PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Parking Equipment

We, HITACHI LIMITED, a Japanese body corporate of 4, 1-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to parking equipment, and more particularly to a system of detecting full and empty parking cages which is especially suitable for a parking building in which parking lots are disposed in vertically spaced relation for endless circulation, that is, a parking building of so-called merry-go-round type.

Generally, presence or absence of automotive vehicles in a plurality of parking cages in a parking building of the merry-go-round type has heretofore been indicated by a system in which means such as a plurality of snap switches or key switches, one for each parking cage, are provided and mechanically manipulated by a care-taker on his judgment, or by a system in which detecting means is provided for each parking cage. However, these systems have been defective in that, in the former system, the switches must be manipulated each time any one cage is filled or emptied, while a high installational cost is required in the latter system.

The present invention has for its object to eliminate the above drawbacks of the prior systems and to provide parking equipment having single full-empty detecting means by which presence or absence of automotive vehicles in a plurality of parking cages can safely and accurately be detected in an automatic manner and signalled in a highly efficient manner.

The present invention is thus characterized in that presence of absence of automotive vehicles in a plurality of parking cages can always be ascertained by the single full-empty detecting means.

According to the invention, there is provided parking equipment comprising an outer structure, a plurality of parking cages arranged in vertically spaced apart relation in said outer structure, means for driving said parking cages for endless circulation, a predetermined position in said outer structure at which an automotive vehicle enters and leaves said parking cages, full-empty detecting means operative in response to stoppage of any one of said parking cages at said predetermined position for detecting presence or absence of an automotive vehicle in said parking cage, memory means for storing a memory of what is detected by the detecting means, and means for altering the memory, if necessary, in dependence upon what is detected by the detecting means when the latter acts again on the same parking cage.

There are other objects and particularities of the invention which will become obvious from the following description with reference to the accompanying drawings, in which:

Fig. 1 is a schematic side elevational view of parking equipment embodying the invention;

Fig. 2 is a schematic front elevational view of the parking equipment;

Fig. 3 is a front elevational view of a filled parking cage situated at an entrance and exit of the parking equipment, showing a relation between the parking cage and an arrangement of photoelectric means as one form of full-empty detecting means of the invention;

Fig. 4 is a plan view of Fig. 3; and

Fig. 5 is a circuit diagram of one form of a signal circuit of the invention.

A preferred embodiment of the invention

[Price 4s. 6d.]

will now be explained with reference to the drawings. For convenience of explanation, it is assumed that the parking equipment of the invention includes sixteen parking cages therein and photo-electric means are employed as a most preferred form of full-empty detecting means.

Referring to Figs. 1 and 2, there is shown an outer structure 1 of the parking building in which an endless chain 2 is vertically movably disposed. The endless chain 2 is driven by a main drive gear 3 and supported at opposite ends by follower sprocket wheels 4 and 4'. Parking cages C_1-C_{16} are suspended in equally spaced apart relation from the endless chain 2. In Figs. 1 and 2, it will be seen that the parking cages C_1, C_2, C_9 and C_{10} are only shown in which C_1 and C_{10} are filled, while C_2 and C_9 are empty.

In Figs. 3 and 4, one of the parking cages C_1 is shown as carrying therein an automotive vehicle T and resting at the lowermost position shown in Fig. 2, that is, an entrance and exit of the parking building. However, it will be understood that the entrance and exit may be provided at any position in the parking building. Full-empty detecting means PH_1-PH_3 in the form of photoelectric means are disposed on opposite walls of the position at which the parking cage C_1 is at rest.

Fig. 5 shows one form of a signal circuit adapted for the invention, which is energized by a power source indicated at (+) and (−). The signal circuit includes signalling relays K_1-K_{16}, which are actually so-called keep relays. The keep relay operates in a manner that it is energized when excited at the side A thereof, held in the energized state even when excitation at the side A is ceased, and deenergized when excited at the side B thereof. Thus, the relays K_1-K_{16} can be used as memory means. Symbols K_{1a}-K_{16a} and K_{1b}-K_{16b} denote auxiliary contacts of the keep relays K_1-K_{16}. Hereinafter, normally open or make contacts and normally closed or break contacts of relays are suffixed with *a* and *b*, respectively, to clearly distinguish the former from the latter.

Symbols P_1-P_3 indicate auxiliary relays of the respective photoelectric means PH_1-PH_3 and are connected to the power source in a manner that they are energized by respective contacts PH_{1a}-PH_{3a} which are closed whenever beams of the photoelectric means PH_1-PH_3 are intercepted by the vehicle T. Symbols F_1-F_{16} indicate full-cage indicating lamps for the respective parking cages C_1-C_{16} and are arranged to be lit when the respective signalling relays K_1-K_{16} are energized. Symbols E_1-E_{16} indicate empty-cage indicating lamps for the respective parking cages C_1-C_{16} and are arranged to be lit when the respective signalling relays K_1-K_{16} are in their deenergized state. Symbols S_1-S_{16} denote relays which are energized when the respective parking cages C_1-C_{16} come to rest at the vehicle entrance and exit. For the sake of avoiding any confusion, driving coils of the relays S_1-S_{16} are not illustrated.

A full-cage detecting relay G is provided in the circuit and connected to the signalling relays K_1-K_{16} through contacts of the auxiliary relays P_1-P_3 for the photoelectric means so that it may be energized when an automotive vehicle T gets into any one parking cage resting at the vehicle entrance and exit and takes a normal position in the parking cage. A relay is provided which is energized when the parking cages C_1-C_{16} are driven for endless circulation by the rotation of the endless chain 2 which is driven by the main drive gear 3 in Fig. 2. An auxiliary contact 10b of this relay is closed only when the parking cages are not in operation.

Now, assume that all of the parking cages C_1-C_{16} are empty. Since, in this case, the contacts PH_{1a}-PH_{3a} of the photoelectric means PH_1-PH_3 are kept open, the full-cage detecting relay G continues to be deenergized and all of the full-empty signalling relays K_1-K_{16} are inoperative. Therefore, the empty-cage indicating lamps E_1-E_{16} are lit by the closure of the respective contacts K_{1b}-K_{16b} to indicate that all of the parking cages C_1-C_{16} are now empty. Suppose that, under this condition, an automotive vehicle T gets into the parking cage C_1 which is at rest at the vehicle entrance and exit and takes the normal position in the cage as shown in Figs. 3 and 4. Then, the beam of the photoelectric means PH_2 is solely intercepted and its contact PH_{2a} is closed in Fig. 5. Therefore, the auxiliary relay P_2 is energized by a circuit of (+)-10_b-PH_{2a}-P_2-(−) and its contact P_{2a} is urged to the closed position. By the closure of the contact P_{2a}, the full-cage detecting relay G is energized by a circuit of (+)-10_b-P_{2a}-P_{1b1}-P_{3b1}-G-(−) and its contact G_a is urged to the closed position. Since the parking cage C_1 is at rest at the vehicle entrance and exit, the contact S_{1a1} is closed and the full-empty signalling relay K_1 associated with the parking cage C_1 is energized by a circuit of (+)-10_b-G_a-S_{1a1}-K_1-(−) to close its contact K_{1a}, resulting in the lighting of the full-cage indicating lamp F_1 associated with the parking cage C_1.

Explanation will next be made with regard to a case of bringing the empty cage C_2 to the vehicle entrance and exit for parking another vehicle therein. As the parking cage C_2 is moved to the entrance and exit, all of the contacts 10_b, G_a and S_{1a} are opened, but the keep relay K_1 as the memory means is kept in its energized state,

and the full-cage indicating lamp F_1 associated with the cage C_1 is kept lit. When the empty parking cage C_2 is finally brought to a halt at the vehicle entrance and exit, the contacts 10_b, S_{2a1} and S_{2a2} are closed. Therefore, the keep relay K_2 is excited at its side B by a circuit of (+)-10_b-G_b-P_{1b2}-P_{3b2}-S_{2a2}-K_2 (side B)-(−), but would not be energized and the lamp E_2 is still indicating that the parking cage C_2 is empty. Now, an automotive vehicle gets into the parking cage C_2 and intercepts the beam of the photoelectric means PH_2. The auxiliary relay P_1 is energized by the closure of the contact PH_{1a}, but the full-cage detecting relay G is not energized. The full-cage detecting relay G is held from energization and the signal device remains intact as long as the beam from the photoelectric means PH_1 is kept intercepted, even when the beam from the photoelectric means PH_2 is intercepted to close its contact PH_{2a} which thereby energized the auxiliary relay P_2 to close its contact P_{2a}.

Then, when the vehicle is further advanced into the cage until it takes the position as shown in Fig. 4 at which the rear portion of the vehicle body no more intercepts the beam from the photoelectric means PH_1, the contact P_{1b1} is closed and the full-cage detecting relay G is energized by a circuit of (+)-10_b-P_{2a}-P_{1b1}-P_{3b1}-G-(−). This full-cage detecting relay G acts as a transfer means for altering the memory stored in the keep relay K_2 working as the memory means. Or more precisely, by the closure of its contact G_a, the full-empty signalling relay K_2 associated with the parking cage C_2 is energized by a circuit of (+)-10_b-G_a-S_{2a1}-K_2 (side A)-(−) so that the full-cage indicating lamp F_2 is lit by a circuit of (+)-K_{2a}-F_2-(−) and at the same time the empty-cage indicating lamp E_2 is deenergized. As described with regard to the former case, this condition is maintained even after the parking cage C_2 is moved upwardly away from the vehicle entrance and exit.

Then, consider a case wherein the parking cage C_{15} (not shown) is full and an automotive vehicle therein is taken out. Since the cage C_{15} is full, the keep relay K_{15} is kept in its energized state and the full-cage indicating lamp F_{15} associated with the cage C_{15} is lit by a circuit of (+)-K_{15a}-F_{15}-(−). When now the endless chain 2 is rotated and the train of the parking cages starts to move, the contact 10_b is urged to the open position to cut off the signal control circuit from the power source. All of the keep relays K_1-K_{16} remain in their respective states and the full-cage indicating lamp F_{15} remains lit. When the parking cage C_{15} is brought down to the vehicle entrance and exit and brought to a halt thereat, the contacts 10_b, S_{15a1} and S_{15a2} are closed. The relay G is energized as soon as the parking cage C_{15} carrying therein the vehicle comes to rest at the vehicle entrance and exit as shown in Fig. 4. When, under this condition, the vehicle moves backwardly to get out of the parking cage C_{15} and in its backward movement intercepts the beam from the photoelectric means PH_1 with its rear portion of the body, the contact P_{1b1} is urged to the open position and the full-cage detecting relay G having been energized is now released, resulting in the opening of the contact G_a and closure of the contact G_b. When the vehicle further moves backwardly and finally completely gets out of the parking cage C_{15}, the contact P_{1b2} is closed and the keep relay K_{15} is excited at the side B by a circuit of (+)-10_b-G_b-P_{1b2}-P_{3b2}-S_{15a2}-K_{15} (side B)-(−) and is therefore deenergized. By the deenergization of the keep relay K_{15}, the contact K_{15a} is now open and the contact K_{15b} is closed. Therefore, the full-cage indicating lamp F_{15} associated with the parking cage C_{15} is deenergized and the empty-cage indicating lamp E_{15} is now lit to indicate that the parking cage C_{15} is now empty. It will be readily known that, by successive repetition of the above operations, it is possible to indicate at all times the full or empty state of the parking cages C_1-C_{16}.

WHAT WE CLAIM IS:

1. Parking equipment comprising an outer structure, a plurality of parking cages arranged in vertically spaced relation in said outer structure, means for driving said parking cages for endless circulation, a predetermined position in said outer structure at which an automotive vehicle enters and leaves said parking cages, full-empty detecting means operative in response to stoppage of any one of said parking cages at said predetermined position for detecting presence or absence of an automotive vehicle in said parking cage, memory means for storing a memory of what is detected by the detecting means, and means for altering the memory if necessary, in dependence upon what is detected by the detecting means when the latter acts again on the same parking cage.

2. Parking equipment substantially as hereinbefore described with reference to and as shown by the accompanying drawings.

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and the full-cage indicating lamp F_1 associated with the cage C_1 is kept lit. When the empty parking cage C_2 is finally brought to a halt at the vehicle entrance and exit, the contacts 10_b, S_{2a1} and S_{2a2} are closed. Therefore, the keep relay K_2 is excited at its side B by a circuit of (+)-10_b-G_b-P_{1b2}-P_{3b2}-S_{2a2}-K_2 (side B)-(−), but would not be energized and the lamp E_2 is still indicating that the parking cage C_2 is empty. Now, an automotive vehicle gets into the parking cage C_2 and intercepts the beam of the photoelectric means PH_0. The auxiliary relay P_1 is energized by the closure of the contact PH_{1a}, but the full-cage detecting relay G is not energized. The full-cage detecting relay G is held from energization and the signal device remains intact as long as the beam from the photoelectric means PH_1 is kept intercepted, even when the beam from the photoelectric means PH_2 is intercepted to close its contact PH_{2a} which thereby energized the auxiliary relay P_2 to close its contact P_{2a}.

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