

# INDUCTION GATE FOR PARKING LOT AND TOLL COLLECTION EQUIPMENT USING THE SAME

## FIELD OF THE INVENTION

**[0001]** The present invention relates to an induction device, and more particularly to an induction device for a parking lot and toll collection equipment using the same.

## BACKGROUND OF THE INVENTION

**[0002]** In a conventional parking lot, a ticket card machine and a lifting fence are disposed at the entrance. When a vehicle travels to the front of the lifting fence and the vehicle driver picks up a ticket card from the ticket card machine, the lifting fence is automatically lifted and then the driver can drive the vehicle into the parking lot. Similarly, another ticket card machine and another lifting fence are also disposed at the exit of the parking lot. In addition, a sensing device for sensing vehicles is also disposed at the entrance and exit of a conventional parking lot to lower the lifting fence after a vehicle passes through the lifting fence.

**[0003]** Conventionally, an induction coil of an induction device is disposed under a land of a parking lot, therefore, it is necessary to dig a groove, for example, 15 cm from the land surface to dispose the induction coil. However, if the induction device is disposed on the second or higher floor, the induction coil may be not disposed at a specific position due to the limit of the floor thickness. In addition, it may be difficult to dispose the induction coil if the land surface of an outdoor parking lot is not flat. In addition, under the structure that the induction coil is disposed under the land surface, some problems such as poor induction or

mis-induction may happen. For example, a poor induction may happen if the chassis of a vehicle is too far from the ground (a raised chassis). In addition, when a passenger carrying a metal objects passes behind the lifting fence, the induction coil may be induced by the metal object and an erroneous contact may occur accordingly.

## SUMMARY OF THE INVENTION

[0004] The present invention provides an induction gate for improving the problems that the disposition of a conventional induction device is easily limited by environment and having poor induction or mis-induction.

[0005] The present invention further provides a toll collection equipment of a parking lot for improving the problem that the disposition of a conventional induction device is easily limited by environment and providing the function of reading the payment information.

[0006] In order to achieve the above-mentioned advantages, the present invention provides an induction gate for a parking lot. The induction gate includes a door frame and an induction device. The door frame is disposed in a lane of the parking lot. The induction device includes an induction coil disposed around the door frame and the lane and to stand on the lane.

[0007] In one embodiment of the present invention, the aforementioned door frame includes a main body and a plurality of support columns. The main body is opposite to the lane. The support columns stand on the lane and support the main body. The induction coil is disposed along the support columns and the main body. A part of the induction coil opposite to the main body is connected to the lane.

**[0008]** In one embodiment of the present invention, the aforementioned induction gate further includes a protective cover disposed to cover the part of the induction coil opposite to the main body.

**[0009]** In one embodiment of the present invention, the aforementioned induction device further includes a magnetic wave absorbing element disposed along the induction coil.

**[0010]** In one embodiment of the present invention, a thickness of the aforementioned magnetic wave absorbing element is between 0.12 mm and 2.5 mm.

**[0011]** In one embodiment of the present invention, a material of the aforementioned magnetic wave absorbing element includes a magnetic powder, a rubber or a halogen.

**[0012]** In one embodiment of the present invention, the aforementioned induction gate further includes at least one vehicle detection device disposed on the door frame.

**[0013]** In one embodiment of the present invention, the aforementioned induction gate further includes a fence device disposed on one side of the door frame and electrically connected to the induction device.

**[0014]** In order to achieve the above-mentioned advantages, the present invention further provides a toll collection equipment of a parking lot. The toll collection equipment includes an induction element and the aforementioned induction gate. The induction element is disposed on a vehicle. The induction coil of the induction gate is configured to induct the induction element when the vehicle passes through the door frame.

**[0015]** In one embodiment of the present invention, the aforementioned toll collection equipment further includes a base disposed

on the vehicle. The induction element is fixed on the base. The base includes a magnetic wave absorbing sheet.

**[0016]** In one embodiment of the present invention, the aforementioned toll collection equipment further includes a base disposed on the vehicle. The induction element is fixed on the base. The base includes an inductive signal enhancement coil.

**[0017]** In summary, in the induction gate of the embodiment of the present invention, because the induction coil is disposed to stand on a land instead of being under the road, the problem caused by the disposition of a conventional induction device being easily limited by environment is solved. Further, in the toll collection equipment of a parking lot of the embodiment of the present invention, because a vehicle can pass through the induction coil, the inducing effect is increased; therefore, the problem of poor induction or mis-induction of the conventional technology is improved and the function of reading the payment information is provided.

#### BRIEF DESCRIPTION OF THE DRAWING

**[0018]** FIG. 1 is a schematic view of an induction gate in accordance with an embodiment of the present invention;

**[0019]** FIG. 2 is a schematic view of a toll collection equipment of a parking lot in accordance with an embodiment of the present invention;

**[0020]** FIG. 3 is a schematic view of a base and an induction element of a toll collection equipment of a parking lot in accordance with an embodiment of the present invention; and

**[0021]** FIG. 4 is a schematic view of a base and an induction element of a toll collection equipment of a parking lot in accordance with another embodiment of the present invention.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

**[0022]** The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only. It is not intended to be exhaustive or to be limited to the precise form disclosed.

**[0023]** FIG. 1 is a schematic view of an induction gate in accordance with an embodiment of the present invention. As shown in FIG. 1, the induction gate 100 of the present embodiment is applied to a parking lot and includes a door frame 110 and an induction device 120. The door frame 110 is disposed in a lane A of the parking lot. The induction device 120 includes an induction coil 121. The induction coil 121 is disposed around the door frame 110 and the lane A and stand on the lane A. The induction gate 100 is disposed, for example, in the lane A at the entrance or exit of the parking lot, and the present invention does not limit any device incorporating the induction gate 100 for the access control. For example, the induction gate 100 may further incorporate a fence device 130. The fence device 130 is, disposed for example, in the lane A, adjacent to an outlet side of the door frame 110 and electrically connected to the induction device 120. The specific structures and dispositions of the door frame 110, the induction device 120 and the fence device 130 are not limited to those shown in FIG. 1.

**[0024]** The door frame 110 includes a main body 111 and a plurality of support columns 112. The main body 111 is opposed to the lanes A, and the support columns 112 stand on the lane A and support the main body 111. The induction coil 121 is disposed along the support columns

112 and the main body 111, and a part of the induction coil 121 which is opposite to the main body 111 is connected to the lane A. The number of the support columns 112 is, for example, two, and the two ends of each support column 112 are respectively connected to the main body 111 and the lane A. However, the number and disposition of the support columns 112 are not limited to those shown in FIG. 1. The number of the support columns 112 may be more than two, or the support columns 112 may be inclined with respect to the lane A. In addition, the main body 111 and the support columns 112 are made of, for example, non-metallic materials, so as to prevent the electromagnetic interference of the door frame 111 on the induction device 120. The aforementioned non-metallic materials include, for example, plastic, rubber, glass, acrylic or ceramic.

**[0025]** The induction coil 121 of the present embodiment is disposed, for example, around the door frame 110 and the lane A one or more turns (FIG. 1 is exemplified by a plurality of turns). The induction coil 121 is located, for example, inside the support columns 112 and the main body 111 of the door frame 110, or, may be located outside the support columns 112 and the main body 111, and is not limited to that shown in FIG. 1. In addition, the induction gate 100 may further include a protective cover 140. The protective cover 140 is disposed to cover a part of the induction coil 121 opposite to the main body 111, that is, a part of the induction coil 121 disposed in the lane A, thereby preventing the induction coil 121 from being crushed and damaged by a vehicle (not shown). The specific shape of the protective cover 140 is not limited to that shown in FIG. 1, and the material of the protective cover 140 may be the same as that of the door frame 110.

**[0026]** In addition, in order to further enhance the inducting effect of

the induction device 120, the induction device 120 may further include a magnetic wave absorbing element 122. The magnetic wave absorbing element 122 is disposed along the induction coil 121; for example, the magnetic wave absorbing element 122 may be disposed around the induction coil 121. The magnetic wave absorbing element 122 may be disposed on the rear side of the induction coil 121 (the outlet side of the door frame 110), or the magnetic wave absorbing element 122 may be disposed in the door frame 110. In addition, the magnetic wave absorbing element 122 may be disposed in the protective cover 140. The thickness D of the magnetic wave absorbing element 122 is, for example, between 0.12 mm and 2.5 mm, and the length and width of the magnetic wave absorbing element 122 can be adjusted in accordance with the overall size of the induction coil 121. The magnetic wave absorbing element 122 is, for example, a magnetic dielectric, and may include magnetic powder, rubber or halogen. Thus, the magnetic wave absorbing element 122 of the present embodiment can reduce the electromagnetic interference caused by the metallic object in the environment to further enhance the inducing effect, thereby increasing the efficiency and sensitivity of the induction device 120.

**[0027]** Because the induction gate 100 of the present embodiment disposes the induction coil 121 around the door frame 110 and the lane A to stand on the lane A, the induction gate 100 is suitable for inducing a vehicle. Further, because the induction coil 121 is not disposed under the lane A, the disposition of the induction gate 100 is not limited by the environment. In addition, compared with the conventional structure in which the induction coil 121 is disposed under the ground, the induction gate 100 of the present embodiment can provide a better inducing effect

by allowing a vehicle passing through the induction coil 121, thereby avoiding the problem caused by poor induction or mis-induction in prior art. In addition, the induction gate 100 of the present embodiment may be designed to sense whether a vehicle passes or not, and the fence device 130 of the parking lot is lowered (or close) when the vehicle passes.

**[0028]** Please refer to FIG. 1 again. The induction gate 100 of the present embodiment further includes, for example, at least one vehicle detection device 150 (FIG. 1 is exemplified by a plurality of vehicle detection devices 150). The vehicle detection device 150 is disposed on the door frame 110 and configured to detect a vehicle, such as detecting a distance between the vehicle and the door frame 110 or the plate number of the vehicle or identifying an identification element (e.g., a radio frequency identification element) on the vehicle. The detection device 150 may include an ultrasonic detecting device, an optical detecting device, an image capturing device, a radio frequency identification detecting device, etc; however, the present invention does not limit the number and type of the detection device 150. The aforementioned optical detecting device is, for example, an infrared ray detecting device or a laser detecting device. The aforementioned radio frequency identification detecting device can be used to read the radio frequency identification element on the vehicle, so that the parking fee can be registered or paid. The aforementioned image capturing device can detect the plate of the vehicle by combining the optical character recognition (OCR) technique.

**[0029]** In addition, the induction gate 100 of the present embodiment may further include a ticket card device 160 and a communication device 170. The ticket card device 160 and the communication device 170 are

disposed in the lane A, and the communication device 170 may be disposed on the ticket card device 160. However, the specific positions of the ticket card device 160 and the communication device 170 are not limited to those shown in FIG. 1; for example, the ticket card device 160 and the communication device 170 may be disposed inside one of the support columns 112. The ticket card device 160 is electrically connected to the induction device 120 and the fence device 130. The ticket card device 160 is configured to determine whether there is a vehicle via a ticket card (not shown), thereby lifting (or opening) the fence device 130. The communication device 170 is configured to communicate with the parking lot manager.

**[0030]** The induction coil 121 may also be designed to induct an induction element within a vehicle B. FIG. 2 is a schematic view of a toll collection equipment of a parking lot in accordance with an embodiment of the present invention. As shown in FIG. 2, the toll collection equipment 200 of a parking lot of the present embodiment includes an induction element 210 and the aforementioned induction gate 100. The induction coil 121 of the induction gate 100 is configured to induct the induction element 210 while the vehicle B passes through the door frame 110. The induction element 210 is, for example, a card having a passive induction coil, such as a radio frequency identification card. The present invention does not limit the type of the induction element 210 as long as the induction element 210 is able to induct with the induction coil 121.

**[0031]** The toll collection equipment 200 of a parking lot of the present embodiment is configured to provide registration or payment of a parking fee. Specifically, when the vehicle B is to enter the parking lot, the induction gate 100 disposed at the entrance of the parking lot inducts

the induction element 210 of the vehicle B to record the entry time of the vehicle B (for a parking lot open to the public) or identify whether or not the vehicle B is allowed to enter (for a parking lot for particular users). The fence device 130 is determined to be lifted (or open) or not after the induction is completed. When the vehicle B is to leave the parking lot, the induction gate 100 disposed at the exit of the parking lot inducts the induction element 210 of the vehicle B to discriminate whether the vehicle B can leave or to complete the payment directly by way of induction charging. The fence device 130 is determined to be lifted (or open) or not after the induction is completed. In addition, in other embodiments, the toll collection equipment 200 of a parking lot may perform the registration or payment of parking fees by other means, such as the vehicle detection device 150 (a radio frequency identification detection device) in FIG. 1, or via the vehicle detection device 150 (an image capture device) or the ticket card device 160 to achieve the similar function.

**[0032]** FIG. 3 is a schematic view of a base and an induction element of a toll collection equipment of a parking lot in accordance with an embodiment of the present invention. Please refer to FIGs. 2 and 3 together. The toll collection equipment 200 of a parking lot of the present embodiment further includes, for example, a base 220. The base 220 is adapted to be disposed on the vehicle B, and the induction element 210 is adapted to be fixed on the base 220. Specifically, the base 220 is disposed, for example, inside a windshield of the vehicle B. The base 220 has an accommodating slot 221, and the induction element 210 is disposed, for example, in the containing slot 221. However, the specific shape of the base 220 is not limited to that shown in FIG. 3. In addition, the base 220 may further include, for example, a magnetic wave absorbing

sheet 222, and the material of the magnetic wave-absorbing sheet 222 may be the same as that of the magnetic wave absorbing device 122 shown in FIG. 1, thereby enhancing the inducing effect.

**[0033]** FIG. 4 is a schematic view of a base and an induction element of a toll collection equipment of a parking lot in accordance with another embodiment of the present invention. As shown in FIG. 4, the base 220 of the present embodiment further includes, for example, an inductive signal enhancement coil 223. Since the inductive signal enhancement coil 223 is disposed close to the induction element 210, the mutual inductance between the induction coil 121 and the induction element 210 can be increased and the induction effect is improved accordingly.

**[0034]** In summary, in the induction gate of the embodiment of the present invention, because the induction coil is disposed to stand on a land instead of being under the road, the problem caused by the disposition of a conventional induction device being easily limited by environment is solved. Further, in the toll collection equipment of a parking lot of the embodiment of the present invention, because a vehicle can pass through the induction coil, the inducing effect is increased; therefore, the problem of poor induction or mis-induction of the conventional technology is improved and the function of reading the payment information is provided.

**[0035]** While the invention has been described in terms of what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention needs not be limited to the disclosed embodiment. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar

structures.

## WHAT IS CLAIMED IS:

1. An induction gate for a parking lot, comprising:
  - a door frame, disposed in a lane of the parking lot; and
  - an induction device, comprising an induction coil disposed around the door frame and the lane and to stand on the lane.
2. The induction gate according to claim 1, wherein the door frame comprises a main body and a plurality of support columns, the main body is opposite to the lane, the support columns stand on the lane and support the main body, the induction coil is disposed along the support columns and the main body, and a part of the induction coil opposite to the main body is connected to the lane.
3. The induction gate according to claim 2, further comprising a protective cover disposed to cover the part of the induction coil opposite to the main body.
4. The induction gate according to claim 1, wherein the induction device further comprises a magnetic wave absorbing element disposed along the induction coil.
5. The induction gate according to claim 4, wherein a thickness of the magnetic wave absorbing element is between 0.12 mm and 2.5 mm.
6. The induction gate according to claim 4, wherein a material of the magnetic wave absorbing element comprises a magnetic powder, a rubber or a halogen.

7. The induction gate according to claim 1, further comprising at least one vehicle detection device disposed on the door frame.

8. The induction gate according to claim 1, further comprising a fence device disposed on one side of the door frame and electrically connected to the induction device.

9. A toll collection equipment of a parking lot, comprising:  
an induction element, disposed on a vehicle; and  
the induction gate as claimed in any one of claims 1 to 8, wherein the induction coil of the induction gate is configured to induct the induction element when the vehicle passes through the door frame.

10. The toll collection equipment according to claim 9, further comprising a base disposed on the vehicle, wherein the induction element is fixed on the base, and the base comprises a magnetic wave absorbing sheet.

11. The toll collection equipment according to claim 9, further comprising a base disposed on the vehicle, wherein the induction element is fixed on the base, and the base comprises an inductive signal enhancement coil.