June 9, 1964 E. CONTINI 3,136,092

PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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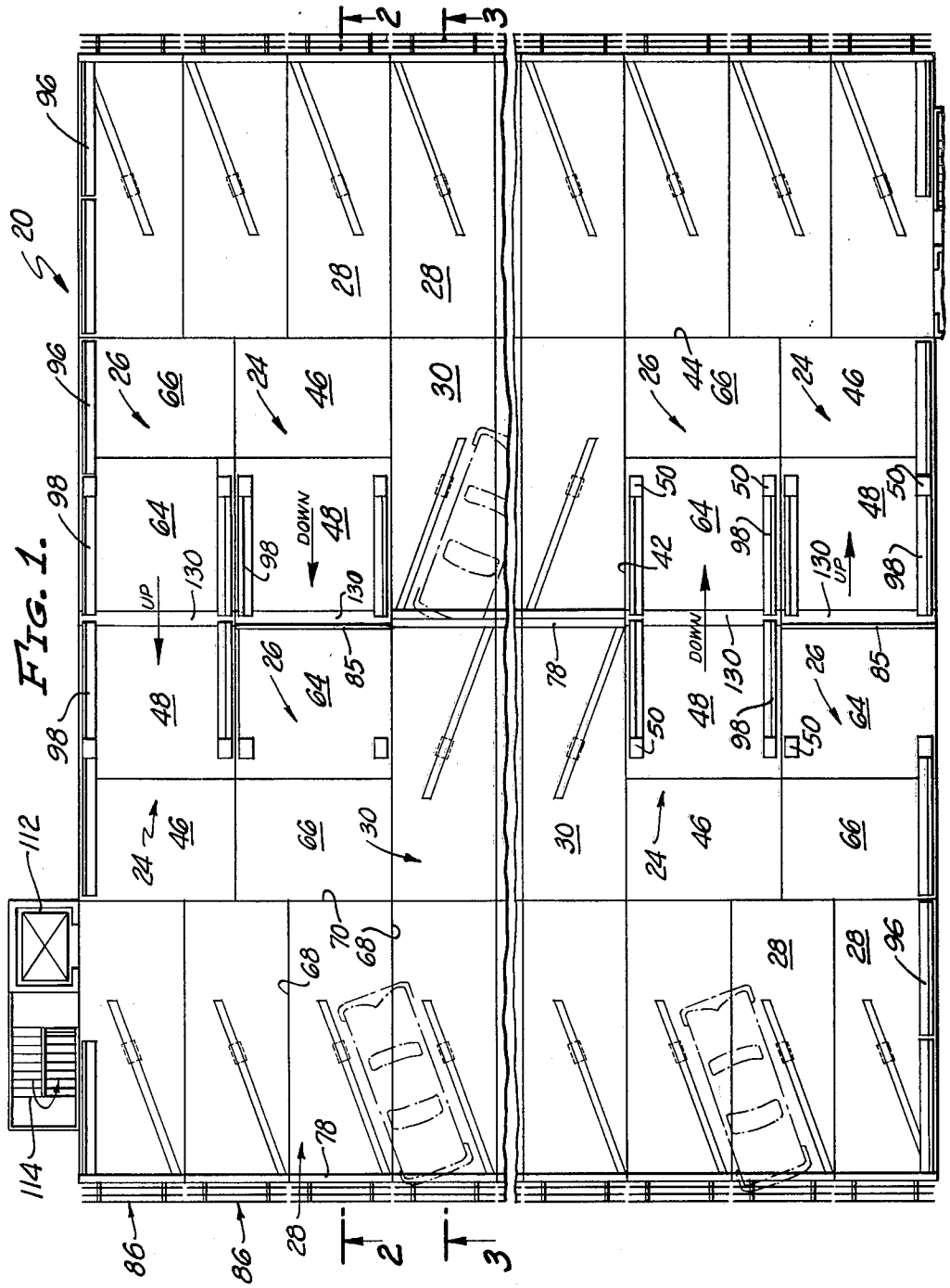



FIG. 1.

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PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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FIG. 2.

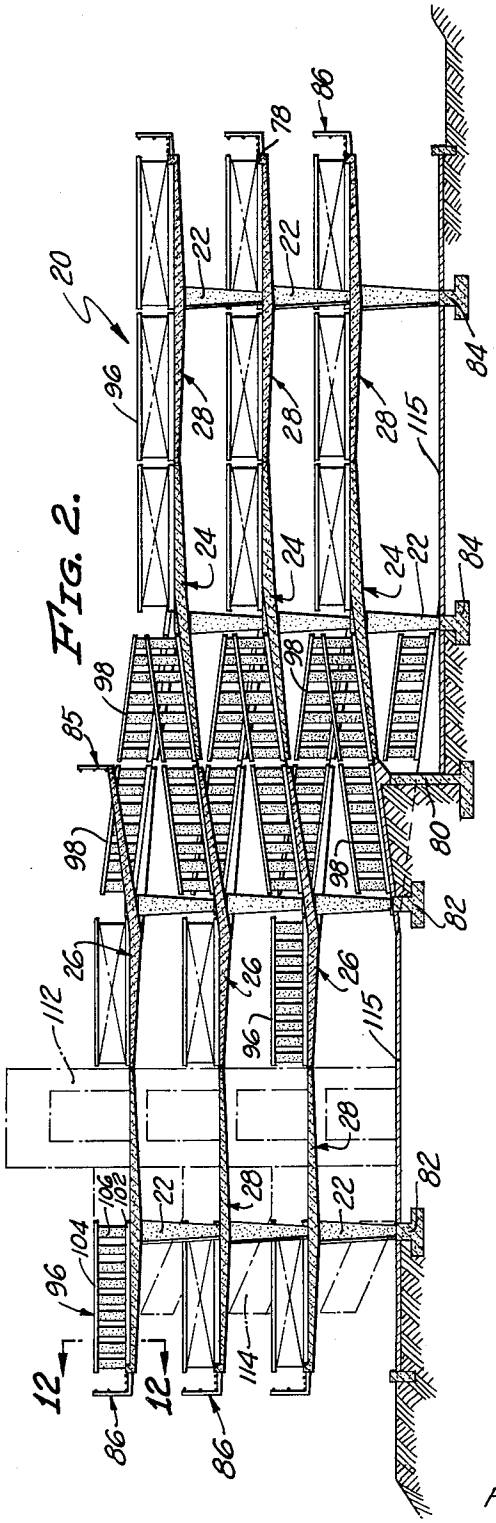
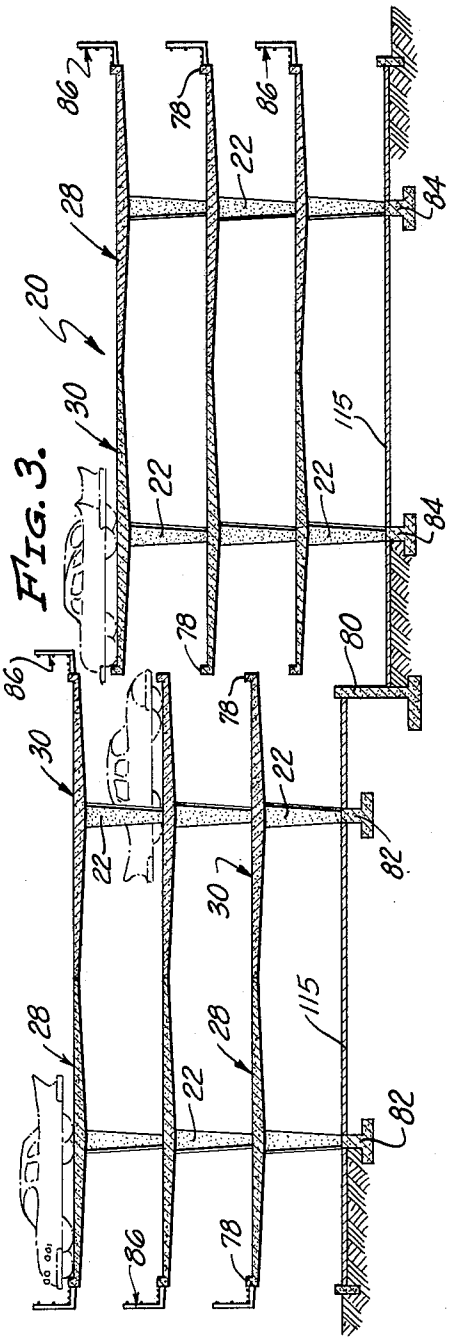



FIG. 3.




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PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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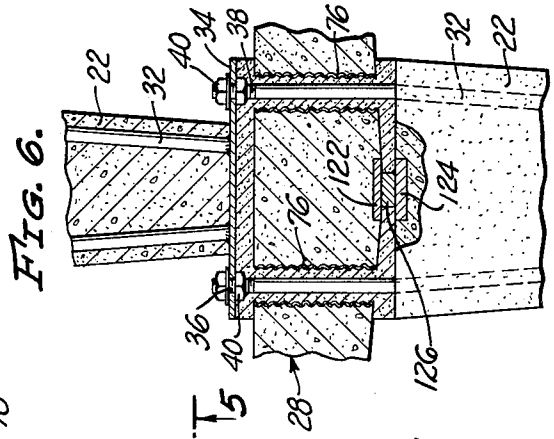



FIG. 6.

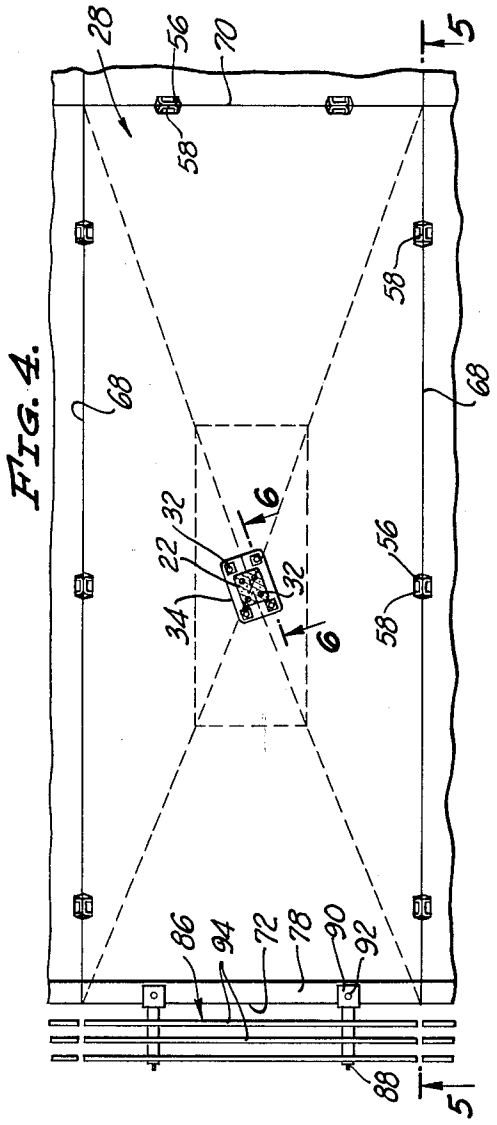



FIG. 4.

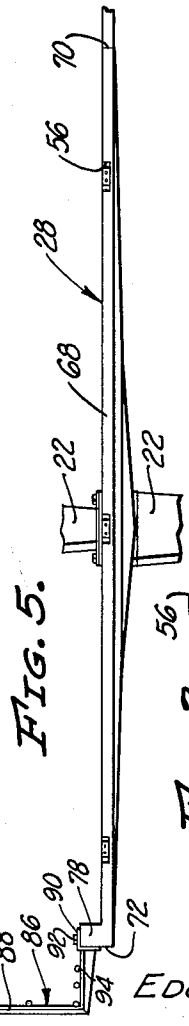



FIG. 5.

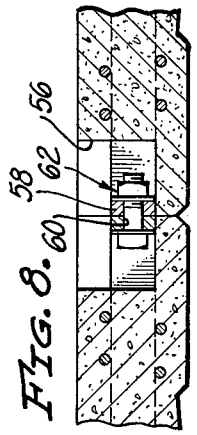



FIG. 8.

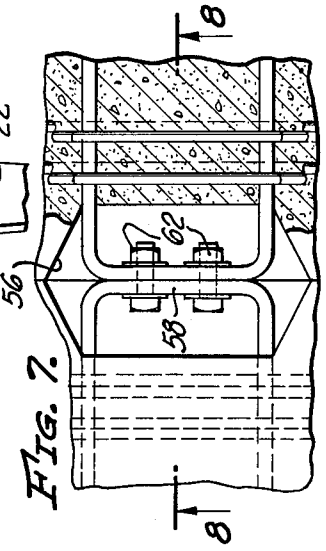



FIG. 7.

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PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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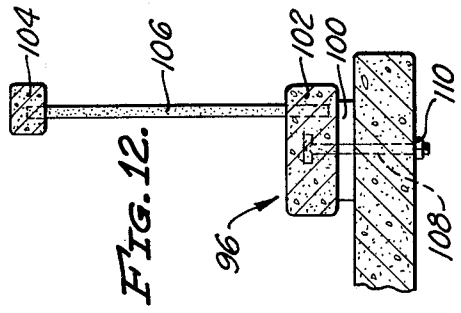



FIG. 12.

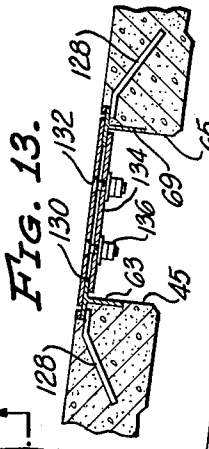



FIG. 13.

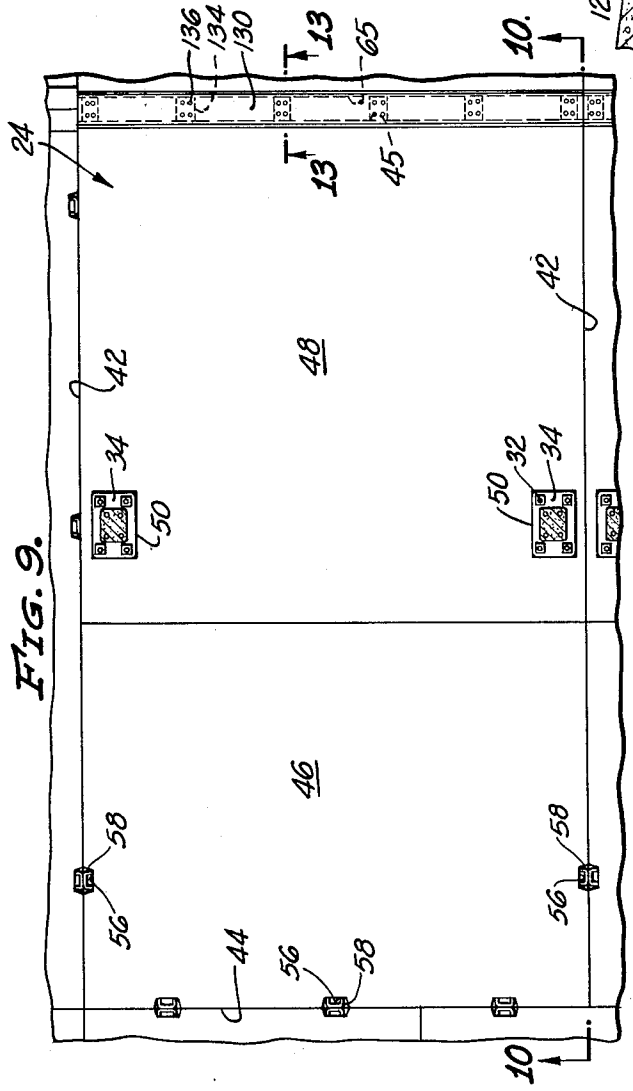



FIG. 9.

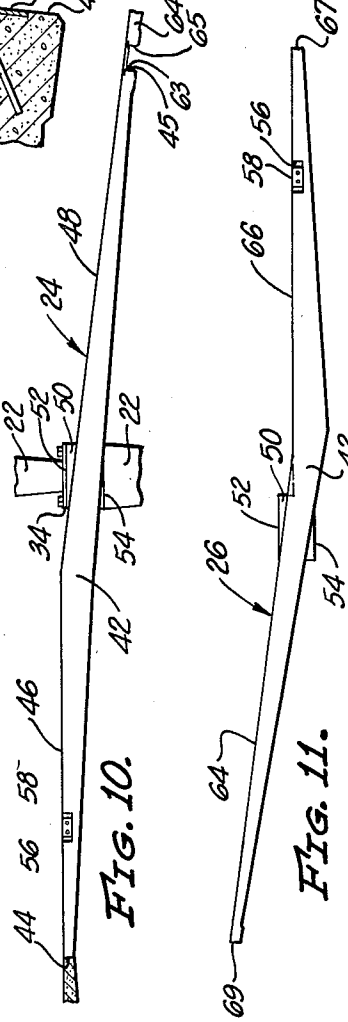



FIG. 10.




FIG. 11.

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PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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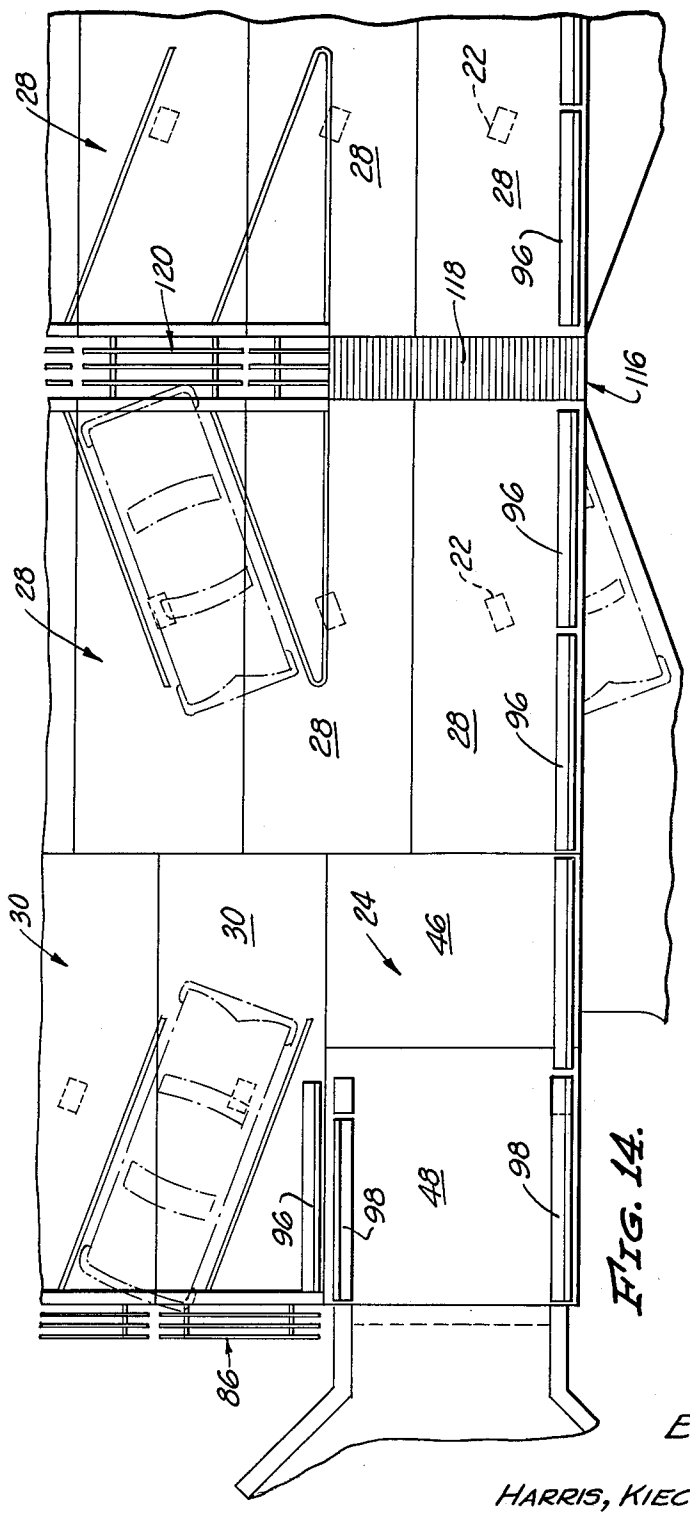



FIG. 14.

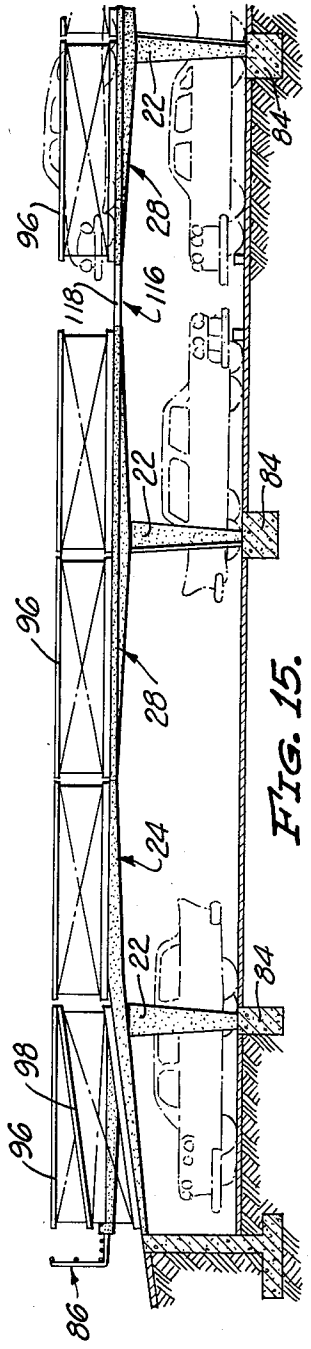



FIG. 15.

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PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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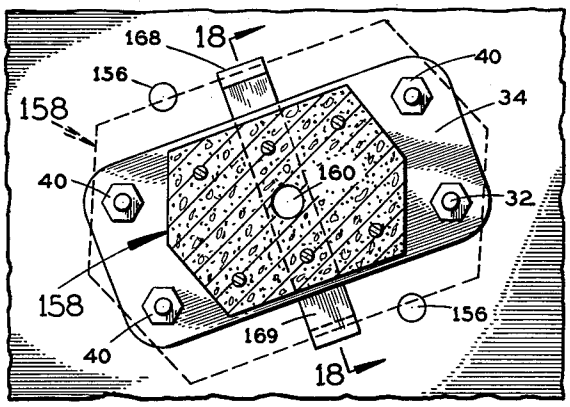



FIG. 17

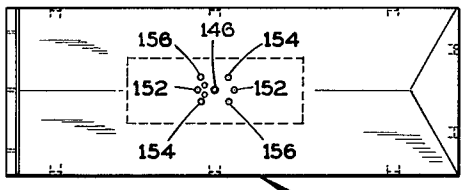



FIG. 16

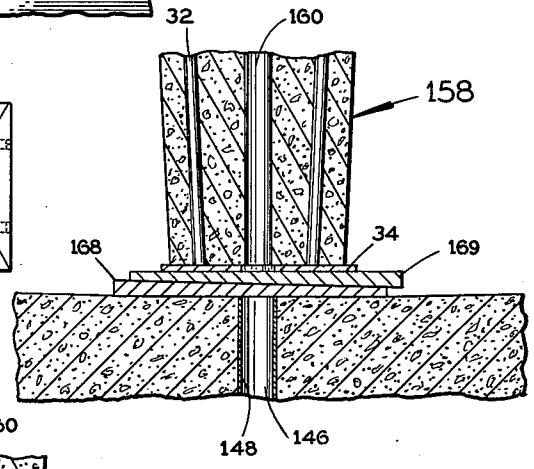



FIG. 18

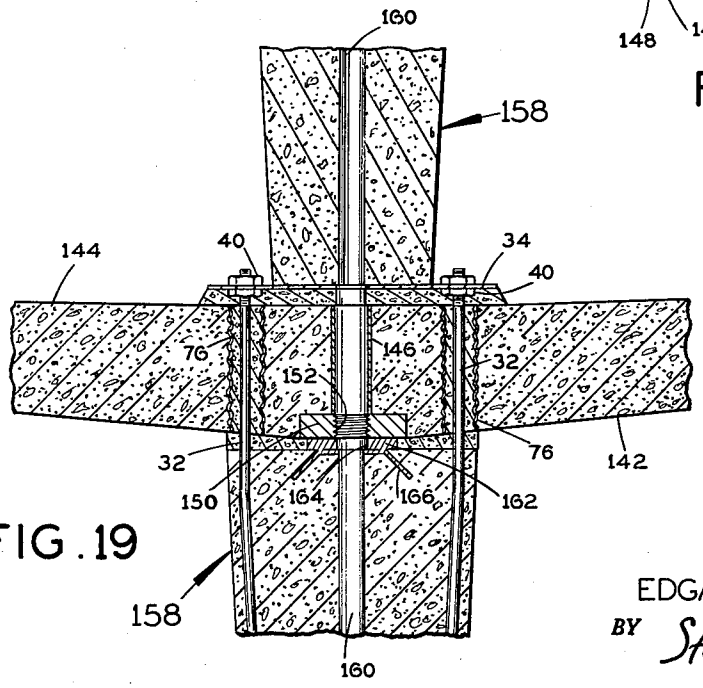



FIG. 19

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United States Patent Office 3,136,092 Patented June 9, 1964



3,136,092

# PREFABRICATED CONCRETE PARKING STRUCTURE OR THE LIKE

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Filed Dec. 5, 1960, Ser. No. 73,953
8 Claims. (Cl. 50—140)

The present invention relates generally to the building art and more particularly to a novel prefabricated parking structure or the like made from precast, prestressed concrete structural components of standardized design. The present application is a continuation-in-part of the copending patent application Serial No. 859,616 filed December 15, 1959 in the name of Edgardo Contini and now abandoned.

It is well known that at the present time the parking of automotive vehicles and the like in the downtown or business areas of large cities presents a considerable problem. In many cities old buildings are torn down to provide street-level parking space. Parking structures as such are usually not erected because of the expense involved and because of the possibilities that the area may be used for the erection of a new store or office building in the immediate future.

It is an object of the present invention therefore to provide a novel prefabricated parking structure which is made from prefabricated or precast concrete structural components which can be easily and quickly erected and easily and quickly disassembled whenever necessary. More particularly, it is an object to provide such a structure formed from precast concrete slabs and columns which can be easily and quickly fastened together and to footings by removable connections, to provide a strong, safe, rigid fireproof structure which can be easily and quickly demounted for reuse in other locations.

Another object is to provide standardized precast concrete structural components which are exceedingly few in number and which can be used for the erection of both single deck and multideck parking structures and the like with deck areas of various sizes. More particularly, it is an object to provide such standardized concrete structural components which can be precast and stockpiled for future use in various arrangements to provide both single deck and multideck parking structures to accommodate any predetermined number of automotive vehicles.

A further object is to provide a novel multideck parking structure erected from four basic precast concrete structural components, which includes a double spiral system of entering and exiting to accommodate all required movement with a single pattern of one-way circulation.

Yet another object is to provide a novel means for interconnecting the units and for rigidly connecting the slab units to the columns, whereby the entire resultant structure comprises a series of three hinged arches pinned at the base of the columns and hinged at the edge connections between adjacent units.

An additional object is to provide a novel means for quickly and accurately fastening the units to the top of the columns and for erecting one column above the other in a multideck structure.

Further objects and advantages of the present invention will be apparent from the following detailed description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are shown.

Briefly stated, the present invention comprises the use of a limited number of standardized precast concrete structural components, including a column, one type of slab unit and two types of ramp units, for erecting either



single deck or multideck parking structures and the like. Each of the slab units is preferably of double cantilevered construction, and is supported by a column positioned adjacent to the center of the unit, and the ramp units are also supported adjacent the centers thereof so that when erected, the entire structure provides a series of three hinged arches pinned at the bases of the columns and hinged at the edge connections between adjacent units. The invention also includes a novel means for fastening the units to the supporting columns and for supporting one column above the other, whereby the structure can be easily and quickly erected and demounted by even inexperienced personnel.

In the drawings:

FIG. 1 is a top plan view of a multideck parking structure constructed in accordance with the teachings of the present invention;

FIG. 2 is a vertical sectional view taken on the line **2—2** in FIG. 1;

FIG. 3 is a vertical sectional view taken on the line **3—3** of FIG. 1;

FIG. 4 is an enlarged top plan view of one of the slab units, the unit shown being a so-called "left-hand unit";

FIG. 5 is a vertical sectional view taken on line **5—5** in FIG. 4;

FIG. 6 is an enlarged fragmentary vertical sectional view taken on the line **6—6** in FIG. 4;

FIG. 7 is an enlarged fragmentary top plan view of the slab unit connecting means;

FIG. 8 is a vertical sectional view taken on the line **8—8** in FIG. 7;

FIG. 9 is an enlarged top plan view of the upper type of ramp slab construction;

FIG. 10 is a vertical sectional view taken on the line **10—10** in FIG. 9;

FIG. 11 is a vertical sectional view similar to FIG. 10, showing the lower type of ramp slab unit, the two types being used together to bridge the distance between vertically spaced adjacent deck areas;

FIG. 12 is an enlarged vertical sectional view taken on the line **12—12** in FIG. 2;

FIG. 13 is an enlarged fragmentary vertical sectional view taken on the line **13—13** in FIG. 9, illustrating the bridging construction between the inclined portions of the ramp units;

FIG. 14 is a fragmentary top plan view of a single deck parking structure constructed in accordance with the teachings of the present invention;

FIG. 15 is a fragmentary side elevational view of the single deck structure shown in FIG. 14, the footings and retaining walls being shown in cross section;

FIG. 16 is a top plan view of another form of slab unit according to the present invention;

FIG. 17 is an enlarged horizontal fragmentary sectional view illustrating the erection and assembly of the slab unit shown in FIG. 16 with modified forms of columns;

FIG. 18 is a sectional view taken along line **18—18** in FIG. 17; and

FIG. 19 is a fragmentary vertical sectional view of the final assembly of the columns and slab unit.

Referring to the drawings more particularly by reference numerals, specifically FIG. 1, **20** indicates a multideck parking structure embodying the teachings of the present invention, which is erected from a plurality of standardized prefabricated prestressed concrete structural units. These units include supporting columns **22** (FIGS. 2 and 3), upper ramp units **24** (FIG. 10), lower ramp units **26** (FIG. 11), left-hand slab units **28** (FIGS. 1, 4 and 5), and right-hand slab units **30** (FIG. 1). Although the right- and left-hand slab units differ in details, they are the same basic unit and are made in the same mold,

and moreover, the unit illustrated in FIG. 16 of the drawings may be selectively employed as a right hand or left hand unit, as will be later set forth. As indicated in FIGS. 4 and 6, each column 22 is of rectangular horizontal cross section and may contain four vertically extending steel reinforcing rods 32 embedded therein which have the lower ends thereof welded to a rectangular metal plate 34 which is in abutting relationship with the lower end of the column and which contains four apertures 36 adjacent the corners thereof. The upper ends of the reinforcing rods 32 project above the upper end of the concrete column and may be threaded as at 38 to receive locking nuts 40.

The upper ramp unit 24 (FIG. 10) is of substantially dihedral rectangular shape and has opposed side edges 42 and opposed upper and lower ends 44 and 45, respectively. It includes a horizontal wing portion 46 and a downwardly inclined wing portion 48, each of which tapers outwardly to a relatively thin end. At the middle of the ramp unit and adjacent the side edges 42 are column-receiving shoulders or protuberances 50 which have spaced-apart parallel upper and lower faces 52 and 54, respectively. Four spaced-apart passageways extend through the protuberances between the faces to receive the upper ends of column rods 32 as will be described more fully hereinafter. Formed in the side edges 42 and the upper end 44 are spaced-apart cup-like recesses 56 which contain U-shaped fastening brackets 58 (FIGS. 7 and 8), the legs thereof being embedded in the concrete unit and the transverse portion containing spaced-apart apertures 60 for receiving bolt and nut assemblies 62. The lower end 45 contains a structural T member 63 embedded thereon for a purpose to appear.

The lower ramp unit 26 is similar in shape to the upper ramp unit 24 and contains like recesses 56 and fastening brackets 58 at the sides and one end and like column-receiving protuberances 50. However, the inclined wing portion 64 extends upwardly with an upper end 65 which contains an embedded structural T 69 and the horizontal wing portion 66 contains a lower end 67, whereby the upper and lower ramp units can be bridged adjacent the ends 45 and 65 to provide an inclined interconnecting surface between two vertically spaced, side-by-side parking areas, as will be described more fully hereafter.

The left-hand slab unit 28 (FIGS. 4 and 5) is of rectangular shape with opposed side edges 68 and an inner end 70 and an outer end 72. The side edges 68 and the inner end 70 are provided with spaced cup-like recesses 56 and U-shaped brackets 58 similar in construction to those previously described with respect to the ramp units. The slab unit 28 is of double cantilever tapered construction with a thick center portion 74 preferably longitudinally offset toward the slab outer end 72, and relatively thin outer edges. The offsetting of the center portion 74 toward the slab outer end results, in the finally assembled structure, in inner cantilever wings of greater length than the outer cantilever wings contributing to superior floor spacing arrangement and to better balance of the assembled structure, particularly when under normal load. The inner cantilever wings form sections of three-hinged arches. Adjacent the center of the portion 74 are four spaced-apart vertically extending corrugated metal sleeves 76 (FIG. 6) which are grouped in the form of a rectangle and cast in the slab to provide passageways between the upper and lower surfaces thereof to receive the upper ends of the column rods 32. The only difference between the left-hand slab unit 28 and the right-hand slab unit 30 is that in the left-hand unit the major axis of the sleeve grouping (as viewed from the inner end 70) extends outwardly to the left, whereas in the right-hand slab unit the major axis of the sleeve grouping extends outwardly to the right. This is to provide for the angle parking of the automotive vehicles, as will be described more fully hereinafter. Referring to FIGS. 1, 4, and 5, it will be noted that the outer ends 72 of both slab units are provided with an integrally formed upstanding curb 78 for the purpose to appear. As previously mentioned, the same mold is used for forming both of these slab units, the only difference is the positioning of the sleeves 76 prior to pouring. The same is true if the unit is to have a half curb instead of a full curb.

To erect a multideck parking structure 20 of the type shown in FIGS. 1, 2 and 3, a barrier wall 80 may be provided between two contiguous level surfaces which are at different elevations and a plurality of continuous column footings 82 poured in the upper area and a plurality of similarly spaced continuous column footings 84 poured in the lower area. The vertical distance between the upper surfaces of the two sets of footings is approximately one-half the height of a column 22 for a reason to appear shortly. Embedded in these footings are anchor bolts (not shown) which are spaced apart so as to coincide with the spacings of the openings 36 in the plate 34 at the base of the column 22. The anchor bolts in the footings are arranged so that when the columns 22 are mounted on them, the latter will be positioned in the proper angular relationship relative to the barrier wall 80 so as to be adapted to receive a right- or left-hand slab unit or a straight-away ramp unit.

The first tier of columns 22 is then positioned in a series or row, as illustrated, on the footings in both the upper and lower areas and leveled by means of a double nut arrangement of the type shown in FIG. 6. The space between the upper surface of each footing and the base plate 34 of the column positioned thereon can then be dry-packed in a conventional manner. Thereafter, the first tier of lower slab units 28 and 30 and the ramp units 24 and 26 are mounted on top of the first tier of columns 22 in the lower area (at right of FIGS. 2 and 3) and connected together, and the same is done with the first tier of upper slab and ramp units in the upper area (at the left in FIGS. 2 and 3). To mount a slab unit on a column, e.g. a left-hand unit 28 (FIGS. 4–8), the unit is positioned above the column 22 so that the upper ends of the reinforcing rods 32 project through the sleeves 76. If desired, metal bearing plates 122 and 124 (FIG. 6) can be embedded in the units and columns, respectively, and a metal spaced block welded to the column bearing plate 124. With the slab unit positioned on the accurately leveled column, it is connected to adjacent slab units by means of the brackets 58 (FIGS. 7 and 8) previously described. Thus, the cup-like recesses 56 are in alignment so as to place the brackets 58 in abutting relationship whereby the bolt assemblies 62 can be fitted in the openings 60. The recesses 56 are then filled with grout to provide a smooth upper surface level with the upper surfaces of the slab units. When the slab unit is properly connected to adjacent units, the space between the slab and column is sealed off, as by means of strips, and grout is forced down through the sleeve 76 and into the aforementioned space. As mentioned previously, the sleeves 76 are of greater diameter than the reinforcing rods 32 to permit the lateral adjustment of the slab on the column and to permit the grout to be introduced into the sleeve between the slab and the top of the column.

The ramp units 24 and 26 between the upper and lower slab units in the first tier (and between the lower tier and the ground area) are mounted on their respective columns in like manner and the ends of the slab units which are adjacent to the ends of slab units are connected thereto by means of the brackets 58 previously described.

However, because of expansion and alignment problems, the opposed ends 45 and 65 of the ramp units are not connected together, but, instead, are preferably bridged by means of an expansion joint shown in FIG. 13. As previously described, structural T members 63 and 69 are embedded in the ends 45 and 65, respectively, of the ramp units and held in position therein as by means of strap anchors 128 welded to said members. Extending across the upper portions of the opposed T members is

a metal bridging plate 130 which contains a plurality of spaced pairs of countersunk openings 132. A plurality of relatively narrow clamping plates 134 are positioned below the bridging plate so as to engage the underside of the T members and are fastened to the bridging plate by screw and lock nut assemblies 136. Thus, the space between the ends of the inclined portions of the ramp units are bridged with a variable expansion type joint to compensate for minor differences in alignment and for slight movement between adjacent deck areas.

After the first tier of slab and ramp units are leveled on the first tier of columns and connected together, the second tier of upper and lower columns 22 is mounted directly above the first tier in the manner shown in FIG. 6. Thus, the plate 34 of the upper column 22 is positioned over the upper ends of the column rods 32 and the column plumbed by means of the leveling nuts 40. After the column is in proper position, the space between the upper surface of the slab 28 and the plate 34 is dry-packed as previously described. The same procedure is followed with respect to all of the columns and then the slab and ramp units in the second tier are mounted on top of the second tier of columns and connected together in the same manner as described hereinabove. Obviously, any number of decks can be erected, one above the other, in the manner just described. Also, it will be understood that the reinforcing rods of the top tier of columns will not project beyond the upper surfaces of the slab or ramp unit which it supports.

In order to facilitate the accurate positioning of the slab units and ramp units relative to each other and the underlying support columns, temporary adjustable columns or A-frames are advantageously located between the rows of columns adjacent the inner ends of the slab and ramp units. The units are lowered into the desired positions and supported by the corresponding concrete columns and temporary columns or frames. Thereafter the various slab and ramp connections may be effected, the temporary columns or frames being adjusted to bring the edges of the ramp and slab units into their optimum contiguous positions. The temporary columns and frames are removed preferably after the various dry packs and groutings have set. Suitable temporary cross bracing may also be employed during erection.

As shown in FIG. 2, in addition to the ramp units connecting the lower slab units of the first tier with the upper slab units of that tier, there are similar ramp units connecting the upper slab units of the first tier with the lower slab units of the second tier, and so on. Thus, with the footings 82 and 84 vertically spaced a distance equal to one-half the height of the columns, the same type of ramp units can be used for connecting together the upper and lower slab units in the same tier and for connecting together the adjacent slab units in succeeding tiers. As shown in FIGS. 1 and 2, two extra lower type ramp units 26 with railings 85 across the upper ends thereof are required in the upper level of the uppermost tier.

Referring to FIGS. 1, 4 and 9, it will be noted that all of the ramp units are one and one-half times the width of the slab units, and that the inner ends 70 of the slab units contain two spaced-apart recesses 56 which are spaced inwardly from the side edges 68 a distance equal to one-fourth the width of the slab, and that the ends 44 and 67 of the ramp units contain three recesses 56, i.e. a recess in the center and side recesses spaced inwardly from the side edges 42 a distance equal to one-sixth of the ramp width. Thus, it will be apparent from FIG. 1 that two ramp units in side-by-side relationship span the width of three slab units so that the end recesses 56 of each group will be in exact alignment to permit them to be fastened together as previously described. Also, the width of each slab unit (and the spacing between adjacent columns) is slightly greater than the width of an automotive vehicle to be parked in the structure, and the length of each slab unit is about one and one-half times the length of such a vehicle. It will also be noted from FIG. 1 that the curb 78 which is formed at the outer end of each slab unit provides an inner barrier insofar as the right-hand slab units 30 are concerned and an outer barrier for the left-hand slab units 28.

After the slab units and ramp units have been placed in position and interconnected, prefabricated metal guard railings 86 (FIG. 4) are mounted on the curbs 78 of the left-hand slab units 28 which form the outer ends of the parking structure. Each railing unit 86 is preferably prefabricated from angle irons which are welded together in back-to-back relationship to form L-shaped supports 88 which are welded to angle plates 90, which in turn are adapted to be mounted on the curbing by means of bolts 92 and expansion anchors (not shown). Lengths of pipe 94 are welded to both legs of the supports 88 in spaced-apart relationship and the length of the entire railing unit 86 is preferably just a few inches shorter than the width of a slab unit 28 so that it is only necessary to stock one size of railing unit.

In order to guard the sides of the parking structure and the areas adjacent the ramps, two types of precast concrete curb railings are provided, a straight section 96 and a sloping section 98 (FIGS. 2 and 12). Each straight concrete railing section 96 includes spacer blocks 100 which support a base member 102, a top rail 104, and spaced-apart flat panels 106 which extend between the top rail and the base member. As shown in FIG. 12, the railings are preferably fastened to the slab and ramp units by means of depending rods 108 which extend through openings formed in said units and which have nuts 110 threaded on the free ends thereof. The straight sections 96 are also of uniform length and slightly shorter than one-half the length of a slab unit so that two straight sections 96 run the length of each right-hand or left-hand slab unit.

The sloping concrete railing section 98 is similar in construction to the straight section 96 previously described and is of such a length that two such sloping sections fit between the supporting columns (FIG. 2) which are mounted on adjacent upper and lower ramp units.

If desired, an elevator shaft 112 and a staircase 114 (FIG. 1) may be provided, but these are ancillary features and do not form any part of the present invention. As indicated in FIGS. 2 and 3, the lower parking areas are normally paved with asphalt 115, or the like.

If desired, the same standard concrete structural components previously described can be utilized in erecting a single deck parking structure of the type shown in FIGS. 14 and 15. Thus, similar footings 84 are provided to support preformed columns 22 on which are mounted upper ramp units 24, left-hand slab units 28, and right-hand slab units 30 in the manner previously described. Prefabricated metal railings 86 are also provided at the ends of the structure, and straight and sloping precast concrete railings 96 and 98, respectively, are provided at the sides thereof. One difference between the multideck and the single deck structures shown is that in the latter, the sets of left- and right-hand slab units 28 and 30 which form each parking area are spaced apart as at 116 to provide clearance space between the ends of the automotive vehicles and to provide natural light for the lower parking area. Suitable heavy-duty traffic grating 118 is provided between the ends of the slab units at the sides of the structure to permit traffic to move from one parking area to another and a pipe grill 120 similar in construction to the prefabricated metal railings 86 previously described closes off the remaining spacing 116 between the ends of the slab units so as to prevent customers from falling therethrough.

Obviously, the spacing between parking areas on the same level and the accompanying grillwork just described can also be used with a multideck parking structure if it is desirable to have additional overhead natural light, as may occur where other sets of slab units are added

to the ends of the units shown in FIGS. 2 and 3 to increase the capacity of the structure without increasing its height. It is also to be understood that the various precast concrete structural units which have been described can be assembled and utilized in other combinations. Stating it differently, the concept of double cantilevered, tapered, prestressed, concrete slab units and precast ramp units which can be connected together in different arrangements and mounted on standard precast columns opens a wide field for various types of single deck and multideck parking structures and the like. Because there are only four basic structural units, they can be precast at minimum expense and stored for subsequent use. Due to the simplicity of the mounting and interconnecting means, the structures can be erected in a very short time at minimum expense by relatively inexperienced personnel. Because the only field work needed on the site is the pouring of the foundations and footings, the parking structure can be erected over an existing surfaced parking area with a minimum of interruption in the use of the facilities. The entire system, once assembled, provides a series of three hinged arches pinned at the base of the columns and hinged at the edge connections between adjacent horizontal units. Consequently, the system is not only stable for vertical loads but also for horizontal forces, and therefore no shear walls or bracing are required. Also, and what is very important, if the land is subsequently sold for other purposes, the parking structure can be easily and quickly dismantled and the units reused in the erection of another structure. Thus, the grout covering the brackets **38** can be easily chipped away and the concrete in the sleeves **76** removed by means of conventional coring machines of the type used for taking concrete test samples.

Reference is now made to FIGS. 16 to 19 of the drawings which illustrate modified forms of the column and slab unit and the method of assembly and erection which may be employed to great advantage in place of the corresponding units and procedure previously described. The modified slab unit differs from that previously described primarily in the provision of a vertical drain defining bore and in the arrangement of the coupling rod-receiving bores and sleeves which permits the use of the identical slab as a right hand and left hand unit. The modified column differs from that previously described in that it is provided with a vertical axial drain defining bore. In assembling the upper column atop the underlying slab it is first plumbed and levelled by the leveling nuts, as aforesaid, and a pair of mating wedges are driven between the slab and column base plate extending from the edge of the base plate across the drain bore and bear directly against the underface of the column. After the filling between the column and slab unit has set the wedges are removed to provide a channel to the drain bore. The upper face of the slab is dished to the center thereof to provide suitable run off.

Specifically, the modified slab unit is designated by the reference numeral **140** and as in the earlier described slabs is of rectangular configuration, being tapered toward the thinner side edges and inner and outer ends thereof and being provided with fastening brackets along said side edges and inner end. A thick center portion **142** is symmetrically located along the medial longitudinal axis of the slab unit **140** and is longitudinally offset toward the outer end of the slab unit, the top face **144** of the slab unit being concave or dished toward the center of the thick portion **140**.

A vertical drain defining bore **146** is formed through the center of the thick portion **142** and is lined with a metal sleeve **148**. Imbedded in the underface of the thick portion **142** is a metal bearing plate **150** having a tapped central opening **152** in alignment with the sleeve **148**. Also formed in the slab thick portion **142** are a first pair of vertical bores **152** lying along the slab medial longitudinal axis and symmetrical to the central drain bore **146**, a second pair of bores **154** on opposite sides of the bore **146** and a third pair of bores **154** on opposite sides of the bore **146**, the bores **152** and **154** being symmetrical to the slab longitudinal axis. The bores **152** and **156** are disposed at the corners of a rectangle whose major axis forms a predetermined angle with the slab longitudinal axis and the bores **152** and **154** are disposed at the corners of a similar rectangle whose major axis forms said predetermined angle with the slab longitudinal axis but in an opposite sense. Thus the slab unit **140** may be selectively employed as a right hand or left hand slab unit by bringing the bore set **152** and **154** or **152** and **156** in registry with corresponding column rods **32**. Each of the bores **152**, **154** and **156** is lined with a corrugated metal sleeve **76**.

As above indicated, the modified column **158** differs from the column **22** in the provision of a vertical axial drain defining bore **160** and the centrally apertured upper bearing or spacing plate **162**. The plate **162** is of rectangular configuration having a funnel shaped central opening **164** registering with the bore **160** and rests on the top end face of the column **158** and is affixed thereto by rods **166** welded to the underface of the plate **162** and imbedded in the column.

The assembly and erection procedure employing the slab units **140** and columns **158** is similar to that previously described except in the use of the mating steel wedge elements **168** and **169**. Specifically a slab unit **140** is transported into resting position atop a column **158** with the upper ends of the rods **34** thereof registering with the set of bores **152**, **154** or **152**, **156** to define a left handed or right handed mounting respectively. After the space between the underface of the slab unit **140** and the top of the column **158** has been dry packed and the bores **152**, **154** and **156** grouted, an upper column **158** is mounted in the slab unit **140** directly above the lower column **158**, the openings in the column base plate **34** engaging the upper threaded ends of the rods **32**, and the column is plumbed by means of the leveling nuts **40**. A pair of mating wedge members **168** and **169** having abutting inclined surfaces and parallel horizontal upper and lower surfaces is disposed between the base plate **34** and the upper face of the slab unit **140** transversely across the ends of the drain bores **146** and **160**. The base plate **34** has a central opening formed therein registering with the drain bores. The wedge members **168** and **169** are tapped lightly together to effect a direct bearing of the upper column **158**, and the space between the plate **34** and slab unit **144** is then dry packed. The wedge members **168** and **169** are removed only after the dry pack under the base plate **34** has reached full strength to leave a channel which affords free communication between the drain bores and the top faces of the slab units. Thus any water reaching the slab units flows toward the center thereof by reason of the dished surface and flows through the channels into the drain bores from which it is disposed in the usual manner. In all other respects the use of the columns **150** and slab units **140** and the erection and assembly procedure are similar to those earlier described. It should be pointed out that the tapped opening **152** in the bearing plate **150** may be employed to releasably engage the threaded end of a rod entering the bore **146** to facilitate the lifting of the slab unit and its maneuvering into position upon a supporting column.

It is to be understood that the foregoing description and the accompanying drawings have been given only by way of illustration and example and that changes and alterations in the present disclosure which will be readily apparent to one skilled in the art are contemplated as within the scope of the present invention.

I claim:

1. In a parking structure erected from precast concrete structural components: an inner row of spaced lower columns of predetermined length having upper ends; an

outer row of spaced lower columns of substantially the same length and having upper ends; rectangular lower slab units having inner and outer ends and supported on the upper ends of the outer lower columns adjacent the center of each unit; a rectangular lower ramp unit containing an upper inclined portion with an upper end and a lower horizontal portion with a lower end supported on the upper ends of the inner lower columns, the lower end of the horizontal portion being in abutting engagement with the inner ends of the lower slab units; an inner row of spaced upper columns having upper ends and a length substantially the same as the length of the lower columns; an outer row of spaced upper columns of substantially the same length and having upper ends, the upper ends of the upper columns being spaced above the upper ends of the lower columns a distance equal to about one-half the length of a column; rectangular upper slab units having inner and outer ends and supported on and rigidly affixed to the upper ends of the outer upper columns adjacent the center of each unit; a rectangular upper ramp unit containing an upper horizontal portion with an upper end and a lower inclined portion with a lower end supported on the upper ends of the inner upper columns, the upper end of the horizontal portion being in abutting engagement with the inner ends of the upper slab units and the lower end of the inclined portion being adjacent the upper end of the inclined portion of the lower ramp unit; and means interconnecting the abutting edges of the units.

2. The structure according to claim 1 wherein the slab units are of double-cantilevered, tapered construction.

3. The structure according to claim 1 wherein the width of a slab unit is slightly greater than the width of an automotive vehicle to be parked in the structure, the length of the slab unit is approximately one and one-half times the length of said vehicle; and the horizontal projected length of a ramp unit is substantially the same as the length of the slab unit.

4. The structure according to claim 1 wherein the columns contain reinforcing rods projecting above the upper ends thereof, and the units contain preformed openings adjacent the centers thereof receiving the projecting ends of the rods.

5. In a parking structure erected from precast concrete structural components: a row of spaced first tier lower inner columns of predetermined length having upper ends; a row of spaced first tier lower outer columns of substantially the same length and having upper ends, the outer columns being displaced laterally from the inner columns; rectangular first tier lower slab units having inner and outer ends and supported on the first tier outer lower columns adjacent the center of each slab unit; a rectangular first tier lower ramp unit containing an upper inclined portion with an upper end and a lower horizontal portion with a lower end and supported on the upper ends of the first tier lower inner columns, the lower end of the horizontal portion being in abutting engagement with the inner ends of the first tier lower slab units; an inner row of spaced first tier upper columns displaced laterally from the lower columns and having upper ends and being of a length substantially the same as the other columns; an outer row of spaced first tier upper columns displaced laterally from the upper inner columns and having upper ends and being of substantially the same length, the upper ends of the first tier upper columns being spaced above the upper ends of the first tier lower columns a distance equal to about one-half the length of a column; rectangular first tier upper slab units having inner and outer ends and supported on the upper ends of the first tier upper outer columns adjacent the center of each unit; a first rectangular first tier upper ramp unit containing a horizontal upper portion with an upper end and a lower inclined portion with a lower end and supported on the upper ends of the first tier upper inner columns, the upper end of the horizontal portion being in abutting engagement with the inner ends of the first tier upper slab units and the lower end of the inclined portion being positioned adjacent to the upper end of the inclined portion of the first tier lower ramp unit; a second rectangular first tier upper ramp unit containing a lower horizontal portion with a lower end and an inclined upper portion with an upper end and supported on the upper ends of other of the first tier upper inner columns; a row of spaced second tier inner columns mounted directly above the first tier lower inner columns and being of substantially the same length; a row of spaced second tier outer columns mounted directly above the first tier lower outer columns and being of substantially the same length; rectangular second tier slab units having inner and outer ends and supported on the second tier outer columns adjacent the center of each slab unit; a rectangular second tier ramp unit having an upper horizontal portion with an upper end and a lower inclined portion with a lower end and supported on the upper ends of the second tier inner columns, the upper end of the horizontal portion being in abutting engagement with the inner ends of the second tier slab units and the lower end being positioned adjacent to the upper end of the second first tier upper ramp unit; and means interconnecting the abutting ends of the units.

6. The structure according to claim 5 wherein the slab units are of double-cantilevered tapered construction, the outer columns are of rectangular horizontal cross section with the major axis thereof at an angle relative to the major axis of the slab unit which it supports, the columns containing reinforcing rods projecting above the upper ends thereof, and the units containing preformed openings adjacent the centers thereof for receiving the projecting ends of the rods when the units are positioned on the columns.

7. In a parking structure erected from precast concrete structural components: an inner row of spaced lower columns of predetermined length having upper ends; an outer row of spaced lower columns of substantially the same length and having upper ends; rectangular lower slab units having inner and outer ends and supported on the upper parts of the outer lower columns; a rectangular lower ramp unit containing an upper inclined portion with an upper end and a lower horizontal portion with a lower end supported on the upper ends of the inner lower columns, the lower end of the horizontal portion being in abutting engagement with the inner ends of the lower slab units; an inner row of spaced upper columns having upper ends and a length substantially the same as the length of the lower columns; an outer row of spaced upper columns of substantially the same length and having upper ends, the upper ends of the upper columns being spaced above the upper ends of the lower columns a distance equal to about one-half the length of a column; rectangular upper slab units having inner and outer ends and supported on and affixed to the upper parts of the outer upper columns; a rectangular upper ramp unit containing an upper horizontal portion with an upper end and a lower inclined portion with a lower end supported on the upper ends of the inner upper columns, the upper end of the horizontal portion being in abutting engagement with the inner ends of the upper slab units and the lower end of the inclined portion being adjacent the upper end of the inclined portion of the lower ramp unit; and means interconnecting the abutting edges of the units.

8. In a parking structure erected from precast concrete structural components: an inner series of spaced lower columns of predetermined length having upper ends; an outer series of spaced lower columns of substantially the same length and having upper ends; rectangular lower slab units having inner and outer ends and supported on the upper parts of the outer lower columns; a rectangular lower ramp unit containing an upper inclined portion with an upper end and a lower horizontal portion with a lower end supported on the upper ends of the inner lower column, the lower end of the horizontal portion being in

abutting engagement with the inner ends of the lower slab units; an inner series of spaced upper columns having upper ends and a length substantially the same as the length of the lower columns; an outer series of spaced upper columns of substantially the same length and having upper ends, the upper ends of the upper columns being spaced above the upper ends of the lower columns a distance equal to about one-half the length of a column; rectangular upper slab units having inner and outer ends and supported on and affixed to the upper parts of the outer upper columns; a rectangular upper ramp unit containing an upper horizontal portion with an upper end and a lower inclined portion with a lower end supported on the upper ends of the inner upper columns, the upper end of the horizontal portion being in abutting engagement with the inner ends of the upper slab units and the lower end of the inclined portion being adjacent the upper end of the inclined portion of the lower ramp unit; and means interconnecting the abutting edges of the units.


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