

METHOD FOR SIMULTANEOUSLY CONTROLLING AND PROGRAMMING A
PLURALITY OF TRANSPONDERS AND DEVICE FOR IMPLEMENTING THIS
METHOD

5 The present invention relates to a method of monitoring
and programming a plurality of transponders automatically and
simultaneously, and also to apparatus for implementing the
method.

10 Transponders are electronic devices of small size and low
cost which can be placed on objects or in a very wide variety
of locations for the purpose of transmitting in predetermined
form data which has been programmed in their respective
memories, whenever they are subjected to external radiation of
predetermined characteristics, e.g. electromagnetic radiation.

15 In general, such transponders do not have their own
electrical power supplies, and the energy required for
transmitting the data they contain is a result of the fact that
the radiation sent to them and picked up by them is used, for
example, to charge a capacitor which then delivers its energy
to an electronic circuit of the transponder to enable it to
20 perform the transmission that serves as a medium for the data
it sends.

 The responses provided by the transponders, after they
have been subjected to the action of external radiation that
triggers their operation, are governed by rules of a specific
25 protocol which determines successive time intervals (or
transmission windows) during which a transponder transmits the
radiation which conveys the data contained in its memory, and
successive time intervals (or reception windows) during which a
transponder does not transmit, but during which it is capable
30 of receiving data transmitted in the form of radiation coming
from an external transmitter. This latter data can then be
stored in the transponder.

 It will be understood that in order to perform its
function, a transponder must be associated with an external

transmitter/receiver whose characteristics are such that firstly it is capable of transmitting radiation that will supply the transponder with the energy it needs, and secondly that it can receive and understand data transmitted by the transponder in its transmission windows, and can also transmit data that the transponder can receive and understand in its reception windows.

The simplest and cheapest transponders are said to be "read-only" since they cannot be programmed to record new data and are capable only of transmitting unchanging data contained in memory.

Higher performance and slightly more expensive transponders are said to be "read/write" transponders and they can receive data from the external transmitter and conserve it in memory for subsequent retransmission when interrogated.

Such data writable in the memory of a transponder of this type can be modified at will with the help of the external transmitter.

In a variant of this second category, transponders that are said to be "respond to order" transponders transmit to the external receiver only when the external transmitter instructs them so to do, thereby enabling them to be synchronized by sending the same order simultaneously to all of the transponders.

A further improved, third category of transponders is said to be "addressable", in which the transponders can be interrogated and programmed individually even when they are grouped together, however such transponders are significantly more expensive than those of the preceding category.

Transponders are presently in use in very large numbers in many fields, in particular during manufacture for the purpose of identifying objects at various stages of manufacture.

They are used in particular when manufacturing garments or other textile products to identify a large number of garment

parts during manufacture, or once manufactured, what parts are all contained in a common container, each part including a transponder that needs to store in its memory various kinds of data concerning the garment.

5 Thus, during garment manufacture, the transponder of the garment must contain in its memory a first data group concerning the type of garment, the kind and color of the fabric, and also the size.

10 Garments are generally manufactured in series of identical garments which are grouped together in a common container, and it is necessary to inject this first data group into the respective memories of the transponders in this series of garments.

15 For shipping to customers, the garments manufactured in this way are then distributed in various different containers, each capable of receiving garments of different types, different colors, and different sizes, thereby making it necessary to inject into each of the transponders a second data group concerning the identity of the customer and shipping
20 conditions, naturally while making no changes to the data in the first group concerning, for example, the size and the color of the fabric.

25 In the state of the art, such programming of the various transponders associated with each garment is an operation that is difficult and expensive.

30 When read/write transponders are used, it is not possible to program them all simultaneously, since the transmitter will not, as a general rule, recognize them as constituting a single transponder given that the transmitter is incapable of reading simultaneously the identity signals from all of the transponders, which signals are not synchronized.

 When using addressable transponders of much higher cost, the transmitter can address each transponder individually to program in its memory the data that is to be inserted therein,

however inserting the data group into all of the articles takes a considerable length of time since it is necessary to interrogate and program in succession each of the transponders in the batch that is to be programmed.

5 The invention makes it possible in a manner that is simple, cheap, and fast to store a data group in the respective memories of a plurality of transponders simultaneously, the transponders being located in a common container and each of them already containing data that may differ from one
10 transponder to another.

 The method of the invention is characterized by the facts that: radiation coming from an external transmitter which supplies the energy required for transponder operation is transmitted to a plurality of transponders, e.g. all to be
15 found in a common container and forming a batch; an external receiver picks up the identity data transmitted by the transponders during a first transmission window that is allocated to them for this purpose; the external receiver determines whether the identity data does or does not present
20 dispersion; if said data presents dispersion, then radiation from the external transmitter is interrupted for a length of time that is sufficient to deactivate all of the transponders; the external transmitter is put back into operation and the identity data transmitted by the set of transponders during the
25 first window for identity transmission that is allocated to them for this purpose is picked up again; and after verifying that the data does not present any dispersion, the external transmitter sends a data group in a transponder reception window, which data group is programmed simultaneously in the
30 respective memories of all of the transponders.

 If the receiver continues to perceive dispersion in identity transmission after the first attempt, that means that at least one transponder is of a type that is different from the others and needs to be changed.

In a preferred embodiment of the method of the invention, after programming in each of the transponders of several pluralities of articles data groups that are identical for each plurality, the various articles belonging to several pluralities are grouped together; radiation from an external transmitter is transmitted to the articles grouped together in this way; by proceeding in the manner described above, it is verified that the external receiver does not perceive dispersion in the first identity transmission window of the transponders; and the external transmitter sends a second data group which is programmed in the respective memories of all of the transponders.

The method of the invention is based on the fact that identical transponders, identified in the same manner, and subjected simultaneously to the same external radiation ought to transmit the identity data they contain in memory with accurate synchronization, the transmission windows being accurately interposed between the reception windows during which all of the transponders can receive and record the data that reaches them by means of the radiation from the external transmitter, and the respective identity binary signals from all of the transponders are perceived simultaneously by the external receiver.

When a transponder is different in structure from the other transponders, or when its identity has been programmed in a different manner, then the transponder transmits to the external receiver identity data having binary signals that are no longer synchronous with those from the other transponders, and this is perceived by the external receiver as unreadable dispersion in the data sent thereto by the set of transponders.

As explained before, the method of the invention is based on the fact that the external receiver is sufficiently sensitive to be able to distinguish between binary signals transmitted by a small number of transponders at a moment when

nearly all of the other transponders are not transmitting binary signals and when said small number of transponders ought not to be transmitting binary signals, either.

5 The method of the invention serves in particular to detect circumstances where, e.g. because of their positions, certain transmitters were not subjected initially to radiation from the external transmitter at exactly the same moment as the other transponders, in which case the identity transmission windows of those transponders are offset from the windows of the other
10 transponders, thus leading to dispersion which, according to the invention, is detected.

The present invention also provides apparatus for implementing the above-described method, which apparatus is characterized by the fact that it comprises an external
15 transmitter suitable for transmitting external radiation to the transponders to feed them with energy, and an external receiver suitable for detecting any dispersion in the identity data transmitted by the various transponders, i.e. identity data coming from one or more transponders without being completely
20 synchronized with all of the other transponders.

In a particular embodiment, if the apparatus observes dispersion in the identity data transmitted by the transponders, it interrupts the radiation from the external transmitter which feeds energy to the transponders, thereby
25 stopping them, after which it re-establishes the radiation thus synchronizing all of the transponders, and after receiving the identity data without dispersion, it sends an data group that all of the transponders record simultaneously in their respective memories.

30 In a particular embodiment of the invention, the external transmitter is provided with a transmission antenna in the form of a solenoid of volume and length that are sufficient to receive the container containing the products provided with transponders, thereby making it possible to send the radiation

to all of the transponders for the purpose of feeding them with energy.

In a variant of the invention, "respond to order" type transponders are used, thereby enabling them to be synchronized not by sending radiation which feeds them with energy, but by the external transmitter sending a signal intended to cause all of the transponders to transmit identity data simultaneously.

In a preferred embodiment, the transmitter/receiver is provided with apparatus that modifies the characteristics of its antenna to maintain accurate tuning with the antennas of the transponders, in spite of variations in the electromagnetic environment.

In order to make the invention better understood, there follows a description by way of non-limiting example of an embodiment thereof given with reference to the accompanying drawing, in which:

. Figure 1 shows waveform diagrams for external transmitter transmission and for the transponders; and

. Figure 2 is a diagram showing one way of embodying the apparatus of the invention.

In Figure 1, the abscissa corresponds to time, and Figure 2 is a diagrammatic view of an embodiment of the apparatus of the invention.

Waveform diagram I corresponds to radiation being transmitted from the external transmitter which delivers the energy required to enable the transponders to operate.

Waveform diagram II corresponds to the envelope of the signals transmitted during the transmission windows of the transponders.

In Figure 1 of the drawing, point 1 on the time axis marks the time from which the radiation that powers the transponders is sent from the external transmitter. This radiation is at substantially constant power throughout the time during which it is being transmitted.

Waveform diagram II has the same time scale and shows transmissions coming from the transponder that are directed towards the external receiver.

Point 2 corresponds to the instant where, after receiving the radiation sent thereto by the external transmitter at time 1, the transponder begins to transmit a first data group that can be received by the external receiver and which serves to identify the transponder.

The window during which such identity signals can be transmitted lies between time 2 and time 3.

It may be observed that time 2 is offset from time 1 at which external radiation began to be transmitted to the transponders, with the time interval 1-2 corresponding to the delay in the response of a transponder, marked TRR in the drawing.

The data transmitted during window 2-3 is a succession of very short duration signals separated by intervals likewise of very short duration, constituting binary signals corresponding to the identity of the transponder transmitting it.

When the identity signals transmitted by all of the transponders that are being monitored are not exactly synchronous, i.e. when they do not all transmit at every instant binary signals that add constructively, the external receiver perceives signals of low intensity coming from various transponders at moments when it is not receiving any signal of normal intensity as transmitted by nearly all of the transponders. This gives rise to the signals being "dispersed" in the terminology adopted in the drafting of the present description.

Such dispersion can come from the fact that at least one transponder has received radiation that supplies it with energy not at time 1 but with a certain delay, e.g. due to the fact that it was not yet in the transmission field at time 1.

However, such dispersion can also come from the fact that when all of the transponders have indeed received the data that provides them with energy simultaneously, at least one of the transponders is identified by binary signals that are
5 different, and as a result the signals it transmits in the window 2-3 to convey its identity are not the same as the signals from the other transponders, thereby giving rise to dispersion which is perceived by the external receiver.

10 In accordance with the invention, when such dispersion is perceived by the external receiver, it causes the radiation that supplies energy to the transponders to be switched off, and shortly thereafter the transponders become inactive.

The external transmitter then restarts transmission of the radiation that supplies energy to all the transponders, and at
15 the end of the response delay time TRR, all of the transponders again transmit in transmission window 2-3.

It is then extremely probable that all of the transponders receive the radiation simultaneously, thereby enabling them to trigger their own operation simultaneously. Any transponder
20 still not in the field of the antenna at time 1 will have been able to change its position relative to the antenna and thus find itself in the field radiated thereby.

If the external receiver receives the signals transmitted by the transponders in window 2-3 without dispersion, that
25 means that all of the transponders have the same identity, and are properly synchronized, thereby making it possible to continue with the programming process without any risk of overwriting or destroying data already programmed in the transponders.

30 Otherwise, if the signals perceived by the external receiver in the window 2-3 continue to give rise to dispersion, that means that it is highly probable that at least one transponder of a different kind is mixed in with the transponders that are being monitored.

Under such circumstances, it is then appropriate to look for transponders that are not of the desired type and to remove or replace any such transponders.

5 This incident is unusual since, in general, transponders are delivered in batches that are completely uniform.

Under the most likely circumstances, the external receiver perceives the binary signals transmitted in the window 2-3 by all of the transponders without any dispersion, so the radiation which delivers energy to the transponders continues
10 to be transmitted and the external transmitter selects the transponder reception window that corresponds to programming the data group that is to be stored in the transponders, and it sends the corresponding signals which are recorded by all of the transponders.

15 Figure 2 is a diagram showing apparatus for implementing the method of the invention.

In this apparatus, a container 7 represented diagrammatically in Figure 2, contains various articles, for example garments, each provided with its own transponder in
20 which it is desired to program a data group which is identical for all of the transponders.

In accordance with the invention, the container 7 is placed inside an antenna 8 constituted by a solenoid connected to the external transmitter/receiver 9 via its end turns 10 and
25 11.

The dimensions of the solenoid are such that the electromagnetic field of the radiation transmitted by the solenoid is the same at all points within the container 7, and consequently at all points where the various transponders may
30 be located.

When the container is put into position under the conditions described above, the identity data transmitted by the various transponders after energy has been conveyed to them from the external transmitter/receiver via the antenna, is

completely synchronized and is perceived by the transmitter/receiver as constituting a single set of signals without any dispersion.

As described above, this makes it possible to write a new data group in each of the transponders without disturbing the data they already contain in memory.

Naturally, it is important for the radiation transmitted by the solenoid 9 to be tuned to the reception frequency of the various transponders.

In a preferred embodiment of the device of the invention, account is taken of elements that disturb the electromagnetic environment in the vicinity of the apparatus, for example disturbances that can be created by motors or other electric fields. For this purpose, the transmitter/receiver 9 is associated with apparatus that modifies the characteristics of the antenna 8 so that it continues to be properly tuned to the antennas of the transponders in spite of variations in the electromagnetic environment.

It can be seen that the invention makes it possible in a manner that is simple and fast to store simultaneously in the memories of all of the transponders a common data group without modifying the data which is already stored in the transponders, which data may differ from one transponder to another.

It will thus be understood that by means of the invention it is possible to associate each article provided with a transponder with successive data groups corresponding to various stages of manufacture or sale, said various data groups being recorded on each occasion simultaneously in a plurality of transponders.

The transponders and the externally located transmitter/receiver can be made using conventional techniques.

Naturally, it is necessary for transmission and reception by the transponders and by the external transmitter/receiver to

have characteristics that are appropriate for enabling them to co-operate.

Naturally, the embodiment described is not limiting in any way and may be modified in any desirable manner without thereby
5 going beyond the ambit of the invention.



CLAIMS

1/ A method of storing a data group in memory simultaneously in a plurality of transponders of the "read and write" type that are collected together, e.g. in a common container (7), each of
5 them already containing data that may differ from one transponder to another, the method being characterized by the facts that:

radiation is transmitted to the plurality of transponders from a transmitter (9), thereby supplying the energy required
10 for transponder operation;

an external receiver (9) picks up the identity data transmitted by the transponders during a first transmission window that is allocated to them for this purpose;

the external receiver (9) determines whether the identity
15 data does or does not present dispersion;

if said data presents dispersion, then the radiation from the external transmitter (9) is interrupted for a length of time that is sufficient to deactivate all of the transponders;

the external transmitter (9) is put back into operation
20 and the identity data as transmitted by all of the transponders is picked up during the first window for identity transmission that is allocated to the transponders for this purpose; and once it has been verified that the data is not subject to dispersion, the transmitter (9) acts during a transponder
25 reception window to send a data group that is programmed simultaneously in the respective memories of all of the transponders.

2/ A method according to claim 1, characterized by the fact
30 that "respond to order" transponders are used to cause them to transmit their identities, and when the identity data transmitted by the set of transponders presents dispersion, a new identity request order is transmitted to the transponders in order to pick up again the identity data transmitted by the

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set of transponders, and once it has been verified that said data does not present dispersion, the transmitter (9) sends a data group in a transponder reception window, which data group is programmed simultaneously in the respective memories of all
5 of the transponders.

3/ A method according to claim 1, characterized by the fact that after programming data groups in each of the transponders of several pluralities of articles, with the data groups being
10 identical for each plurality, the various articles belonging to the various pluralities are grouped together, it is verified that the external receiver (9) does not perceive dispersion in the first window for transmitting transponder identities; and a second data group is sent by means of the external transmitter,
15 which group is programmed in the respective memories of all of the transponders.

4/ Apparatus for implementing the method according to claim 1, 2, or 3, characterized by the fact that it comprises an
20 external transmitter (9) designed to feed energy to the transponders, and an external receiver (9) suitable for detecting possible dispersion in the identity data transmitted by the various transponders.

5/ Apparatus according to claim 4, characterized by the fact that if the external receiver (9) observes dispersion in the identity data transmitted by the transponders, it interrupts the radiation from the external transmitter that feeds energy to the transponders, thereby causing them to stop; it then re-
25 establishes the radiation, thereby synchronizing all of the transponders; and after receiving identity data without dispersion it causes a data group to be transmitted which is recorded by all of the transponders simultaneously in their
30 respective memories.

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6/ Apparatus according to claim 3, characterized by the fact that the transponders are of the "respond to order" type and by the fact that if the external receiver (9) observes dispersion
5 in the identity data transmitted by the transponders, it sends a new identification order to the set of transponders; and only after receiving identity data from the set of transponders without dispersion does it transmit a data group which all of the transponders record simultaneously in their respective
10 memories.

7/ Apparatus according to any one of claims 3 to 6, characterized by the fact that the external transmitter (9) is provided with a transmission antenna (8) in the form of a
15 solenoid of volume and length that are sufficient for receiving a container (7) containing the products which are provided with transponders so as to be able to send simultaneously to all of the transponders the radiation which feeds them with energy and/or the order to cause them to transmit their identities.

20

8/ Apparatus according to claim 7, characterized by the fact that the external transmitter (9) is provided with apparatus which modifies the characteristics of its antenna (8) to maintain good tuning with the antennas of the transponders in
25 spite of variations in the electromagnetic environment.

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