Title: STORAGE STRUCTURE FOR FILING DOCUMENTS EQUIPPED WITH TRANSPONDERS

Abstract: A storage structure (1, 50, 100) comprising one or more shelves (2, 20) for filing a plurality of documents (D); at least one transponder (3) fitted to each of the documents (D) and monitoring means (4) comprising at least one unit (5) for receiving-transmitting radiofrequency signals from and to the transponders (3), connected to a plurality of antennas (6, 21, 51) positioned inside each shelf (2, 20), wherein the antennas (6, 21, 51) consist of substantially flat laminar bodies (7) spaced at a distance from each other and aligned according to a horizontal direction defined by each of the shelves (2, 20) to be inserted between the documents (D).
with amended claims and statement

For two-letter codes and other abbreviations, refer to the “Guidance Notes on Codes and Abbreviations” appearing at the beginning of each regular issue of the PCT Gazette.
Description of the Industrial Invention Patent entitled: "STORAGE STRUCTURE FOR FILING DOCUMENTS EQUIPPED WITH TRANSPONDERS".

In the name of Messrs. FRANCHIN Stefano – Via Baseggio, 139 – 30038 SPINEA (VE) and COCCHIGLIA Giorgio – Via Wagner, 6 – 35132 PADOVA (PD).

DESCRIPTION

This invention concerns a storage structure for filing documents equipped with transponders, suitable to allow rapid location and identification of the documents it contains.

Public organisations, offices and libraries are known to have the need to file and store a considerable quantity of documents that must be inventoried and easily made available to the user.

The filed documents can be books, folders, files or individual elements.

One of the known techniques for the semiautomatic filing and inventorying of documents foresees that each document inserted in the filing system is fitted with an electronic tag commonly called a transponder.

The transponder contains one or more identification parameters of the document to which it is applied and can transmit them, by means of a radiofrequency signal, to appropriate monitoring means.

In particular, the transponders monitoring means can be equipped with a mobile antenna which is moved towards each document contained in the storage structure in order to identify it, or in other cases it is the storage structure itself which is internally equipped with a plurality of antennas for the identification of the transponders.

Storage structures equipped with built-in antennas belonging to the background art essentially comprise a plurality of structures for storing items provided with transponders and means for monitoring the items consisting of a receiver-transmitter unit fitted to each of the storing structures.

Each storing structure is equipped with a pair of antennas, each substantially consisting of an insulating film coated with a layer of conductive material, which are fitted on the inner surface of the structure as shown in fig.1.

The antennas are connected to the receiver-transmitter unit to generate an electromagnetic field which is picked up by the transponder and provides it the necessary energy to transmit the data it contains to the receiver part of the
receiver-transmitter unit itself.
The data are then sent to a processor, operatively connected to each individual
receiver-transmitter unit, where they are processed and stored.
Every single item contained in the storage structure can thus be identified and
easily made available to the user.
A storage structure corresponding to the features mentioned above is
described in the Italian Patent application no. V100A000168, filed by the same
applicants as for this patent.
All the known semi-automatic storage structures of the type described above,
however, present a series of recognised drawbacks.
One recognised drawback of the semi-automatic storage systems, equipped
with antennas associated with each storing structure, consists of the fact that
the number of transponders that can be identified by each pair of antennas
associated with the individual storing structure cannot be too high, due to the
reciprocal interference that the transponders have on each other when their
density is excessive.
It is therefore evident that document filing, which necessarily involves a high
density of items inside each storage structure, makes the use of such systems
not very suitable for filing small-size documents and/or objects fitted with
transponders.
A recognised drawback, on the other hand, of structures equipped with mobile
antennas for the identification of documents is the difficulty of finding each
individual document quickly.
In this case, indeed, it is necessary to move the antenna close to the
documents stored on the shelves of the storage structures in order to identify
the document being searched for.
This invention intends to eliminate the drawbacks described above.
The first aim of the invention is to provide a storage structure suitable to
contain a high density of documents fitted with transponders in which each
individual document can be located and identified quickly and precisely.
Another aim is to provide a storage structure in which the effect of the
interference between the transponders fitted to the documents stored in the
structure is less than occurs in the known structures described above.
A further aim is to provide a storage structure which reduces the need for the
presence of an operator.
Yet another aim is that the structure according to the invention does not require mobile systems for interrogation of the transponders. These aims are achieved by means of a storage structure which, according to the main claim, comprises:

- one or more shelves for filing a plurality of documents;
- at least one transponder fitted to each of said documents;
- monitoring means comprising at least one unit for receiving/transmitting radiofrequency signals to said transponders, connected to a plurality of antennas internally mounted on each shelf,

and which is characterised in that said antennas consist of substantially flat laminar bodies arranged vertically and spaced at a distance from each other, these laminar bodies being aligned according to the horizontal direction defined by each of said shelves to be inserted between said documents.

Advantageously, the presence of a plurality of laminar antennas positioned between the documents makes it possible to dimension the structure according to the density of documents to be stored so as to limit the number of transponders located between two adjacent antennas and to avoid the interference that occurs in the known structures described above.

These aims and advantages will be clearer on reading the description of preferred embodiments of the invention, provided as non-binding examples with reference to the accompanying drawings in which:

- fig. 1 shows a semi-automatic structure belonging to the background art;
- fig. 2 shows an axonometric view of the structure according to the invention;
- fig. 3 shows a detail of the structure of fig. 2;
- fig. 4 shows an enlarged detail of the structure of fig. 2;
- fig. 5 shows a transponder fitted to a document contained in the structure of fig. 2;
- figures 6, 7 and 8 show further embodiments of the structure of fig. 2.

As can be seen in fig. 2, the structure according to the invention, indicated overall with 1, comprises:

- one or more shelves 2 for filing a plurality of documents D;
- at least one transponder 3 fitted to each of said documents D;
- monitoring means 4 comprising at least one unit 5 for receiving/transmitting radiofrequency signals to said transponders 3, connected to a plurality of
antennas 6 fitted inside each shelf 2.
According to the invention, the antennas 6 consist of substantially flat laminar bodies 7 arranged vertically and spaced at a distance from each other, said laminar bodies 7 being aligned according to the horizontal direction defined by each of the shelves 2 to be inserted between said documents D.
In the embodiment shown in the figure, the storage structure consists of a shelving, indicated overall with 8, which comprises a support structure 9 fitted with a plurality of horizontal shelves 2.
The back panel 10 of each shelf 2 is equipped with the antennas 6 positioned orthogonally to it, as can be seen in fig. 2, and connected, by means of electric cables 11, to the receiver-transmitter unit 5, which represents the unit suitable to emit and receive the signals exchanged between the antennas 6 and the transponders 3.
The transponders 3, fitted to each document D, are passive transponders, of the type known per se, and are enabled to transmit the information and data they contain to the receiver-transmitter unit 5 receiving the necessary energy from the electromagnetic field generated by the antennas 6.
The receiver-transmitter units 5 connected to the antennas 6 transmit the received data to a processor 12 which collects and files them, making them available to the user.
In other embodiments, the antennas can be fitted to the lower and/or upper surface of each shelf and also be placed parallel to the back panel of the storage structure.
In the embodiment shown in fig. 8, indicated overall with 50, the antennas 51 are fitted to the back panel 52 of the shelving 53 and positioned horizontally to allow documents to be filed in stacks, for example inside containers and/or drawers 54 of the type shown.
In another embodiment shown in fig. 6, the antennas are fitted to mobile containers 13 of the documents D which are equipped with transponders 3 positioned on the shelves 2 and connected to one or more receiver-transmitter units 5.
As regards the antennas 6 which transmit the radiofrequency signals to the transponders 3, these are of the active type consisting substantially of a radiating element 14, a tuner circuit 15 suitable to cause each antenna 6 to resound at the working frequency of the transponder 3, and a coupler circuit 16.
suitable to balance the line impedance.
The active antenna 6 is the source of emission of the electromagnetic field
necessary to enable the transponders 3 and, at the same time, is the element
which receives the reply signal.

All the active antennas 6 belonging to one or more shelves 2 are connected to
the receiver-transmitter unit 5, commonly called a transceiver, which comprises
a transmitter section suitable to send the signal to the transponders 3 and a
receiver section suitable to receive the signal from the transponders 3 and
send it to the described data processing means 12.

The storage structure 1 according to the invention can also be equipped with
passive antennas, alternated with the active antennas, which are not
connected to the receiver-transmitter units 5 and thus act exclusively as
resounding elements for the signal emitted by the active antennas 6.
The passive antennas comprise a radiating element similar to the one
previously described for the active antennas 6 and a tuner circuit suitable to
make it resound at the frequency of the transponders 3.

In the described embodiment, the tuner circuit 15 is a static tuner circuit;
however, in other embodiments of the invention this can also be a dynamic
tuner circuit, that is to say able to vary the antenna tuning to improve the
response of the various transponders.

It is obvious that the use of a certain number of passive antennas combined
with active ones leads to a reduction in the cost of the structure but limits the
precision of the document search.

Each radiating element 14 of the antennas 6 consists, as can be seen in fig. 4,
of a laminar body 7, preferably but not necessarily made of plastic material,
inside which is a conductor 17 which acts as the transmission and reception
element for the signal emitted/received by the antenna 6.

Between the receiver-transmitter unit 5 and the antennas 6 are means 18 for
selecting the antennas 6 which make it possible to modulate the signal
transmitted by the various antennas 6.

In particular, the electromagnetic signal can be emitted simultaneously by all
the antennas 6, or alternatively by each individual antenna 6 in succession, or
also by predefined groups of antennas 6.

It is thus possible to modulate the electromagnetic field to detect the
transponders 3 located in the most critical positions which, otherwise, would
not be reached by the signal. Moreover, by modulating the signal to the various antennas 6 as described above, it is possible to progressively refine the search to identify each document D inside the storage structure 1.

The search is made even more reliable by the presence of static or variable tuning means 19, positioned between the receiver-transmitter unit 5 and the antennas 6, which make it possible to vary the frequency of the signal emitted by the antennas 6 to allow enabling of the transponders 3 which, due to external or reciprocal interference, do not respond to their nominal frequency.

If variable tuning means 19 are used, these allow one or more not enabled antennas 6, which would otherwise act as passive antennas, to be made inert by completely detuning them, reducing the precision of locating the document D being searched for.

The selection means 18 and the tuning means 19 can be used as described, together or individually, to make the identification of each document D contained in the storage structure 1 easier.

Another embodiment of the storage structure according to the invention is shown in fig. 7 where it is indicated overall with 100. In this case, the storage structure 100 consists of an automatic structure, of the type known per se, equipped with a plurality of mobile shelves 20 which revolve as a closed ring on an essentially vertical plane.

The antennas 21 are fixed inside the storage structure casing 22, while the transponders 3 fitted to the individual documents D are enabled and exchange signals with the antennas 21 when the revolving mobile shelf 20 passes through said antennas 21.

It is obvious that in this case the number of antennas 21 installed in the storage structure 100 for the identification of the documents D will be lower thanks to the possibility of moving the shelves 20 and consequently of using the same antennas 21 to monitor several shelves 20.

Operatively, each document D is fitted with an electronic label 3 consisting of a passive transponder and the document is then inserted in one of the shelves 2 or 20 of the storage structure 1 or 100.

To find any document D present in the storage structure 1, 100 the operator enables the search procedure through the processing means 12, 23 which transmit a signal to the antennas by means of the transceiver units 5.
As described, the antennas 6, 20 can be enabled simultaneously, in succession and/or in groups to identify the required document D and to define its precise location inside the storage structure.

If the document D is not identified in this first stage, the presence of the tuning means 19 allows the antennas 6, 20 to emit a signal with a different frequency with respect to the nominal frequency, in order to identify the transponders 3 which, due for example to interference caused by other documents D, do not respond to the signal.

When the document D has been identified, the operator is informed and given the data relative to its position.

From the above description it is clear that the storage structure of the invention achieves all the preset aims.

In particular, it is achieved the aim of providing a storage structure suitable to contain a high density of documents fitted with transponders, in which it is possible to identify and locate each individual document quickly and precisely.

It is also achieved the aim of providing a storage structure in which the effect of reciprocal interference of the transponders fitted to each document is less than is found in the known storage structures.

Indeed, it is clear that the presence of a large quantity of antennas placed between filed documents makes it possible to reduce the number of transponders between two adjacent antennas and thus to avoid possible interference which prevents identification.

It is also achieved the aim of providing a storage structure that reduces the presence of an operator and does not require the use of mobile systems for transponders interrogation.

Modifications and variations not described and not shown can be made during production of the storage structure according to the invention.

Should these variations, not described and not mentioned, be within the scope of the claims that follow, they shall all be considered as protected by this patent.
CLAIMS

1) A storage structure (1, 50, 100) comprising:
   - one or more shelves (2, 20) on which a plurality of documents (D) can be
     filed and stored;
   - at least one transponder (3) fitted to each of said documents (D);
   - monitoring means (4) comprising at least one unit (5) for receiving and
     transmitting radiofrequency signals from and to said transponders (3),
     connected to a plurality of antennas (6, 21, 51) positioned internally to each
     shelf (2, 20),
   - characterised in that said antennas (6, 21, 51) consist of substantially flat
     laminar bodies (7) spaced at a distance from each other, said laminar bodies
     (7) being aligned according to a horizontal direction defined by each of said
     shelves (2, 20) to be inserted between said documents (D).

2) A storage structure (1, 50) according to claim 1) characterised in
   that said antennas (6, 51) are fitted to the back panel (10) of said shelves (2).

3) A storage structure according to claim 1) characterised in that said
   antennas are fitted to the surface of said horizontal shelves.

4) A storage structure (1, 50) according to claim 1) characterised in
   that said antennas (6, 51) are fitted to mobile containers (13, 54) suitable to
   contain said documents (D) and to be inserted in said shelves (2).

5) A storage structure (1) according to claim 1) characterised in that
   said laminar bodies (7) are positioned vertically in said shelves (2).

6) A storage structure (50) according to claim 1) characterised in that
   said laminar bodies are positioned horizontally in said shelves.

7) A storage structure (1, 50, 100) according to claim 1) characterised
   in that said monitoring means (4) comprise memory means (12, 23) for
   collecting/filing the data suitable to exchange information with said receiver-
   transmitter unit (5).

8) A storage structure (1, 50, 100) according to claim 7) characterised
   in that said memory means (12, 23) belong to a processing system suitable to
   process said data.

9) A storage structure (1, 50, 100) according to claim 1) characterised
   in that said antennas (6, 21, 51) are active antennas suitable to generate an
   electromagnetic field for enabling said transponders (3).

10) A storage structure (1, 50, 100) according to claim 1) characterised
in that said antennas are passive antennas electrically connected to a circuit resounding at the excitation frequency of said transponders (3).

11) A storage structure (1, 50, 100) according to claim 1) characterised in that said receiver-transmitter unit (5) comprises a transmitter section suitable to emit said signal to said transponders (3) and a receiver section suitable to receive said signal from said transponders (3).

12) A storage structure (1, 50, 100) according to claim 1) characterised in that between said receiver-transmitter unit (5) and said antennas (6, 21, 51) there are selection means (18) suitable to modulate the signal transmitted to said antennas (6, 21, 51).

13) A storage structure (1, 50, 100) according to claim 1) characterised in that between said receiver-transmitter unit (5) and said antennas (6, 21, 51) there are tuning means (19) suitable to vary the frequency of the signal transmitted to said antennas (6, 21, 51).

14) A storage structure (1, 50, 100) according to claim 1) characterised in that said tuning means (19) are static tuning means.

15) A storage structure (1, 50, 100) according to claim 1) characterised in that said tuning means (19) are variable tuning means suitable to de-tune one or more antennas (6, 21, 51).

16) A storage structure (1, 50, 100) according to claim 9) characterised in that said monitoring means (4) comprise at least one synchronisation circuit electrically connected to each of said active antennas (6, 21, 51) to synchronise each of the signals enabling said transponders (3) emitted by said active antennas (6, 21, 51) and prevent interference.

17) A storage structure (1, 50, 100) according to claim 1) characterised in that each of said antennas (6, 21, 51) comprises a laminar body (7) inside which is a layer (17) of conductive material representing the transmission/receiving element of said signal of said antenna (6, 21, 51).

18) A storage structure (1, 50, 100) according to claim 7) characterised in that said active antennas (6, 21, 51) comprise at least one tuning circuit (15) suitable to make the antennas resound at the working frequency of said transponder (3).

19) A storage structure (1, 50, 100) according to claim 18) characterised in that said tuning circuit (15) is a static tuning circuit.

20) A storage structure according to claim 18) characterised in that
said tuning circuit is a dynamic tuning circuit.

21) A storage structure (1, 50, 100) according to any of the claims 9) or 18) **characterised in that** said active antennas (6, 21, 51) comprise at least one coupling circuit (16) suitable to balance the line impedance.

22) A storage structure (1, 50, 100) according to claim 1) **characterised in that** each of said transponders (3) is of the passive type.

23) A storage structure (1, 50) according to claim 1) **characterised in that** it comprises one or more shelving structures (8) with fixed shelves (2).

24) A storage structure (100) according to claim 1) **characterised in that** it comprises a plurality of mobile shelves (20).

25) A storage structure (100) according to claim 24) **characterised in that** said mobile shelves (20) are revolving shelves.

26) A storage structure according to claim 24) **characterised in that** said mobile shelves are translating shelves.

27) A storage structure according to claim 1) **characterised in that** it comprises one or more mobile shelving structures on rails with fixed shelves.

28) A storage structure (1, 100) substantially according to what is described and shown.
AMENDED CLAIMS
[received by the International Bureau on 05 October 2005 (05.10.05);
original claims 1 to 28 replaced by new claims 1 to 37]

STATEMENT
CLAIMS

1) A storage structure (1, 50, 100) comprising:
   - one or more shelves (2, 20) on which an high density of documents (D) can be filed and stored;
   - at least one transponder (3) fitted to each of said documents (D);
   - monitoring means (4) comprising at least one unit (5) for receiving and transmitting radio frequency signals from and to said transponders (3), connected to a plurality of antennas (6, 21, 51) positioned internally to each shelf (2, 20),
   - characterised in that said antennas (6, 21, 51) consist of substantially flat laminar bodies (7) spaced at equal distances from each other, said laminar bodies (7) being aligned according to a horizontal direction defined by each of said shelves (2, 20) to be inserted between said documents (D), said antennas (6, 21, 51) being suitable to define a modulate electromagnetic field between said antennas (6, 21, 51).

2) The storage structure (1, 50) according to claim 1) characterised in that said antennas (6, 51) are fitted to the back panel (10) of said shelves (2).

3) The storage structure according to claim 1) characterised in that said antennas are fitted to the surface of said horizontal shelves.

4) The storage structure (1, 50) according to claim 1) characterised in that said antennas (6, 51) are fitted to mobile containers (13, 54) suitable to contain said documents (D) and to be inserted in said shelves (2).

5) The storage structure (1) according to claim 1) characterised in that said laminar bodies (7) are positioned vertically in said shelves (2).

6) The storage structure (50) according to claim 1) characterised in that said laminar bodies are positioned horizontally in said shelves.

7) The storage structure (1, 50, 100) according to claim 1) characterised in that said monitoring means (4) comprise memory means (12, 23) for collecting/filing the data suitable to exchange information with said receiver-transmitter unit (5).

8) The storage structure (1, 50, 100) according to claim 7) characterised in that said memory means (12, 23) belong to a processing system suitable to process said data.

9) The storage structure (1, 50, 100) according to claim 1) characterised in that said antennas (6, 21, 51) are active antennas suitable to
generate an electromagnetic field for enabling said transponders (3).

10) The storage structure (1, 50, 100) according to claim 1) characterised in that said antennas are passive antennas electrically connected to a circuit resounding at the excitation frequency of said transponders (3).

11) The storage structure (1, 50, 100) according to claim 1) characterised in that said receiver-transmitter unit (5) comprises a transmitter section suitable to emit said signal to said transponders (3) and a receiver section suitable to receive said signal from said transponders (3).

12) The storage structure (1, 50, 100) according to claim 1) characterised in that between said receiver-transmitter unit (5) and said antennas (6, 21, 51) there are selection means (18) suitable to modulate the signal transmitted to said antennas (6, 21, 51).

13) The storage structure (1, 50, 100) according to claim 1) characterised in that between said receiver-transmitter unit (5) and said antennas (6, 21, 51) there are tuning means (19) suitable to vary the frequency of the signal transmitted to said antennas (6, 21, 51).

14) The storage structure (1, 50, 100) according to claim 1) characterised in that said tuning means (19) are static tuning means.

15) The storage structure (1, 50, 100) according to claim 1) characterised in that said tuning means (19) are variable tuning means suitable to de-tune one or more antennas (6, 21, 51).

16) The storage structure (1, 50, 100) according to claim 7) characterised in that said monitoring means (4) comprise at least one synchronization circuit electrically connected to each of said active antennas (6, 21, 51) to synchronize each of the signals enabling said transponders (3) emitted by said active antennas (6, 21, 51) and prevent interference.

17) The storage structure (1, 50, 100) according to claim 1) characterised in that each of said antennas (6, 21, 51) comprises a laminar body (7) inside which is a layer (17) of conductive material representing the transmission/receiving element of said signal of said antenna (6, 21, 51).

18) The storage structure (1, 50, 100) according to claim 9) characterised in that said active antennas (6, 21, 51) comprise at least one tuning circuit (15) suitable to make the antennas resound at the working frequency of said transponder (3).
19) The storage structure (1, 50, 100) according to claim 18) **characterised in that** said tuning circuit (15) is a static tuning circuit.

20) The storage structure according to claim 18) **characterised in that** said tuning circuit is a dynamic tuning circuit.

21) The storage structure (1, 50, 100) according to any of the claims 9) or 18) **characterised in that** said active antennas (6, 21, 51) comprise at least one coupling circuit (16) suitable to balance the line impedance.

22) The storage structure (1, 50, 100) according to claim 1) **characterised in that** each of said transponders (3) is of the passive type.

23) The storage structure (1, 50) according to claim 1) **characterised in that** it comprises one or more shelving structures (8) with fixed shelves (2).

24) The storage structure (100) according to claim 1) **characterised in that** it comprises a plurality of mobile shelves (20).

25) The storage structure (100) according to claim 24) **characterised in that** said mobile shelves (20) are revolving shelves.

26) The storage structure according to claim 24) **characterised in that** said mobile shelves are translating shelves.

27) The storage structure according to claim 1) **characterised in that** it comprises one or more mobile shelving structures on rails with fixed shelves.

28) A method of storing an high density of documents (D) in a storage structure (1, 50, 100) which comprises:

- one or more shelves (2, 20) on which said high density of documents (D) can be filed and stored;

- at least one transponder (3) fitted to each of said documents (D);

- a plurality of documents (D) inserted on said one or more shelves (2, 20);

- monitoring means (4) comprising at least one unit (5) for receiving and transmitting radio frequency signals from and to said transponders (3), connected to a plurality of antennas (6, 21, 51) positioned internally to each shelf (2, 20), said antennas (6, 21, 51) consisting of substantially flat laminar bodies (7) spaced at equal distances from each other, said laminar bodies (7) being aligned according to a horizontal direction defined by each of said shelves (2, 20) to be inserted between said documents (D), **characterised by** providing a modulation of the electromagnetic field made by said radio frequency signals, said electromagnetic field being present between said antennas (6, 21, 51) to interact with all transponders (3) placed in a high

**AMENDED SHEET (ARTICLE 19)**
density between said antennas (6, 21, 51).

29) The method according to claim 28) characterised in that said modulation is provided by using selection means (18) placed between said receiver-transmitter unit (5) and said antennas (6, 21, 51) and suitable to modulate the signal transmitted to said antennas (6, 21, 51).

30) The method according to claim 28) characterised in that said modulation is provided by activating tuning means (19) placed between said receiver-transmitter unit (5) and said antennas (6, 21, 51) and suitable to vary the frequency of the signal transmitted to said antennas (6, 21, 51).

31) The method according to claim 30) characterised in that said tuning means (19) are static tuning means (19).

32) The method according to claim 30) characterised in that said tuning means (19) are variable tuning means (19) to perform a detuning operation of one or more of said antennas (6, 21, 51).

33) The method according to claim 28) characterised by comprising a phase synchronization operation on each one of said radio frequency signals transmitted by said antennas (6, 21, 51) to said transponders (3) to prevent interference, said phase synchronization operation being realized using at least one synchronization circuit electrically connected to each of said antennas (6, 21, 51).

34) The method according to claim 33) characterised by using active antennas (6, 21, 51) that resound at the working frequencies of said transponders (3) by using at least one tuning circuit (15).

35) The method according to claim 33) characterised in that said active antennas (6, 21, 51) comprise at least one coupling circuit (16) suitable to balance the line impedance.

36) The method according to claim 33) characterised in that said tuning circuit (15) is a static tuning circuit.

37) The method according to claim 34) characterised in that said tuning circuit is a dynamic tuning circuit.
After having received the International Search Report and the Written Opinion of the International Searching Authority for the above mentioned International application, the Applicant has duly taken into consideration the objections of the Authorized Officer, especially in respect of the novelty and of the inventive step of the Claims as filed, considering the prior art opposed.

Therefore, the Applicant submits herewith some arguments with the purpose to put in evidence which is the real difference between the present invention and the opposed prior art.

In document D1 (US '418), a plurality of movable loop antennas are provided in a plurality of shelves, only in the same shelf, in order to better detect non-contact id tags on articles. But there is not hint in this document in relation to how to solve the problem which arises when the articles to detect are stored with a very high density themselves.

In this event, the transponders of each article are very close each other, i.e. they are strictly packaged with each other. As a result of this, the transponders blanket one another and their location is substantially impossible.

The problem-solution approach of the invention is different from D1.

In effect, the solution proposed by D1 is in substance to increase the number of movable loop antennas in the same shelf.

The solution proposed by the instant invention is not limited to increase the number of movable loop antennas, but it also provides a modulation of the electromagnetic field present between said antennas and generated by the radio frequency signals.
Said kind of modulation of the signals of the transmitting / receiving radio frequency unit permits to interact with all transponders, in spite of their high density arrangement.

To better put in evidence the real key point of the invention, Claim 1 has been duly amended and also a method claim has been added (Claim 28).

According to the Description, there are many different ways to modulate the electromagnetic field:

a) according to one embodiment of the invention, the modulation of the signals is reached by switching-on groups of antennas by selection means (see page 5, lines 28-33 and the corresponding Claim 12);

b) according to another embodiment of the invention, the modulation of the signals is reached by varying the frequency of said signals through tuning means (see page 6, lines 2-9 and the corresponding Claim 13);

c) according to another embodiment of the invention, the modulation of the signals is reached by detuning one or more antenna (see page 6, lines 10-13 and the corresponding Claim 15);

d) according to another embodiment of the invention, the modulation of the signals is reached by varying the working frequency of the antennas by at least one tuning circuit (see page 5, lines 14-20 and the corresponding Claims 18, 19, 20).
**INTERNATIONAL SEARCH REPORT**

*Classification of Subject Matter*

<table>
<thead>
<tr>
<th>IPC</th>
<th>7</th>
<th></th>
</tr>
</thead>
</table>

*According to International Patent Classification (IPC) or to both national classification and IPC*

**B. Fields Searched**

*Minimum documentation searched (classification system followed by classification symbols)*

| IPC   | 7 | G06K | B65G |

*Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched*

**Electronic data base consulted during the international search (name of data base and, where practical, search terms used)**

EPO-Internal, WPI Data, PAJ

**C. Documents Considered to be Relevant**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6 595 418 B1 (IGARASHI KEISUKE ET AL) 22 July 2003 (2003-07-22) column 6, line 60 - column 8, line 2; figures 11a, 11d</td>
<td>1-28</td>
</tr>
<tr>
<td>X</td>
<td>EP 1 331 590 A (TEXAS INSTRUMENTS INCORPORATED) 30 July 2003 (2003-07-30) paragraphs ‘0008!, ‘0009!; figure 1</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>US 6 714 121 B1 (MOORE SCOTT E) 30 March 2004 (2004-03-30) column 5, line 47 - line 58; figures 1a, 1b, 2 column 8, line 24 - line 35</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>WO 02/095695 A (KVALHEIM AS; KVALHEIM, VIDAR, JR) 28 November 2002 (2002-11-28) claim 5; figure 1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Further documents are listed in the continuation of box C.*

**Date of the actual completion of the international search**

22 July 2005

**Date of mailing of the international search report**

05/08/2005

**Name and mailing address of the ISA**

European Patent Office, P.O. Box 5672, 2280 NL, 2280 HT, The Hague (with: +31-70 944 00-00, Fax: +31-70 944 00-01)

**Authorized officer**

Fichter, U
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>JP 2001097511 A</td>
<td>10-04-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2001097512 A</td>
<td>10-04-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2001101285 A</td>
<td>13-04-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1331590 A2</td>
<td>30-07-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2003001725 A1</td>
<td>02-01-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2002196145 A1</td>
<td>26-12-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2002196146 A1</td>
<td>26-12-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2003001726 A1</td>
<td>02-01-2003</td>
</tr>
<tr>
<td>WO 02095695 A 28-11-2002</td>
<td></td>
<td>NO 20012210 A</td>
<td>05-11-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2446104 A1</td>
<td>28-11-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1507607 A</td>
<td>23-06-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1384210 A1</td>
<td>28-01-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 02095695 A1</td>
<td>28-11-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2004129779 A1</td>
<td>08-07-2004</td>
</tr>
</tbody>
</table>