Dec. 3, 1957 B. B. ASHEIM ET AL 2,815,133

STAGGER STALL PARKING

Filed July 13, 1954 3 Sheets-Sheet 1

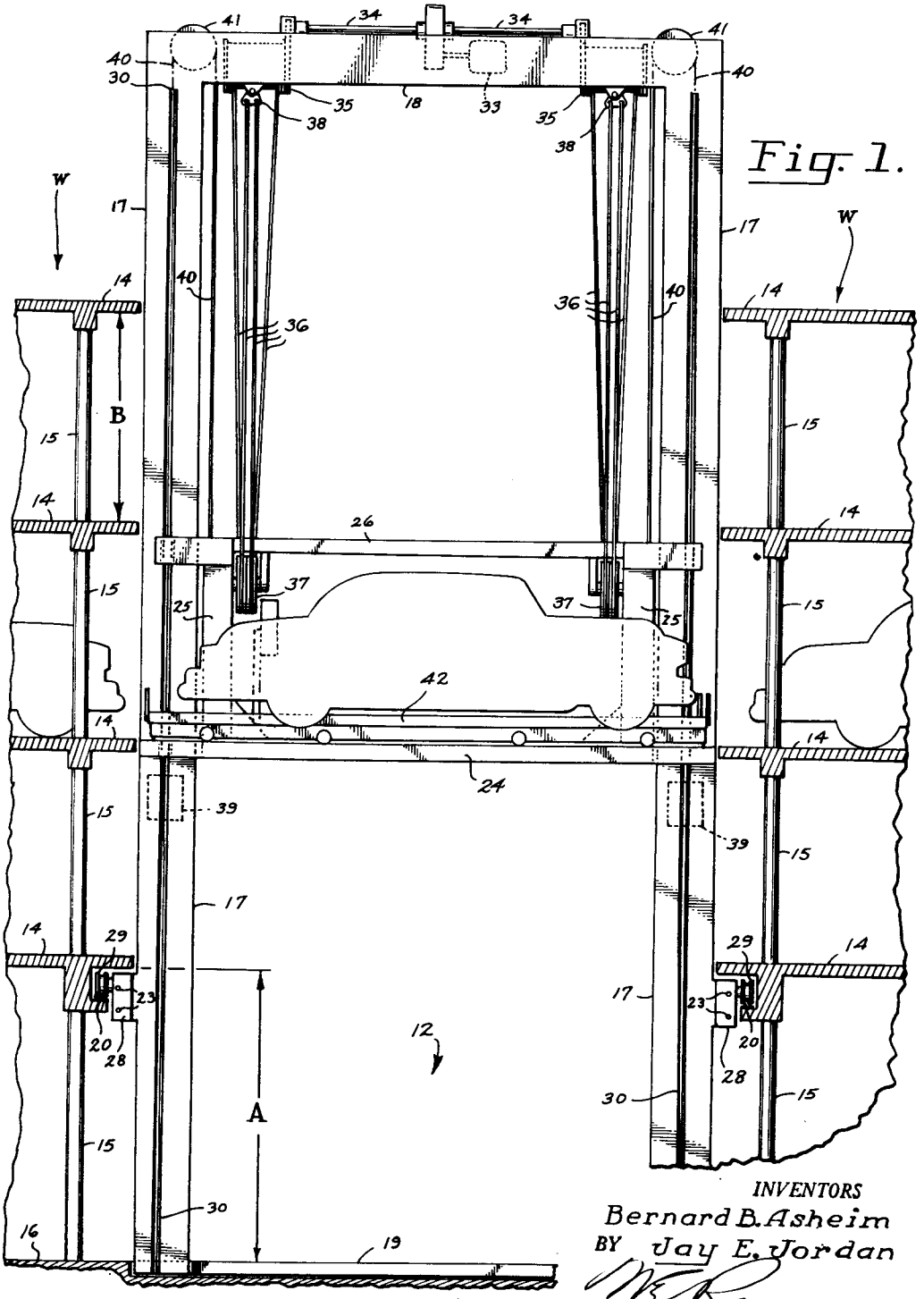


Fig. 1.

INVENTORS
Bernard B. Asheim
BY Jay E. Jordan
Ramey, Atty.

Dec. 3, 1957 B. B. ASHEIM ET AL 2,815,133

STAGGER STALL PARKING

Filed July 13, 1954 3 Sheets-Sheet 2

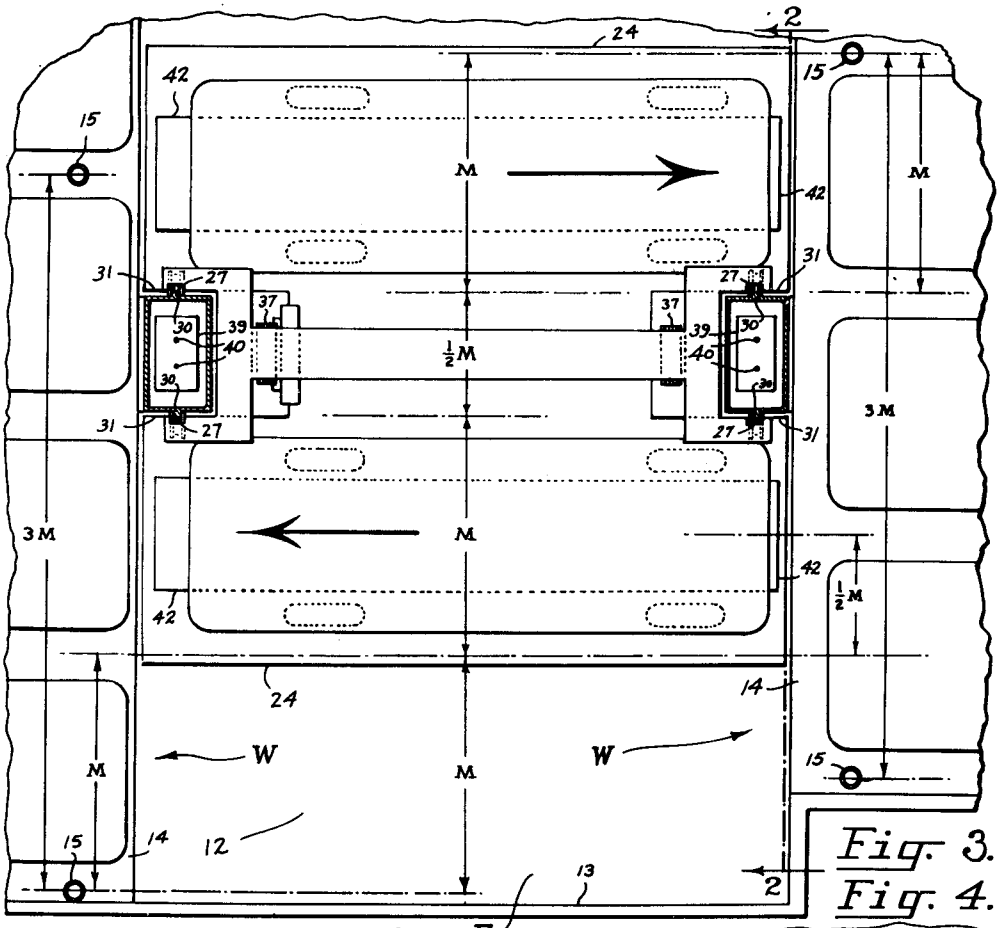


Fig. 3.

Fig. 4.

INVENTORS
Bernard B. Asheim
BY Jay E. Jordan
Atty.

Dec. 3, 1957 B. B. ASHEIM ET AL 2,815,133

STAGGER STALL PARKING

Filed July 13, 1954 3 Sheets-Sheet 3

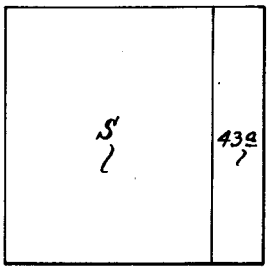


Fig. 5.

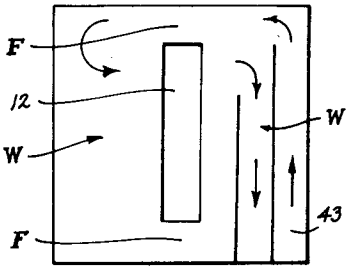


Fig. 6.

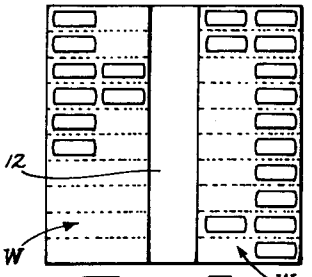


Fig. 7.

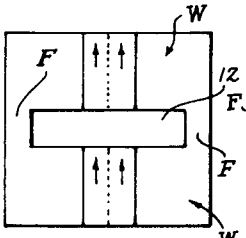


Fig. 8.

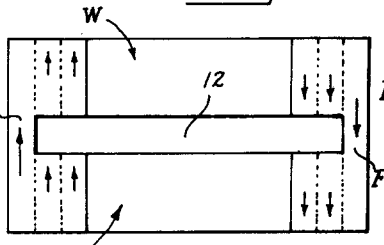


Fig. 9.

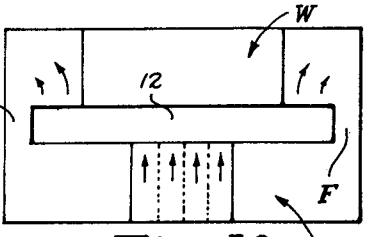
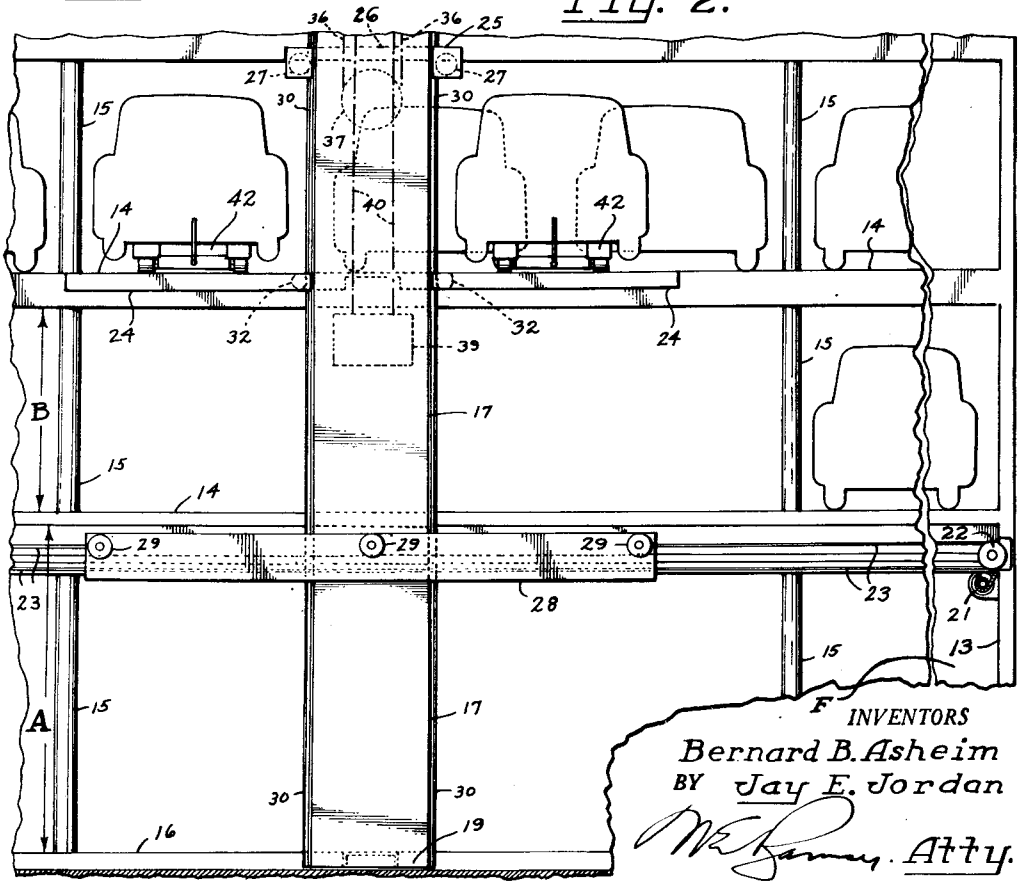


Fig. 10.

Fig. 2.



INVENTORS
Bernard B. Asheim
BY Jay E. Jordan
M. E. Ramey. Atty.

United States Patent Office

2,815,133

Patented Dec. 3, 1957

2,815,133

STAGGER STALL PARKING

Bernard B. Asheim and Jay E. Jordan, Portland, Oreg.

Application July 13, 1954, Serial No. 442,952

12 Claims. (Cl. 214—16.1)

This invention relates to a multistory mechanical parking structure or building and to the combination of various automobile movement mechanisms with such a building, the automobile movement mechanism per se and the building structure per se being the subject matter of separate copending common assignee applications entitled Modular Parking, Serial Number 444,755, and now abandoned; Elevator for Mechanical Parking, Serial Number 442,954; Hydraulic Piston Parking Dolly, Serial Number 448,621; and Self-Propelled Mechanical Parking Dolly, Serial Number 442,953.

In particular, this invention is concerned with a novel mechanical parking structure having a gantry crane which carries an elevator for moving pairs of automobiles to and from upper story parking stalls within the structure. A primary object of the invention is to provide a mechanical parking facility in which a majority of the floor area on the lower or ground level of the building is reserved by the parking operator for subrental to retail shops and stores. This contrasts with the use of the lower level as parking space and allows the ground floor subrental income to pay for the cost of the parking operator's lease covering the land upon which the composite facility is constructed. Financial studies show that the attainment of this objective will spell the difference between a financially successful and a profitless or at best marginal mechanical parking facility.

In a conventional mechanical parking facility, there is provided a multistory building in which an elevator is arranged to move laterally and vertically to service various stories of the building in the parking of automobiles. Additionally, some means is provided or carried by the elevator to move or carry automobiles to and from parking spaces within the building. In contrast with such a conventional elevator, our invention provides a two automobile capacity cantilever elevator whereby two automobiles, simultaneously, can be moved within the structure. Additionally, the other features of our invention provide structure which will pick up, park, and deliver two automobiles simultaneously. In function, these various provisions for dual handling of automobiles cooperate with tandem parking stalls to speed the pick up, movement and delivery of automobiles throughout the structure and thus to increase the earning rate thereof.

In summarized description, our mechanical parking facility includes a multistory building which is constructed with two parallel wings both of which border on an elevator well which extends the full length of the building through the upper stories thereof but extends less than the full length of the building on the lower or ground floor. Additionally, the ground or lower floor of the structure is occupied by retail shops or stores and by an entrance and exit way for the ingress and egress of automobiles to the elevator. Within the elevator well, a laterally movable gantry crane and a vertically movable elevator cooperate to move automobiles about in service to all of the stories of the building.

An adequate understanding of one of the important

features of our invention requires an appreciation of the problems presented by the provision of tandem and dual parking service and the manner in which the provision of such a service is modified by the requirement that the lower floor of the structure produce sufficient rental income to cover the ground rental for the entire structure. Thus, it is the valuable high rental land areas of metropolitan cities where the need for off-street mechanical parking most acutely is felt. Many of these costly midtown areas are not now used for parking facilities because the land owner can realize more income by operating or leasing to a non-parking establishment such as a retail store. It is our considered observation that the answer to the high lease cost for metropolitan parking is to be found in the reservation of the ground level space for retail shop rental such that sufficient income can be generated by these retail subrentals to cover most or all of the operator's lease cost for the entire area occupied by his mechanical parking facility. The upper story parking facility then can operate substantially rent free.

Several factors require observation when it is intended to provide a parking facility wherein the ground or street level is reserved for retail shop sub-rental. Firstly, it is evident that the more valuable the land area, the higher the retail rental income will be from sub-lessees. This factor alone substantially favors our invention since a conventional or prior art mechanical parking facility in a high rent area usually is marginal or unprofitable if the entire ground or street level area is consumed by parking and automobile movement facilities. Secondly, the provision of first class retail stores on the ground floor under a mechanical parking structure maintains and improves the character of a given shopping district. This is in direct contrast with a parking lot or parking facility having no retail stores along the street since the latter facilities interrupt the continuity of the shopping district and leave a dead spot unfavorable to the surrounding stores in the area. Thirdly, it is a rule of thumb for land owners that the ground rent burden of a metropolitan land area must be carried substantially entirely by ground floor tenants. This rule of thumb is already applied to hotels, office buildings, and many other metropolitan structures and, with our inventive structure, it can be applied as well to a mechanical parking facility. Lastly, financiers and economists have determined that a mechanical parking facility which is erected for $1,200.00 per parking stall can be amortized in twenty-five years at 5% interest by constant income of only $7.02 per parking space per month. That is to say, a structure which is erected initially for $1,200.00 per parking space can be amortized, as an investment, in twenty-five years and with 5% interest if an average daily income of slightly less than 25¢ per parking space is realized. Accordingly and since 25¢ per stall per day is a realistic figure, $1,200.00 today is recognized as the break even point in planning a parking facility. With the instant invention and the previously mentioned copending inventions related thereto, a mechanical parking facility can be erected at a cost of substantially less than $1,200.00 per parking stall and the ground rent can be paid by the subletting of the ground floor area to retail shops and stores. In total then, our inventive structures provide one of the most profitable means by which private enterprise can redevelop large areas in the heart of metropolitan business districts to alleviate the off-street parking problems now becoming acute to these business districts.

A secondary problem met in the operation of mechanical parking is that presented by the peak loading and unloading capacities dictated by the shopping and work habits of many motorists in metropolitan areas. For example, a mechanical parking facility which is provided in an office area mixed with retail shops and stores, will

find a peak arrival of motorists between 8:00 and 9:00 A. M. when office workers go to work and between 9:00 and 10:00 A. M. when the retail shops and department stores open for business. A similar exit or reclaim peak is experienced in the late afternoon when workers and shoppers alike claim their automobiles to return home. With our invention, the operator of the mechanical parking facility is enabled to meet these peaks since we provide dual automobile movement mechanism and tandem parking both of which are supplemented by the ability of the movement mechanism to load and discharge automobiles two at a time.

To the above ends, our mechanical parking facility is constructed with two parallel wings arranged with an elevator well centrally of the wings, with entrance and exit passages on the first floor and with parking facilities per se in the upper stories. Additionally, the elevator well is occupied by a combination gantry crane and elevator structure of two automobile capacity. In the initial construction of the building, a modular length and width is selected for a parking stall. This modular length and width then is repeated throughout the upper stories of the structure to define multiple identical parking stalls each of which is of sufficient width to park one and only one automobile. In similar manner, the elevator which carries the automobiles is constructed with two modular width parking stalls thereon. It is our observation, however, that such a modular construction per se is insufficient to effect a full utilization of all available floor area within a given structure. Thus, since the elevator and gantry crane need not work the full length of the elevator well on the ground floor but need only service the width of a two automobile entrance and exit way, a substantial portion of the elevator well at the first floor area can be utilized for retail shop space. Accordingly, we have provided and it is one object of our invention to provide an elevator well that extends the entire length of the building throughout the upper stories but less than the full length of the building on the lower or ground floor of a mechanical parking facility.

In conjunction with the above, it is another object of our invention to provide a twin towered gantry crane and cooperating elevator which are supported for horizontal movement upon a track located above the first floor of the building in order to clear the first floor for retail shop use and in order to allow the utilization of all the parking stalls including the end parking stalls throughout the upper stories of the building. These factors, we have found, dictate the construction of the elevator and gantry crane such that a cantilever type elevator must be provided to reach out over obstacles which occupy a portion of the lower level of the elevator well.

In further explanation, the first or ground floor of our mechanical parking facility is constructed with a longitudinal elevator well which terminates short of the ends of the building yet is of sufficient length to permit movement of the elevator and crane across the two or fourth car width of a pick up and a delivery entrance and exit. The space thus gained at the ends of the elevator well we term a "free space" and are enabled to utilize as retail shop area in conjunction with the abutting retail shop area which occupies the remainder of the ground floor area. In total our novel structure loses only an entrance and exit space but gains elevator well space on the first floor so as to allow a maximum of this first floor area to be sublet for retail purposes.

Progressing upwardly through the full length of the building, the crane operates on horizontal tracks which extend the full length of the building and the upper stories of the building are provided with recurring parking stalls of modular widths which are arranged side by side throughout the length of the building. The elevator and crane are enabled to service all of the upper story parking stalls since, first of all, the elevator is of cantilever construction allowing it to reach over the obstructions in the well on the first floor and, secondly, the tracks for the gantry crane extend the full length of the building. With a cantilever type elevator, however, an additional problem is presented. Thus, the two automobile lifting stalls and dollies aboard the elevator are spaced one from another and are cantilevered out from the opposite sides of a central support which straddles and is guided upon the gantry crane towers during vertical movement of the elevator. This spacing of the elevator lifting stalls does not correspond to the spacing of the modular width parking stalls in the upper stories since the parking stalls are arranged in the closest possible abutting, side by side, relationship. Since these spacings do not coincide, it would appear impossible to either load or unload two spaced automobiles simultaneously yet have both automobiles parked in close abutting relationship. Apparently, a lateral or sidewise movement and adjustment of the gantry crane would be required to position the second automobile closely side by side with the first automobile after the latter has been parked. We have solved this problem, however, with novel structure, which is part of our invention and which now will be explained in summarized fashion.

In constructing the two parallel wings of our mechanical parking facility, we have staggered the modular width stalls in one wing with respect to those in the other wing. This staggering of the stalls has been effected in cooperation with the spaced stalls upon the elevator such that an automobile aligned with a parking stall in one wing automatically effects an alignment of the other automobile on the elevator with an opposite parking stall in the opposite wing of the buildling. Thus, in a preferred embodiment, the stalls in one wing are staggered one-half a modular distance with respect to the stalls in the opposite wing and the stalls aboard the elevator similarly are spaced one-half a modular width. In function, this staggering aligns one elevator lifting stall with a parking stall in one wing at the same time that the other elevator lifting stall is aligned with a parking stall in the opposite wing of the structure. When so aligned, both automobiles can be discharged simultaneously, one automobile entering one wing and the other automobile entering the other wing. In reverse, two automobiles can be picked up simultaneously, one automobile from a first wing and another automobile from the opposite wing. These provisions we term "staggered stalls" and in substance they allow a maximum utilization of both the parking and the ground floor area of the mechanical parking facility and are an important object of our invention.

A further object of our invention is to provide, in a staggered stall mechanical parking facility, an elevator and gantry crane which are movable in an elevator well extending the full length of the building throughout the upper stories but less than the full length of the building on the lower floor in order to preserve as much lower floor area as is possible for use as other than parking area, an exemplary use being as subrental to retail shops and stores.

A further object of our invention is to provide a mechanical parking facility with an elevator having two single automobile stalls which are spaced the same distance that the stalls in one wing of the structure are staggered with respect to the stalls in the other wing of the structure whereby simultaneous movement of two automobiles onto and off of the elevator is practical.

Another object of our invention is to provide a staggered stall mechanical parking facility with a gantry crane and elevator which are mounted for movement throughout the length of the building upon tracks disposed above the first floor of the structure but below the top floor thereof whereby a maximum clear area is provided on the first floor.

Yet another object of our invention is to provide a mechanical parking facility with correlated parking stall,

entrance and exit way, elevator, and gantry crane structures such that a majority of the floor area on the ground or first level of the structure can be utilized for retail shop or store purposes rather than parking or automobile movement purposes.

These and other advantages, objects and capabilities inherent in and encompassed by our invention will become apparent from the ensuing description, taken in conjunction with the accompanying drawings, the first four of which are partial views of a structure of recurring symmetry and wherein:

Fig. 1 is a side view of a portion of a complete multistory mechanical parking structure showing the gantry crane and elevator which service the structure, automobiles being shown in place on the elevator and in the parking stalls on the upper stories of the structure;

Fig. 2 is an end view looking across the elevator well of a portion of a multistory mechanical parking structure in accordance with my invention and showing the gantry crane, the tracks, the dollies, the elevators, and other mechanisms associated therewith;

Fig. 3 is a plan view of a portion of one of the upper stories of a structure looking down upon the elevator well, gantry crane, and elevator mechanism and showing the relationship of the modular width parking stalls one to another and to each other;

Fig. 4 is a diagrammatic representation of the lower or ground level floor which underlies the upper story in Fig. 3, this figure showing automobiles entering the building, being loaded aboard the elevator and leaving the building; and

Figs. 5 to 10 inclusive, are diagrammatic representations of various building structures employing the novel mechanisms and constructions of our invention, the arrows representing directions of vehicular movement and the diagrammatic representations themselves serving to illustrate firstly, the manner in which retail shop or store space can be provided on the lower or the ground level of a mechanical parking facility and secondly, the manner in which the elevator well is constructed to cooperate with the provision of such retail space.

An adequate understanding of the principle of our stagger stall parking requires, initially, an understanding of the details of the elevator and gantry crane structure which service the stagger stalls. To this end, each of the first three figures of the drawings illustrates a portion of a multistory mechanical parking facility having two elongated parallel wings W arranged on either side of a common open elevator well **12**. The wings W are joined by end members **13** which may be either complete walls or merely bare girders and the various upper stories **14** are supported on columns **15** over a lower or ground level floor **16**.

In accordance with one object of our invention, the floor area of the lower or ground level **16** is reserved for an entrance and an exit way (see Figs. 4 to 10 inclusive) and for retail shop space whereas the floor area of the upper stories **14** is occupied only by automobile parking stalls. To service the upper stories from the entrance and exit ways, a gantry crane carrying a vertically movable elevator is provided. It is this gantry crane and elevator structure which now will be described in detail.

Referring to Figs. 1 to 3, the gantry crane is constructed with twin vertical towers **17** which are joined top and bottom by lateral tower support members **18** and **19**, respectively. It is the function of the gantry crane to carry the vertically movable elevator longitudinally back and forth across the length of the building structure within the well **12**. To this end, a horizontal track **20** extends longitudinally of the building along each side of the elevator well **12**. As best shown in Fig. 1, the horizontal tracks **20** are arranged adjacent the ceiling line of the ground or first floor **16** rather than at the bottom of the elevator well **12** as might be expected. This positioning of the track structure upon which the gantry crane moves above the lower story but below the top story of the mechanical parking building and the cooperative positioning of the wheels **29** upon which the crane rides intermediate the top and bottom of each tower **17** is a feature of our invention.

We prefer to construct the lower floor **16** of the building with a greater ceiling height than the upper floors **14**, so that retail shops can occupy the lower floor area. This differential in ceiling height is illustrated by the arrowed letters A and B in Figs. 1 and 2, the letter A representing the lower and the letter B the upper story ceiling heights. For example, the ceiling height of the lower floor may be ten or twelve feet, whereas the ceiling height of each of the upper floors need be but seven feet to clear the roof of a parked automobile. This differential in ceiling height cooperates with the positioning of the wheels **29** and the tracks **20** in that the gantry crane thereby is permitted to traverse the entire length of the building through the upper stories, yet a portion of the elevator well on the lower story can be reserved for retail shops. Thus, the tracks **20** can extend the full length of the building, yet the space at each end of the elevator well **12** can be reserved for retail shop or other use as hereinafter will be described with reference to Figs. 4 to 10 inclusive.

In cooperation with the horizontal tracks **20**, each of the box-like towers **17** of the gantry crane carries a horizontally disposed bottom support member **28**, on which are journaled the aforementioned flanged wheels **29** for cooperation with the tracks. Additionally, each of the end members of the building **13** has mounted thereon a pair of electric drive motors **21** and a rotatable driving drum or winch **22** about which pulling cables **23** are reeved in definition of an actuation means for the gantry crane. Thus, each of the cables **23** is joined to the crane, as by attachment to one of the support members **28**, so that actuation of a corresponding pair of the electric motors **21** and driving drums **22** will move the gantry crane along the tracks **20** in one direction. Similar motor, drum and cable structure is provided at each end of the elevator well operatively joined to each end of the crane, yielding a total of four such structures functioning to move the gantry crane, as a unit, back and forth along the tracks.

The automobile carrying elevator of our invention includes a horizontal platform member **24** having vertical end supports **25** and an overhead elevator support beam **26**. The beam **26** is bifurcated at both ends as shown in Fig. 3, and noncircular sheave means **27** is carried by each of the bifurcated arms. These sheaves are journaled on the arms of the beam **26** for rotation relative thereto and they ride upon noncircular vertical guides **30** which protrude from and are fixed to the exterior surface of the box-like tower members **17**. In function, this structure serves as a central support for the elevator platform **24**, the noncircular sheaves and guide rods or rails being one portion of a two-pair guide mechanism for the elevator during vertical movement.

The second pair of the above guide mechanism is provided within recesses **31** which are formed centrally in the platform **24**, and are adapted to straddle the box-like towers **17** in similar manner to that with which the bifurcated arms of the beam **26** straddle the tower. Within the recesses **31**, a pair of journaled, noncircular sheave means **32** are carried for cooperation with the aforementioned guide bars or rails **30**. Referring to Fig. 2 of the drawings, it will be seen that the sheaves **27** and **32** are disposed in vertical alignment both coacting with the noncircular guide rods **30** to roll thereover. In function, this structure is a spaced guiding structure for the elevator to resist rotation or other unwanted side motion during movement of the elevator vertically of the gantry crane towers **17**.

To actuate the elevator, an electric motor **33** is mounted on the top support member **18** of the gantry crane (see Figure 1) and operatively is geared to turn an

elongated drive shaft **34**. The drive shaft **34**, is in turn joined at each end to a winch or drum **35** such that rotation of the electric motor **33** will turn the winches **35** simultaneously in the same direction. Multiple cables **36** depend from each of the drums **35** and are reeved about dual capacity idler sheaves **37** which are journaled rotatably upon the elevator support beam **26** and associated end supports **25** previously mentioned. The free end of each cable **36** is joined to a triangular balance pivot **38** carried by the top support member **18** to equalize the cable tension during operation of the elevator. Additionally, twin side counterweights **39** are joined to individual counterweight cables **40** which in turn are reeved over journaled pulleys **41** and secured to the aforementioned elevator support beam **26**. In function, operation of the electric motor **33** causes the drive shaft **34** to rotate the two drums **35** and raise or lower the elevator platform **24**. As the elevator is raised or lowered, the counterweights **39** move up and down within the hollow interiors of the box-like tower members **17** to counterbalance the operation of the elevator. Appropriate control mechanism and/or push buttons for operation of the motor **33** and the motors **21** can be provided in any conventional manner either aboard the elevator platform **24** or at a central point in the mechanical parking building.

As will be noted in Figs. 2 and 3, the elevator platform **24** is of cantilever construction and both margins thereof extend out beyond the central support and guide mechanism. In function, each of the laterally extending portions of the platform **24** defines a lifting stall in which a movable dolly **42** rests, an automobile being shown aboard each of the dollies **42** in Fig. 2. The structural details of each of the dollies **42** are set forth in the copending application entitled Self-Propelled Mechanical Parking Dolly, Serial No. 442,953. Suffice to say at this point, each of the dollies **42** is movable across the elevator platform **24** and into and out of the parking stalls and the entrance and exit ways of the mechanical parking, and each is provided with a vertically movable platform for lifting and carrying automobiles. Electric control of the dolly movements can be effected from a central point as with the elevator and crane controls.

Turning now to Fig. 3, there is shown, in top or plan view, the elevator **24** with two dollies **42**, each of which is carrying an automobile. Throughout this figure and related Fig. 4 of the drawings (Fig. 4 is the lower or ground level and Fig. 3 is the upper level) various dimensions are indicated by arrows with the letter M. This letter M signifies a modular distance which is arrived at in the following manner. Initially, all of the automobiles in use in the particular locality where the mechanical parking facility is to be constructed are canvassed and the maximum dimensions thereof noted in tabular form. Thereafter the widest automobile which conveniently can be parked in the mechanical parking facility is selected and our elevator and building are constructed about this standard or modular width M. In the United States, this modular width preferably is 7½ feet since the widest automobiles normally encountered (better than 99% of American built automobiles) are but 6 feet 10 inches in width. The remaining difference between 7 feet 6 inches and 6 feet 10 inches in definition of the modular width M is necessary, firstly, to clear the vertical columns **15** every third parking stall and secondly, to provide a small margin of safety to minimize chance side swiping or fender scraping during operations within the mechanical parking facility. As can be seen in Figs. 3 and 4, the dollies **42** and the lifting stalls occupied thereby protrude out from the central support structure of the elevator substantially the width of an automobile in order to provide dual side by side stalls on the elevator with which two automobiles can be moved simultaneously. This provision for side-by-side dual movement greatly speeds parking within the mechanical parking facility and is complementary to the provision of tandem-type parking stalls which we also prefer to employ.

In constructing the building which houses the mechanical parking facility, the vertical columns **15** are arranged in rows laterally of the building and are spaced one from the other three modular widths or, in the preferred United States embodiment, 22½ feet. This spacing of the columns is indicated in Figs. 3 and 4 by the arrowed legend 3M. Intermediate each row of columns, three parallel tandem-type parking stalls are arranged. The width of each of these stalls is one modular distance (M) or, in the preferred United States embodiment, 7½ feet. This modular width of the parking stalls is indicated by the arrowed letter M. As to the elevator, each of the lifting stalls for the dollies **24** also is of modular width M and the space between the stalls on each dolly is one-half a modular width or M/2 also as shown by the arrowed legend in Figs. 3 and 4. The entrance and exit ways of Fig. 4 provide two paths of modular width in the same space occupied by three parking stalls as claimed in the copending application Modular Parking, Serial Number 444,755.

Turning now to Figs. 5 to 10 inclusive, we have shown by diagrammatic representation, various floor plans in building structures with which the above described gantry crane, elevator and modular staggered stall parking are of particular utility. Thus, Figs. 5, 6 and 7 are related floor plans of the same building, Fig. 5 representing the ground floor, Fig. 6 the roof or first floor above the ground floor, and Fig. 7 being typical of all succeeding upper stories of the same building. In this exemplary structure, the floor area shown in Fig. 5 may be occupied by retail shops such as a grocery store less the area **43***a* underlying the ramp **43**. The succeeding upper story areas shown in Figs. 6 and 7 then may be occupied by an automobile parking structure of the type heretofore disclosed. With this construction, of course, the lower parking floor actually is the roof of a retail store and we intend the term "lower level" to be so generic. In Fig. 6, the numeral **43** indicates a drive-up ramp with the direction of vehicular movement indicated by arrows. As in the other figures, the letter W indicates the wings of the parking portion of the building and the numeral **12** indicates the elevator well which is shown in more detail in Figs. 1 and 3. As can be seen, the upper stories such as shown in Fig. 7 consist essentially of two wings W having multiple tandem parking stalls which are separated by and which border upon the common elevator well **12**. A comparison of Figs. 6 and 7 reveals that the elevator well **12** extends the full length of the multistory parking facility through the upper stories of the building, but it extends less than this full length on the lower story or roof. This construction of the elevator well is in accordance with the previously described structure for a cantilever type elevator supported centrally upon a tower like gantry crane, and is of importance because a free area, designated by the letter F, is defined at each end of the elevator well **12** on the first floor of Fig. 6. Thus, it will be recalled that the gantry crane is supported upon tracks **20** which are disposed the entire length of the building above the first or lower story thereof and that the elevator is of cantilever construction allowing the cantilevered portions thereof to reach out over obstacles and obstructions occupying the lower part of the elevator well (see Figure 2).

In function, we employ in various ways the so-called "free space" or lower floor clear area at each end of the elevator well **12** which is gained by the cooperative cantilever construction of the elevator and upper level disposition of the gantry crane tracks. For example, in the structure of Figs. 5 and 7 inclusive, this free space F can be employed in service of several diverse functions. The arrows in Fig. 6 indicate vehicular movement up and down the ramp **43** and into and out of the loading

position for the elevator. At one end of the building it will be noted, the free space F is used as a by-pass for vehicles proceeding to the entrance or loading space for the elevator which occupies the well **12**. That is to say, an automobile enters the elevator by driving up the right side of the ramp **43**, making a left turn, passing through the free space F, making a U-turn and, lastly, being loaded aboard the elevator by one of the aforementioned dollies **42**, located aboard the elevator and gantry crane within the well **12**. In exit, an automobile is unloaded from the elevator by a dolly 42 and, thereafter, is driven down the inside lane of the ramp as indicated by the arrows in Fig. 6. A motorist thus keeps to his right in this exemplary structure as is conventional in the United States. At the opposite end of the building in Fig. 6, the free space F can be utilized for an escalator or elevator to carry motorists from the parking level of Fig. 6 down to the shopping level of Fig. 5 after they leave their automobiles. At the same time, reference to Fig. 2 of the drawings will make clear that the free space F does not block access to the end parking stall in the upper stories of the building such as shown in Fig. 7.

In Fig. 2, one of the free spaces F is shown at the lower right and it will be noted that an automobile is parked directly thereabove on the next upper story. This parking is permitted by the cantilever elevator structure whereby the lifting stalls are cantilevered out from the central support allowing a full utilization of this end lifting stall in direct contrast with the manner in which this end parking space woud be blocked by a corner supported elevator and gantry crane. When the elevator platform **24** is moved flush against the end wall of the building to utilize the parking space directly above a free space F, it will be noted that the gantry crane towers **17** abut but do not enter free space F. When it is recalled that the ground floor area of the building is the most valuable, incomewise, it will be seen that the cooperative cantilever type elevator and central gantry crane support are of particular importance in a mechanical parking facility which occupies high value, metropolitan land areas.

In Fig. 8, we have represented the lower floor plan of a different structure in which the elevator well **12** is served by a single central entrance from one street and a single central exit to an opposite street. In this arrangement of a mechanical parking structure, all of the remaining ground floor area, including the free spaces F, can be utilized for retail shops or stores, the cantilever elevator being constructed to clear the spaces F above the ground floor to allow utilization of the end parking stalls in all of the upper stories. Similarly, the free spaces F in the building of Fig. 10, can be utilized for retail shop space. In this latter figure, there is shown a construction wherein the mechanical parking facility is serviced by two elevators and is bounded on three sides by streets and on the fourth side by another abutting building. Such a location requires that the exit from the mechanical parking structure be through the space which normally would be utilized for retail shop areas as shown by the vehicular movement arrows. The central back portion of this structure in Fig. 10, can be utilized as an automobile repair and/or a gasoline service facility to preserve the retail value thereof if such is desired.

In Fig. 9, we have shown yet another building floor plan with a central elevator well **12** which, on the lower ground floor, extends less than the full length of the building and, on all the upper stories, extends the full length of the building. With this particular facility, entrance and exit ways are provided at each end of the building for service by two elevators operating within the elevator well **12**. This type of structure illustrates an additional use to which the free end spaces F can be put. In Fig. 9, these free spaces F are shown employed as drive-through spaces for automobiles or as walk ways for pedestrians. As will be understood, the elevator well **12** extends the full length of the building above the walk ways or driveways which occupy the free spaces F on the lower level.

In summarization of Figs. 5 to 10 inclusive, it will be noted that a major portion of the lower or ground level area of our mechanical parking facility can be utilized for other than automobile movement and storage facilities. In each of these exemplary parking facilities, automobile storage stalls occupy the upper stories and other than automobile storage stalls occupy a major portion of the floor area of the lower story, only automobile entrance and exit ways being required in said lower story so far as parking is concerned. In conjunction therewith, the open elevator well **12** extends the full length of the multistory parking facility through the upper stories but extends less than the full length of the lower or ground level. The tracks of the gantry crane, of course, extend the full length of the building in each construction to allow service of the end stalls and thus more effectively to utilize the available high cost and ofttimes limited land area of metropolitan business districts.

In operation, both the lower and the upper stories of our mechanical parking facility are serviced by the gantry crane and elevator. The motorist normally will drive in through one of the entrance ways, provided as shown in Fig. 4 on the lower or ground floor (the roof or deck in some structures such as that shown in Fig. 5) where he will park his automobile, set the brakes and lock the automobile to prevent tampering or theft. Thereafter, one of the dollies **42**, will leave the elevator platform **24** and move between the wheels under the automobile. The vertically movable platform mechanism aboard the dolly **42** then lifts the automobile clear of the floor of the entrance way and both the dolly and automobile return aboard the elevator as a unit. Because of the cantilever construction of the elevator, two dollies are provided and two automobiles thus can be loaded simultaneously or serially as desired at the entrance way.

Once the elevator is loaded, the motors **21** are actuated to move the gantry crane longitudinally through the building at the same time that the motor **33** is actuated to lift the elevator vertically on the twin towers **17** of the gantry crane to a location adjacent a pair of vacant parking stalls in the opposed wings W of the structure. The vertical elevator movements, of course, are guided by the coaction of the noncircular guides and sheaves **32**, **30**, **27**.

When the elevator and gantry crane arrive opposite a pair of vacant stalls in an upper story of the structure, the various mechanisms will be positioned as shown in Fig. 3 of the drawings. It there will be noted that by staggering the stalls in the left wing one-half a modular distance with respect to the stalls in the right wing, both automobiles have been positioned opposite a vacant stall, the vacant stalls being located in the opposite wings of the structure. Thereafter, the two dollies **42** will move in the directions of the large arrows in Fig. 3, the lower automobile in this drawing being moved into the left wing of the structure simultaneously as the upper automobile is moved into the right wing of the structure. Once in a parking stall, of course, the automobile is lowered onto the floor and the dollies return to the elevator. In reverse, the return of a vehicle from a parking stall to the exit way of the structure also can be accomplished with simultaneous movements of the dolly in cooperation with the dual capacity of the elevator.

In summary, it will be seen that we have served our inventive objects by providing an improved cantilever elevator structure which is mounted on a laterally movable gantry crane such that substantially the entire area of the mechanical parking structure can be serviced by one elevator and such that even the end stalls on each of the upper floors can be utilized to park automobiles. Additionally, a majority of the ground floor area can be uti-

lized for purposes other than parking. In a typical installation, it is believed that the ground floor area which is available will be employed for retail shops in order to pay the ground rent for the area occupied by the mechanical parking facility. This provision is in service of our primary objective, which is to provide a financially practical and sound mechanical parking facility in which a majority of the ground floor area can be utilized as retail shop area rather than as automobile parking or movement area. In combination with the inventions of the previously listed copending applications, the above provisions are of primary utility in the alleviation of off-street parking problems in the large metropolitan business areas of the world.

We claim:

1. In combination with an elongated multistory building having automobile parking facilities in the upper stories and retail shop facilities on the lower floor, said building having two parallel wings abutting a common elevator well which extends longitudinally the full length of said building through each upper story but less than said full length on the lower floor of the building, each of said upper stories having a plurality of parallel parking stall means each of which is of an identical modular width sufficient to park one and only one automobile between the marginal sides thereof, some of said parking stall means in one wing having stall divider means between them, which are also staggered one-half module width from like divider means in the other wing, the parking stalls in one of said wings being parallel those in the other wing but being staggered one-half said modular width with respect to the corresponding stalls in the said other wing and an elevator means mounted for vertical and longitudinal movement in said common well and having two parallel lifting stalls arranged laterally of said building with each stall being of sufficient length and width to receive one automobile, said lifting stalls being spaced one from another a distance equal to one-half said modular width.

2. A mechanical parking structure, comprising a building having two elongated parallel wings spaced laterally by an open elevator well, said wings being multistoried with the corresponding stories in each wing lying in the same horizontal plane, a plurality of parallel parking stall means arranged laterally of said building in abutting side by side relationship within each of the upper stories of said building, each of said stalls being of an identical modular width sufficient to park one and only one automobile between the marginal sides thereof, some of said parking stall means in one wing having stall divider means between them, which are also staggered one-half module width from like divider means in the other wing, the stalls on a given story in one of said wings being staggered and displaced one-half said modular width with respect to the corresponding stalls on the same corresponding story in the other of said wings and an elevator means mounted for vertical and longitudinal movement in said common well and having two parallel lifting stalls arranged laterally of said building with each stall being of sufficient length and width to receive one automobile, said lifting stalls being spaced one from another a distance equal to one-half said modular width.

3. In combination with an elongated multistory building having automobile parking facilities in the upper stories only, said building having two parallel wings abutting a common elevator well which extends longitudinally the full length of said building through each upper story but less than said full length on the lower floor of the building, the corresponding stories in each wing lying in the same horizontal plane, each of said upper stories having a plurality of parallel parking stall means, said parking stalls each being of an identical modular width sufficient to park one and only one automobile between the marginal sides thereof, some of said parking stall means in one wing having stall divider means between them, which are also staggered one-half module width from like divider means in the other wing, the center lines of the stalls in one of said wings being staggered one-half said modular width with respect to the center lines of the corresponding stalls in the opposite wing, and an elevator means mounted for vertical and longitudinal movement in said common well and having two parallel lifting stalls arranged laterally of said building with each stall being of sufficient length and width to receive one automobile, said lifting stalls being spaced one from another a distance equal to one-half said modular width.

4. A mechanical parking structure, comprising a multistory building having two elongated parallel wings spaced laterally by an open elevator well and joined at the ends by lateral connecting means, a plurality of parallel parking stall means open to said elevator well and arranged laterally of said building in abutting side by side relationship within each of the upper stories of said building, each of said stalls being of an identical modular width sufficient to park one and only one automobile between the marginal sides thereof, some of said parking stall means in one wing having stall divider means between them, which are also staggered one-half module width from like divider means in the other wing, the stalls in one of said wings being offset and staggered longitudinally of said building a distance equal to one-half said modular width with respect to the corresponding stalls in the other of said wings, and an elevator means mounted for vertical and longitudinal movement in said well to service both of said wings, said elevator having two parallel lifting stalls arranged laterally of said building with each stall being of sufficient length and width to receive one automobile, the center lines of said lifting stalls being spaced longitudinally of said building a distance equal to three halves said modular width whereby alignment of one lifting stall with a parking stall in one wing causes alignment of the other lifting stall with a parking stall on the same corresponding story in the other wing.

5. A mechanical parking structure, comprising a multistory building in which automobile parking stalls occupy the floor areas of the upper stories and other than park-ink stalls occupy a major portion of the lower story floor area, said building being constructed with vertical columns which extend upwardly through the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in parallel rows, adjacent rows being spanned by three parallel single parking stalls of uniform modular width sufficient to park one automobile per stall, the parking stalls and rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing.

6. A mechanical parking structure, comprising a multistory building in which automobile parking facilities occupy the upper stories and other than parking facilities occupy a major portion of the lower story floor area, said building being constructed with horizontal girders in each story spanning vertical columns which extend upwardly through the building, said building having two elongated parallel wings, the vertical columns within each wing being arranged in laterally extending parallel rows with the rows in one wing being arranged parallel with but not in alignment with those in the other wing, adjacent rows of said columns within each wing being spaced a uniform distance to define bays of uniform width, each of said bays being spanned by three parallel tandem length single width parking stalls supported upon said horizontal beams, said parking stalls being of uniform modular width sufficient to park one automobile per stall width in close and parallel side by side relationship with the stalls adjacent thereto, the parking stalls, bays and

rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half of said uniform modular width with respect to the parking stalls, bays and rows of columns in the other said wing.

7. A mechanical parking structure, comprising a multistory building in which automobile parking facilities occupy the upper stories, said building being constructed with vertical columns which extend upwardly through the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows with the rows in one wing being arranged parallel with but not in alignment with those in the other wing, adjacent rows of said columns within each wing being spanned by three parallel and abutting single width parking stalls of uniform modular width sufficient to park one automobile per stall, the parking stalls and rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing, and an elevator means with capacity to lift two automobiles mounted within and laterally spanning said well for movement vertically and longitudinally to service both said wings simultaneously.

8. A mechanical parking structure, comprising a multistory building in which automobile parking facilities occupy the upper stories and other than parking facilities occupy a major portion of the lower story floor area, said building being constructed with horizontal girders in each story spanning vertical columns which extend upwardly through the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows, adjacent rows of said columns on the upper stories within each wing being spanned by three parallel single width parking stalls supported upon said horizontal beams, said parking stalls being of uniform modular width sufficient to park one automobile per stall in close and parallel side by side relationship with the stalls adjacent thereto, the parking stalls and rows of columns in one of said wings being offset and staggered longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing, and an elevator means mounted within and laterally spanning said well for movement vertically and longitudinally to service both said wings simultaneously, said elevator having two elongated lifting stalls arranged parallel said column rows with each lifting stall being of sufficient width to receive one automobile, said lifting stalls being spaced laterally by central mounting means for said elevator a distance equal to one-half said uniform modular width.

9. A mechanical parking structure, comprising a multistory building in which automobile parking facilities occupy the upper stories and retail shops occupy a major portion of the lower story floor area, said building being constructed with horizontal girders in each story spanning vertical columns which extend upwardly through all the stories of said building, said building having two elongated parallel wings separated laterally by an elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows with the rows in one wing being arranged parallel with but not in alignment with those in the other wing, adjacent rows of said columns within each wing being spaced to define bays, each of said bays in said upper stories being spanned by three parallel tandem length single width parking stalls supported upon said horizontal beams, said parking stalls being of uniform modular width sufficient to park one automobile per stall in close and parallel side by side relationship with the stalls adjacent thereto, the parking stalls, bays and rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls, bays and rows of columns in the other said wing, and an elevator means mounted within and laterally spanning said well for movement vertically and longitudinally to service both said wings simultaneously, said elevator having two elongated lifting stalls arranged parallel said column rows with each lifting stall being of sufficient width to receive one automobile, said lifting stalls being spaced laterally by central mounting means for said elevator and being cantilevered outwardly therefrom, the center lines of said lifting stalls being spaced a distance equal to one and one-half said uniform modular width whereby alignment of one lifting stall with a parking stall in one wing aligns the other lifting stall with a parking stall in the other wing.

10. A mechanical parking structure, comprising a multistory building constructed with continuous vertical columns which extend upwardly through the entire height of the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows, adjacent rows of said columns within each wing being spanned by three parallel, single width but tandem length parking stalls of uniform modular width sufficient to park the width of one automobile per stall, the parking stalls and rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing.

11. A mechanical parking structure, comprising a multistory building constructed with vertical columns which extend upwardly through the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows with the rows in one wing arranged parallel with but not in alignment with those in the other wing, adjacent rows of said columns within each wing being spanned by three parallel and abutting single parking stalls of uniform modular width sufficient to park one automobile per stall, the parking stalls and rows of columns in one of said wings being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing, and an elevator means having two automobile lifting capacity mounted within and laterally spanning said well for movement vertically and longitudinally to serve both said wings simultaneously.

12. A mechanical parking structure, comprising a multistory building constructed with horizontal girders in each story spanning vertical columns which extend upwardly through the building, said building having two elongated parallel wings separated laterally by an open elevator well, the vertical columns within each wing being arranged in laterally extending parallel rows, adjacent rows of said columns within each wing being spanned by three parallel single parking stalls supported upon said horizontal beams, said stalls being of uniform modular width sufficient to park one automobile per stall in close and parallel side by side relationship with the stalls adjacent thereto, the parking stalls and rows of columns in one of said wings all being offset longitudinally of said building a distance equal to one-half said uniform modular width with respect to the parking stalls and rows of columns in the other said wing, and an elevator means mounted within and laterally spanning said well for movement vertically and longitudinally to service both said wings simultaneously, said elevator having two elongated stalls arranged parallel said column rows with each lifting stall being of sufficient width to receive one automobile, said lifting stalls being spaced laterally by central mounting means for said elevator a distance equal to one-half said uniform modular width whereby alignment of

one lifting stall with a parking stall in one wing aligns the other lifting stall with a parking stall in the other wing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,554,584	Lake	Sept. 22, 1925
1,779,998	Beecher et al.	Oct. 28, 1930
2,280,567	Austin	Apr. 21, 1942
2,633,809	Robinson et al.	Apr. 7, 1953
2,714,456	Managh	Aug. 2, 1955

FOREIGN PATENTS

337,726	Great Britain	Oct. 28, 1930
416,781	Great Britain	Sept. 18, 1934
458,984	Great Britain	Dec. 31, 1936
888,334	France	Sept. 6, 1943