

PATENT SPECIFICATION

1,188,930

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Improvements in or relating to Multi-Storey Mechanical Article Storage Systems.

I, ANTHONY SIGSTON THOMPSON, a British subject, of Raglan Chambers, Harrogate, Yorkshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to multi-storey mechanical article storage systems, and is concerned with a modification or improvement of the storage system described and claimed in Application No. 32154/67 (Serial No. 1,187,510). The term article as used throughout this specification is intended to include motor vehicles such as cars, containers and the like.

Claim 1 of Application No. 32154/67 (Serial No. 1,187,510) reads as follows:—

"A multi-storey mechanical storage system comprising a number of superimposed receiving spaces for articles, disposed on at least one side of a lift shaft having a lifting structure for supporting an article and movable up and down in the lift shaft and power means for effecting that movement, an individual pallet or the like associated with each receiving space, means for reciprocally moving each pallet between a first limit position wherein the pallet is located wholly in the associated receiving space and a second limit position wherein the pallet is partly in the associated receiving space but projects substantially into the lift shaft, and means in the lift shaft for supporting a pallet when so projected into the shaft, the pallets being formed with supports so shaped and disposed that when a pallet is in its second limit position such supports will upon a relative vertical movement between the lifting structure and the pallet pass

through spaces between supports formed on the lifting structure, the arrangement being such that when a pallet is in its second limit position a defined vertical movement of the lifting structure will effect transfer of the article from the lifting structure to the pallet or from the pallet to the lifting structure and such that movement of a pallet between the limit positions will when the pallet is carrying the article cause the article to be moved from the path of the lifting structure to the respective receiving space or from the respective receiving space to the path of the lifting structure."

As disclosed in the specification of Application No. 32154/67 (Serial No. 1,187,510) movement of the pallet between its first and second limit positions took place in a direction which was substantially transverse to the supports on the pallets and on the lifting structure. If the storage system was used for storing motor cars then the car would move into and out of the receiving spaces in a direction longitudinally of the car and these spaces thus needed to have a length which would accommodate the length of a car and a width which would accommodate the width of a car. It has now been desirable in some cases to provide a storage system wherein the length of the receiving space can be the width of a car and the width of a receiving space the length of a car, and the improvement or modification described and claimed in this specification is directed to this embodiment.

According to the present invention in a multi-storey mechanical storage system according to claim 1 of Application No. 32154/67 (Serial No. 1,187,510) the supports on the pallets and on the lifting struc-

[Price 5s. 0d.]

ture extend substantially parallel to the direction of movement of the pallet when moving between its first and second limit positions.

5 Preferably each pallet comprises two spaced apart horizontal transverse members joined toward one end thereof by a longitudinal cross member to which the supports are secured to extend in cantilever fashion
10 from the cross member towards the lift shaft substantially parallel to the horizontal transverse members.

The aforesaid application described a construction wherein the pallets were moved
15 between their first and second limit positions by a rack and pinion drive operated by an electric motor. This drive system can also be applied to the modification described herein, but it has now been found
20 preferable to drive each pallet by way of a linear induction motor.

As described in the aforesaid pending application the supports on each pallet were
25 in the form of tines. Similar supports may be used in the present modification and they may be of circular, rectangular or square cross-section. It may be found however, that when storing motor cars the contact
30 area between the car tyres and the tines is quite small so giving a high contact pressure and unduly stressing the tyres. Accordingly a further improvement consists in making each tine of circular cross-section
35 and mounting thereon a part-cylindrical sleeve member for rotation about the axis of the tine, a plate being secured to the sleeve member, the longitudinal axis of the plate being parallel to the longitudinal axis
40 of the tine and the width of the plate being less than the distance between adjacent supports on the lifting structure.

Embodiments of storage systems according to the invention will now be described in more detail, by way of example, with reference to the accompanying drawings in
45 which:—

Figure 1 is a side elevation of a multi-storey car parking system;

Figure 2 is a section on the line II—II of
50 Figure 1;

Figure 3 is a schematic view of the system showing a sequence of car parking operations;

Figure 4 is a similar view to Figure 3 showing part of the system in more detail;

Figure 5 is a part end elevation part section of the system; and

Figure 6 shows a cross-section of a tine structure which may be used in the system.

60 Referring to Figures 1 and 2 of the drawings there is shown a multi-storey mechanical car parking system comprising a vertically extending open frame-work which provides a lift shaft indicated at 10 and on
65 either side of the lift shaft further shafts 11

which are divided into vertically spaced compartments or receiving spaces 12 in which cars may be parked.

The framework comprises four I-section vertically extending columns 13 spaced
70 apart at the corners of a rectangle. The lift shaft 10 is defined within the rectangle by four further vertically extending columns 14 also spaced apart at the corners of a rectangle and located so as to leave said further
75 shafts 11 on either side of the lift shaft 10.

The framework is divided into a number of levels by horizontal beams 15 which connect the columns together and thereby render the framework rigid. The columns 13
80 are also connected to the columns 14 by X-braces 16 which further stiffen the framework and further X-braces (not shown) connect the columns 13 at each end of the structure together.

Working within the lift shaft is a lift frame 18 referred to in greater detail later. Extending along each of the columns 14 and around sprockets 19 and 20 at the upper
90 ends of the columns are chains 21. The sprockets 19 and 20 are drivably rotated in either direction by a motor (not shown). One end of each of the chains is secured to a corner of the lift frame and a counterweight 22 is secured to the other end.

As best seen in Figures 2 and 4 the lift frame 18 comprises a base portion 23 from which a number of spaced supports 24 project upwardly. End members 25 and 26 are
100 secured to the base portion 23, and the end members are secured to the chains 21.

In each of the compartments 12 there is arranged a pallet 27 on which a car is supported during parking in the compartment.
105 The pallet comprises two spaced apart horizontal transverse members 28 and 29 joined together toward the end remote from the lift shaft 10 by a longitudinal cross member 30. A plurality of supports in the form of tines 31 are secured to the cross
110 member 30 to extend therefrom in cantilever fashion towards the lift shaft 10 substantially parallel to the horizontal transverse members 28 and 29. The tines 31 may be secured to the cross member 30 in any convenient manner. The outer ends of the cantilevered tines 31 and the tines closest to the transverse members 28 and 29 may be raised above the level of the remaining tines of the pallet to prevent a car supported on the tines from inadvertently moving off the pallet.

The pallet is movably arranged so that it can be moved into the lift shaft to receive a car from the lift frame 18 as will be described later. The pallet is supported at
125 each side by three wheels 31, 32 and 33, each wheel being mounted on a stub shaft depending from the respective transverse member 28 or 29. The wheels engage
130

each side of the receiving compartment, and similar tracks 35 are continued across the side of the lift shaft level with the tracks in each receiving space. The tracks in the lift shaft are broken toward each end thereof to allow passage of the chains 21 and end members 25 and 26. A single wheel 31 is provided toward the end of the transverse member lying further from the lift shaft, and a pair of wheels 32 and 33 are provided at the end of the transverse member nearer the lift shaft.

The pallet is driven out of and into its compartment by a reversible linear induction motors 36 mounted at both sides of each compartment 12 so that each motor co-operates with a transverse horizontal member 28 or 29 of the pallet. The members 28 and 29 are formed with an extension which projects past the cross member 30 to the side thereof remote from the lift shaft 10, so that the motors can drive the pallet to and from its limit position in the lift shaft. The linear induction motors 36 operate in well known manner to drive the pallet either towards or away from the lift shaft. Conventional control means are provided for the linear induction motor and are arranged so that the pallet can be stopped accurately at either of its two limit positions.

The system is arranged to be substantially completely under automatic control. For this purpose indicating means are provided at ground level to show which of the compartments are vacant, and selector mechanism is provided for selecting a compartment into which a car is to be despatched. The car is manoeuvred onto the lifting frame 18 which is at the bottom of its travel whereupon the motor which drives the sprockets 19 and 20 is set into operation and is automatically stopped by control means (not shown) when the structure reaches a position wherein the tops of supports 24 lie slightly above the level of the tines 31 of a pallet situated in the selected compartment as shown in the top arrangement of Figure 3 and the base portion 23 lies below the level of the tines 31. The switch mechanism for operating the pallet is then actuated so that the pallet is moved into the lift shaft as shown in the centre arrangement of Figure 3. Towards the end of the movement of the pallet the linear induction motors 36 are controlled to stop the pallet accurately in the required position, and at the same time a switch is actuated which commences lowering of the lifting frame. The supports 24 of the lifting frame and the tines 31 of the pallet are so dimensioned and positioned that when the pallet is in its second limit position the supports of the lifting frame pass through the spaces

between the tines of the pallet and vice versa, and the tines lie above the base 23. By lowering the lifting frame the car on the lifting frame is thereby transferred to the pallet. When the car has been deposited on the pallet a switch associated with the motors 36 is actuated so that the motors move the pallet with the car on it into the compartment as shown in the bottom view of Figure 3. When the pallet is nearly in the compartment the linear induction motors operate to bring the pallet to a halt in the required first limit position. In the meantime the lifting frame would have returned to ground level and its motor switch (not shown) will have been operated for de-energising its motor.

Below the space occupied by the pallet in each compartment there is arranged an apron (not shown) which extends across the compartment and prevents extraneous matter from one vehicle falling through onto another vehicle.

It will be appreciated that the aforesaid framework may be arranged to stand independently on its own foundation or it may be supported against a wall of a building, in which case parts of the framework are keyed into the building.

While the system described employs linear induction motors for movement of the pallet into and out of the lift shaft it will be appreciated that other systems may be used. In particular the electric motor and rack and pinion system disclosed in copending Application No. 32154/67 may be employed.

The configuration of the supports 24 on the lifting frames 18 may vary from the vertically disposed plate form shown, and the tines 31 of the pallets may be of circular, square or rectangular cross-section. Figure 6 shows a tine construction for the pallet which may be desirable in certain cases. As shown in Figure 6 each tine comprises a support member 40 which is secured to the cross member 30 of the pallet and which is of circular cross-section. Mounted on the support section 40 is a part-cylindrical sleeve 41 which may rotate about the axis of the member 40. A plate 42 is secured as by welding to the sleeve 41, and the longitudinal axis of the plate 42 is parallel to the longitudinal axis of the member 40. The width of the plate 42 must be less than the distance between adjacent supports 24 on the lifting frame 18 so that the supports 24 can pass between the plates 42 and vice versa. A stop 43 is provided to provide angular limits of rotation for the plate 42.

The plate 42 is conveniently dimensioned so that it extends on each side of the horizontal centre line of the member 40 a distance of $3\frac{1}{2}$ inches or more, to make a total width of at least 7 inches. The average contact length between a tyre and a flat hori-

zontal surface for a car weighing 22 cwt. is approximately 7 inches and therefore use of a plate 42 some 7 inches in width means that the contact pressure on a tyre during storage of a car does not exceed the normal contact pressure. This contact pressure could be exceeded if the car was merely standing on tines of circular cross-section. The fact that the flat surface 42 will not be horizontal, except on occasions when the vehicle's wheel axle is immediately above and coincident with the horizontal centre line of the member 40 is inconsequential. There will be occasions when a vehicle is supported by two flat plates 42 attached to adjacent tines; this occurring when a wheel axle is midway between the centre line of adjacent members 40.

It will be appreciated that the lift arrangement can be modified as desired, and that the control system used for the car park can be of any suitable form.

WHAT I CLAIM IS:—

1. A multi-storey mechanical storage system according to claim 1 of Application No. 32154/67 (Serial No. 1,187,510) in which the supports on the pallets and on the lifting structure extend substantially parallel to the direction of movement of the pallet when moving between its first and second limit positions.

2. A system according to claim 1 in which the lifting structure is provided with a base portion from which the supports project upwardly.

3. A system according to claim 1 or claim 2 in which each pallet comprises two spaced apart horizontal transverse members joined toward one end thereof by a longitudinal cross member to which the supports are secured to extend in cantilever fashion from the cross member towards the lift shaft substantially parallel to the horizontal transverse members.

4. A system according to claim 3 in which the length of the transverse members

is such that the cross member never crosses the lift shaft.

5. A system according to claim 3 or claim 4 in which each pallet carries wheels on its transverse members, which wheels run on tracks formed at either side of the receiving space and at either side of the lift shaft lever with the tracks in each receiving space.

6. A system according to any one of the preceding claims in which each pallet is driven between its first and second limit positions by an electric motor.

7. A system according to claim 6 in which the electric motor is a linear induction motor.

8. A system according to claims 3, 5 and 7 in which a linear induction motor is provided at each side of every receiving space in co-operative relation with the transverse members of the pallets.

9. A system according to any one of the preceding claims in which each support on each pallet is a tine.

10. A system according to claim 9 in which each tine is of circular cross-section and has mounted thereon a part-cylindrical sleeve member, for rotation about the axis of the tine, and a plate is secured to the sleeve member, the longitudinal axis of the plate being parallel to the longitudinal axis of the tine and the width of the plate being less than the distance between adjacent supports on the lifting structure.

11. A multi-storey mechanical storage system substantially as herein described with reference to the accompanying drawings.

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