Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 1

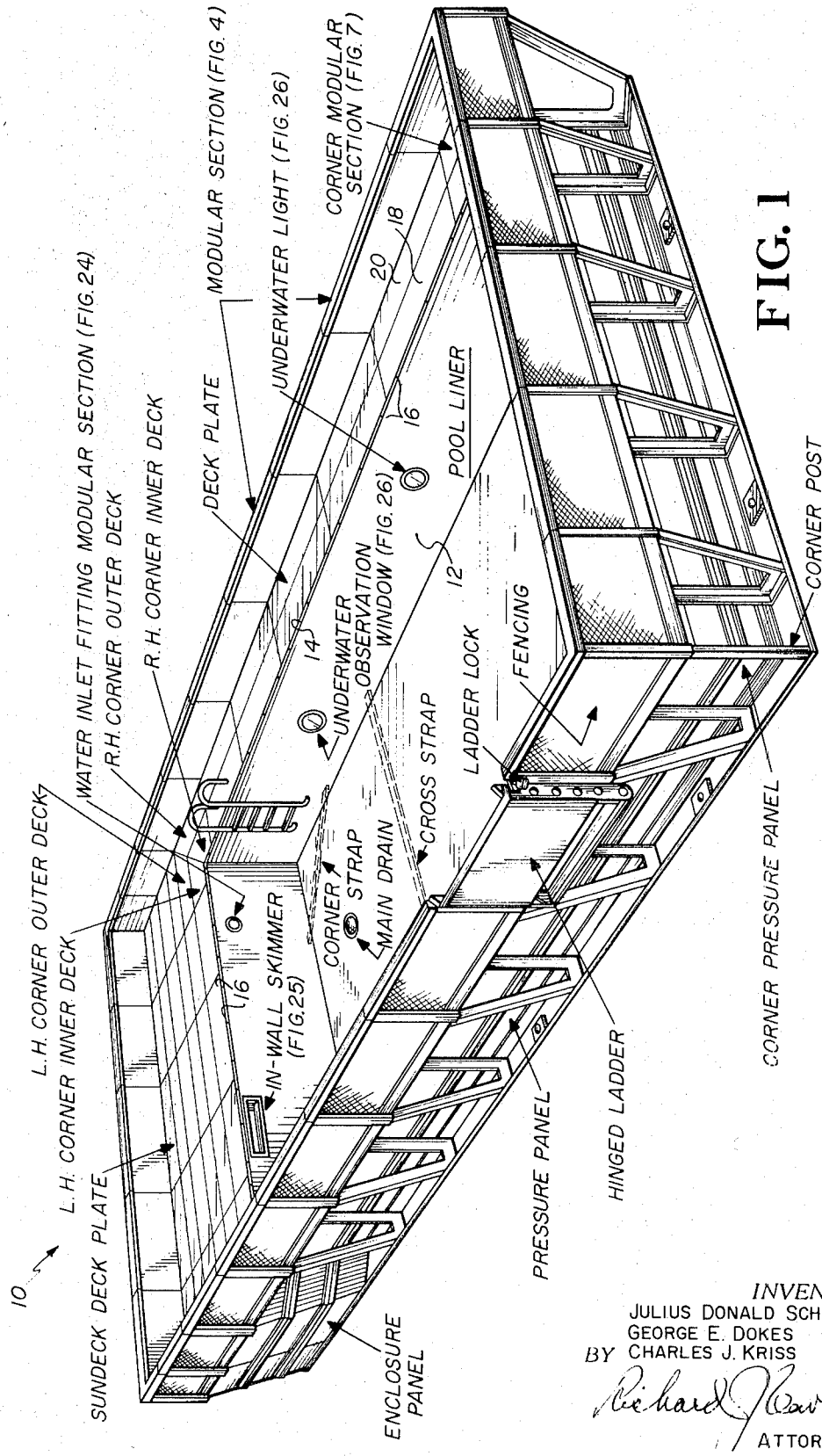


FIG. 1

INVENTORS
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GEORGE E. DOKES
BY CHARLES J. KRISS
Richard J. Bartlett
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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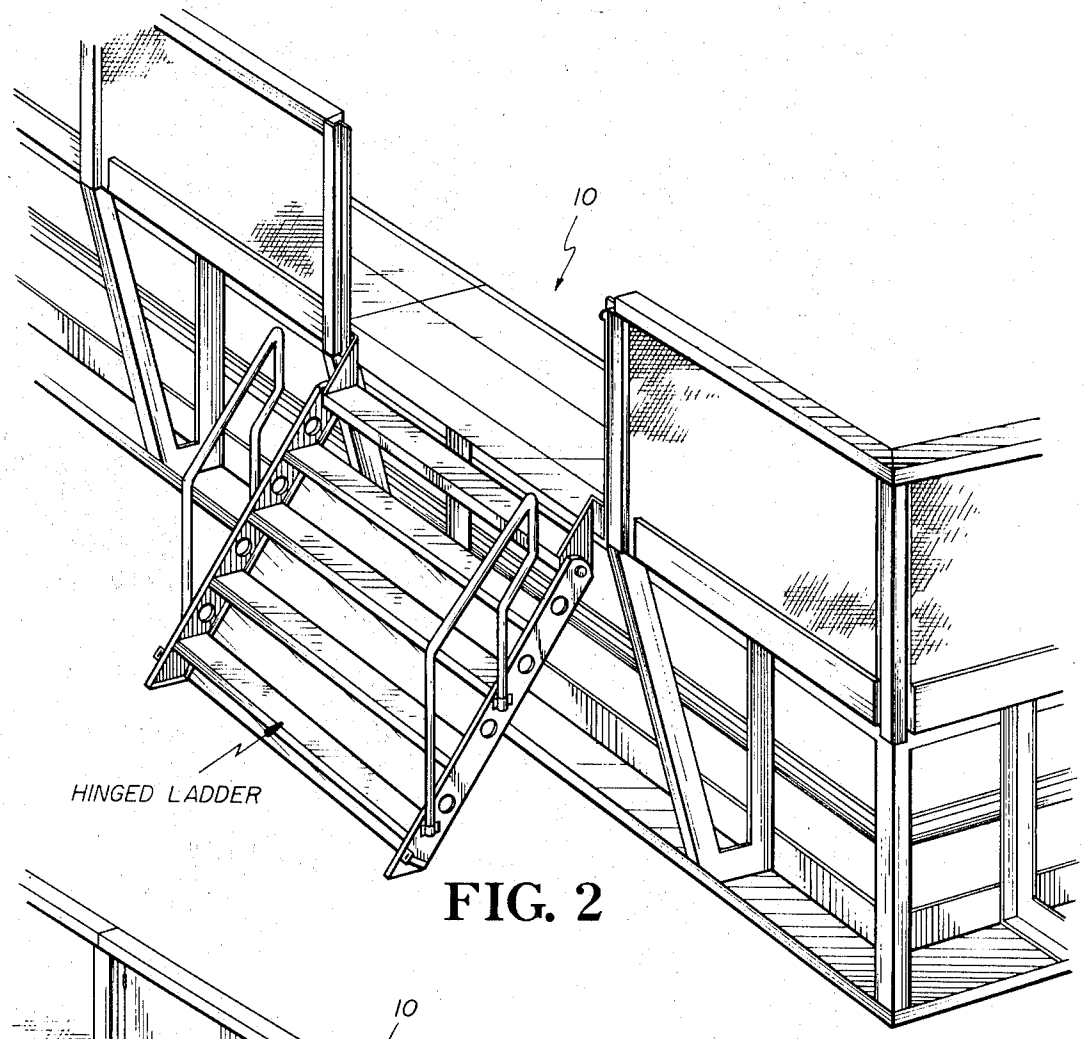


FIG. 2

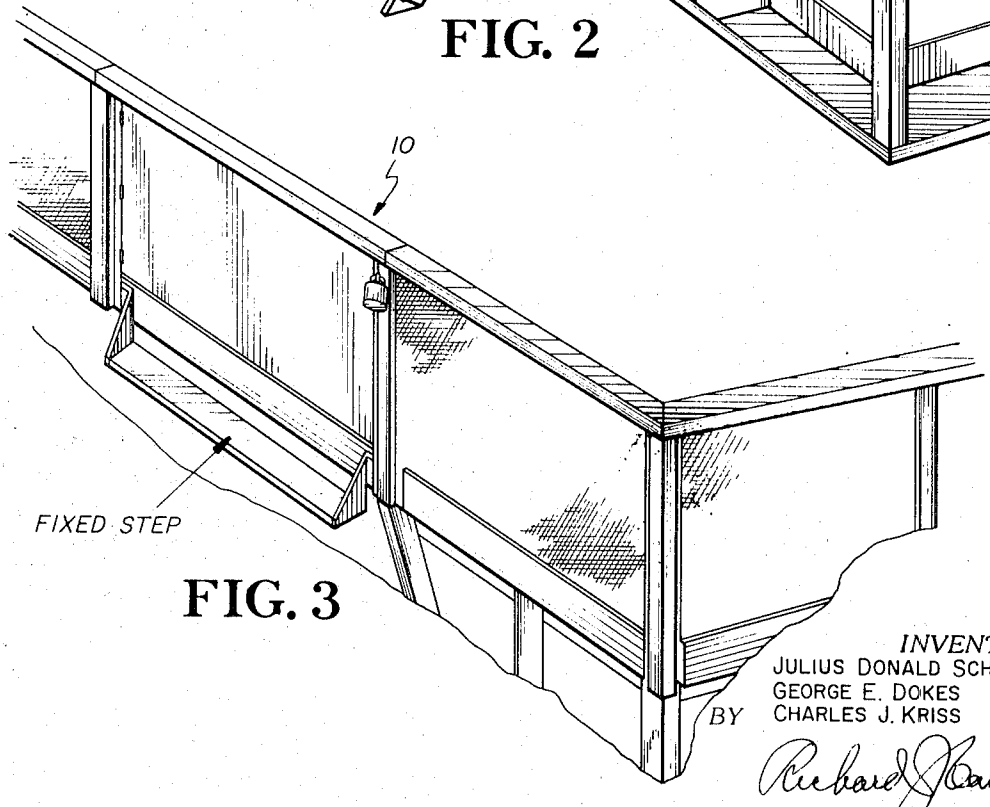


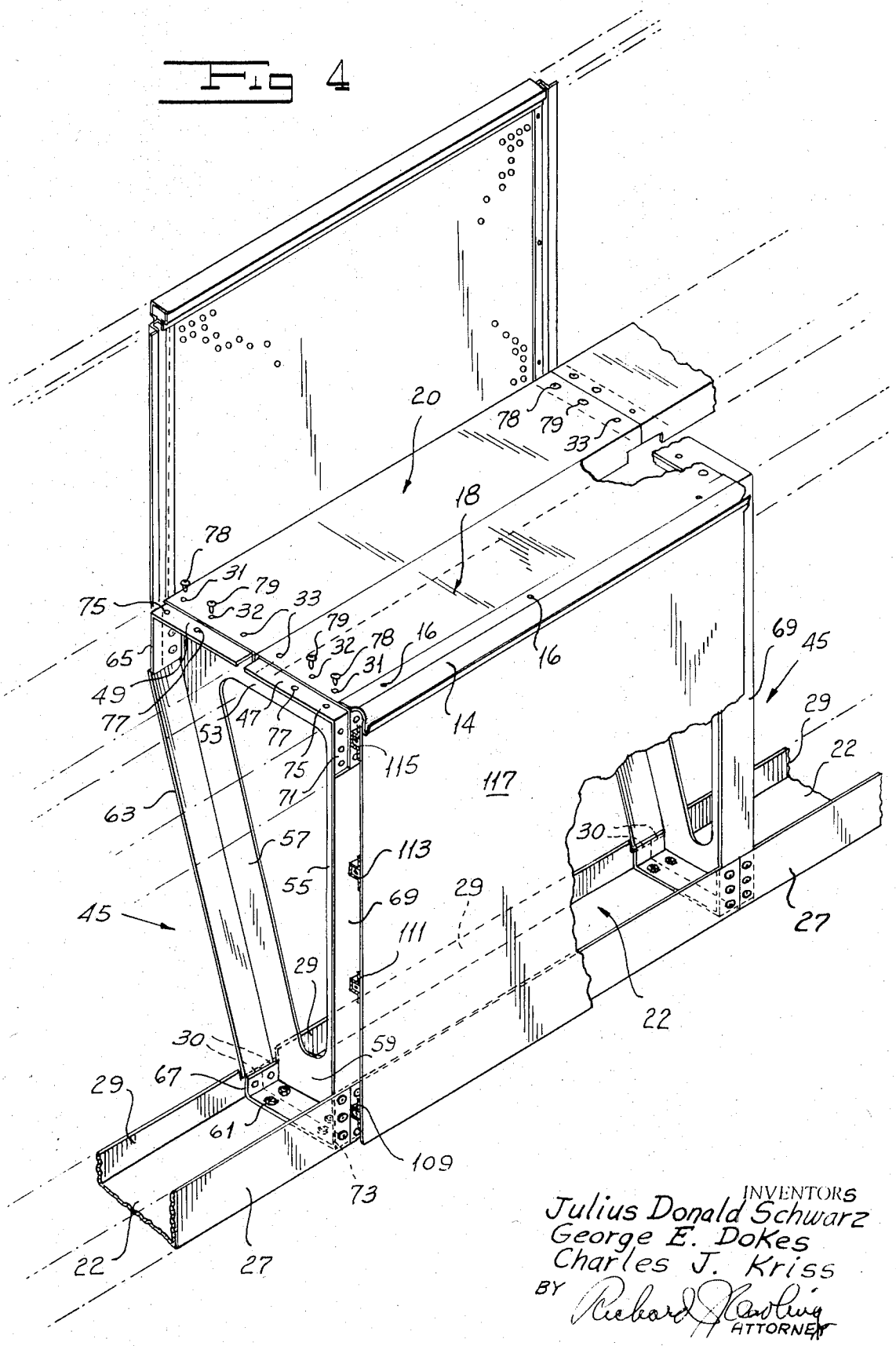
FIG. 3

INVENTORS
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BY Richard J. Bartlett
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MODULAR SWIMMING POOL ASSEMBLY

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Fig 4



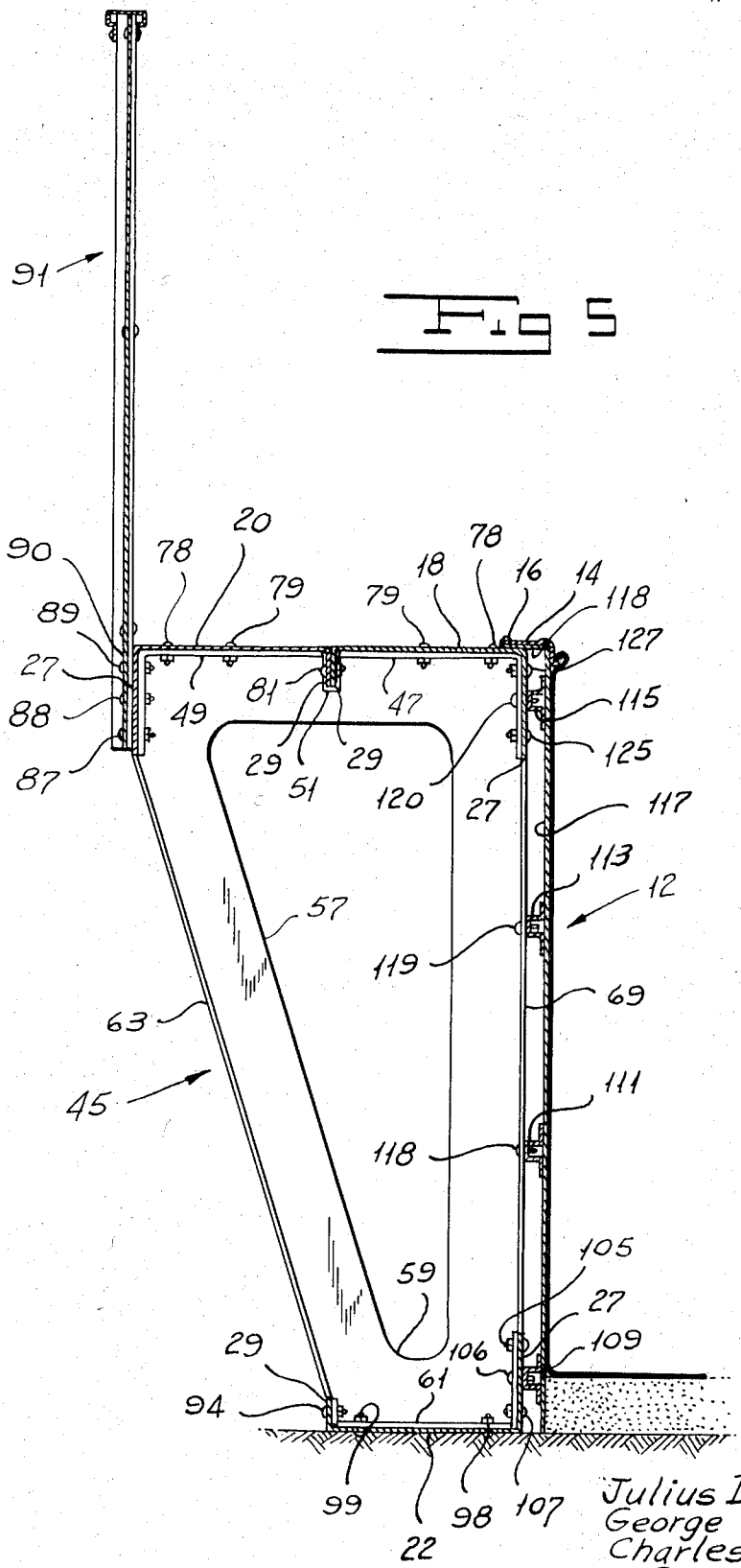
INVENTORS
Julius Donald Schwarz
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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FIG 5



INVENTORS
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BY Richard Rawlins
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MODULAR SWIMMING POOL ASSEMBLY

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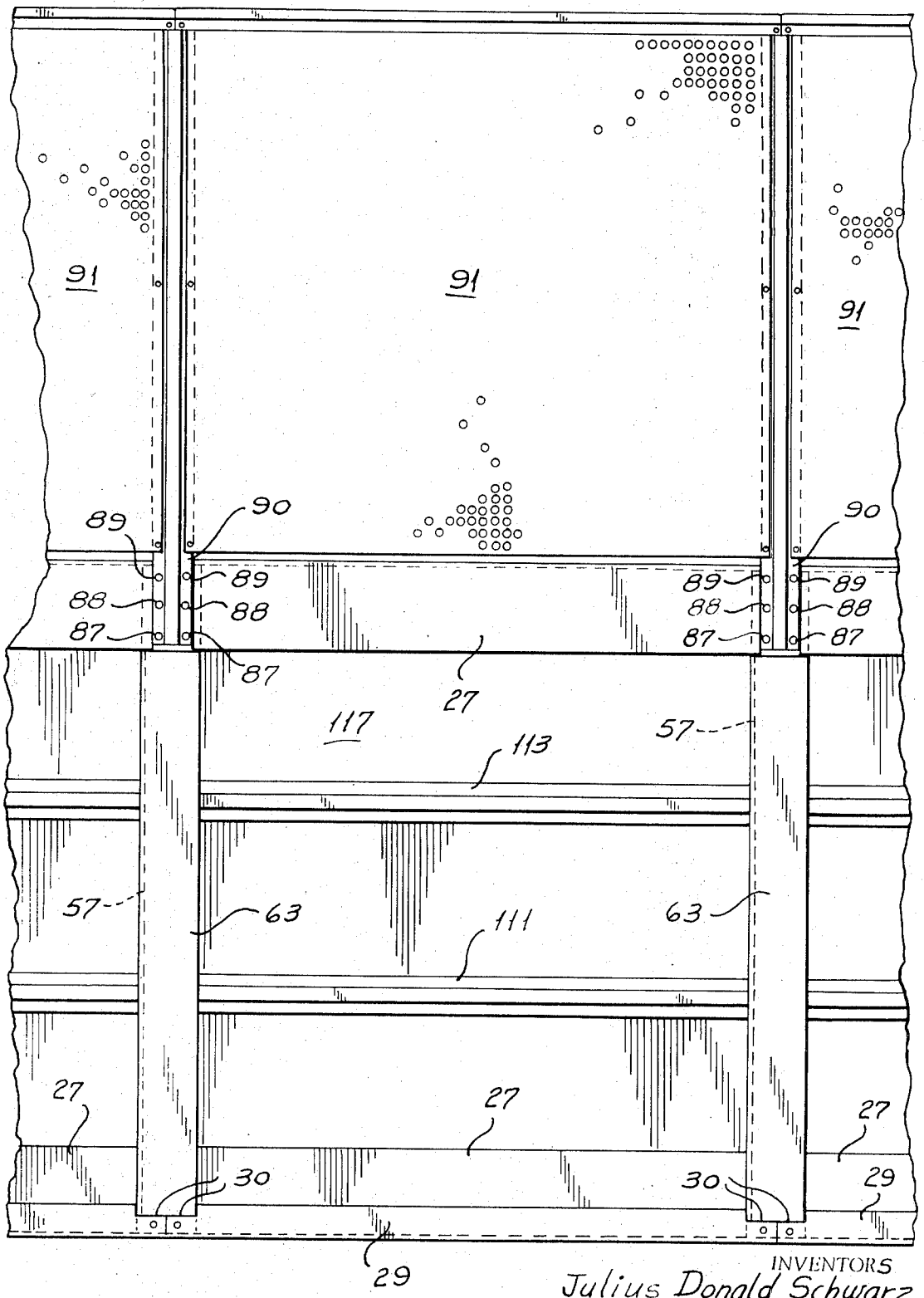


Fig 6

INVENTORS
Julius Donald Schwarz
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Charles J. Kriss
BY Richard Rawlins
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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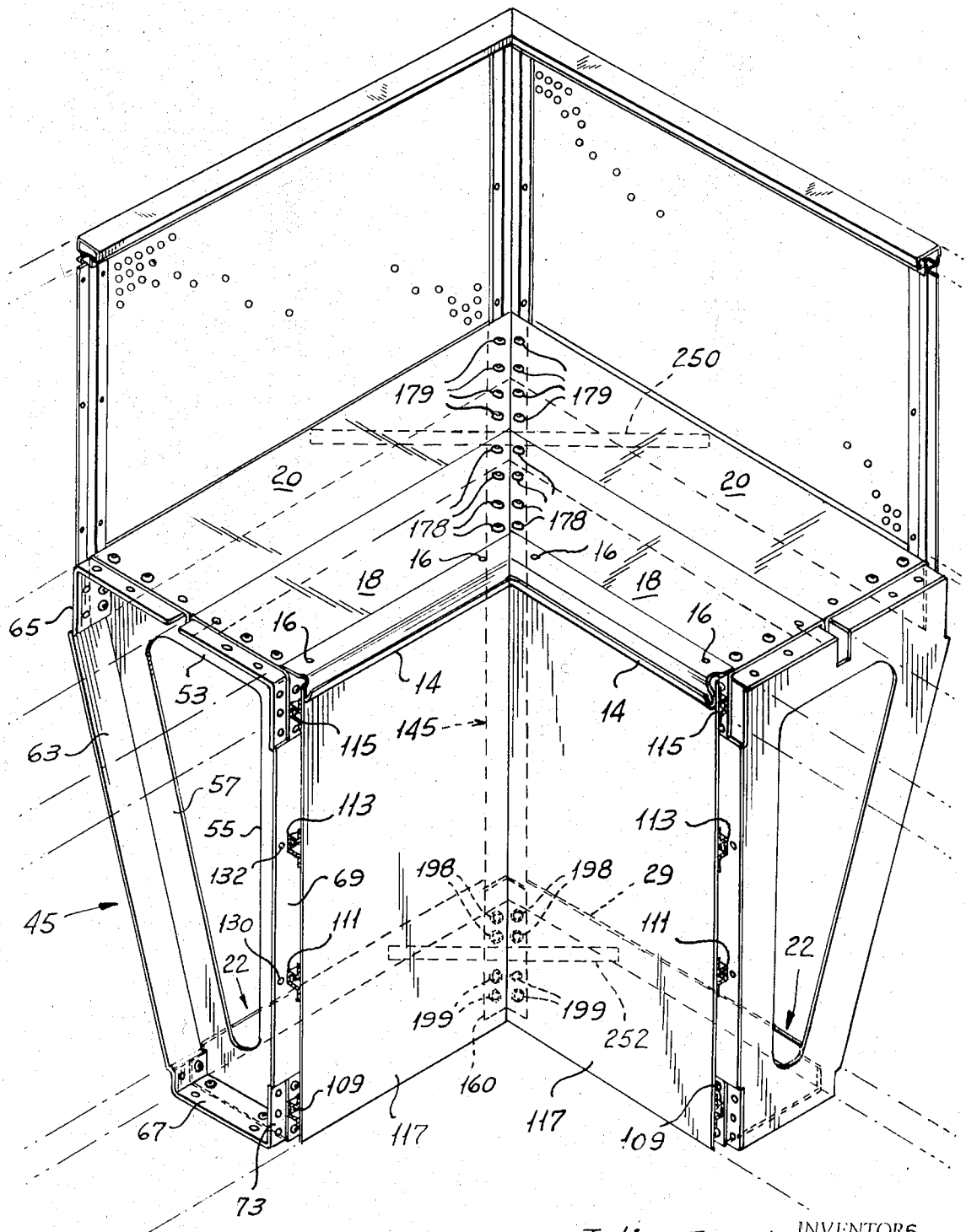


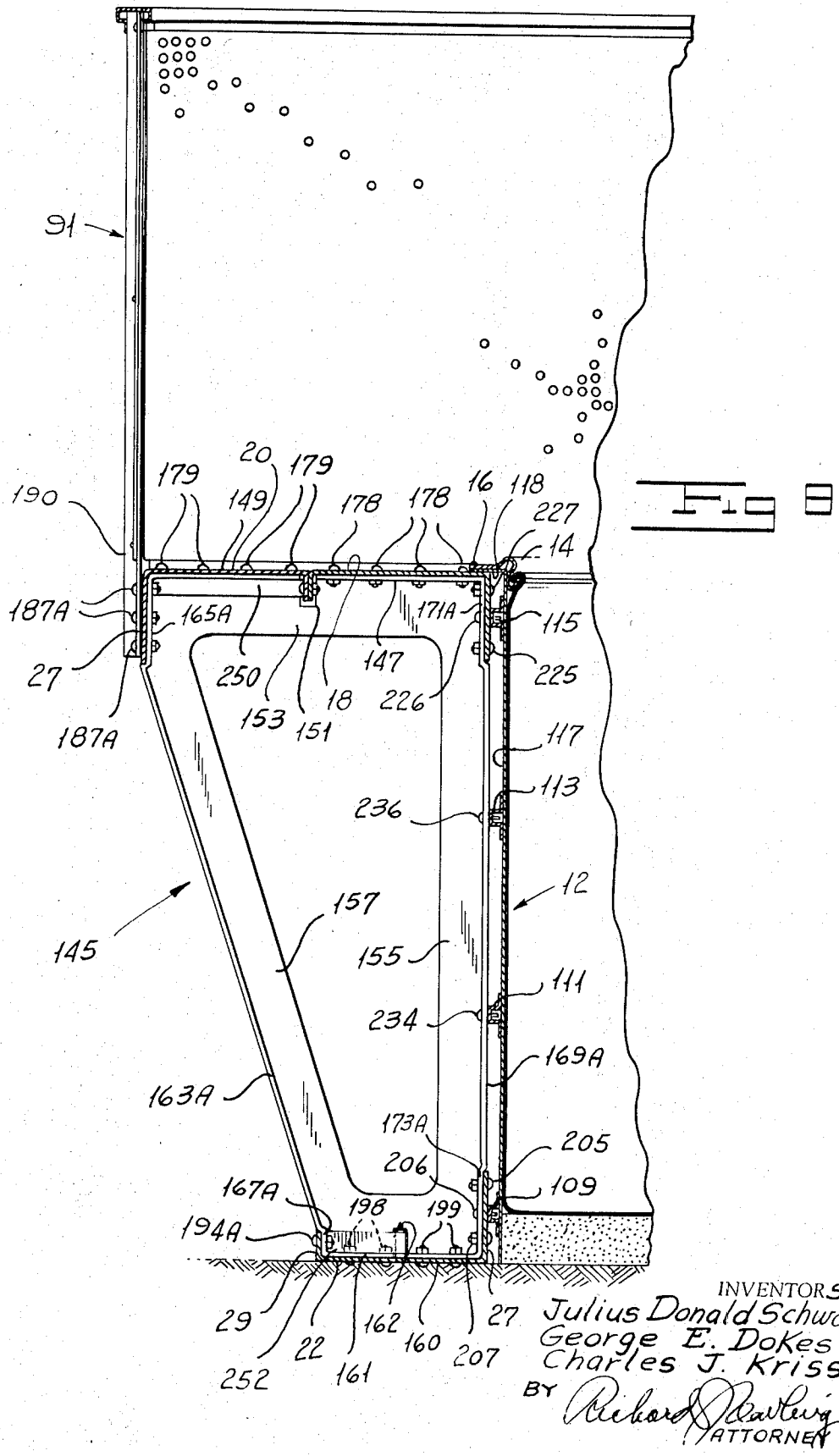
Fig 7

INVENTORS
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BY Richard J. Darling
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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INVENTORS
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Charles J. Kriss
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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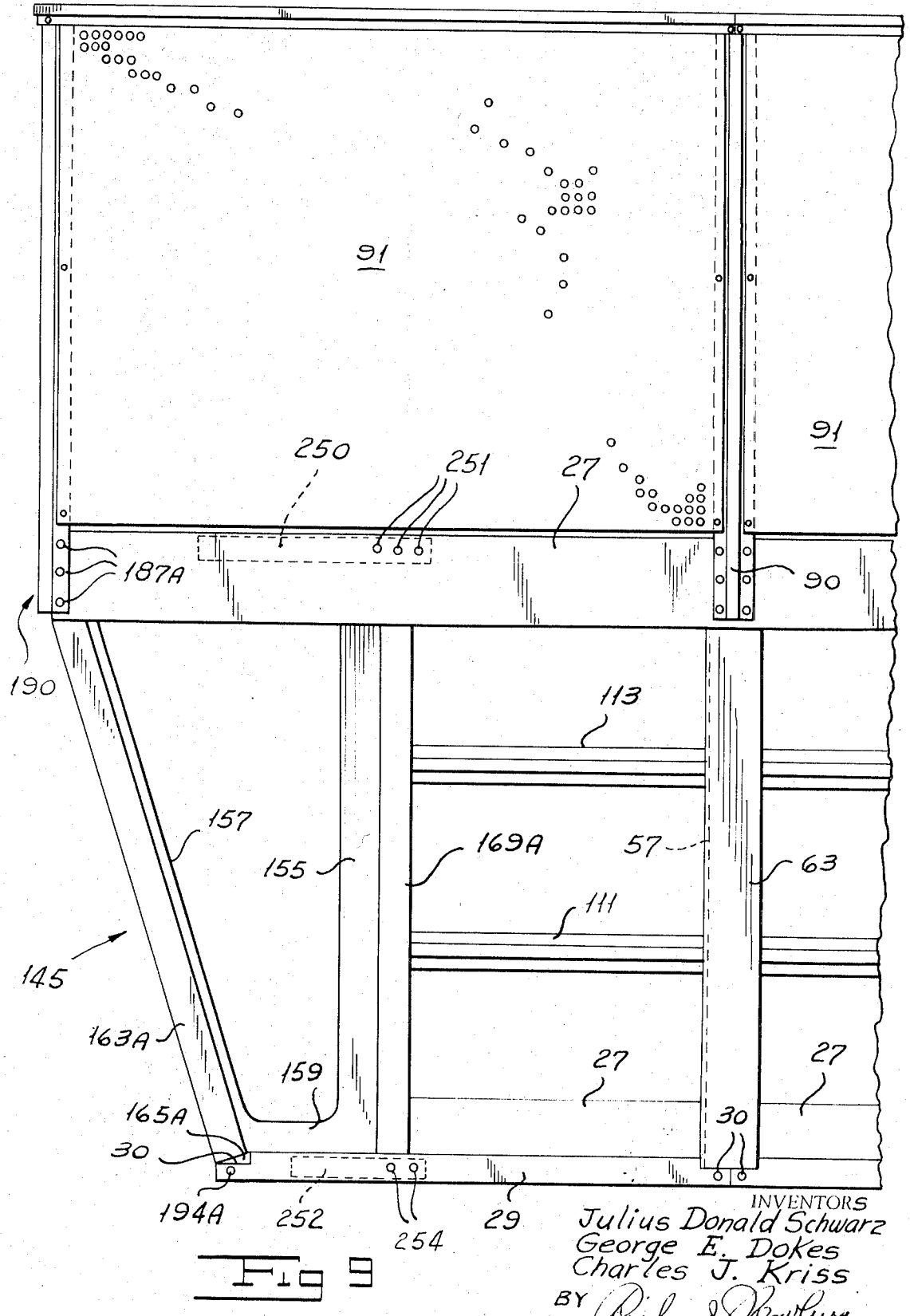


Fig 9

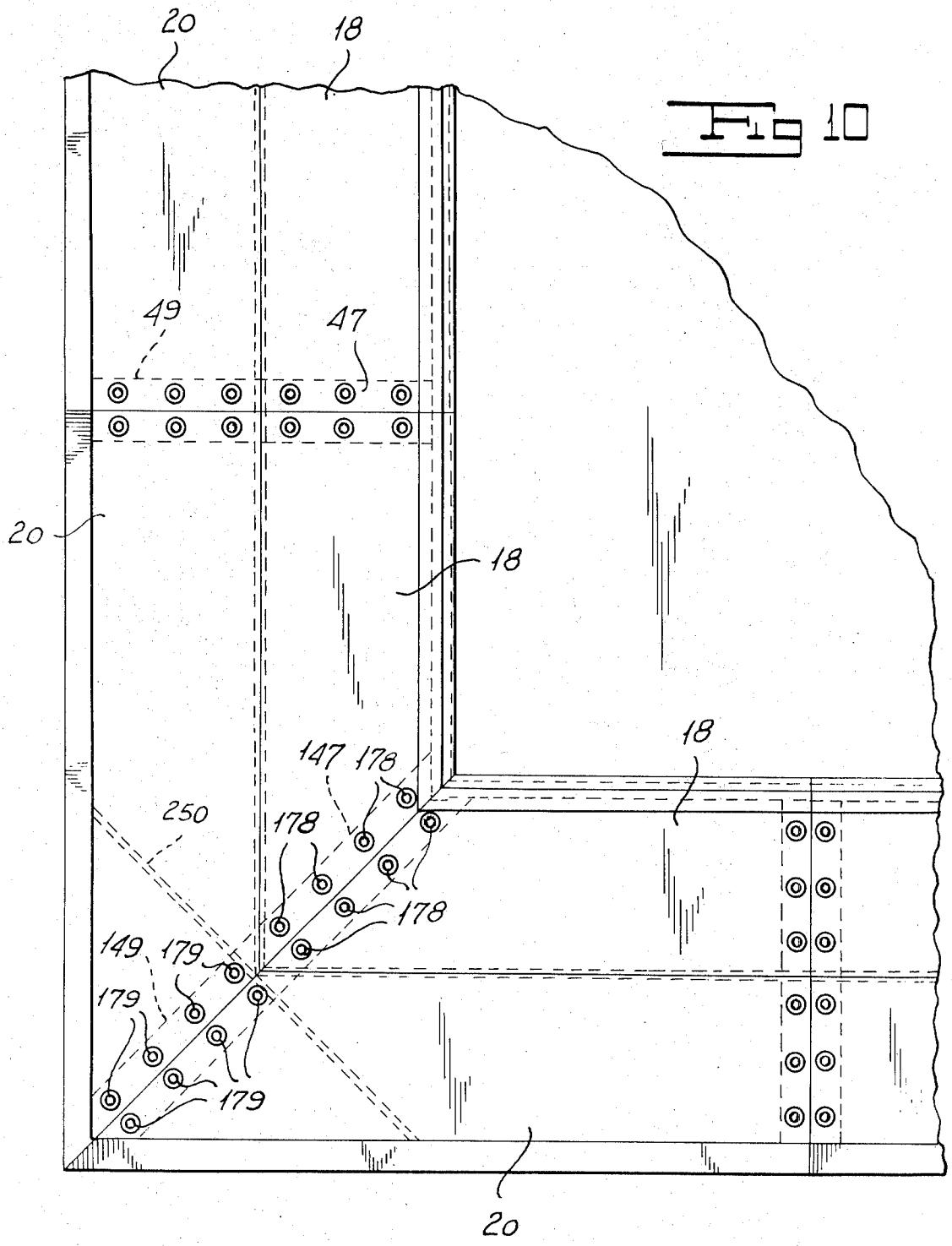
INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 9

Fig 10



INVENTORS
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BY Richard J. Hawkins
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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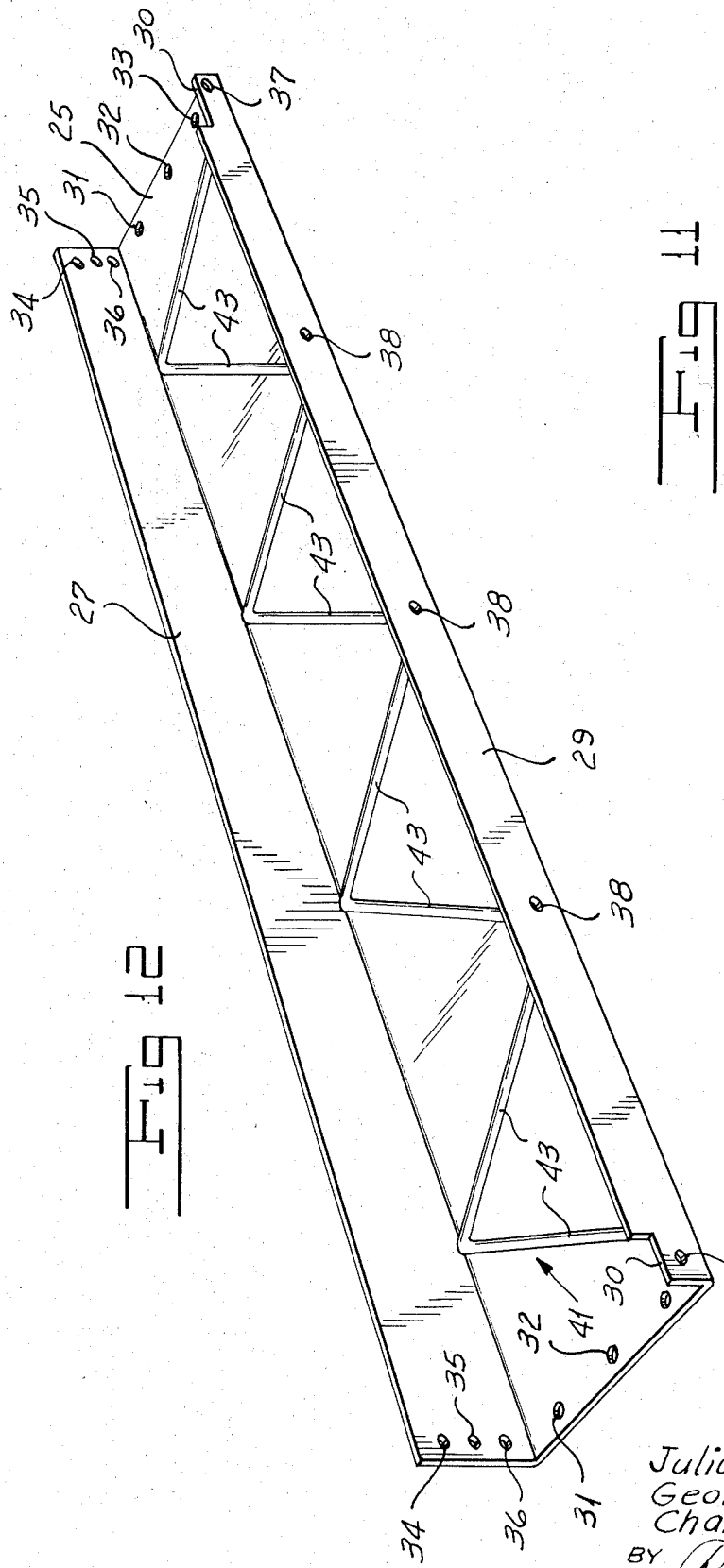


Fig 12

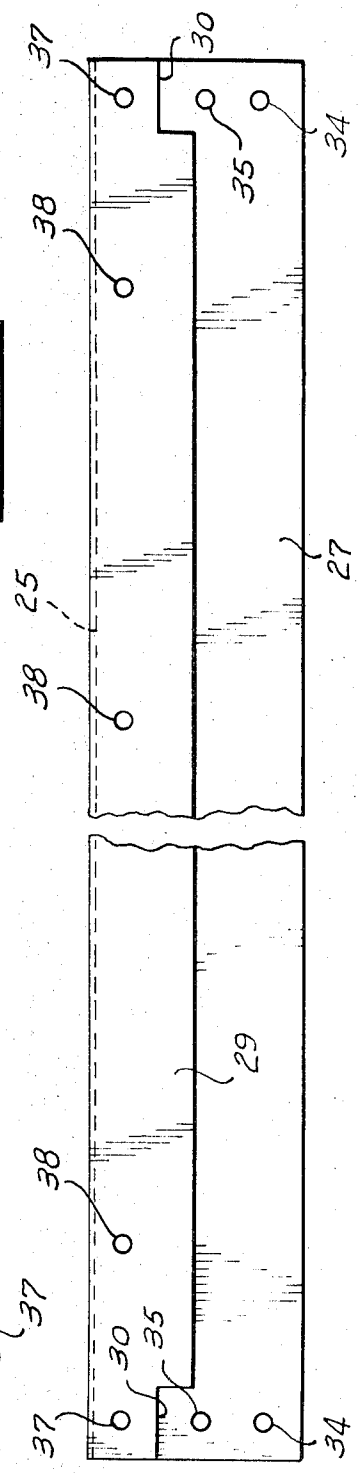


Fig 11

INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
BY Richard J. Rowling
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 11

Fig 17

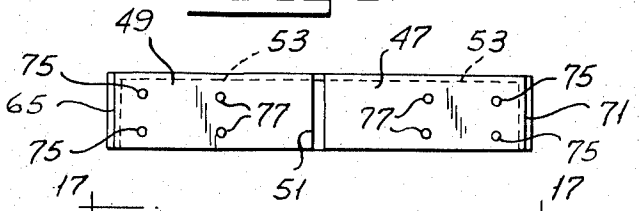


Fig 13

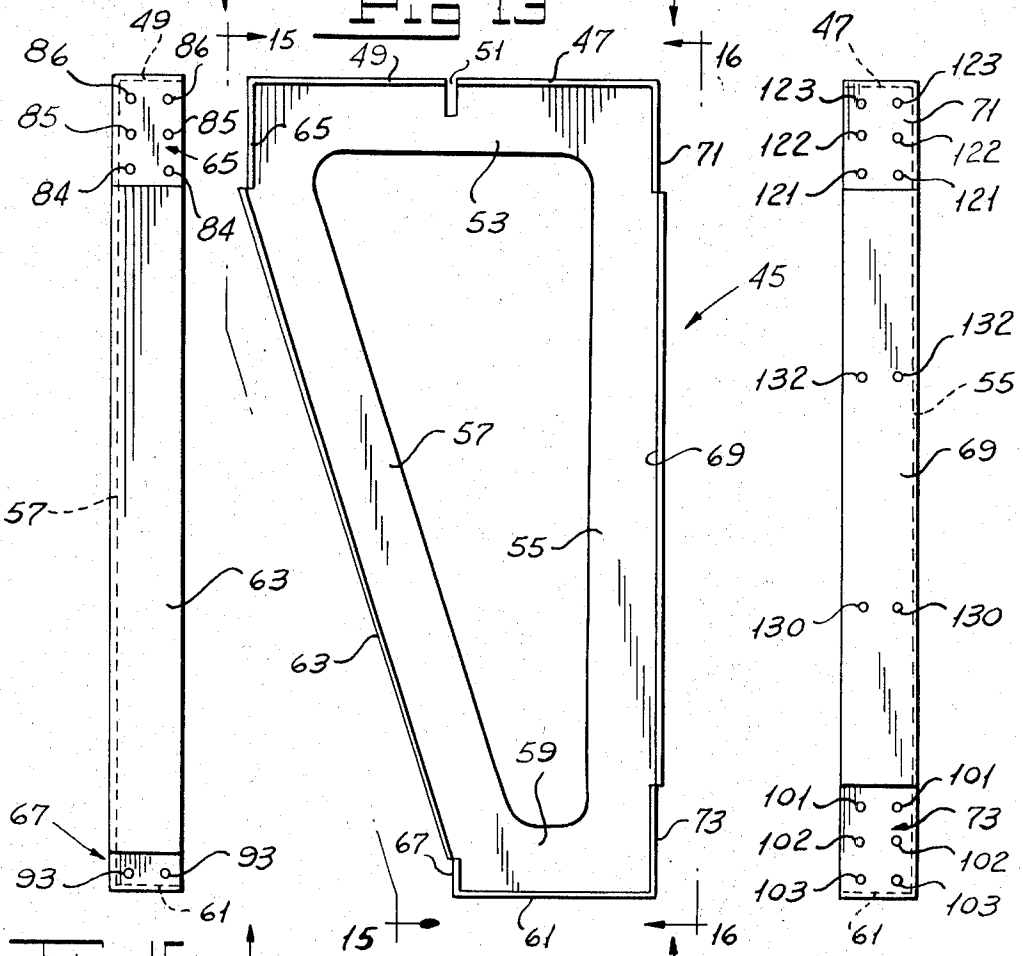


Fig 15

Fig 16

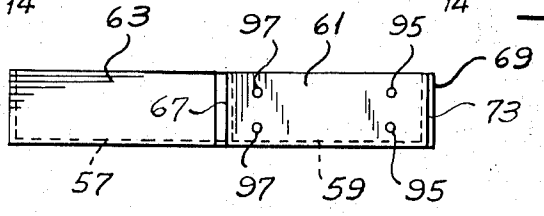


Fig 14

INVENTORS
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MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 12

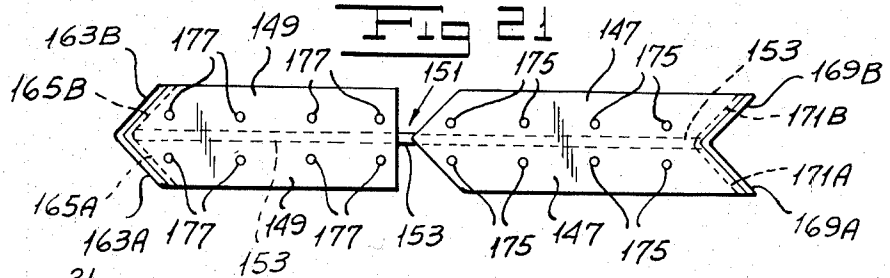


Fig 21

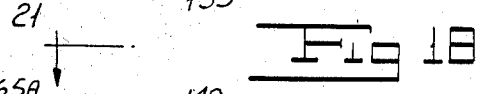


Fig 18

Fig 20

Fig 22

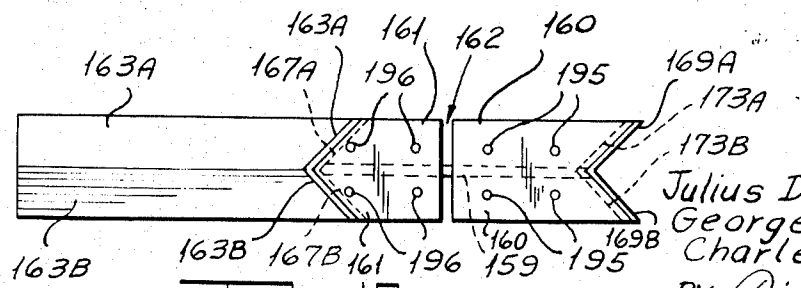


Fig 19

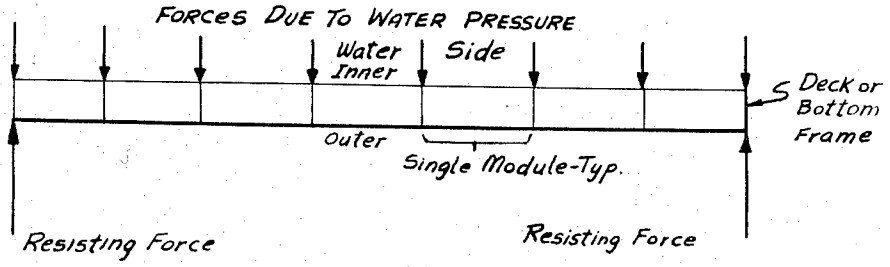
INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
BY Richard J. Hawkins
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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Fig 23A



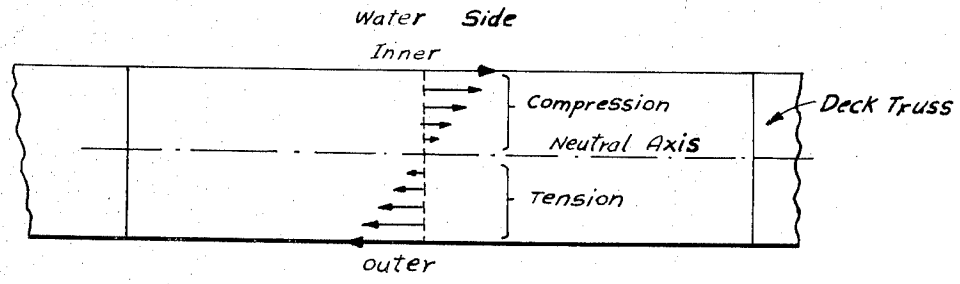


Fig 23B

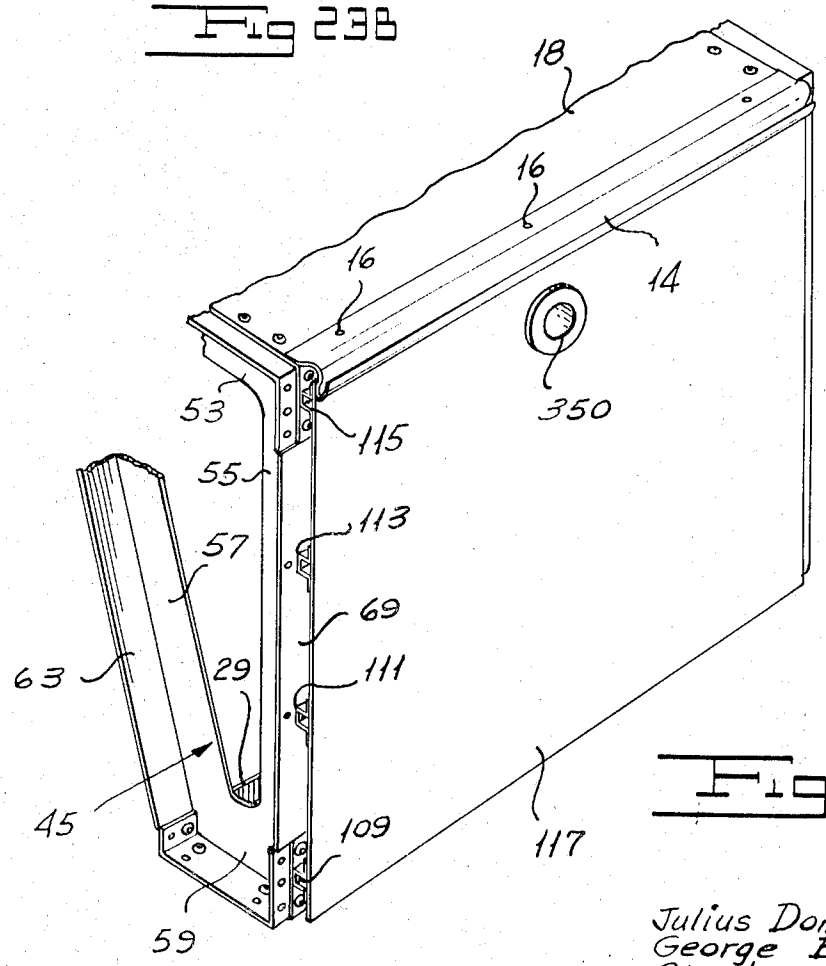


Fig 24

INVENTORS
Julius Donald Schwarz
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Charles J. Kriss
BY Richard Rawlins
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 14

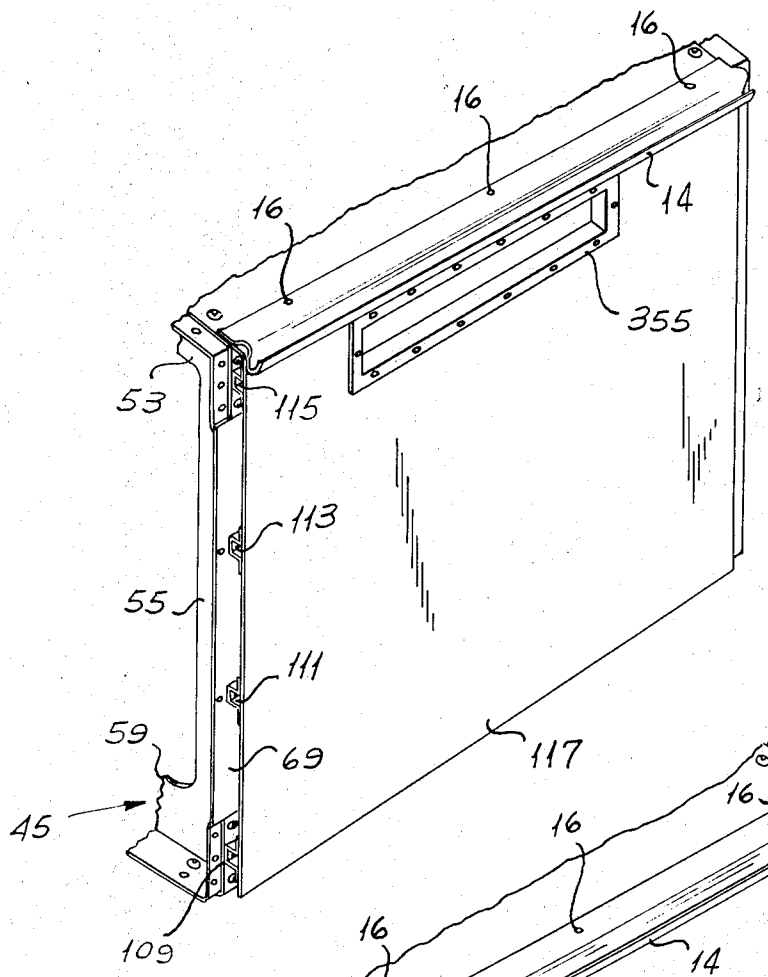


Fig 25

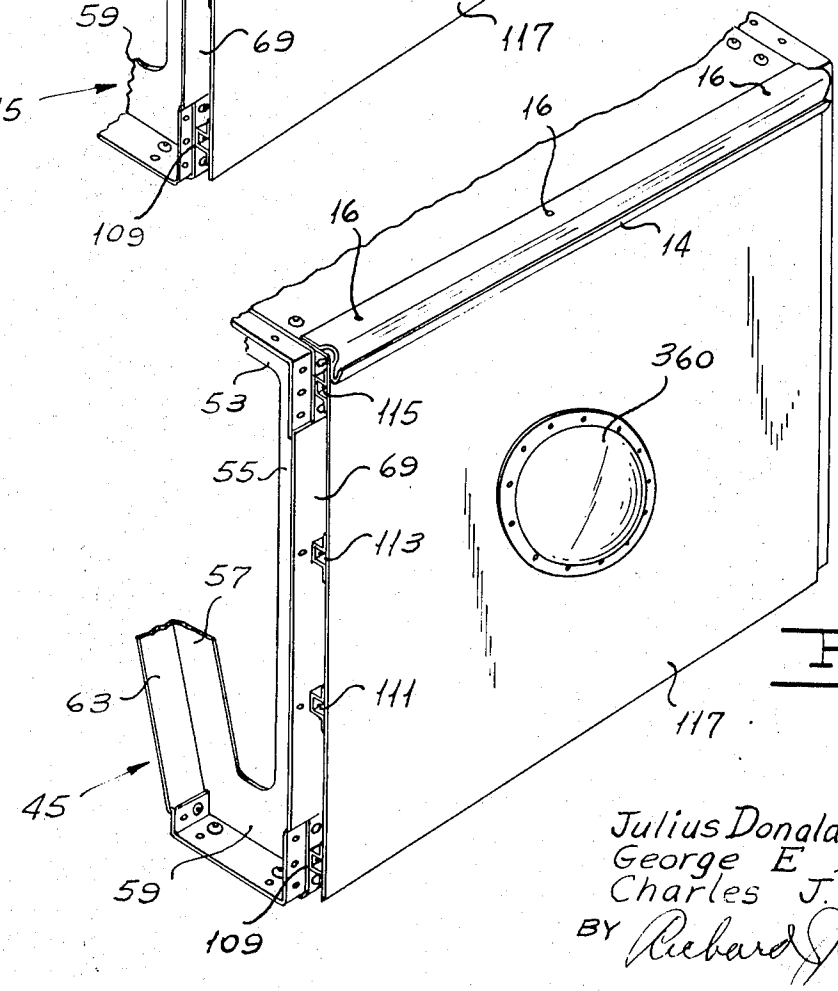


Fig 26

INVENTORS
Julius Donald Schwarz
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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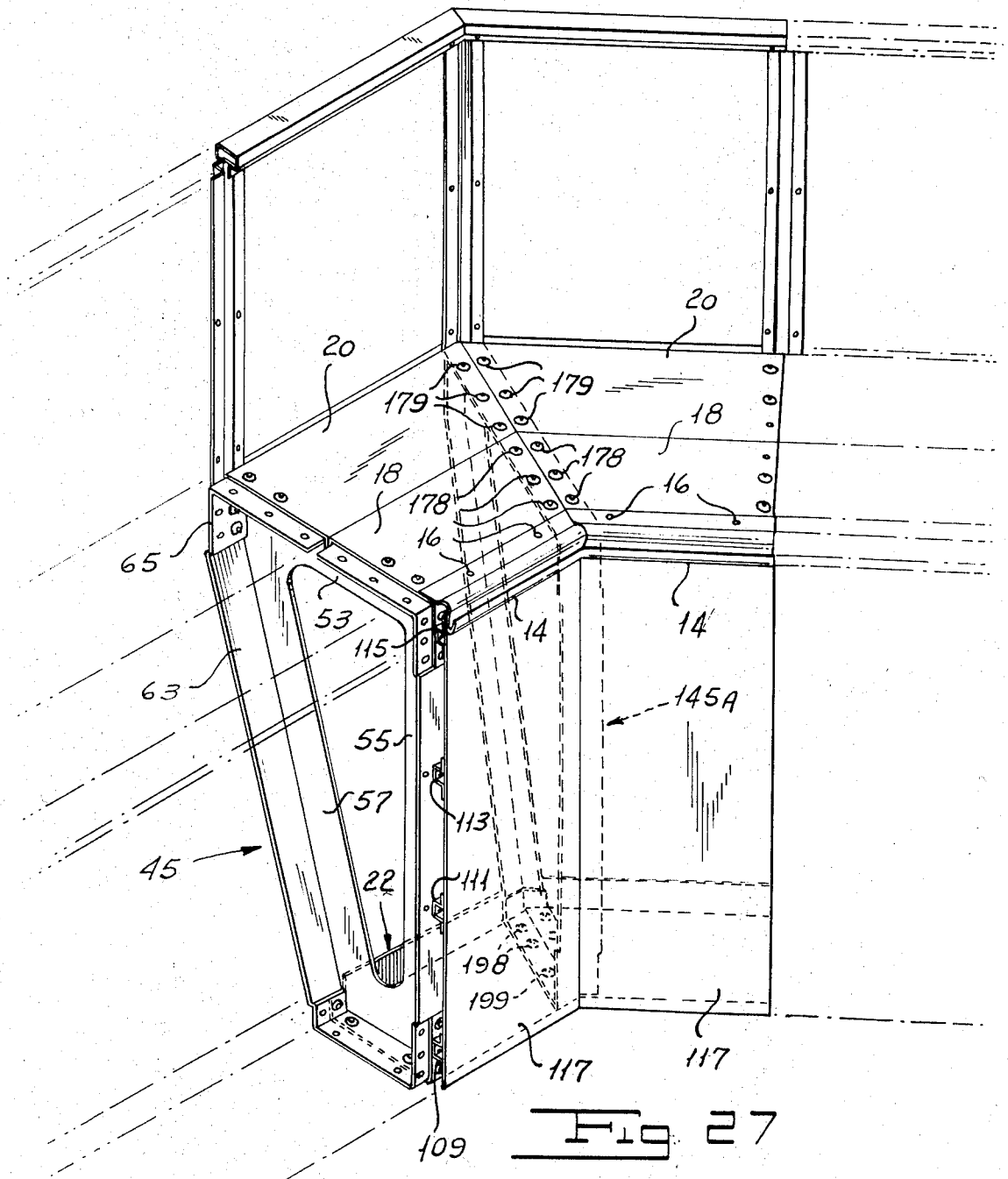


Fig 27

INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
BY Richard J. Crawford
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 16

Fig 28

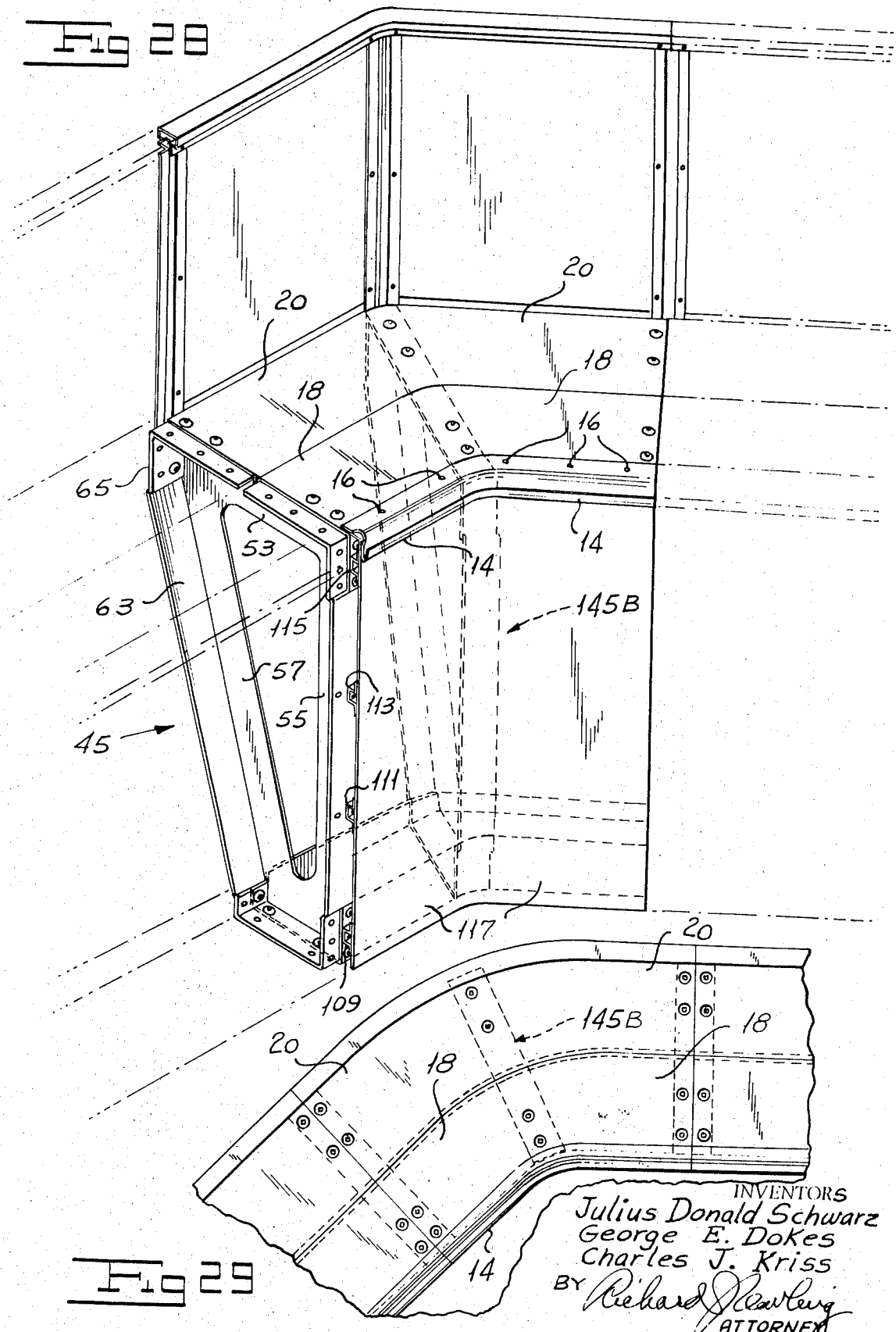


Fig 29

INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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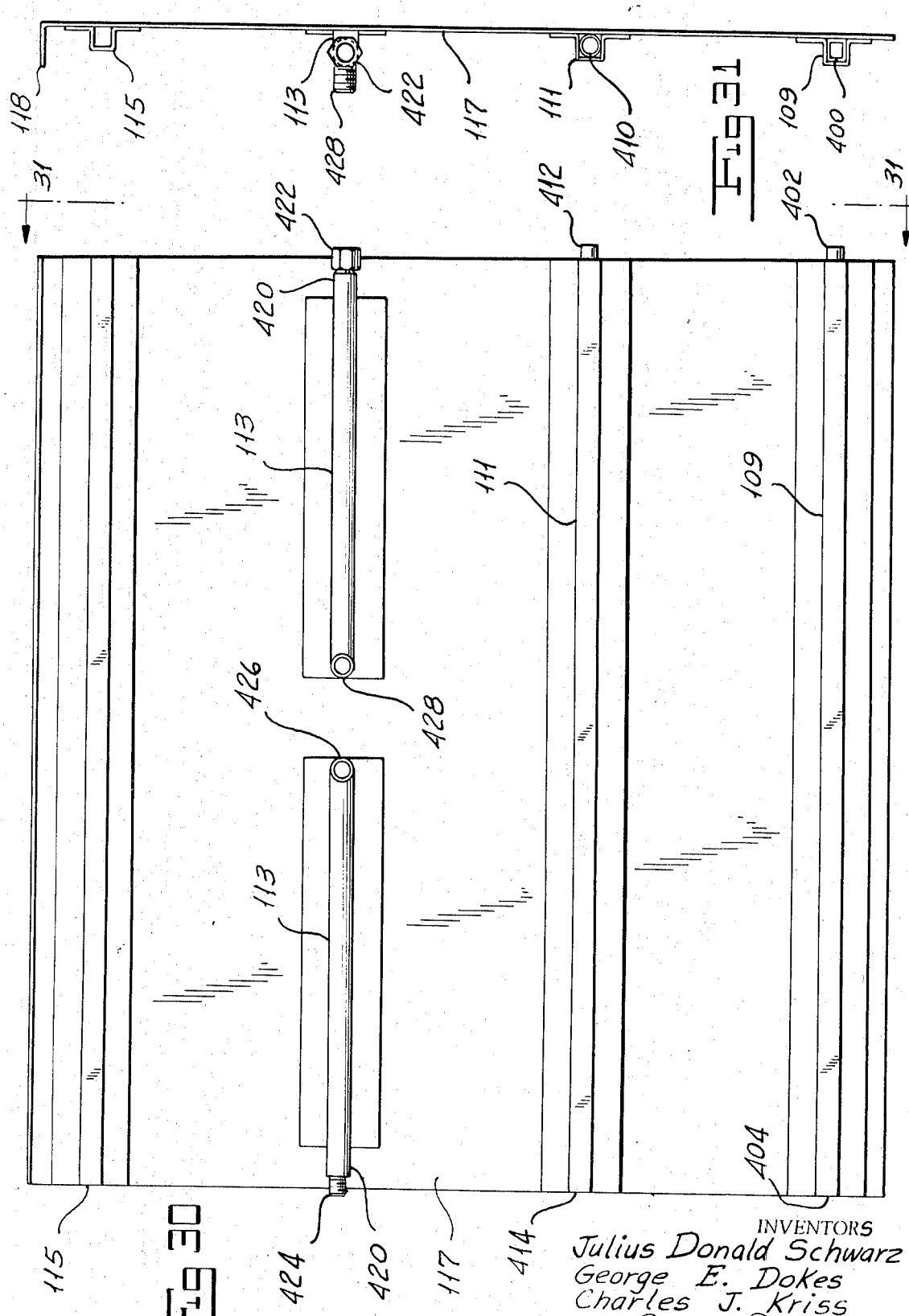


Fig 31

Fig 30

INVENTORS
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BY Richard Rawlins
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 18

Fig 32

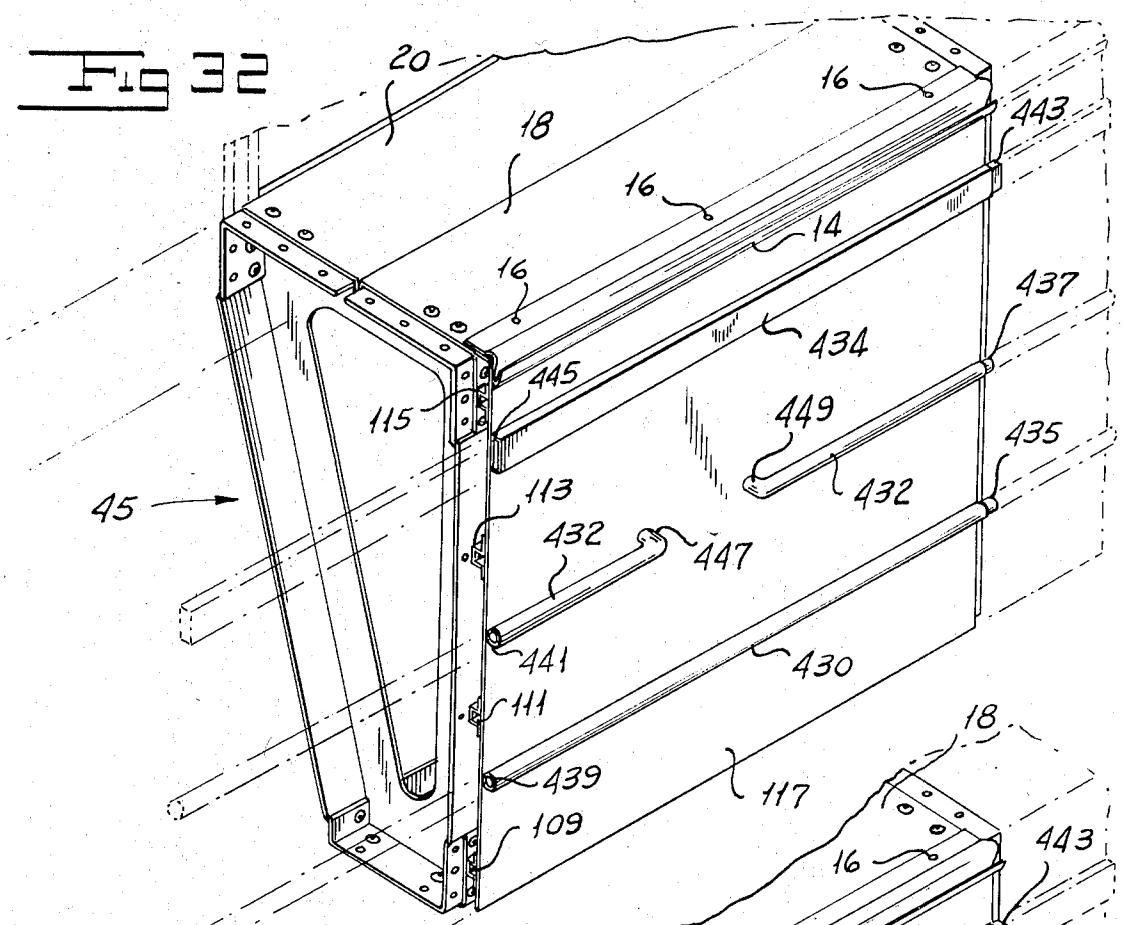
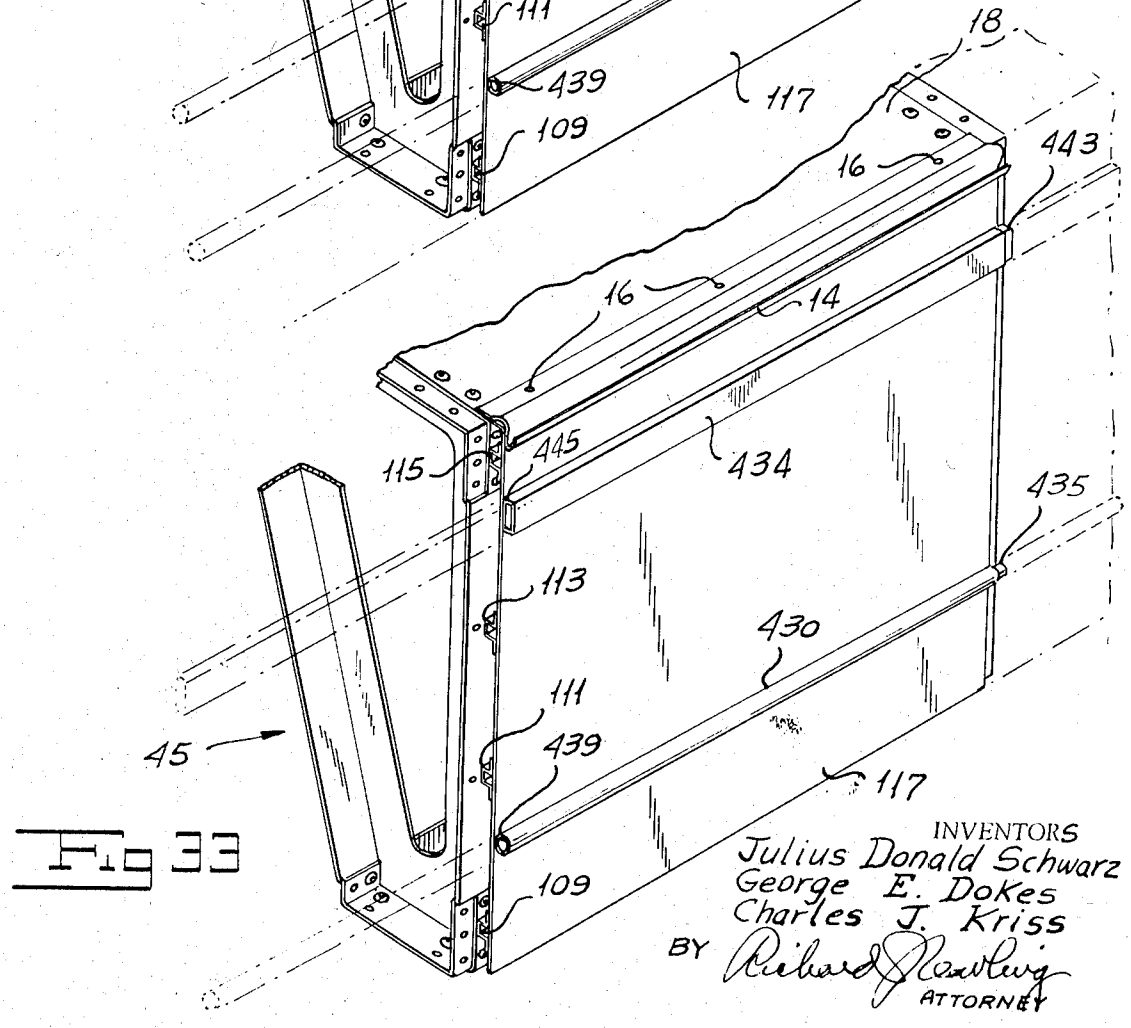
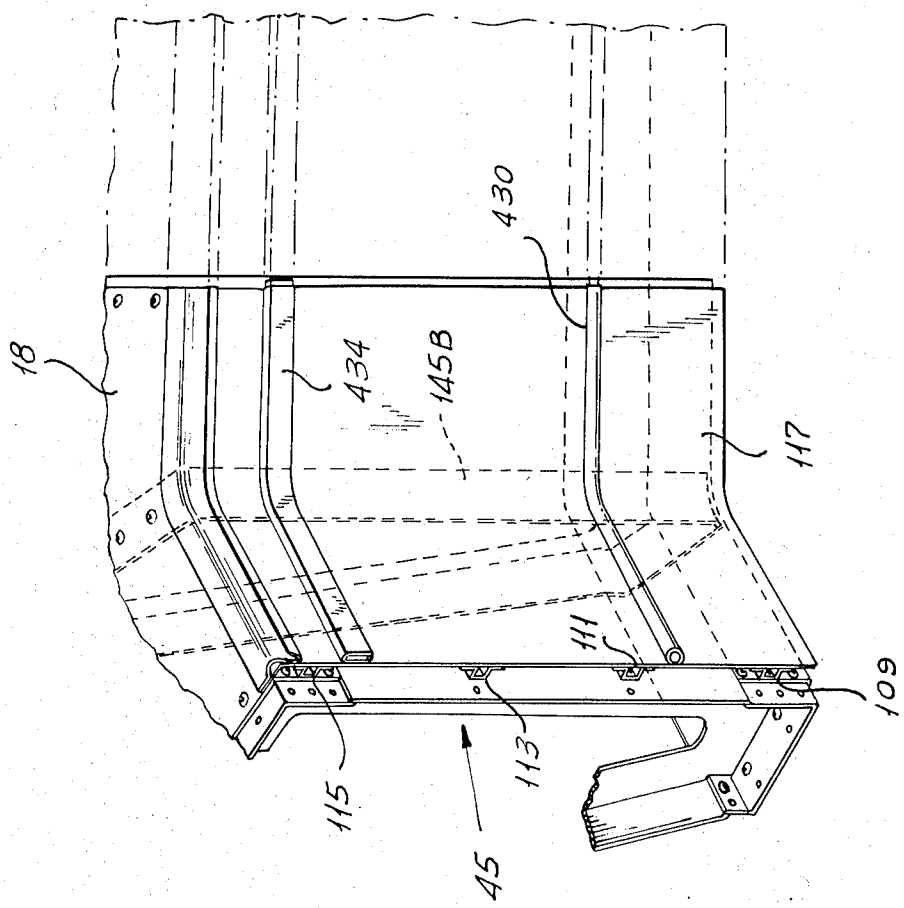


Fig 33



INVENTORS
Julius Donald Schwarz
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BY Richard Rosenberg
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Fig 34



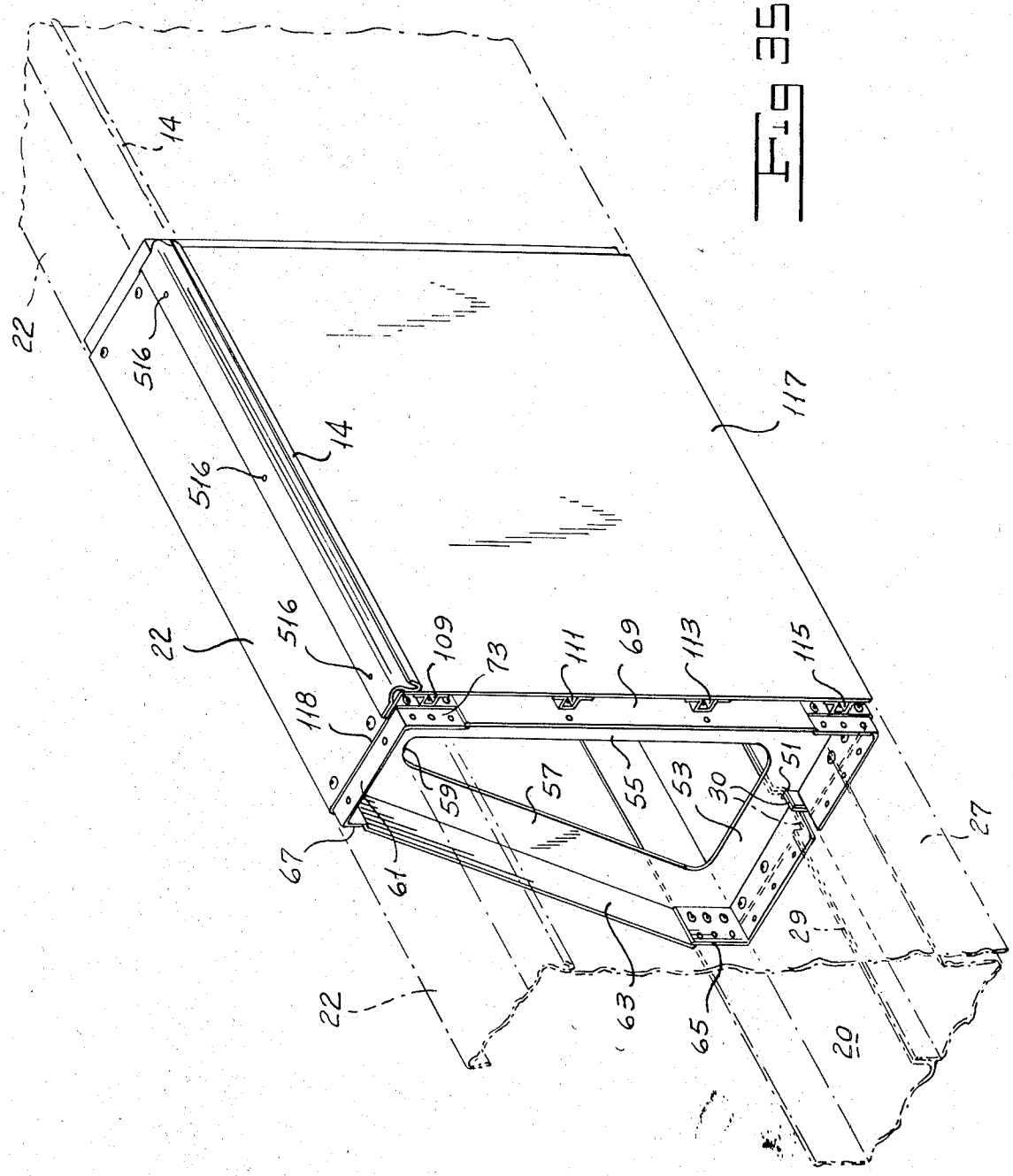
INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
BY Richard J. Crowley
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 20

Fig 35



INVENTORS
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Charles J. Kriss
BY Richard J. Crawford
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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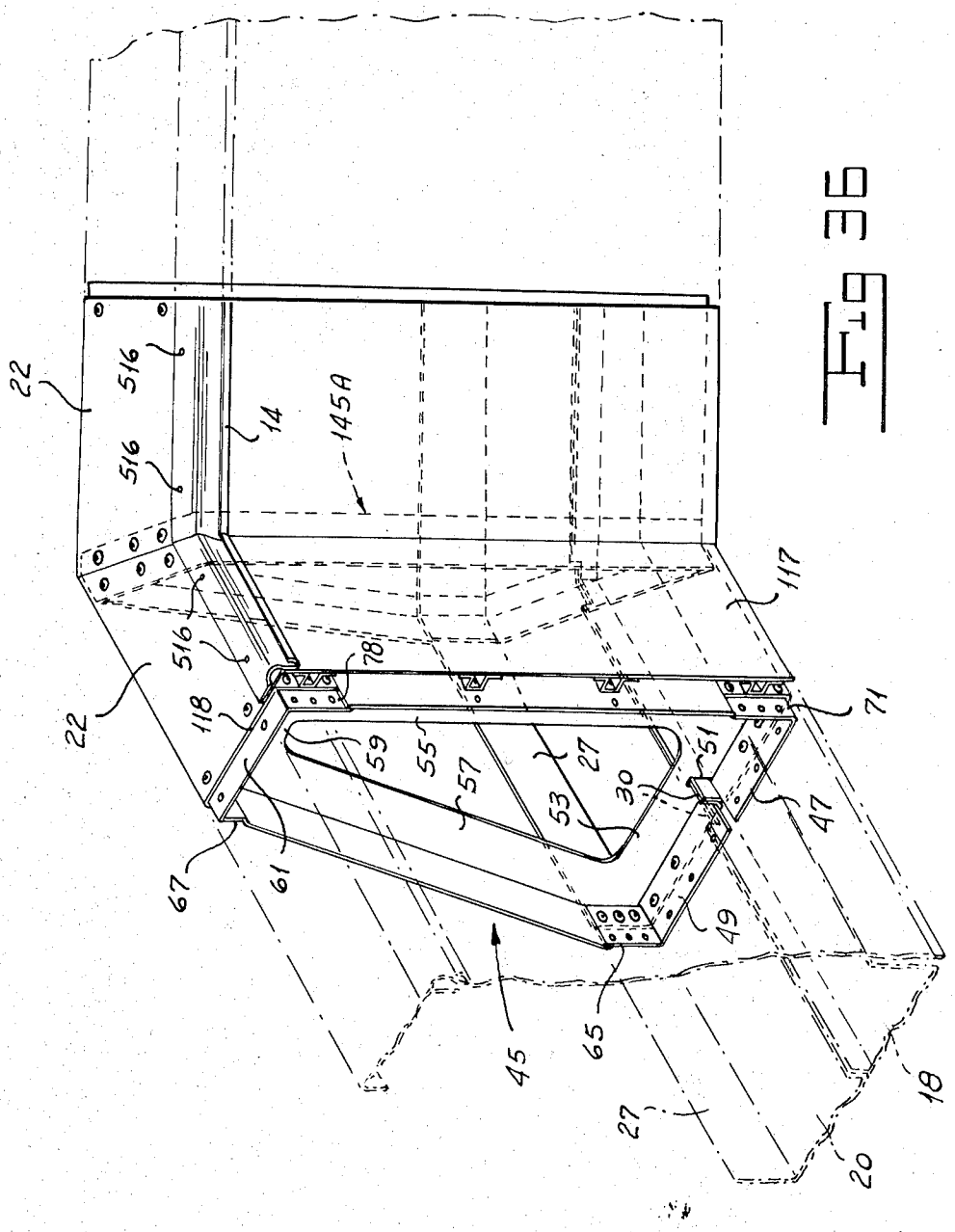


Fig 36

INVENTORS
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George E. Dokes
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BY Richard J. Crawford
ATTORNEY

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967

27 Sheets-Sheet 22

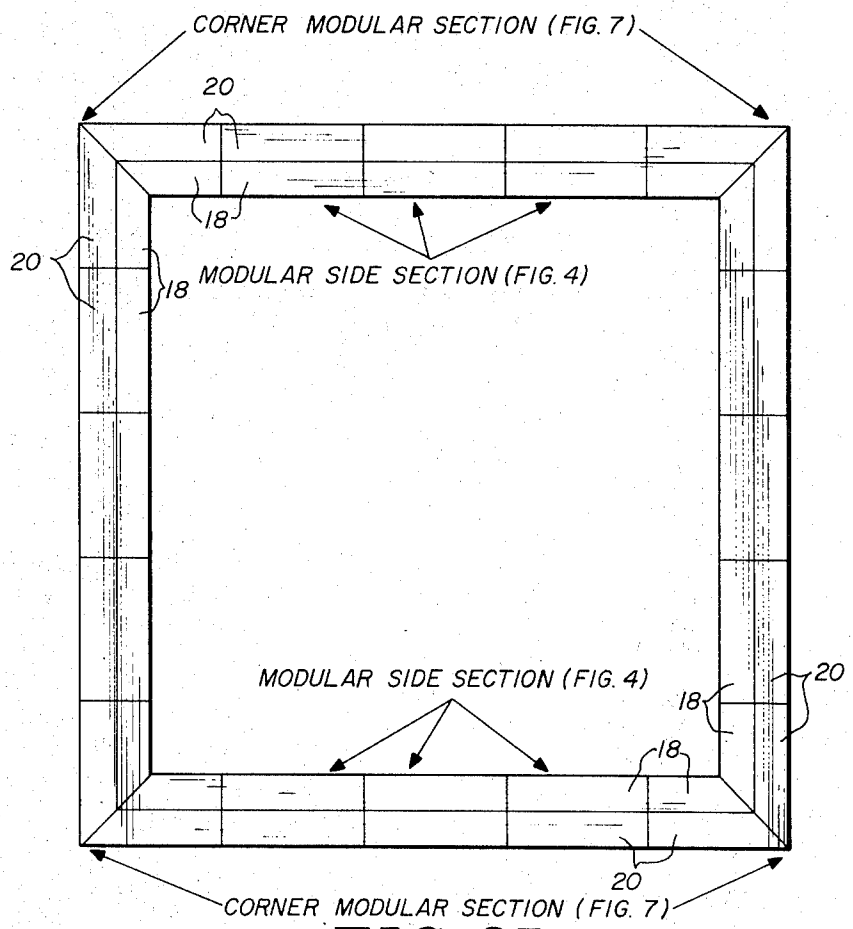


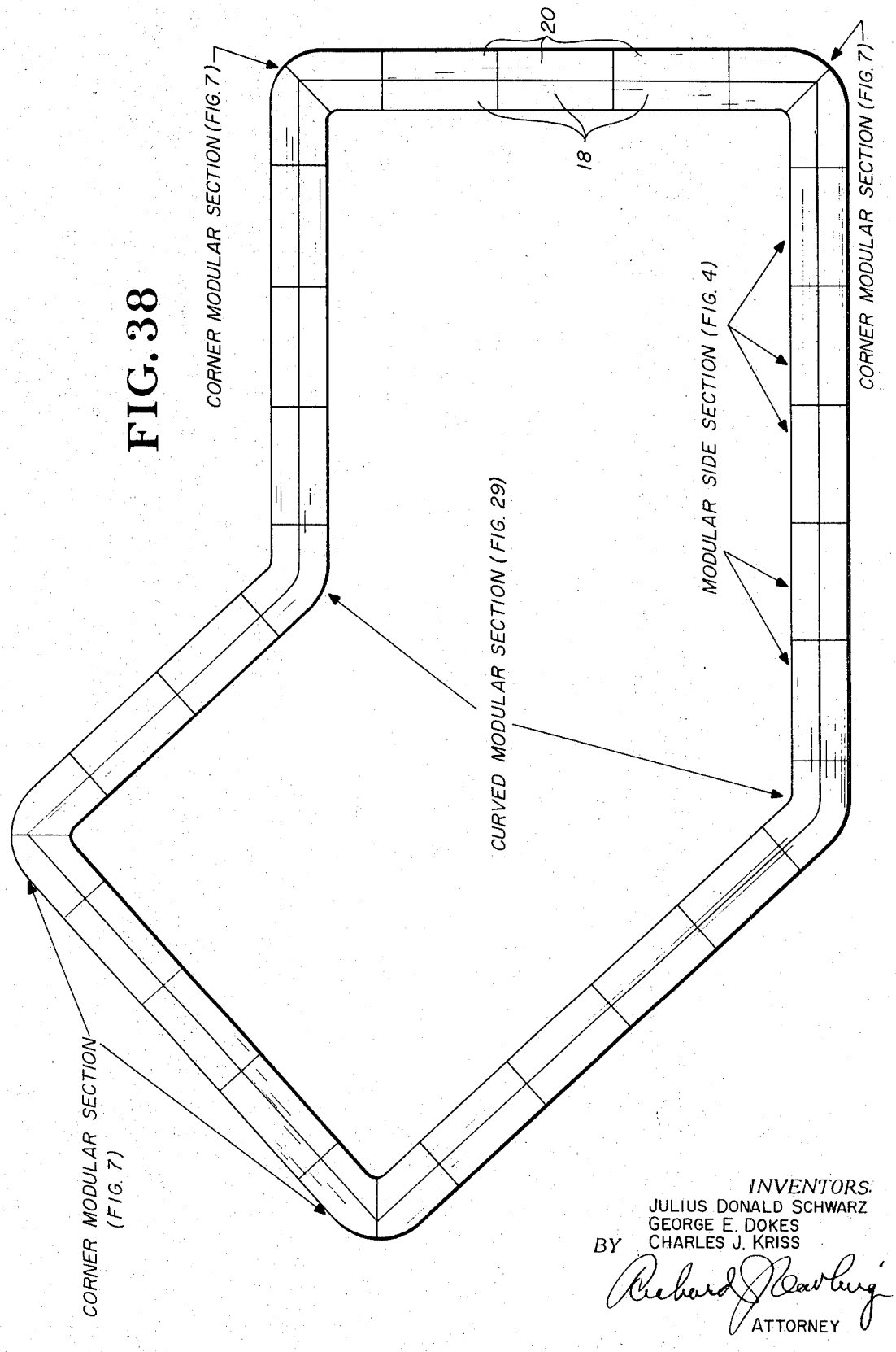
FIG. 37

INVENTORS:
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BY CHARLES J. KRISS
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MODULAR SWIMMING POOL ASSEMBLY

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FIG. 38



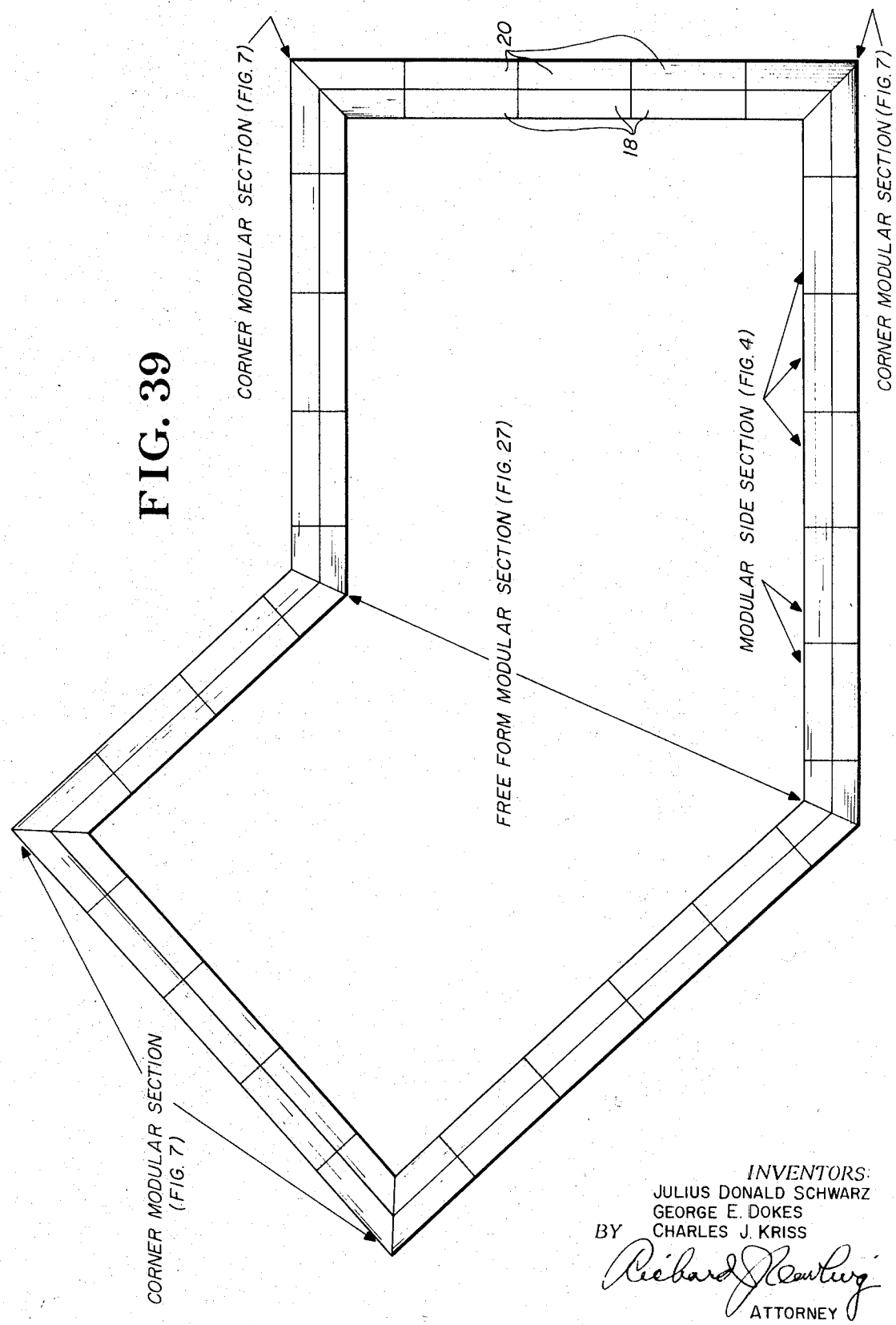
INVENTORS:
JULIUS DONALD SCHWARZ
GEORGE E. DOKES
CHARLES J. KRISS
BY Richard J. Bartlett
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 24

FIG. 39



INVENTORS:
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GEORGE E. DOKES
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BY Richard J. Hawkins
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Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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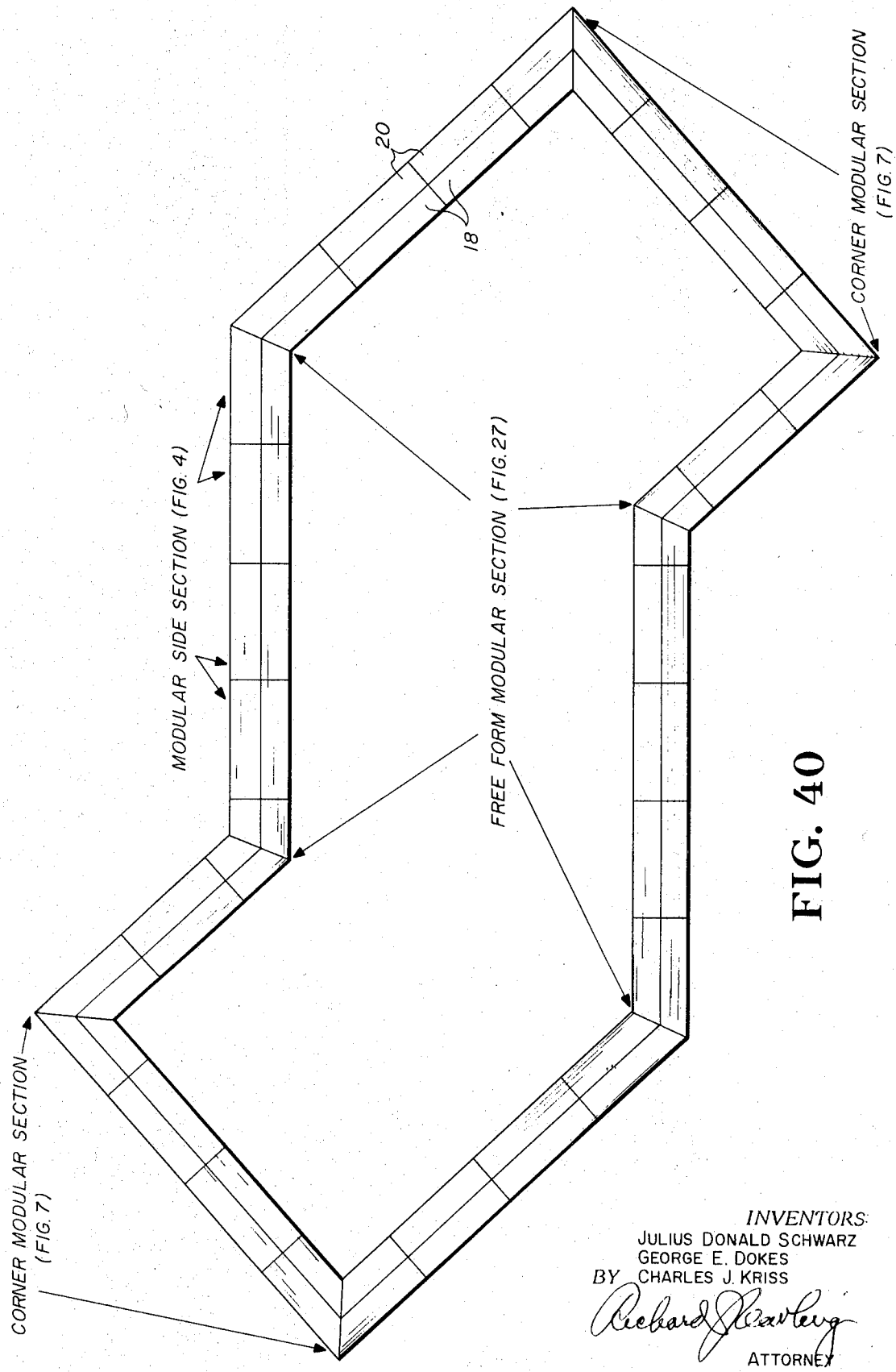


FIG. 40

INVENTORS:
JULIUS DONALD SCHWARZ
GEORGE E. DOKES
CHARLES J. KRISS
BY Richard Schwartz
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

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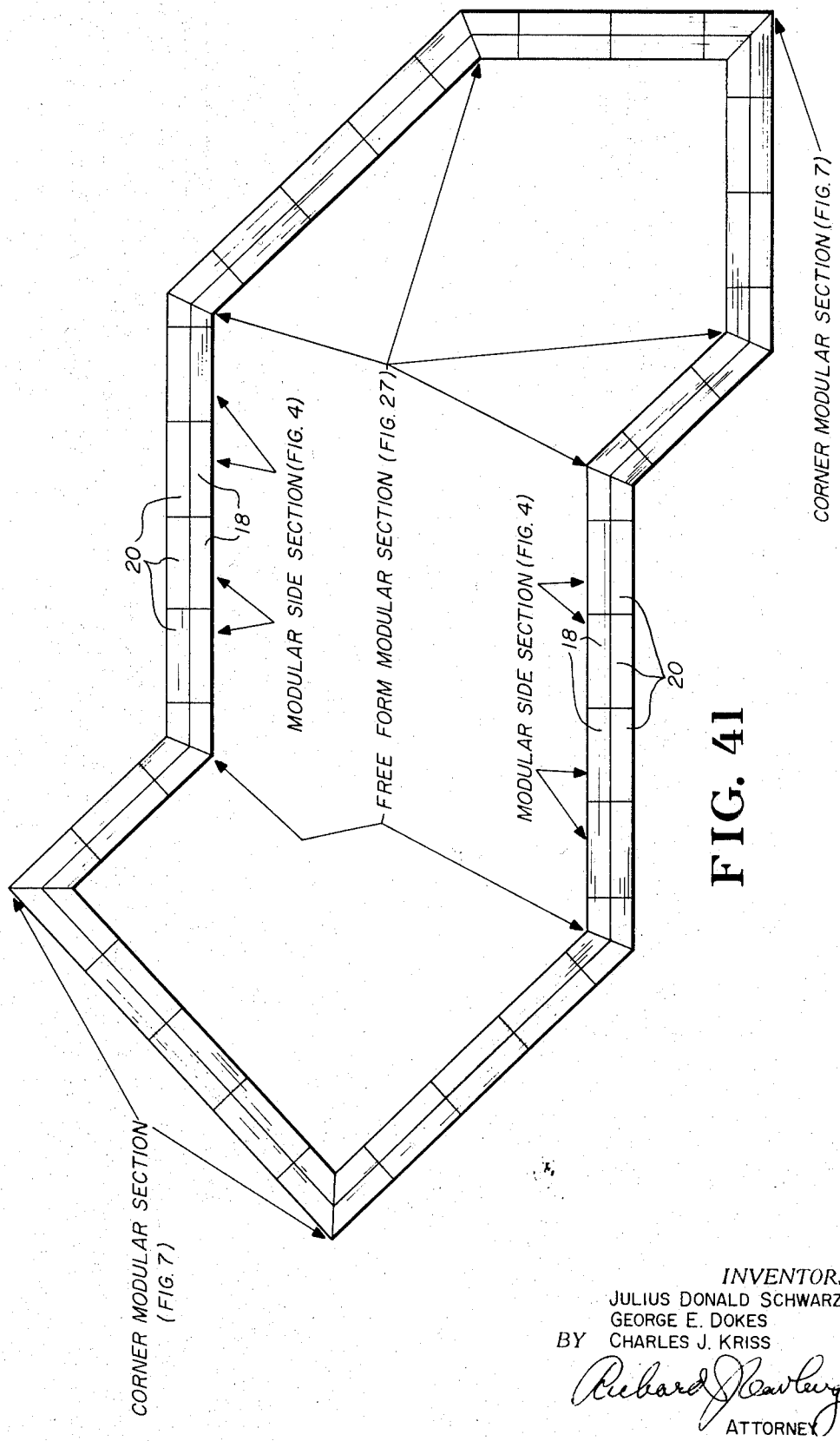


FIG. 41

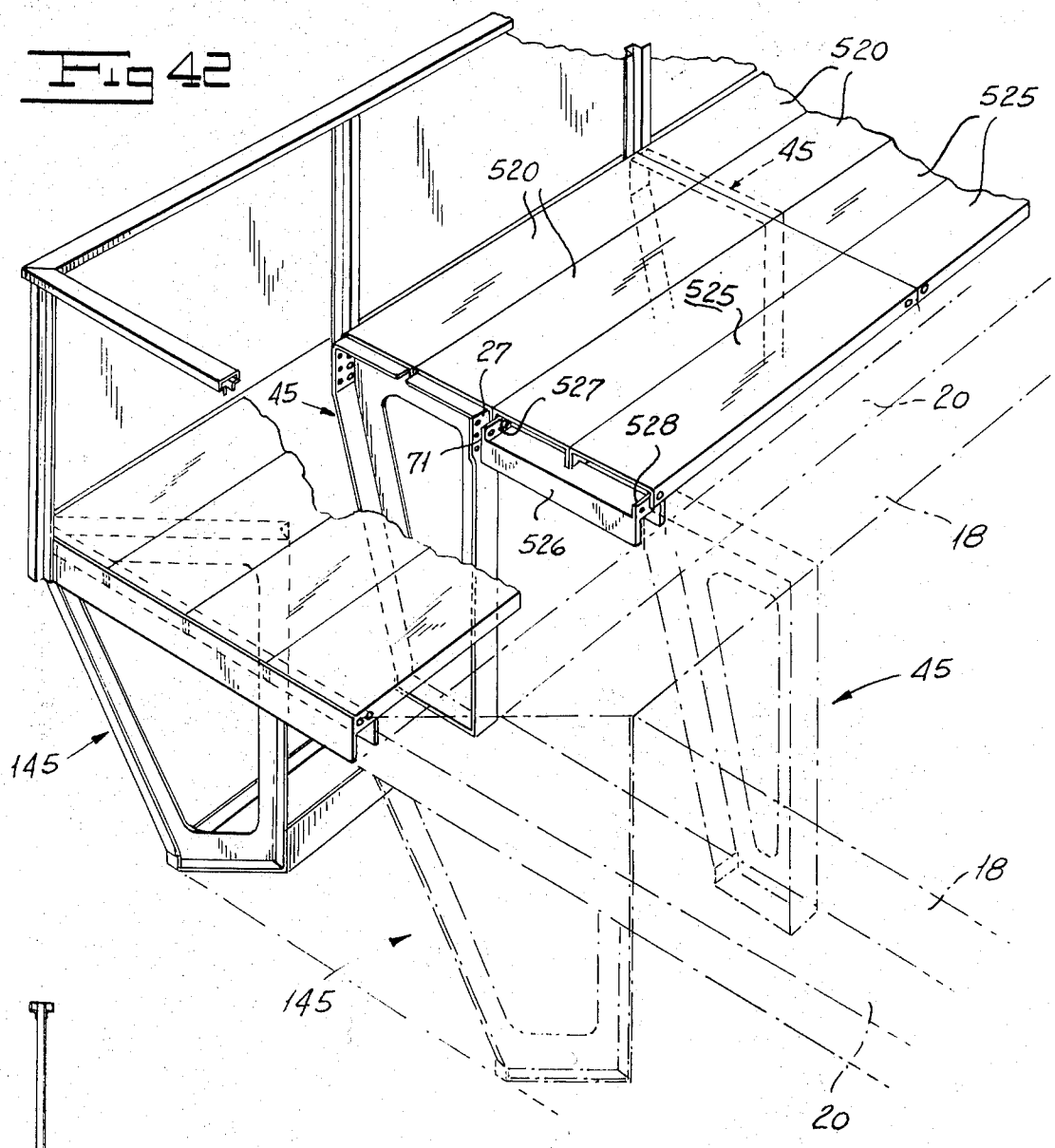
INVENTORS:
JULIUS DONALD SCHWARZ
GEORGE E. DOKES
BY CHARLES J. KRISS
Richard J. Bartlett
ATTORNEY

Jan. 19, 1971 J. D. SCHWARZ ET AL 3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Filed Dec. 21, 1967 27 Sheets-Sheet 27

Fig 42



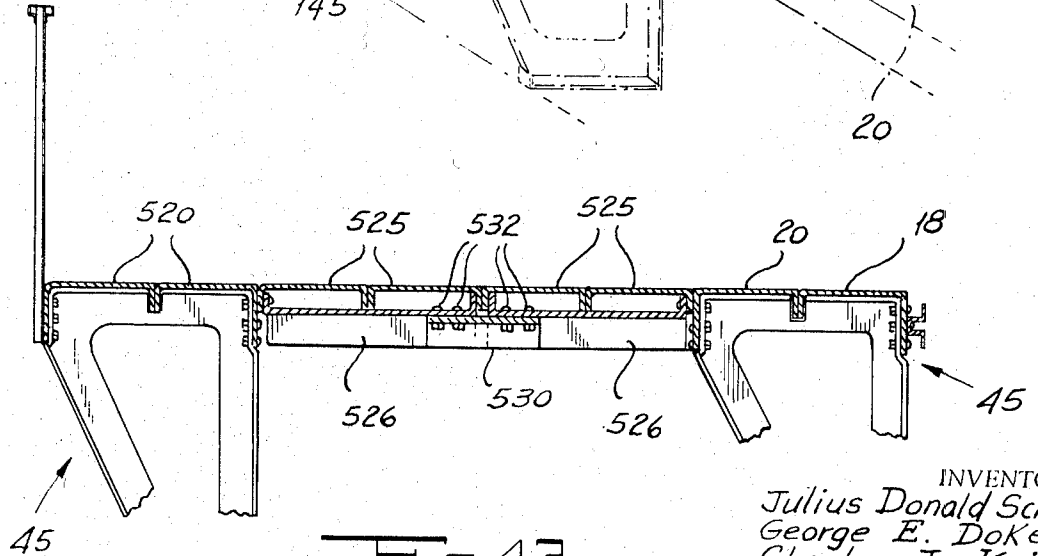


Fig 43

INVENTORS
Julius Donald Schwarz
George E. Dokes
Charles J. Kriss
Richard Rawlings
ATTORNEY

United States Patent Office 3,555,575 Patented Jan. 19, 1971

3,555,575

MODULAR SWIMMING POOL ASSEMBLY

Julius Donald Schwarz, Teaneck, George E. Dokes, Hillsdale, and Charles J. Kriss, Upper Saddle River, N.J., assignors to Hendon Construction Company, Little Ferry, N.J., a corporation of New Jersey

Filed Dec. 21, 1967, Ser. No. 692,406
Int. Cl. E04h 3/16
U.S. Cl. 4—172.19 8 Claims

ABSTRACT OF THE DISCLOSURE

A swimming pool assembly of a modular construction for ease of assembly in an infinite variety of sizes and shapes in installations above ground, below ground or partially in the ground, and in a construction in which modular sections include means providing for the accurate alignment and positioning of outrigger post assemblies and deck plates, with the post assemblies being invertible to provide a broader base channel assembly to effect a greater distribution of weight of the pool assembly. The modular pool assembly includes a modular section to provide underwater lighting; a modular section including an underwater observation window; a modular section including a water inlet fitting for introducing water into the pool portion of the assembly; a modular section including a combination in-wall skimmer and outlet at a predetermined level; a modular section to provide an underwater speaker; and modular sections including a plurality of tubes for circulating steam or hot water under pressure of a pump around the perimeter of the sidewalls of the pool assembly to provide for a rapid heating of the pool water.

CROSS-REFERENCE TO RELATED APPLICATIONS

The presnet invention relates to improvements in a swimming pool assembly of a type which may embody features described and claimed in a copending United States application Ser. No. 655,886, filed July 25, 1967, by Julius Donald Schwarz and George E. Dokes for a camber truss upper frame supporting means for the sidewalls of a swimming pool; and United States application Ser. No. 672,604, filed Oct. 3, 1967, by Julius Donald Schwarz, George E. Dokes, Otokar von Bradsky and Sidney J. Goodman for a permanent metal or plastic liner for a swimming pool.

BACKGROUND OF THE INVENTION

(1) Field of the invention

Means for providing a swimming pool assembly of a modular construction for carrying the water of a swimming pool above ground, below ground or partially in the ground.

(2) The prior art

Heretofore, as described in British Pat. No. 876,480, complete specification published on Sept. 6, 1961, there has been disclosed a swimming pool for indoor or outdoor use to be assembled by unskilled persons. Furthermore, in United States Letters Pat. No. 3,335,430, issued Aug. 15, 1967, to Julius Donald Schwarz and George E. Dokes, there has been disclosed a swimming pool assembly and means for supporting the sidewalls of the pool. In United States Letters Pat. No. 3,354,473, issued Nov. 28, 1967, to Julius Donald Schwarz and George E. Dokes, there has been disclosed a locking strip for a liner of a swimming pool.

These prior art patents fail to suggest the improvements in the modular swimming pool assembly of the present invention, particularly in the modular sections for effecting a swimming pool assembly of an infinite variety of

sizes and shapes in above or below ground installations and in the novel provisions of the several modules for effecting heating, lighting and sound effects for persons utilizing the pool as well as controlling the supply of water to and from the pool and the accurate alignment and positioning of the posts and deck assemblies and weight distribution of the pool assembly.

SUMMARY OF THE INVENTION

In the present invention, there are provided channel bar deck plates arranged in supporting relation about upper portions of upright sidewalls of a swimming pool, together with one piece outrigger posts having a lower end suitably secured is a base channel bar plate and an upper end portion having assembly notch provided therein for receiving flange portions of the channel bar deck plates, and one piece outrigger corner posts having an assembly notch provided in the lower end thereof for receiving a bottom corner strap as well as an assembly notch in the upper end thereof for receiving the flange portions of the channel bar deck plates and a top corner strap, the outrigger posts carrying horizontally extending braces secured to sidewall panels positioned in a supporting relation to a liner for carrying the water of the swimming pool in an arrangement in which the several supporting elements for the liner may be conveniently secured in the aforenoted assembly by conventional fastening bolts so as to facilitate a knockdown construction thereof, and a construction which may be readily assembled and disassembled.

In an alternate arrangement of the invention, the one piece outrigger posts may be inverted so as to provide a broader base or a broader base channel bar arrangement which may be desirable in an installation of a swimming pool assembly under certain soil conditions of a nature that require a greater distribution of weight on the base channel bars.

It is within the contemplation of the present invention to provide a swimming pool liner supporting means of a simple construction that may be readily assembled with no special tools or skills and with a sidewall structure providing superior strength and support to prevent distortion and bursting of the sidewalls of the pool under the pressure of the water contained therein.

An object of the present invention is to provide, in such a swimming pool sidewalls supporting structure, channel bar deck plates having flange portions notched at end portions thereof to cooperate in assembly notches in the upper end portion of the outrigger posts while other channel bar plates at the base of the structure have similar notches provided in a flange portion to be cooperatively arranged with lower portions of the outrigger posts so as to effect an automatic alignment, which provides an exact relationship of perpendicular positioning between the several outrigger post assemblies and the channel bar plates at the base and deck of the assembly, facilitating rapid and exact assembly of the several parts of the pool assembly while preventing inner and outer movement as well as sideward motion at both the base and the upper deck of the pool assembly.

Another object of the invention is the provision, in a swimming pool assembly, of a precalculated truss system including a plurality of channel bar deck plates extending longitudinally in adjacent relation to provide a top frame for effecting a flexural support of a linear carrying the pool water.

A further object of the invention is to provide in a rectangular swimming pool assembly a construction wherein the walls of the pool may be restrained against water pressure by the use of a truss arrangement in the same manner as a roof of a building may be held up by a truss, whereby there has been provided an arrangement in which one of the trusses forms a frame about an upper portion

of the walls of the pool and the other of the trusses forms a frame about a lower portion of the walls of the pool, and each of the truss frames being aided by cross-straps at the corners thereof with a single channel bar truss providing the lower truss frame while a double channel bar truss provides the upper truss frame in order to restrain the walls at the upper portions thereof against a greater water pressure applied thereto than at the lower portion thereof.

Another object of the invention is to provide in such a swimming pool assembly, a corner post assembly which cooperates with the cross-straps at the corners of the pool assembly and with the pressure panel walls thereof so as to transmit the forces of the water pressure applied to the panels to deck plates forming the upper truss and base plates forming the lower truss in an arrangement in which a plurality of modules, including individual deck and base plates, are serially fastened rigidly together and supported at each end to resist the pressure forces of the pool water, which tend to bias the deck plates and base plates out at the middle so as to cause an outer portion of the upper and lower trusses to stretch (tension) and an inner portion of the trusses to compress (compression), and which forces are transferred through the corner post assembly from the deck and base plates at one side of the corner post assembly to the deck and base plates at the opposite side of the corner post assembly and through the corner straps so as to effectively lessen the stress in the corner by causing the corner straps to take a portion of the applied tension directly across the corner so as to result in a greater distribution of the compression to be transferred through the corner post whereby this greater distribution results in a lower maximum compression and tension stress across each corner of the pool assembly.

A further object of the invention is to provide in such a swimming pool assembly one piece outrigger posts with alignment steps or recesses for receiving end portions of both the base and deck channel bar plates to prevent movement of the plates in relation to the outrigger posts as well as to facilitate simplicity and ease of assembly.

Another object of the invention is the provision of a one piecve outrigger corner post having flared portions arranged to be positioned upon assembly in the pool structure to bisect the outer corner of the sidewalls of the pool assembly and in combination with the other structural corner members of the pool assembly to absorb secondary moments of force exerted by pressure of the pool water carried within the pool liner to yield a maximum of offsetting structural strength.

A further object of the invention is to provide a plurality of one piece outrigger corner posts having assembly notches cooperating with corner straps to control the flexing of the deck channel bar plates associated therewith by a precalculation of the exact position and size of the assembly notches in relation to the corner straps.

Another object of the invention is the provision of a plurality of one piece outrigger corner posts each having an upper assembly notch and a lower assembly notch cooperating with a top corner strap and a bottom corner strap, respectively; the upper assembly notch and the lower assembly notch being of a precalculated size and so prepositioned in relation to the top and bottom corner straps that each corner post assembly acts through the top corner strap and in combination with adjacent outer channel bar deck plates and through the bottom corner strap and in combination with adjacent inner channel bar deck plates to provide a transfer of the moments of force developed by the pressure of the water carried by the pool liner from one adjacent side of the pool assembly to another adjacent side of the pool assembly, thereby effectively counterbalancing and cancelling out the moments of force so developed the minimize the forces thereof depending upon the relative lengths of each adjacent side of the pool assembly, providing a minimum end resulting stress factor.

A further object of the invention is to combine in a swimming pool assembly a plurality of unitary outrigger posts, together with a plurality of channel bar deck and base plates and cooperatively arranged corner straps fastened together, as by bolting, welding or other suitable means, with upright sidewall panels to provide a plurality of trusses and a flexible frame for supporting a liner carrying the pool water, and a frame which, upon being positioned on a level site, will provide a walk-a-round perimeter deck and the bases for the pool assembly.

A further object of the invention is the provision of a simplified truss structure for supporting the channel bar plates at the base and deck of the swimming pool assembly through the provision of truss rods of a zig-zag form, which may be positioned directly within the channel portion of the channel bar plates in an arrangement in which opposite ends of the truss rod in each channel bar plate is suitably affixed, as by welding to inner surfaces of the opposite flange portions of the channel bar plate, while intermediate diagonal portions of the zig-zag formed truss rod extend from the inner surfaces of the opposite flange portions of the channel bar plate with the apex of each turn of the truss rod being suitably affixed, as by welding, to an inner surface of an adjacent flange portion of the channel bar plate to reinforce the steel channel bar deck plates in supporting in cooperative relation with the steel channel bar plates at the base of the assembly a liner for a swimming pool under pressure of the water carried within the liner.

Another object of the invention is to provide in such a swimming pool assembly modular sections including outer panel structures to enclose any part or all of the sidewalls of the swimming pool or deck to increase structural strength or for esthetic appeal, and which enclosure panels may be hinged or placed on a suitable sliding track on one or more modules so as to provide convenient access beneath an above-ground sun deck or pool assembly to filtration equipment, water inlet or outlet skimmer in the wall of the pool or other devices which may be utilized in the operation or maintenance of the swimming pool.

A further object of the invention is the provision in such a swimming pool assembly of modular sections to provide a water inlet fitting, a water outlet or in-wall skimmer fitting, an underwater lighting fixture, an underwater observation window, an underwater speaker, and modular sections including a plurality of tubes for circulating steam or hot water under pressure of a pump around the perimeter of the pool assembly to effectively heat the pool water or maintain the pool water at a predetermined uniform temperature for the comfort of persons utilizing the pool.

Another object of the invention is to provide a method and means for the circulation of a heating medium around a perimeter of a swimming pool to heat the pool water carried within a liner, as distinguished from circulating heated water in and out of the pool liner with attendant loss of time and heat energy. Thus, in the present invention, the circulation of the heating medium through the perimeter conduits adjacent the sidewalls of the pool assembly effects a more efficient and uniform heating of the pool water and provides a further advantage in that the circulated heating medium is free of all chemicals that may be deposited in the swimming pool water for sanitary purposes and thus avoids a build up of a residue of such materials in the heating system, which might otherwise be destructive or impair the operation of the heating system.

A further object of the invention is the provision in such a swimming pool assembly of a modular section with fully sealed pressure panel braces, together with connectors, for effecting entry and discharge of separately pumped hot water or steam for applying the heating medium about the perimeter of the pool liner to effect the rapid and efficient heating of the pool water at a predetermined heated temperature.

Another object of the invention is to provide a modular swimming pool assembly comprised of prefabricated inter-

changeable modules from which may be assembled an infinite variety of sizes, shapes and types of swimming pool structures, which modular units may serve to overcome the extreme bulkiness, weight and excessive space requirements for storage by manufacturers, distributors and/or dealers so as to substantially decrease the cost of handling, shipping and storing such modular parts, while the interchangeability of the parts permits the ready replacement of the individual module, the enlargement or reshaping of the design of the pool assembly, and further facilitates the complete removal of a pool assembly for transportation to another location without damage to the various modular components which may be separately disassembled from the pool structure for transportation without damage.

A further object of the invention is the provision of a modular swimming pool structure utilizing a minimum number of different parts, wherein many of the parts have multiple usage so as to reduce inventory, manufacturing and tooling costs to a minimum, while permitting the assembly of the swimming pool structure more rapidly, with greater accuracy and at less expense.

These and other objects and advantages of the invention are pointed out in the following description in terms of the embodiments thereof, which are shown in the accompanying drawings. It is to be understood, however, that the drawings are for the purpose of illustration only and are not a definition of the limits of the invention, reference being had to the appended claims for this purpose.

DESCRIPTION OF THE DRAWINGS

In the drawings in which corresponding parts have been indicated by like numerals:

FIG. 1 is a perspective plan view of a swimming pool assembly embodying the present invention in a above ground installation, showing a hinged pool entry ladder in a raised position;

FIG. 2 is a fragmentary plan view of the swimming pool assembly of FIG. 1, showing the pool hinged entry ladder in a lowered position;

FIG. 3 is a fragmentary plan view of the swimming pool assembly of FIG. 1 in a semi-in-ground installation with a fixed step and a gate closing the entry to the pool;

FIG. 4 is an enlarged fragmentary perspective view of a self-aligning modular section such as may be utilized in the side of the pool assembly of FIGS. 1, 2, 3 and 37 through 41, inclusive;

FIG. 5 is an enlarged sectional view of the modular section of FIG. 4;

FIG. 6 is a fragmentary outer side view of the modular section of FIG. 5;

FIG. 7 is an enlarged fragmentary perspective view of a right angled corner self-aligning modular section such as may be utilized in the pool assembly of FIG. 1 and FIGS. 37, 39, 40 and 41, inclusive;

FIG. 8 is an enlarged sectional view of the modular section of FIG. 7;

FIG. 9 is a fragmentary outer side view of the corner modular section of FIG. 8;

FIG. 10 is a fragmentary top view of the corner modular section of FIG. 8;

FIG. 11 is an enlarged side view of the channel bar plate utilized as deck and base plates in FIGS. 4 and 7, and showing self-aligning end notches in a flange portion thereof;

FIG. 12 is a perspective view of a modified form of the channel bar plate of FIG. 11, illustrating a truss rod of a zig-zag form positioned directly within the channel portion of the plate, which channel bar plate may be utilized as a base or deck plate, as shown in FIGS. 4, 5, 7, 8 and 10;

FIG. 13 is a side view of the one piece outrigger of FIG. 5, and showing channel alignment steps or recesses and an assembly notch;

FIG. 14 is a bottom plan view of FIG. 13, taken substantially along the lines **14—14** thereof, and looking in the direction of the arrows;

FIG. 15 is an end view of FIG. 13, taken substantially along the lines **15—15** thereof, and looking in the direction of the arrows;

FIG. 16 is an opposite end view of FIG. 13, taken substantially along the lines **16—16** thereof, and looking in the direction of the arrows;

FIG. 17 is a top plan view of FIG. 13, taken substantially along the lines **17—17** thereof, and looking in the direction of the arrows;

FIG. 18 is a side view of the one piece outrigger corner post and showing the channel alignment steps or recesses and assembly notches;

FIG. 19 is a bottom plan view of FIG. 18, taken substantially along the lines **19—19** thereof; and looking in the direction of the arrows;

FIG. 20 is an end view of FIG. 18, taken substantially along the lines **20—20** thereof, and looking in the direction of the arrows;

FIG. 21 is a top plan view of FIG. 18, taken substantially along the lines **21—21** thereof, and looking in the direction of the arrows;

FIG. 22 is an end view of FIG. 18, taken substantially along the lines **22—22** thereof, and looking in the direction of the arrows;

FIG. 23A is a diagrammatic view illustrating the manner in which the upper deck frame and lower base frame act as trusses in resisting the forces applied by the pressure of the water carried within the pool liner;

FIG. 23B illustrates diagrammatically the manner in which the upper and lower frame trusses under the force of the pressures applied by the water carried within the pool liner tends to bow the truss, causing, as indicated by the arrows, an outer half of the truss to stretch (tension) and an inner half of the truss to compress (compression) while the relative magnitude of the compression or tension stresses in the truss are indicated by the lengths of the respective arrows;

FIG. 24 is an enlarged fragmentary perspective view illustrating another modular section of the side of the pool assembly of FIG. 1, and showing the water inlet fitting;

FIG. 25 is an enlarged fragmentary perspective view illustrating another modular section of the side of the pool assembly of FIG. 4, and showing the combination outlet and in-wall skimmer;

FIG. 26 is an enlarged fragmentary perspective view illustrating another modular section of the side of the pool assembly of FIG. 1, and showing an accessory mounting which may be an under water light, an under water sound device, such as a loudspeaker, or an under water observation window;

FIG. 27 is an enlarged perspective view of a modified corner modular section, such as may be used in a dog leg or free form pool assembly, as shown for example by the modified forms of the pool assemblies of FIGS. 38, 40 and 41;

FIG. 28 is an enlarged perspective view of a curved free form corner modular section such as may be used for example in the modified form of the pool assembly of FIG. 38;

FIG. 29 is a fragmentary top view of the curved free form corner modular section of FIG. 28;

FIG. 30 is an enlarged view of a modified form of the pressure panel section that may be embodied in the modular sections of FIGS. 4, 5, 6, 24, 25 and 26, and illustrating pressure panel braces utilized as exterior rectangular tubing or channels for circulating hot water or other fluid heating medium about the perimeter of a pool liner for heating the water carried by the liner;

FIG. 31 is an enlarged end view of the pressure panel section of FIG. 30, taken substantially along the lines **31—31** thereof, and looking in the direction of the arrows so as to illustrate the exterior heating tubes for circulat-

ing the hot water or fluid heating medium about the perimeter of the pool liner for heating the water carried within the liner;

FIG. 32 is an enlarged fragmentary perspective view illustrating a modified modular section which may be embodied in the pool assembly, showing a modular section with interior heating tubes and illustrating a hot water inlet from a pressure pump to the heating tubes and an outlet from the heating tubes;

FIG. 33 is an enlarged fragmentary perspective view illustrating another modular section, which may be embodied in the pool assembly, together with the modular section of FIG. 32, with interior heating tubes for the circulation of hot water or other fluid heating medium under pressure of a pump about the perimeter of the pool liner for heating the water carried by the liner;

FIG. 34 is an enlarged fragmentary perspective view illustrating the application to a curved free form corner modular section, such as illustrated by FIG. 28, of interior heating tubes for the circulation of hot water or other fluid heating medium about the perimeter of the pool liner for heating the water carried by the liner;

FIG. 35 is an enlarged perspective view of a modified form of a modular section that may be embodied in a side of a modular pool assembly embodying the invention, showing an outrigger post in an inverted position from FIG. 4, to provide a broader base channel plate assembly to effect a greater distribution of weight of the pool assembly;

FIG. 36 is an enlarged perspective view of a modified form of a modular corner section that may be used in a modular pool assembly embodying the invention and showing the outrigger posts in an inverted position from that shown by FIG. 7;

FIG. 37 is a top plan view of a square swimming pool assembly constructed of modular sections embodying the present invention;

FIG. 38 is a top plan view of a curved corner dog leg swimming pool assembly constructed of modular sections embodying the present invention;

FIG. 39 is a top plan view of a square cornered dog leg swimming pool assembly constructed of modular sections embodying the present invention;

FIG. 40 is a top plan view of a free form dog leg swimming pool assembly constructed of the modular sections embodying the present invention;

FIG. 41 is a top plan view of a pointed free form dog leg swimming pool assembly constructed of the modular sections embodying the present invention;

FIG. 42 is an enlarged fragmentary perspective view of the sun deck assembly of FIG. 1, with certain parts being broken away for a better illustration of the assembly thereof; and

FIG. 43 is a fragmentary sectional view illustrating a modified form of the sun deck assembly of FIG. 42, and convenient means for enlarging the sun deck by applying additional channel bar deck plates thereto.

DESCRIPTION OF THE INVENTION

Referring now to the drawings and particularly to FIGS. 1, 2 and 3 thereof, there is shown a modular swimming pool assembly **10**, embodying an improved construction of the present invention, and which may be of a type described and claimed in United States Letters Patent No. 3,335,430, issued Aug. 15, 1967, to Julius Donald Schwarz and George E. Dokes, and an improved modular swimming pool assembly which may be mounted above ground level, as shown in FIGS. 1 and 2, and below ground level or partially in the ground, as shown by FIG. 3.

The pool construction may include a fluid tight liner indicated generally by the numeral **12**. The liner **12** may be a permanent metal or plastic liner for a swimming pool of a type described and claimed in a co-pending United States application Ser. No. 672,604, filed Oct. 3, 1967, by Julius Donald Schwarz, George E. Dokes, Otokar von Bradsky and Sidney J. Goodman. The liner may also be of a suitable vinyl plastic flexible sheet material that is somewhat stretchable, such as polyvinylchloride, which has been found to be satisfactory. There is provided along the upper or top free edge of the liner **12** an extruded bead that may be snapped into a liner lock strip **14**, as described in the aforementioned United States Letters Patent No. 3,335,430, or the attaching means may be of a type described and claimed in United States Letters Patent No. 3,354,473.

Referring now to FIG. 5, the liner lock strip **14** and a flange **118** of a pressure plate panel **117** are fastened by suitable means, such as rivets **16**, to the upper side of a channel bar inner deck plate **18** of an identical construction to that of a channel bar outer deck plate **20**. The deck plates **18** and **20** extend longitudinally in adjacent parallel relation in FIGS. 1, 37, 38, 39, 40 and 41, and in detail in the corresponding modular sections of FIGS. 4, 7, 27, 28 and 29. In a modular assembly embodying heating tubes, the modular sections may include the structures shown by FIGS. 30, 31, 32, 33 and 34, in which like numerals indicate corresponding parts in the several views.

CHANNEL BAR PLATES

The channel bar deck plates **18** and **20**, as shown by FIG. 4, have an identical structure to that of the base plates **22** in that each of the plates is formed of a sheet steel material, and, as shown by FIGS. 11 and 12, each includes a longitudinally extending body portion **25**, having flange portions **27** and **29** projecting at right angles from opposite sides thereof. The flange portion **27** is formed of a greater width than the flange portion **29**, while the flange **29** has notches **30** provided therein at opposite end portions thereof for a purpose to be explained hereinafter.

Adjacent opposite ends of the longitudinally extending portion **25**, as shown by FIGS. 11 and 12, there are provided therein precisely located fastening holes **31**, **32** and **33**. Similarly, in the flange portion **27**, there are provided other precisely located fastening holes **34**, **35** and **36** adjacent the opposite ends thereof. Also, in the flange portion **29** and adjacent each end, there is formed a precisely located fastening hole **37**, and positioned in spaced relation thereto and precisely located along the flange **29** are other fastening holes **38**.

The purpose of the notches **30** in the flange portion **29**, the several fastening holes **31**, **32** and **33** in the body portion **25**, the several fastening holes **34**, **35** and **36** in the flange portion **27** and the several fastening holes **37** and **38** in the flange portion **29** in the assembly of the respective channel bar plates in the modular sections will be explained hereinafter in detail.

The structure of the channel bar deck plates **18** and **20** and the base plates **22**, as described with reference to FIGSS. 11 and 12, may be utilized in the assembly of the several modular sections of the swimming pool assembly or optionally there may be included a truss rod **41** of a zig-zag form, as shown by FIG. 12, to reinforce the channel bar plates.

In the latter arrangement, the truss rod **41** is positioned directly within the channel portion of the channel bar plate with diagonal portions **43** of the truss rod **41** extending between inner surfaces of the opposite flange portions **27** and **29**. The opposite ends of the truss rod **41** are suitably affixed, as by welding, to inner surfaces of the flange portions **27** and **29** at points suitably spaced from the opposite ends of the channel bar plate.

The channel bar deck plates **18** and **20** in the assembly of each of the modular side sections are mounted on upper portions of a pair of one piece outrigger posts **45**, while the channel bar base plate **22** supports therein an opposite lower portion of each of the pair of outrigger posts **45**, as shown for example by FIGS. 4 and 5.

SIDE OUTRIGGER POSTS

Each of the side outrigger posts **45** has a structure identical to the structure shown by FIGS. 13, 14, 15, 16 and 17, and is formed of a sheet metal or steel material. The outrigger post **45** includes flat flange portions **47** and **49** separated by an assembly slot **51** formed in an upper cross bar **53** from which project the flange portions **47** and **49**, as shown best in FIGS. 13 and 17.

The cross bar **53**, as shown by FIG. 13, connects a vertically extending post **55** to a supporting meam **57**, as indicated at the upper end thereof, while the other end of the post **55** is in turn connected by a lower cross bar **59** of a shorter length to the supporting beam **57**. The lower cross bar **59**, as shown by FIGS. 13 and 14, has projecting therefrom a flat flange portion **61**.

The supporting beam **57** has projecting from an outer edge thereof a flange portion **63** in which there is provided a flat step or recess portion **65** at an upper end thereof contiguous with an adjacent end of the upper cross bar **53**, while at a lower end of the supporting beam **57** there is provided a flat step or recess portion **67** in the flange portion **63** contiguous with an adjacent end of the lower cross bar **59**.

Similarly, the vertically extending post **55** has projecting from an outer edge thereof a flange portion **69** in which there is provided a flat step or recess portion **71** at an upper end thereof contiguous with an adjacent end of the upper cross bar **53**, while at a lower end of the post **55** there is provided a flat step or recess portion **73** in the flange **69** contiguous with an adjacent end of the lower cross bar **59**.

The cross bar **53**, vertically extending post **55**, supporting beam **57**, cross bar **59** and the several flange portions projecting therefrom are formed integrally to provide a one piece outrigger post **45**.

THE SIDE MODULAR SECTION ASSEMBLY

To effect the side modular section assembly of FIGS. 4 and 5, there are provided in the flat flange portions **47** and **49** of FIG. 17 two sets of fastening holes **75** and **77** precisely positioned so as to coincide with fastening bolts **78** and **79** inserted through the fastening holes **31** and **32** in the channel bar deck plates **18** and **20** and into the fastening holes **75** and **77** to secure the same in position in the modular section upon engagement of the bolts with suitable fastening nuts, as shown by FIG. 5, while the slotted end portions **30** of the flanges **29** of the inner and outer deck plates **18** and **20** are snuggly received in the assembly slot **51** of the outrigger post **45** with the adjacent ends of the flanges **29** of the companion deck plates **18** and **20** being secured together by the passage of fastening bolts **81** through coinciding holes **37** adjacent the end portions of the flanges **29** of the respective deck plates **18** and **20**. The bolts **81** may be secured in position by suitable fastening nuts, as shown by FIG. 5. The flanges **29** of the companion deck plates **18** and **20** may be similarly secured together by the passage of suitable fastening bolts through coinciding holes **38** in the flange **29**, as shown by FIG. 12, and securing the same in position by conventional fastening nuts.

Furthermore, as shown by FIG. 15, there are provided in the flat step portion **65** of the flanges **63** two sets of fastening holes **84**, **85** and **86** precisely positoned so as to coincide with fastening bolts **87**, **88** and **89** inserted through the fastening holes **34**, **35** and **36** in the end portions of the flange **27** of the outer channel bar deck plate **20** for securing the one to the other upon engagement by suitable fastening nuts, as shown by FIG. 5, as well as securing to the modular section a supporting post **90** of a fencing **91** for the pool assembly, as shown by FIGS. 5 and 6.

Referring now to FIG. 15, in the flat step portion **67** of the flange **63**, there are provided two fastening holes **93** each precisely positioned so as to coincide with a fastening bolt **94** inserted through the fastening hole **37** adjacent an end of the flange **29** of the channel bar base plate **22** for securing the one to the other upon engagement by a suitable fastening nut, as shown in FIG. 5.

Also, the flat flange portion **61**, projecting from the lower cross bar **59**, as shown by FIGS. 13 and 14, has provided therein two sets of fastening holes **95** and **97** precisely positioned so as to coincide with fastening bolts **98** and **99** inserted through the fastening holes **31** and **33**, respectively in the channel bar base plate **22** to secure the same in position upon engagement of the bolts **98** and **99** with suitable fastening nuts at the inner side of the flange **61**, as shown by FIG. 5.

There is shown in FIGS. 13 and 16, in the flat step portion **73** of the flange **69**, two sets of fastening holes **101**, **102** and **103** precisely positioned to coincide with threaded fastening bolts **105**, **106** and **107**, as shown by FIG. 5, inserted through the fastening holes **34**, **35** and **36** in the flange **27** of the channel bar base plate **22** to secure the same in position upon engagement of the bolts **105** and **107** at the inner side of the flange **69** by suitable fastening nuts, while the bolt **106** is secured in position by engagement in a threaded hole in a rib portion of a brace **109** positioned at an outer side of the flange **27** of the base plate **22**, as shown in FIG. 5.

Steel braces **109**, **111**, **113** and **115** extend horizontally in a spaced parallel relation along the length of a panel plate **117** formed of a sheet steel material, as shown by FIGS. 5 and 6, and having a flange portion **118**, as shown by FIG. 31, to fit over an inner edge of the deck plate **18**. The braces **109**, **111**, **113** and **115** are secured to the outer surface of the panel plate **117** by suitable means, such as welding, and each brace has a raised rib portion having a threaded hole provided for receiving correspondingly threaded securing bolts **106**, **118**, **119** and **120**, respectively, projecting through fastening holes **102**, **130**, **132** and **122** in the flange **69** of the integral outrigger post **45**, as hereinafter explained.

Referring now to FIGS. 13 and 16, there is shown in the flat step portion **71** of the flange **69**, two sets of fastening holes **121**, **122** and **123** precisely positioned so as to coincide with threaded fastening bolts **125**, **126** and **127**, as shown in FIG. 5, inserted through the fastening holes **34**, **35** and **36** in the flange **27** of the inner channel bar deck plate **18**. The deck plate **18** is secured in position upon engagement of the bolts **125** and **127** at the inner side of the flange **69** by suitable fastening nuts, while the bolt **120** is secured in position by engagement in the threaded holes in the rib portion of the brace **115**, which is positioned at an outer side of the flange **27** of the inner deck plate **18**.

Furthermore, as shown by FIG. 16, there are provided in the flange **69** two sets of precisely positioned fastening holes **130** and **132**, which are arranged in spaced relation and so positioned that bolts **118** and **119** inserted therethrough from the inner side of the flange **69** will coincide with correspondingly threaded holes in the rib portions of the respective braces **111** and **113** to secure the bolts **118** and **119** therein at the outer side of the flange **69** of the outrigger post **45**, and the pressure plate **117** and the braces **111** and **113** as best shown in FIGS. 4 and 5.

CORNER OUTRIGGER POSTS

In the corner modular section assembly of FIGS. 7, 8, 9 and 10, there is shown corresponding structures to that heretofore described with reference to FIGS. 4, 5 and 6, which have been indicated by like numerals.

However, the corner outrigger posts indicated generally by the numeral **145** have a somewhat different structure from the side outrigger posts **45** although formed of a like sheet steel material.

The outrigger post **145**, as shown by FIGS. 18, 19, 20, 21 and 22, includes flat flange portions **147** and **149** separated by a post assembly notch **151** formed in an upper cross bar **153** from which project at opposite sides there-

of the flange poritons 147 and 149, as shown by FIGS. 18 and 21.

The cross bar 153, as shown by FIG. 18 connects a vertically extending post 155 to a supporting beam 157 at the upper end thereof, while the other end of the post 155 is in turn connected by a lower cross bar 159 of a shorter length to the supporting beam 157. The lower cross bar 159, as shown by FIGS. 18 and 19, has projecting from opposite sides thereof two flat flange portions 160 and 161 separated by a second post assembly notch 162.

The supporting beam 157 has projecting from an outer edge and opposite sides thereof flange portions 163A and 163B extending at a forty-five degree angle to the side surfaces of the supporting beam 157, while the flange portion 163A extends at a ninety degree angle to the flange portion 163B. At the upper end of the flange portions 163A and 163B there is provided a step or recess portion 165A and 165B, respectively, contiguous with an adjacent end of the upper cross bar 153, as shown by FIGS. 18, 20 and 21.

At the lower end of the flange portions 163A and 163B there is provided a step or recess portion 167A and 167B in the flange portions 163A and 163B, respectively, contiguous with an adjacent end of the lower cross bar 159, as shown by FIGS. 18, 19 and 20.

Similarly, the vertically extending post 155 has projecting from an outer edge and opposite sides thereof flange portions 169A and 169B extending at one hundred and thirty-five degree angle to the side surfaces of the post 155 while the flange portion 169A extends at an angle of ninety degrees to the flange portion 169B. At an upper end of the flange portions 169A and 169B there is provided a step or recess portion 171A and 171B in the flange portions 169A and 169B, respectively, contiguous with an adjacent end of the upper cross bar 153, as best shown by FIGS. 18, 21 and 22.

At the lower end of the flange portions 169A and 169B there is provided a step or recess portion 173A and 173B in the flange portions 169A and 169B and in the flange portions 169A and 169B, respectively, contiguous with an adjacent end of the lower cross bar 159, as shown in FIGS. 18, 19 and 22.

The upper cross bar 153, vertically extending post 155, supporting beam 157, lower cross bar 159 and the several flange portions projecting therefrom are formed integrally one with the other so as to provide a one piece outrigger corner post 145.

CORNER MODULAR SECTION ASSEMBLY

In order to effect the corner modular section assembly, as shown by FIGS. 7, 8, 9 and 10, there are provided in each of the flat flange portions 147 and 149, two sets of precisely positioned fastening holes 175 and 177 arranged to receive fastening bolts 178 and 179, as shown by FIGS. 7, 8 and 10, inserted through corresponding holes in the channel bar deck plates 18 and 20 adjacent corner end portions thereof cut on a forty-five degree angle, as shown by FIGS. 7 and 10, and secured by suitable fastening nuts at the underside of the flange portions 147 and 149, as shown by FIG. 8, while the flange portions 29 of the two oposite sets of deck plates18 and 20 are received in the assembly slot 151 in the upper cros bar 153, as shown by FIGS. 8 and 10.

Referring now to FIGS. 18 and 20, there are provided in the flat step portions 165A and 165B of the respective flange portions 163A and 163B two sets of three fastening holes 184A and 184B, respectively, precisely positioned so as to coincide with fastening bolts 187A and 187B inserted through corresponding fastening holes 34, 35 and 36 in the end portion of the flange 27 of the opposite outer channel bar deck plates 20, as shown by FIGS. 8 and 10, for securing the one to the other upon 163A and 163B, respectively, as well as secured to the corner modular assembly a corner supporting post 190 for a fencing 91 for the pool assembly, as shown by FIG. 9. The corner supporting post 190 and the fencing 91 may be a part of each modular section, if desired.

Referring further to FIGS. 18 and 20, there is shown in each of the flat step portions 167A and 167B of the flanges 163A and 163B, a fastening hole 193A and 193B, respectively, each hole being precisely positioned so as to coincide with a fastening bolt 194A and 194B inserted through a fastening hole 37 adjacent an end of the flange 29 of each of the adjacent channel bar base plates 22 to the flange 163A and 163B, respectively, upon the bolts 194A and 194B being secured at the inner side of the step portions 167A and 167B of the flanges 163A and 163B, respectively, by a suitable fastening nut, as shown in FIG. 8.

The flat flange portions 160 and 161, projecting from the opposite sides of the lower edge of the lower cross bar 159, each has provided therein two sets of two fastening holes 195 and 196, respectively, precisely positioned so as to coincide with two sets of fastening bolts 198 and 199, respectively, inserted through corresponding holes in the channel bar base plates 22 adjacent end portions thereof cut on a forty-five degree angle, as shown by FIG. 7, and secured by suitable fastening nuts at the inner side of the flange portions 160 and 161, as shown by FIG. 8.

There is shown in FIGS. 18 and 22, in the flat step portions 173A and 173B of the flanges 169A and 169B, respectively, two sets of fastening holes 201, 202 and 203, precisely positioned so as to coincide with threaded fastening bolts 205, 206 and 207, respectively, inserted through the fastening holes 34, 35 and 36 in the flange plate 27 of the channel bar base plate 22 to secure the same in position upon engagement of the bolts 205 and 207 at the inner side of the flanges 173A and 173B by suitable fastening nuts, while the bolt 206 is secured in position by engagement in a threaded hole in the rib portion of the brace 109 positioned at the outer side of the flange 27 of each associated base plate 22, as shown in FIGS. 7, 8 and 9.

There is also shown in FIGS. 18 and 22, in the flat step portions 171A and 171B of the flanges 169A and 169B, two sets of fastening holes 221, 222 and 223 precisely positioned so as to coincide with threaded fastening bolts 225, 226 and 227 inserted through the fastening holes 34, 35 and 36 in the flange plate 27 of the associated inner channel deck plate 18. The deck plates 18 are secured in position upon engagement of the bolts 225 and 227 at the inner side of the associated flange portions 169A and 169B by suitable fastening nuts, while bolt 226 is secured in position by engagement in the threaded hole in the rib portion of the brace 115 positioned at an outer side of the flange 27 of the associated inner deck plates 18.

Further, as shown by FIG. 22, there are provided in the flange portions 169A and 169B two sets of precisely positioned fastening holes 230A and 232A; and 230B and 232B, respectively, so arranged that bolts 234 and 236 inserted therethrough from the inner side of the flange portions 169A and 169B will coincide with corresponding threaded holes in the rib portions of the braces 111 and 113 to secure the bolts 234 and 236 therein at the outer side of the flange portions 169A and 169B of the outrigger corner post 145, as shown in FIGS. 7, 8 and 9.

In the modular corner assembly, a top corner strap 250 of a flexible steel material is inserted in the upper post assembly notch 151 and secured at its opposite ends by bolts 251 to the flange 27 of the two corner abutting outer deck plates 20, as shown by FIGS. 8, 9 and 10, while another lower corner strap 252 is inserted in the lower post assembly notch 162 and secured at its opposite ends by bolts 254 to the flange 29 of the two corner abutting base plates 22, as shown by FIGS. 8 and 9.

ASSEMBLY OF THE POOL STRUCTURE

In the assembly of the side modular sections of FIG. 4, the flat steps portions **65**, **67**, **71** and **73** of the outrigger posts **45** of FIGS. 13 to 17 provide alignment steps which act to prevent vertical movement of the deck and base plates **18**, **20** and **22**, while similarly in the corner modular section of FIG. 7, the flat step portions **165A** and **165B**, **167A** and **167B**, **171A** and **171B** and **173A** and **173B** of the corner outrigger post **145** of FIGS. 18 and 22, provide alignment steps which act to prevent vertical movement of the inner and outer left and right corner deck and base plates **18**, **20** and **22**. The alignment steps in the outrigger posts **45** and **145** facilitate simplicity and ease of assembly of the respective modular sections of FIGS. 4 and 7.

Moreover, in the respective modular sections of FIGS. 4 and 7, the pressure panels **117** include the horizontally extending braces **109**, **111**, **113** and **115** secured to the outer surface of the pressure panel **117** and releasably secured to the outrigger posts **45** and **145** so as to provide for ease of assembly of the modular sections of FIGS. 4 and 7.

Furthermore, ease of assembly of the respective modular sections is further effectuated by the provision of the readily interchangeable channel bar plates of FIGS. 11 and 12, which may be used as deck plates **18** and **20** or as the base plate **22** in combination with interchangeable outrigger posts **45** and interchangeable outrigger posts **145**, which posts include the aforenoted step portions providing automatic alignment of the respective deck and base plates.

As shown by FIG. 4, the automatic alignment step portions give exact relationship of perpendicular positioning between the post assembly **45** and the aligning plate **22** at the base of each modular section and the plates **18** and **20** at the upper deck of the modular section. Also, through the automatic alignment step portions, the same relative automatic positioning is achieved between corner posts **145** and the aligning corner deck and base plates, as shown for example by FIG. 7. The foregoing facilitates the rapid and exact assembly of the modular sections of FIGS. 4 and 7 in the shop or field by relatively unskilled labor.

Further, a plurality of the modular side sections of FIG. 4 and the modular corner sections of FIG. 7 may be serially interconnected to provide the rectangular pool assembly of FIGS. 1 and 37 through the aligning deck plates **18** and **20** and the aligning base plates **22** and the outrigger post assemblies **45** as well as the plurality of outrigger corner post assemblies **145** and the left inner aligning deck plates **18** and the right inner aligning deck plates **18** and the left outer aligning deck plates **20** and the right outer aligning deck plates **20**, which, in turn, combine to prevent upward and downward movement at both the base plate **22** and the upper deck plates **18** and **20**, and also limit the inner and outer movement of both the base and the upper deck, thereby further combining so as to prevent sideward motion at both the base and the upper deck of the pool assembly, as shown by FIGS. 1 and 37.

OPERATION

In such a rectangular swimming pool assembly, the walls of fluid-tight liner **12** of the pool may be restrained against water pressure by the provision of a truss arrangement in the same manner as the roof of a building may be held up by a truss.

The swimming pool assembly of FIG. 1 has two such trusses, one being located at the top of the swimming pool assembly and the other at the bottom of the swimming pool assembly. The truss at the bottom of the pool assembly may be aided by cross and corner straps, as indicated in dotted lines on FIG. 1, and which may be of the type described and explained in United States Letters Patent No. 3,335,430, supra.

The truss at the bottom of the swimming pool assembly need not be as strong as the truss at the top of the swimming pool assembly, which must span a much greater length and has a greater water pressure applied thereto. Thus, in the swimming pool assembly of FIGS. 1 and 37, embodying the modular sections of FIGS. 4 and 7, a plurality of channel bar plates **22** is serially connected to form the bottom frame or base truss, while a plurality of channel bar plates **18** and **20**, identical to the channel bar plates **22**, are serially connected in parallel so as to form the top frame or deck truss.

In a straight modular side section, as shown by FIG. 4, the force of the water pressure applied through the liner **12** to the pressure panel **117** is transmitted to the outrigger post assembly **45**. The outrigger post assembly **45**, in turn, transmits the force of the water pressure to the channel bar deck plates **18** and **20**, which form the deck of the pool assembly and the top frame or truss, and to the channel bar plates **22** which form the base of the pool assembly and the bottom frame or truss.

When a number of the modular sections of the type described with reference to FIG. 4 are serially fastened rigidly together and supported at each end by the corner modular sections described with reference to FIG. 7, as shown for example by FIGS. 1 and 37, the force of the water carried by the pool liner **12** is resiliently resisted by the channel bar plates **18** and **20** of the deck or upper frame and the channel bar plates **22** of the base or lower frame, which act as upper and lower frame trusses, respectively, to resist the pressure forces applied by the water carried within the pool liner **12** in a manner best illustrated diagrammatically by FIG. 23A.

Thus, the channel bar plates of the upper deck frame and the lower base frame, being fastened rigidly together at their respective outrigger posts **45** and **145**, the individual channel bar plates **18**, **20** and **22** form a unit which may be considered a single deck frame upper truss in the case of the channel bar plates **18** and **20** and a single base frame lower truss in the case of the channel bar plates **22**.

The force of the pressures of the water carried within the pool liner **12** is transmitted to the deck frame upper truss and to the base frame lower truss at regularly spaced intervals corresponding to the points at which the braces **109**, **111**, **113** and **115** are secured to the outrigger posts **45** and **145**, as indicated by the arrows of FIG. 23A. The deck frame upper truss and the base frame lower truss is restrained at each end by resisting forces (in the case of the base frame lower truss additional resisting forces may be applied by cross straps indicated by the dotted lines in FIG. 1, as heretofore explained), the sum of which forces are equal and opposite to the total force of the water pressure on the wall of the pool under consideration. Thus, since the deck frame upper truss is supported only at the ends (the base frame lower truss acts in a similar manner), the forces applied by the pressure of the water carried within the pool liner **12** act in a sense tending to bow the deck frame upper truss out at its middle portion. This bowing of the upper truss causes the outer half of the deck frame upper truss to stretch (tension) and the inner half of the deck frame upper truss to compress (compression), as illustrated diagrammatically by the arrows of FIG. 23B.

In between the tension and compression portions of the truss is a neutral axis, as illustrated diagrammatically by FIG. 23B, which is neither in tension nor compression. The length of the several arrows of FIG. 23B indicates the relative magnitude of the compression or tension stresses in the deck frame upper truss. These stresses, which build up in the deck truss due to the bowing thereof, resist further bowing once an equilibrium condition is obtained. The truss will be safe as long as the maximum tension or compression stress does not exceed the allowable stress for the material of the deck truss. These stresses, as indicated by the arrows of FIG. 23B, are at a maximum at the middle of the deck truss along the length of the deck truss and taper off towards the opposite ends. Theoretically, the stresses are zero at the ends of the deck

truss, but in actuality the stresses exist at the opposite ends of the deck truss and are utilized to advantage in the present invention. Thus, through the provision of the corner modular sections of FIG. 7, these stresses at the ends of the deck truss are so utilized as to reduce the bowing of the truss.

The corner modular sections of FIG. 7 are so constructed as to effectively transfer the tension and compression forces applied to its sides by the trusses around the corner. Obviously, the corner inner and outer deck plates **18** and **20** of the upper deck truss at one side of the corner transfer their tension and compression forces through the corner post assembly of FIG. 7 to the corner inner and outer deck plates **18** and **20** of the upper deck truss at the opposite side of the corner post assembly. The top corner strap **250** has the effect of lessening the maximum stress in the corner. This is accomplished by the top corner strap **250** taking a portion of the tension across the corner directly so as to result in a greater distribution of the compression and tension forces to be transferred through the corner post. This greater distribution results in a lower maximum compression-tension stress across the corner.

The corner base plate **22** of the lower base truss at one side of the corner similarly transfer its tension and compression forces through the corner post assembly of FIG. 7 to the corner inner and outer base plate **22** of the lower base truss at the opposite side of the corner post assembly. The lower corner strap **252** has a similar effect to that of the upper corner strap **250** in lessening the maximum stress in the corner. This is accomplished by the lower corner strap **252** taking a portion of the tension across the corner directly to result in a greater distribution of the compression and tension forces to be transferred through the corner post by the lower base truss, thereby resulting in a lower maximum compression-tension stress across the corner.

MODIFIED MODULAR SECTIONS OF THE INVENTION

In the swimming pool assembly, the side modular sections may be of the form heretofore described with reference to FIG. 4, or the serially connected side modular sections may include modified side modular sections, such as shown by FIGS. 24, 25 and 26, in which corresponding numerals indicate corresponding parts to those heretofore described with reference to FIG. 4, and which modular sections may be provided in a pool assembly, as shown for example by FIG. 1.

The modified side modular section of FIG. 24 includes a water inlet fitting **350** mounted in the pressure panel **117**. The water inlet fitting **350** is operably connected at the opposite side of the pressure panel **117** and within the modular section of FIG. 24 with suitable plumbing means (not shown) for supplying water through the inlet fitting **350** to the interior of the pool liner **12**, as shown pictorially by FIG. 1. The water inlet fitting **350** may be conveniently arranged so as to project through an opening provided in the liner **12** and be secured therein by suitable fastening means.

The modified side modular section of FIG. 25 includes a combination outlet and in-wall skimmer device **355** of a rectangular shape mounted in the pressure panel **117**. The in-wall skimmer device **355** is operably connected at the opposite side of the pressure panel **117** and within the modular sections of FIG. 25 with suitable plumbing means (not shown) for draining water from the interior of the pool liner in excess of a predetermined level, which is controlled by the positioned height of the device **355**, as shown pictorially by FIG. 1. The in-wall skimmer device **355** may be conveniently arranged so as to project through an opening provided in the liner **12** and be secured in the liner **12** by suitable fastening means.

The modified side modular section of FIG. 26 includes a circular window **360** mounted in the pressure panel **117** in a position normally below the level of the water carried within the liner **12** so as to provide an underwater observation window, light or loud speaker, as shown pictorially in FIG. 1. The circular window **360** is operably connected to the pressure panel **117** and around a suitable opening formed in the panel **117**, and there may be provided within the modular section of FIG. 25 a suitable electric lamp or loudspeaker (not shown) to provide the underwater lighting or sound effects that may be desired. The circular window **360** is conveniently arranged so as to project through an opening provided in the liner **12** and be secured in the liner **12** by suitable fastening means.

MODIFIED POOL STRUCTURES

In addition to the rectangular type pool structure illustrated by FIGS. 1 and 37, the present invention may be applied to pool structures of many different sizes and shapes. For example, the modular sections of the types shown by FIGS. 4 and 7 may be applied in pool structures of a square cornered dog leg free form type, such as shown for example by FIGS. 38, 39, 40 and 41. However, in such free form pool structures, there may be also applied free form modular corner sections of the type shown by FIG. 27 to provide a one hundred and thirty-five degree modular corner section in the wall of the pool structure.

In the free form modular corner section of FIG. 27, corresponding numerals indicate corresponding parts to those heretofore described with reference to FIG. 7. The corner outrigger post indicated by the numeral **145A** has flange portions extending at a one hundred and thirty-five degree angle one to the other from both the vertical post and the supporting beam of the corner outrigger post rather than at a ninety degree angle as in the case of the corresponding flange portions of the corner outrigger post **145** of the square corner modular section of the type shown by FIG. 7.

Furthermore, other free form modular corner sections may be provided in the wall of the opposite side of the pool structure to provide a two hundred and twenty-five degree angle modular corner section in the wall of the pool structure, as shown for example by FIGS. 39, 40 and 41.

The structures of the latter free form modular corner sections are not shown in detail, but the same may be of a type shown by the structures of FIG. 27, except that in such case the corner outrigger post corresponding to the post **145A** has the flange portions extending at a two hundred and twenty-five degree angle one to the other from both the vertical post and the supporting beam of the corner outrigger post, rather than at the one hundred and twenty-five degree angle as in the case of the flanges of the post **145A** of the structure of FIG. 27.

In addition, the modular sections of the types shown by FIGS. 4 and 7 may be applied to a pool structure of a curved cornered dog leg free form type, such as shown for example by FIG. 38. However, in such free form pool structure, the square cornered modular section of the type shown by FIG. 7 may be suitably modified to provide the curved inner and outer corners, as shown for example by FIG. 38, and, in addition, there may be also applied free form modular corner sections of the type shown by FIGS. 28 and 29 to provide a curved or arcuate one hundred and thirty-five degree modular corner section in the wall of the pool structure.

In the free form modular curved section of FIGS. 28 and 29, corresponding numerals indicate corresponding parts to those heretofore described with reference to FIG. 27, except that in the form of FIGS. 28 and 29, the corner outrigger post **145B** has a curved concave flange portion extending from the inner vertical post and a curved convex flange portion extending from the supporting beam of the corner outrigger post rather than the angularly extending flange portions of the corner outrigger posts **145** and **145A** of the corner modular sections of the type shown by FIGS. 7 and 27, respectively, so as to provide the desired curved modular corner section.

Further free form curved modular sections may be provided in the wall at the opposite side of the pool structure to provide a two hundred and twenty-five degree curved or arcuate modular corner section in the wall of the pool structure, as shown for example by FIG. 38.

The structure of the latter type free form curved modular corner section is not shown in detail, but the same may be of a type shown by the structure of FIGS. 28 and 29, except that, in such case, the corner outrigger post corresponding to the post **145B** has a convex curved flange portion extending over a two hundred and twenty-five degree arc extending from the vertical post and a concave curved flange portion extending over a corresponding arc from the supporting beam of the corner post, rather than at the opposite one hundred and thirty-five degree arc as in the case of the curved flanges of the post **145B** of the structures of FIGS. 28 and 29, so as to effect the opposite curved modular section in the wall of the pool structure, as shown for example by FIG. 38.

While typical examples of modular corner sections have been illustrated and explained with reference to FIGS. 7, 27, 28 and 29, it will be readily apparent that in the present invention the precise angles and arcs of the respective flange plates provided therein may be varied to meet the desired requirements of the corner and free form modular sections to be applied in the precise form of the pool structure under consideration, which may be assembled of varied sizes and shapes due to the novel modular sections of the present invention.

METHOD AND MEANS FOR HEATING WATER OF THE POOL ASSEMBLIES

A further feature of the invention resides in the provision of a novel means and method for heating the water of the pool assemblies by the circulation of a fluid heating medium, such as steam, heated water or other substance around the perimeter of the pool.

In one form of the invention, this is effected by providing the steel braces **109**, **111** and **113** mounted along the outer surfaces of the pressure panel plates **117** of the modular sections of FIGS. 4 and 7 with suitably interconnected conduits for the fluid heating medium, as illustrated by FIGS. 30 and 31.

Thus, as shown in FIG. 31, there may be mounted in the raised rib portion of the panel brace **109** a square tubular fluid conduit **400**, having a square protruding connector portion **402**, as shown by FIG. 30, arranged to be inserted in an adjacent open end **404** of an associate fluid conduit **400** provided in a corresponding rib portion of the panel brace **109** of the panel plate **117** of the adjacent interconnected modular section of a type shown by either FIG. 4 or FIG. 7.

Also, as shown in FIG. 31, there may be mounted in the raised rib portion of the panel brace **111** a round tubular fluid conduit **410**, having a round protruding connector portion **412**, as shown by FIG. 30, arranged to be inserted in an adjacent open end **414** of an associated fluid conduit **410** provided in a corresponding rib portion of a panel brace **111** of the panel plate **117** of the adjacent interconnected modular section of the type shown by either FIG. 4 or 7.

The raised rib portion of a third panel brace **113** of the pressure panel plates **117** may include therein a similar round conduit **420** for a fluid heating medium having an internally threaded connector fitting **422** freely mounted on an end of the conduit **420** and arranged to cooperate in threaded engagement into a externally threaded end portion **424** of an adjacent associated fluid conduit **420** provided in a corresponding rib portion of the brace **113**.

Each of the fluid conduits **400**, **410** and **420** is arranged on one of the pressure panels **117** so as to have opposite ends thereof connected to a suitable source (not shown) of a fluid heating medium, such as steam or hot water, supplied for example under pressure of a fluid pump (not shown). Thus, as shown by the examples in FIGS. 30 and 31, the fluid conduit **420** has opposite externally threaded ends **426** and **428** projecting from the outer side of the pressure panel **117** for connection to the source of fluid heating medium. The fluid conduits **400** and **410** have similar opposite ends arranged on other of the pressure panels **117** of the serially connected modular sections for connection to the source of fluid heating medium. The modular sections may be of a type, such as shown for example by FIGS. 4 and 7.

The heating medium, such as steam or hot water, may be circulated from such a source of supply (not shown) into an end of each of the fluid conduits **400**, **410** and **420**, and therethrough around the perimeter of the swimming pool defined by the pressure panel plates **117** carried by the several serially connected modular sections, as shown for example by FIGS. 1 and 37. The fluid heating medium thus circulated through the conduits **400**, **410** and **420** serves to heat the sheet steel panels **117**, and, in turn, heat the water carried within the liner **12** pressed by the forces of the water against the inner surface of the panel plates **117**, as shown by FIGS. 5 and 6, thereby maintaining the water of the pool at a desired temperature.

In a further modified form of the invention illustrated by FIG. 32, instead of mounting the conduits **400**, **410** and **420** for carrying the fluid heating medium along the outer surface of the pressure panel **117** and within the raised rib portions of the panel braces **109**, **111** and **113**, as shown by FIGS. 30 and 31, there may be provided corresponding conduits **430**, **432** and **434** extending along the inner surface of the pressure panel **117** for carrying the fluid heating medium, as shown by FIG. 32.

The conduits **430**, **432** and **434** may be affixed to the inner surface of the pressure panel **117** by suitable means such as welding and the conduits **430** and **432** may be of a round metal tubular type having round protruding connector portions **435** and **437** arranged to be inserted in adjacent open ends **439** and **441** of associated fluid conduits **430** and **432**, respectively, mounted on the inner surface of the panel plate **117** of the adjacent interconnected modular sections of the types shown by either FIG. 4 or FIG. 7.

The fluid conduit **432**, as shown by FIG. 32, has opposite ends **447** and **449** projecting through suitable openings in the panel **117** to the outer side of the pressure panel **117**, and there connected to a suitable fluid pump source (not shown).

The fluid conduits **430** and **434** have similar opposite ends (not shown) arranged to project through suitable openings in other of the pressure panels **117** of the serially connected modular sections to the outer side of the pressure panels **117** and there connected to the source (not shown) of the fluid heating medium.

The fluid heating medium, such as steam or hot water, is applied by the source under pressure into an end of each of the fluid conduits **430**, **432** and **434**, and circulated therethrough around the perimeter of the swimming pool defined by the pressure panel plates **117** so as to heat the water carried within the liner **12**, which is pressed under force of the water against the inner surface of the panel plates **117** and the conduits **430**, **432** and **434** mounted on the inner surface of the panel plates **117** so that the fluid heating medium circulated in these conduits may serve to maintain the water of the pool at a desired temperature.

In the modified form of the invention shown in FIGS. 33 and 34, the two conduits **430** and **434** for circulating the fluid heating medium are shown affixed to the inner surface of the panel **17**. The structure and operation of the conduits **430** and **434** are otherwise the same as heretofore explained with reference to FIG. 32, but there is effected a heating of the pool water carried within the liner **12** by the two fluid heating conduits in the modular

structure of FIGS. 33 and 34 in a similar manner, but at a somewhat slower rate than through the provision of three heating conduits of FIG. 32.

Thus, as shown by FIGS. 30, 31, 32, 33 and 34, the modular sections of the swimming pool assembly of FIGS. 1, 37, 38, 39, 40 and 41 may include conduits for circulating a fluid heating medium from a suitable source (not shown) around the perimeter of the pool liner **12** carrying the water of the pool so as to effectively heat the pool water to a desired temperature.

The advantages of the improved method and means of the present invention for heating the water of a swimming pool assembly over prior methods and means of directly heating the water supplied to the pool for use in swimming may be readily realized when it is considered that the pool water may not be used efficiently, since in the main such pool water may require many hours for recirculation and heating to effect the desired temperature, while the present method and means of providing a forced circulation of a relatively small quantity of a separate source of a fluid heating medium, such as steam or hot water, in a heat exchange relationship about the perimeter of the main body of the pool water, there may be effected a very rapid heating of the pool water by the circulated fluid heating medium in a matter of a few minutes.

Furthermore, the method and means herein provided for effecting the heating of the pool water may be effected with a uniformity which is not attainable under the prior method and means for heating the pool water directly as supplied to the pool for recirculation since the circulation of the heated pool water is never uniform throughout the main body of the pool water.

Another advantage in the present method and means in providing an isolated system for heating the pool water carried by the liner **12** resides in the fact that the separate fluid heating medium utilized for heating the main body of the pool water is free of the chemicals necessarily deposited in the main body of the pool water to assure sanitation, so that there would not be a resultant build-up of a chemical residue of insulating or corrosive material which would otherwise be destructive of the heating system.

MODIFIED REVERSIBLE POOL ASSEMBLY STRUCTURE

A further feature of the present invention is in the provision of an outrigger post modular side section, such as shown by FIG. 4, which may be assembled in an alternate inverted position, as shown by FIG. 35, as well as outrigger post modular corner sections, such as shown by FIGS. 7 and 27, which may be assembled in an alternate inverted position, as shown by FIG. 36, so that the normally double channel bar deck plates 18 and 20 provides in the alternate inverted position a broader base while the normally single channel bar base plate **22** provides in the alternate position a relatively narrow deck plate when the respective modular sections are serially connected in a pool structure assembly.

In the inverted arrangement of the modular sections, as shown by FIGS. 35 and 36, the liner lock strip **14** and the flange **118** of the pressure plate **117** are secured by suitable means, such as rivets **516**, to the upper side of the channel bar plate **22**, which in the inverted arrangement of the modular sections, serves as the deck plate of the pool structure assembly. In FIGS. 35 and 36 corresponding parts to those heretofore described with reference to FIGS. 4, 7 and 27 have been indicated by corresponding numerals, but such parts are shown in an inverted relation.

The feature of the reversibility in the assembly of the respective modular sections is particularly desirable in an above ground installation when the soil conditions are of a nature that require a greater distribution of the weight of the pool assembly at the base than may be effected with the normal arrangement, as shown by FIGS. 4, 7 and 27.

This feature of the invention may also be desirable for the same purpose under similar soil conditions on certain in-ground installations of the pool assembly structure.

Furthermore, in such inverted installation assemblies, the same alignment steps and positioning holes on the outrigger posts of FIGS. 13 through 17 and outrigger corner posts of FIGS. 18 through 22 would be applicable, and the deck and base plates **18**, **20** and **22** would still be aligned to receive fence posts and corner fence posts of the modular safety fence should the use thereof be desired.

SUN DECK PATIO

A further feature of the invention is the provision of a sun deck patio, as shown by FIG. 1, and in detail by FIG. 42, which may be used optionally to make up the modular sections, including, as shown by FIG. 42, the outrigger post **45** of FIGS. 13 through 17; the outrigger corner post **145** of FIGS. 18 through 22; the channel bar deck plates **520** of a type as shown by FIG. 11; and modified deck plates **525** of a type corresponding to the deck plates **520** except that projecting at right angles from opposite sides of a longitudinally extending body portion of the deck plates **525** are flange portions of equal width corresponding to the width of the flange portion **29** of the deck plate **520**. The edges of the flange portions of the deck plate **525** rest upon a sun deck support **526**, having projecting ears **527** and **528** at opposite ends. The ear **527** is secured with the flange **27** of the deck plate **520** and the adjacent flange of the deck plate **525** to the outrigger post **45** at the step **71** by suitable threaded bolts engageable by positioning nuts. The ear **528** is similarly secured to the outrigger post **45**, as shown in FIG. 42.

The sun deck patio of FIGS. 1 and 42, having a width of six deck plates, may be extended to any desired width by merely splicing two or more of the sun deck supports **526** together by using the simple deck splice **520** and the securing bolts and nuts **532** to effectively splice the supports **526** together to support thereon the additional deck plates **525**, as shown by FIG. 43.

Thus, the patio sun deck of the present invention can be optionally extended to any desired length by a plurality of the aforementioned sun deck components in two or more of the modules provided.

Further, the sun deck patio may be assembled not only at an end of the pool, as shown by FIG. 1, but also the sun deck patio may be assembled at any point along the side of the pool, at one side, both sides and at either end or both ends of the pool assembly.

Inasmuch as each of the primary set of pool assembly component parts match the sizes, shapes alignment holes, notches and alignment recesses of the other cooperative component parts, thereof, it will be apparent that, in the pool assemblies embodying the present invention, the costs of tooling for production, fabricating, packaging, shipping, storing and handling are effectively kept at a minimum so as to attain the greatest possible flexibility in end use for the manufacturer, distributor, dealer and the ultimate user of the improvements.

Although only several embodiments of the invention have been illustrated and described, various changes in the form and relative arrangement of the parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention, reference being had to the appended claims for a definition of the limits of the invention.

What we claim is:

1. For use in a modular swimming pool assembly of a type including sidewalls, a bottom channel bar frame for supporting the sidewalls at lower portions thereof, a top channel bar frame for supporting the sidewalls at up-

per portions thereof; a combination comprising a first bar, a second upper cross bar, a third lower cross bar, said cross bars projecting from upper and lower portions of the first bar, a fourth supporting bar connecting end portions of the second and third cross bars opposite from said first bar, said first, second, third and fourth bars being formed integrally one with the other, first means for securing said first bar to at least one of said sidewalls including flange portions projecting from opposite sides of the first bar, second means for securing one of said cross bars in one of the channel bar frames including flange portions projecting from opposite sides of one of said cross bars, and third means for securing the other of said cross bars in the other of the channel bar frames including flange portions projecting from opposite sides of the other of said cross bars, the flange portions of said second and third securing means being arranged so as to be received in said one and said other of said channel bar frames, and outrigger corner post means in which said one of said cross bars has a first assembly notch therein intermediate opposite ends thereof for receiving a corner strap of the modular swimming pool assembly, said other of said cross bars having a second assembly notch therein intermediate opposite ends thereof for receiving another corner strap of the modular swimming pool assembly, the flange portions of said second securing means being arranged in spaced relation and at opposite sides of said first assembly notch in said one cross bar, and the flange portions of said third securing means being arranged in spaced relation and at opposite sides of said second assembly notch in said other cross bar.

2. The combination defined in claim **1** of a sheet metal material and including flange portions projecting in predetermined angular relation one to the other from opposite sides of the fourth supporting bar, the flange portions projecting from opposite sides of said fourth supporting bar having first alignment steps therein adjacent an end of said one cross bar and second alignment steps therein adjacent an opposite end of said other cross bar, the flange portions projecting from said first bar having third alignment steps therein adjacent an opposite end of said one cross bar and fourth alignment steps therein adjacent an opposite end of said other cross bar, said first and third alignment steps being arranged to receive end portions of adjacent sections of said one channel bar frame, said second and fourth alignment steps being arranged to receive end portions of adjacent sections of said other channel bar frame, and said alignment steps providing a predetermined relationship in assemblage between said outrigger corner post means and the adjacent sections of said one and said other channel bar frames so as to facilitate an accurate assembly of the corner of the modular swimming pool assembly.

3. In a modular section for a swimming pool assembly of a type including sidewalls, a bottom channel bar frame for supporting the sidewalls at lower portions thereof, a top channel bar frame for supporting the sidewalls at upper portions thereof; the modular section comprising a unitary assembly post including a first bar, a second upper cross bar, a third lower cross bar, said cross bars projecting from upper and lower portions of the first bar, one of said cross bars having a greater length than the other of said cross bars, and a fourth supporting bar connecting end portions of the second and third cross bars opposite from said first bar, and said first, second, third and fourth bars being integral one with the other, a pair of channel bar plates providing a section of one of said channel bar frames, a channel bar plate providing a section of the other of said channel bar frames, a panel section of one of said sidewalls, first means for securing said first bar to said panel section including flange portions projecting from opposite sides of the first bar, one of said flange portions for securing the panel section to said first bar, another panel section of another of said sidewalls, the other of said flange portions for securing said other panel section to said first bar, second means for securing said one cross bar in said pair of channel bar plates providing the section of said one channel bar frame, and third means for securing the other of said cross bars in the channel bar plate providing the section of said other of said channel bar frames, said one cross bar having an assembly slot therein intermediate opposite ends of said one cross bar for receiving flange portions of said pair of channel bar plates providing a section of one of said channel bar frames.

4. The modular section defined by claim **3** in which the flange portions of said first securing means project in a predetermined angular relation one to the other from the opposite sides of the first bar for securing said first bar to said panel sections for providing a corner modular section for the swimming pool assembly and in which said one cross bar has a first assembly notch therein intermediate opposite ends of said one cross bar, a first corner strap positioned in said first assembly notch and connected across a corner section of said one channel bar frame, said other cross bar having a second assembly notch therein intermediate opposite ends of said other cross bar, a second corner strap positioned in said second assembly notch and connected across a corner section of said other channel bar frame.

5. A swimming pool assembly comprising, in combination, a plurality of side wall sections, a plurality of corner wall sections, each of said sections including upper and lower channel bars, means for connecting opposite ends of the channel bars of each section with ends of corresponding channel bars of adjacent sections to provide upper and lower channel bar frames for the swimming pool assembly, each section including means positioned between the upper and lower channel bars for supporting the upper and lower channel bar frames and the walls of said sections under pressure of the water of the pool assembly, said means including posts positioned between upper and lower channel bars for supporting the upper and lower channel bar frames, a pressure panel plate, braces affixed to the panels in spaced parallel relation one to the other and means for connecting the braces to the posts of the corresponding section so as to extend in a horizontal relation between the posts of said corresponding section whereby said posts support the panel plates of said sections under pressure of the water of the pool assembly, a liner for carrying the water of the pool assembly, said liner having side portions, a bottom portion and an upper free edge, the side portions of the liner extending adjacent the surfaces of the panel plates under pressure of the water carried by the liner, the bottom portion of the liner being positioned adjacent a ground surface, means carried by the upper channel bar frame for securing the upper free edge of the liner adjacent to the upper frame, and fluid conduit means mounted adjacent and in heat exchange relation to the panel plates for conducting a fluid heating medium about the perimeter of the pool assembly for heating the water carried by the liner.

6. The swimming pool assembly defined by claim **5** in which the braces include the fluid conduit means mounted adjacent the panel plates for conducting the fluid heating medium about the perimeter of the pool assembly for heating the water carried by the liner.

7. A swimming pool assembly comprising, in combination, a plurality of side wall sections, a plurality of corner wall sections, each of said sections including upper and lower channel bars, means for connecting opposite ends of the channels bars of each section with ends of corresponding channel bars of adjacent sections to provide upper and lower channel bar frames for the swimming pool assembly, each section including means positioned between the upper and lower channel bars for supporting the upper and lower channel bar frames and the walls of said sections under pressure of the water of the pool assembly, said means including posts positioned between

upper and lower channel bars for supporting the upper and lower channel bar frames, a pressure panel plate, braces affixed to the panels in spaced parallel relation one to the other and means for connecting the braces to the posts of the corresponding section so as to extend in a horizontal relation between the posts of said corresponding section whereby said posts support the panel plates of said sections under pressure of the water of the pool assembly, each of said sections including outrigger posts positioned between the upper and lower channel bars for supporting the upper and lower channel bar frames, each of said corner wall sections including in addition an outrigger corner post positioned between the upper and lower channel bars of the corresponding corner wall section, each outrigger corner post having a first notch therein adjacent the lower channel bars of the corner wall section, a bottom corner strap secured at opposite ends to adjacent lower channel bars and positioned in said first notch at the outrigger corner post so as to extend across the adjacent lower channel bars of the corresponding corner wall section, each outrigger corner post having a second notch therein adjacent the upper channel bars of the corner wall section, a top corner strap secured at opposite ends to adjacent top channel bars and positioned in said second notch of the outrigger corner post so as to extend across the adjacent upper channel bars of the corresponding corner wall section, the upper and lower channel bar frames each providing a truss which tends to bow under pressure of the water carried by the pool assembly while the top and bottom corner straps of the corner wall sections act to transfer forces applied at a channel bar at one side of the corner wall section to an adjacent channel bar at another side of the corner wall section.

8. A swimming pool assembly comprising, in combination, a plurality of side wall sections, a plurality of corner wall sections, each of said sections including upper and lower channel bars, means for connecting opposite ends of the channel bars of each section with ends of corresponding channel bars of adjacent sections to provide upper and lower channel bar frames for the swimming

pool assembly, each section including means positioned between the upper and lower channel bars for supporting the upper and lower channel bar frames and the walls of said sections under pressure of the water of the pool assembly, said means including posts positioned between upper and lower channel bars for supporting the upper and lower channel bar frames, a pressure panel plate, braces affixed to the panels in spaced parallel relation one to the other and means for connecting the braces to the posts of the corresponding section so as to extend in a horizontal relation between the posts of said corresponding section whereby said posts support the panel plates of said sections under pressure of the water of the pool assembly, the braces including fluid conduit means mounted adjacent and in heat exchange relation to the panel plates for conducting a fluid heating medium about the perimeter of the pool assembly for heating the water carried by the liner.

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52—169