Method and Device for Producing

Individually Coded Read Patterns

Specification

This invention relates to a device for producing individually coded read patterns ~~as claimed in Claim 1~~, a corresponding method ~~as claimed in Claim 9~~ as well as a read pattern produced by the method ~~as claimed in Claim 15~~. The read patterns as claimed in the invention are used especially as components of RFID chips.

RFID components are becoming more and more important. The advantage of RFID components in contrast to the still common bar codes is that they can be read out electronically without direct visual contact and can be connected to more and more complex modules in an increasingly extremely cost-effective manner. Thus for example the first RFID components were simple transponders which delivered a response signal to an incoming signal. Currently development is proceeding in the direction of RFID components which can be operated without a power supply only by the induction of the electromagnetic radiation of a high frequency signal even together with other functional modules. Mainly memory modules which can be programmed and read out should be mentioned here. Modern RFID components have a coil, preferably a flat coil, a rectifier for converting the AC signal into DC, as well as the aforementioned functional modules.

In the early years the RFID technology was already being used in industry to mark goods in a production chain. A semifinished product received an RFID "label" and could be tracked, registered and monitored up to final installation within a factory. Furthermore RFID technology was also introduced into retail chains in which goods were protected against theft by RFID. Due to increasing miniaturization these components are not only being provided with more functions, but

also are becoming increasingly smaller and at the same time cheaper.

One of the main problems is the "coding" of the so-called code reflectors (resonators). Each RFID component has its own "number" (coding) which can be read out. The number is not present as software in a memory which must be read out, but is physically coded in a code reflector. The incoming electromagnetic "read wave" in a (flat) coil induces a current which feeds the RFID circuit. The resonator "returns" as the response signal a coded analog and/or digital signal which is emitted via an antenna. The resonators, in primitive terms, consist of line patterns. By providing line patterns at certain locations the resonant frequencies can be set. The problem is that several RFID chips or resonators are produced on one wafer in order to be able to economically produce a plurality of resonators. Of course each of the RFID chips must have its own "identification", therefore its own and mainly unique code. Of course a mask could be produced which justifies this circumstance by there being simply a corresponding pattern in the mask at each chip position. However the cost of preparing one mask per wafer is disproportionate. Since to date there has been no possibility of producing "dynamically variable masks", the production process of the resonators must take place separately from the other structures of the chip.

Until today, to produce resonators lithographic methods have been used in which the line patterns are produced individually. Technical problems are posed by the resolution which constitutes a limiting factor due to the ratio of the wavelength to the aperture. The smaller the patterns, the smaller the wavelengths must also be, and the more complicated the lithographic systems must be; this leads to a corresponding cost explosion.

Embodiments~~The object~~ of this invention ~~is therefore to~~ simplify the production of individually coded read patterns and thus to make available more economical RFID chips.

According to a first aspect, there is provided a device for producing individually coded read patterns, especially resonators for use in RFID chips, with a structuring apparatus for producing a basic pattern with at least one group of individual patterns on a carrier substrate and a processing apparatus for forming from a subset of a total set of the individual patterns of each group at least one read pattern with read elements, each read pattern being individually coded.

According to a second aspect, there is provided a method for producing individually coded read patterns, especially resonators for use with RFID chips, with the following steps, especially the following sequence: producing a basic pattern with at least one group of individual patterns on a carrier substrate by means of a structuring apparatus and forming at least one individually coded read pattern with read elements from a selected or selectable subset of a total set of individual patterns of each group.

According to a third aspect, there is provided a read pattern produced according to the above method and/or produced by the above device.

~~This object is achieved with the features of Claims 1, 9 and 15. Advantageous developments of the invention are given in the dependent claims.~~ All combinations of at least two of the features given in the specification, the claims and/or the figures also fall within the scope of the invention. At the given value ranges, values within the indicated limits will also be considered to be disclosed as boundary values and will be claimed in any combination.

Embodiments~~The main idea~~ of this invention ~~is~~ first of all ~~to~~ form an especially uniform basic pattern which is easy to produce on a carrier substrate and then on the foundation of this basic pattern to form an individually coded read pattern by processing of the basic pattern. Thus, for producing the basic pattern standard methods can be used so that in spite of providing several steps up to production of the read pattern, production is enabled which is more economical compared to the prior art.

An embodiment of the~~independent~~ invention is therefore a device for producing individually coded read patterns, especially resonators, with the following features:

- a structuring apparatus, especially in the form of a lithography system, for producing a basic pattern with at least one group of individual patterns on a carrier substrate and
- a processing apparatus which consists of several apparatus for forming at least one individually coded read pattern at a time with read elements from a selected or selectable subset of a total set of the individual patterns of each group.

According to one advantageous embodiment of the invention it is provided that the processing apparatus has application means for at least partial covering of an unselected remaining number of the total number of individual patterns of each group with a fluid, especially a polymer. Thus the formation of read elements or a read pattern on the covered individual patterns can be

prevented by controlled triggering of the application means. This leads to a significant simplification and more economical production of the read patterns.

To the extent the application means have at least one dispenser which has a nozzle, especially a nanodispenser, exact and prompt metering of even extremely small amounts of fluid is possible.

Advantageously it is furthermore provided that the structuring apparatus, especially as an embossing apparatus, is made to produce the individual patterns in alternation as depressions and especially elevations which have been formed by formation of the depressions. The individual patterns can be especially economically produced in this way with extremely small dimensions.

By the device being set up in an advantageous configuration such that each read element is made on one individual pattern at a time, especially exclusively on one depression at a time, the covering of the respective unselected individual pattern can be especially easily and reliably implemented.

Moreover as per embodiments of~~claimed in~~ the invention it is conceivable that the processing apparatus has reducing agents which act especially by etching, for especially uniform reduction of the thickness D_1 of the basic pattern, especially at least by one height h of the depressions (of the carrier substrate). Thus the surface of the depressions after reduction/stripping is formed by the carrier substrate so that material which is then introduced in the depressions for the formation of the read pattern can be joined directly to the carrier substrate.

In another advantageous embodiment of the invention it can be provided that the processing apparatus has coating means for especially blanket coating, especially deposition, of a coating material which at least partially forms the read pattern, on the groups or the basic pattern. The

coating material can be easily applied in this way over the entire surface, unselected individual patterns being impeded from coating by the covering with the fluid. The unselected individual patterns are thus not coated.

Advantageously the processing apparatus has means for especially complete dissolution of the basic pattern which has been reduced especially by the reducing agents from the carrier substrate. Thus, the coating which had been applied in the selected individual patterns, especially depressions, now remains on the carrier substrate so that an individual read pattern results from the selected individual patterns and moreover allows clear delineation between the individual read elements and can be made especially thin.

An embodiment of the~~independent~~ invention is a method for producing individually coded read patterns, especially resonators, with the following steps, especially the following sequence:

- producing a basic structure with at least one group of individual patterns on a carrier substrate by means of a structuring apparatus and
- forming at least one individually coded read pattern with read elements from a selected or selectable subset of a total set of individual patterns of each group.

Insofar as features relating to the device have been described, they should also be considered disclosed as features relating to the method.

Furthermore embodiments of this invention relate~~s~~ to a read pattern which has been produced by the described device and the described method.

Embodiments of the~~The~~ invention relate~~s~~ not only to the production of RFID resonators, but in general to the production of individually coded mechanical-electronic binary patterns. The RFIDs are one preferred embodiment or preferred use of the invention. One alternative use of embodiments of the invention ~~as~~

~~claimed in the invention~~ would be the production of mechanical-electronic patterns which provide devices with a serial number in order to uniquely identify them. These serial numbers are stored mainly electronically in the prior art, especially permanently in flash memories, or semipermanently. These memories can however be manipulated, replaced or altered. Thus the embodiment as claimed in the invention allows the production of individually codable patterns in a mass production process. The use of these patterns can be diverse, as shown using some preferred embodiments.

Other advantages, features and details of the invention will become apparent from the following description of the figures. The figures are schematic and highly enlarged.

Figure 1 shows a cross sectional view of a carrier substrate by way of extract, with a basic pattern as claimed in the invention,

Figure 2 shows a schematic of application means which can be aligned and which is located above the basic pattern,

Figure 3 shows the application of a fluid to the basic pattern, as claimed in the invention,

Figure 4 shows a step of reducing/stripping of the thickness D_1 of the basic pattern, as claimed in the invention,

Figure 5 shows a step of coating of the basic pattern, as claimed in the invention, and

Figure 6 shows a step of dissolving the basic pattern, as claimed in the invention.

In the figures, advantages and features of the invention are labeled with these reference numbers which identify them according to embodiments of the invention, components or features with the same function or function with the same effect being labeled with identical reference numbers.