

POWER-FREE ELECTRONIC CONTAINER LOCK
WITH UHF OMNIDIRECTIONAL ANTENNA

FIELD OF THE INVENTION

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The present invention relates to an electronic container lock, and more particularly, to an electronic container lock that does not require a power supply and includes an omnidirectional antenna to allow
10 all-directional transmission of container data stored on a chip embedded in the lock to an external reader.

BACKGROUND OF THE INVENTION

15 Fig. 1 shows a conventional mechanical type container lock, which includes a female connector 3 and a male connector 4. The female connector 3 defines a central cavity 31. A pair of annular grooves 32 is formed in the central cavity 31 to receive two retaining elements
20 33 therein. The male connector 4 is in the form of a long bar having a rounded conical end 41 and a narrowed neck portion 42 located behind the conical end 41. To use the container lock, first extend the male connector 4 through lock holes formed on door latches
25 of the container, and engage the male connector 4 with the female connector 3, so that the rounded conical

head 41 of the male connector 4 is passed through the two annular grooves 32 in the female connector 3. At this point, the narrowed neck portion 42 is engaged with the two retaining elements 33 in the two annular
5 grooves 32 to prevent the male connector 4 from being pulled out of the central cavity 31 of the female connector 3. That is, the container lock is in a locked state.

10 While the conventional mechanical container lock is non-expensive for use, it does not fulfill the requirement of container clearance automation.

There has been developed a type of radio frequency
15 identification (RFID) electronic container lock in response to the requirement of container clearance automation. In the currently available RFID electronic container lock, a signal indicating the ID of a container is emitted by radio frequency (RF)
20 to allow automated container clearance. However, the electronic container lock is very expensive and has a big volume, and requires battery power to transmit the ID signal. Moreover, the current electronic container lock must be regularly maintained at short
25 intervals, and can not be easily recollected for use again. When the RFID electronic container lock uses

a high frequency of 13.56MHz to emit the signal, the signal can only be transmitted within a short distance and in a fixed direction. The signal transmitted from the current RFID electronic container lock is therefore
5 not easily receivable.

It is therefore tried by the inventor to develop a power-free electronic container lock with UHF omnidirectional antenna to eliminate the drawbacks
10 in the conventional RFID electronic container lock.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide
15 a power-free electronic container lock with ultrahigh frequency (UHF) omnidirectional antenna, which does not require a power supply and allows all-directional transmission of container data stored on a chip embedded in the lock to an external reader.

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To achieve the above and other objects, the power-free electronic container lock with ultrahigh frequency (UHF) omnidirectional antenna according to the present invention includes a hollow lock bar and a lock body.
25 The lock bar has an RFID chip and a cable connector embedded therein to electrically connect to each other.

The lock body internally includes a mating connector corresponding to the cable connector in the lock bar, and an antenna connected to the mating connector. The antenna is a spiral antenna allowing data signal transmission in all directions. When the lock bar is extended into the lock body to lock the container lock, the cable connector in the lock bar is engaged with the mating connector in the lock body to thereby connect the RFID chip to the antenna, allowing data on the RFID chip to be normally transmitted to and read in by an external reader. With these arrangements, the electronic container lock of the present invention meets the requirement of container clearance automation.

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BRIEF DESCRIPTION OF THE DRAWINGS

The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

Fig. 1 shows a conventional mechanical type container lock;

Fig. 2 is a sectional view of an electronic container lock according to the present invention; and

Fig. 3 is a constitutional block diagram of the
5 electronic container lock of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please refer to Figs. 2 and 3 that are sectional view
10 and constitutional block diagram, respectively, of
an electronic container lock according to the present
invention. As shown, the electronic container lock
of the present invention is a power-free electronic
container lock with UHF (ultrahigh frequency)
15 omnidirectional antenna, and includes a lock bar 1
and a lock body 2. The lock bar 1 includes a hollow
metal tubular member 11 and a lock bar case 12 covering
middle and top portions of the metal tubular member
11. The metal tubular member 11 defines an internal
20 space 111. A cable connector 13 is embedded in the
internal space 111 near a bottom portion of the metal
tubular member 11. The lock bar case 12 has a radio
frequency identification (RFID) chip 14 embedded
therein. The RFID chip 14 is electrically connected
25 to the cable connector 13 via a cable 15 and an impedance
matcher 16. The cable 15 is extended from the RFID

chip 14 through the internal space 111 of the metal tubular member 11 to the cable connector 13. The impedance matcher 16 is located in the internal space 111 of the metal tubular member 11 to match with the
5 RFID chip 14, the cable connector 13, and an antenna 24, which will be described in more details later, so as to obtain an optimal impedance match value to enable enhanced data transmission performance and transmission distance.

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Broadly speaking, the lock bar 1 is a hollow metal member defining an internal space; and the cable connector 13, the RFID chip 14, the cable 15, and the impedance matcher 16 are embedded in the internal space
15 of the lock bar 1.

The hollow metal member, that is, the metal tubular member 11, is provided at predetermined positions on an outer surface with two annular grooves 112, and
20 at the top portion with a substantially conical metal block 113, such that the lock bar case 12 has a flared head, preventing the conical metal block 113 from being forcefully pulled out to open the lock. The lock bar case 12 may be made of a rubber-plastic material, such
25 as ABS (Acrylonitrile butadiene styrene), to tightly enclose the middle and top portions of the metal tubular

member 11 therein, and ensure firm association of the metal tubular member 11 with the lock bar case 12.

The lock body 2 includes a metal sleeve 21 for fitly receiving the bottom portion of the metal tubular member 11 of the lock bar 1 therein, and a rubber-plastic case 22 enclosing the metal sleeve 21 therein. A mating connector 23 is embedded in a bottom portion of the metal sleeve 21 for correspondingly engaging with the cable connector 13 in the lock bar 1. An antenna 24 is then welded to the mating connector 23. The antenna 24 is in a spiral form, so as to enable transmission of a data signal of the RFID chip 14 without being limited to any specific transmission direction. Therefore, the spiral antenna 24 has enhanced signal transmitting and receiving ability. The antenna 24 is outward projected from the rubber-plastic case 22 to transmit and receive data signal of the RFID chip 14.

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To protect the antenna 24 against damage, an antenna hood 25 is mounted on and around the rubber-plastic case 22. The antenna hood 25 is also made of the ABS material.

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Broadly speaking, the lock body 2 is a hollow metal

member matching with the lock bar 1, and defining a space for receiving the mating connector 23 therein; the antenna 24 is outward projected from the hollow metal member of the lock body 2; and the antenna hood
5 25 is mounted around the hollow metal member.

The hollow metal member, that is, the metal sleeve 21 of the lock body 2, is internally provided with two retaining springs 27 at positions corresponding
10 to the two annular grooves 112 on the metal tubular member 11 of the lock bar 1. A seal ring 26 is embedded in the rubber-plastic case 22 of the lock body 2 to seal a clearance between the metal tubular member 11 and the lock body 2, so as to prevent water from entering
15 into the lock body 2 and the lock bar 1 via the clearance.

To use the electronic container lock of the present invention, first extend the bottom portion of the metal tubular member 11 of the lock bar 1 into the metal
20 sleeve 21 of the lock body 2 until the lock bar 1 is in a locked position. At this point, the cable connector 13 in the metal tubular member 11 is engaged with and electrically connected to the mating connector 23 in the metal sleeve 21 of the lock body 2, so that the
25 RFID chip 14 in the lock bar 1 is electrically connected to the mating connector 23 and the antenna 14 via the

cable 15, the impedance matcher 16, and the cable
connector 13 to commence working, allowing an external
reader (not shown) to read or write data from or into
the RFID chip 14, as shown in Fig. 3. Since the cable
5 connector 13 is located in the internal space 111 of
the metal tubular member 11 and isolated from
unintentional touch by a user, it is impossible for
an external reader to read data from the RFID chip
14 via human body induction when the lock bar 1 is
10 not extended into the lock body 2.

Meanwhile, the metal sleeve 21 of the lock body 2 is
provided on an inner wall surface with two annular
grooves 212, and the retaining springs 27 are disposed
15 in the two annular grooves 212. When the bottom portion
of the metal tubular member 11 of the lock bar 1 has
been fully inserted into the metal sleeve 21 of the
lock body 2 to the locked position, the retaining springs
27 are aligned and engaged with the two annular grooves
20 112 on the outer surface of the metal tubular member
11 to resist a pull as high as 1 metric ton or more,
preventing the lock bar 1 from being forcefully pulled
out of the lock body 2.

25 As can be seen from Fig. 2, when the electronic container
lock of the present invention has been locked to

container doors, the cable connector 13 in the lock bar 1 is engaged with the mating connector 23 to electrically connect the RFID chip 14 in the lock bar 1 to the antenna 24 in the lock body 2, so that the
5 RFID chip 14 is in a working state. When a truck carrying the container is moved to a clearance gate and located within an effective data transmission and receiving distance of the antenna 24, such as 10 meters or more, the RFID chip 14 is able to receive via the antenna
10 24 a signal transmitted from a reader at the clearance gate. The RFID chip 14 is thereby triggered by the received signal to send out a data signal thereof via the antenna 24. The data signal of the RFID chip 14 is received by the reader and transferred to a computer
15 host for processing. Therefore, the electronic container lock could be read by an external reader without the need of being equipped with a power source, and meets the requirement of container clearance automation.

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When the electronic container lock of the present invention is unlocked, the cable connector 13 and the mating connector 23 are disconnected from each other, and the RFID chip 14 is sealed in the lock bar 1. The
25 internal space 111 of the metal tubular member 11 of the lock bar 1 blocks the receiving of any external

electromagnetic wave and transmission of any internal
electromagnetic signal, ensuring that the data of the
RFID chip 14 is not read via human body induction when
the electronic container lock is unlocked. Meanwhile,
5 a container cargo owner can be duly reminded of an
unlocked electronic container lock when the container
passes the customs clearance and the data of the RFID
chip 14 could not be read.

10 The present invention has been described with a
preferred embodiment thereof and it is understood that
many changes and modifications in the described
embodiment can be carried out without departing from
the scope and the spirit of the invention that is intended
15 to be limited only by the appended claims.

What is claimed is:

1. A power-free electronic container lock with UHF omnidirectional antenna, comprising:

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a lock bar having an RFID chip and a cable connector embedded therein to electrically connect to each other, wherein the RFID chip is electrically connected to the cable connector with an impedance
10 matcher provided between the RFID chip and the cable connector, the lock bar is a first hollow metal member, and the RFID chip, the cable connector and the impedance matcher are embedded in an internal space defined by the first hollow metal member; and

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a lock body being internally provided with a mating connector corresponding to the cable connector, and an antenna connected to the mating connector, wherein the antenna is a spiral antenna, the lock body is
20 a second hollow metal member matching with the lock bar; the mating connector being embedded in a space defined in the second hollow metal member; and the antenna being outward projected from the second hollow metal member.

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2. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 1, wherein the RFID chip is electrically connected to the cable connector via a cable.
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3. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 1, wherein the lock bar includes a metal tubular member and a lock bar case covering a middle and a top portion of the metal tubular member; the metal tubular member defining an internal space, and the cable connector being embedded in the internal space near a bottom portion of the metal tubular member; the RFID chip being embedded in the lock bar case; and the cable connecting the RFID chip to the cable connector being extended through the internal space of the metal tubular member.
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4. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 3, wherein the lock bar case is made of a rubber-plastic material to cover the middle and top portion of the metal tubular member.
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- 25 5. The power-free electronic container lock with UHF

omnidirectional antenna as claimed in claim 4,
wherein the rubber-plastic material is ABS
(Acrylonitrile butadiene styrene).

- 5 6. The power-free electronic container lock with UHF
omnidirectional antenna as claimed in claim 3,
wherein the metal tubular member includes a flared
conical metal block provided at the top portion
thereof.

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7. The power-free electronic container lock with UHF
omnidirectional antenna as claimed in claim 3,
wherein the lock body includes a metal sleeve and
a rubber-plastic case enclosing the metal sleeve
15 therein; the metal sleeve being adapted to fitly
receive the metal tubular member of the lock bar
therein, the mating connector being embedded in the
metal sleeve, and the antenna being outward projected
from the rubber-plastic case.

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8. The power-free electronic container lock with UHF
omnidirectional antenna as claimed in claim 1,
further comprising an antenna hood mounted on and
around the hollow metal member.

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9. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 8, further comprising an antenna hood mounted on and around the rubber-plastic case.

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10. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 1, wherein the hollow metal member of the lock bar is provided on an outer surface with two annular grooves, and the hollow metal member of the lock body is provided on an inner surface with two retaining springs; such that the retaining springs are aligned and engaged with the two annular grooves on the outer surface of the hollow metal member of the lock bar when the lock bar is extended into the lock body to a locked position.

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11. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 7, wherein the metal tubular member of the lock bar is provided on an outer surface with two annular grooves, and the metal sleeve of the lock body is provided on an inner surface with two retaining springs; such that the retaining springs are aligned and engaged with the two annular grooves on the outer

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surface of the metal tubular member of the lock bar when the lock bar is extended into the lock body to a locked position.

- 5 12. The power-free electronic container lock with UHF omnidirectional antenna as claimed in claim 7, wherein the lock body is internally provided with a seal ring to seal a clearance between the lock bar and the lock body.