



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 184 935 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.03.2002 Bulletin 2002/10

(51) Int Cl.7: **H01Q 1/24, H01Q 1/44**

(21) Application number: **00118271.6**

(22) Date of filing: **04.09.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Yang, Hong-Doo
Kangseo-ku, Seoul 157-200 (KR)**

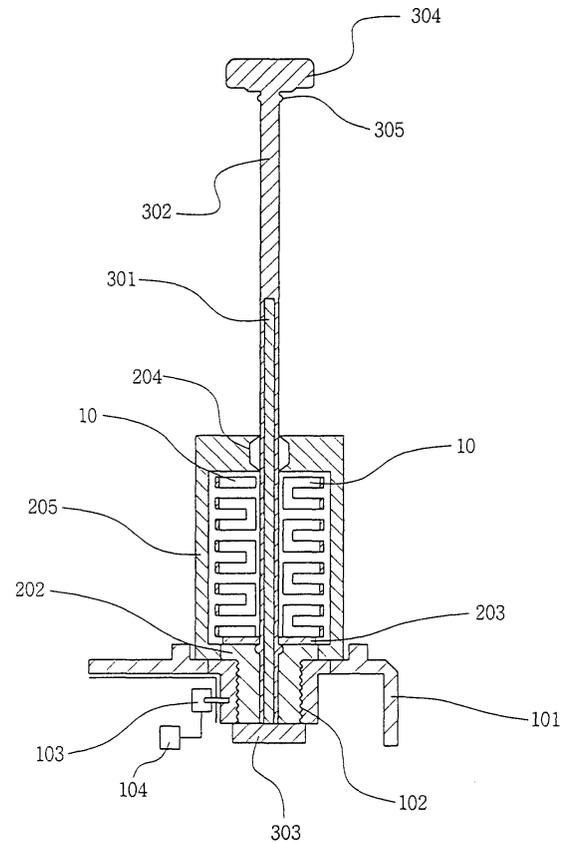
(74) Representative:
**Patentanwälte Ruff, Wilhelm, Beier, Dauster &
Partner
Postfach 10 40 36
70035 Stuttgart (DE)**

(71) Applicant: **Yang, Hong-Doo
Kangseo-ku, Seoul 157-200 (KR)**

(54) **Meander antenna for mobile telephone**

(57) The antenna assembly structure having a stage type antenna in a radiotelephone to improve a characteristic, productivity and assembling nature of an antenna comprises a rod antenna; a stage type antenna having a story structure gained by alternately connecting a plurality of stages having partially opened respective loop shapes in a confronted direction through a use of connective parts; and a stage type antenna cover having a central hole into which the rod antenna is extendable upwards from an instrumental main body and having an internal space for accepting the stage type antenna, the stage type antenna cover being combinedly fixed to the instrumental main body.

FIG. 4



EP 1 184 935 A1

DescriptionBACKGROUND OF THE INVENTION5 Field of the Invention

[0001] The present invention relates to a radiotelephone, and more particularly, to an antenna assembly structure of a radiotelephone with an improved structure.

10 Discussion of Related Art

[0002] In general, a radiotelephone such as a handheld telephone, a portable telephone, a PCS telephone or a cellular telephone, etc. is being widely spread as a personal mobile communication unit. People living in rather various life patterns and busy social life according to an advanced and civilized society utilize the radiotelephone more frequently with more time to execute a mobile telephone conversation or a data communication in radio with their desired parties.

[0003] In such radiotelephone, an antenna part such as an antenna assembly body etc. is the device having charge of a very important function in performing a bilateral communication. The antenna part is designed to receive an electric signal supplied from an electronic circuit block such as a control circuit etc. to effectively radiate radio wave on the basis of a determined characteristic in a determined direction, in performing a transmission, and is also designed so as to receive in optimum radio wave required among radio wave flowing in from a space in performing a receipt.

[0004] The antenna assembly body of the radiotelephone is typically formed by a combinational structure of a rod antenna and a helical antenna. The helical antenna is generally installed in the inside of an antenna cover projected from an upper part of the radiotelephone main body, and the rod antenna is set to be extended upwards through an inner diameter of the helical antenna in the instrumental main body or to be retracted inside the instrumental main body. The helical antenna has an aperture diameter gapped by a constant distance centering on the rod antenna and is formed as a helical line wound by the given number.

[0005] In case the rod antenna is retracted into the instrumental main body, the rod antenna is electrically isolated from the helical antenna, which is generally named a stand-by mode. While, in case the rod antenna is extended from the instrumental main body, the rod antenna is electrically connected with the helical antenna, which is generally named a conversation mode. An antenna assembly body gained by a combination of the rod and helical antennas is provided to transmit and receive linear polarization signals respectively appropriate to the conversation and stand-by modes.

[0006] In the antenna assembly body, the conventional helical antenna is generally manufactured by an insert molding method, that is, it is obtained by inserting a helical spring into a mold based on a constant shape and injecting molding material to be provided as an antenna cover into the inside of an injection aperture of the mold, thereby in one body shape. In such insert molding method, a molding pressure within the mold becomes very large, which may cause some change from a designed size of the helical spring. In other words, the helical spring inserted then bound with the molding material may be changed in the interior and exterior aperture diameters or in a pitch thereof. In this case, a frequency deviation in the transmission and receipt becomes serious even in the same product group, thus an inferiority rate is increased in calibrating a finished product. Further, the manufacture of the helical antenna by the insert molding method causes a manufacturing cost to be heightened and a manufacturing time to be comparatively lengthened. Therefore, an improved technique to settle such problems in this field is required essentially.

[0007] It is also needed that antenna characteristics in the conventional helical antenna, for example, a gain, a radiation pattern relating to a directivity, a polarization characteristic and an antenna efficiency, are wholly improved.

SUMMARY OF THE INVENTION

[0008] It is, therefore, a primary object of the present invention to provide an antenna assembly structure of a radiotelephone capable of settling the conventional problems mentioned above.

[0009] Another object of the present invention is to provide an antenna assembly structure of a radiotelephone capable of improving an antenna characteristic, productivity and assembling nature.

[0010] A still another object of the present invention is to provide an improved antenna structure employing a stage type antenna instead of a helical antenna.

[0011] A further object of the invention is to provide an antenna assembly structure of a portable radiotelephone and its perfume diffusing method, in which an attachment or detachment thereof, or its exchange is free without influencing upon a small-sized instrument formation or a conversation over the telephone.

[0012] To achieve the above objects and advantages, in accordance with one aspect of the present invention, an

antenna assembly structure of a radiotelephone comprises a rod antenna; a stage type antenna based on a story structure gained by alternately connecting a plurality of stages having partially opened respective loop shapes in a confronted direction through a use of connective parts; and a stage type antenna cover having a central hole into which the rod antenna is extendable upwards from an instrumental main body and having an internal space for accepting the stage type antenna, the stage type antenna cover being combinedly fixed to the instrumental main body. Preferably, this antenna assembly structure of the radiotelephone may further comprise a perfume accepting part which includes an internal space wrapping around the exterior of the stage type antenna cover and having perfume therein, and which also includes a perfume diffusing aperture. Herewith, a fixing connection part is set to fixedly connect a lower part of the perfume accepting part to the instrumental main body so that the perfume accepting part is combinedly fixed to the instrumental main body. A knob of the rod antenna is provided to open and close the perfume diffusing aperture of the perfume accepting part through an extension or retraction of the rod antenna.

[0013] In accordance with the present invention, a method for manufacturing a stage type antenna of an antenna assembly structure in a radiotelephone comprises the steps of patterning a conductive metal plate into a size determined; forming a stage type antenna by transferring and gradually bending the metal plate patterned so that partially opened individual loop shapes may become a plurality of stages which are alternately connected in a confronted direction to get a stories-type structure; and cutting repeatedly the formed stage type antenna into a constant length unit. Herewith, it is preferable that material of the stage type antenna is a conductive metal plate such as copper etc. for mass production and a patterning of a stage shape is executed by a mechanical cutting method through a use of a press etc.

[0014] The antenna assembly body with such construction has advantages of improving a producing and assembling nature without causing a drop of an antenna characteristic. In equipping a perfume accepting part additionally, desired perfume based on a solid, liquid or gas state can be diffused outside in an optimum state with a free attachment and detachment, or a free exchange of the assembly body, without influencing upon a small-sized instrumental construction or a conversation over the telephone.

BRIEF DESCRIPTION OF THE ATTACHED DRAWING

[0015] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

- Fig. 1 is a solid view of a stage type antenna in accordance with the preferred embodiment of the present invention;
- Fig. 2 presents a development view for the stage type antenna of Fig. 1;
- Fig. 3 depicts plane and front views for the stage type antenna of Fig. 1;
- Fig. 4 illustrates a sectional view showing an antenna assembly structure in which the stage type antenna of Fig. 1 is employed in a conventional radiotelephone; and
- Fig. 5 sets forth a sectional view showing an antenna assembly structure in which the stage type antenna of Fig. 1 is employed in a radiotelephone having a perfume diffusion function.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0016] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. The same or similar parts herein have the same or similar reference numbers as possible, for the sake of a descriptive and understanding convenience.

[0017] Fig. 1 is a solid view of a stage type antenna in accordance with the preferred embodiment of the present invention. In accordance with the present invention it is shown in Fig. 1 a stage type antenna 10 having a stage structure, namely, a story structure, which is entirely different from a structure of a conventional helical antenna. Herewith, it will be noted with a special attention that the term as a "stage type antenna" is definitely discriminated from the helical antenna having a conventional spiral structure, that is, the stage type antenna is realized by alternately connecting a plurality of stages respectively having a partially opened ring or loop shape in a confronted direction through a use of connective parts and also respective turns of the stages are provided horizontally so as to gain a parallel structure among adjacent stages, escaping from the helical structure having a lead. In Fig. 1, a reference number 4 or 5 indicates the connective parts. One individual stage has an opened mostly-circle shape formed in parallel and includes a first edge part 2 or 3 as a starting edge part of the opened curve line and a second edge part as an end edge part of the opened curve line. The first edge part is gapped from the second edge part by a given gap G shown in the drawing. A first edge part 6 or 7 of an upper stage adjacent to and gapped by a distance T2 from the above stage is connected to the second edge part confronted with the first edge part 2,3 through the connective part 4 or 5, wherein the connective

part alternately connects the plurality of stages with one another in a confronted direction.

[0018] Fig. 2 presents a spread view for the stage type antenna of Fig. 1, as a development view, which becomes a source plate for a manufacture of an antenna. In the drawing, a reference character L indicates a size of deciding an aperture diameter of the stage type antenna 10. As an example, in a general PCS telephone using a frequency band from about 1.2GHz to about 1.9GHz, the size L becomes about 8.32mm. In this case, an internal aperture diameter may be about 2.65mm and its thickness can be 0.3mm, and an outer aperture diameter may be about 3.25mm. T3 and T2 may be 0.7mm individually.

[0019] Meanwhile, in a cellular telephone using lower frequency, for example, 800MHz~900MHz, than that of the PCS telephone, the size L becomes 17mm. In this case, the internal aperture diameter may be about 5.4mm, the thickness can be 0.3mm, and the outer aperture diameter may be about 6.0mm. T3 and T2 may be 0.5mm individually, commonly.

[0020] A pattern of Fig. 2 is gained by using, as raw material, metal material satisfied in an electric conduction extent, for example, a metal plate containing a copper component, then patterning it by a determined size through a mechanical cutting process method such as by a press etc. to thus get the patterns at mass production. It will be remarkable that the patterned metal plate shown in Fig. 2 is transferred and gradually bent by using a jig having a circular shape thereby the stage type antenna 10 of Fig. 1 is manufactured. This bending process is the plastic working gained by an excess of a plasticity limitation for the metal plate, and in this working, it is formed a story structure in which the plurality of stages individually having a partially opened loop shape are alternately connected one another in a confronted direction. Preferably, a patterning working and a bending working are executed in a consecutive process, then in a final completion procedure, it is cut by a unit of a constant length in order.

[0021] Therefore, if two stages can be called one unit stage part, the unit stage part includes a first loop part 2 horizontally formed as an opened curve line of a circular shape and composed of a first edge part as a starting edge part of the opened curve line and a second edge part as an end edge part of the opened curve line; a second loop part 6 set horizontally, the second loop part 6 actually having the same shape as the first loop part; and a connective part 4 for connecting the second edge part of the first loop part and a first edge part of the second loop part each other, vertically against the horizontal formation of the stages.

[0022] Fig. 3 depicts plane and front views for the stage type antenna of Fig. 1, and the plane view is shown in an upper part of the drawing and the front view is shown in a lower part of the drawing. In Fig. 3, in which a reference number D1 indicates an internal diameter of the stage type antenna and a reference number D2 represents an outer diameter thereof. A reference character G provides a gap equal to the reference character G shown in Fig. 1, and becomes about 0.3mm in a case of the cellular telephone. This shape has a characteristic of a nondirectional antenna in which horizontal and vertical radiation patterns can be transmitted and received simultaneously.

[0023] In modes represented according to a type of radiation patterns in the antenna 10 of Fig. 1, it can be recognized through several kinds of test waveform that a normal mode performing a radiation in a vertical direction against an axis direction and an axis mode having a directivity to an axis direction do not fall behind the conventional helical antenna, in their function. In a telephone for a mobile communication, a radiation pattern has a doughnut shape centering around the antenna, and a normal mode which has a butterfly shape shown in a vertically sectional state and has a circle shape shown in a horizontally sectional state, is used. The antenna 10 has two electric field components having a phase difference of vertical and horizontal angles as above-mentioned, therefore, signals can be smoothly received thereto even though the telephone is positioned at any place.

[0024] It can be noted that the stage type antenna 10 was improved in part in its characteristic by testing a return loss, a VSWR and a Smith chart in comparison with the conventional helical antenna. The following table 1 represents a return loss and a VSWR provided in the cellular telephone.

[Table 1]

		Retraction of rod antenna (non-combination)	Extension of rod antenna (combination)	Remarks
Return loss	824M Hz	-11.733 (dB)	-15.464(dB)	Central frequency 859MHz
	849M Hz	-18.319 (dB)	-18.837(dB)	
	869M Hz	-19.302 (dB)	-25.941(dB)	
	894M Hz	-11.303(dB)	-18.551(dB)	
VSWR	824M Hz	1.405 (dB)	1.6933 (dB)	
	849M Hz	1.258 (dB)	1.2752 (dB)	
	869M Hz	1.106 (dB)	1.351 (dB)	
	894M Hz	1.268 (dB)	1.742 (dB)	

[0025] An antenna characteristic in the communication terminal decides a radiation pattern, a polarization characteristic and an antenna efficiency which are generally related to a gain and a directivity of an antenna. In this antenna 10, a bandwidth is increased in embodying a single band, and a low cost and a small-sized construction thereof can be realized, and it is also applicable to frequency of a cellular telephone, a GSM, a PCS and an IMT-2000 of base and top types, etc.

[0026] Like this, the stage pattern antenna provided in this embodiment of the invention is not manufactured by an insert molding method, that is, it can be settled such a problem caused in the conventional technique as a size change occurring due to an injection pressure, to thus lessen an inferiority rate. In this case, only an antenna cover may be manufactured by a general injection system. In addition, the vertical and horizontal polarization can be transmitted and received at the same time therein, and the nondirection, the utmost lightened-weight and the utmost small-sized construction can be realized to provide an advantage proper to a mass production automatic process.

[0027] The inventive stage type antenna structure and its manufacturing method were disclosed through the description of Figs. 1, 2 and 3 as the above.

[0028] It will be described as follows that the antenna assembly body is constructed by combining the inventive stage type antenna with the general rod antenna.

[0029] Fig. 4 is a sectional view showing an antenna assembly structure gained by employing the stage type antenna of Fig. 1 in the conventional radiotelephone. With reference to Fig. 4, reference numbers are represented as 10 for the inventive stage type antenna, 101 for a main body housing of the radiotelephone, 102 for a metal fitting, 103 for an antenna clip, 104 for a power supplying circuit, 202 for a first metal fitting, 203 for a second metal fitting, 204 for a snap-in recess, 205 for the stage type antenna cover, 301 for the rod antenna, 302 for a rod antenna cover, 303 for a metal stopper, 304 for a knob and 305 for a second snap-in projection part. The antenna cover 205 has a formation of a central hole in which the rod antenna 301 is extendable upwards from an instrumental main body 101. The antenna cover 205 is combinedly fixed to the instrumental main body 101 through the metal fitting 102,202.

[0030] Fig. 4 in the present invention has a similar structure to a drawing disclosed in U.S. Patent No. 5,764,191 granted on June 09, 1998. However, in the present invention there is a new characteristic by employing the noble stage type antenna definitely different from the helical antenna disclosed in this U.S. patent granted.

[0031] It can be constructed as shown in Fig. 5 a structure changed from the antenna assembly structure of Fig. 4, which is capable of diffusing outside desired perfume in optimum with its free attachment or detachment or exchange, without influencing upon a small-sized instrumental construction and a conversation over the telephone.

[0032] Fig. 5 is a sectional view showing an antenna assembly structure provided by employing the stage type antenna of Fig. 1 in the radiotelephone having a perfume diffusion function. Fig. 5 shows an internal space to accept the stage type antenna 10 gapped by a constant distance centering around the rod antenna 301. The metal fitting 202 is provided to completely fix a perfume accepting part 405 of the inventive embodiment to the main body 101. The perfume accepting part 405 includes an internal space wrapping around the exterior of the antenna cover and putting with perfume 500 and also includes a perfume diffusing aperture 404. The perfume accepting part 405 may be a receptacle made of ABS, PP, PC or polyurethane material, which is put with perfume into, and this perfume accepting part 405 may be manufactured by the injection molding method. The perfume accepting part 405 should be maintained in a sealing state in case liquid perfume is put therein, and a perfume diffusion controlling film 401 made of sponge or cotton can be installed in the internal space of the perfume accepting part 405 to prevent the perfume from being wasted excessively.

[0033] The perfume accepting part 405 is closely fixed to the instrumental main body 101 through a fixing force of

the metal fitting 202. The perfume accepting part 405 is exchangeable freely and is also free in its attachment and detachment by a screw combination. The knob 304 of the rod antenna 301 opens or closes the perfume diffusing aperture 404 of the perfume accepting part 405 according to an extension and retraction thereof. That is, perfume is diffused when a user extends the antenna upwards from the main body of the radiotelephone, and the perfume is not diffused when the antenna is retracted into the main body of the radiotelephone. According to that, perfume having desired fragrance can be diffused with an optimum quantity to the outside suitably.

[0034] The metal stopper 303 may be combined by screw with a screw unit of the rod antenna 301 so as to enable to pull the rod antenna from the perfume accepting part 405 to smoothly replace the receptacle with another when the perfume is used up, wherein the perfume may be one out of solid, liquid and gas state, and herewith it is desirable that the state of perfume is maintained as a gel state.

[0035] Though for the sake of a descriptive convenience in the above embodiment, a case for a base loading system was disclosed as one example, namely, though it was disclosed in the above description the case that the antenna cover 205 is combinedly fixed to the instrumental main body 101 even under an extension of the rod antenna 301, it is also natural that a perfume diffusion function can be obtained by a partial exchange of the concerned structure even in a case of a top loading system that all of the rod antenna 301 and the stage type antenna cover 205 are extended upwards from the instrumental main body 101. There is herein a further advantage of protecting the human body from harmful electromagnetic wave during a telephone conversation when paint for the electromagnetic wave shielding is coated on the surface of the rod antenna cover 302 or the stage type antenna cover 205.

[0036] As afore-mentioned, in the antenna assembly structure of the present invention, characteristic, productivity and assembling nature of an antenna are improved and an inferiority rate is reduced, to thereby gain an effect of curtailing a manufacture cost of a radiotelephone and diffusing desired perfume to the outside in optimum with its free attachment or detachment or exchange, without influencing upon a small-sized instrumental construction and a conversation over the telephone.

[0037] Although the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims. It is, of course, available to variously change an externally visual shape or material of an inventive stage type antenna as an example.

Claims

1. An antenna assembly structure in a radiotelephone, comprising:

- a rod antenna (301);

characterized by

- a stage type antenna (10) having a story structure gained by alternately connecting a plurality of stages having partially opened respective loop shapes in a confronted direction through a use of connective parts; and
- a stage type antenna cover (205) having a central hole into which the rod antenna is extendable upwards from an instrumental main body (101) and having an internal space for accepting the stage type antenna, said stage type antenna cover being combinedly fixed to the instrumental main body.

2. The antenna assembly structure of claim 1, wherein the stages adjacent to one another have a mutually parallel structure, and one individual stage has a mostly circular shape based on a parallel opened curve line and is composed of a first edge part as a starting edge part of the opened curve line and a second edge part as an end edge part of the opened curve line, said first edge part of the stage provided in an upper part thereof being alternately connected to the second edge part of the stage provided in a lower part thereof through a use of the connective parts.

3. The antenna assembly structure of claim 1 or 2, further comprising a perfume accepting part (405) which has an internal space wrapping around the exterior of the stage type antenna cover and put with perfume and has a perfume diffusing aperture.

4. A structure of an antenna as a partial construction of an antenna assembly body in a radiotelephone, **characterized by** comprising a plurality of unit stage parts, wherein said unit stage part includes:

- a first loop part (2) horizontally formed as an opened curve line of a circular shape and composed of a first

EP 1 184 935 A1

edge part as a starting edge part of the opened curve line and a second edge part as an end edge part of the opened curve line;

- a second loop part (6) set horizontally, said second loop part actually having the same shape as the first loop part; and
- a connective part (4) for connecting the second edge part of the first loop part and a first edge part of the second loop part each other, vertically against the horizontal formation of the stages.

5. A method for manufacturing a stage type antenna applied to a radiotelephone, said method being **characterized by** the steps of:

- patterning continuously a conductive metal plate into a size determined;
- forming a stage type antenna by transferring and gradually bending the metal plate patterned so that partially opened individual loop shapes may be formed to obtain a plurality of stages alternately connected in a confronted direction to thus gain a stories structure thereof; and
- cutting repeatedly the formed stage type antenna into a constant length unit.

FIG. 1

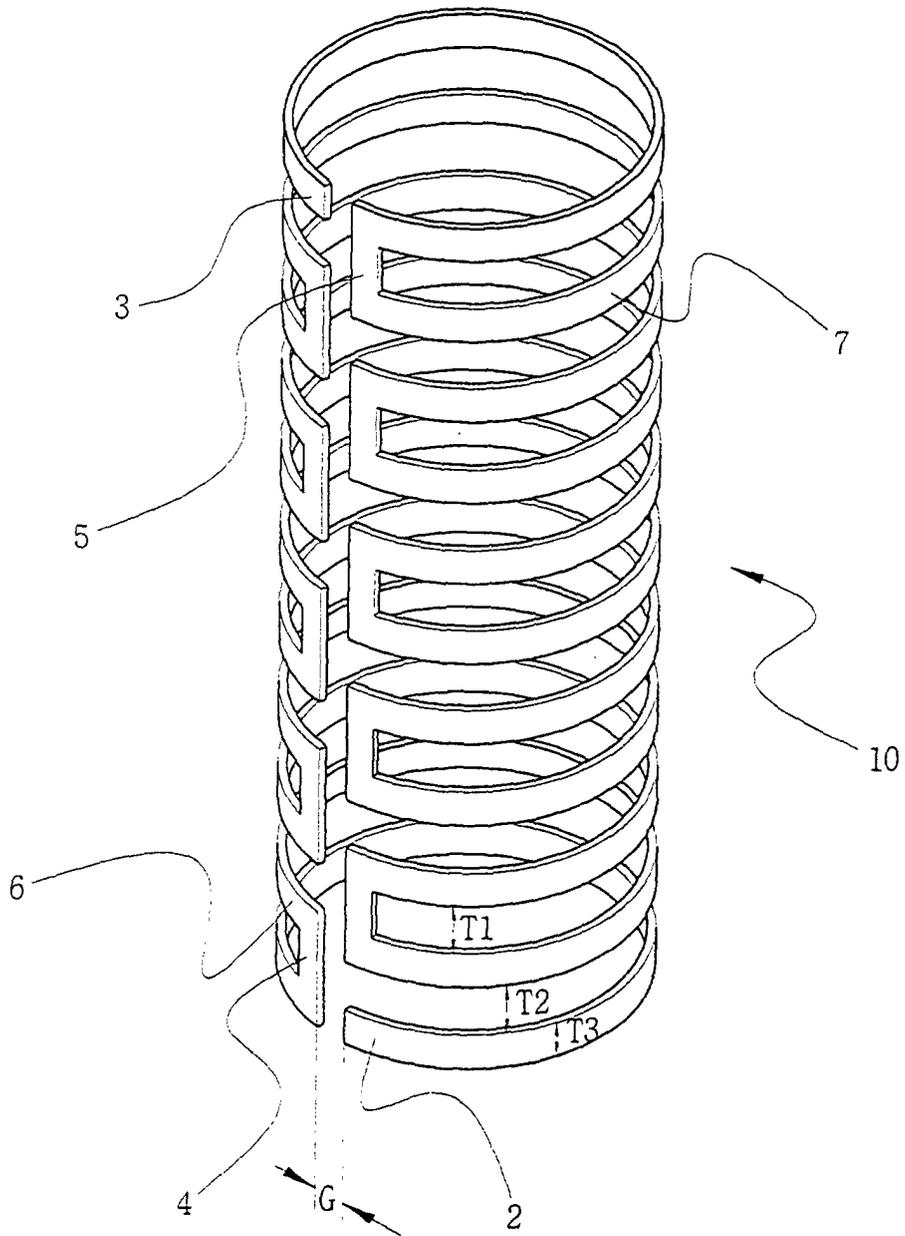


FIG. 2

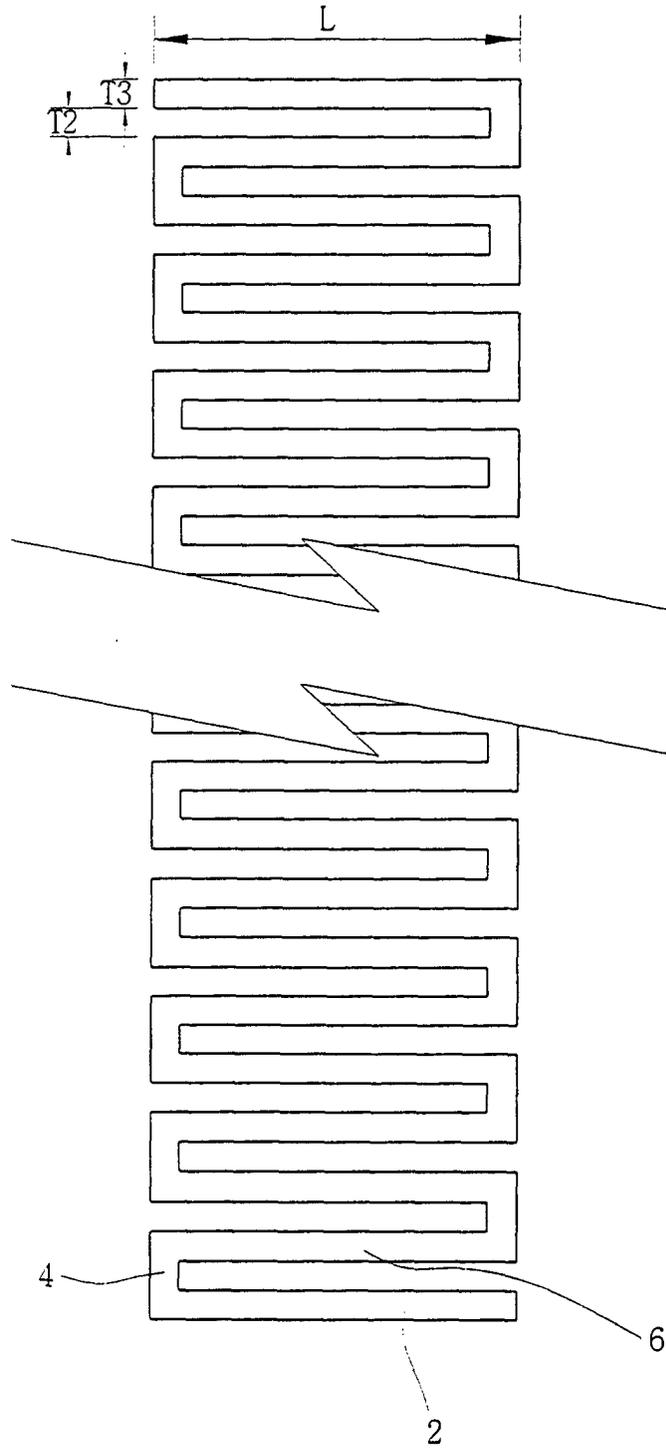


FIG.3

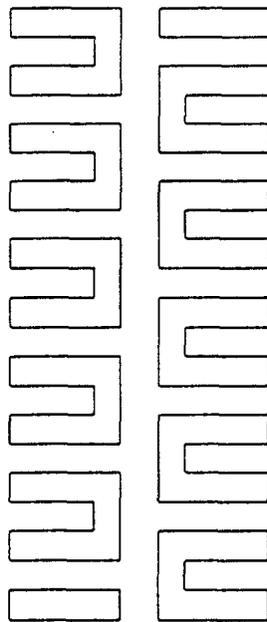
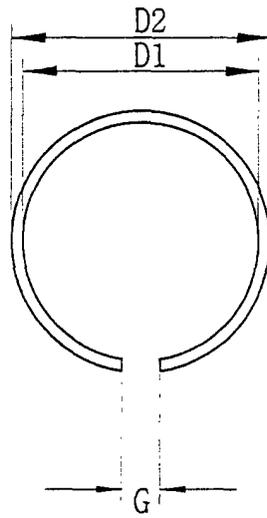


FIG. 4

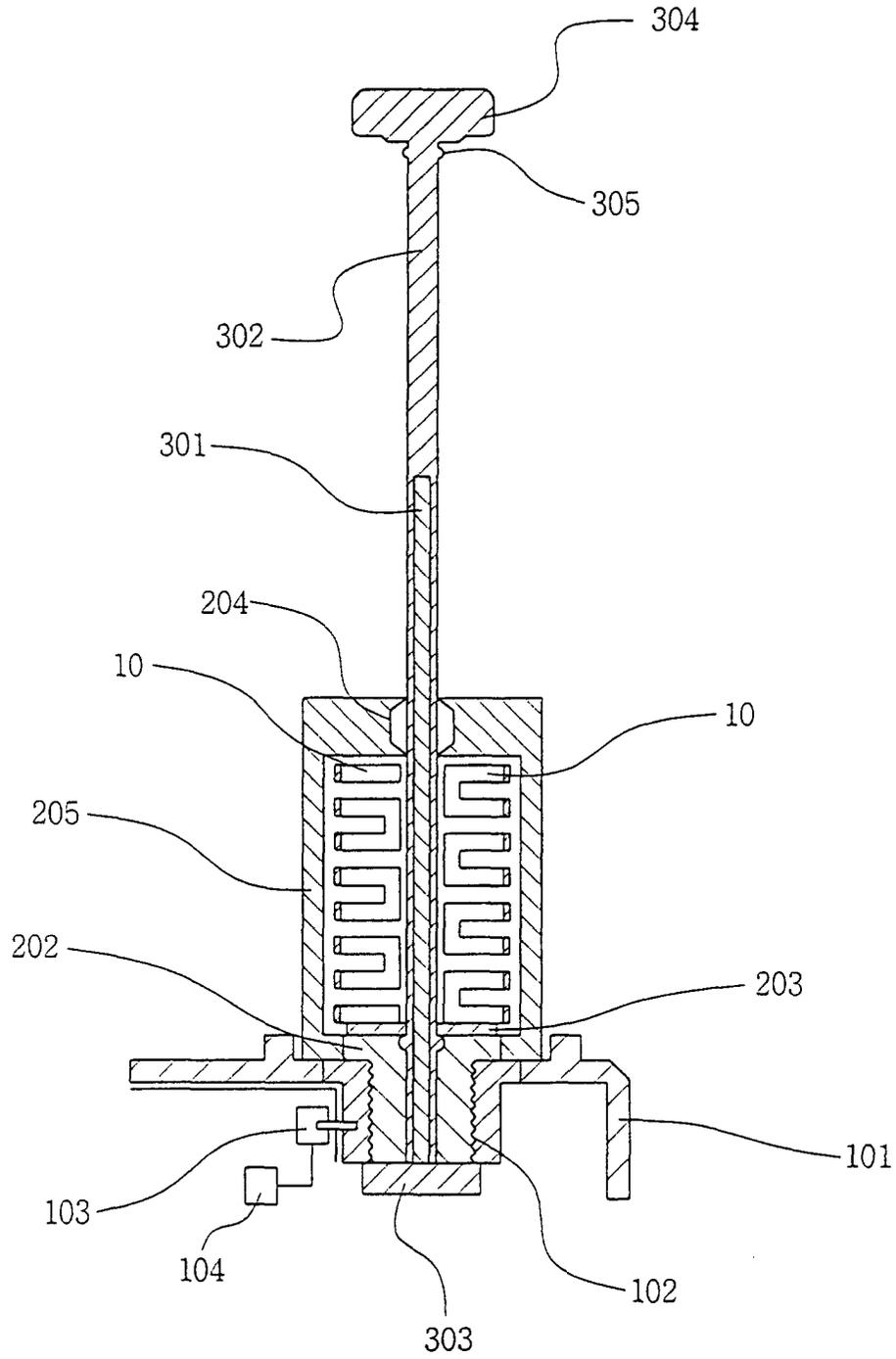
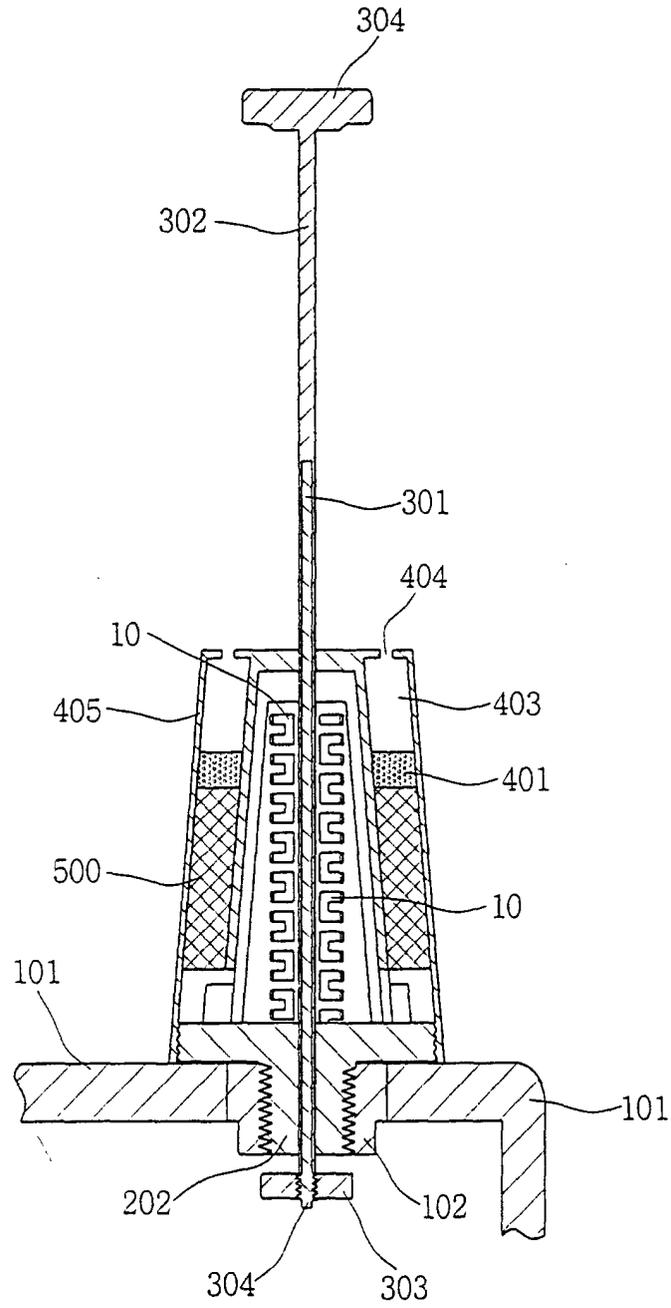


FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 8271

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 069 592 A (WASS B0) 30 May 2000 (2000-05-30)	1,2,4	H01Q1/24 H01Q1/44
Y	* column 3, line 14 - line 29 * * column 4, line 41 - line 67; claims 1,8-16; figures 1,2,4-10 *	5	
A	--- PATENT ABSTRACTS OF JAPAN vol. 1995, no. 08, 29 September 1995 (1995-09-29) & JP 07 115561 A (MINORU UCHIUMI), 2 May 1995 (1995-05-02) * abstract *	3	
Y	--- EP 0 843 377 A (SIEMENS AG) 20 May 1998 (1998-05-20) * page 2, right-hand column, line 6 - line 16; claims 1,2; figure 1 *	5	
A	--- US 5 446 469 A (MAKINO MITSUYA) 29 August 1995 (1995-08-29) * column 2, line 32 - line 50; figure 1 *	1	
A	--- GB 2 292 271 A (HUNG CHIN KUO) 14 February 1996 (1996-02-14) * page 3, line 6 - line 15 *	3	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H01Q
A	--- US 3 969 730 A (FUCHSER TROY D) 13 July 1976 (1976-07-13) * column 2, line 46 - line 60; figure 2 *	5	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 January 2001	Examiner Moumen, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 8271

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-01-2001

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6069592	A	30-05-2000	SE 509638 C	15-02-1999
			AU 3280897 A	07-01-1998
			EP 0904611 A	31-03-1999
			SE 9602387 A	16-12-1997
			WO 9749141 A	24-12-1997

JP 07115561	A	02-05-1995	NONE	

EP 0843377	A	20-05-1998	DE 29620127 U	20-03-1997
			JP 10163725 A	19-06-1998

US 5446469	A	29-08-1995	JP 6216630 A	05-08-1994

GB 2292271	A	14-02-1996	NONE	

US 3969730	A	13-07-1976	NONE	
