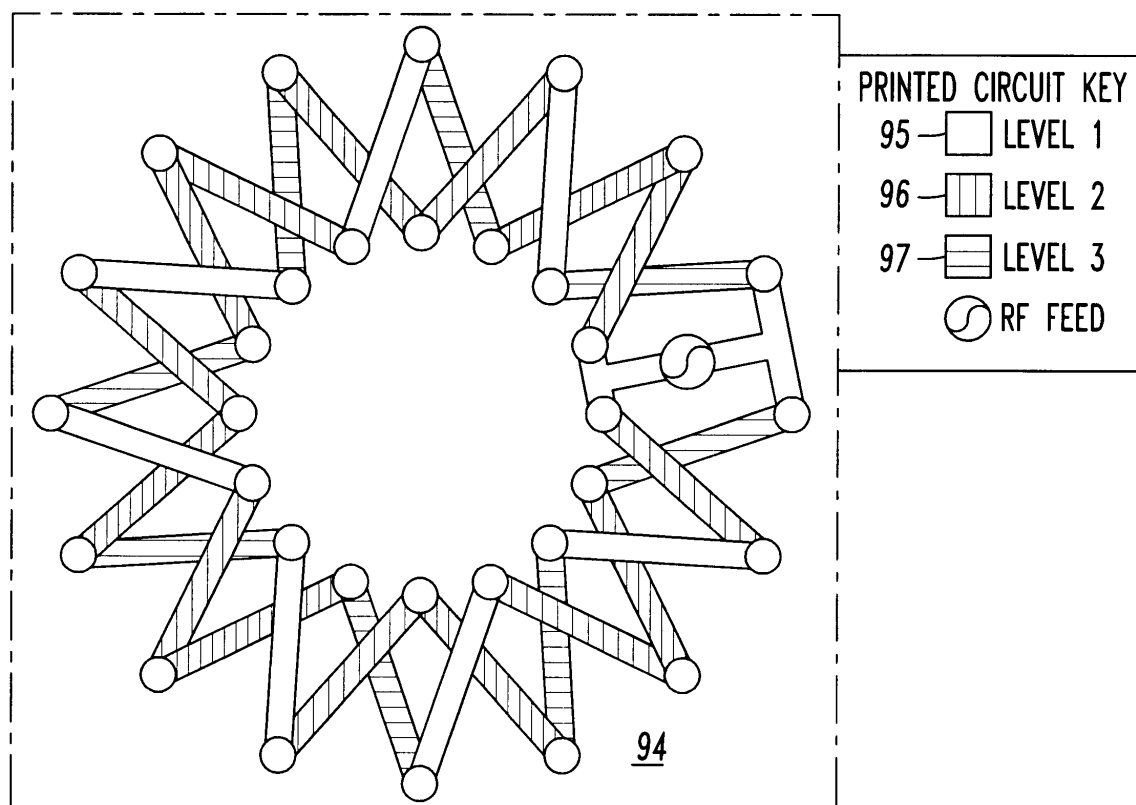
UNIVERSITY OF WEST VIRGINIA

Family 4/13 - FAMPAT - ©Questel

**Title**

(US6593900)

Flexible printed circuit board antenna

**Images****Publication data including kind & date**[US6593900](#)

B1 2003-07-15 US6593900

**Abstract**

(US6593900)

An electromagnetic antenna for a non-planar surface includes a flexible printed circuit board having three or four conductive levels. The flexible printed circuit board is adapted to conform to the non-planar surface and includes a plurality of electrical connections between the conductive levels and a plurality of electrical traces on the conductive levels. The electrical connections and the electrical traces form a first helix having a first helical pitch sense from a first node to a second node, and also form a second helix having a second helical pitch sense, which is opposite from the first helical pitch sense, from a third node to a fourth node. The first and second helices are contrawound relative to each other. First and second signal terminals are provided and are electrically connected with at least one of the nodes.

**Inventors**

CRAVEN ROBERT P M

SMITH JAMES E

ROLLAND JR JOFFRE J

**Latest standardized assignees - inventors removed**

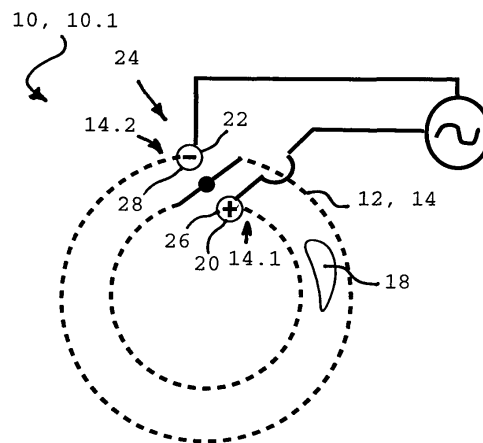
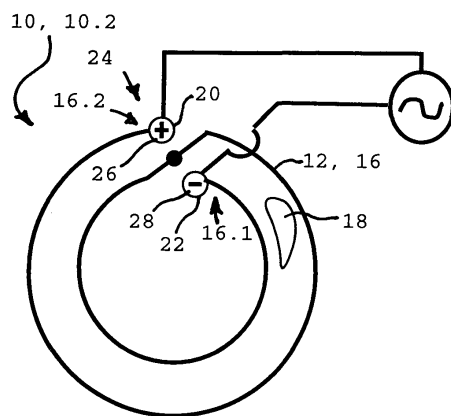
UNIVERSITY OF WEST VIRGINIA

Family 5/13 - FAMPAT - ©Questel

**Title**

(WO9909608)

Toroidal helical antenna

**Images****Publication data including kind & date**[WO99/09608](#)

A1 1999-02-25 WO9909608

[AU8915098](#)

A 1999-03-08 AU9889150

**Abstract**

(WO9909608)

An electromagnetic antenna (10) comprises a continuous conductor (12) comprising a first length portion (14) and a second length portion (16), the first and second length portions each having a first end and a second end whereby the first end (14.1) of the first length portion (14) is connected to the second end (16.2) of the second length portion (16) at a first node (20), and the second end (14.2) of the first length portion is connected to the first end (16.1) of the second length portion (16.1) at a second node (22). The continuous conductor (12) extends in a generalized helical pattern as a single closed circuit around and over the surface of a generalized toroid (18). The first (14) and second (16) length portions of the continuous conductor are generally contrawound relative to one another, are insulated from one another and overlap one another.

**Inventors**

VAN VOORHIES KURT L

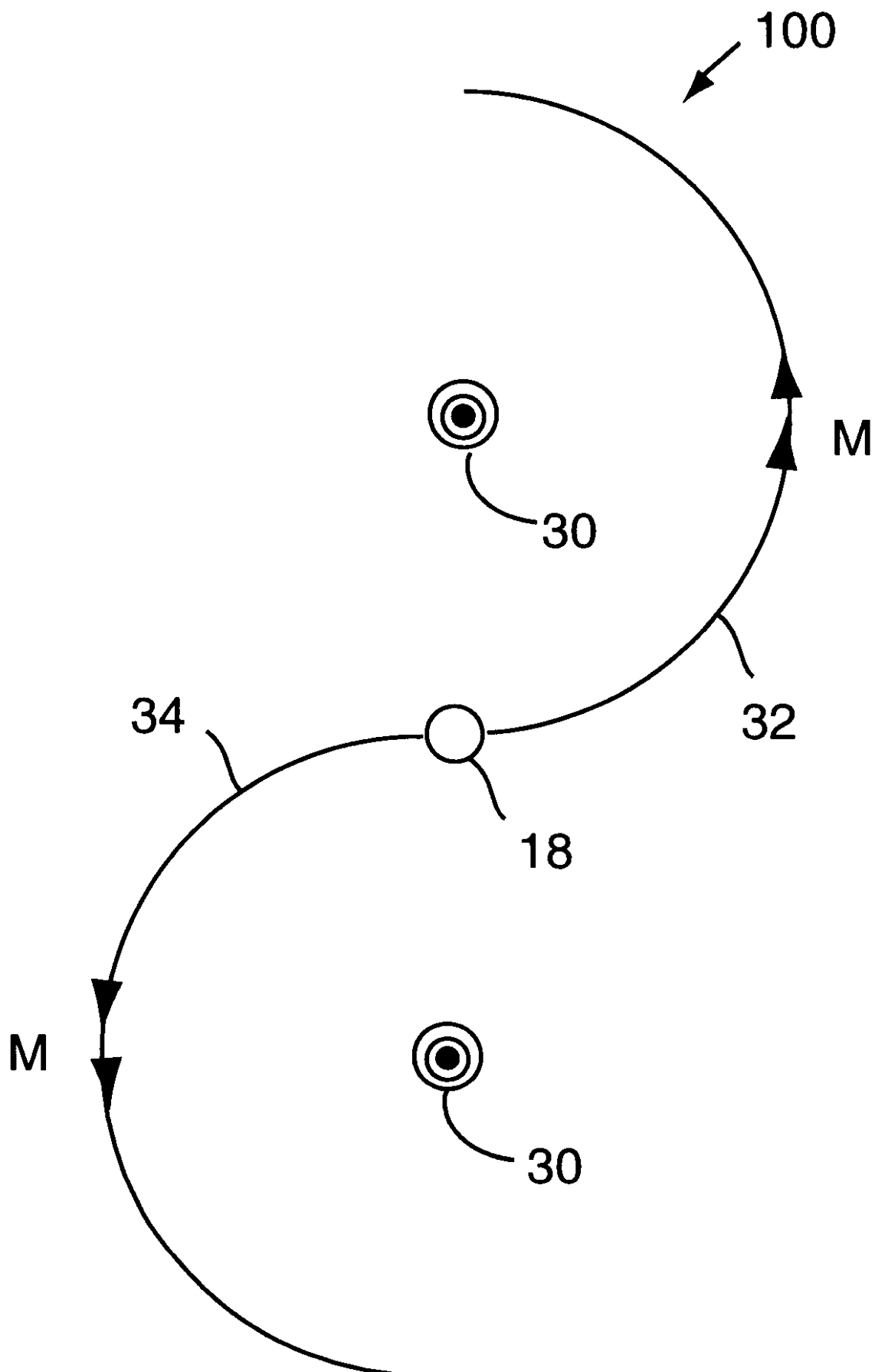
Family 6/13 - FAMPAT - ©Questel

**Title**

(EP1084521)

Contrawound helical antenna

**Images**

**Publication data including kind & date**

|                            |    |            |           |
|----------------------------|----|------------|-----------|
| <a href="#">WO99/52179</a> | A1 | 1999-10-14 | WO9952179 |
| <a href="#">CA2327739</a>  | A1 | 1999-10-14 | CA2327739 |
| <a href="#">AU4068899</a>  | A  | 1999-10-25 | AU9940688 |



|                               |    |            |               |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|-------------------------------|----|------------|---------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <a href="#">EP1084521</a>     | A1 | 2001-03-21 | EP1084521     |  |  |  |  |
| <a href="#">KR20010034757</a> | A  | 2001-04-25 | KR20010034757 |  |  |  |  |
| <a href="#">CN1296650</a>     | A  | 2001-05-23 | CN1296650     |  |  |  |  |
| <a href="#">US6320550</a>     | B1 | 2001-11-20 | US6320550     |  |  |  |  |
| <a href="#">IL138935</a>      | A  | 2001-11-25 | IL-138935     |  |  |  |  |
| <a href="#">AU749533</a>      | B2 | 2002-06-27 | AU-749533     |  |  |  |  |
| <a href="#">JP2003529226</a>  | A  | 2003-09-30 | JP2003529226  |  |  |  |  |
| <a href="#">CN1123947</a>     | C  | 2003-10-08 | CN1123947C    |  |  |  |  |
| <a href="#">RU2218637</a>     | C2 | 2003-12-10 | RU2218637     |  |  |  |  |
| <a href="#">EP1084521</a>     | A4 | 2004-05-19 | EP1084521     |  |  |  |  |
| <a href="#">IL138935</a>      | B  | 2004-07-25 | IL-138935     |  |  |  |  |
| <a href="#">CN1560960</a>     | A  | 2005-01-05 | CN1560960     |  |  |  |  |
| <a href="#">CN100546099</a>   | C  | 2009-09-30 | CN100546099C  |  |  |  |  |
| <a href="#">CA2327739</a>     | C  | 2010-01-26 | CA2327739     |  |  |  |  |

**Abstract**

(EP1084521)

A contrawound helical antenna (100, 130) produces a uniformly directed circulation of magnetic current (M) with a plurality of magnetic dipole elements (32, 34, 35). In one embodiment, the magnetic dipole elements (32, 34) have the same curvature, and the magnetic currents (M) on respective magnetic dipole elements (32, 34) are each directed in the same direction, relative to the central signal coupler (18) of the magnetic dipole antenna (100). In another embodiment, the magnetic dipole elements (32, 35) have the opposite curvature, and the magnetic currents (M) on respective magnetic dipole elements (32, 35) are each directed in opposite directions, relative to the central signal coupler (18) of the magnetic dipole antenna (130).

**Inventors**

WEST VIRGINIA UNIVERSITY

**Latest standardized assignees - inventors removed**

UNIVERSITY OF WEST VIRGINIA

Family 7/13 - FAMPAT - ©Questel

**Title**

(EP-830711)

Toroidal antenna

**Images**



|               |    |            |               |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|---------------|----|------------|---------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| KR19990022703 | A  | 1999-03-25 | KR19990022703 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| JPH11506886   | A  | 1999-06-15 | JP11506886    |  |  |  |  |
| HU9900859     | A2 | 1999-07-28 | HU9900859     |  |  |                                                                                     |  |
| HU9900859     | A3 | 1999-11-29 | HU9900859     |  |  |                                                                                     |  |
| BR9609058     | A  | 1999-12-14 | BR9609058     |  |  |  |  |
| BRPI9609058   | A1 | 1999-12-14 | BR9609058     |  |  |  |  |
| NZ310166      | A  | 2000-01-28 | NZ-310166     |  |  |  |  |
| US6028558     | A  | 2000-02-22 | US6028558     |  |  |  |  |
| CZ287680      | B6 | 2001-01-17 | CZ-287680     |  |  |                                                                                     |  |
| PL180556      | B1 | 2001-02-28 | PL-180556     |  |  |                                                                                     |  |
| US6204821     | B1 | 2001-03-20 | US6204821     |  |  |  |  |
| RU2170996     | C2 | 2001-07-20 | RU2170996     |  |  |                                                                                     |  |
| CZ289371      | B6 | 2002-01-16 | CZ-289371     |  |  |                                                                                     |  |
| EP0830711     | B1 | 2002-11-27 | EP-830711     |  |  |  |  |
| DE69625060    | D1 | 2003-01-09 | DE69625060    |  |  |  |  |
| KR100416631   | B1 | 2004-06-04 | KR100416631   |  |  |  |  |
| CA2223244     | C  | 2006-02-14 | CA2223244     |  |  |  |  |
| JP3913779     | B2 | 2007-02-09 | JP3913779     |  |  |  |  |
| BRPI9609058   | A2 | 2011-12-06 | BR9609058     |  |  |  |  |

**Abstract**

(EP-830711)

An antenna is disclosed that has windings that are contrawound in segments on a toroid form and that have opposed currents on selected segments. An antenna is disclosed that has one or more insulated conductor circuits with windings that are contrawound around and over a multiply connected surface, such as a toroidal surface. The insulated conductor circuits may form one or more endless conductive paths around and over the multiply connected surface. The windings may have a helical pattern, poloidal peripheral pattern or may be constructed from a slotted conductor on the toroid. Poloidal loop winds are disclosed with a toroid hub on a toroid that has two plates that provides a capacitive feed to the loops, which are selectively connected to one of the plates. Associated methods are also disclosed.

**Inventors**

VAN VOORHIES KURT L

**Latest standardized assignees - inventors removed**

UNIVERSITY OF WEST VIRGINIA

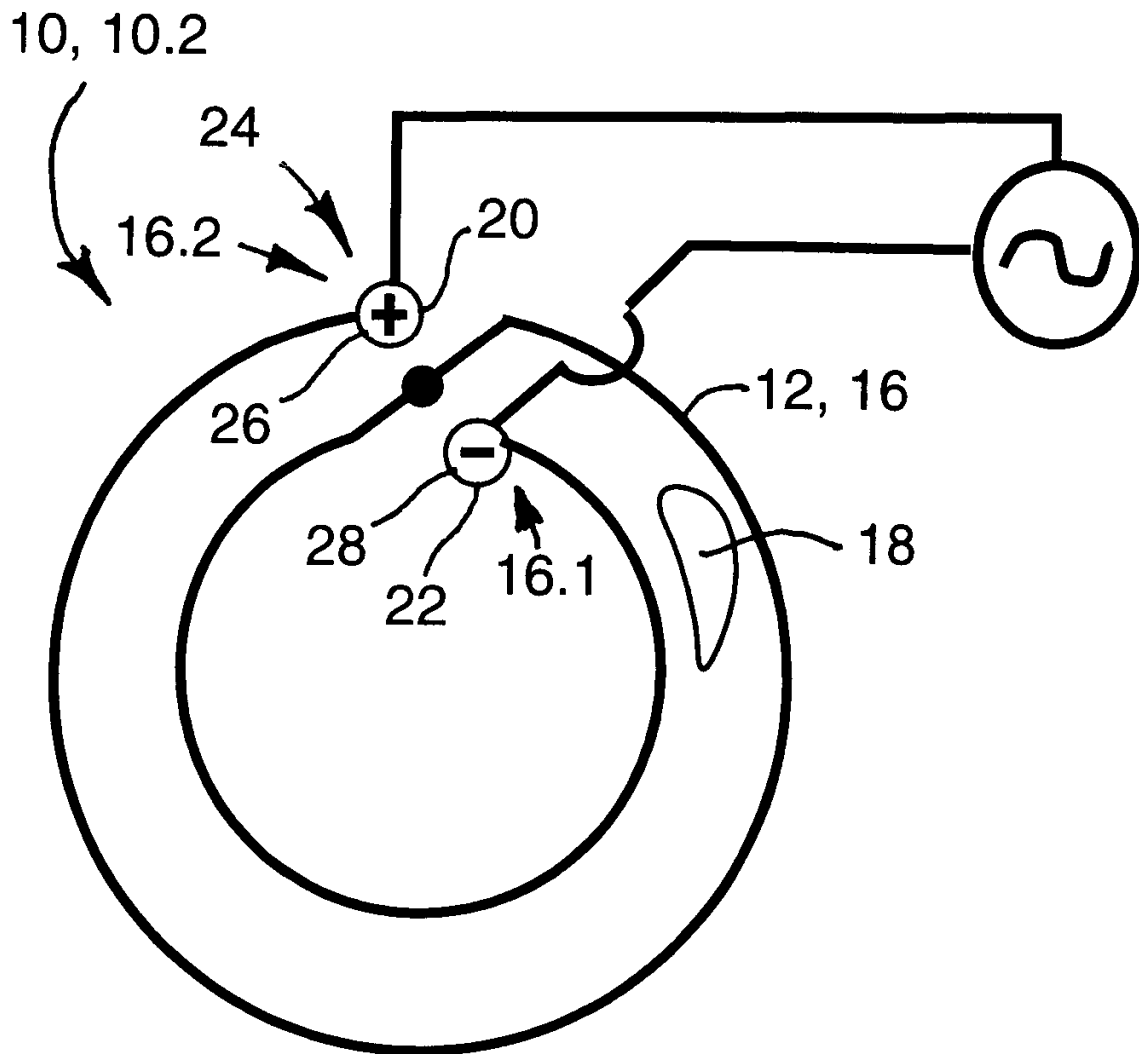
Family 8/13 - FAMPAT - ©Questel

**Title**

(US6218998)

Toroidal helical antenna

**Images**

**Publication data including kind & date**

US6218998

B1 2001-04-17 US6218998

**Abstract**

(US6218998)

In an electromagnetic antenna a continuous conductor comprises a first length portion and a second length portion, the first and second length portions each having a first end and a second end whereby the first end of the first length portion is connected to the second end of the second length portion at a first node, and the second end of the first length portion is connected to the first end of the second length portion at a second node. The continuous conductor extends in a generalized helical pattern as a single closed circuit around and over the surface of a generalized toroid, whereby the first length portion 14 thereof has a first helical pitch sense and extends around the major axis of the generalized toroid for a first plurality of turns, and the generalized helical pattern of the second length portion thereof has a second helical pitch sense and extends around the major axis of the generalized toroid for a second plurality of turns, whereby the first and second helical pitch senses are opposite one another. The first and second pluralities are preferably equal to one another, and are both equal to two. The first and second length portions of the continuous conductor are generally contrawound relative to one another, are insulated from one another and overlap one another. The first and second nodes are in proximate location to one another and collectively constitute a port. A signal feed is operatively connected to the port, and first and second signal terminals are operatively connected to the signal feed.

**Inventors**

VAN VOORHIES KURT LOUIS

**Latest standardized assignees - inventors removed**

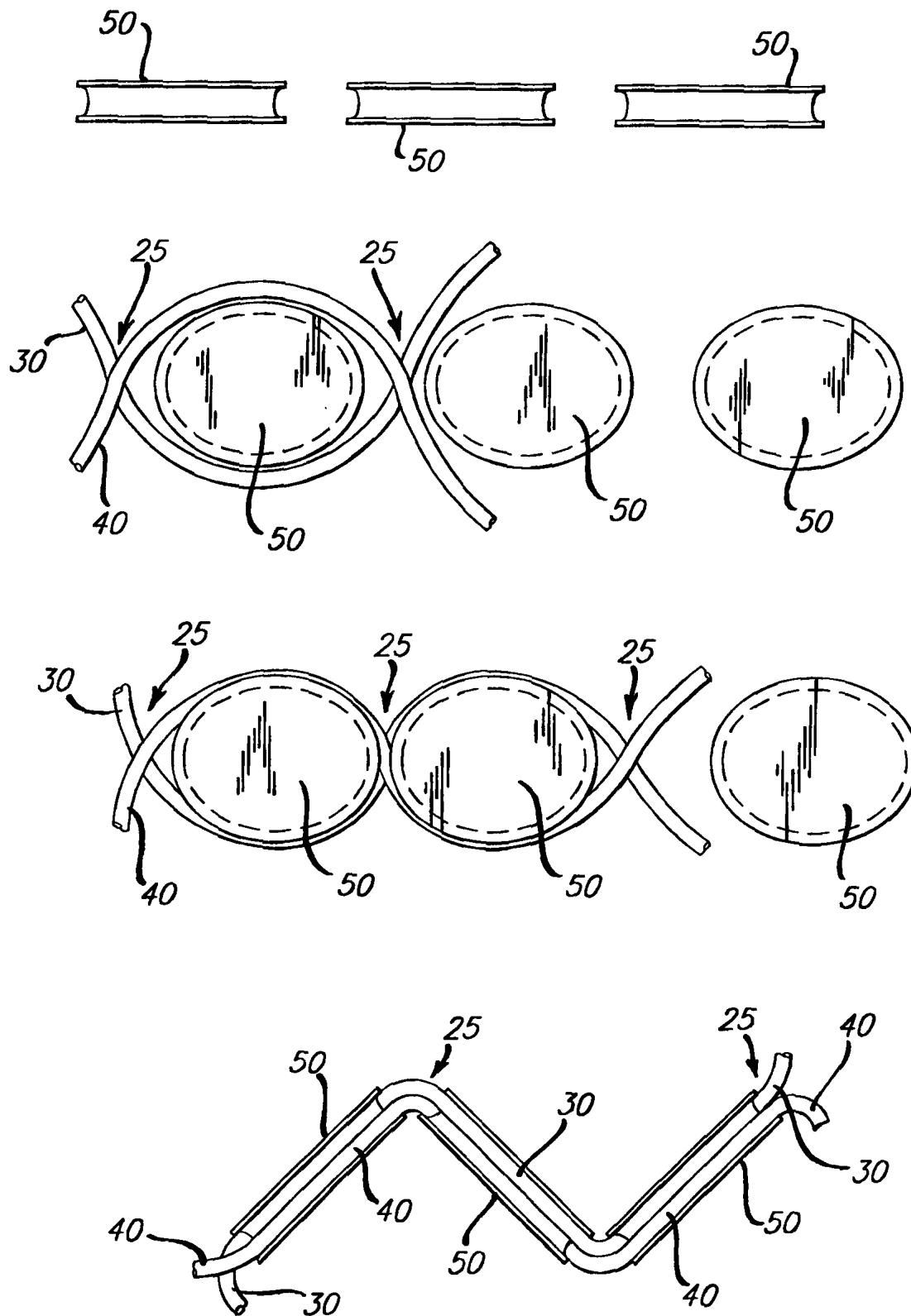
UNIVERSITY OF WEST VIRGINIA

Family 9/13 - FAMPAT - ©Questel

**Title**

(WO9909609)

Method of manufacturing a contrawound toroidal helical antenna

**Images**

AU9111298

A 1999-03-08 AU9891112

**Abstract**

(WO9909609)

A contrawound helical winding is manufactured by forming first (30) and second (40) conductors in respective first and second cyclic patterns of opposite spatial phase relative to one another and which cross one another at a plurality of nodes (25). The nodes (25) are located along the axis of the contrawound helical winding and alternate nodes are displaced in alternate directions. A contrawound toroidal helical antenna is formed from a contrawound helical winding by starting the contrawound helical winding at the first ends of the first (30) and second (40) conductors, ending the contrawound helical winding at the second ends of the first (30) and second (40) conductors, connecting the first end of the first conductor (30) to the second end of the second conductor (40), and connecting the first end of the second conductor (40) to the second end of the first conductor (30), so as to form an endless conductive path.

**Inventors**

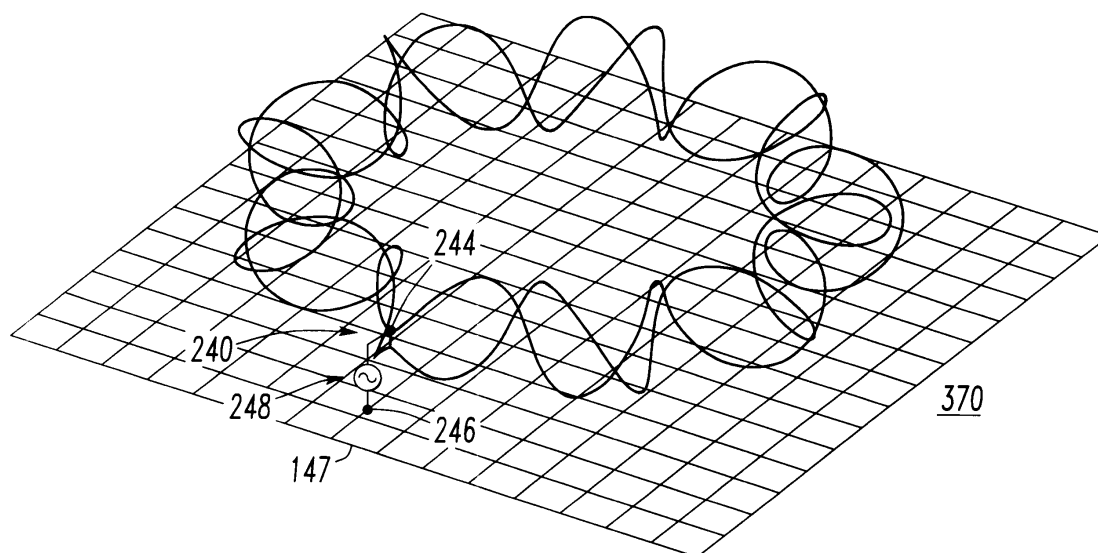
VAN VOORHIES KURT L

Family 10/13 - FAMPAT - ©Questel

**Title**

(WO200215329)

Contrawound antenna

**Images****Publication data including kind & date**

|            |    |            |             |
|------------|----|------------|-------------|
| WO02/15329 | A1 | 2002-02-21 | WO200215329 |
| AU8120901  | A  | 2002-02-25 | AU200181209 |
| WO02/15329 | B1 | 2002-05-10 | WO200215329 |
| US6437751  | B1 | 2002-08-20 | US6437751   |

**Abstract**

(WO200215329)

An electromagnetic antenna (16, 17, 30) includes a multiply connected surface, such as a toroidal surface; first and second insulated conductors (18, 20); and first and second signal terminals (34, 36). The first insulated conductor (18) extends around and over the surface with a first pitch or winding sense from a first node (A) to a second node (D). The second insulated conductor (20) also extends around and over the surface with a second pitch or winding sense, which is opposite from the first pitch or winding sense, from a third node (C) to a fourth node (B). The first and second insulated conductors (18, 20) are contrawound relative to each other around and over the surface. In one embodiment (80) of the invention, at least one of the nodes (B, C) is open. In other embodiments (410) of the invention, the signal terminals (412, 414) are structured for connection to a cooperative antenna structure (418).

**Inventors**

CRAVEN ROBERT P M

SMITH JAMES E

HAWKS LARRY

NUTTER ROY S JR

PERTL FRANZ A

**Latest standardized assignees - inventors removed**

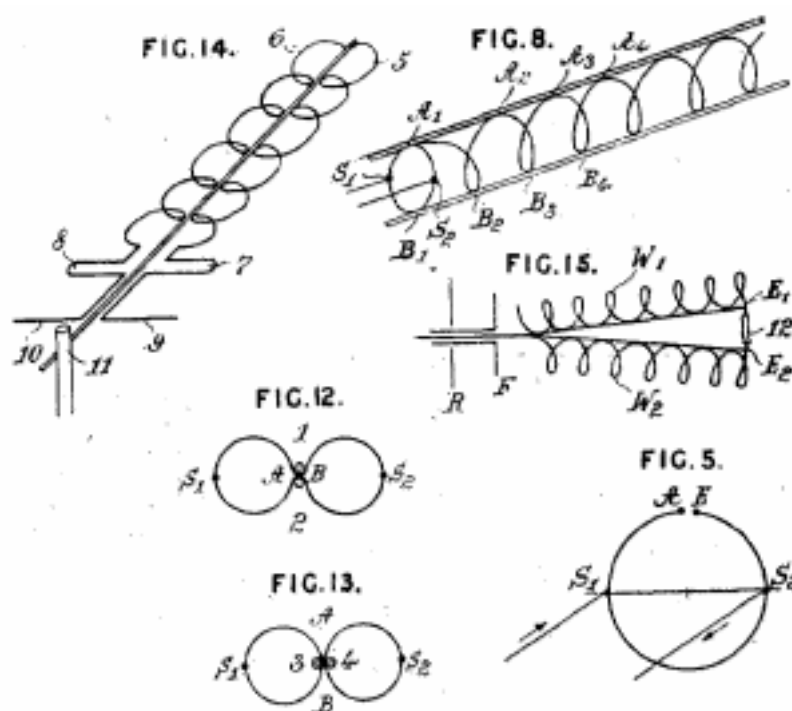
UNIVERSITY OF WEST VIRGINIA

Family 11/13 - FAMPAT - ©Questel

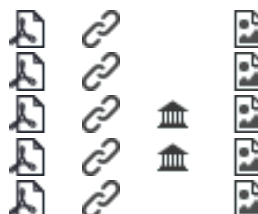
**Title**

(FR1337276)

Directional antenna

**Images****Publication data including kind & date**

|                           |    |            |            |
|---------------------------|----|------------|------------|
| <a href="#">NL279396</a>  | A  | 0          | NL-279396D |
| <a href="#">LU41871</a>   | A1 | 1962-08-13 | LU--41871  |
| <a href="#">FR1337276</a> | A  | 1963-09-13 | FR1337276  |
| <a href="#">GB1001240</a> | A  | 1965-08-11 | GB1001240  |
| <a href="#">AT243342</a>  | B  | 1965-11-10 | AT-243342  |

**Abstract**

(GB1001240)

1,001,240. Aerials. H. EHRENSPECK. June 6, 1962 [June 13, 1961], No. 21841/62. Heading H4A. Relates to an end fire aerial comprising one or two helices adapted to produce linear or plane polarization, the crosssection of the helices being circular, square or triangular. Such an aerial may comprise (1) a single helix having a mean turn circumference of one wavelength ( $\lambda$ ) at the intended frequency of use, (2) two helices arranged side by side in close proximity to one another each having a mean turn circumference of half a wavelength ( $\lambda/2$ ) or (3) a single helix having a mean turn circumference of  $\lambda/2$  and located adjacent a ground plane. When the aerial comprises one helix it may be fed at one end at two points  $S_1$ ,  $S_2$ , Fig. 5, diametrically opposite on the end turn. A discussion with reference to Figs. 6 and 7 (not shown) of the voltage and current distributions on such a turn indicates that if its circumference is one wavelength each half behaves as a centred halfwave dipole to produce linear polarization. An embodiment in accordance with this aspect of the invention

comprises a single turn helix of the dimensions indicated above, fed at S 1 , S 2 , Fig. 8, supported at points A 1 , A 2 , A 3 &c. and B 1 , B 2 , B 3 &c. (A and B being diametrically opposite) by metallic or plastic rods. For an aerial comprising two helices in contact or close proximity along a common tangent and fed at points S 1 , S 2 , Fig. 13, on the end turns at opposite ends of diameters meeting at the common tangent, a discussion with reference to Figs. 10 and 11 (not shown) indicates that if the circumference of each is  $\pi/2$ , the aerial produces linear polarization. The two helices may be wound in the same or opposite directions. One embodiment according to this aspect of the invention is shown in Fig. 13 in which 3 and 4 represent supporting rods. Such an arrangement may also be produced from a single helix by compressing the turns of the helix with metal or insulating support rods 1 and 2, Fig. 12, or the double helix may be formed from a single wire wound with figure - eight turns. In another embodiment the fed end turn of each helix is formed in to a folded dipole 7, 8, Fig. 14, the dipole being connected to a feeder and a reflector 9 being disposed behind the dipole. In a further embodiment the helices W 1 , W 2 , Fig. 15, diverge from each other by a small angle and are excited by a dipole F and reflector R. The angle of divergence is made adjustable to vary the tuning of the aerial and a resistor 12 may be provided to improve matching. In the case of a single helix adjacent a ground plane, tuning may be effected by varying the displacement of the helix from, or its inclination to, the ground plane. To increase the frequency range of the aerial a variation of diameter and/or pitch of the turns with length may be employed. The aerial may be made from a collapsible spring or may be formed of metallized plastic tube cut into a helix. The Specification also refers to known linearly polarized helical aerial systems comprising two parallel spaced contrawound helices. Fig. 2 (not shown), or two collinear contrawound helices, Fig. 3 (not shown).

**Inventors**

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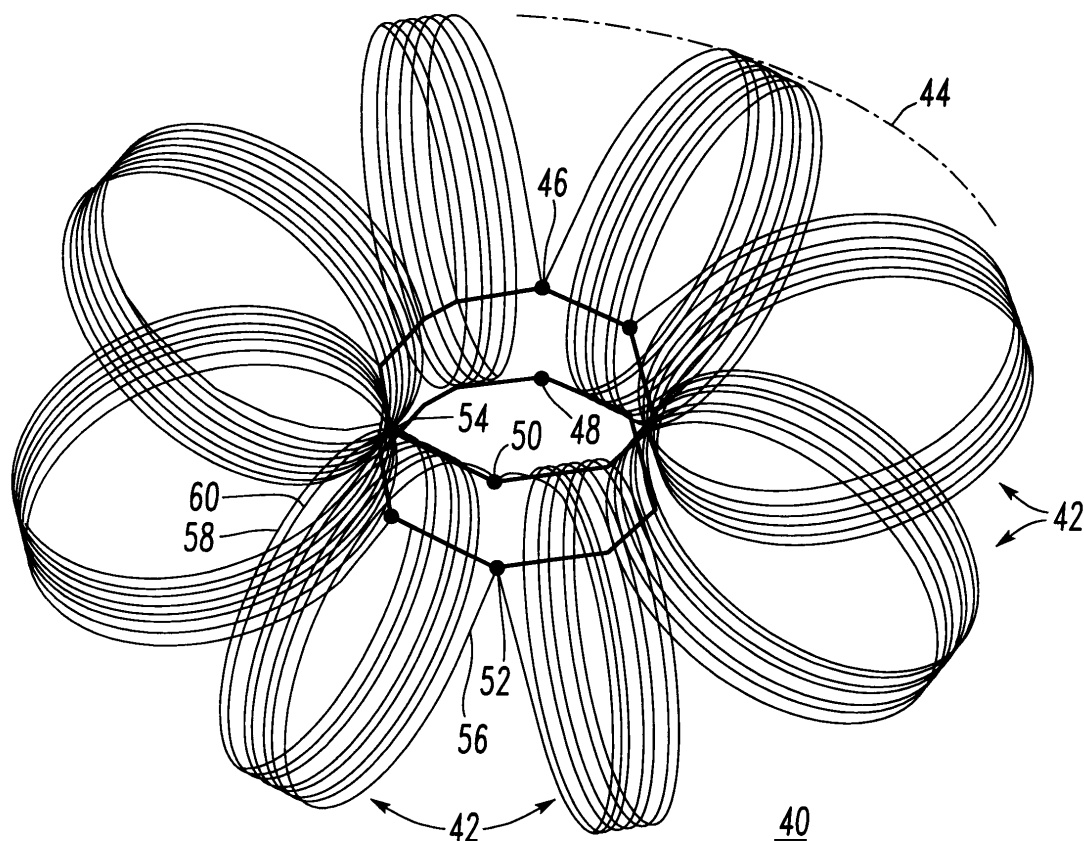
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**Title**

(WO200215328)

Electromagnetic antenna

**Images**



#### Publication data including kind & date

|                            |    |            |             |
|----------------------------|----|------------|-------------|
| <a href="#">US6300920</a>  | B1 | 2001-10-09 | US6300920   |
| <a href="#">WO02/15328</a> | A1 | 2002-02-21 | WO200215328 |
| <a href="#">AU8121001</a>  | A  | 2002-02-25 | AU200181210 |



#### Abstract

(WO200215328)

An electromagnetic antenna (40) includes a multiply connected surface, such as a toroidal surface (44); a first conductive loop (46) proximate to the toroidal surface (44); a second conductive loop (48) proximate to the toroidal surface (44); first and second signal carrying terminals (50, 52) electrically or magnetically connect to the first and second conductive loops (46, 48), respectively; and a plurality of conductive transceiver elements, such as plural pairs of contrawound insulated conductor windings (42). Each pair of the contrawound insulated conductor windings (42) has a first end (54), a plurality of turns, and a second end (56), and extends around and at least partially about the toroidal surface (44). Each pair of these windings (42) is electrically connected to the first and second conductive loops (46, 48). The first end (54) of the windings (42) is electrically connected to one of the first and second conductive loops (46, 48), and the second end (56) of the windings (42) is electrically connected to the other of the first and second conductive loops (46, 48).

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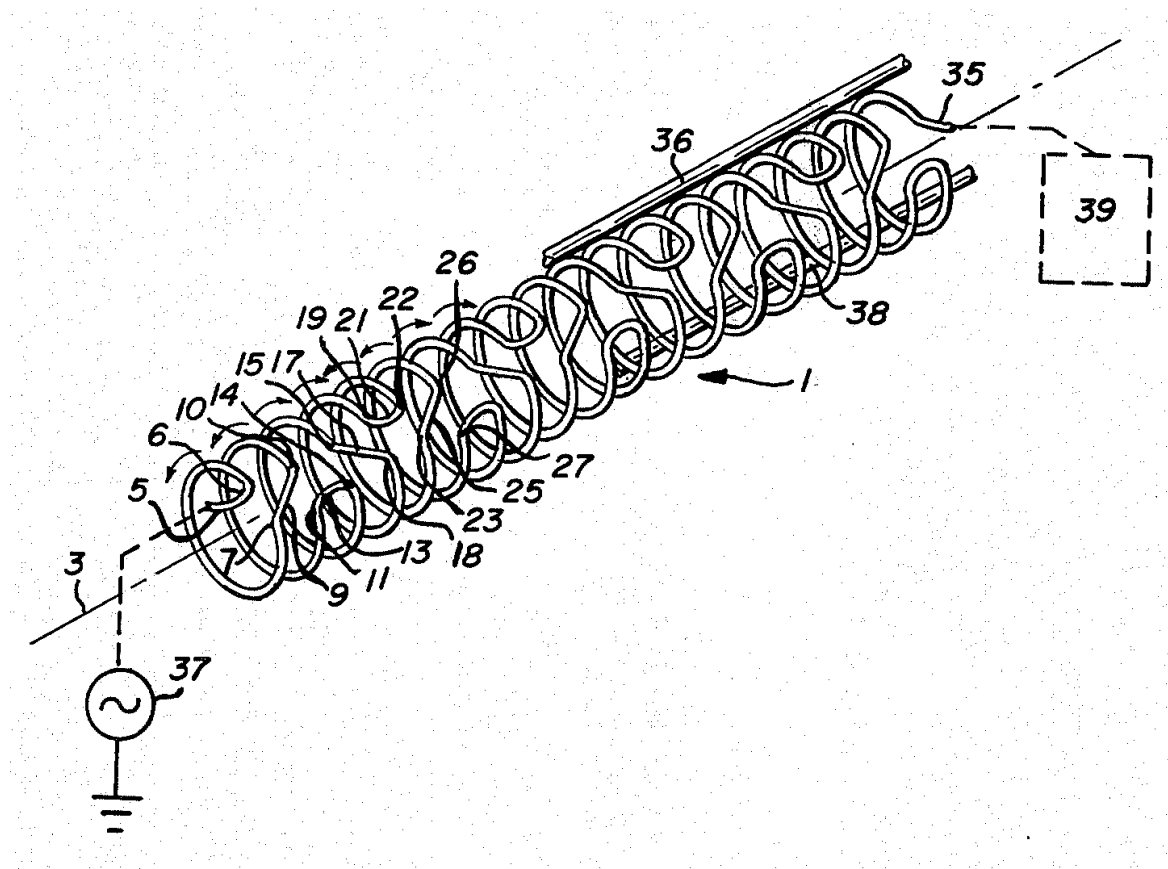
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#### Title

(US4004179)

Slow wave circuit having serially connected contrawound two-turn helices

## Images



### Publication data including kind & date

US4004179

A 1977-01-18 US4004179



## Abstract

(US4004179)

As part of a microwave frequency device, such as a traveling wave tube, a novel slow wave structure is presented which comprises an electrically conductive wire formed into a series of interconnected loops which are spaced apart and parallel along a common axis, with said loops being arranged in alternate and intermediate pairs, the ones of said loops in said alternate pairs extending clockwise about said common axis and with the ones of said loops in said intermediate pairs extending counterclockwise about said axis and interconnecting portions of said wires joining ends of adjacent loops together to define a series electrical path which progresses from one end of the wire to the other seriatim through all said loops.

## Inventors

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LITTON SYSTEMS