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(54) Security card with electronic recognition key

(57) An electronic card (1) comprises a matrix of erasable ROM cells (2) of the FAMOS or MNOS type, within which a non-erasable recognition key is constituted by a group of effaced cell (2′). Each of the cells (2) has a control electrode (3) connected to a source (4) of effacing voltage through destructible component (5), by which the destructible component (5) may be destroyed.

Fig.1

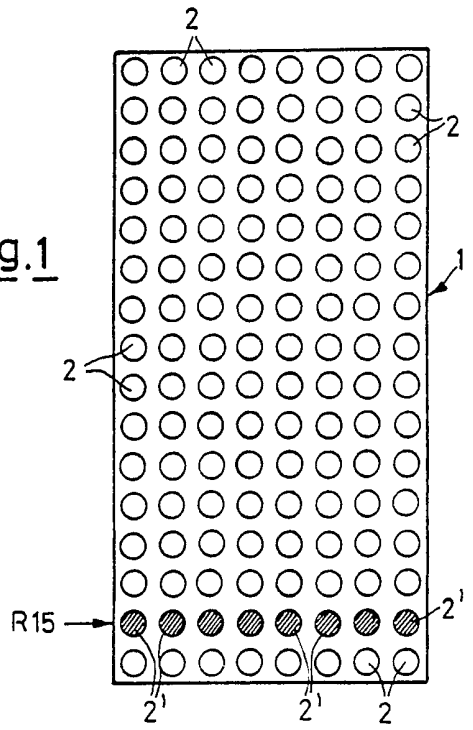
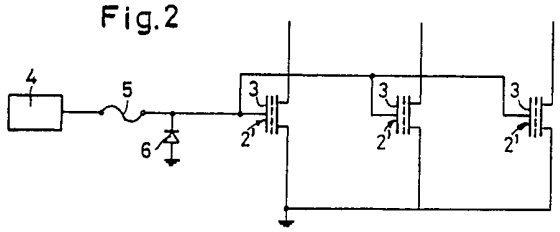


Fig.2



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig.1

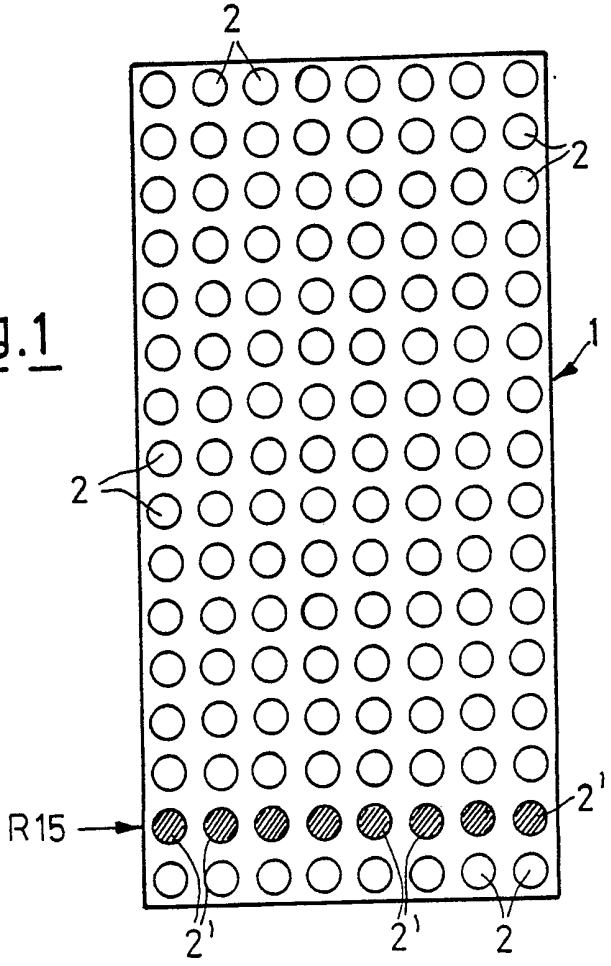
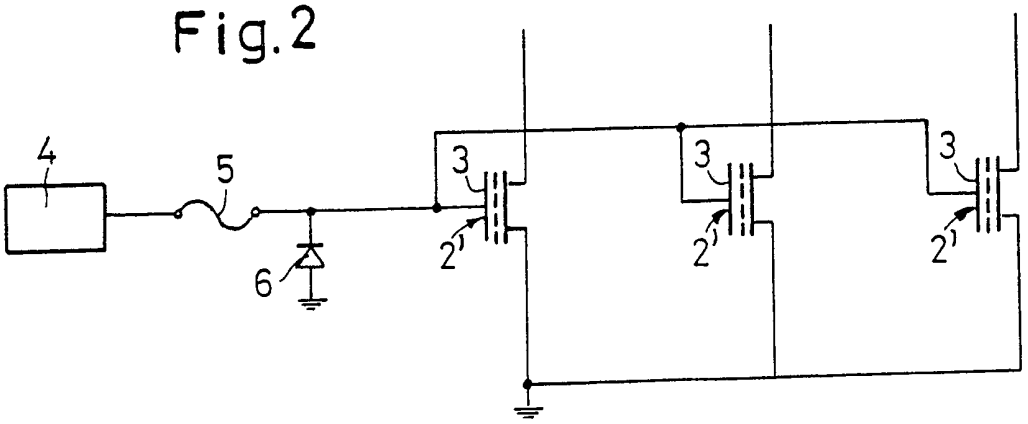


Fig.2



SPECIFICATION

Electronic card comprising effaceable cells with a non-reproducible recognition key, and a method of providing said non-reproducible key

This invention relates to an effaceable electronic card with a non-reproducible recognition key for goods or services distribution apparatus, and a method of providing said non-reproducible key.

There is an increasingly widespread use of electronic cards which are suitably programmed for operating goods or services distribution apparatus of various kinds, for example telephones, automatic distributors for drinks or other foodstuffs, and motorway toll gates, and for calculating the charge to be debited.

In particular, cards are known which include a matrix of effaceable cells, i.e. semiconductor cells which can be switched from one state to another by the application of suitable voltages to their electrodes.

Said semiconductor cells could advantageously be of the known FAMOS type (floating gate avalanche injection metal oxide semiconductor) with a control electrode, having the facility to be switched from one state (conduction) to the other (blocked) and to remain so for a more or less infinite time by injecting high energy electrons into an electrode (floating gate) of the cell which is completely embedded in an insulation oxide layer. The FAMOS cells are in this respect preferred above all others which can be produced by present-day techniques, from the economical viewpoint.

In order to prevent falsification or their unauthorised use, FAMOS cell cards could also be easily provided with a recognition key in the form of a group of cells, for example one row of the matrix, which have been previously effaced. Such a key could be read and recognised by a suitable device connected into the apparatus for which the card is intended.

However, FAMOS cells have one negative characteristic in terms of their use in an effaceable cell card for distribution apparatus, this being that they can be reset to their initial state by exposure to ultraviolet or X-rays. This means that a FAMOS cell card which has already been completely effaced could be illegally restored to its initial virgin state and reused an infinite number of times, with evident economical damage to the authorities or companies which distribute the goods or services for which the card is used.

It is evidently true that by restoring all the cells to their initial state, the recognition key also disappears, but it is also true that the same key can then be reinstated by previously effacing the correct group of cells.

Another type of semiconductor cell which can be used for the effaceable electronic card is that produced in the known art under the symbol MNOS (metal-nitride-oxide semiconductor). In common with the FAMOS cell, this has the capacity for changing its state by load injection, and although it is normally cancelled electrically, it can be cancelled by ultraviolet or X rays as in the case of the FAMOS.

An object of the present invention is to provide a cell card of FAMOS or MNOS type, which cannot be reused after cancellation of the effaced cells because it is provided with a non-reproducible recognition key.

According to the present invention, there is provided an electronic card comprising effaceable cells with a recognition key for goods or services distribution apparatus, comprising a matrix of cells of the FAMOS or MNOS type with a programme recognition key constituted by a predetermined group of previously effaced cells, each cell of said group of cells having a control electrode connected to a source of effacing voltage by way of a circuit means comprising at least one destructible component, which is destroyed when programming has taken place.

Further, according to the present invention, a method for providing said programmed recognition key in the card as set forth above and making it non-reproducible comprises applying through said destructible component the effacing voltage to the control electrodes of the cells which comprise the recognition key, and then destroying the destructible component.

In this manner, the card can be used only once, as any illegal cancellation of the card would also lead to cancellation of the key, which could then no longer be reinstated because of the interrupted connection deriving from the construction of said component.

A card is thus obtained with is very economical and at the same time free from the drawbacks which otherwise derive from the facility for cancellation of the FAMOS and MNOS cells.

An embodiment of this invention will now be described by way of example, with reference to the accompanying drawings in which:–

Figure 1 is a diagrammatic view of the cell matrix of a card according to the invention;

Figure 2 shows the electrical connection made by the destructible component between the control electrode of the cell group which forms the card recognition key and the relative source of effacing voltage.

Fig. 1 shows by way of example a matrix 1 of effaceable FAMOS cells 2 disposed in sixteen rows and eight columns. All the cells 2 are in their conducting state, i.e. are not effaced, except for those which are shaded and indicated by the reference numeral 2′, forming part of the fifteenth row from the top,

indicated in its turn by R15. Said effaced cells 2′ constitute the "key" for recognising the card 1 by the reading and recognition device, which is suitably incorporated in the goods or services distribution apparatus for which the card is intended. Said device is not described herein because it is not included in the invention and is of any reading and comparator type easily constructed by an expert of the art.

The cells 2′ are effaced, i.e. the recognition key for the card is programmed, by the circuit of Fig. 2, in which all the cells 2′ of the row R15 have their control electrode 3 connected to a voltage source 4 by way of a destructible component constituted, by way of example, by a fuse 5. A diode 6 is connected between earth and any intermediate point between the fuse 5 and cells 2′.

The cells 2′ are programed by applying a suitable effacing voltage (for example 25V), supplied by the source 4, to the control electrodes 3 of all the cells 2′ of the row R15 for a predetermined time (for example 50 ms) by way of the fuse 5, after applying a suitable voltage between the other electrodes of each cell. Said cells then switch their initial state (conduction) so that they all take on a different state (blocked), in which they remain characteristically for a more or less infinite time. The cells 2′ are thus effaced.

On terminating the operation, the fuse 5 is burnt by passing through it a current of suitable value (for example 40 mA) fed in the conduction direction of the diode 6.

The card is thus ready for use, during which all the other cells 2 become progressively effaced under the control of the distribution apparatus and by means of different circuits of conventional type free from fuses and including suitable selection members.

When the card has been completely used up it cannot be restored to its initial condition and thus reused, because any cancellation of the cells by known ultraviolet or X-ray systems would also cancel the cells 2′, i.e. the recognition key, which could not then be reinstated because of the fact that the fuse 5 is burnt out.

In a further embodiment of the invention, which is not represented but is easily understood, the effacing voltage could be applied to one of the electrodes of the cells of the recognition key not directly through a fuse, but through a circuit means having the function of an electronic switch, the control electrode of which receives the effacing voltage through the fuse. This circuit means could be a MOS (metal-oxide semiconductor) in series with one of the cell electrodes, and having the control electrode (gate) connected to the fuse.

CLAIMS

1. An electronic card comprising effaceable cells with a recognition key for goods or services distribution apparatus, comprising a matrix of cells of the FAMOS or MNOS type with a programmed recognition key constituted by a predetermined group of previously effaced cells, each cell of said group of cells having a control electrode connected to a source of effacing voltage by way of a circuit means comprising at least one destructible component, which is destroyed when programming has taken place.

2. A card as claimed in claim 1, wherein said destructible component is a fuse.

3. A method for providing said programmed recognition key in the card in accordance with claim 1 and making it non-reproducible, comprising applying said effacing voltage through said destructible component to the control electrodes of the cells which comprise said recognition key, and then destroying said destructible component.

4. An electronic card substantially as hereinbefore described with reference to the accompanying drawings.

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