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(54) Multiple aerial for metal detector.

(57) An antenna for metal detectors utilizable as a transmitter and/or receiver comprising multiple cylindrical supports (6,7,8) in insulating material each of which supports a winding (1,2,3) formed by a set of coils substantially in the form of a parallelogram of helicoid or flat extension, positioned concentrically or otherwise and connected in an adequate way to excitation and/or detection means for the generation of magnetic fields and/or the detection of their variations. The system of multiple cylindrical supports with the respective sets of coils is housed inside a tubular insulating support (5) suitable to protect the windings from possible external stress of mechanical nature.

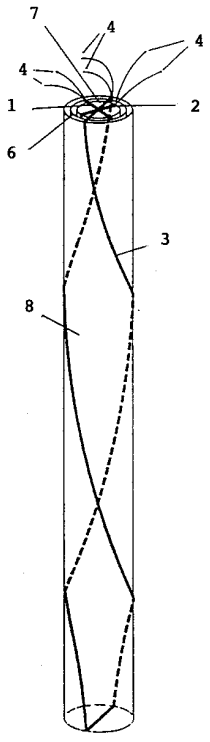

fig. 3

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The present invention relates to a multiple type antenna for metal detectors.

More precisely, the invention relates to a column type antenna which can be used both as a transmitter and a receiver in a device for detecting the movement of metal objects, such as fire-arms, through passageways of guarded places (banks, jewelry stores, airports and the like).

The transmission and reception antennas of currently available detectors are basically of two types. The first is a two-dimensional, rectangular form with coils which alternate to produce discordant magnetic polarities in order to attenuate the effects induced by external parasitic fields, with a reduction of the disturbances originating from a certain preferential direction.

The second type is a cylindrical form with coils which constitute a helicoid winding so that they originate discordant magnetic polarities in order to attenuate disturbances coming from any direction.

In both types of detectors an electric screen is provided for composed of a winding which follows the coils with its beginning connected to ground and its end left free; this is done to reduce the parasitic effects introduced by possible electrostatic effects.

In both solutions the alternation of the magnetic polarities in the windings make it so that the external parasitic electromagnetic fields have alternatively discordant induced effects and can therefore be attenuated. Furthermore, in both solutions, along the generatrices of the flat and cylindrical antennas, the electromagnetic field irradiated by the transducer, used as a transmitter, changes intensity reaching minimum values in correspondence with the inversion of the magnetic polarity.

In those areas of minimum irradiation, improperly called "magnetic holes", the intensity of the electromagnetic field is so low that it induces, in a hypothetical metallic object crossing such an area, induced currents that are too weak to produce secondary inertial effects in the receiving transducer sufficient to produce an alarm. In other words, a metallic object, and naturally a weapon, can pass through these areas without being detected.

While in the two-dimensional rectangular solution with flat coils the point in which the intensity of the electromagnetic field is too weak is well-defined by the geometry of the winding, in the solution of cylindrical form, with coils constituting a helicoid winding, that minimum field point can be translated along the generatrices of the support, rotating the antenna around the axis of the cylinder that supports the winding.

In both of the antenna solutions, the structure of the windings is such that there is a well-defined lobe of radiation; in practice, it is not possible to eliminate the areas of minimum electromagnetic field irradiated from the transducer, used as a transmitter, or those areas in which moving metallic objects produce, in the transducer used as a receiver, secondary inertial effects that are negligible with respect to other points, nor is it possible to considerably reduce the secondary inertial effects deriving from external parasitic fields.

The main object of the present invention is to provide a multiple type antenna for metal detectors allowing for the obviation of the above-described inconveniences being able, through the reciprocal movement of individual windings, to vary the lobe of radiation.

A particular object of the present invention is to provide an antenna of the above-mentioned type realized in the form of a column along the generatrices of which, when the transducer is used as a transmitter, no point exists wherein the electromagnetic field has a null or negligible intensity with respect to the other points.

A further object of the present invention is to provide an antenna of the above-mentioned type which has characteristics versatile enough to allow both for the optimization of its operation in any installation eliminating those areas wherein, when the transducer is used as a receiver, moving metal objects produce negligible secondary inertial effects and for the reduction of the secondary inertial effects produced by electromagnetic disturbances extraneous to the system.

These objects are accomplished by the antenna for metal detectors according to the present invention, comprising multiple column supports formed in insulating material each of which supports a winding formed by coils of helicoid or flat extension with a distribution of coils that can be greater towards the extremities of the support, and connected to exciting and/or detecting means for the generation of electromagnetic fields and the detection of the secondary inertial effects.

The supports, either cylindrical or of other forms, with which the antenna is realized can assume reciprocal positions that are concentric or not concentric, for instance flanked; furthermore each part of the antenna, constituted by the individual cylindrical support along with the individual winding, can be rotated or translated with respect to the other partial antennas so as to compensate for the points in which the intensity of the electromagnetic field irradiated by the transducer, used as a transmitter, is too weak and to reduce to a minimum its capacity to intercept spurious parasitic disturbances, on the part of the transducer used as a receiver, which originate from a certain preferential direction; in this way the use of the transducers is considerably optimized.

Further characteristics and advantages of the multiple antenna for metal detectors according to the present invention will be made apparent in the description which follows of one of its possible embodiments, given as an example and not limitative, with reference to the attached drawings in which:

- figure 1 shows schematically three sets of helicoid or flat coils forming the windings for the antenna according to the present invention;
- figure 2 shows schematically the forms of the two types of supports respectively supporting the three sets of coils (6, 7 e 8) and the protection from external mechanical stress (5);
- figure 3 shows schematically an embodiment according to which the three individual antennas are positioned concentrically to one another where the cylindrical supports have the same length but different diameters;
- figure 4 shows schematically an embodiment according to which the three individual antennas are concentrically positioned but translated with respect to one another where the cylindrical supports have different lengths and diameters;
- figures 5 and 6 show other possible embodiments of the multiple antenna according to the present invention.

With reference to figure 1, numbers 1, 2 and 3 indicate three sets of coils connected to an electric power supply (not shown) by means of electric terminals 4. The three sets of coils can be helicoid or flat.

With the object of intensifying the electromagnetic field in correspondence with the extremities of the cylindrical support in order to obtain almost constant field values, two sets of auxiliary coils also of helicoid or flat form, indicated in figure 1 by 1a, 1b, 2a, 2b, 3a and 3b, are placed respectively on the upper and lower terminal portions of the coils 1, 2 and 3.

With reference to figure 2, numbers 6, 7 and 8 indicate the support posts of the three sets of coils and 5 indicates the support of mechanical protection of the multiple antenna; the various supports have a tubular form of not necessarily equal length and diameter and are made in insulating material so that they influence neither the spatial distribution of the electromagnetic field nor the energetic balance of the same variable field of a frequency suitable for the particular application.

Using the present invention as a transmitter, with reference to figures 3, 4, 5 and 6, the three windings 1, 2 and 3 can be individually rotated or vertically translated in order to avoid the minimums of the electromagnetic field that occur in correspondence with the inversion of polarity of each winding; this can be achieved in particular by making correspond for example, the maximum value of the electromagnetic field produced by the winding 2 in the area in which there is found the minimum value of the electromagnetic field, produced for example by the winding 3, and possibly reinforce a certain area for the interception particular applications by means of the remaining winding 1.

In this way, the intensity of the field is such that on the entire support 5 there is no point where moving metallic objects produce secondary inertial effects that are negligible with respect to the other points.

Using the invention as a receiver, with reference to figures 3, 4, 5 and 6, the three windings 1, 2 and 3 can be individually rotated or vertically translated so as to improve the ratio between the signal deriving from the secondary inertial effects caused by moving metallic objects and the background noise generated by the electronic components and the environment as well as to reduce to a minimum, consistently with the environmental conditions, the parasitic effects derived from external disturbances: this can be achieved in particular by rotating the winding 1 until completely eliminating the environmental disturbances coming from a particular direction and rotating the windings 2 and 3 to the point of obtaining the conditions of maximum value of the signal and therefore minimum value of the noise/signal ratio.

It is important to note that the multiple antenna according to the present invention, with respect to already known antennas, requires less excitation power and a smaller number of coils.

The multiple antenna according to the present invention, in its illustrated possible embodiments, concentric (figures 3 and 4) and flanked (figures 5 and 6), is enclosed in an external envelop or container 5, and the supports 6, 7 and 8 for the windings 1, 2 and 3 are mechanically connected to one another, in a way that is obvious to an expert in the field, so as to allow for their mutual translation and/or rotation.

Further variations and/or modifications can be brought to the multiple type antenna for metal detectors according to the present invention, without departing from the scope of the invention itself.

Claims

1. Antenna for metal detectors utilizable as a transmitter and/or receiver comprising a set of antennas, each realized with a column support (6,7,8) in insulating material, and a winding (1,2,3) formed by a set of coils having a helicoid or flat extension and connected to exiciting and/detecting means for the genera-

tion of electromagnetic fields and the detection of their variations in intensity, said antenna being characterized by the fact that the individual sets of coils supported by the respective cylindrical supports are placed in a concentric way or flanked inside a single container (5), said supports being suitable to be reciprocally rotated and/or translated among themselves.

2. Antenna according to claim 1, wherein the lobe of radiation is variable in order to adapt it to the particular application.

3. Antenna according to claim 1, wherein, when it is used as a transmitter, the component windings are suitable to be rotated or translated individually so that no point exists where the electromagnetic field has a null or negligible intensity with respect to the other points.

4. Antenna according to claim 1, wherein, when used as a receiver, the component windings are suitable to be rotated or translated individually in order to reduce the secondary inertial effects produced by electromagnetic disturbances extraneous to the system and to eliminate those areas wherein the moving metallic objects create secondary inertial effects that are negligible.

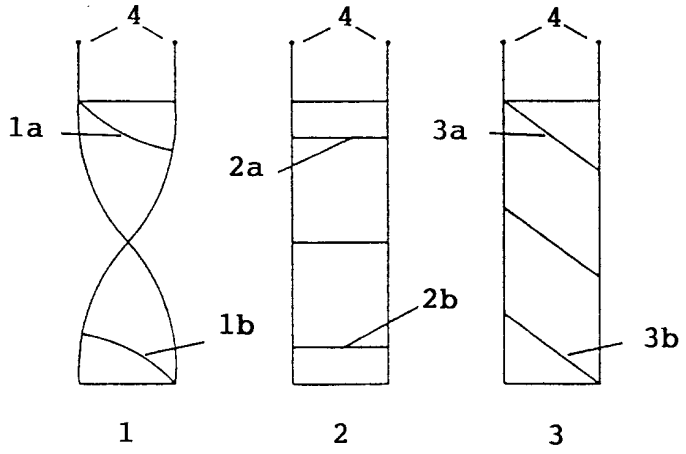

fig. 1

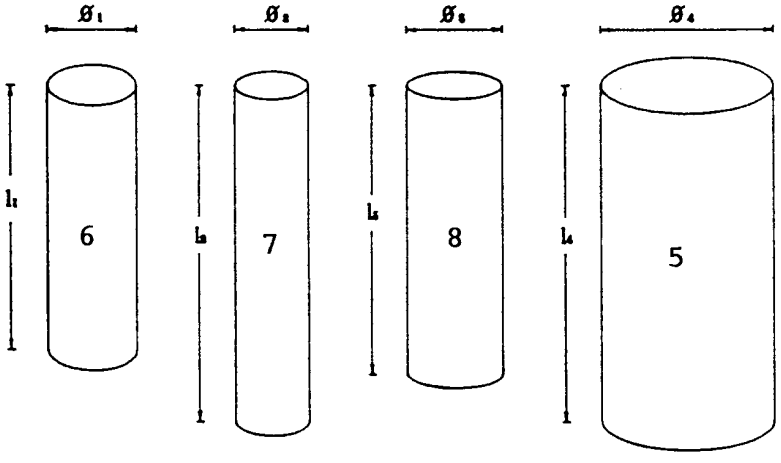

fig. 2

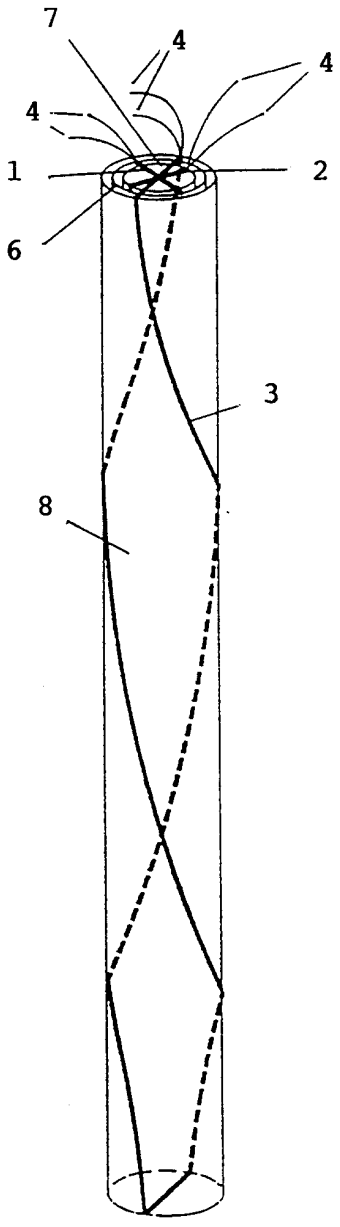

fig. 3

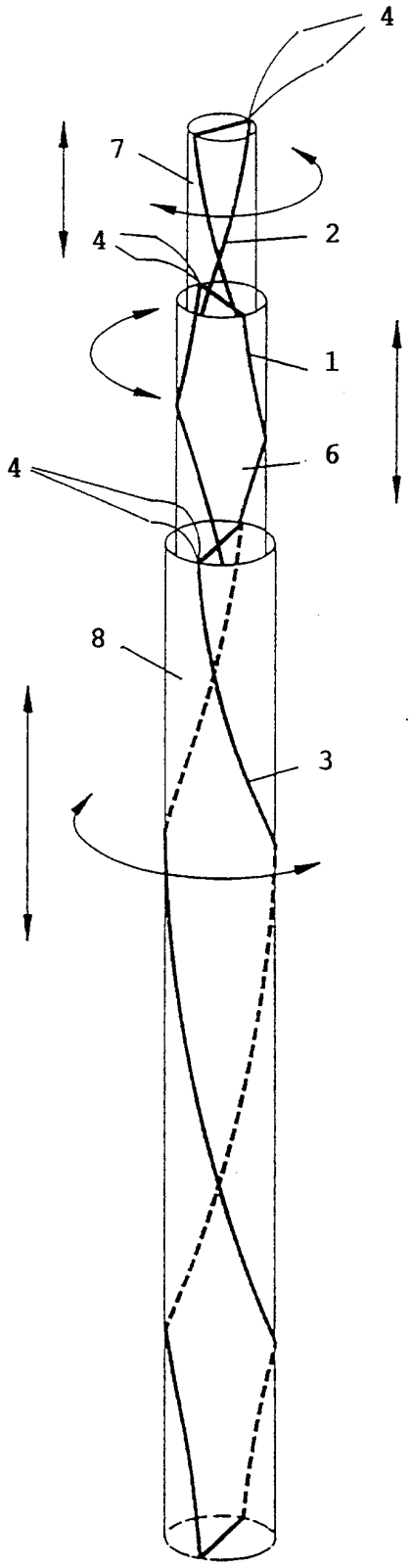

fig. 4

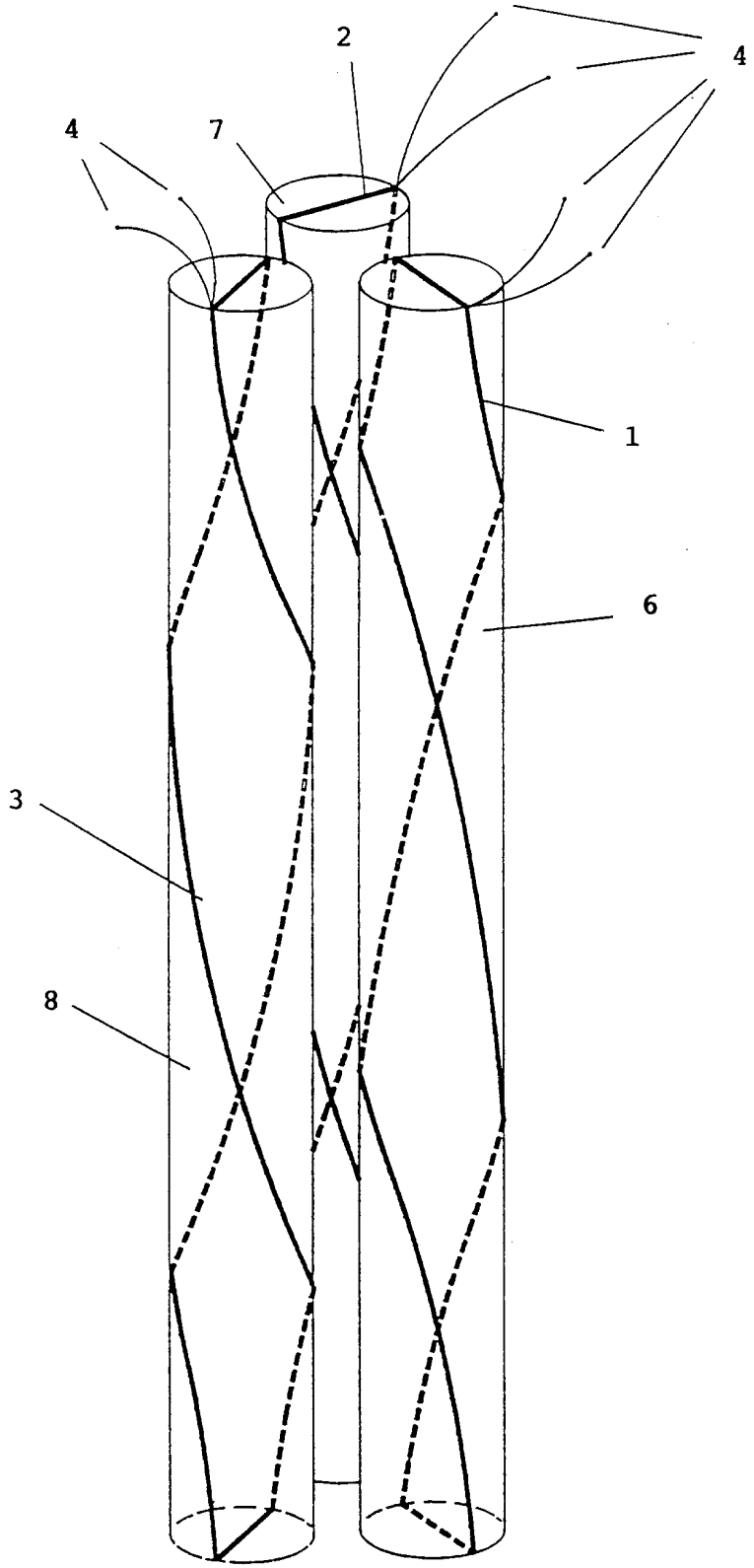

fig. 5

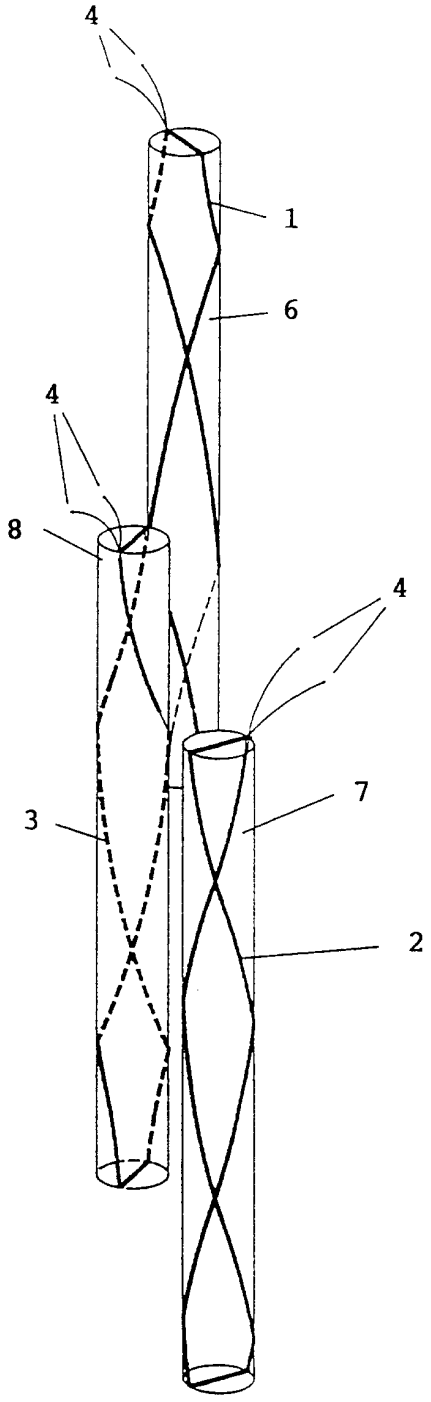

fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 10 2347

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.5)
A	FR-A-2 607 937 (MANNESCHI) * page 3, line 25 - line 32; figures 2-4 *	1	G01V3/10
A	DE-A-32 25 166 (GEBHARD BALLUFF FABRIK GMBH & CO.) * abstract; figure 2 * * page 8, line 1 - line 9 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

G01V
H01Q
G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	30 May 1994	Danielidis, S

CATEGORY OF CITED DOCUMENTS

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